TENDER DOCUMENTS TOWARDS DESIGN, CONSTRUCTION, SUPPLY OF EQUIPMENT, SERVICES & UTILITIES, ERECTION, TESTING, COMMISSIONING & GUARANTEED TRIAL RUN OF FULLY AUTOMATED 5 LAKH LITER PER DAY CAPACITY DAIRY PLANT COMPRISING OF MILK RECEPTION, PROCESSING, PACKING, 60 KLPD UHT PLANT, 10 KLPD ICE-CREAM PLANT, PRODUCT MANUFACTURING , 20 MTPD POWDER PLANT, SERVICES & UTILITIES ON TURNKEY EXECUTION BASIS INCLUDING STRUCTURAL AND CIVIL CONSTRUCTION WORK AT ARILO-GOVINDPUR UNDER BARANG TAHASIL, DIST-CUTTACK, STATE – ODISHA.

THE ORISSA STATE CO-OPERATIVE MILK PRODUCERS' FEDERATION LTD. BHUBANESWAR

JULY - 2017

Tender paper Cost: Rs.10,500/- (including tax)

The Odisha State Cooperative, Milk Producers' Federation Ltd.
D-2, SAHID NAGAR, BHUBANESWAR-751 007.
Ph No- 2546030/2540273/2540417, Fax No (0674)2540974
Email – omfed@yahoo.com

e-PROCUREMENT NOTICE

Letter No. 3340 // Date. 27.06.2017 //

Bid Identification No. PROJ/184/New dairy plant/17/3340

OMFED invites envelope from experienced Civil-Mechanical & Electrical erector/manufacturer TO-WARDS DESIGN, CONSTRUCTION, SUPPLY OF EQUIPMENT, SERVICES & UTILITIES, ERECTION, TESTING, COMMISSIONING & GUARANTEED TRIAL RUN OF FULLY AUTOMATED 5 LAKH LITER PER DAY CAPACITY DAIRY PLANT COMPRISING OF MILK RECEPTION, PROCESSING, PACKING, 60 KLPD UHT PLANT, 10 KLPD ICE-CREAM PLANT, PRODUCT MANUFACTURING , 20 MTPD POWDER PLANT, SERVICES & UTILITIES ON TURNKEY EXECUTION BASIS INCLUDING STRUCTURAL AND CIVIL CONSTRUCTION WORK AT ARILO-GOVINDPUR UNDER BARANG TAHASIL, DIST-CUTTACK, STATE – ODISHA.

1. The tender is invited on-line through 'e'-procurement of Govt. of Odisha web Portal **https://tendersorissa.gov.in**. The bidders should have the necessary portal enrolment with his own Digital Signature Certificate.

2. The bidders may submit bids for the following work

Sl. No	Name of work	Cost of tender paper. (Rs.)	Estimated Cost (Rs)	Availability of Tender for online bidding		Date of opening	Bid Security (Rs.)	Class of Contractor	Period of completion
1	2	3	4	5	6	7	8	9	10
				From	To				
01	TENDER DOCUMENTS TOWARDS DESIGN, CONSTRUCTION, SUPPLY OF EQUIPMENT, SERVICES & UTILITIES, ERECTION, TESTING, COMMISSIONING & GUARANTEED TRIAL RUN OF FULLY AUTOMATED 5 LAKH LITER PER DAY CAPACITY DAIRY PLANT COMPRISING OF MILK RECEPTION, PROCESSING, PACKING, 60 KLPD UHT PLANT, 10 KLPD ICE-CREAM PLANT, PRODUCT MANUFACTURING , 20 MTPD POWDER PLANT, SERVICES & UTILITIES ON TURNKEY EXECUTION BASIS INCLUDING STRUCTURAL AND CIVIL CONSTRUCTION WORK AT ARILO-GOVINDPUR UNDER BARANG TAHASIL, DIST-CUTTACK, STATE – ODISHA	10,500/- including tax In shape of separate Demand Draft Payable at Bhubaneswar	Turnkey execution to be evaluated by the bidder	29.06.2017 on 10.00A.M	12.08.2017 on 5.00P.M	17.08.2017 on 11.00 A.M.	2.5 crore	As per DTCN	20 (twenty) calendar months

OMFED BIDDER

3. Bid documents consisting of specifications, the schedule of quantities and the set of terms and conditions of contract and other necessary documents can be seen in the website: **https://tendersorissa.gov.in**. The corrigendum/amendment to this notice if required shall be published only in the OMFED web site **https://www.omfed.com** and will not be published again in news paper.

4. The **Bid documents will be available** in the website: https://tendersorissa.gov.in from **10.00 AM of 29.06.2017 to 05.00 PM of 12.08.2017** for online bidding.

5. The tender paper cost in the form of D/D and EMD in the form of D/D or Bank Guarantee in original and Photo Copy of **VAT, PAN, Registration Certificate of firm, Experience Certificate, other documents as per DTCN** shall have to be deposited in two different envelop within 10.00 A.M. from 16.08.2017 to 05:00PM of 16.08.2017 at the OMFED Corporate office, Bhubaneswar.

6. The pre-bid meeting shall be held on 21.07.2017 at 11:00AM at OMFED Corporate office.

7. Non submission of cost of bid document and bid security within the period shall debar from participating in the online bidding system and his portal registration shall be cancelled. His name shall also be informed to the registering authority for cancellation of his registration.

8. Bids shall be received only "on line" on or before 5.00 PM of 12.08.2017.

9. Bids received on line shall be opened at 11.00 A.M. on 17.08.2017 at OMFED Corporate office in the presence of the bidders. Bidders who participated in the bid can witness the opening of bids after logging on to the site through their DSC. If the office happens to be closed on the last date of opening of the bids as specified, the bids will be opened on the next working day at the same time and venue.

10. The bids of the technically qualified bidders will be opened for evaluation of the price bid.

11. It is for the information of all concerned, that EMD is binding for all participates i. e. 2.5crores in the shape of DD / Bank Guarantee.

12. The cost of bid documents & EMD issued from any Nationalized Scheduled Bank may be prepared in favour of OMFED, payable at Bhubaneswar.

13. Other details can be seen in the bidding documents.

14.Any corrigendum / Addendum will be displayed in the website **https://www.omfed.com.**

15. The management reserves the right to cancel any or all bids without assigning any reason.

Managing Director
OMFED

OMFED BIDDER

INSTRUCTION TO BIDDER

1. NAME OF WORK : DESIGN, CONSTRUCTION, SUPPLY OF EQUIPMENT, SERVICES & UTILITIES, ERECTION, TESTING, COMMISSIONING & GUARANTEED TRIAL RUN OF FULLY AUTOMATED 5 LAKH LITER PER DAY CAPACITY DAIRY PLANT COMPRISING OF MILK RECEPTION, PROCESSING, PACKING, 60 KLPD UHT PLANT, 10 KLPD ICE-CREAM PLANT, PRODUCT MANUFACTURING , 20 MTPD POWDER PLANT, SERVICES & UTILITIES ON TURNKEY EXECUTION BASIS INCLUDING STRUCTURAL AND CIVIL CONSTRUCTION WORK AT ARILO-GOVINDPUR UNDER BARANG TAHASIL, DIST-CUTTACK, STATE – ODISHA.

2.	PERIOD OF COMPLETION OF PLANT	:	20 Months
3.	TIME, DATE AND PLACE OF PRE-BID CONFERENCE		: 21.07.2017 at 11.00 AM OMFED, D-2, Sahid Nagar Bhubaneswar-751007,
4.	LAST DATE, TIME AND FOR RECEIPT OF BIDS ON ONLINE		: 12.08.2017 up to 05:00 PM
5.	*TIME , DATE AND PLACE OF OPENING OF TECHNICAL BIDS		: DATE- 17.08.2017 TIME 11.00 AM at- OMFED, D-2, Sahid Nagar, Bhubaneswar-751 007.
6.	*TIME AND DATE OF OPENING COMMERCIAL BIDS		: SHALL BE INTIMATED BY E-MAIL IN ADVANCE
7.	PLACE OF OPENING OF COMMERCIAL BIDS		: OMFED, D-2, Sahid Nagar, Bhubaneswar-751 007.
8.	LAST DATE OF BID VALIDITY		: 180 days after 17.08.2017
9.	OFFICER INVITING BIDS		: Managing Director, OMFED
10.	CONTACT PERSON		: General Manager (Project) OMFED, D-2, Sahid Nagar, Bhubaneswar-751 007. Email- omfed@yahoo.com Mobile No- 9437206282

OMFED BIDDER

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SECTION 1

INSTRUCTION TO BIDDERS

A. GENERAL

Scope of Bid

The OMFED invites bids TO-WARDS DESIGN, CONSTRUCTION, SUPPLY OF EQUIPMENT, SERVICES & UTILITIES, ERECTION, TESTING, COMMISSIONING & GUARANTEED TRIAL RUN OF FULLY AUTOMATED 5 LAKH LITER PER DAY CAPACITY DAIRY PLANT COMPRISING OF MILK RECEPTION, PROCESSING, PACKING, 60 KLPD UHT PLANT, 10 KLPD ICE-CREAM PLANT, PRODUCT MANUFACTURING , 20 MTPD POWDER PLANT, SERVICES & UTILITIES ON TURNKEY EXECUTION BASIS AT ARILO-GOVINDPUR UNDER BARANG TAHASIL, DIST-CUTTACK, STATE – ODISHA.

The successful bidder will be expected to complete the works by the intended completion date specified in the General Conditions of Contract.

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

Source of Funds

Rural Infrastructure Development Funding.

Eligible Bidders

This *Invitation for Bids* is open to all bidders.

All bidders shall provide in Section 2, Forms of Bid and Qualification Information, a statement that the Bidder is neither associated, nor has been associated, directly or indirectly, with the OMFED personnels any other entity that has prepared the design, specifications, and other documents for the Project or being proposed as Project Manager for the Contract, involve in supervision of the contract. A firm that has been engaged by the OMFED to provide the services for the preparation or supervision of the works, and any of its affiliates, shall not be eligible to bid.

Bidders shall not be under a declaration of in eligibility for corrupt and fraudulent practices by the State Govt. or Central Govt. or Public Undertaking, Autonomous Body.

Qualification of the Bidder

All bidders shall provide in Section 2, Forms of Bid and Qualification Information, a preliminary description of the proposed work method and schedule, including drawings and charts, as necessary.

All bidders shall also furnish the following information in Section 2.

(i) Evidence of access to or availability of credit facilities (minimum 10% of estimated cost) certified by the bankers.

(ii) Undertaking that bidder would be able to invest a minimum of cost upto 25% of the contract value of work, during implementation of contract.

(iii) Proposals, if any, for sub contracting of elements of work, costing more that 10% of the bid amount.

(iv) Power of attorney.

Latest income tax return copy for the financial year 2015-16 .

If the OMFED has not undertaken prequalification of potential bidders, all bidders shall include the following information and documents with their bids in Section2:

(a) copies of original documents defining the constitution or legal status, place of registration, and principal place of business; written power of attorney of the signatory of the Bid to commit the Bidder;

(b) total monetary value of construction work performed for each of the last five years;

(c) experience in works of a similar nature and size for the last five years, and details of works underway or contractually committed; and clients who may be contacted for further information on those contracts.

(d) major items of construction equipment proposed to carry out the Contract or evidence of arrangement of possessing them on hire/lease/buying as defined therein;

(e) qualifications and experience of key site management and technical personnel proposed for contract;

(f) reports on the financial standing of the Bidder, such as profit and loss statements, Balance Sheet and auditor's reports for the past five years;

(g) evidence of access to line(s) of credit and availability of other financial resources facilities (10% of contract value), certified by the Bankers (Not more than 3 months old)

(h) undertaking that the bidder will be able to invest a minimum cash up to 25% of contract value of work, during implementation of work.

(i) authority to seek references from the Bidder's bankers.

(j) information regarding any litigation, current or during the last five years, in which the Bidder is involved, the parties concerned and dispute amount.

(k) proposals for subcontracting components of the Works amounting to more that 10% of the Bid Price (for each, the qualifications and experience of the identified sub-contractor in the relevant field should be annexed); (*for all contracts over Rs. 2.00 Crore)* and

(l) the proposed methodology and programme of construction, backed with equipment planning and deployment, duly supported with broad calculations and quality control procedures proposed to be adopted, justifying their capability of execution and completion of the work as per technical specifications within the stipulated period of completion as per milestones (*for all contracts over Rs. 2.00 Crore)*

A) To qualify for award of the contract, each bidder in its name should have in the last five years as referred to in Appendix.

(a) To qualify for award of the contract each bidder in its name should have in the last five year (from FY 2012-13 to FY 2016-17) achieved a minimum annual financial turnover indicated in Section 2, Qualification Information (in all class of civil / mechanical / electrical engineering / construction works only) at 2016-17 price level in any financial year (attached copy of certificates of authenticity to be enclosed by the tenderer from an appropriate authority). Weightage of 10% per year shall be given on financial turnover of previous years to bring them to 2016-17 price leve.

(b) satisfactorily completed as a prime contractor (or as a nominated subcontractor, where the subcontract involved execution of all main items of work described in the bid document, provided further that all other qualification criteria indicated in Section –2 (Qualification Information).

(c) The contractor or his identified sub-contractor should possess required valid electrical license for executing the building electrification works and should have executed similar electrical works for a minimum amount as indicated in Section –2 (Qualification Information) in any one year.

(d) The contractor or his identified sub-contractor should possess required valid license for executing the water supply/sanitary engineering works and should have executed similar water supply/sanitary engineering works for a minimum amount as indicated in Section –2 (Qualification Information), in any one year.

B. Each bidder should further demonstrate:

(a) Availability (either owned or leased or by procurement against mobilization advances) of the following key and critical equipment for this work:

Based on the studies, carried out by the Engineer the minimum suggested major equipment to attain the completion of works in accordance with the prescribed construction schedule are shown in the **Annexure-I.**

The bidders should, however, undertake their own studies and furnish with their bid, a detailed construction planning and methodology supported with layout and necessary drawings and calculations above to allow the OMFED to review their proposals. The numbers, types and capacities of each plant/equipment shall be shown in the proposals along with the cycle time for each operation for the given production capacity to match the requirements.

(b) Availability for this work of personnel with adequate experience as required; as per **Annexure-2.**

(c) Liquid assets and/or availability of credit facilities of no less than amount indicated in Appendix

C. To qualify for a contract made up of this and other contract for which bids are invited in the IFB, the bidder must demonstrate having experience and resources sufficient to meet the aggregate of the qualifying criteria for the individual contracts.

Sub-contractors' experience and resources shall not be taken into account in determining the bidder's compliance with the qualifying criteria.

Bidders who meet the minimum qualification criteria will be qualified only if their available bid capacity is more than the total bid value. The available bid capacity will be calculated as under:

Assessed Available Bid capacity = (A*N*2 -B) Where

A = Maximum value of civil/mechanical/electrical engineering works executed in any one year during the last five years (updated to the price level of the year indicated in Appendix) taking into account the completed as well as works in progress.

N = Number of years prescribed for completion of the works for which bids are invited.

B = Value (updated to the price level of the year indicated in Appendix) of existing commitments and on-going works to be completed during the next one year.

Note: The statements showing the value of existing commitments and on-going works as well as the stipulated period of completion remaining for each of the works listed should be countersigned by the Engineer in charge, not below the rank of an Executive Engineer or equivalent.

Even though the bidders meet the above qualifying criteria, they are subject to be disqualified if they have:

- made misleading or false representations in the forms, statements and attachments submitted in proof of the qualification requirements; and/or
- record of poor performance such as abandoning the works, not properly completing the

contract, inordinate delays in completion, litigation history, or financial failures etc; and/or

- participated in the previous bidding for the same work and had quoted unreasonably high bid prices and could not furnish rational justification to the OMFED.

One Bid per Bidder

Each bidder shall submit only one bid for any work package or group. A bidder who submits or participates in more than one bid (other than as a sub-contractor or in cases of alternatives that have been permitted or requested) will cause all the proposals with the bidder's participation to be disqualified.

Cost of Bidding

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

Site Visit

The Bidder, at the Bidder's own responsibility and risk in encouraged to visit and examine the Site of Works and its surroundings and obtain all information that may be necessary for preparing the Bid and entering into a contract for construction of the Works. The costs of visiting the Site shall be at the Bidder's own expense.

B. BIDDING DOCUMENTS

Content of Bidding Documents

The set of bidding documents comprises the documents listed below.

Section	Particulars
	Invitation for Bids
1	Instructions to Bidders
2	Qualifications of Bidders
3	Conditions of Contracts / Payment Terms
4	Special Condition Of Contract
5	Design Basis
6	Technical Specification
7	Commercial Bid
8	Securities and other forms

The bidder is expected to examine carefully all instructions, conditions of contract, contract data, forms, terms, technical specifications, bill of quantities, forms, Annexes in the Bid Document. Failure to comply with the requirements of Bid Documents shall be at the bidder's own risk. Bids which are not substantially responsive to the requirements of the Bid Documents shall be rejected.

Clarification of Bidding Documents

Pre-bid meeting

The bidder or his official representative is invited to attend a pre-bid meeting which will take

place at the address, venue, time and date as indicated in appendix.

The purpose of the meeting will be to clarify issues and to answer questions on any matter that may be raised at that stage.

The bidder is requested to submit any questions in writing or by Email to reach the OMFED not later than one week before the meeting.

Minutes of the meeting, including the text of the questions raised (without identifying the source of enquiry) and the responses given will be transmitted without delay to all purchasers of the bidding documents. Clarification, if any finalised during the pre-bid meeting on the schedule date, shall be intimated to the bidders through corrigendum notice to be published in the website well in advance.

Non-attendance at the pre-bid meeting will not be a cause for disqualification of a bidder.

Amendment of Bidding Documents

The corrigendum/amendment to this notice if required shall be published only in the OMFED website and will not be published again in newspaper. The OMFED will assume no responsibility for any delays.

To give prospective bidders reasonable time in which to take an addendum into account in preparing their bids, the OMFED may, at his discretion, extend as necessary the deadline for submission of bids.

C. **PREPARATION OF BIDS**

Language of the Bid

All documents relating to the bid shall be in the English language.

Documents Comprising the Bid

The bid to be submitted by the bidder as per the bidding document shall be in two separate parts;

Part I shall be named "Technical Bid" and shall comprise

(i) Tender Paper Cost

(ii) Earnest money in the form specified in tender document.

(iii) Qualification Information and supporting documents as specified in Section- 2

(iv) Certificates, undertakings, affidavits as specified in Section 2

(v) Central Excise registration number / Service Tax registration number / TIN / CST no. /PAN no.

(vi) Any other information required as specified in Section -1 of tender document.

(vii) Undertaking that the bid shall remain valid for the period of 180days.

(viii) The bidder shall submit conceptual drawings relating to site layout plan, plant layout, front elevation and equipment & machinery layout etc in 3 sets each.

(ix) An affidavit affirming the information be has furnished in the bidding document is correct to the best of his knowledge and belief.

Part II shall be named "Financial Bid" and shall comprise

(i) Form of Bid as specified in **Section 9** .

(ii) Priced Bill of Quantities as specified in **Section 6.**

Each part will be separately sealed .

Following documents, which are not submitted with the bid, will be deemed to be part of the bid.

Section	Particulars
1	Invitation for Bids (IFB)
2	Instructions to Bidders (ITB)
3	Conditions of Contract
6	Specifications

Bid Prices

All duties, taxes, and other levies payable by the contractor under the contract or for any other cause shall be included in the rates, prices and total Bid Price submitted by the Bidder.

The rate and prices quoted by the bidder shall be fixed for the duration of the Contract and shall not be subject to adjustment on any account (For contracts up to 20 months period).

Currencies of Bid and Payment

The units rates and the prices shall be quoted by the bidder entirely in Indian Rupees. All payments shall be made in Indian Rupees.

Bid Validity

Bids shall remain valid for a period not less than 180 days after the deadline date for bid submission. A bid valid for a shorter period shall be rejected by the OMFED as non-responsive.

In exceptional circumstances, prior to expiry of the original time limit, the OMFED may request that the bidders may extend the period of validity for a specified additional period. The request and the bidders' responses shall be made in writing or by mail. A bidder may refuse the request without forfeiting his bid security.

Earnest Money

1. **The bidder shall furnish, as part of its bid, bid security for a value of 2.5 Crore.**
2. The bid security is required to protect the purchaser against the risk of bidder's conduct, which would warrant the security's forfeiture.
3. The bid security shall be in one of the following forms:

(a) A bank guarantee issued by a Nationalized/Scheduled bank in India only in the form strictly in accordance to the sample form provided in the bidding documents and valid from the date of bid opening as prescribed in the tender notice till 180 days beyond the validity of the bid.

Or

(b) A demand draft or pay order in favour of Orissa State Cooperative Milk Producers Federation Limited, Payable at Bhubaneswar.

4. Any bid not secured in accordance with tender norms, will be rejected by OMFED as non-responsive and the 2nd cover (price bid) shall not be opened at all.
5. Unsuccessful bidders bid security will be discharged/ returned as promptly as possible but not later than 180 days after the expiration of the period of bid validity prescribed in the bidding document.
6. The successful bidders bid security will be discharged upon the bidders executing the agreement furnishing the performance security deposit.
7. No interest shall be paid b OMFED on the bid security furnished by the bidder.

8. The bid security may be forfeited:

(a) If a bidder withdraws or modifies his bid during the period of bid validity;

Or

(b) In the case of these successful bidder, if the bidder fails:

i) To sign the agreement in accordance with tender norms;

Or

ii) To furnish the required performance security deposit as per tender norms.

Alternative Proposals by Bidder

Bidders shall submit offers that fully comply with the requirements of the bidding documents, including the conditions of contract ,basic technical design as indicated in technical data.

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

Format and Signing of Bid

The Bidder shall submit two sets of the bid comprising of the Technical bid & Price bid designed by the Bidder.

The original and copy of the Bid shall be typed or written in indelible ink and shall be signed by a person or persons duly authorized to sign on behalf of the Bidder. All parts of the bid where entries or amendments have been made shall be initialed by the person or persons signing the bid.

The Bid shall contain no alterations or additions, except those to comply with instructions issued by the OMFED, or as necessary to correct errors made by the bidder, in which case such corrections shall be initialled by the person or persons signing the bid.

D. SUBMISSION OF BIDS

Sealing and Marking of Bids

The Bidder shall place the two separate envelopes. The two envelopes (called as inner envelopes) shall be marked Technical Bid and Financial Bid and the be inside one outer envelope. The marked "Technical Bid" and "Financial Bid" will have additional markings as follows.

- Technical Bid: To be opened on 17.08.2017 at 11:00Hrs. (date of Technical Bid opening) in the presence of Evaluation Committee.
- Financial Bid: Not to be opened except with the approval of Evaluation Committee.

The contents of Technical and Financial Bids will be as specified in document.

The inner, outer and separate envelopes containing Technical and Financial Bids shall

(a) be addressed to the OMFED at the address given in Appendix

(b) bear the identification no of contract as indicated in Appendix.

(c) provide a warning not to open before the specified time and date for bid opening as specified in ITB.

In addition to the identification required as per above each of the envelopes shall indicate the name and address of the bidder to enable the bid to be returned unopened in case it is declared late, or the Evaluation Committee declares the bid as non responsive.

If the outer envelope is not sealed and marked as above, the OMFED will assume no responsibility for the misplacement or premature opening of the bid.

Deadline for Submission of the Bids

Complete Bids (including Technical and Financial) must be received by the OMFED at the address specified above not later than the date indicated in appendix. In the event of the specified date for the submission of bids declared a holiday for the OMFED, the Bids will be received up to the appointed time on the next working day.

The OMFED may extend the deadline for submission of bids by issuing an amendment in accordance with as per tender document, in which case all rights and obligations of the OMFED and the bidders previously subject to the original deadline will then be subject to the new deadline.

Late Bids

Any Bid received by the OMFED after the deadline will be returned unopened to the bidder.

E. BID OPENING AND EVALUATION

Bid Opening

The OMFED will open all the Bids received (except those received late), including modifications made, in the presence of the Bidders or their representatives who choose to attend at time, date and the place specified in Appendix. In the event of the specified date of Bid opening being declared a holiday for the OMFED, the Bids will be opened at the appointed time and location on the next working day.

If any of the tenderers or their agents are not present at the time of opening, the OMFED will open the tender in their absence and prepare a statement and that will be binding on the absent terderers

The envelope containing "Technical Bid" shall be opened. The amount, form and validity of the Earnest money furnished with each bid will be announced. If the bid security furnished does not conform to the amount and validity period as specified in the Invitation for Bid, and has not been furnished in the form specified as per tender specification, the remaining technical bid and the sealed financial bid will be returned to the bidder.

(i) Subject to confirmation of the bid security by the issuing Bank, the bids accompanied with valid security will be taken up for evaluation.

(ii) After receipt of confirmation of the bid security, the bidder will be asked in writing (usually within 10 days of opening of the Technical Bid) to clarify or modify his technical bid, if necessary, with respect to any rectifiable defects.

(iii) The bidders will respond in not more than 7 days of issue of the clarification letter, which will also indicate the date, time and venue of opening of the Financial Bid.

(iv) Immediately on receipt of these clarifications the Evaluation Committee will finalize the list of responsive bidders whose financial bids are eligible for consideration.

At the time of opening of "Financial Bid", the names of the bidders were found responsive in accordance with as per tender document will be announced. The bids of only these bidders will be opened. The remaining bids will be returned to the bidders unopened. The responsive Bidders' names, the Bid prices, the total amount of each bid, any discounts, Bid Modifications and withdrawals, and such other details as the OMFED may consider appropriate, will be announced by the OMFED at the opening. Any Bid price or discount, which is not read out and recorded, will not be taken into account in Bid Evaluation.

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

The OMFED shall prepare minutes of the Bid opening, including the information disclosed.

Process to be Confidential

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

Clarification of Financial Bids

To assist in the examination, evaluation and comparison of Bids, the OMFED may, at his discretion, ask any bidder for clarification of his bid, including breakdown of unit rates. The request for clarification and the response shall be sought, offered or permitted except as required to confirm the correction of arithmetic errors discovered by the OMFED in the evaluation of the bids.

No Bidder shall contact the OMFED on any matter relating to his bid from the time of the bid opening to the time of contract awarded. If bidder wishes to bring additional information to the notice of the OMFED, it should do so in writing.

Any effort by the bidder to influence the OMFED in the OMFED's bid evaluation, bid comparison or contract award, decision may result in the rejection of the Bidders bid.

Examination of Bids and Determination of Responsiveness

During detailed evaluation of "Technical Bids", the OMFED will determine whether each Bid (a) meets the eligibility criteria defined in tender documents; (b) has been properly signed; (c) is accompanied by the required securities and; (d) is substantially responsive to the requirements of the Bidding documents. During the detailed evaluation of the "Financial Bid", the responsiveness of the bids will be further determined with respect to the remaining bid conditions, i.e., priced bill of quantities, technical specifications, and drawings.

A substantially responsive "Financial Bid" is one which conforms to all the terms, conditions, and specifications of the Bidding documents, without material deviation or reservation. A material deviation or reservation is one (a) which affects in any substantial way the scope, quality or performance of the Works; (b) which limits in any substantial way, inconsistent with the Bidding documents, the OMFED's rights or the Bidder's obligations under the Contract; or (c) whose rectification would affect unfairly the competitive position of other Bidders presenting substantially responsive Bids.

If a "Financial Bid" is not substantially responsive, it will be rejected by the OMFED, and may not subsequently be made responsive by correction or withdrawal of the non-conforming deviation or reservation.

Correction of Errors

"Financial Bids" determined to be substantially responsive will be checked by the OMFED for any arithmetic errors. Errors will be corrected by the OMFED as follows:

(a) where there is a discrepancy between the rates in figures and in words, the rate in words will govern; and

(b) where there is a discrepancy between the unit rate and the line item total resulting from multiplying the unit rate by the quanity, the unit rate as quoted will govern.

The amount stated in the "Financial Bid" will be corrected by the OMFED in accordance with the above procedure and the bid amount adjusted with the concurrence of the Bidder in the following manner:

(a) If the Bid price increases as a result of these corrections, the amount as stated in the bid will be the 'bid price' and the increase will be treated as rebate;

(b) If the bid price decreases as a result of the corrections, the decreased amount will be treated as the 'bid price'

Such adjusted bid price shall be considered as binding upon the Bidder. If the Bidder does not accept the corrected amount the Bid will be rejected, and the Earnest money may be forfeited.

Evaluation and Comparison of Financial Bids

The OMFED will evaluate and compare only the Bids determined to be substantially responsive as per tender norms.

In evaluating the Bids, the OMFED will determine for each Bid the evaluated Bid Price by adjusting the Bid Price as follows:

(a) making any correction for errors if required as tender condition

(b) making an appropriate adjustments for any other acceptable variations, deviations.

The OMFED reserves the right to accept or reject any variation or deviation. Variations and deviations and other factors, which are in excess of the requirements of the Bidding documents or otherwise result in unsolicited benefits for the OMFED, shall not be taken into account in Bid evaluation.

If the Bid of the successful Bidder is seriously unbalanced in relation to the Engineer's estimate of the cost of work to be performed under the contract, the OMFED may require the Bidder to produce detailed price analyses for any or all items of the Bill of Quantities, to demonstrate the internal consistency of those prices with the construction methods and schedule proposed. After evaluation of the price analyses, the OMFED may require that the amount of the performance security will be increased at the expense of the successful Bidder to a level sufficient to protect the OMFED against financial loss in the event of default of the successful Bidder under the Contract.

A bid which contains several items in the Bill of Quantities which are unrealistically priced low and which cannot be substantiated satisfactorily by the bidder may be rejected as non-responsive.

AWARD OF CONTRACT

Award Criteria

The OMFED will award the Contract to the Bidder whose Bid has been determined

(i) to be substantially responsive to the Bidding documents and who has offered the lowest evaluated Bid Price; and

(ii) to be within the available bid capacity adjusted to account for his bid price which is evaluated the lowest any of the packages opened earlier than the one under consideration.

In no case, the contract shall be awarded to any bidder whose available bid capacity is less than the evaluated bid price, even if the said bid is the lowest evaluated bid. The contract will in such cases be awarded to the next lowest bidder at his evaluated bid price.

OMFED's Right to accept any Bid and to reject any or all Bids

The OMFED reserves the right to accept or reject any Bid, and to cancel the Bidding process and reject all Bids, at any time prior to the award of Contract, without thereby in incurring any liability to the affected Bidder or Bidders or any obligation to inform the affected Bidder or Bidders of the ground for the OMFED's action.

Notification of Award and Signing of Agreement

The Bidder whose Bid has been accepted will be notified of the award by the OMFED prior to expiration of the Bid validity period by email, fax or by hand with acceptance letter from the bidder, confirmed by registered letter. This letter (hereinafter and in the *General Conditions of Contract* called the "Letter of Acceptance") will state the sum that the OMFED will pay the Contractor in consideration of the execution, completion and maintenance of the Works by the Contractor as prescribed by the Contract (hereinafter and in the Contract called the "Contract Price").

The notification of award will constitute the formation of the Contract, subject only to the furnishing of the performance security in accordance with the provisions of tender clause.

The Agreement will incorporate all agreements between the OMFED and the successful Bidder. It will be signed by the OMFED and the successful Bidder, after the performance security is furnished.

Performance Security

Within 15 (Fifteen) days of receipt of the Letter of Acceptance, the successful Bidder shall deliver to the OMFED a Performance Security in any of the forms given below for an amount equivalent 5% of the Contract price.

If the performance security is provided by the successful Bidder in the form of an Bank Guarantee or fixed deposit receipts in the name of OMFED, it shall be issued either (a) at the Bidder's option, by a Nationalized / Scheduled Indian bank within state or (b) acceptable to the OMFED.

Failure of the successful Bidder to comply with the requirements of tender clause shall constitute sufficient grounds for cancellation of the award and forfeiture of the Bid Security.

Advance Payment and Security

The OMFED will provide an Advance Payment on the Contract Price as stipulated in the terms of payment of tender, subject to maximum amount, as stated in the tender document.

Corrupt or Fraudulent Practices

The OMFED will reject a proposal for award if it determines that the Bidder recommended for award has engaged in corrupt or fraudulent practices in competing for the contract in question and will declare the firm ineligible, either indefinitely or for a stated period of time, to be awarded a contract with PWD and any other agencies, if it at any time determines that the firm has engaged in corrupt or fraudulent practices in competing for the contractor, or in execution.

Furthermore, Bidders shall be aware of the provision stated in Tender Clause of the General Condition of contract.

Bids from Joint Ventures are also allowed (Criteria for Joint Venture)

Bids from joint venture are only allowed for the works having estimated cost more than **30.00** cr. Bids submitted by a joint venture (JV) of not more than a total of three firms as partners shall comply with the following requirements:-

There shall be a joint venture Agreement (Refer Annexure specific for the contract package between the constituent firms indicating clearly, amongst other things, the proposed distribution of responsibilities both financial as well as technical for execution of the work amongst them. For the purpose of this clause, the most experience lead partner will be the one defined. A copy of the joint Venture agreement in accordance with requirements mentioned in Annexure - III shall be necessarily submitted with the bid.

Alternatively, a letter of intent to execute a JV in the event of successful bid shall be signed by all partner of JV and submitted with the bid together with a copy of the proposed agreement. Pursuant to the foregoing, the JV shall include amount other things, the joint venture's objectives, the proposed management structure, the contribution of each partner to joint venture operation, the commitment of the partners to joint and several liability for due performance recourse/ sanction within the joint venture in the event of default or withdrawl of any partner and arrangements for providing the required indemnities.

The JV so formed shall also have to be registered with the concerned department after issue of LOA but before the agreement.

The bid, and in the case of the successful bidder, the form of agreement etc, shall be signed and/ or executed in such a manner as may be required for making it legally binding on all partners (including operative parts of the ensuing contract in respect of Agreement of Arbitration, etc.). On award of work, the form of Agreement and contract Documents shall be signed by all partners of the joint venture to conclude contract Agreement.

Lead partner shall be nominated as being partner-in-charge: and this authorization shall be evidenced by submitting a power of attorney signed by the legally authorized signatories of all the partners.

The partner -in- charge shall be authorized to incur liabilities and to receive instruction for and on behalf of the partners of the joint venture, whether jointly or severally and entire execution of the contract (including payment) shall be carried out exclusively through the partner-in-charge. A copy of the said authorization shall be furnished with the bid.

All partners of the joint venture shall be liable jointly and severally for the execution of the contract in accordance with contract terms, and a relevant statement to this effect shall be included in the authorization mentioned under tender document above as well as in the Form of tender and the Form of Agreement (in case of a successful bidder).

In the event of default, all the partners of the joint venture will retain the full and undivided responsibility for the performance of their obligations under the contract and /or for satisfactory completion of the works.

The bid submitted shall include all there event information as required under the provisions of ITB (Information to Bidder) and furnished separately for each partner. The requirement of key plants & equipments construction equipments as per Annexure 1 and testing equipment for establishing field laboratory, key personnel to be employed on contract work as per Annexure II shall be counted altogether for the partners it shall be less than the requirement.

The bank guarantee/other suitable instrument in shape of bid security shall be issued in the name of JV and pledged in favor of OMFED.

Each partner of the JV must produce:

The permanent account number (PAN) of Income tax.

An affidavit though 1st class Executive Magistrate that the information furnished with the bid documents is correct in all respect: and.

Each bidder must demonstrate:-

Availability for construction work, either owned, or on lease or on hire, of the key equipment stated in the Annexure - I including equipments required for establishing field laberatory to perform mandatory test. The requirement of key plants & equipments construction equipments as per Annexure 1 testing equipment for establishing field laboratory key personal to be employed on contract work as per Annexure II shall be counted altogether for the partners it shall be less than the requirement.

The joint venture must satisfy collectively the criteria laid down in tender document above.

Liquid assets and/ or credit facilities, net of other contractual commitments and exclusive of any advance payments which any be made under the contract, of not less than the amount specified in the tender document.

The bidder must not have in his employment:

The near relations (defined as first blood relations, and their spouses, of the bidder or the bidders spouse) of persons, The bidder must produce an affidavit stating that the near relations of the departmental officers are not in his employment:

To qualify for a package of contracts made up of this and other contracts for which bids are invited in the Notice inviting Tender, the bidder must demonstrate having experience and resources sufficient to meet the aggregate of the qualifying criteria for the individual contract.

If bidder is joint venture, the partners would be limited to three (including lead partner). Joint venture firm shall jointly and severally responsible for completion of the project. Joint venture must full fill the following minimum qualification requirement.

The lead partner shall meet not less than 50% (fifty percent) of qualification criteria.

Each of the remaining partners shall meet not less than 25% (Twenty five percent) of qualification criteria.

The joint venture must also collectively satisfy the subject of the criteria of tender clause as per ITB for this purpose the relevant figures for each of the partners shall be 100% or more.

In the event that the OMFED has caused to disqualify under tender clause of ITB and the constitutions stated below of all the joint Venture partners will be disqualified.

Joint venture applicants shall provide certified copy of the Joint Venture Agreement in demonstration of the partners undertaking joint and several liabilities for the performance of any contract entered into with the bid.

The available bid capacity of the JV as required under tender clause of ITB below will be applied for each partner to the extent of his proposed participation in the execution of the work. The total bid capacity available shall be more than estimated contract value.

The available bid capacity/annual turnover will be calculated

as under Assessed Available Bid capacity =(A*N*2-B) Where

A = Maximum value of (in all class of civil / mechanical / electrical engineering / construction) work executed in any one year during the last five years (up dated to the price level of the year indicated in apendix) taking into account the completed as well as works in progress.

N = Number of years prescribed for completion of the works for which bids are invited.

B = Value, at the current price level, of existing commitments and on-going works to be completed during the period of completion of the works for which bids are invited.

Note: - The statements showing the value of existing commitments and ongoing works as well as the stipulated period of completion remaining for each of the works listed should be countersigned by the Engineer- In- Charge, not below the rank of an executive Engineer or equivalent.

Sub- Contractors (duly authorized) experience and resources shall be taken into account in determining the bidders compliance with the qualifying criteria. The sub contractors role may be verified by the OMFED.

Qualification of a joint venture does not necessarily qualify any or its partners individually or as a

partner to any other joint venture. In case of dissolution of a joint venture, each one of the constituent firms may qualify if they meet all the qualification, requirements subject to the written approval of the OMFED.

The rescinding of contract of a joint venture on account of reasons other than non- performance, such as most experienced partner of joint venture pulling out, court direction leading to breaking up of a joint venture before the start of work, which are not attributable to the poor performance of the contractor will, however, not affect the qualification of the individual partners.

Submission of Project Report

The successful bidder must submit the Detailed Project Report containing detailed design/drawing/specification/estimation of Dairy/UHT/Powder/Ice-Cream Plant/ETP/and other as specified in tender along with the Layout Plan according to rules & guideline of the Directory of Factory & Boiler (Odisha).

APPENDIX to ITB

1. Name of the employer - Odisha State Cooperative Milk Producers' Federation Ltd.(OMFED), D-2, Sahid Nagar,Bhubaneswar-7

2. The last five years

   2012- 2013

   2013- 2014

   2014- 2015

   2015-2016

   2016-2017

3. Quantities of work are :

   Quantity of the different items along with standard specification of

   PWD (Odisha) will have to be submitted by the bidder. The bidder has to design and work out bills of quantity for commercial bidding.

   Submitted by the Bidder. However for Mechanical/Electrical works List/Quantities is enclosed for quoting the rate.

4. Price level of the financial year 2016-2017. Rate of inflation may be taken as 10% per year (escallation factor).

5. The pre-bid meeting will take place at 21.07.2017 at 11:00 Hrs. (address of the venue) on OMFED office, Bhubaneswar (time and date)

6. The technical bid will be opened on 17.08.2017 at 11:00AM (address of the venue) at OMFED Corporate Office, Bhubaneswar

7. Address of the OMFED, Bhubaneswar

D-2, Saheed Nagar, Bhubaneswar -751007.

8. The bid should be submitted latest by 16.08.2017 till 5:00PM

- Identification: Towards Design, Construction, Fabrication, Supply, Erection, Testing Commissioning And Guaranteed Trail Run Including All Necessary Civil, Mechanical, Instrumentation And Electrical Works Etc, Complete Including Taking Statutory Approvals of fully automated 5 Lakh Liter Per Day Capacity Dairy Plant Comprising Of Milk Reception, Processing, Packing, 60 KLPD UHT Plant, 10 KLPD Ice-Cream Plant, Product Manufacturing , 20 MTPD Powder Plant, Services & Utilities On Turnkey Execution Basis At Arilo-Govindpur Under Barang, Tahasil, Dist-Cuttack, State – Odisha.
- Do not open before at 17.08.2017 at 11:00AM (time and date)

9. The Bank Draft in favour of OMFED payable at Bhubaneswar

10. Escalation factors @10% per year (for the cost of works executed and financial figure to common base value for works completed)

Year before	Multiply factor
One	1.10
Two	1.21
Three	1.33
Four	1.46
Five	1.61

ANNEXURE – I

Major items of constructional plant to be deployed by the bidder.

Sr.no	description of Equipment	No's available with the bidder In working Condition.	no's proposed to be deployed At site.
1.	Concrete mixers		
2.	Vibrators		
	a) Needle type		
	b) Surface type		
3.	Weight batcher		
4.	Concrete cube Testing equipment		
5.	Steel scaffolding		
6.	Shuttering material		
7.	Water pumps		
8.	Air compressors		
9.	Welding equipments		
10.	Elevators		

ANNEXURE – II

List of Key Personnel to be deployed on Contract Work

Sl. No.	Personnel	Qualification	
1.	Project Manager	B.E. Civil + 15 Years Exp. (5 years as Manager)	1 No.
2.	Site Engineer	B.E. Civil + 10 Years (5 years Exp. in Building Construction)	1 No.
3.	Plant Engineer	B.E. Civil + 10 Years Exp. or B.E. Mech + 15 Years Exp.	1 No. Each
4.	Plant Engineer	B.E. Mech. + 7 Years Exp. / B.E. Elect. + 07 Years Exp	2 No. Each
5.	Soil & Material Engineer	B.E. Civil + 10 Years Exp.	1 No. Each
6.	Survey Engineer	B.E. Civil + 5 Years Exp. or Dip. Civil + 8 Years Exp.	1No.

SECTION 2

QUALIFICATION INFORMARION

(To be filled in by Bidder)

QUALIFICATION CRITERIA

1. For Individual Bidders/Consortium of Firms

Constitution or legal status of Bidder
(Attach copy)

Place of registration:

Principal place of business:

Power of attorney of signatory of Bid:
(Attach)

Total value of Civil/Mechanical/ Electrical works in Dairy Industry construction

2. Pre-Qualification Criteria

The firms should meet the following minimum qualifying criteria for getting pre-qualified

Past Similar Experience in last 5 Years (To fullfill either of three options)

Single project -	Rs.**100.00 Crores each**
Two projects -	Rs.**50.00 Crores each**
Three projects -	Rs.**25.00 Crores each**

Should have successfully completed any of the following works:-

- Should have experience in setting up of one number of fully automated 5 lakh litters per day dairy plant with milk powder plant, UHT plant on turnkey execution basis.

- Should have experience in setting up at least two numbers of fully automated 2 lakh litters per day dairy plant or more with milk powder plant, UHT plant on turnkey execution basis.

4.0 Annual Turnover - Rs. Not less than ***100.00 Crores at least****

Latest Bank Solvency-Rs. Not less than ***20.00 Crores at least***

**** to qualify for award of the contract each bidder in its name should have in the last five years (FY 2012-13 to FY 2016-17) achieved minimum annual financial turnover(in all class of civil / mechanical / electrical engineering / construction work) of Rs.100.00 crore at 2016-17 price level in any one financial year (attested copy of certificates of authority is to be enclosed by the tenderer from an appropriate authority. Weightage of 10% per year shall be given on financial turnover of previous years to ring them to 2016-17 price level.***

5.0 Work performed in the last five years**

(in Rs.)
2012-2013
2013-2014
2014-2015
2015-2016
2016-2017

Work performed as prime contractor, work performed in the past as a nominated sub- contractor will also be considered provided the sub-contract involved execution of all main items of work described in the bid document, provided further that all other qualification criteria are satisfied (in the same name) on works of a similar nature over the last five years.**

Project Name	Name of the Bidder*	Description work	Contract No.	Value Contract (Rs. Crore)	Date issue work order	Stipulated period completion	Actual date of completion *	Remarks explaining reasons for delay & work completed)

** Attach certificate(s) from the Engineer(s)-in-Charge*

*** Immediately preceding the financial year in which bids are received with certificate from Chartered Accountant.*

6.0 Quantities of work executed as prime contractor, work performed in the past as a nominated sub-contractor will also be considered provided the sub-contract involved execution of all main items of work described in the bid document, provided further that all other qualification criteria are satisfied (in the same name and style) in the last five years :** (Civil Work)

Year	Name of the work	Name of the	Quantity of work performed (cum) @ Remarks							
			Cement Concrete (including RCC & PCC)	Masonry	Earth	WBM	WMM	tuminous Work	Mech / Electrical	Remarks* (indicate Contract) Ref
2012-2013 2013-2014 2014-2015 2015-2016 2016-2017										

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

(a) Existing commitments and on-going works:

Description of works	Place & State	Contract No.	Name & Address of OMFED	Value of Contract (Rs Cr)	Stipulated Period of Completion	Value of works* remaining to be completed (Rs Cr)	Anticipated date completion
1	2	3	4	5	6	7	8

** Attach certificate(s) from the Engineer(s)-in-Charge*

@ The item of work for which data is requested should tally with that specified in ITB.

*** Immediately preceding the financial year in which bids are received.*

 # Delete, if prequalification has been carried out.

(b) Works for which bids already submitted :

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

8.0 Availability of key items of Contractor's Equipment essential for carrying out the Works. The Bidder should list all the information requested below. Refer also the Instruction to Bidders.

scription works	Requirement		Availability proposals			Remarks (from whom to be purchased)
	No.	Capacity	Owned/ Leased to be procured	Nos./Capacity	Age/ Condition	
1	2	3	4	5	6	7

9.0 Qualifications and experience of key personnel required for administration and execution of the Contract. Attach biographical data. Refer also to instructions to Bidders and of the Condition of Contract.

Position	Name	Qualification	Year of Experience (General)	Years of experience in the proposed position

10.0 Proposed sub-contracts and firms involved.

Sanction of the works	Value of Sub-contract	Sub-contractor (Name & Address)	Experience in similar work
1	2	3	4

Attach copies of certificates on possession of valid license for executing water supply/ sanitary work/ building electrification works .

11.0 Financial reports for the last five years: balance sheets, profit and loss statements, auditors' reports (in case of companies/corporation), etc. List them below and attach copies.

12.0 Evidence of access to financial resources to meet the qualification requirements: cash in hand, lines of credit, etc. List them below and attach copies of support documents.

13.0 Name, address and telephone, telex and fax numbers of the Bidders' bankers who may provide references if contacted by the OMFED.

14.0 Information on litigation history in which the Bidder is involved.

Other Party(ies)	OMFED	Cause of Dispute	Amount involved	Remarks whowing Prese Status

15.0 Proposed work method and schedule. The Bidder should attach descriptions, drawings and charts as necessary to comply with the requirements of the Bidding documents.

16.0 Programme

The bidder has to submit the detailed Programme report/ time bar chart/pert chart towards progress of work to be implemented at site.

It is evident from the bar chart that the entire work will be completed within a period of 20 months from the date of acceptance of work order.

17.0 Quality Assurance Programme

The plant / machineries , services, utilities and all other miscellaneous items should confirm to various national / international standard specification.

SAMPLE FORMAT FOR EVIDENCE OF ACCESS TO OR AVAILABILITY OF CREDIT FACILITIES

BANK CERTIFICATE

This is to certify that M/s._____ is reputed company with a good financial standing.

If the contract for the work, namely_____is awarded to the above firm, we shall be able to provide overdraft/credit facilities to the extent of Rs._____ to meet their working capital requirements for executing to the above contract during the contract period.

_____

(Signature) Name of Bank

Senior Bank

Manager

Address of the

Bank

AFFIDAVIT

1. I, the undersigned, do hereby certify that all the statements made in the required attachments are true and correct.

2. The undersigned also hereby certifies that neither our firm M/s_____has abandoned any work awarded to us for such works have been rescinded, during last five years prior to the date of this bid.

3. The undersigned hereby author use(s) and request(s) any bank, person, firm or corporation to furnish pertinent information deemed necessary and requested by the Department to verify this statement or regarding my (our) competence and general reputation.

4. The undersigned understand and agrees that further qualifying information may be requested, and agrees to furnish any such information at the request of the Department Project implementing agency.

_____

(Signed by an Authorised Officer of the Firm)

_____

Title of Officer

_____

Name of Firm

_____

DATE

UNDERTAKING

I, the undersigned do hereby undertake that our firm M/s _____ would invest a minimum cash up to 25% of the value of the work during implementation of the Contract.

_____

(Signed by an Authorised Officer of the Firm)

_____

Title of Officer

_____

Name of Firm

_____

DATE

Odisha State Cooperative Milk Producers[Federation Ltd.

T E N D E R

I/We have read and examined the notice inviting tender, tender clause. Specifications applicable, General Rules and Directions, Conditions of Contract, clauses of contract, Special conditions & other documents and Rules referred to in the conditions of contract and all other contents in the tender document for the work.

I/We hereby tender for the execution of the work specified for the OMFED within the time specified in tender document, viz., technical data and in accordance in all in respects with the of the Conditions of contract and with such materials as are provided for, by, and in respect in accordance with, such conditions so far as applicable.

We agree to keep the tender open for one hundred twenty (180) days from the due date of submission thereof and not to make any modifications in its terms and conditions.

A sum of Rs. ..... has been deposited as earnest money. If I/We, fail to furnish the prescribed performance guarantee within prescribed period, I/we agree that the said OMFED or his successors in office shall without prejudice to any other right or remedy, be at liberty to forfeit the said earnest money absolutely. Further, if/we fail to commence work as specified, I/we agree that OMFED or his successors in office shall without prejudice to any other right or remedy available in law, be at liberty to forfeit the said earnest money and the performance guarantee absolutely, otherwise they said earnest money shall be retained by him towards security deposit to execute all the works referred to in the tender documents upon the terms and conditions contained or referred to therein and to carry out such deviations as may be ordered, up to maximum of the percentage mentioned in tender document and those in excess of that limit at the rates to be determined in accordance with the provision contained in the tender form.

I/We hereby declare that I/We shall treat the tender documents and other records connected with the work as secret/confidential documents and shall not communicate information/derived there from to any person other than a person to whom I/We am/are authorized to communicate the same or use the information in any manner prejudicial to the safety of the State.

Dated..... Signature of Contractor
Postal Address
Witness :
Address:
Occupation :

SECTION - 3

CONDITIONS OF CONTRACT

GENERAL CONDITIONS OF CONTRACT

Part - I

SCOPE OF BIDDER

01) Cleaning of site and construction of boundary wall prior to execution of work.

02) Turn Key execution of the project including civil/structural work, mechanical/services, utilities, supply, erection, installation, testing and commissioning and trial run including civil foundation for machineries.

03) Permanent electrical power supply/installation of 11 KVA sub-station with adequate capacity transformer and VCB in line with the local electrical distribution company.

04) Temporary electrical power and water supply at the site for the purpose of construction/commissioning and trial run.

05) Permanent water supply from deep bore well meeting to the requirement of plant with standby provision to be installed at site on chargeable basis.

06) Main LT Panel with required incoming and outgoing feeders and motor control centre as per requirements.

07) Cables, conduits and earth pit, obtaining permission from local power distribution company and work estimate for installation of 11 KVA substation, statutory inspection of LT,HT & DG set etc.

08) Obtaining NOC consent to establish and operate from OSPCB.

09) Obtaining registration from DIC/MSME for coal license.

10) Pre-project investigation as required under the project.

11) Statutory approval from Directorate of Factory & Boilers for mechanical installation building and drawings etc.

12) Statutory approval for steam boilers /pipe lines from Directorate of Factories & Boilers.

13) Statutory approval relating to legal meteorology.

14) Electricity dues and other dues as applicable during the period of execution of the project till handing over.

15) All such items which are not mentioned here but required for Turn Key Execution of the project, commissioning and trial run.

16) Supply of lubricating oil/Refrigerant during commissioning/trial run.

17) Submission of all civil/structural/mechanical/electrical drawings with project authority for approval and execution.

18) Watch & ward duty for 24 hours throughout the project period.

19) Temporary storage godown for construction material, plant and machineries, site office, & labour amenities etc.

20) Govt. fees as applicable under the project.

21) The bidder should quote item wise rate and break up in detail.

SCOPE OF OMFED

Supply of raw material, packing material, fuel and chemicals during commissioning and trial run.

GENERAL CONDITIONS OF CONTRACT

Part - II

1. The contract means the document forming the tender and acceptances thereof and the formal agreement executed between the competent authority on behalf of the Odisha State Cooperative Milk Producers' Federation Ltd., Bhubaneswar (referred hereinafter as 'OMFED') and the Contractor, together with the documents referred to therein including these conditions, the specifications, designs, drawings and instructions issued from time to time form one contract and shall be complementary to one another.

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

i) The expression works or work shall, unless there be something either in the subject or context repugnant to such construction, be construed and taken to mean the works by or by virtue of the contract contracted to be executed whether temporary or permanent, and whether original, altered, substituted or additional.

ii) The **site** shall mean the land/or other places on. into or through which work is to be executed under the contract or any adjacent land, path or street through which 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.

iii) The **Contractor** shall mean the individual, firm or company, whether incorporate or not, undertaking the works and shall include the legal personal representative of such individual or the persons composing such firm or company, or the successors of such firm or company and the permitted assignees of such individual, firm of company.

iv) The OMFED means the Odisha State Cooperative Milk Producers' Federation Ltd.

v) The Engineer -In-Charge means the Engineer/ officer who shall supervise and be in-charge of the work.

vi) **OMFED shall** mean the Odisha State Cooperative Milk Producers' Federation Ltd..

vii) **Competent Person to sign agreement**: - Managing Director or the person authorized by Managing Director shall be competent authority to sign.

viii) **Excepted Risk** are risks due to riots (other than those on account of contractor employees), war (whether declared or not) invasion, act of foreign enemies, hostilities, civil war, rebellion revolution, insurrection, military or usurped power, any acts of **OMFED**, damages from aircraft, acts of God, such as earthquake, lightening and unprecedented floods, and other causes over which the contractor has no control and accepted as such by the **Accepting Authority** or causes solely due to use or occupation by OMFED of the part of the works in respect of which a certificate of completion has been issued or a cause solely due to OMFED's faulty design of works.

Provided that the Contractor is to take all necessary measures to prevent such adverse impact and damage and he would also show that he has taken all due precaution to prevent /minimize any adverse effect/ damage from the above.

ix) **The Defect liability certificate** is the certificate issued by General Manager (Proj) after defect liability period has ended and upon correction of defects by the contractor.

x) **The defect liability period** is will be decided by OMFED for different nature of works from date of completion of the work and must be mentioned in the Agreement. It would be decided by the OMFED for different nature of work from time to time as mentioned in Contract data.

xi) **The intended completion** is the time intended to complete the work by the contractor.

xii) **The start date** is given in the contract data. It is the date when the contractor shall commence execution of the works. It does not necessarily coincide with any of the site possession date.

xiii) **A sub contractor** is a person or corporate body who has a contract with the contractor to carry out a part of the construction work in the contract, which includes work on the site.

xiv) **Temporary works** are works designed, constructed, installed and removed by the contractor that are needed for construction or installation of the works.

xv) **Authority** means Managing Director, Odisha State Cooperative Milk Producers' Federation Ltd., Odisha who invites tenders on behalf of **OMFED** as specified in tender document.

xvi) **Specifications** mean the specifications followed by relevant Authority of the Government of India or State Government in the area where the work is to be executed and/or as specified by OMFED.

xx) **Tender value/Agreement value** means the value of the entire work as stipulated in the letter award;

3. Where the context so requires, words imparting the singular only also include the plural and vice versa. Any reference to masculine gender shall whenever required include feminine gender and vice versa.
4. Heading and Marginal notes to these General Conditions of Contract shall not be deemed to form part thereof or be taken in to consideration in the interpretation or construction thereof or of the contract.
5. The contractor must furnish, free of cost one certified copy of the contract documents with standard specifications and such other printed and published documents, together with all drawings in three sets & in CD as may be forming part of the tender papers. None of these documents shall be used for any purpose other that of this contract.
6. The work to be carried out under the Contract shall, except as otherwise provided these conditions, include all labour, materials, tools, plants, equipment and transport which may be required in preparation of and for and in the full and entire execution and completion of the works.
7. The contractor shall be deemed to have satisfied himself before tendering as to the correctness and sufficiency of his tender for the works and of the rates and prices quoted in the Financial Bid, which rates and prices shall, except as otherwise provided cover all his obligations under the Contract and all matters and things necessary for the proper completion and maintenance of the works.
8. The several documents forming the contract are to be taken as mutually explanatory of one another, detailed drawings being followed in preference to small scale drawing and figured dimensions in preference to scale and special conditions in preference to General Conditions.

i) In the case of discrepancy between the schedule of Quantities, the Specifications and/or the Drawings, the following order of preference shall be observed:-
ii) Description of Schedule of Quantities.
iii) Particular Specification and Special Condition, if any
iv) Drawings.
v) Indian Standard Specifications of B.I.S.

If there are varying or conflicting provisions made in any one document forming part of the contract, Managing Director shall be the deciding authority with regard to the intention of the document and his decision shall be final and binding on the contractor.

Any error in description, quantity or rate in Schedule of Quantities or any omission there from shall not vitiate the Contract or release the Contractor from the execution of the whole or any part of the works comprised therein according to drawings and specifications or from any of his obligations under the contract.

9. The successful tenderer/contractor, after submitting the performance guarantee i.e. within 15 days of receipt of letter of acceptance shall attend OMFED for authentication, signing and completion of the contractor document and execute the agreement consisting of:-

i) The notice inviting tender, all the documents including drawings, if any, forming the tender as issued at the time of invitation of tender and acceptance thereof together with any correspondence leading thereto.

ii) Standard Form as mentioned in tender format consisting of:

Various standard clauses with corrections up to the date stipulated in tender norms along with annexure thereto.

CLAUSE OF CONTRACT

CLAUSE 1 (Performance Guarantee)

The contractor shall submit an irrevocable PERFORMANCE GUARANTEE of 5% (Five percent) of the contract amount in the shape as

- Demand Draft of a nationalised / scheduled Bank issued in favour OMFED,

Or

- A bank guarantee issued by a Nationalized/Scheduled bank in India.

iii) The security shall be repaid to the bidder after 15 (Fifteen) month of successful installation / trial run & successful commissioning / handing over of entire.

(i) The performance Guarantee shall be initially valid up to Twenty Months beyond the defect liability period. In case the time for completion of work gets enlarged, the contractor shall get the validity of performance Guarantee extended to cover such enlarged time for completion of work. After recording of the completion certificate for the work by the competent authority, the performance guarantee shall be returned to the contractor without any interest.

(ii) The authority shall not make a claim under the Performance guarantee except for amounts to which the OMFED is entitled under the contract (notwithstanding and/or without prejudice to any other provisions in the contract agreement) in the event of:

(a) Failure by the contractor to extend the validity of the Performance Guarantee as described herein above, in which event the OMFED may claim the full amount of the Performance guarantee.

(b) Failure by the contractor to pay OMFED any amount due, either as agreed by the contractor or determined under any of the Clauses/Conditions of the agreement, within 30 days of the service of notice to this effect by General Manger Project..

(c) Failure by the Agency to rectify any defects as defined in the defect liability clause in the tender of contract data to the satisfaction of the Engineer in charge the contractor has to pay OMFED, any amount due, either as agreed by the Contractor or determined under any of the Clauses/ Conditions of the Agreement, within 30 days of the service of notice to this effect by Engineer in Charge.

(iii) In the event of the contract being determined or rescinded under provisions of any of the clause/condition of the agreement, the performance guarantee shall stand forfeited in full and shall be absolutely at the disposal of the **OMFED**.

CLAUSE 1 A (Deduction from contractor)

All compensations or the other sums of money payable by the contractor under the terms of this contract may be deducted from, or paid by the sale of a sufficient part of his security deposit or, from any sums which may be due to or may become due to the contractor by the OMFED on any account whatsoever and in the event of his Security Deposit being reduced by reason of any such deductions or sale as aforesaid, the contractor shall within 10 days make good in cash or fixed deposit receipt tendered by the Scheduled Banks (if deposited for more than 12 months) endorsed in favour of the OMFED, Bhubaneswar any sum or sums which may have been deducted from, or raised by sale of his security deposit or any part thereof.

CLAUSE 2 (Contractor failed to maintain the required progress)

If the contractor fails to maintain the required progress as per tender clause or to complete the work and clear the site on or before the contract or extended date of completion, he shall, without prejudice to any other right or remedy available under the law to the **OMFED** on account of such breach, pay as agreed compensation the amount calculated at the rates stipulated below as the Managing Director (whose decision in writing shall be final and binding) may decide on the amount of tendered value of the work for every completed day/month (as applicable) that the progress remains below that or that the work remains incomplete.

This will also apply to items or group of items for which a separate period of completion has been specified.

Compensation @ 1.5 % per month of delay to for delay of work be computed on per Day basis

Provided always that the total amount of compensation for delay to be paid under this condition shall not exceed **10% of the Tendered Value** of work or to the Tendered Value of the item or group of items of work for which a separate period of completion is originally given.

The amount of compensation may be adjusted or set-off against any sum payable to the Contractor under this or any other contract with the OMFED. In case, the contractor does not achieve a particular milestone mentioned in tender clause, the amount shown against that milestone shall be withheld, to be adjusted against the compensation levied at the final grant of extension of time. Withholding of this amount on failure to achieve a milestone, shall be automatic without any notice to the contractor. However, if the contractor catches up with the progress of work on the subsequent milestone(s), the withheld amount shall be released. In case the contractor fails to make up for the delay in subsequent milestone(s), amount mentioned against each milestone missed subsequently also shall be withheld. However, no interest, whatsoever, shall be payable on such withheld amount.

CLAUSE 3 (Remedy against the contractor for inferior workmanship)

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

i) If the contractor having been given by the Engineer In Charge a notice in writing to rectify, reconstruct or replace any defective work or that the work is being performed in an inefficient or otherwise improper or unworkman like manner shall omit to comply with the requirement of such notice for a period of seven days thereafter.

ii) If the contractor being a company shall pass a resolution or the court shall make an order that the company shall be wound up or if a receiver or a manager on behalf of a creditor shall be appointed or if circumstances shall arise which entitle the court or the creditor to appoint a receiver or a manager or which entitle the court to make a winding up order.

iii) if the contractor has, without reasonable cause, suspended progress of the work or has failed to proceed with the work with due diligence so that in the opinion of the Engineer In Charge (which shall be final and binding) he will be unable to secure completion of the work by the date for completion and continues to do so after a notice in writing of seven days .

iv) If the contractor fails to complete the work within the stipulated date or items of work with individual date of completion, if any stipulated, on or before such date(s) of completion and does not complete them within the period specified in a notice given in writing in that behalf by the Engineer In Charge.

v) If the contractor persistently neglects to carry out his obligations under the contract and/or commits default in complying with any of the terms and conditions of the contract and does not remedy it or take effective steps to remedy it within 7 days after a notice in writing is given to him in that behalf by the Engineer In Charge.

vi) If the contractor commits any acts mentioned in tender clause hereof:

vii) If the work not started by the contractor within One month of the stipulated time subject to maximum of 45 days.

When the contractor has made himself liable for action under any of the cases aforesaid, the Engineer In Charge on behalf of OMFED shall have powers:

a) To determine or rescind the contract as aforesaid (of which termination or rescission notice in writing to the contractor under the hand of Engineer In Charge shall be conclusive evidence). Upon such determination or rescission the Earnest Money Deposit, Security Deposit already recovered and Performance Guarantee under the contract shall be liable to be forfeited and shall be absolutely at the disposal of the OMFED.

b) After giving notice to the contractor to measure up the work of the contractor and to take such whole, or the balance or part thereof as shall be un-executed out of his hands and to give it to another contractor to complete the work. The contractor, whose contract is determined or rescinded as above, shall not be allowed to participate in the tendering process for the balance work.

In the event of above course(s) being adopted by the Engineer In Charge the contractor shall have no claim to compensation for any loss sustained by him by reasons of his having purchased or procured any materials or entered into any engagements or made any advances on account or with a view to the execution of the work or the performance of the contract. And in case action is taken under any of the provision aforesaid, the contractor shall not be entitled to recover or be paid any sum for any work thereof or actually performed under this contract

unless and until the Engineer In Charge has certified in writing the performance of such work and the value payable in respect thereof and he shall only be entitled to be paid the value so certified.

CLAUSE 3A (Delay due unforeseen situation)

In case, the work cannot be started due to reasons not within the control of the contractor within One month of the stipulated time for completion of work, either party may close the contract. In such eventuality, the Earnest Money deposit and the Performance Guarantee of the contractor shall be refunded, but no payment on account of interest, loss of profit or damages etc. shall be payable at all.

CLAUSE 4 (Extra liabilities to contractor)

In any case in which any of the powers conferred upon the Engineer in charge by Clause- 3 thereof, shall have become exercisable and the same are not exercised the non-exercise thereof shall not constitute a waiver of any of the conditions hereof and such powers shall not withstanding be exercisable in the event of any future case of default by the contractor and the liability of the contractor for compensation shall remain unaffected. In the event of the Engineer in charge putting in force all or any of the powers vested in him under the preceding clause he may, if he so desires after giving a notice in writing to the contractor, take possession of (or at the sole discretion of the Engineer in charge which shall be final and binding on the contractor) use as on hire (the amount of the hire money being also in the final determination of the Engineer-in-charge) all or any tools, plant, materials and stores, in or upon the works, or the site thereof belonging to the contractor, or procured by the contractor and intended to be used for the execution of the work. or any part thereof, paying or allowing for the same in account at the contract rates or, in the case of these not being applicable, at current market rates to be certified by the Consultant-In-Charge, whose certificate thereof shall be final, and binding on the contractor, clerk of the works, foreman or other authorized agent to remove such tools, plant, materials, or stores from the premises (within a time to be specified in such notice) in the event of the contractor failing to comply with any such requisition, the Engineer in charge may remove them at the contractor's expense or sell them by auction or private sale on account of the contractor and his risk in all respects and the certificate of the Engineer in charge as to the expenses of any such removal and the amount of the proceeds and expenses of any such sale shall be final and conclusive against the contractor.

CLAUSE 5 (Time and Extension for Delay)

The time allowed for execution of the Works as specified in the tender or the extended time in accordance with these conditions shall be the **essence of the Contract**. The execution of the works shall commence from such time period as mentioned in letter of acceptance or from the date of handing over of the site whichever is later. If the Contractor commits default in commencing the execution of the work as aforesaid, **OMFED** shall without prejudice to any other right or remedy available in law, be at liberty to forfeit the earnest money and performance guarantee absolutely.

As soon as possible, after the contract is concluded, the Contractor shall submit a Time

& Progress Chart for each milestone and get it approved by OMFED. The Chart shall be prepared in direct relation to the time stated in the Contract documents for completion of items of the work. It shall indicate the forecast of the dates of commencement and completion of various trades of sections of the work and may be amended as necessary by agreement between the Engineer in charge and Contractor within the limitations of time imposed in the contract documents, and further to ensure good progress during the execution of the work, the contractor shall in all cases in which the time allowed for any work, exceeds one month (save for special jobs for which a separate Programme has been agreed upon) complete the work as per milestone given in tender.

If the work(s) be delayed by.

i) Force majeure, or
ii) Abnormally bad weather, or
iii) Serious loss or damage by fire, of

iv) Civil commotion, local/commotion of workmen, strike or lockout] affecting any of the trades employed on the work, or

v) Delay on the part of other contractors or tradesmen engaged by Engineer in charge in executing work not forming part of the Contract, or

vi) Any other cause which, in the absolute discretion of the authority or beyond the Contractor's control, then upon the happening of any such event causing delay, the Contractor shall immediately give notice thereof in writing to the Engineer in charge but shall nevertheless use constantly his best endeavors to prevent or make good the delay and shall do all that may be reasonably required to the satisfaction of the Engineer in charge to proceed with the works.

Request for the rescheduling of Milestones and extension of time, to be eligible for consideration, shall be made by the contractor in writing within fourteen days of the happening of the event causing delay on the prescribed form. The Contractor may also, if practicable, indicate in such a request, the period for which extension is desired.

In any such case the OMFED give a fair and reasonable extension of time and reschedule the milestones for completion of work. Such extension shall be communicated to the Contractor by the Engineer in charge in writing, within 3 months of the date of receipt of such request. Non application by the contractor for extension of time shall not be a bar for giving a fair and reasonable extension by the Engineer in charge and this shall be binding on the contractor.

CLAUSE 6 (Measurement of Work Done)

Engineer in Charge shall, except as otherwise provided, ascertain and determine measurement and the value in accordance with the contract of work done.

All measurement of all items having financial value shall be entered in Measurement Book and/or level field book; so that a complete record is obtained of all works performed under the contract. All measurements and levels shall be taken jointly by the Engineer in Charge or his authorized representative and by the contractor or his authorized representative from time to time during the progress of the work and such measurements shall be signed and dated by the Engineer in Charge and the contractor or their representatives in token of their acceptance. If the contractor objects to any of

the measurements recorded, a note shall be made to that effect with reason and signed by both the parties.

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

The contractor shall, without extra charge, provide all assistance with every appliance, labor and other things necessary for measurements and recording levels.

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

The contractor shall give not less than seven days notice to the General Manager (Proj)or his authorized representative 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 dimension thereof be taken before the same is covered up or placed beyond the reach of measurement and shall not cover up and place beyond reach of measurement any work without consent in writing of the Engineer-In-Charge or his authorized representative in charge of the work who shall within the aforesaid period of seven days inspect the work, and if any work shall be covered up or placed beyond the reach of measurements without such notice having been given or the Consultant-In- Charge's consent being obtained in writing, the same shall be uncovered at the contractor's expense, or in default thereof, no payment or allowance shall be made for such work or the materials with which the same was executed.

General Manager (Proj) or his authorized representative may cause either themselves or through another officer of the OMFED to check the measurements recorded jointly or otherwise as aforesaid and all provisions stipulated herein above shall be applicable to such checking of measurements or levels.

It is also a term of this contract that recording of measurements of any item of work in the measurement book and/or its payment in 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 defects noticed till completion of the defects liability period.

CLAUSE 7 (Payment on Intermediate Certificate to be regarded as Advances)

All such interim payments shall be regarded as payment by way of advances against final payment only and shall not preclude the requiring of bad, unsound and imperfect or unskilled work to be rejected, removed, taken away and reconstruct of such payment may be modified or corrected by any subsequent such certificate(s) or by the final certificate and shall not by itself be conclusive evidence that any work or materials to which it relates is/are in accordance with the contract and specifications. Any such interim payment, or any part thereof shall not in any respect conclude, determine or affect in any way powers of the General Manager (Proj) under the contract or any of such payments be treated as final settlement and adjustment of accounts or in any way vary or affect the contract.

Pending consideration of extension of date of completion interim payments shall continue to be made as herein provided, without prejudice to the right of the OMFED to take action under the terms of this contract for delay in the completion of work, if the extension of date of completion is not granted by the competent authority.

CLAUSE 8 (Completion notice)

Within ten days of the completion of the work, the contractor shall give notice of such completion to the General Manager (Project) and within thirty days of the receipt of such notice, the General Manager (Project)shall inspect the work and if there is no defect in the work shall furnish the contractor with a final certificate of completion, otherwise a provisional certificate of physical completion indicating defects (a) to be rectified by the contractor and/or (b) for which payment will be made at reduced rates, shall be issued. But no final certificate of completion shall be issued, nor shall the work be considered to be complete until the contractor shall have removed from the premises on which the work shall be executed all scaffolding, surplus materials, rubbish and all huts and sanitary arrangements required for his/their work people on the site in connection with the execution of the works as shall have been erected or constructed by the contractor(s) and cleaned off the dirt from all wood work, doors, windows, walls, floor or other parts of the building, in, upon, or about which the work is to be executed or of which he may have had possession for the purpose of execution thereof, If the contractor shall fail to comply with the requirements of this clause as to removal of scaffolding, surplus materials and rubbish and all huts and sanitary arrangements as aforesaid and cleaning off dirt on or before the date fixed for the completion of work, the General Manager (Proj) may at the expense of the contractor remove such scaffolding surplus materials and rubbish etc. and dispose of the same as he thinks fit and clean off such dirt as aforesaid, and the contractor shall have no claim in respect of scaffolding or surplus materials as aforesaid except for any sum actually realized by the sale thereof.

CLAUSE 8 A (Contractor to Keep Site Clean)

When the annual repairs and maintenance of works are carried out, the

splashes and droppings from white washing, color washing, painting etc. on walls, floor, windows etc. shall be removed and the surface cleaned simultaneously with the completion of these items of work in the individual rooms, quarters or premises etc. where the work is done without waiting for the actual completion of all the other items of work in the contract. In case the contractor fails to comply with the requirements of this clause, the Engineer in charge shall have the right to get this work done at the cost of the contractor either ideally or through any other agency. Before taking such action, the Engineer in charge shall give ten days notice in writing to the contractor.

CLAUSE 8 B (Completion Plans to be submitted by the Contractor)

The contractor shall submit completion plan as required vide General Specifications within thirty days of the completion of the work.

In case, the contractor fails to submit the completion plan as aforesaid, he shall be liable to pay a sum equivalent to 1.5% of the value of the work.

CLAUSE 9 (Payment of Final Bill)

The final bill shall be submitted by the contractor in the same manner as specified in payment terms details within three months of physical completion of the work or within one month of the date of the final certificate of completion furnished by the Engineer in charge whichever is earlier. No further claims shall be made by the contractor after submission of the final bill and these shall be deemed to have been waived and extinguished. Payments of those items of the bill in respect of which there is no dispute and of items in dispute, for quantities and rates as approved by Engineer in charge, will, as far as possible be made within the period specified herein under, the period being reckoned from the date of receipt of the bill by the Engineer in charge.

CLAUSE 10 (Materials to be supplied by OMFED) Deleted

CLAUSE 10 A (The contractor shall, at his own expense, provide all materials**)**

The contractor shall, at his own expense and without delay; supply to the Engineer in charge samples of materials to be used on the work and shall get these approved in advance. All such materials to be provided by the Contractor shall be in conformity with the specifications laid down or referred to in the contract. The contractor shall, if requested by the Engineer in charge furnish proof, to the satisfaction of the Engineer in charge that the materials so comply. The Engineer in charge shall within thirty days of supply of samples or within such further period as he may require intimate to the Contractor in writing whether sample are approved by him or not. If samples are not approved, the Contractor shall forthwith arrange to supply to the Engineer in charge for his approval fresh samples complying with the specifications laid down in the contract. When materials are required to be tested in accordance with specifications, approval of the Engineer in charge shall be issued after the test results are received.

The Contractor shall at his risk and cost submit the samples of materials to be tested or analyzed and shall not make use of or incorporate in the work any

materials represented by the samples until the required testes or analysis have been made and materials finally accepted by the Engineer in charge. The Contractor shall not be eligible for any claim or compensation either arising out of any delay in the work or due to any corrective measures required to be taken on account of and as a result of testing of materials.

The contractor shall, at his risk and cost, make all arrangements and shall provide all facilities as the Engineer in charge may require for collecting, and preparing the required number of samples for such tests at such time and to such place or places as may be directed by the Engineer in charge and bear all charges and cost of testing unless specifically provided for otherwise elsewhere in the contract or specifications. The Engineer in charge or his authorized representative shall at all time have access to the works and to all workshops and places where work is being prepared or from where materials, manufactured articles or machinery are being obtained for the works and the contractor shall afford every facility and every assistance in obtaining the right to such access.

The Engineer in charge shall have full powers to require the removal from the premises of all materials which in his opinion are not in accordance with the specifications and in case of default the Engineer in charge shall be at liberty to employ at the expense of the contractor, other persons to remove the same without being answerable or accountable for any loss for damage that may happen or arise to such materials. The Engineer in charge shall also have full powers to require other proper materials to be substituted thereof and in case of default the Engineer in charge may cause the same to be supplied and all costs which may attend such removal and substitution shall borne by the Contractor.

CLAUSE 10 B (Deleted) (Secured Advance on Non-perishable Materials / Interest & Recovery)

i) The contractor, on signing an indenture in the form to be specified by the Engineer in Charge, shall be entitled to be paid during the progress of the execution of the work up to 75% of the assessed value of any materials which are in the opinion of the Engineer In Charge non perishable, non-fragile and non combustible and are in accordance with the contract and which have been brought on the site in connection therewith and are adequately stored and/or protected against damage by weather or other causes but which have not at the time of advance been incorporated in the works. When materials on account of which ad advance has been made under this sub-clause are incorporated in the work the amount of such advance shall be recovered/deducted from the next payment made under any or the clause or clauses of this contract.

ii) Any materials including tools, plants, equipments etc. brought to the site shall not be removed from the sites without the written permission of the Engineer In Charge.

CLAUSE 10 C (Payment on Account of Increase/decrease in Price of construction

materials after receipt of tender/ Rate offer (For all projects Irrespective of cost & completion period less than 18 months)

If after submission of the Rate Offer the price of any material incorporated in the works (not being a material supplied form the Engineer in Charge stores in accordance with tender clause thereof) and/or wages of labour increases as a direct result of the coming into force of any fresh law, or statutory rule or order (but not due to any changes in sales tax) and such increase in the price and /or wages prevailing at the time of the last stipulated date for receipt of the Rate Offers including extensions if any for the work, and the Agency thereupon necessarily and properly pays in respect of that material (incorporated in the works) such increased price and/or in respect of labour engaged on the execution, of the work such increased wages. Then the amount of the contract shall accordingly be varied and provided further that any such increase shall not be payable if such increase has become operative after the stipulated date of completion of the work in question.
submission of the Rate Offer, the price of any material incorporated in the works (not being a material supplied from the Engineer in Charge stores in accordance with clause 10 thereof) and/or wages of labour is decreased as a direct result of the coming not force of any law or statutory rules or order (but not due to any changes in sales tax) and such decrease in the prices and/or wages prevailing at the time of receipt of the Rate Offer for the work. OMFED shall in respect of materials incorporated in the works (not being materials supplied from the Manager's (Engg) stores in accordance with tender clause thereof) and/or labour engaged on the execution of the work after the date of coming into force of such law statutory rule or order be entitled to deduct form the dues of the Agency such amount as shall be equivalent to the difference between the prices of the materials and/or wages as prevailed at the time of the last stipulated date for receipt of Rate Offers including extensions if any for the work and the price of materials and/or wages of labour on the coming into force of such law, statutory rule or order.
The Agency shall, for purpose of this condition, keep such books of account and other documents as are necessary to show the amount of any increase claimed or reduction available and shall allow inspection of the same by a duly authorized representative of OMFED, and further shall, at the request of the Engineer in Charge may require any documents so kept and such other information as the Engineer in Charge may require.
The Agency shall, within a reasonable time of his becoming aware of any alteration in the price of any such material and/or wages of labour, give notice thereof to the Engineer in Charge stating that the same is given pursuant to this condition together with all information relating thereto which he may be in position to supply.

CLAUSE 10 CA (Payment due to Increase/Decrease in Prices/Wages after Receipt of Tender for Works (Time Period more than 18 months)

If after submission of the tender/Rate offer, the price of cement or steel reinforcement bars/bitumen incorporated in the works increase (s) beyond the price(s) prevailing at the time of the last stipulated date for receipt of tenders rate imitation (including extensions, if any) for the work, then the amount of the contract shall accordingly be varied and provided further that any such increase shall not be payable if such increase has become operative after the stipulated date of completion of work in question.

If after submission of the tender/Rate offer the price of cement and/or steel reinforcement bars/bitumen incorporated in the works is decreased. OMFED shall in respect of these materials incorporated in the works be entitled to deduct from the dues of the contractor such amount as shall be equivalent to the difference between the prices of Cement and/or Steel reinforcement bars/bitumen as prevailed at the time of last stipulated date for receipt of tenders including extensions if any for the work and the prices of these materials on the coming into force of such base price of cement and/or steel reinforcement bars/bitumen issued under authority of Schedule of Rate Committee.

The amount increase/decrease in; prices shall be determined by the All India Wholesale Price Indices for Cement and Steel (bars and rods) as published by Economic Advisor to Government of India, Ministry of Commerce and Industry and base price for cement and/ or steel reinforcement bars/ bitumen as issued under authority of Schedule of Rate Committee as valid on the last stipulated date of receipt of tender, including extension if any and for the period under consideration.

The amount of the contract shall accordingly be varied for cement or steel reinforcement bars/ bitumen and will be worked out as per the formula given below:-
Adjustment for Cement component

(i) Price adjustment for increase or decrease in the cost of cement procured by the contractor shall be paid in accordance with the following formula

$$Vc=Pc \times Qc \times (C-C0)/C0$$

Vc= Variation in cement cost i.e. increase or decrease in the amount in rupees to be paid or recovered.
Pc= Base Price of cement as issued under Prevalent Schedule of Rate at the time of the last stipulated date of receipt of tender including extensions, if any.
Qc= Quantity of cement used in the works since previous bill.
C0= The all India wholesale price index for cement on 28 days preceding the date of opening of Bids as published by the Ministry of Industrial Development, Government of India, New Delhi.

C1= The all India average wholesale price index for cement for the month under consideration as published by Ministry of Industrial Development, Government of India, New Delhi.
(In respect of the period, time of extension is granted by the OMFED, the index prevailing at the time of stipulated date of completion or the prevailing index of the period under consideration, whichever is less, shall be considered.)
Adjustment for Steel component
(I) Price adjustment for increase or decrease in the cost of steel procured by the contractor shall be paid in accordance with the following formula:

$$Vs= Ps \times Qc \times (S1-S0)/S0$$

Vs= Variation in cost of steel reinforcement bars i.e. increase or decrease in the amount in rupees to be paid or recovered.
Ps= Base Price of steel as issued under Prevalent Schedule of Rate at the time of the last stipulated date of receipt of tender including extensions, if any.
Qs= Quantity of steel used in the works since previous bill.

S0= The all India wholesale price index for steel (Bars and Rods) on 25 days preceding the date of opening of Bids as published by the Ministry of Industrial Development, Government of India, New Delhi.

S1= The all India average wholesale price index for steel (Bars and Rods) for the month under consideration as published by Ministry of Industrial Development, Government of India, New Delhi.

(In respect of the period, time of extension is granted by the OMFED, the index prevailing at the time of stipulated date of completion or the prevailing index of the period under consideration, whichever is less, shall be considered.)

Note: For the application of this clause, index of Bars and Rods has been chosen to represent steel group.

Adjustment for bitumen component

(ii) Price adjustment for increase or decrease in the cost of bitumen shall be paid in accordance with the following formula:

Vb= Pb x Qb x (B1-B0)/B0

Vb= Variation in cost of bitumen reinforcement bars i.e. increase or decrease in the amount in rupees to be paid or recovered.

Pb= Base Price of bitumen as issued under Prevalent Schedule of Rate at the time of the last stipulated date of receipt of tender including extensions, if any.

Qb= Quantity of bitumen used in the works since previous bill.

B0= The office retail price of bitumen at the IOC depot at nearest center on the daye 28 days prio to date of opening of Bids.

B1= The official retail price of bitumen of IOC depot at nearest center for the 15th day of the month under consideration.

(In respect of the period, time of extension is granted by the OMFED, the index prevailing at the time of stipulated date of completion or the prevailing index of the period under consideration, whichever is less, shall be considered.)

CLAUSE 10 CC (Decrease / increase of other items)

If the price of materials and/or wages of labour required for execution of the work increase, the contractor shall be compensated for such increase as per provision detailed below and the amount of the contract shall accordingly be varied, subject to the condition that such compensation for escalation in prices shall be available only for the work done during the stipulated period of the contract. No escalation shall be paid for work executed in extended contract period even of extension of time is granted without any action under tender Clause and also no such compensation shall be payable for a work for which the stipulated period of completion is equal to or less than the time as specified in tender document. Such compensation for escalation in the prices of material and labour, when due, shall be worked out based on the following provisions:-

i) The base date for working out such escalation shall be the last stipulated date of receipt lf tender including extension, if any.

ii) The cost of work on which escalation will be payable shall be reckoned as below:

a) Gross value of work done up to this quarter: (A)

b) Gross value of work done up to the last quarter: (B)

c) Gross value of work done since previous quarter (A-B): (C)

d) Full assessed value of Secured Advance fresh paid in this quarter : (D)

e) Full assessed value of Secured Advance recovered in this quarter : (E)

f) Full assessed value of Secured Advance for which Escalation in payable in this quarter (D-E):
(F)

g) Advance payment made during this quarter: (G)

h) Advance payment recovered during this quarter: (H)

i) Advance payment for which escalation is payable in this quarter (G-H) : (I)

j) Extra items paid as per Clause 12 based on prevailing market rates during this quarter : (J)

Then, $M = C \pm F \pm I - J$

$N = 0.85\ M$

k) Less cost of material supplied by the OMFED as per Clause 10 and recovered during the quarter : (K)

l) Less cost of services rendered at fixed charges as per Clause 34 and recovered during the quarter : (L)

Cost of work for which escalation is applicable:

$W = N - (K+L)$

iii) Components of cement, steel, materials, labour, P.O.L., etc. shall be pre-determined for every work and incorporated in the conditions of contract attached to the tender papers included in Schedule 'E'. The decision of the Engineer in Charge in working out such percentage shall be binding on the contractor.

iv) The compensation for escalation for cement, steel, materials and P.O.L. shall be worked out as per the formula given below:-

a) Adjustment for component of **'Cement'**

$$V_C = W \times \frac{X_C}{100} \times \frac{CI - CI_O}{CI_O}$$

V_C = Variation in cement cost i.e. increase or decrease in the amount in rupees to be paid or recovered.

W = Cost of work done worked out as indicated in sub-para (ii) of Clause 10CC.

X_C = Component of cement expressed as percent of the total value of work.

CI = All India Whole Sale Price Index for cement for the period under consideration as published by the Economic Advisor to Government of India, Ministry of Industry & Commerce.

CI_O : All India Whole Sale Price Index for cement as published by the Economic Advisor to Government of India, Ministry of Industry & Commerce as valid on the last stipulated date of receipt of tenders including extensions, if any.

b) Adjustment for component of **'Steel'**

SI_O

$$V_S = W \times \frac{X_S}{} \times \frac{SI - SI_O}{}$$

V_S = Variation in steel cost i.e. increase or decrease in the amount in rupees to be paid or recovered.

W = Cost of work done worked out as indicated in Clause 10CB

X_S = Component of steel expressed as percent of the total value of work.

SI = All India Whole Sale Price Index for steel (bars & rods) for the period under consideration as published by the Economic Advisor to Government of India , Ministry of Industry & Commerce. However the price index shall be limited to for the month when the last consignment of steel reinforcement for the work is procured or for the month in which half of the stipulated contract period is over which ever of these two is earlier.

SI_O = All India Whole Sale Price Index for steel (bars & rods) as published by the Economic Advisor to Government of India, Ministry of Industry & Commerce as valid on the last stipulated date of receipt of tenders including extensions, if any.

c) Adjustment for civil component (except cement and steel)/ electrical component of construction **'Materials'**

$$V_m = W \times \frac{X_m}{MI_O} \times \frac{MI - MI_O}{}$$

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

W = Cost of work done worked out as indicated in Clause 10CB.

X_m = Component of 'materials' expressed as percent of the total value of work.

MI = All India Whole Sale Price Index for civil component/electrical component of construction materials as worked out on the basis of All India Wholesale Price Index for Individual Commodities/Group Items for the period under consideration as published by the Economic Advisor to Government of India, Ministry of Industry & Commerce and applying weightage to the Individual Commodities/Grout Items.

MI_O = All India Whole Sale Price Index for civil component/electrical component of construction materials as worked out on the basis of All India Wholesale Price Index for Individual Commodities/Group Items valid on the last stipulated date of receipt of tender including extension, if any, as published by the Economic Advisor to Government of India, Ministry of Industry & Commerce and applying weightages to the Individual Commodities/Grout Items.

***Note :** relevant component only will be applicable.

(d) Adjustment for component of **'POL'**

$$V_F = W \times \frac{Z}{100} \times \frac{(FI - FI_O)}{FI_O}$$

V_F = Variation in cost of fuel, oil and lubricant, increase or decrease in the amount in rupees to be paid or recovered.

W = Cost of work done worked out as indicated in Clause 10CB.

Z = Component of P.O.L. expressed as a percent of total value of work as indicated under the special conditions of contract.

FI = All India Wholesale Price Index for Fuel, Oil & Lubricant for the period under consideration as published by Economic Advisor to Govt. of India, Ministry of Industry & Commerce, New Delhi.

FI_O = All India Wholesale Price Index for Fuel, Oil & Lubricant valid on the last

stipulated date of receipt of tender including extension, if any.

v) The following principles shall be followed while working out the indices mentioned in para (iii) above.

(a) The compensation for escalation shall be worked out at quarterly intervals and shall be with respect to the cost of work done as per bills paid during the three calendar months of the said quarter. The first such payment shall be made at the end of three months after the month (excluding) in which the tender was accepted and thereafter at three months interval. At the time of completion of the work, the last period for payment might become less than 3 months, depending on the actual date of completion.

(b) The index (MI/FI etc.) relevant to any quarter/period for which such compensation is paid shall be the arithmetical average of the indices relevant to the three calendar months. If the period up to date of completion after the quarter covered by the last such installment of payment, is less than three months, the index MI and FI shall be the average of the indices for the months falling within that period.

vi) The compensation for escalation for labour shall be worked out as per the formula given below :-

$$V_L = W \times \frac{Y}{100} \times \frac{(LI - LI_o)}{LI_o}$$

V_L : Variation in labour cost i.e. amount of increase or decrease in rupees to be paid or recovered.

W : Value of work done worked out as indicated in sub-para (ii) above.

Y : Component of labour expressed as a percentage of total value of the work.

LI_o : Minimum daily wage in rupees of an unskilled adult male mazdoor, fixed under any law, statutory rule or order as on the last stipulated date of receipt of tender including extension, if any.

LI : Minimum wage in rupees of an unskilled adult male mazdoor, fixed under any law, statutory rule or order as applicable on the last date of the quarter previous to the one under consideration.

vii) The following principles will be followed while working out the compensation as per sub-para (vi) above.

(a) The minimum wage of an unskilled male mazdoor mentioned in sub para (vi) above shall be the higher of the wage notified by Government of India, Ministry of Labour and that notified by the local administration both relevant to the place of work and the period of reckoning.

(b) The escalation for labour also shall be paid at the same quarterly intervals when escalation due to increase in cost of materials and/or P.O.L. is paid under this clause. If such revision of minimum wages take place during any such quarterly intervals, the escalation compensation shall be payable at revised rates only for work done in subsequent quarters.

(c) Irrespective of variations in minimum wages of any category of labour, for the purpose of this clause, the variation in the rates for an unskilled adult male mazdoor alone shall from the basis for working out the escalation compensation payable on the labour component.

viii) In the event the price of materials and/or wages of labour required for execution of the work decrease/s, there shall be a downward adjustment of the cost of work so that such price of materials and/or wages of labour shall be deductible from the cost of work under this contract and in this regard the formula here in before stated under the clause under the clause 10(CC) shall mutatis mutandis apply, provided that

a) No such adjustment for the decrease in the price of materials and / or weiges of labour aforementioned would be made in case of contracts in which the stipulated period or completion of work is equal to or less than the time as specified in tender document.

b) The Engineer in charge shall otherwise be entitled to lay down the procedure by which the provision of this sub clause shall be implemented from time to time and the decision of the Engineer in charge in this behalf shall be final and binding on the contractor.

ix) Provided always that the provision of the preceding clause 10C and 10CA shall not be applicable for contracts where provision of this clause are applicable but in cases where provisions of this clause are not applicable, the provision of clause 10C and 10CA will become applicable.

CLAUSE 10 D (Dismantling of materials)

The contractor shall treat all materials obtained during dismantling of a structure, excavation of the site for a work, etc. as OMFED's property and such materials shall be disposed off to the best advantage of Government according to the PWD code provision**.**

CLAUSE 11(Work to be executed in Accordance with Specifications, Drawings, Orders etc)

The contractor shall execute the whole and every part of the work in the most substantial and workmanlike manner both as regards materials and otherwise in every respect in strict accordance with the specifications. The contractor shall also conform exactly, fully and faithfully to the design, drawings and instructions in writing in respect of the work signed by the Engineer in Charge and the contractor shall be furnished free of charge one copy of the contract documents together with specification, designs, drawings and instruction as are not included in the standard specifications of Public Works Department specified in tender document or in any Bureau of Indian Standard or any other, published standard or code or, Schedule of Rates or any other printed publication referred to elsewhere in the contract.

The contractor shall comply with the provisions of the contract and with the care and diligence execute and maintain the works and provide all labour and materials, tools and plants including for measurements and supervision of all works, structural plans and other things of temporary or permanent nature required for such execution and maintenance in so far as the necessity for providing these, is specified or is reasonably inferred from the contract. The Contractor shall take full responsibility for adequacy, suitability and safety of all the works and methods of construction.

CLAUSE 12 (Deviations/ Excess item Variations Extent and Pricing) , Deviation, Extra items and Pricing, Deviation, Substituted Items, Pricing, Deviation, Deviated Quantities, Pricing

The Engineer in Charge shall have power (i) to make alternation in, omissions from, additions to, or substitutions for the original specifications, drawings, designs and instructions that may appear to him to be necessary or advisable during the progress of the work, and (ii) to omit a part of the works in case of non-availability of a portion of the site or for any other reasons and the contractor shall be bound to carry out the works in accordance with any instructions given to

him in writing signed by the Engineer in Charge after approval from competent authority and such alterations omissions, additions or substitutions shall form part of the contract as if originally provided therein and any altered, additional or substituted work which the contractor may be directed to do in the manner specified above as part of the works, shall be carried out by the contractor on the same conditions in all respects including price on which he agreed to do the main work except as hereafter provided.

The time for completion of the works shall, in the event of any deviations resulting in additional cost over the tendered value sum being ordered, be extend, if requested by the contractor, as follows :

i) In the proportion which the additional cost of the altered, additional or substituted work, bears to the original tendered value plus.

ii) 25% of the time calculated in (i) above or such further additional time as may be considered reasonable by the Engineer in Charge after approval from competent authority

In the case of extra item(s) the contractor may within fifteen days of receipt of order or occurrence of the item(s) claim rates, supported by proper analysis, for the work and the Engineer in Charge after approval from competent authority shall within one month of the receipt of the claims supported by analysis, after giving consideration to the analysis of the rates submitted by the contractor, determine the rates as per power delegated in PWD Code/ OMFED regulation and on the basis of the market rates and the contractor shall be paid in accordance with the rates so determined.

In the case of substituted items, the rate for the agreement item (to be substituted) and substituted item shall also be determined in the manner as mentioned in the aforesaid para.

If the market rate for the substituted item so determined is more than the market rate of the agreement item (to be substituted) the rate payable to the contractor for the substituted item shall be the rate for the agreement item (to be substituted) so increased to the extent of the difference between the market rates of substituted item and the agreement item (to be substituted).

If the market rate for the substituted item so determined is less than the market rate of the agreement item (to be substituted) the rate payable to the contractor for the substituted item shall be the rate for the agreement item (to be substituted) so decreased to the extent of the difference between the market rates of substituted item and the agreement item (to be substituted).

In the case of contract items, substituted items, contract cum substituted items, which exceed the limits laid down in Schedule F, the contractor may within fifteen days of receipt of order or occurrence of the excess, claim revision of the rates, supported by proper analysis, for the work in excess of the above mentioned limits, provided that if the rates so claimed are in excess of the rates specified in the schedule of quantities the Engineer in Charge shall within one month of receipt of the claims supported by analysis, after giving consideration to the analysis of the rates submitted by

the contractor, determined the rates as per power delegated in PWD Code/ OMFED regulation and on the basis of the market rates and the contractor shall be paid in accordance with the rates so determined.

The contractor shall send to the Engineer in Charge once every three months an up to date account giving complete details of all claims for additional payments to which the contractor may consider himself entitled and of all additional work ordered by the Engineer in Charge after approval from competent authority which he has executed during the preceding quarter failing which the contractor shall be deemed to have waived his right. However, the Managing Director is authorized for consideration of such claims on merits.

For the purpose of operation of tender clause the following works shall be treated as works relating to foundation:

i) For buildings, compound walls, plinth level or 1.2 meters (4 feet) above ground level whichever is lower excluding items of flooring and D.P.G. but including base concrete below the floors.
ii) For abutments, piers, retaining walls of culverts and bridges, walls of water reservoirs the bed of floor level.
iii) For retaining walls where floor level is not determinate 1.2 meters above the average ground level or bed level.
iv) For Roads all items of excavation and filling including treatment of sub-base.

Foreclosure of Contract due to Abandonment or Reduction in Scope of Work

Any operation incidental to or necessarily has to be in contemplation of tenderer while filing tender, or necessary for proper execution of the item included in the Schedule of quantities or in the schedule of rates mentioned above, whether or not, specifically indicated in the description of the item and the relevant specifications, shall be deemed to be included in the rates quoted by the tenderer or the rate given in the said schedule of rates, as the case may be. Nothing extra shall be admissible for such operations.

CLAUSE 13 (OMFED can abandon or reduce the scope of work)

If at any time after acceptance of the tender OMFED shall decide to abandon or reduce the scope of the works for any reason whatsoever and hence not require the whole or any part of the works to be carried out, the Engineer in Charge shall give notice in writing to that effect to the contractor and the contractor shall act accordingly in the matter. The contractor shall have no claim to any payment of compensation or otherwise whatsoever, on account of any profit or advantage which he might have derived from the execution of the works in full but which he did not derive in consequence of the foreclosure of the whole or part of the works.

The contractor shall be paid at contract rates full amount for works executed at site and in addition, a reasonable amount as certified by the Engineer in Charge for the items hereunder mentioned which could not be utilized on the work to the full extent in view of the foreclosure.

i) Any expenditure incurred on preliminary site work, e.g. temporary access roads, temporary labour huts, staff quarters and site office, storage accommodation and

water storage tanks.

ii) **OMFED** shall have the option to take over contractor's materials or any part thereof either brought to site or of which the contractor is legally bound to accept delivery from suppliers (for incorporation in or incidental to the work) provided, however, **OMFED** shall be bound to take over the materials or such portions thereof as the contractor does not desire to retain. For materials taken over or to be taken over by **OMFED,** cost of such materials as detailed by Engineer in Charge shall be paid. The cost shall, however, take into account purchase price, cost of transportation and deterioration of damage which may have been caused to materials whilst in the custody of the contractor.

iii) If any materials supplied by **OMFED** are rendered surplus, the same except normal wastage shall be returned by the contractor to **OMFED** at rates not exceeding those at which these were originally issued less allowance for any deterioration or damage which may have been caused whilst the materials were in the custody of the contractor. In addition, cost of transporting such materials from site to Government stores, if so required by **OMFED**, shall be paid.

iv) Reasonable compensation for transfer of T & P from site to contractor's permanent stores or to his other works, whichever is less. If T & P are not transported to either of the said places, no cost of transportation shall be payable.

v) Reasonable compensation for repatriation of contractor's site staff and imported labour to the extent necessary.

The contractor shall, if required by the Engineer in Charge furnish to him books of account, wage books, time sheets and other relevant documents and evidence as may be necessary to enable him to certify the reasonable amount payable under this condition.
The reasonable amount of items on (i), (iv) and (v) above shall not be in excess of 2% of the cost of the work remaining incomplete on the date of closure, i.e. total stipulated cost of the work as per accepted tender less the cost of work actually executed under the contract and less the cost of contractor's materials at site taken over by OMFED as per item (ii) above. Provided always that against any payments due to the contractor on this account or otherwise, the Engineer in Charge shall be entitled to recover or be credited with any outstanding balances due from the contractor for advance paid in respect of any tool, plants and materials and any other sums which at the date of termination were recoverable by OMFED from the contractor under the terms of the contract.

CLAUSE 14(Cancellation of contract in full or part)

i) At any time makes default in proceeding with the works or any part of the work with the due diligence and continues to do so after a notice in writing of 7 days from the Engineer-In-Charge; or

ii) commits default to comply with any of the terms and conditions of the contract and does not remedy it or take effective steps to remedy it within 7 days after a notice in writing is given to him.

iii) fails to complete the works or items of work with individual dates of completion,

on or before the date(s) of completion, and does not complete then within the period specified in a notice given in writing .

iv) shall offer or give or agree to give to any person working at OMFED on contract/deputation or to any other person on his behalf any gift or consideration of any kind as an inducement or reward for doing or forbearing to do or for having done or forborne to do any action relation to the obtaining or execution of this or any other contract for OMFED; or

v) shall enter into a contract with **OMFED** in connection with which commission has been paid or agreed to be paid by him or to his knowledge, unless the particulars of any such commission and the terms of payment thereof have been previously disclosed in writing to the Competent Authority; or

vi) shall obtain a contract with OMFED as a result of wrong tendering or other non-bonafide methods of competitive tendering; or

vii) being an individual, or if a firm, any partner thereof shall at any time be adjudged insolvent or have a receiving order or order for administration of his estate made against him or shall take any proceedings for liquidation or composition (other than a voluntary liquidation for the purpose of amalgamation or reconstruction) under any Insolvency Act for the time being in force or make any conveyance or assignment of his effects or composition or arrangement for the benefit of his creditors or purport so to do, or if any application be made under any Insolvency Act for the time being in force for the sequestration of his estate or if a trust deed be executed by him for benefit of his creditors; or

viii) being a company, shall pass a resolution or the Court shall make an order for the winding up of the company, or a receiver or manager on behalf of the debenture holders or otherwise shall be appointed or circumstances shall arise which entitle the Court or debenture holders to appoint a receiver or manager; or

ix) shall suffer an execution being levied on his goods and allow it to be continued for a period of 21 days; or

x) assigns, transfers, sublets (engagement of labour on a piece-work basis or of labour with materials not to be incorporated in the work, shall not be deemed to be subletting) or otherwise parts with or attempts to assign, transfer sublet or otherwise parts with the entire works or any portion thereof without the prior written approval of the Competent Authority;

The Competent Authority may, without prejudice to any other right or remedy which shall have accrued or shall accrue hereafter to OMFED by a notice in writing to cancel the contract as a whole or only such item of work in default from the Contract.

The Engineer in Charge shall on such cancellation by the Competent Authority have powers to:

(a) take possession of the site and any materials, constructional plant, implements stores, etc., thereon; and/or

(b) carry out the incomplete work by any means at the risk and cost of the contractor.

On cancellation of the contract in full or in part, the Engineer in Charge shall determine what amount, if any, is recoverable from the contractor for completion of the works or part of the works or in case the works or part of the works is not to be completed, the loss of damage suffered by OMFED. In determining the amount, credit shall be given to the contractor for the value of the work executed by him up to the time of cancellation, the value of contractor's materials taken over and incorporated in the work and use of plant and machinery belonging to the contractor.

Any excess expenditure incurred or to be incurred by **OMFED** in completing the works or part of the works or the excess loss or damages suffered or may be suffered by **OMFED** as aforesaid after allowing such credit shall without prejudice to any other right or remedy available to OMFED in law be recovered from any moneys due to the contractor on any account, and if such moneys are not sufficient the contractor shall be called upon in writing and shall be liable to pay the same within 31 days.

If the contractor shall fails to pay the required sum within the aforesaid period of 30 days the Engineer in Charge shall have the right to sell any or all of the contractors unused materials, constructional plant, implements, temporary buildings, etc. and apply the proceeds of sale thereof towards the satisfaction of any sums due from the contractor under the contract and if thereafter there be any balance outstanding from the contractor, it shall be recovered in accordance with the provisions of the contract.

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

CLAUSE 15 (Suspension of Work)

i) The contractor shall, on receipt of the order in writing of the Engineer in Charge (whose decision shall be final and binding on the contractor) suspend the progress of the works or any part thereof for such time and in such manner as the Engineer in Charge may consider necessary so as not to cause any damage or injury to the work already done or endanger the safety thereof for any of the following reasons:

a) on account of any default on the part of the contractor or;
b) for proper execution of the works or part thereof for reasons other than the default of the contractor; or

c) for safety of the works or part thereof.

The contractor shall, during such suspension, properly protect and secure the works to the extent necessary and carry out the instructions given in that behalf by the Consultant- In-Charge.

ii) If the suspension is ordered for reasons (b) and (c) in sub-para (i) above.

a) the contractor shall be entitled to an extension of time equal to the period of every such suspension PLUS 25%, for completion of the item or group of items of work for which a separate period of completion is specified in the contract and of which the suspended work forms a part, and;

If the total period of all such suspensions in respect of an item or group of items or work for which a separate period of completion is specified in the contract exceeds thirty days, the contractor shall, in addition, be entitled to such compensation as the Engineer in Charge may consider reasonable in respect of salaries and/or wages paid by the contractor to his employees and labour at site, remaining idle during the period of suspension, adding thereto 2% to cover indirect expenses of the contractor. Provided the contractor submits his claim supported by details to the Engineer in

Charge within fifteen days of the expiry of the period of 30 days.

(iii) If the works or part thereof is suspended on the orders of the Engineer in Charge for more than three months at a time, except when suspension is ordered for reason (a) in sub- Para (i) above, the contractor may after receipt of such order serve a written notice on the Engineer in Charge requiring permission within fifteen days from receipt by the Engineer in Charge of the said notice, to proceed with the work or part thereof in regard to which progress has been suspended and if such permission is not granted within that time, the contractor, if he intends to treat the suspension, where it affects only a part of the works as an omission of such part by **OMFED** or where it affects whole of the works, as an abandonment of the works by **OMFED**, shall within ten days of expiry of such period of 15 days give notice in writing of his intention to the Consultant-In-Charge. In the event of the contractor treating the suspension as an abandonment of the contract by **OMFED**, he shall have no claim to payment of any compensation on account of any profit or advantage which he might have derived from the execution of the work in full but which he could not derive in consequence of the abandonment. He shall, however, be entitled to such compensation, as the Engineer in Charge may consider reasonable, in respect of salaries and/or wages paid by him to his employees and labour at site, remaining idle in consequence adding to the total thereof 2% to cover indirect expenses of the contractor provided the contractor submits his claim supported by details to the Engineer in Charge within 30 days of the expiry of the period of 3 months.

CLAUSE 16 (Action in case Work not done as per Specifications)

All works under or in course of execution or executed in pursuance of the contract shall at all times be open and accessible to the inspection and supervision of the Consultant-In-Charge/ Engineer in charge / Managing Director or his authorized subordinates in charge of the work and all the superior officers, officer of the Organization of the OMFED and the contractor shall, at all times, during the usual working hours and at all other times at which reasonable notice of the visit of such officers has been given to the contractor, either himself be present to receive orders and instructions of 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.

It shall appear to the Engineer in Charge or his authorized subordinates in charge of or his subordinate officers, that any work has been executed with unsound, imperfect, or unskillful workmanship, or with materials or article provides by him for the execution of the work which are unsound or of a quality inferior to that contracted or otherwise not in accordance with the contract the contractor shall, on demand in writing which shall be made within six months of the completion of the work from the Engineer in Charge specifying the work, materials or articles complained of notwithstanding that the same may have been passed, certified and paid for forthwith rectify, or remove and reconstruct the work so specified in whole or in part, as the case may require or as the case may be, remove the materials or articles so specified and provide other proper and suitable materials or articles at his own charge and cost. In the event of the failing

do so within a period specified by the Engineer in Charge in his demand aforesaid, then the contractor shall be liable to pay compensation at the same rate as under clause of the contract (for non-completion of the work in time) for this default.
In such case the Engineer in Charge may not accept the item of work at the rates applicable under the contract but may accept such items at reduced rates as the competent authority may consider reasonable during the preparation of on account bills or final bill if the item is so acceptable without detriment to the safety and utility of the item and the structure and incidental items rectified, or removed and re-executed at the risk and cost or contractor. Decision of the Engineer in Charge to be conveyed in writing in respect of the same will be final and binding on the contractor.

CLAUSE 17 (Contractor Liable for Damages, defects during maintenance period)

If the contractor or his working people or servants shall break, deface, injure or destroy any part of building in which they may be working, or any building, road, road curb, fence, enclosure, water pipe, cables, drains, electric or telephone post or wired, trees, grass or grassland, or cultivated ground contiguous to the premises on which the work or any part is being executed, or if any damage shall happen to the work while in progress, from any cause whatever or if any defect, shrinkage or other faults appear in the work within defect liability period after a certificate final or otherwise of its completion shall have been given by the Engineer in Charge as aforesaid arising out of defect or improper materials or workmanship the contractor shall upon receipt of a

notice in writing on that behalf make the same good at his own expense or in default the Engineer in Charge cause the same to be made good by other workmen and deduct the expense from any sums that may be due or at any time thereafter may become due to the contractor, or from his security deposit except for the portion pertaining to asphaltic work which is governed by sub-para
(iii) of clause 35 or the proceeds of sale thereof or of a sufficient option thereof. The security deposit of the contractor shall not be refunded before the expiry of defect liability period after the issue of the certificate final or otherwise, of completion of work, or till the final bill has been prepared and passed whichever is later.

In case of Maintenance and Operation works of E & M services, the security deposit deducted from contractors shall be refunded within one month from the date of final payment or within one month from the date of completion of the maintenance contract whichever is earlier.

CLAUSE 18 (Contractor to Supply Tools & Plants etc.)

The contractor shall provide at his own cost all materials (except such special materials, if any, as may in accordance with the contract be supplied from the Consultant-In-Charge's stores), plant, tools, appliances, implements, ladders, cordage, tackle, scaffolding and temporary works required for the proper execution of the work, whether original, altered or substituted and whether included in the specification or other document forming part of the contract or referred to in these conditions or not, or which may be necessary for the purpose of satisfying or complying with the requirements of the Engineer in Charge 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 therefore 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 works, and counting, weighing and assisting the measurement for 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 Engineer in Charge at to the contractor, under this contract or otherwise and/or from his security deposit or the proceeds of sale thereof, or of a sufficient portions thereof.

CLAUSE 18 A (Recovery of Compensation paid to Workman)

In every cash in which by virtue of the provisions sub-section (1) of Section 12, of the Workmen's Compensations Act, 1923, OMFED is obliged to pay compensation to a workman employed by the contractor, in execution of the works, Government will recover from the contractor the amount of the compensation so paid; and without prejudice to the right of the OMFED under sub-section (2) of section 12, of the said Act, OMFED 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 OMFED to the contractor whether under this contract or otherwise. OMFED shall not be bound to contest any claim made against it under sub-section (1) Section 12, of the said Act, except on the written request of the contractor and upon his giving to Government full security for all costs for which Government might become liable in consequence of contesting such claim.

CLUASE 18 B(Ensuring Payment and Amenities to Workers if Contractor fails)

In every case in which by virtue of the provisions of the Contract Labour (Regulation and Abolition) Act, 1970, and of the Contract Labour (Regulation and Abolition) Central Rules, 1971, **OMFED** is obliged to pay any amounts of wages to a workman employed by the contractor in execution of the works, or to incur any expenditure in providing welfare and health amenities required to be provided under the above said Act and the rules under Clause 19H or under the State Labour Regulations, or under the Rules framed by **OMFED** from time to time for the protection of health and sanitary arrangements for workers employed by contractors working for OMFED, **OMFED** will recover from the contractor the amount of wages so paid or the amount of expenditure so incurred; and without prejudice to the rights of the **OMFED** under sub-section (2) of Section 20, and sub-section (4) of Section 21, of the Contract Labour (Regulation and Abolition) Act, 1970, **OMFED** 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 **OMFED** to the contractor whether under this contract or otherwise **OMFED** shall not be bound to contest any claim made against it under sub-section (1) of Section 20, sub-section (4) of Section 21, of the said Act, except on the written request of the contractor and upon his giving to the OMFED full security for all costs for which Government might become liable in contesting such claim.

CLAUSE 19(Labour Laws to be complied by the Contractor)

The contractor shall obtain a valid license under the State Labour Act, and the Contract Labour (Regulation and Abolition) Central rules 1971, before the commencement of the work, and continue to have a valid license until the completion of the work. The contractor shall also abide by the provisions of the Child Labour (Prohibition and Regulation) Act, 1986.

The contractor shall also comply with the provisions of the building and other Construction Workers (Regulation of Employment & Conditions of Service) Act, 1996 and the building and other Construction Workers Welfare Cess Act, 1996.

Any failure to fulfill these requirements shall attract the penal provisions of

the contract arising out of the resultant non-execution of the work.

CLAUSE 19 A (labour below the age of fourteen years)

No labour below the age of fourteen years shall be employed on the work.

CLAUSE 19 B (Payment of Wages)

i) The contractor shall pay to labour employed by him either directly or through sub-contractors, wages not less than fair wages as defined in State Labour Regulations or as per the provisions of the Contract Labour (Regulation and Abolition) Act 1970 and the contract Labour (Regulation and Abolition) Central Rules, 1971, wherever applicable.

ii) The contractor shall, notwithstanding the provisions of any contract to the contrary, cause to be paid fair wage to labour indirectly engaged on the work including any labour engaged by his sub-contractors in connection with the said work, as if the labour had been immediately employed by him.

iii) In respect of all labour directly or indirectly employed in the works for performance of the contractor's part of this contract, the contractor shall comply with or cause to be complied with the state Labour Regulations made by Government from time to time in regard to payment of wages, wage period, deductions from wages recovery of wages not paid and deductions unauthorized made, maintenance of wage books or wage slips, publication of scale of wages and other terms of employment, inspection and submission of periodical returns and all other matters of the like nature or as per the provisions of the Contract Labour (Regulation and Abolition) Act, 1970, and the Contract Labour (Regulation And Abolition) Central Rules, 1971, wherever applicable.

iv)

a) The Engineer in Charge concerned shall have the right to deduct from the moneys 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 nonfulfilment of the conditions of the contract for the benefit of the workers, non-payment of wages or of deductions made from his or their wages which are not justified by their terms of the contract or non- observance of the Regulations.

b) Under the provision of Minimum Wages (Central) Rules 1950, the contractor is bound to allow to the labours directly or indirectly employed in the works one day rest for 6 days continuous work and pay wages at same rate as for duty. In the event of default, the Engineer in Charge shall have the right to deduct the sum or sums not paid on account of wages for weekly holidays to any labours and pay the same to the persons entitled thereto from any money due to the contractor by the Engineer in Charge concerned.

v) The contractor shall comply with the provisions of the Payment of Wages Act, 1936, Minimum Wages Act, 1948, Employees Liability Act, 1938, Workmen's Compensation Act, 1923, Industrial Disputes Act, 1947, Maternity Act, 1970, or the modifications thereof or any other laws relating thereto and the rules made thereunder from time to time.

vi) The contractor shall indemnify and keep indemnified OMFED again payments to be made under and for the observance of the laws aforesaid and the State Labour Regulations without prejudice to his right to claim indemnity from his sub-contractors.

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

viii) Whatever is the minimum wage for the time being, or if the wage payable higher than such wage, such wage shall be paid by the contractor to the workmen directly without the intervention of Jamadar and that Jamadar shall not be entitled to deduct or recover any amount from the minimum wage payable to the workmen as and by way of commission or otherwise.

ix) The contractor shall ensure that no amount by way of commission or otherwise is deducted or recovered by the Jamadar from the wage of workmen.

CLAUSE 19 C (Safety code for labour)

In respect of all labour directly or indirectly employed in the work for the performance of the contractor's part of this contract, the contractor shall at his own expense arrange for the safety provisions as per P.W.D. Safety Code framed from time to time and shall at his own expense provide for all facilities in connection therewith. In case the contractor fails to make arrangement and provide necessary facilities as aforesaid he shall be liable to pay a penalty of Rs. 200/- for each default and in addition the Engineer in Charge shall be at liberty to make arrangement and provide facilities as aforesaid and recover the costs incurred in that behalf from the contractor.

CLAUSE 19 D (Information on labour engaged)

The contractor shall submit by the 4th and 19th of every month, to the Engineer in Charge a true statement showing in respect of the second half of the preceding month and the first half of the current month respectively :-

(1) the number of labourers employed by him on the work,
(2) their working hours,
(3) the wages paid to them,
(4) the accidents that occurred during the said fortnight showing the circumstance under which they happened and the extent of damage and injury caused by them, and
(5) the number of female workers who have been allowed maternity benefit according to Clause 19F and the amount paid to them.

Failing which the contractor shall be liable to pay to Government a sum not exceeding Rs. 200/- for each default or materially incorrect statement. The decision of the Chief Consultant shall be final in deducting from any bill due to the contractor the amount levied as fine and be binding on the contractor.

CLAUSE 19 E (Health and sanitation for labours)

In respect of all labour directly, or indirectly employed in the works for the performance of the contractor's part of this contract, the contractor shall comply with or cause to be complied with all the rules framed by Government from time to time for the protection of health and sanitary arrangements for workers employed by the **OMFED** and contractors.

CLAUSE 19 H (Accomodation for labours)

The contractor(s) shall at his/their own cost provide his/their labour with a sufficient number of huts (hereinafter referred to as the camp) of the following specifications on a suitable plot of land to be approved by the Consultant-In-Charge.

i) a) The minimum height of each hut at the eaves level shall be 2.10m (7ft.) and the floor area to be provided will be at the rate of 2.7 sq. m. (30 sq. ft.) for each member of the worker's family staying with the labourer.

b) The contractor(s) shall in addition construct suitable cooking places having a minimum area of 1.80m X 1.50m (6' X 5') adjacent to the hut for each family.

c) The contractor(s) shall also construct temporary latrines and urinals for the use of the labourers each on the scale of not less than four per each one hundred of the total strength, separate latrines and urinals being provided for women.

d) The contractor(s) shall construct sufficient number of bathing and washing places, one unit for every 25 persons residing in the camp. These bathing and washing places shall be suitably screened.

ii) a) All the huts shall have walls of sun-dried or burnt-bricks laid in mud mortar or other suitable local materials as may be approved by the Consultant-In-Charge.

In case of sun-dried bricks, the walls should be plastered with mud gobri on both sides. The floor may be kutcha but plastered with mud gobri and shall be at least 15 cm (6") above the surrounding ground. The roofs shall be laid with thatch or any other materials as may be approved by the Engineer in Chargeand the contractor shall ensure that throughout the period of their occupation the roofs remain water-tight.

b) The contractor(s) shall provide each hut with proper ventilation.

c) All doors, windows, and ventilators shall be provided with suitable leaves for security purposes.

d) There shall be kept an open space of at least 7.2m (8 yards) between the rows of huts which may be reduced to 6m (20 ft.) according to the availability of site with the approval of the Consultant-In-Charge. Back to back construction will be allowed.

iii) **Water supply -** The contractor(s) shall provide adequate supply of water for the use of labourers. The provisions shall not be less than two gallons of pure and wholesome water per head per day for drinking purposes and three gallons of clean water per head per day for bathing and washing purposes. Where piped water supply is available, supply shall be at stand posts and where the supply is from wells or river, tanks which may be of metal or masonry, shall be provided. The contractor(s) shall also at his/their own cost make arrangements for laying pipe lines of water supply to his/their labour camp from the existing mains wherever available, and shall pay all fees and charges therefore.

iv) The site selected for the camp shall be high ground, removed from jungle.

v) **Disposal of Excreta -** The contractor(s) shall make necessary arrangements for the disposal of excreta from the latrines by trenching or incineration which shall

be according to the requirements laid down by the Local Health Authorities. If trenching or incineration is not allowed the contractor(s) shall make arrangements for the removal of the excreta through the Municipal Committee/authority and inform it about the number of labourers employed so that arrangements may be made by such Committee/authority for the removal of the excreta. All charges on this account shall be borne by the contractor and paid direct by him to the Municipality/authority. The contractor shall provide one sweeper for every eight seats in case of dry system.

vi) **Drainage -** The contractor(s) shall provide efficient arrangements for draining away sullage water so as to keep the camp neat and tidy.

vii) The contractor(s) shall make necessary arrangements for keeping the camp area sufficiently lighted to avoid accidents to the workers.

viii) **Sanitation -** The contractor(s) shall make arrangements for conservancy and sanitation in the labour camps according to the rules of the Local Public Health and Medical Authorities.

CLAUSE 19 I (Removal of labour with misconduct)

The Engineer in Charge may require the contractor to dismiss or remove from the site of the work any person or persons in the contractor's employment upon the work who may be incompetent or who misconducts himself and the contractor shall forthwith comply with such requirements.

CLAUSE 19 J (Illegal occupation of constructed building)

It shall be the responsibility of the contractor to see that the building under construction is not occupied by anybody unauthorized during construction, and is handed over to the Engineer in Charge with vacant possession of complete building. If such building though completed is occupied illegally, then the Engineer in Charge shall have the option to refuse to accept the said building/buildings in that position. Any delay in acceptance on this account will be treated as the delay in completion and for such delay a levy up to 5% of tendered value of work may be imposed by the Engineer in Charge upon approval of Managing Director whose decision shall be final both with regard to the justification and quantum and be binding on the contractor.

However, the Engineer in Charge, through a notice, may require the contractor to remove the illegal occupation any time on or before construction and delivery.

CLAUSE 20 (Comply to the minimum wage act)

The Contractor shall at least pay and comply with all the provisions of the Minimum Wages Acts and Rules framed there under other labour laws related to contract labour.

CLAUSE 21 (Work not to be sublet. Action in case of In solvency)

The contract shall not be assigned or sublet without the written approval of the Engineer in Charge with approval of Managing Director. And if the contractor shall assign or sublet his contract, or attempt to do so, or become insolvent or commence any insolvency proceedings or make any composition with his creditors or attempt to

do so, or if any bribe, gratuity, gift, loan, perquisite, reward or advantage pecuniary or otherwise, shall either directly or indirectly, be given, promised or offered by the contractor, or any of his servants or agent to any public officer or person in the employ of Government 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 Engineer in Charge on behalf of the **OMFED** shall have power to adopt the courses specified in Clause 3 hereof in the interest of Government and in the event of such course being adopted the consequences specified in the said Clause 3 shall ensue.

CLAUSE 22 (Paymant of compensation)

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 OMFED without reference to the actual loss or damage sustained and whether or not any damage shall have been sustained.

CLUASE 23 (Changes in firm's Constitution to be intimated)

Where the contractor is a partnership firm, the previous approval in writing of the Managing Director shall be obtained before any change is made in the constitution of the firm where the contractor is an individual or a Hindu undivided family business concern such approval as

aforesaid shall likewise be obtained before the contractor enters into any partnership agreement where under the partnership firm would have the right to carry out the works hereby undertaken by the contractor. If previous approval as aforesaid is not obtained, the contract shall be deemed to have been assigned in contravention of Clause 21 thereof and the same action may be taken, and the same consequences shall ensue as provided in the said Clause 21.

CLAUSE 24 (Work to be executed as per direction of OMFED)

All works to be executed under the contract shall be executed under the direction and subject to the approval in all respects of the Engineer in Chargewho 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 (Settlement of Disputes and Arbitration)

- All disputes or differences in respect of which the decision is not final and conclusive shall, on the initiative of either party, be referred to the adjudication of a sole Arbitrator, to be appointed by OMFED. The appointment of sole Arbitrator so made shall be final and conclusive.
- If the Arbitrator so appointed is unable or unwilling to act or resigns his appointment or vacates his office due to any reason whatsoever another Sole Arbitrator shall be appointed as aforesaid.

- The Arbitrator shall be deemed to have entered in the reference on the date he issues notices to both the parties fixing the date of the first hearing.

- The Arbitrator from time to time, with the consent of the parties enlarges the time for making and publishing the award.

- The venue of the Arbitration shall be in **Bhubaneswar** only and jurisdiction for any matter/dispute arising out of or concerning or connected with such Arbitration shall be of such courts as exercising jurisdiction over Bhubaneswar.

- The fees, if any, of the Arbitration shall, if required to be paid before the award is made and published, be paid at half by each of the parties. The costs of the reference and the award including the fees, if any , of the Arbitrator shall be in the discretion of the Arbitrator who may direct to and by whom and in what manner , such costs or any part thereof shall be paid and may fix and settle the amount of costs to be so paid .

- The award of the Arbitrator shall be final and binding on both the parties.

- The Arbitration proceedings shall be governed by Arbitration and Conciliation Act 1996 and the Rules made there under or any statutory modification thereof for the time being in force. Performance under the Contract, shall, if reasonably possible, continue during the Arbitration proceedings and the payments due to the Contractor by the OMFED shall not be withheld, unless they are the subjects of the Arbitration proceedings.

- Neither party is entitled to bring a claim or dispute to Arbitration after thirty days of expiration of the maintenance period.

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

if the contractor considered any work demanded of him to be outside the requirements of the contract, or dispute any drawings, record or decision given in writing by the Engineer-in-Charge on any matter in connection with or arising out of the contract or carrying out of the contract or carrying out of the work, to be unacceptable, he shall promptly within 7 days request the Engineer in Charge in writing for written instruction or decision. Thereupon, the Engineer in Charge shall give his written instructions or decision within a period of fifteen days from the receipt of the Contractor's letter.

If the Engineer in Charge fails to give his instruction of decision in writing within the aforesaid period or if the contractor is dissatisfied with the instructions or

decision of the Engineer in Charge, the contractor may, within 15 days of the receipt of Engineer in Charge decision, appeal to the General Manager (OMFED) who shall afford an opportunity to the contractor to be heard, if the latter so desires, and to offer evidence in support of his appeal. The General Manager (OMFED) shall give his decision within 30 days of receipt of contractor's appeal. If the contractor is dissatisfied with this decision, the contractor shall within a period of 30 days from receipt of the decision, give notice to the General Manager (OMFED) for appointment of arbitrator failing which the said decision shall be final binding and conclusive and not referable to adjudication by the arbitrator.

Expert where the decision has become final, binding and conclusive in terms of sub para (i) above disputes or difference shall be referred for adjudication through arbitrator appointed by Managing Director (OMFED). If the arbitrator so appointed is unable or unwilling to act or resign his appointment or vacates his office due to any reason whatsoever another sole arbitrator shall be appointed in the manner aforesaid. Such person shall be entitled to proceed with the reference from the stage at which it was left by his predecessor.

It is a tern of this contract that the party invoking arbitration shall give a list of disputes with amounts claimed in respect of each such dispute along with the notice for appointment of arbitrator and giving reference to the rejection by the General Manager (OMFED) of the appeal.

It is also a term of the contract that the arbitrator shall be deemed to have entered on the reference on the date he issued notice to both the parties calling them to submit their statement of claims and counter statement of claims. The decision of arbitrator will be final & binding to the parties.

All arbitration shall be held at Bhubaneswar and at no other place.

CLAUSE 26 (Contractor to indemnity Govt. against Patent Rights)

The contractor shall fully indemnify and deep indemnified the **OMFED** against any action, claim or proceeding relating to infringement or use of any patent or design or any alleged patent or design rights and shall pay any royalties which may be payable in respect of any article or part thereof included in the contract. In the event of any claims made under the action brought against **OMFED** in respect of any such matter as aforesaid the contractor shall be immediately notified thereof and the contractor shall be at liberty, at his own expense, to settle any dispute or to conduct any litigation that may arise there from, provided that the contractor shall not be liable to indemnify the **OMFED** if the infringement of the patent or design or any alleged patent or design right is the direct result of an order passed by the Engineer in Charge in this behalf.

CLAUSE 27 (Lumpsum Provisions in Tender)

When the estimate on which a tender is made includes lump sum in respect of parts of the work, the contractor shall be entitled to payment in respect of the items of work involved or the part of the work in question at the same rates as are payable under this contract for such items, or if the part of the work in question is not, in the opinion of the Engineer in Charge payable of measurement, The Engineer in Charge may at his discretion pay the lump-sum amount entered in the estimate, and the certificate in

writing of the Engineer in Charge shall be final and conclusive against the contractor with regard to any sum or sums payable to him under the provisions of the clause.

CLAUSE 28 (Action where no Specifications are specified)

In the case of any class of work for which there is no such specifications as referred to in Clause 11, such work shall be carried out in accordance with the Bureau of Indian Standards Specifications, Indian Road Congress for road works and Indian Building Congress for building works or any central government agency. In case there is no such specifications in Bureau of Indian Standards, the work shall be carried out as per manufacturers specifications. If not available then as per District Specifications. In case there are no such specifications as required above, the work shall be carried out in all respects in accordance with the instructions and requirements of the Consultant-In-Charge.

CLAUSE 29 (With-holding and lien in)

Whenever any claim or claims for payment of a sum of money arises out of or under the contract or against the contractor, the Engineer in Charge or the **OMFED** shall be entitled to without and also have a lien to retain such sum or sums in whole or in part from the security, if any deposited by the contractor and for the purpose aforesaid, the Engineer in Charge or the **OMFED** shall be entitled to withhold the security deposit, if any, furnished as the case may be and also have a lien over the same pending finalization or adjudication of any such claim. In the event of the security being insufficient to cover the claimed amount or amounts or if no security has been taken from the contractor, the Engineer in Charge or the **OMFED** shall be entitled to withhold and have a lien to retain to the extent of payable or which may at any time thereafter become payable to the contractor under the same contract or any other contract with the Engineer in Charge of the **OMFED** or any contracting person through the Engineer in Charge of the **OMFED** or any person through the Engineer in Charge pending finalization of adjudication of any such claim.

- **respect of sums due from contractor**

It is an agreed term of the contract that the sum of money or moneys so withheld or retained under the lien referred to above by the Engineer in Charge or **OMFED** will be kept, withheld or retained as such by the Engineer in Charge or **OMFED** till the claim arising out of or under the contract is determined by the arbitrator (if the contract is governed by the arbitration clause) by the competent court, as the case may be and that the contractor will have no claim for interest or damages whatsoever on any account in respect of such withholding or retention under the lien referred to above and duly notified as such to the contractor. For the purpose of this clause, where the contractor is a Partnership firm or a limited company, the Engineer in Charge or the **OMFED** shall be entitled to withhold and also have a lien to retain towards such claimed amount or amounts in whole or in part from any sum found payable to any partner/limited company as the case may be, whether in his individual capacity or otherwise.

- **Lien in respect of claims in other Contracts**

i) **OMFED** shall have the right to cause an audit and technical examination of the works and the final bills of the contractor including all supporting vouchers, abstract etc., to be made after payment of the final bill and if as a result of such audit and technical examination any sum is found to have been overpaid in respect of any work done by the contractor under the contract or any work claimed to have been done by him under the contract and found not to have

been executed, the contractor shall be liable to refund the amount of over-payment and it shall be lawful for **OMFED** to recover the same from him in the manner prescribed in sub-clause (i) of this clause or in any other manner legally permissible; and if is found that the contractor was paid less than what was due to him under the contract in respect of any work executed by him under it, the amount of such under payment shall be duly paid by OMFED to the contractor, without any interest thereon whatsoever.

CLAUSE 29 A (withhold of payment)

Any sum of money due and payable to the contractor (including the security deposit returnable to him) under the contract may be withheld or retained by way of lien by the Engineer in Charge or the **OMFED** or any other contracting person or persons through Engineer in Charge against any claim of the Engineer in Charge or **OMFED** or such other person or persons in respect of payment of a sum of money arising out of or under any other contract made by the contractor with the Engineer in Charge or the **OMFED** or with such other person or persons.

It is an agreed term of the contract that the sum of money so withheld or retained under this clause by the Engineer in Charge or the **OMFED** will be kept withheld or retained as such by the Engineer in Charge or the **OMFED** or till his claim arising out of the same contract or any other contract is either mutually settled or determined by the arbitration clause or by the competent court, as the case may be and that the contractor shall have no claim for interest or damages whatsoever on this account or on any other ground in respect of any sum of money withheld or retained under this clause and duly notified as such to the contractor.

CLAUSE 30 (Unfiltered water supply)

The contractor(s) shall make his/their own arrangements for water required for the work and nothing extra will be paid for the same. This will be subject to the following conditions.

a) That the water used by the contractor(s) shall be fit for construction purposes to the satisfaction of the Engineer in Charge.
b) The Engineer in Charge shall make alternative arrangements for supply of water at the risk and cost of contractor(s) if the arrangements made by the contractor(s) for procurement of water are in the opinion of the Engineer in Charge, unsatisfactory.

CLAUSE 33(Employment of Technical Staff and employees)

Contractors Superintendence, Supervision, Technical Staff & Employees

The contractor shall provide all necessary superintendence during execution of the work and as along thereafter as may be necessary for proper fulfillment of the obligations under the contract.

The contractor along with bidding of the tender, intimate in writing to the Engineer in Charge the name, qualifications, experience, age, address and other particulars along with certificates, of the principal technical representative to be in charge of the work. Such qualifications and experience shall not be lower than specified in Qualification

Criteria. The Engineer in Charge shall within 15 days of issue of letter of acceptance intimate in writing his approval or otherwise of such a representative to the contractor, intimate in writing his approval or otherwise of such a representative to the contractor. Any such approval may at any time be withdrawn and in case of such withdrawal the contractor shall appoint another such representative according to the provisions of this clause. Decision of the tender Managing Director shall be final and binding on the contractor in this respect. Such a principal technical representative shall be appointed by the contractor soon after receipt of the approval from Managing Director or any other person so authorized by him. Technical staff shall be available at site within fifteen days of start of work.

If the contractor (or any partner in case of firm/company) who himself has such qualifications, it will not be necessary for the said contractor to appoint such a principal technical representative but the contractor shall designate and appoint a responsible agent to represent him and to be present at the work whenever the contractor is not in a position to be so present. All the provisions applicable to the principal technical representative under the Clause will also be applicable in such a case to contractor or his responsible agent. The principal technical representative and/or the contractor or his responsible authorized agent shall be actually available at site also during recording of measurement of works and whenever so required by the Engineer in Charge by a notice as aforesaid and shall also note down instructions conveyed by the Engineer in Charge or his designated down the instructions and in token of acceptance of measurements.

If the Engineer in Charge, whose decision in this respect is final and binding on the contractor, is convinced that no such technical representative or agent is effectively appointed or is effectively attending or fulfilling the provision of this clause, a recovery shall be effected from the contractor as specified in tender cluse and the decision of the Engineer in Charge as recorded in the site order book and measurement recorded in Measurement Books shall be final and binding on the contractor. Further if the contractor fails to appoint a suitable technical representative or responsible agent and if such appointed persons are not effectively present or do not discharge their responsibilities satisfactorily, the Engineer in Charge shall have full powers to suspend the execution of the work until such date as a suitable agent is appointed and the contractor shall submit a certificate of employment of the technical representative/responsible agent along with every on account bill/fixed bill and shall produce evidence if at any time so required by the Engineer in Charge.

i) The Contractor shall provide and employ on the site only such technical assistants as are skilled and experienced in their respective fields and such foremen and supervisory staff as are competent to give proper supervision to the work.
The contractor shall provide and employ skilled, semi- skilled and unskilled labour as is necessary for proper and timely execution of the work.

The Engineer in Charge shall be at liberty to object to and require the contractor to remove from the works any person who in his opinion misconducts himself, or is incompetent or negligent in the performance of his duties or whose employment is otherwise considered by the Engineer in Charge to be undesirable. Such person shall not be employed again at works site without the written permission of the Engineer in Charge and the persons so removed shall be replaced as soon as possible by competent substitutes.

CLAUSE 34 (Levy/Taxes payable by Contractor)

- Conditions for reimbursement of levy/taxes if levied if levied after receipt of tenders

i) Sales Tax, any other tax on materials or Labour Welfare Tax (if applicable) in respect of this contract shall be payable by the contractor and **OMFED** shall not entertain any claim whatsoever in this respect.
ii) The contractor shall deposit royalty and obtain necessary permit for supply of the red bajri, earth, moorum, sand, stone chips, kankar, etc. from local authorities.

If pursuant to or under any law, notification or order any royalty, cess or the like becomes payable to the Government of India and does not at any time become payable by the contractor to the Government. Local authorities in respect of any material used by the contractor in the works then in such a case, it shall be lawful to the Government of India and it will have the right and be entitled to recover the amount paid in the circumstances as aforesaid from dues of the contractor.

CLAUSE 35(All tendered rates shall be inclusive of all taxes and levies)

All tendered rates shall be inclusive of all taxes and levies payable under respective statutes. However, pursuant to the Constitution (46th Amendment) Act, 1982, if any further tax or levy is imposed by Statute, after the last stipu7lated date for the receipt of Tender offer including extensions if any and the Contractor thereupon necessarily and properly pays such taxes / levies,
the Contractor shall be reimbursed the amount so paid, provided such payments, if any, is not, in the opinion of the Engineer in Charge/ Chief Engineer(whose decision shall be final and binding on the Contractor) attributable to delay in execution of work within the control of Contractor.

(ii) The Contractor shall keep necessary books of accounts and other documents for the purpose of this condition as may be necessary and shall allow inspection of the same by a duly authorized representative of the OMFED and /or the Engineer In Charge and further shall furnish such other information/ document as the Engineer in Charge may require from time to time.

The contractor shall, within a period of 30 days of the imposition of any such further tax or levy, pursuant to the Constitution (46th Amendment) Act, 1982, give a written notice thereof to the Engineer in Charge that the same is given pursuant to this condition, together with all necessary information relating thereto.

CLAUSE 36 (Termination of contract in case of imprisonment)

If the contractor is imprisoned, becomes insolvent compound with his creditors, has a receiving order made against him or carries on business under a receiver for the benefit of the creditors or any of them, or being a partnership firm becomes dissolved, or being a company or corporations goes into liquidation or commences to be wound up not being a voluntary winding up for the purpose only of amalgamation or reconstitution the Nigam shall be at liberty.

To give such liquidator, receiver, or other person in whom the contract may become vested, the option of carrying out the contract or a position there of to be determined by the Nigam, subject to his providing an appropriate guarantee for the performance of such contractor.

To terminate the contract, forthwith by notice in writing to the Agency, the liquidator, the receiver or person in whom the contract may become vested and take further action as provided in the relevant clauses of the contract.

CLAUSE 37 (Termination of Contract on death of contractor)

Without prejudice to any of the rights or remedies under this contract if the contractor dies, the Managing Director on behalf of the **OMFED** shall have the option of terminating the contract without compensation to the contractor after the affidavit of his/their legal heir/heirs that they are not going to be in this profession in future.

CLAUSE 38(If relation working In OMFED then the Agency not allowed to tender)

The Agency shall not be permitted to Rate Offer for works in the concerned division (responsible for award and execution of contracts) in which his near relative is posted as officer or as an officer in any capacity between the grades of the **officer** He shall also intimate the names of persons who are working with him in any capacity or are subsequently employed by the OMFED. Any breach of this condition by the Agency's of this Nigam shall lead to blacklisting. If however the Agency's is registered in any other State / Central Govt. / State Milk Federation, he shall be debarred from tendering in OMFED for any breach of this condition.

NOTE: By the term "near relatives" is meant wife, husband, parents and grand parents, children and grand children, brothers and sisters, uncles, aunts and cousins and their corresponding in law.

CLAUSE 39 (No-Gezetted- Engineer to work as Agency within two years of retirement)

No engineer of gazetted rank or other gazetted officer employed in engineering or administrative duties in an engineering OMFED shall work as a Agency or employee of a Agency for a period of two years after his retirement from OMFED service without the previous permission of OMFED in writing. This contract is liable to be cancelled if either the Agency or any of his employees is found at any time to be such a person who had not obtained said permission prior to engagement in the Agency's service, as the case may be.

CLAUSE 41 (Repaid of the Performance Security Deposit Amount)

The security shall be repaid to the bidder after 15 (Fifteen) month of successful installation / trial run & successful commissioning / handing over of entire.

Clause 42 (Responsibility of technical staff and employees)

Technical officers/staff deployed by the Contractor at any construction site will also be responsible for inferior quality/poor performance of any work; and his name will be circulated to all division of the department, to debar from any other site, if his name is being proposed by other contractor.

CLAUSE 43 (Contractor's Risks)

All risks of loss of or damage to physical property and of personal injury and death which arise during and in consequence of the performance of the Contract other than the excepted risks are the responsibility of the Contractor.

CLAUSE 44

- Insurance
- Cash flow estimate to be submitted

The Contractor shall provide, in the joint names of the OMFED and the Contractor, insurance cover from the Start Date to the end of the Defects Liability Period, in the amounts and deductibles stated in the Contract Data for the following events which are due to the Contractor's risks: loss of or damage to the Works, Plant and Materials ;
loss of or damage to Equipment;
loss of or damage of property (except the Works, Plant, Materials and Equipment) in connection with the Contract; and Personal injury or death.
Policies and certificates for insurance shall be delivered by the Contractor to the Engineer for the Engineer's approval before the Start Date. All such insurance shall provide for compensation to be payable in the types and proportions of currencies required to rectify the loss or damage incurred.

Policies and certificates for insurance shall be delivered by the Contractor to the Engineer for the Engineer's approval before the Start Date. All such insurance shall provide for compensation to be payable in the types and proportions of currencies required to rectify the loss or damage incurred.

If the Contractor does not provide any of the policies and certificates required, the OMFED may affect the insurance which the Contractor should have provided and recover the premiums the OMFED has paid from payments otherwise due to the Contractor or, if no payment is due, the payment of the premiums shall be a debt due.

Alteration to the terms of insurance shall not be made without the approval of the Managing Director.

Both parties shall comply with any conditions of the insurance policies.

CLAUSE 45 (Safety, Security and Protection of the Environment)

The Contractor shall, within the time stated in special Conditions of contract after the date of the Letter of Acceptance, provide to the Engineer for his information a detailed cash flow estimate, in quarterly periods, of all payments to which the Agency will be entitled under the Contract and the Agency shall subsequently supply revised cash flow estimates at quarterly intervals, if required to do so by the Engineer in charge.

CLAUSE 47 (Cost of Samples)

All samples shall be supplied by the Contractor at his own cost if the supply thereof is clearly intended by or provided for in the Contract.

CLAUSE 48 (Cost of Tests)

The cost of making any test shall be borne by the Contractor if such test is :
clearly intended by or provided for in the Contract, or particularised in the Contract (in

case only of a test under load or of a test to ascertain whether the design of any finished or partially finished work is appropriate for the purposes which it was intended to fulfill) in sufficient detail to enable the Contractor to price or allow for the same in his Tender.

CLAUSE 49 (Cost of Tests not provided for)

If any test required by the Engineer which is : not so intended by or provided for, (in the cases above mentioned) not so particularized, or (though so intended or provided for) required by the Engineer to be carried out at any place other than the Site or the place of manufacture, fabrication or preparation of the materials or Plant tested, shows the materials, Plant or workmanship not to be in accordance with the provisions of the Contract to the satisfaction of the Engineer, then the cost of such test shall be borne by the Contractor, but in any other case Sub-Clause shall apply.

CLAUSE 50 (Commencement of Works)

The contract shall commence the Works as soon as is reasonably possible after the receipt by him of a notice to this effect from the Consultant-In-Charge, which notice shall be issued within the time stated in the Appendix to Tender after the date of the Letter of Acceptance. Thereafter, the Contractor shall proceed with the Works with due expedition and without delay.

CLAUSE 51 (Substantial Completion Parts)

If any part of the Permanent Works has been substantially completed and has satisfactorily passed any Test on Completion prescribed by the Contract, the Engineer may issue a Taking-of Over Certificate in respect of that part of the Permanent Works before completion of the Works and, upon the issue of such Certificate, the Contractor shall be deemed to have undertaken to complete with due expedition any outstanding work in that part of the Permanent Works during the Defects Liability Period.

CLAUSE 52 (Force Majeure)

Neither party shall be liable to the other for any loss or damage occasioned by nor raisin out of acts of GOD such has unprecedented flood, volcanic eruption, Earthquake or other convulsion of nature and other acts such as the general partial strikes by a section of OMFED employees, invasion, the act of foreign countries hostilities or war like operation before or after declaration of war, rebellion military or usurped power which prevent performance of the contract and which could not have been foreseen or avoided by a prudent person.

CLAUSE 53 (Recovery)

Any amount found recoverable from the Agency shall be recovered as public demand under the rule without prejudice to any other mode of recovery.

TERMS OF PAYMENT

Part – III PAYMENT TERMS

PAYMENT TERMS FOR CIVIL/STRUCTURAL WORK

- **10% Advance** Payment against civil work order value (after deposit of PSD & execution of agreement by bidder) against **13% Bank Guarantee** from any Nationalized/Scheduled Bank valid till successful completion of project.

PAYMENT BREAK UP

1.	Up to plinth level including completion of boundary wall	10% of civil work order value. Cumulative Payment- 10%	Subject to 15% of actual execution work. Cumulative execution- 15%
2.	Up to Lintel Level	25% of civil work order value. Cumulative Payment- 35%	Subject to 30% of actual execution work. Cumulative execution- 45%
3.	Up to Roof Level	25% of civil work order value. Cumulative Payment- 60%	Subject to 30% of actual execution work. Cumulative execution- 75%
4.	Finishing work	30% of civil work order value. Cumulative Payment- 90%	Subject to 35% of actual execution work. Cumulative execution- 100%
5.	Balance 10% shall be released after successful completion of civil work.		

PAYMENT TERMS FOR MECHANICAL/ELECTRICAL WORK

- **10% Advance** Payment of Mechanical & Electrical total work order value (after deposit of PSD & execution of agreement by bidder) against **13% Bank Guarantee** from any Nationalized/Scheduled Bank valid till successful completion of project.

- **PAYMENT BREAK UP**

  All payment shall be released against detailed break up cost to be furnished by the bidder in advance and accepted by the payment authority of OMFED.

  a) On Progress of work :

     60% of the mechanical and electrical equipment price components shall be paid on safe delivery of the Goods at the destination.

  b) On Progressive Erection:

     20% of the mechanical and electrical price components shall be paid on the value of the progressive erection work completed for individual components.

  c) On Commissioning:

     10% of the after successful commissioning of the entire plant after obtaining necessary statutory approvals .

  d) On final acceptance:

     The balance 10% of the contract price of the Mechanical & Electrical shall be paid on continuous satisfactory running of the complete plant for one month, on completion of other contracted services and accepted by the OMFED representative, within the scope of this contract.

TAXATION & PATENT RIGHTS AND ROYALTIES

1. The Contractor shall be entirely responsible for all taxes, duties, royalties' license fees , levied by Government etc.

2. The Contractor shall be liable to pay all corporate taxes, income tax and other taxes that shall be levied according to the laws and regulations applicable from time to time in India and the price bid by the Contractor shall include all such taxes. Wherever the laws and regulations require deduction of such taxes at the source of payment, the OMFED shall effect such deductions from the payment due to the Contractor. The remittance of amounts so deducted and issuance of certificate for such deductions shall be made by the OMFED as per the laws and regulations in force. Nothing in the Contract shall relieve the Contractor from his responsibility to pay any tax that may be levied in India on income and profits made by the Contractor in respect of the Contract. The Contractor's staff, personnel and labour will be liable to pay personal income taxes in India in respect of such of their salaries and wages as are chargeable under the laws and regulations for the time being in force, and the Contractor shall perform such duties in regard to such deductions thereof as may be imposed on him by such laws and regulations.
3. It is responsibility of the contractor to pay and finalized the service tax in respect to the contract extra claim regency service tax civil not paid by OMFED.
4. The Contractor shall save harmless and indemnify the OMFED from and against all claims and proceedings for or on account of infringement of any patent rights, design trademark or name or other protected rights in respect of any Constructional plant, machine work or material and for in connection with the works or any of them and from and against all claims, proceedings, damages, costs, charges and expenses whatsoever in respect thereof or in relation thereto. Except where otherwise specified, the Contractor shall pay all tonnage and other loyalties, rent and other payments or compensation, if any, for getting stone, sand, gravel, clay or other materials required for the works or any of them.

BID SECURITY (EARNEST MONEY DEPOSIT)

8. The bidder shall furnish, as part of its bid, bid security for a value of 2.5 Corer.

9. The bid security is required to protect the purchaser against the risk of bidder's conduct, which would warrant the security's forfeiture.

10. The bid security shall be in one of the following forms:

(a) A bank guarantee issued by a Nationalized/Scheduled bank in India only in the form strictly in accordance to the sample form provided in the bidding documents and valid from the date of bid opening as prescribed in the tender notice till 180 days beyond the validity of the bid.

Or

(b) A demand draft or pay order in favour of Orissa State Cooperative Milk Producers Federation Limited, Payable at Bhubaneswar.

11. Any bid not secured in accordance with clause 1 in General Condition of Contract, will be rejected by OMFED as non-responsive and the 2nd cover (price bid) shall not be opened at all.
12. Unsuccessful bidders bid security will be discharged/ returned as promptly as possible but not later than 180 days after the expiration of the period of bid validity prescribed in the bidding document.
13. The successful bidders bid security will be discharged upon the bidders executing the agreement furnishing the performance security deposit.

14. No interest shall be paid b OMFED on the bid security furnished by the bidder.

8. The bid security may be forfeited:

(a) If a bidder withdraws or modifies his bid during the period of bid validity;

Or

(b) In the case of these successful bidder, if the bidder fails:

i) To sign the agreement in accordance with tender norms;

Or

ii) To furnish the required performance security deposit as per tender norms.

Performance Security

The contractor shall submit an irrevocable PERFORMANCE GUARANTEE of 5% (Five percent) of the tendered amount in the shape as

- Demand Draft of a scheduled Bank issued in favour OMFED, pa

Or

- A bank guarantee issued by a Nationalized/Scheduled bank in India.

iv) ***The security shall be repaid to the bidder after 15 (Fifteen) month of successful installation / trial run & successful commissioning / handing over of entire.***

(i) The performance Guarantee shall be initially valid up to Twenty Months beyond the defect liability period. In case the time for completion of work gets enlarged, the contractor shall get the validity of performance Guarantee extended to cover such enlarged time for completion of work. After recording of the completion certificate for the work by the competent authority, the performance guarantee shall be returned to the contractor without any interest.

(ii) The General Manager (Proj) shall not make a claim under the Performance guarantee except for amounts to which the OMFED is entitled under the contract (notwithstanding and/or without prejudice to any other provisions in the contract agreement) in the event of:

(e) Failure by the contractor to extend the validity of the Performance Guarantee as described herein above, in which event the General Manager (Proj) may claim the full amount of the Performance guarantee.

(f) Failure by the contractor to pay OMFED any amount due, either as agreed by the contractor or determined under any of the Clauses/Conditions of the agreement, within 30 days of the service of notice to this effect by General Manger Project..

(g) Failure by the Agency to rectify any defects as defined in the defect liability clause in the tender of contract data to the satisfaction of the Engineer in charge the contractor has to pay OMFED, any amount due, either as agreed by the Contractor or determined under any of the Clauses/ Conditions of the Agreement, within 30 days of the service of notice to this effect by Engineer in Charge.

(iii) In the event of the contract being determined or rescinded under provisions of any of the clause/condition of the agreement, the performance guarantee shall stand forfeited in full and shall be absolutely at the disposal of the **OMFED**.

PAYMENT IN THE EVENT OF FRUSTRATION

If a war or other circumstances outside the control of both parties arises, after the Contract is made so that either party is prevented from fulfilling his Contractual obligation, or under the law governing the Contract, the parties are released from further performance, then the sum payable by the OMFED to the Contractor in respect of the

work executed shall be the same as that which would have been payable under clause36 hereof if the Contract had been terminated under the provisions of clause 36 hereof .

SETTLEMENT OF DISPUTES

1. If the Contractor considers any work demanded of him to be outside the requirements of the contract, or considers any drawings, record or ruling of the Engineer on any matter in connection with or arising out of the Contract or the carrying out of the work to be unacceptable, he shall promptly ask the Engineer in writing, for written instructions of the decision. Thereupon the Engineer shall give his written instructions or decision within a period of 30 days of such requests.

2. Upon the receipt of the written instructions or decisions the Contractor shall promptly proceed without delay to comply with such instructions or decisions.

3. If the Engineer fails to give his instructions or decisions in writing within a period of 30 days after being requested, or if the Contractor is dissatisfied by the instructions and decision he shall appeal to the OMFED which shall afford an opportunity to the Contractor heard and to offer an evidence in support of his appeal. The OMFED shall give a decision within a period of thirty days after the Contractor has given the said evidence in support of his appeal.

4. If the Contractor is dissatisfied with this decision, the Contractor within the period of thirty days from the receipt of the decision shall indicate his intention to refer the dispute to Arbitration, failing which the said decision shall be final and conclusive.

SECTION - 4

SPECIAL CONDITION OF CONTRACT

SPECIAL CONDITION OF CONTRACT

The drawings designs submitted by the bidder shall be verified by the Consultant engaged by OMFED is binding for execution by the bidder.

Part – I For Civil Works

1.0 EARTHWORK

Scope

This section covers the works specification of earthwork in excavation in all kinds of soils including murrum, hard murrum, soft rock (without blasting), hard rock(without blasting), rock(with blasting), filling excavated earth in plinths, sand filling in plinth, rubble soling, and brick on edge soling.

Applicable Codes

The following Indian Standard Codes, unless otherwise specified herein, shall be applicable. In all cases, the latest revision of the codes shall be referred to.

a) IS -4081 Safety code for blasting and related drilling operations

b) IS -1200 Method of measurement of building works.

c) IS -3764 Safety code for excavation work.

d) IS -3385 Code of practice for measurement of Civil Engineering works.

e) IS -2720 Part II Determination of moisture content.

Part VIII Determination of moisture content dry density relation using light compaction.

Part XXVIII Determination of dry density of soils, in-place by the sand replacement method.

Part XXIX Determination of dry density of soils, in-place, by the core cutter method.

Drawings

Engineer will furnish all necessary drawings showing the areas to be excavated, filled, sequence of priorities etc. Contractor shall follow strictly such drawings.

General

Contractor shall provide all tools, plants, instruments, qualified supervisory personnel, labour, materials, and temporary works, consumables, any and everything necessary, whether or not such items are specifically stated herein, for completion of the Work.

Contractor shall carry out the survey of the site before excavation and set properly all lines and establish levels for various works such as earthwork in excavation for leveling, basement, foundations, plinth filling, roads, drains, cable trenches, pipelines etc. Such survey shall be carried out by taking accurate cross sections of the area perpendicular to establish reference/grid lines at 5m intervals or nearer as determined by Engineer based on ground profile. These shall be checked by Engineer and thereafter properly recorded.

The area to be excavated/filled shall be cleared of fences, trees, plants, logs slumps, bush, vegetations, rubbish slush etc. and other objectionable matter. If any roots or stumps of trees are found during excavation, they shall also be burnt or disposed off as directed by Engineer. Where earth fill is intended, the area shall be stripped of all loose/soft patches, top soil containing deleterious matter/materials before fill commences.

Relics, Objects of Antiquity, Etc.

All gold, silver, oil minerals archaeological and other findings of importance, all precious stones, coins, treasures, relics, antiquities and other similar things which may be found in or upon the site shall be the property of owner and Contractor shall dully preserve the same to the satisfaction of Owner/OMFED and from time to time deliver the same to such person or persons as Owner/OMFED may from time to time authorize or appoint to receive the same.

1.01 Earth work in excavation up to 1.50M from existing GL

A) Classification

Any earthwork Will be classified under any of the following categories:-

i) **All kinds of soils**

These shall include all kinds containing kankar, sand, slit, moorum and/or shingle, gravel, clay, loam peat, ash, shale etc. which can generally be excavated by spade, pick-axe 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 bigger than 1 meter in any dimension and not more than 200mm in any one of the other two dimensions.

ii) **Soft Rock**

This shall include rock, boulders, slag, chalk, slate, hard mica schist, laterite etc. which are to be excavated with or without blasting or could be excavated with picks, hammer, crow bars, wedges. This shall also include excavation in macadam and tarred roads and pavements. This shall also include rock boulders not bigger than 1 metre in any dimension and not more than 500 mm in any one of the other two dimensions Rubble masonry to be dismantled will also be measured under this item.

iii) **Hard Rock**

This shall include rock which cannot be easily excavated with pick-axes, hammer, crow bars and wedges but has to be either heated where blasting is prohibited or has to be blasted. They shall be stacked separately for measurement.

B) The earthwork in excavation shall be done as per the Architect and structural consultant's drawings up to required depths and levels and alignments in all sorts of soils. The depth of the foundation will be as per the Engineer's instructions. The lining work should be cone by the Contractor. Roots or trees met with during the excavation shall be cut and smeared with coal tar. Excavated earth shall be stacked at least 3m away from the trenches or as per the Engineer's instructions, so that it may not damage the sides of the excavated trenches. The sides of the excavated trenches shall be vertical and in straight line and bottom uniformly leveled watered, consolidated and ready for termite treatment. The maximum lead for stacking the earth shall be 100m, unless otherwise categorically specified in the item description.

C) In firm soil if the excavation is deeper than 2m the sides of the trenches shall be made bigger by allowing steps of 50 cm on either side so as keep the slope 0.25 to 1. In loose soft or slushy soil

the width of the step shall be suitably increased or the sides sloped or shoring and strutting may be done as per the Engineer's instructions.

D) For excavation for drain work, the sides and the bottoms should be to the required slope, shape and gradient. The cutting shall be done from top to bottom. Under no circumstances shall undermining or under cutting be allowed. The final surface shall be neatly leveled and well compacted. The earth from the cutting shall be directly used for filling either in plinth or on grounds.

E) For excavation in trenches for pipes nothing extra shall be payable for the lift irrespective of the depth unless specifically mentioned otherwise in the Schedule of Quantities.

F) If the trenches are made deeper than specified level due to oversight or negligence of the Contractor the extra depth shall be filled up by lean concrete of mix 1:5:10(1 cement: 5 coarse sand and 10 coarse aggregate of nominal size 40mm) and if the trench is made wider than shown in the drawings the Contractor has to make good at his own cost. The foundation trenches shall be free from water and muck, while the foundation work is in progress.

G) The trenches, which are ready for concreting, shall be got approved by the Engineer.

H) The excavated stacked earth shall be refilled in the trenches and sides of foundation in 150 mm layers and the balance surplus shall be first filled in layers in plinth and the remaining surplus shall be disposed off by uniform spreading within the site/outside the site as directed by the Engineer.

I) Adequate protective measures shall be taken by the Contractor to see that the excavation for the building foundation does not affect the adjoining structure's stability and safety. Contractor will be responsible if he has not taken precaution for the safety of the people, property or neighbor's property caused by his negligence during the constructional operations.

J) To the extent available, selected surplus spoils from excavated materials shall be used as backfill. Fill material shall be free from clods, salts, soleplates, organic & other foreign material. All clods 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 up the voids and the mixture used for filling.

K) As soon as the work in foundation 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 15 cm to 20 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.

i) **Lead**

Lead for deposition/disposal of excavated material, shall be as specified in the respective item of work. If the lead is not specified in the respective item, a basic lead of 100 m shall be considered for quoting rates. Only leads beyond 100m shall be considered as extra lead and the Contractor shall be compensated for the same. For the purpose of measurement of lead the area to be excavated or filled or area on which excavated material is to be deposited/disposed off shall be divided into suitable blocks and for each of the blocks, the distance between centerlines shall be taken as the lead which shall be measured, as far as practically possible, by the shortest straight line route on the plan and not the actual route taken by Contractor. No extra compensation is admissible on the grounds that the lead including that for borrowed materials had to be transported over marshy or katcha land/route.

ii) All excavation shall be measured net. Dimensions for purpose of payment shall be reckoned on the horizontal area of the excavation at the base for foundations of the walls, columns, footings, tanks, rafts or other foundations structure to be built, multiplied by the mean depth from the surface of the ground in accordance with the drawings. Excavation inside slopes shall not be paid for. Contractor may make such allowances in his rates to provide for excavation in side slopes keeping in mind the nature of the soil and safety of excavation. In soft/slushy soil or in firm soil if the excavation is deeper than 2m the sides of the trenches shall be made bigger by allowing steps of 50cm on either side so as to keep slope 0.25:1. This shall be paid as per original tender rate. However, if concreting is proposed against the additional/extra excavation made by the Contractor shall be made good by the Contractor with concrete of the same class as in the foundations at his own cost.

iii) Backfilling as per specification the side of foundations of columns, footings, structures, walls, tanks rafts, trenches etc. with excavated materials will not be paid for separately. It shall be clearly understood that the rate quoted for excavation including backfilling shall include stacking of excavated material as directed, excavation/ stacking of selected stacked material, conveying it to the place of final backfill, compaction etc. as specified. As a rule material to be back filled shall be stacked temporarily within the basic lead of 100 meters unless otherwise specified in the item.

iv) The rates quoted shall also include for dumping of excavated materials in regular heaps, bunds, riprap with regular slopes as directed by Engineer within the lead specified and leveling the same so as to provide natural drainage. Rock/soil excavated shall be stacked properly as directed by Engineer. As a rule, softer material shall be laid along the center of the heaps, the harder and more weather resisting materials forming the casing on the sides and the top. Excavated soft rock or hard rock shall be stacked separately.

v) The bailing out of water shall also be executed by the Contractor at his own cost.

1.02 Earth work in excavation for depth exceeding 1.50 M but not exceeding 3.0 M

The general specification shall be same as for the item 1.01 given above.

1.03 Earth work in excavation for depth exceeding 3.0 M but not exceeding 4.5 M

The general specification shall be same as for the item 1.01 given above.

1.04 Earth work in excavation in rocks upto 1.50 M from EGL

(A) Unless otherwise stated herein, IS 4081, safety code for blasting and related drilling operations shall be followed. After removal of over burden, if any, excavation shall be continued in rock to such widths, lengths, depths and profiles as are shown on the drawings or such other lines and grades as may be specified by Engineer. AS far as possible all blasting shall be completed prior to commencement of construction. At all stages of excavation, precautions, shall be taken to preserve the rock below and beyond the lines specified for the excavating, in the soundest possible condition. The quantity and strength of explosive used, shall be such as will neither damage nor crack the rock outside the limits of excavation. All precautions, as directed by Engineer shall be taken that no damage is caused to adjoining buildings or structure as a result of blasting operations. In case of damage to permanent or temporary structures, Contractor shall repair the same to the satisfactions of Engineer at his cost. As excavation approaches its final lines and levels, the depth of charge holes and amount of explosives used shall be progressively and suitably reduced.

(B) Specific permission of Engineer will have to be taken by Contractor for blasting rock and he shall also obtain a valid blasting license from the authorities concerned. If permission for blasting is refused by Engineer, the rock shall be removed by wedging, pick barring, heating and quenching or other approved means. All loose/loosened rock in the sides shall be removed by barring wedging, etc. The unit rates for excavation in hard shall include the cost of all these operations.

(C) Contractor shall obtain necessary license for storage of explosive fuses and detonators issued to him from Owner's stores or from a supplier arranged by the Contractor, from the authorities dealing with explosives. The fees, if any, required for obtaining such license, shall be borne by

Contractor. Contractor shall have to make necessary storage facilities, for the explosive etc. as per rules and regulations of local, State and Central Govt. authorities and Statutory bodies. Explosives shall be kept dry and shall not be exposed to direct rays of sun or be stored in the vicinity of fire, stoves, steam pipes or heated metal, etc. No explosive shall be brought near the work in excess of quantity required for a particular amount of firing to be done and surplus left after filling the holes shall be removed to the magazine. The magazine shall be built as possible from the area to be blasted. Engineer's prior approval shall be taken for the location proposed for the magazine.

(D) In no case shall blasting be allowed closer than 30 meters to any structure or to locations where concrete has just been placed. In the latter case the concrete must be at least 7 days old.

(E) For blasting operations, the following points shall be observed:-

i) Contractor shall employ a competent and experienced supervisor and licensed blaster in charge for each set of operation, who shall be held personally responsible to ensure that all safety regulations are carried out.

ii) Before any blasting is carried out, Contractor shall intimate Engineer and obtain his approval in writing for resorting to such operations. He shall intimate the hours of firing charges, the nature of ensuring safety.

iii) Contractor shall ensure that all workmen and the personnel at site are excluded from an area within200M radius from the firing point, at least 15 minutes before firing time by sounding warning siren. The areas shall be encircled by red flags. Clearance signal shall also be given sounding a distinguishing siren.

iv) The blasting of rock near any existing buildings, equipment or any other property shall be done under cover and Contractor has to make all such necessary muffling arrangements. Covering may preferably be done by MS plates with adequate dead weight over them. Blasting shall be done with small charges only and where directed by Engineer; a trench shall have to be cut by chiseling prior to the blasting from the existing structures.

v) The firing shall be supervised by a Supervisor and not more than six (6) holes at a time shall be set off successively. If the blasts do not tally with the number fired, the misfired holes shall be carefully located after half an hour and when located, shall be misfired hole(but not nearer than 600 mm from it) and by exploding a new charge.

vi) A wooden tamping rod with a flat end shall be used to push cartridges home and metal rod or hammer shall not be permitted. The charges shall be placed firmly into place and not rammed or pounded. After a hole is filled to the required depth the balance of the hole shall be filed with stemming, which may consist of sand or stone dust or similar inert material.

vii) Contractor shall preferably detonate the explosives electrically.

viii) The explosive shall be exploded by means of a primer, which shall be fired by detonating a fuse instantaneous detonator (FID) or other approved cables. The detonators with FID shall be connected by special nippers.

ix) In dry weather and normal dry excavation, ordinary low explosive gunpowder may be used. In damp rock, high explosive like gelatin with detonator and fuse may be used. Under water or for excavation in rock with substantial accumulated seepage electric detonation shall be used.

x) Holes for charging explosive shall be drilled with pneumatic drills, the drilling pattern being so planned that rock pieces after blasting will be suitable for handling without secondary blasting.

xi) When excavation has almost reached the desired level, hand trimming shall have to be done for dressing the surface to the desired level. Any rock excavation beyond an over break limit of 75mm shall be filled up as instructed by Engineer, with concrete of strength not less than M10. The cost of filling such excess depth shall be borne by Contractor and the excavation carried out beyond the limit specified above will not be paid for. Stepping in rock excavation shall be done by hand trimming.

xii) Contractor shall be responsible for any accident to workmen, public or owner's property due to blasting operations. Contractor shall also be responsible for strict observance of rules, laid by Inspector of explosives, or any other Authority duly constituted under the state and/or Union Government.

xiv) The rate quoted for excavation shall include the following jobs:

a) Refilling of the trenches and consolidating and spreading as per the Engineer's directions.

b) Shoring and strutting as demanded by the site conditions and as instructed by the Engineer.

1.05 Earth work in excavation in rocks depth exceeding 1.50M but not exceeding 3.0M

The general specification is same as item no. 1.04

1.06 Filling in plinth with selected excavated earth

(A) Plinth above in layers 30 cm, watered and compacted with mechanical compaction machines. When filling reaches the finished level, the surface shall be flooded with water, if directed by the Engineer, for at least 24 hours, allowed to dry and then the surface again compacted as specified above to avoid settlements at a later stage. The finished level of the filling shall be trimmed to the level/slope specified.

(B) Where specified in the item description given in the Schedule of Quantities that the compaction of the plinth fill shall be carried out by means of 10/12 tonne rollers smooth wheeled, sheep-foot or wobble wheeled rollers. As rolling proceeds, water sprinkling shall be done to assist consolidation. Water shall not be sprinkled in case of sandy fill.

1.07 Filling in plinth with selected earth for lead exceeding 100 M but not exceeding 300M

The general specification is same as item no. 1.06

1.08 Filling excavated earth in ground for land development

(A) No earthfill shall commence until surface water discharges and streams have been properly intercepted or otherwise dealt with as directed by Engineer.

(B) Filling shall be carried out as indicated in the drawings and as directed by Engineer. If no compaction is called for, the fill may be deposited to the full height in one operation and leveled. If the fill has to be compacted, it shall be placed in layers not exceeding 600 mm and leveled uniformly and compacted before the next layer is deposited.

(C) Field compaction is called for, test shall be carried out at different stages of filling and also after the fill to the entire height has been completed. This shall hold good for embankments as well.

(D) Contractor shall protect the earthfill from being washed away by rain or damaged in any other way. Should any slip occur, Contractor should remove the affected material and make good the slip at his own cost.

(E) The fill shall be carried out to such dimension and levels as indicated on the drawings after the stipulated compaction. The fill shall be considered as incomplete if the desired compaction has not been obtained.

1.09 Filling in plinth and ground with earth brought from outside.

(A) Filling shall be carried out with approved materials as described in 1.01(J). The material and source shall be subject to prior approval of Engineer. The approved area from where the fill material is to be dug, shall be cleared of all bushes, roots, plants, rubbish etc.,top soil containing salts,sulphate and other foreign material shall be removed. The material so removed shall be burnt or disposed off as directed by Engineer. The contractor shall make necessary access roads to those areas and maintain the same, if such access roads do not exist ,at his cost.

(B) If any material is rejected by Engineer, Contractor shall remove the same for with from the site at no extra cost to the owner.Surplous fill material shall be disposed off by uniform spreading within the site as instructed by the Engineer.

(C) The compaction shall be carried out as specified in the item no. 1.06 for filling in plinth and as per item no.1.08 for filling in plinth in ground for land development.

1.10 Providing and filling local sand in trenches, plinth and surrounding areas.

(A) At places backfilling shall be carried out with local sand if directed by the Engineer. The sand used shall be kept flooded with water for 24 hours to ensure maximum consolidation. Any temporary work required to contain sand under flooded condition shall be to Contractor's account. The surface of the consolidated sand shall be dressed to require level or slope.Constructionof floors or other structures on sand fill shall not be started until engineer has inspected and approved the fill.

1.11 **Providing and laying rubble soling**

(A) Rubble used for packing under floors, foundations etc. shall be hard, durable rock, free from veins, flaws and other defects The size of the rubble shall be 100mm-150mm unless, otherwise specified in the item description in the Schedule of quantities and the quality has to be got approved by the Engineer.

(B) Rubble shall be laid closely in position on the subgrade.All interstices between the stones shall be wedged in with smaller stones of suitable size well driven to ensure tight packing and complete filling of interstices. Such filling shall be carried out simultaneously with the placing in position of rubble stone and shall not lag behind.

(C) Small interstices shall be filled with murrum, well watered and rammed.

1.12 **Brick Soling**

(A) Bricks shall be laid on edge or flat as per the item specification .The bricks shall be placed as close as possible. Broken bricks shall not be used except for closing the line. Bricks should not show any efflorescence on drying.

(B) The soling pattern shall be as specified in the item specification; it can be plain, diagonal or herringbone. Suitable slope shall be maintained as specified by the Engineer.

(C) The joints shall be filled with earth or sand as specified. If it is to be filled with cement mortar, the proportion of mortar shall be as specified in the item specification.

1.13 Providing and laying dry stone pitching

(A) Stone subject to marked deterioration by water or weather will not be accepted. The stone shall be hard, durable and fairly regular in shape and its thickness in any one direction shall not be less than the thickness of the pitching as specified in the Schedule of Quantities.

(B) Before laying the pitching the sides of the sloped surface shall be trimmed to the required slope and profiles. The depressions shall be thoroughly filled and compacted. It shall commence from the bottom. The stones shall be placed normal to the slope and the largest dimension is perpendicular to the face of the slope unless such dimension is more than thickness of the pitching. The largest stones shall be placed at the bottom. The joints between the stones shall be filled with good earth. The earth shall be got approved by the Engineer before filling.

1.14 Providing and laying dry stone pitching with cement pointing

(A) The general specification shall be same as the item no. 1.13 but for the joints between the stones shall be filled with cement and mortar of proportion as specified in the item description in the Schedule of Quantities.

1.15 **Providing and filling dry brickbats at all levels**

The brickbats shall be of 40-65mm (average) thickness in size. The brickbats shall be clean and mortar free. They should be washed off dust before it is filled. They shall be filled in places as directed by the Engineer.

2.0 CONCRETE AND ALLIED WORKS

I. Applicable codes

The following codes and standards are made a part of the specifications: All standards, codes of practices referred to herein shall be the latest edition including all applicable official amendments and revisions. In case of discrepancy between this specification and those referred to herein, this specification shall prevail.

(a) Materials

1) IS 269 : Specification for ordinary, rapid hardening and low heat Portland cement.

2) IS 455 : Specification for Portland blast furnace slag.

3) IS1489 : Specification for Portland-pozollana cement.

4) IS 4031 : Methods of physical tests for hydraulic cement.

5) IS 650 : Specification for standard sand for testing of Cement.

6) IS 383 : Specification for coarse and fine aggregates from natural sources for concrete.

7) IS 2386 (Parts I to VIII) : Methods of test for aggregates for concrete.

8) IS 516 : Methods of test for strength of concrete.

9) IS 1199 : Methods of sampling and analysis of concrete.

10) IS 2396(I)
IS 5640 : Flakiness Index of aggregates.

11) IS 3025 : Methods of sampling and test (physical and chemical Water used in industry).

12) IS 432 (Part I &II) : Specification for mild steel and medium tensile steel bars and hard drawn steel wire for concrete reinforcement.

13) IS 1139 : Specification for hot rolled mild steel and medium tensile steel deformed bars for concrete reinforcement.

14) IS 1566 : Specification for plain hard drawn steel wire Febric for concrete reinforcement.

15) IS 1785 : Specification for plain hard drawn (Part I) steel Wire for pre stressed concrete.

16) IS 1786 : Specification for cold twisted steel bars for Concrete reinforcement.

17) IS 2090 : Specification for high tensile steel bars used in Prestressed concrete.

18) IS 4990 : Specification for plywood for concrete shuttering Work.

19) IS 2645 : Specification for integral cement water proofing Compounds.

(b) **Equipment**

1) IS 1791 : Specification for batch type concrete mixers.

2) IS 2438 : Specification for roller pan mixture.

3) IS 2505 : Specification for concrete vibrators immersion Type.

4) IS 2514 : Specifications for concrete vibrating tables.

5) IS 3366 : Specification for pan vibrators.

6) IS 4656 : Specification for form vibrators for concrete.

7) IS 2722 : Specification for portable swing-weigh-batchers for concrete (single and double bucket type).

8) IS 2750 : Specification for steel scaffoldings.

(c) **Codes of practice**

1) IS 456 : Code of practice for plain and reinforced concrete.

2) IS 1343 :33de of practice for prestressed concrete.

3) IS 457 : Code of practice for general construction of Plain and reinforced concrete for dams and Other massive structures.

4) IS 3370 (Part I to IV) : Code of practice for concrete structures for storage of liquids.

5) IS 3935 : Code of practice for composite construction.

6) IS 3201 : Criteria for design and construction of precast Concrete trusses.

7) IS 2204 : Code of practice for construction of reinforced

concrete shell roof.

8) IS 2210 : Criteria for the design of RC shell structures and folded plates.

9) IS 2751 : Code of practice for welding of mild steel bars Used for reinforced concrete construction.

10) IS 2502 : Code of practice for bending and fixing of bars for concrete reinforcement.

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 4014 (Part I& II) : Code of practice for steel tubular scaffolding.

14) IS 2571 : Code of practice for laying in-situ-cement concrete flooring.

(d) **Construction safety**

1) IS 3696 : Safety code for scaffolds and ladders.

(e) **Measurement**

1) IS 1200 : Method of measurement of building works.

2) IS 3385 : Code of practice for measurement of civil engineering works.

II <u>General</u>

The quality of materials, method and control of manufacture and transportation of all concrete work irrespective of mix ,whether reinforced or otherwise shall conform to the applicable portions of this specification.

Engineer shall have the right to inspect the source/s of material/s the layout and operation of procurement and storage of materials, the concrete batching and mixing equipment, and the quality control system. Such an inspection shall be arranged and engineer's approval obtained, prior to starting of concrete work.

III <u>Materials</u>

The ingredients to be used in the manufacture of standard concrete shall consist solely of standard type Portland cement, clean sand, natural coarse aggregate, clean water and mixtures.

(A) **Cement**

a) If the contractor is instructed to supply cement then the following points shall be applicable:

i) Unless otherwise specified the cement shall be ordinary Portland cement in 50kg bags. The use of bulk cement will be permitted only with the approval of the engineer.

ii) A certified report attesting to the conformance of the cement to IS specification by the cement manufacturer's chemist shall be furnished to engineer if demanded.

iii) Cement held in storage for a period of ninety (90) days or longer shall be tested. Should at any time engineer have reasons to consider that any cement is defective, then irrespective of its origin, and/or manufacturers test certificate, such cement shall be tested immediately at contractor's cost at a National Test Laboratory/approved laboratory and until the results of such tests are found satisfactory, it Shall not be used in any work, Contractor shall not be entitled to any claim of any nature on this account.

b) If the cement is supplied by OMFED

i) Contractor will have to make his own arrangements for the storage of minimum 25 MT of cement. If supplies are arranged by OMFED, cement will be issued in quantities to cover work requirements of one month or more, as deemed fit by engineer and it will be the responsibility of the contractor to ensure adequate and proper storage. Cement in bulk may be stored in bins or silos which will provide complete protection from dampness, contamination and minimize caking and false set. Cement bags shall be stored in a dry enclosed shed (storage under tarpaulins will not be permitted),well away from the outer walls and insulated from the floor to avoid contact with moisture from ground and so arranged as to provide ready access damaged or reclaimed or partly set cement will not be permitted to be used and shall be removed from the site. The storage bins and storage arrangements shall be such that there is no dead storage. Not more than 12 bags shall be stacked in any tier. The storage arrangement shall be approved by engineer. Consignments of cement shall be stored as received and shall be consumed in the order of their delivery.

(B) **Aggregates**

a) Aggregates in general designate both fine and coarse inert materials used in the manufacture of concrete. Fine aggregate is aggregate all of which passes through 4.75mm IS sieve. Coarse aggregate is aggregate most of which is retained on 4.75 mm sieve.

b) All fine and coarse aggregates proposed for use in the work shall be subject to engineer's approval and after specific materials have been accepted the source of supply of such materials should not be changed without prior approval of engineer.

c) Aggregates shall, except as noted above, consist of natural sands, crushed stone, and gravel from a source known to produce satisfactory aggregate for concrete and shall be chemically inert ,strong,hard,durable against weathering, of limited porosity and free from deleterious materials that may cause) corrosion of the reinforcement or may impair the strength and/or durability of concrete. The grading of aggregates shall be such as to produce a dense concrete of specified strength and consistency that will work readily into position without segregation and shall be based on the mix design and preliminary tests on concrete specified later.

d) Sampling and testing

Samples of the aggregates for mix design and determination of suitability shall be taken under the supervision of engineer and delivered to the laboratory, well in advance of the scheduled placing of concrete. Records of the tests, which have been made on, proposed aggregates and on concrete made from this source of aggregates shall be furnished to engineer in advance of the work for use in determining aggregate suitability. The cost of all such tests, sampling etc. shall be borne by contractor.

e) Storage of aggregates

All coarse and fine aggregates shall be stacked in stock separately in stockpiles in the material yard near the work site in bins properly constructed to avoid intermixing of different aggregates. Contamination with foreign materials and with earth during storage and while heaping the materials shall be avoided. The aggregate must be of specified quality not only at the time of receiving at site but more so at the time of loading into mixer. Rackers shall be used for lifting the coarse aggregates from the bins or stock piles. Coarse aggregate shall be piled in layers not exceeding 1.20metres in height to prevent coning or segregation. Each layer shall cover the entire area of the stock pile before succeeding layers are started. Aggregates that have become segregated shall be rejected.

f) Specific gravity

Aggregate except as noted above, and for other than light weight concrete shall consist of natural or crushed sand shall conform to IS 383.The sand shall be clean sharp,hard,strong,and durable and shall be free from dust, vegetable substances, adherent coating,clay,alkali,organic matter,mica,salt or other deleterious substances which can be injurious to the setting qualities/strength/durability of concrete.

(C) **Machine made sand**

Machine made sand will be acceptable, provided the constituent rock /gravel composition shall be sound, hard dense, non-organic uncoated and durable against weathering.

i) **Screening and washing**

Sand shall be prepared for use for such screening or washing, or both, as necessary, to remove all objectionable foreign matter while separating the sand grains to the required size fractions.

ii) **Foreign material limitations**

The percentage of determine substances in sand delivered to the mixer shall not exceed the following

i) Material finer than 75 micron IS sieve	3.00	15.00
ii) Shale	1.00	--
iii) Coal and lignite	1.00	1.00
IV) Clay lumps	1.00	1.00
v) Total of all above substances Including items (i) to (IV) for uncrushed sand and items(iii) and (IV) for crushed sand.	5.00	2.00

iii) **Gradation**

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

	Percentage passing for			
IS Sieve Designation	Grading Zone I	Grading Zone II	Grading Zone III	Zone IV
10mm	100	100	100	100
4.75mm	90-100	90-100	90-100	95-100

2.36mm	60-95	75-100	85-100	95-100
1.18mm	30-70	55-90	75-100	90-100
600micron	15-34	35-59	60-79	80-100
300micron	5-20	8-30	12-40	15-50
150micron	0-10	0-10	0-10	0-15

Where the grading falls outside the limits of any particular grading zone of the sieves other than 600micron IS sieve, by total amount not exceeding 5 percent, it shall be regarded as falling within that grading zone. This tolerance shall not be applied to percentage passing the 600micron IS sieve or to percentage passing any other sieve on the coarser limit of grading zone I or the finer limit of grading zone IV.

IV) **Fineness modulus**

The sand shall have a fineness modulus of not less than 2.2 or more than 3.2. The fineness modulus is determined by adding the cumulative percentages retained on the following IS sieves sizes 4.75mm,2.36mm,1.18mm,600micron,300micron,and 150micron and dividing the sum by 100.

(D) **Coarse Aggregate**

a) Coarse aggregate for concrete, except for as noted above and for other than light weight concrete shall conform to IS 383.This shall consist of natural or crushed stone and gravel and shall be clean and free from elongated, flaky, or laminated piece adhering coatings, clay lumps, coal residue, clinkers, slag, alkali, mica, organic matter or other deleterious matter.

b) **Screening and washing**

Natural gravel and crushed rock shall be screened and/or washed for the removal of dirt or dust coating, if so demanded by Engineer.

c) **Grading**

Coarse aggregate shall be graded, in both cases the grading shall be within the following limits:

IS sieve Designation	**% passing for single sized aggregate of nominal size mm**					**%passing for graded aggregate of nominal size mm**			
	40	**20**	**16**	**12.5**	**10**	**40**	**20**	**16**	**12.5**
63mm	100	--	--	--	--	100	--	--	--
40mm	85	100	--	--	--	95	100	--	--
20mm	0-20	85-100	--	--	--	30-95	95-100	--	--
16mm	--	--	85-100	--	--	--	--	90-100	--
12.5mm	--	--	85-100	--	--	--	--	--	90-100
10mm	0.5-20	0-30	0-45	0-100	85-100	10-35	25-55	30-70	40-85
4.75mm	--	0-5	0-5	0-5	0-5	0-5	0-5	0-5	0-5

	5	5	10	20	5	10	10	10
2.36mm	--	--	--	--	0-5	--	--	--	--

The pieces shall be angular in shape and should have granular or crystalline surfaces, Friable, flaky and laminated prices, mica and shale, if present, shall only be in such quantities that will not is the opinion of the Engineer affect adversely the strength and/or durability of concrete. The maximum size of coarse aggregate shall be 75mm for class a concrete, 40mm for class B concrete, and 20mm for class C concrete. The maximum size of coarse aggregate shall be maximum size specified above, but in no case

greater than 1/4 of the minimum thickness of the member provided that the concrete can be placed without difficulty so as to surround all reinforcement thoroughly and fill the corners of the form. Plums above 150 mm and upto any reasonable size can be used in plain mass concrete work of large dimensions of maximum limit of 20% of the volume of concrete when specifically approved by Engineer. For heavily reinforced concrete members the nominal maximum size of the aggregate shall be 5mm less than the minimum clear distance between the reinforcing main bars or 5mm less than the minimum cover to the reinforcement whichever is smaller. The amount of particles occurring in the free state or as loose adherent shall not exceed 1% when determined by laboratory sedimentation tests as per IS 2386. After 24 hours immersion in water, a previously dried sample shall not have gained more than 10% of its oven dry weight in air, as determined by IS 2386.

d) **Foreign Material Limitations**

The percentages of deleterious substance in the coarse aggregate delivered to the mixer shall not exceed the following:

	Percentage by weight	
	Uncrushed	**Crushed**
i) Material finer than 75 micron IS sieve.	3.00	3.00
i) Coal and Lignite	1.00	1.00
iii) Clay Lumps	1.00	1.00

I

V) Soft fragments	3.00	---
v) Total of all the above substances	5.00	5.00

(E) **Water**

a) Water used for both mixing and curing shall be free from injurious amounts of deleterious materials. Portable waters are generally satisfactory for mixing and curing concrete.

b) In case of doubt, the suitability of water for making concrete shall be ascertained by the compressive strength and initial setting time test specified in IS 456.The sample of water taken for testing shall be typical of the water proposed to be used for concreting, due account being paid to seasonal variation. The sample shall not receive any treatment before testing other than that envisaged in the regular supply of water proposed for use in concrete. The sample shall be stored in clean container previously rinsed out with similar water.

c) Average 28 days compressive strength of at least three 15cm concrete cubes prepared with water proposed to be used shall not be less than 90% of the average strength of three similar concrete cubes prepared with distilled water

d) The initial setting time or the test block made with the appropriate set cement and the water proposed to be used shall not be less than 30 minutes and shall not differ by more than plus minus 30seconds from the initial setting time of the control test block prepared with appropriate test cement and distilled water. The test blocks shall be prepared and tested in accordance with the requirements of IS 4031.

e) Where water can be shown to contain an excess of acid, alkali sugar or salt, engineer may refuse to permit its use. As a guide the following concentrations represent the maximum permissible values:

i) To neutralize 200 ml sample of water , using phenolphthalein as indicator , it should not require more than 2ml of 0.1 normal Noah. The details of the tests shall be as given in IS 3025.

ii) To neutralize 900ml sample of water using methyl orange as an indicator, it should not require more than 10ml of 0.1 normal HCl. The details of the tests shall be given in IS 3025.

iii) Percentage of solids when tested in accordance with the method indicated below shall not exceed the following:

	Percent	Method of test (Ref. to clause no. in IS 3025-1964)
Organic	0.02	10 and 11 (organic solids=total solids minus ignited residue).
Inorganic		
Sulphate (as SO4)	0.30	11(Ignited residue)
Alkali chlorides		
(as Cl)	0.05	20
	0.10	24

(F) **Brick aggregates**

The brickbats shall be of new bricks well burnt, hard, durable and broken into sizes, well graded. It shall be free from dust; the size shall be of 37mm and down. It shall be free from earth and other impurities.

(G) **Reinforcement Steel**

a) Reinforcement bars, if supplies are arranged by contractor shall be either plain round mild steel bars grade I as per IS 432(Part I) or medium tensile steel bar as per IS432 (PartI) or hot rolled mild steel and medium tensile steel deformed bars as per IS 1139 or cold twisted steel bars as per IS 1786 as shown and specified on the drawings. Wire mesh or fabric shall be in accordance with IS 1566. Substitution of reinforcement will not be permitted except upon written approval from the engineer.

b) Plain round mild steel bars grade II as per IS 432 (part I) may be issued with prior approval if the engineer in writing and with 10% increase in the reinforcement area but its use shall not be

permitted in structures located in earthquake zones subjected to severe damage (as per IS 1895) and for structures subject to dynamic loading (other than wind loading), such as frames supporting rotary or reciprocating machinery etc.

c) All reinforcement shall be clean, free from grease oil, paint, loose mill scale, loose rust, bituminous material or any other substances that will destroy or reduce the bond. All rods shall be thoroughly cleaned before being fabricated. Pitted and defective rods shall not be used.

2.01 providing and laying Brickbat Cement Concrete 1:4:8 (1 Cement, 4 coarse sand, 8 Brickbats of size 37 mm and down).

The brick bats, sand and cement shall be of quality as described in the materials section above. The materials shall be mixed in volumetric proportions in concrete mixer only. The concrete shall be laid in layers of 150mm thick and well consolidated with rammer of weight 4.5 to 5.5 kg steel rammers of base area 300 sq cm till slurry comes on top before the next layer is laid. Curing shall be done for 7 days. For joints the edge of the concrete shall be finished off with a slope not steeper than 2:1 and well roughened.

2.02 Providing and laying Brickbat Cement Concrete 1:5:10(1 cement, 5 coarse sand, 10 brickbats of size 37mm and down).

The general specification is same as for item no.2.01 but for the volumetric proportion of the sand and brickbats is 5 and 10 instead of 4 and 8 respectively.

2.03 Providing and laying plain cement concrete1:4:8 (1cement:4 coarse sand , 8 graded stone aggregate of nominal size 37 mm and down.

The coarse aggregate, cement and coarse sand shall be of quality as specified in the materials section. The other procedures are same as specified in item no. 2.01

2.04 Providing and laying plain cement concrete 1:3:6(1 cement: 3 coarse sand, graded stone aggregate of nominal size 37 mm and down.

-Do-same as per item no 2.03 but for the volumetric proportions of the coarse sand and the stone aggregate which shall be 3:6 instead of 4:8.

2.05 Providing and laying RCC of mix M 15 for structures of up to plinth level.

Mix design

a) All concrete in the works shall be of design mix as defined in IS 456, unless it is a nominal mix concrete such as 1:3:6,1:4:8 or 1:5:10. Whether reinforced or otherwise, all design mix concrete works to be carried out under this specifications shall be divided into the following classifications:

MINIMUM COMPRESSIVE STRENGTH OF 15 CM CUBES AT 7 AND 28 DAYS AFTER MIXING, CONDUCTED IN ACCORDANCE WITH IS 516

Class	Preliminary Test N/SQ.MM		Work test N/SQ.MM		Max size of Aggregate mm.	Minimum cement content per
	At 7 days	at 18 days	at 7 days	at 28 days		
M 42	35.0	54.0	27.0	46.0	20	550 kg
M 35	31.0	45.0	23.5	39.0	20	470 kg
M 30	28.0	42.0	20.0	33.0	20	420 kg
M 25	23.5	35.0	17.0	28.0	20	370 kg
M 20	19.4	29.0	13.5	22.0	20	320 kg
M 15	14.0	17.0	10	16.0	20	300 kg

b) It shall be very clearly understood that whenever the class of concrete such as M 20 is specified it shall be the Contractor's responsibility to ensure that minimum crushing strength stipulated for the respective class of concrete is obtained at works. The maximum total quantity of aggregate by weight per 50 kg of cement shall not exceed 450 kg except when otherwise specifically permitted by Engineer.

c) To fix the grading of aggregates, water cement ratio, workability and the quantity of cement required to give preliminary and works cubes of the minimum strength specified, the proportions of the mix shall be determined by weight/volume. Adjustment of aggregate proportion due to the moisture present in the aggregate shall be made .Mix proportioning shall be carried out according to Indian Standard Specifications.

d) Whenever there is a change either in required strength of concrete or water cement ratio or workability or the source of aggregates and / or cement, preliminary tests shall be repeated to determine the revised proportions , of the mix to suit the altered conditions .

e) While fixing the value for water cement ratio for preliminary mixes , assistance may be derived from the graph (appendix IS 456 showing the relationship between the 28 day compressive strengths of concrete mixes with different water cement ratios and the 7 days compressive strength of cement tested in accordance with IS 269 .

Preliminary tests

a) Test specimens shall be prepared with at least two different water/cement ratios for each class of concrete , consistent with workability required for the nature of the work. The materials and proportions used in making preliminary tests shall be similar in all respects to those to be actually employed in the works as the object of these tests is to determine the proportions of cement, aggregates and water necessary to produce concrete of required consistency and to give the specified strength .It will be the Contractor's sole responsibility to carry out these tests and he shall therefore furnish to Engineer a statement of proportions proposed to be used for the various concrete mixes .

b) Materials shall be brought to the room temperature and all materials shall be in a dry condition .The quantities of water , cement and aggregates for each mix shall be determined by weight / volume to accuracy of 1 part in 1000 parts .

c) Mixing shall be done by a mixer machine as per IS 516 in such a manner as to avoid loss of water. The cement and fine aggregate shall first be mixed dry until the mixture is uniform in colour. The coarse aggregate shall then be added, mixed and water added and mixed thoroughly for a period not less than 3 minutes until the resulting concrete is uniform in appearance. Each

mix of concrete shall be of such quantity as to leave about 10% excess concrete after molding the desired number of test specimens.

d) The consistency of each mix of concrete shall be measured immediately after mixing, by the slump test in accordance with IS 1199.If in the slump test care is taken to ensure that no water or other material is lost, the materials used for the slump test may be remixed with the reminder of the concrete for making the specimen test cubes. The period of mixing shall be as short as possible yet sufficient to produce a homogenous mass.

e) Compression tests of concrete cubes shall be made as per IS 516 on 15cm cubes. Each mould shall be provided with a metal base having a plane surface so as to support the mould during filling without leakage. The base plate shall be preferably attached to the mould by springs or screws. The parts of the mould when assembled shall be positively and rigidly held together. Before placing concrete the mould and base plate shall be cleaned and oiled. The dimensions and internal faces of the mould shall be accurate within the following limits:

Height and distance between the opposite faces of the mould shall be of specified size plus minus 0.2 mm. The angle between the adjacent internal faces and between internal faces and top and bottom planes of mould shall be 90 deg. Plus minus 5 deg. The interior faces of the mould shall be plane surfaces with a permissible variation 0.03mm.

f) Concrete test cubes shall be moulded by placing fresh concrete in the mould and compacted as specified in IS 516.

g) Curing shall be as specified in IS 516.The cubes shall be kept in moist air of at least 90% relative humidity at a temp. of 27 deg. Cent. Plus minus 2 deg. Cent. For 24 hours plus minus half hour from the time of adding water to the dry ingredients. Thereafter they shall be removed from the moulds and Kept immersed in clean, fresh water and kept at 27 deg. Cent. temp until required for test. Curing water shall be renewed every seven days. A record of maximum and minimum temperatures at the place of storage of the cubes shall be maintained during the period they remain in storage.

h) **Testing of Specimens**

The strength shall be determined based on not less than five cubes tests specimens for each age and each water cement ratio. All these laboratory test results shall be tabulated and furnished to the Engineer. The test result shall be accepted by the Engineer if the average compressive strengths of the specimens are tested subject to the condition that only one out of the five consecutive tests may give a value less than the specified strength for that age. The Engineer may direct the Contractor to repeat the tests if the results are not satisfactory and also to make

such changes as he considers necessary to meet the requirements specified. All these preliminary tests shall be conducted by the Contractor at his own cost in an approved laboratory.

Proportioning consistency, batching and mixing of concrete

Proportioning

a) **Aggregate**

The proportions which shall be decided by conducting preliminary test shall be by volume. These proportions of cement, fine and coarse aggregates shall be maintained during subsequent concrete mixing. The supply of properly graded aggregate of uniform quality shall be maintained over the period of work, the grading of aggregates shall be controlled by obtaining the coarse aggregate in different sizes and blending them in right proportions. The different sizes shall be stocked in separate stock piles. The grading of coarse and fine aggregates shall be checked as frequently as possible as determined by the Engineer, to ensure maintaining of grading in accordance with the samples used in preliminary mix design. The material shall be stock piled well in advance of use.

b) **Cement**

The cement shall be measured by volume.

c) **Water**

Only such quantity of water shall be added to the cement and aggregates in the concrete mix as to ensure dense concrete, specified surface finish, satisfactory workability, consistent with the strength stipulated for each class of concrete. The water added to the mix shall be such as not to cause segregation of material or the collection of excessive free water on the surface of concrete.

The water cement (W/C) ratio is defined as the volume of water in the mix (including the surface moisture of the aggregates) divided by the volume of cement in the mix. The actual water cement ratio to be adopted shall be determined in each instance by the Contractor and approved by the Engineer.

d) **Proportioning by water/cement ratio**

The w/c ratio specified for use by Engineer shall be maintained. The Contractor shall determine the water content of the aggregate as frequently as directed by Engineer as the work progress and as specified in IS 2386(Part III) and the amount of water added at the mixer shall be adjusted as directed by Engineer so as to maintain the specified W/C ratio. To allow for the variation in volume of aggregates due to variation in their moisture content suitable adjustments in the volume of aggregates shall also be made.

e) **Consistency and slump**

Concrete shall be of a consistency and workability suitable for the conditions of the job. After the amount of work for the job is determined, the consistency of the mix shall be maintained throughout the progress of the corresponding parts of the work and approved tests e.g. slump tests, compacting factor tests, in accordance with IS 1199 shall be conducted from time to time to ensure the maintenance of such consistency.

f) The following tabulation gives a range of slumps, which shall generally be used for various types of construction unless otherwise instructed by the Engineer.

SLUMPS FOR VARIOUS TYPES OF CONSTRUCTION

Only sufficient quantity of water shall be added to concrete dur-ing mixing to produce a mix of sufficient workability to enable it to be well consolidated, to be worked into the corners of the shuttering and around the reinforcement, to give the specified surface finish, and to have the specified surface strength. The following slumps shall be adopted for different kinds of works:-

Name of Work	When Vibrator used	When Vibrator not used
Mass concrete in foundations, footings		

Retaining walls and pavements.	10mm to 25mm	50mm to 75mm
Thin sections of floors Of less than 75 mm thick.	25mm to 40mm	75mm to100mm

For Reinforced cement concrete work:

Mass concreting in foundations, footings retaining walls and pavements.	10mm to 25mm	80mm
Beams, slabs, columns	25mm to 40mm	100mm to 125mm
Thin shells, folded Plates etc.	40mm to 50mm	125mm to150mm

Sampling and testing concrete in the field

a) Facilities required for sampling materials and concrete in the field shall be provided by the Contractor at no extra cost. The following equipment with operator shall be made available at Engineer's request (all must be in serviceable condition).

i) One concrete cube testing machine suitable for 15cm machine suitable for 15cm cubes of 100 tones capacity with proving calibration ring.

ii) Twelve cast iron cube moulds of 15cm size.

iii) One Lab. balance to weigh up to 5kg with sensitivity of 10gm.

iv) One set of sieves for coarse and fine aggregates.

v) One set of slump cone complete with tamping rod.

vi) A set of measures from 5 litre to 0.1 litre.

vii) One electric oven with thermostat up to 120 Deg.Cent.

viii) One flakiness gauge.

ix) One elongation index gauge.

x) One sedimentation pipette

xi) One pyconometer

xii) Two calibrated glass jars of 1 litre capacity

Arrangement can be made by the contractor to have the cubes tested in an approved laboratory in lieu of a testing machine at site at his expense, with the prior consent of the Engineer.

b) At least 6 test cubes of each class of concrete shall be made for every 15.0 cu.m. of concrete or part thereof. Such samples shall be drawn on each day for each type of concrete. Of each set of 6 cubes three shall be tested at 7 days age at three at 28 days age. The laboratory test results shall be tabulated and furnished to Engineer. Engineer will pass the concrete if average strength of the specimens tested is not less than the strength specified, subject to the condition that only one out of three consecutive tests may give a value less than the specified strength but this shall not be less than 90% of the specified strength. The cubes shall be tested on 7^{th} and 28^{th} day from the day of casting the cubes.

Admixtures

a) Admixtures may be used in concrete only with the approval of Engineer based upon evidence that, with the passage of time, neither the compressive strength nor its durability reduced. Calcium chloride shall not be used for accelerating setting of the cement for any concrete containing reinforcement or embedded steel parts. When Calcium chloride is permitted to be used, such as in mass concrete works, it shall be dissolved in water and added to the mixing water in an amount not to exceed 1.5% of the volume of the cement in concrete. When admixtures are used, the designed concrete mix shall be corrected accordingly. Admixtures shall be used as per manufacturer's instructions and in the manner and with the control specified by Engineer.

b) **Air entraining agents**

Where specified and approved by Engineer, neutralized vinyl resin or any other approved air-entraining agent may be used to produce the specified amount of air in the concrete mix and these agents shall conform to the requirements of ASTM standard 6260, air entraining admixtures for concrete. The recommended total air content of the concrete is 4% plus minus 1%. The method of measuring air content shall be a per IS 1199.

c) **Water reducing admixtures**

Where specified and approved by Engineer water reducing lignosulfonate mixture shall be added in quantities specified by Engineer. The admixtures shall be added in the form of a solution.

d) **Retarding admixtures**

Where specified and approved by Engineer, retarding agents shall be added to the concrete mix in quantities specified by Engineer.

f) **Water proofing agent**

Where specified and approved by Engineer, water proofing agent conforming to IS: 2645 shall be added in quantities specified by Engineer.

Optional tests

a) Engineer may order tests to be carried out on cement, sand, coarse aggregate in accordance with the relevant Indian standards. Tests on cement shall include (i) fineness test (ii) test for normal consistency (iii) test for setting time (iv) test for soundness (v) test for tensile strength (vi) test for compressive strength (vii) test for heat of hydration by experiment and by calculations in accordance with IS:269 .Test on sand shall include (i) sieve test (ii) test for organic impurities (iii) decantation test for determining clay and silt content (iv) specific gravity test (v) test for unit weight and bulkage factor . Tests on coarse aggregate shall include (i) test for sieve analysis (ii) specific gravity and unit weight of dry loose and rodded aggregate (iii) soundness and alkali aggregate reactivity (iv) pictographic examination (v) deleterious materials and organic impurities (vi) test for aggregate crushing value. Any or all these tests would normally be ordered to carried out only if Engineer feels the materials are not in accordance with the specifications or if the specified concrete strengths are not obtained and shall be performed by contractor at site or an approved test laboratory. If the tests are successful, OMFED shall pay for all such optional tests otherwise the Contractor shall have to pay for them.

b) If the works cubes do not give the stipulated strengths Engineer reserves the right to ask contactor to dismantle such portions of the work, which in his opinion are unacceptable and redo the work to the standard stipulated at contactor's cost.

c) Load test on members or any other tests

i) In the event of any work being suspected as faulty material or workmanship or both, Engineer requiring its removal and reconstruction may order the contractor that it should be load tested in accordance with the following provisions.

ii) The test load shall be 125% of the maximum superimposed load for which the structure was designed. Such test load shall not be applied before 56 days after the effective hardening of the concrete. During the tests, struts strong enough to take the load shall be placed in position leaving a gap under the members. The test load shall be maintained for 24 hours before removal.

iii) If within 24 hours of the removal of the load , the structure does not show a recovery of at least 75% of the maximum deflection shown during the 24 hours under load the test loading shall be repeated after a lapse of at least 72 hours. The structure shall be considered to have failed to pass the testify the recovery after the second test is not at least 75% of the maximum deflection shown during the second test. If the structure is certified as failed by Engineer, the cost of the load test shall be borne by the contractor.

iv) Any other tests e.g. taking out in approved manner concrete cores, examination and tests on such cores removed from such part of the structure as directed by the Engineer, sonic testing etc. shall be carried out by contractor if so directed.

v) Should the results of any test prove unsatisfactory, or the structure shows signs of weakness, undue deflection or faulty construction the contractor shall remove and rebuild the member or members involved or carry out such other remedial measures as may be required by Owner/OMFED. The contractor shall bear the cost of so doing,

unless the failure of member or members to fulfill the test conditions is proved to be solely due to faulty design.

Concrete in alkali soils and alkaline water

Where concrete is liable to attack from alkali salts or alkaline water , special cements containing low amount of tricalcium aluminates shall be used , if so specified in the drawings . Such concrete shall have a minimum 28 days compressive strength of 250 kg per sq.cm and shall contain not less than 370 kg of cement per cubic meter of concrete in place. If specified, additional protection shall be obtained by the use of a chemically resistant stone facing or a layer of plaster of Paris covered with suitable fabric , such as jute thoroughly impregnated with tar.

Preparation prior to concrete placement

a) Before the concrete is actually placed in position, the insides of the form work shall be inspected to see that they have been cleaned and oiled. Temporary openings shall be provided to facilitate inspection, especially at bottom of columns and walls forms to permit removal of saw dust, wood shavings, binding wire, rubbish dirt etc. Openings shall be placed or holes drilled so that these materials and water can be removed easily. Such openings/holes shall be later suitably plugged.

b) The various agencies shall be permitted ample time to install drainage and plumbing lines in floor and trench drains , conduits , hangers , anchors, inserts, sleeves, bolts ,frames and other miscellaneous embedment to be cast in the concrete as indicated on the drawings or as is necessary far the proper execution of the work . Contractor shall cooperate fully with all such agencies and shall permit the use of scaffolding form work etc. by other agencies at no extra cost

c) All embedded parts, inserts etc. supplied by Owner or Contractor shall be correctly positioned and securely held in the forms to prevent displacement during depositing and vibrating of concrete.

d) Anchor bolts shall be positioned and kept in place with the help of proper manufactured templates. The use of all such templates, fixture etc. shall be deemed to be included in the rates.

e) Slots, openings, holes, pockets etc. shall be provided in the concrete work in the positions indicated in the drawings or as directed by Engineer.

f) Prior to concrete placement all work shall be inspected and approved by Engineer and if found unsatisfactory , concrete shall not be poured until after all defects have been corrected at Contractor’s cost. Cat ladders shall be provided on the reinforcement to facilitate labour movement.

g) Approval by Engineer for all materials and work as required herein shall not relieve contractor from his obligation to produce finished concrete in accordance with the drawings and specifications.

h) No concrete shall be placed in wet weather or on water covered surface. Any concrete that has been washed by heavy rains, the work shall be entirely removed, if there is any sign of cement and sand having been washed from the concrete mixture. To guard against damage, which may be caused by rains, the works shall be covered with tarpaulins immediately after the concrete has been placed and compacted. Any water accumulating on the surface of the newly placed concrete shall be removed by approved means and no further concrete shall be placed thereon until such water is removed. To avoid flow of water over/around freshly placed concrete, suitable drains and sumps shall be provided.

i) Immediately after concrete placement begins, proposed surfaces except framework, which will come in contract with the concrete to be placed , shall be covered with a bonding mortar.

Transportation

a) All buckets, containers or conveyors used for transporting concrete shall be mortar tight. Irrespective of the method of transportation adopted , concrete shall be delivered with required consistency and plasticity without segregation or loss of slump. However chutes shall not be used for transport of concrete without the written permission of Engineer and concrete shall not be rehandled before placing.

b) Concrete must be placed in its final position before it becomes too stiff to work . On no account, water shall be added after the initial mixing concrete which has become stiff or has been contaminated with foreign materials shall be rejected and disposed off as directed by Engineer.

c) All equipment used for mixing, transporting and placing of concrete shall be maintained in clean condition. All pans, buckets, hoppers, chutes, pipelines and other equipment shall be thoroughly cleaned after each period of placement.

Procedure for placing concrete

a) Before any concrete is placed, the entire placing programme, consisting of equipment, layout proposed procedures and methods shall be submitted to engineer for approval if so demanded by Engineer and no concrete shall be placed until Engineer’s approval has been received.

Conveyor for conveying concrete shall be of such size and design as to ensure a practically continuous flow of concrete during depositing without segregation of materials, considering the size of the job and placement location.

b) Concrete shall be placed in its final position before the cement shall normally be compacted in its final position within thirty minutes of leaving the mixer and once compacted it shall not be disturbed.

c) Concrete, in all cases, be deposited as nearly as practicable directly in its final position, and shall not be rehandled or caused to flow in a manner which will cause segregation, loss of materials, displacement of reinforcement, shuttering or embedded inserts or impair its strength. For location where direct placement is not possible and narrow forms, contractor shall provide suitable drop and elephant trunks to confine the movement of concrete. Special care shall be taken when concrete is dropped from a height especially if reinforcement is in the way, particularly in columns and thin walls.

d) Except when otherwise approved by Engineer, concrete shall be placed in shovels or other approved implements and shall not be dropped from a height more than 1m or handled in a manner, which will cause segregation.

e) The following specification shall apply when placing of concrete by use of mechanical equipment is specifically called for while inviting bids or is warranted considering the nature of work involved. The control of placing shall begin at the mixer discharger, concrete shall be discharged by a vertical drop into the middle of the bucket or hopper and this principle of a vertical discharge of concrete shall be adhered to thoroughly all stages of delivery until the concrete comes to rest in its final position.

f) Central bottom dump buckets of a type that provides for positive regulation of the amount and rate of deposition of concrete in all dumping position, shall be employed.

g) In placing concrete in large open areas, the bucket shall be spotted directly over the position designated and than lowered for dumping. The open bucket shall clear the concrete already in place and the height of drop shall not exceed 1m. The bucket shall be opened slowly to avoid high vertical bounce. Dumping of buckets on the swing or in any manner which results in separation of ingredients or disturbance of previously placed concrete will not be permitted.

h) Concrete placed in restricted form by wheelbarrows, buggies, cars, short chutes or hand shoveling shall be subject to the requirement for vertical delivery of limited height to avoid segregation and shall be deposited as nearly as practicable in its final position.

i) Where it is necessary to use transfer chutes, specific approval of Engineer must be obtained to the type, length, slopes, baffles, vertical terminals and timing of operations, the discharge and without segregation.

To allow for the loss of mortar against the sides of the chutes, the first mix shall have less coarse aggregate. During cleaning of chutes the wastewater shall be kept clear of forms. Concrete shall not be permitted to fall from the end of the chutes by more than 1m.Chutes when approved for use shall have slopes not flatter than 1:3 and steeper than 1:2 chutes shall be of metal or metal lined and of rounded cross section. The slopes of all chutes sections shall be approximately the

same. The discharge end of the chutes shall be maintained above the surface of the concrete in the forms.

j) Concrete may be conveyed and placed by mechanically operated equipment e.g. pumps or pneumatic placers only with the written permission of Engineer. The slump shall be held to the minimum, necessary for conveying concrete by this method.

k) When pumping is adopted before pumping of concrete is started, the pipeline shall be lubricated with one or two batches of mortar composed of one part cement and two parts sand. The concrete mix shall be specifically designed to suit pumping. Care shall be taken to avoid stoppages in work once pumping has started.

l) When pneumatic placer is used, the manufacturer's advice on layout of pipeline shall be followed to avoid blockages and excessive wear. Restraint shall be provided at the discharge box to cater for the reaction at this end. Manufacturer's advice shall be followed regarding concrete quality and all other related matters when pumping or pneumatic placing equipment are used.

m) Concreting once started, shall be continuous until the pour is completed. Concrete shall be placed in successive horizontal layers of uniform thickness ranging from 15 to 90 mm as directed by Engineer. These shall be placed as rapidly practicable to prevent the formation of cold joints planes of weakness between each succeeding layer within the pour. The thickness of each layer shall be such that it can be deposited before the previous layer has stiffened. The bucket loads or other units of deposit shall be spotted progressively along the face of the layer with such overlap as well facilitate spreading the layer to uniform depth and texture with a minimum of shoveling. Any tendency to segregation shall be corrected by shoveling stones into mortar rather than mortar on to stones. Such a condition shall be corrected redesign of mix or other means, as directed by Engineer.

n) The top surface of each pour and bedding planes shall be approximately horizontal unless otherwise instructed.

o) Compact on

i) Concrete shall be compacted during placing the approved vibrating equipment until the concrete has been consolidated to the maximum practicable density, is free of pockets of coarse aggregate and fits tightly against all form surfaces , reinforcement and embedded fixtures. Particular care shall be taken to ensure that all concrete placed against the forms faces and into corners of forms or against hardened concrete at joints is free from voids and cavities. The use of vibrators shall be consistent with the concrete mix and caution exercised not to over-vibrate the concrete to the point that segregation results.

ii) Vibrators shall conform to IS specifications. Type of vibrator to be used shall depend on the structure where concrete is to be placed. Shutter vibrators to be effective, shall be firmly secured to the formwork which is sufficiently rigid to transmit the vibration and strong enough not to be damaged by it. Immersion vibrators shall have no load frequency, amplitude and acceleration as

per IS 2505 depending on the size of vibrator. Immersion vibrators in sufficient numbers and each of adequate size shall be used to properly consolidate all concrete. Tapping or external vibrating of forms by hand tools or immersion vibrators will not be permitted.

iii) The exact manner of application and the most suitable machines for the purpose must be carefully considered and operated by experienced men. Immersion vibrators shall be inserted vertically at points not more than 450 mm apart and withdrawn when air bubbles cease to come to the surface. Immersion vibrators shall be withdrawn very slowly. In no case shall immersion vibrators be used to transport concrete inside the forms. Particular attention shall be paid to vibration at the top of a lift e.g. in a column or wall.

iv) When placing concrete in layers, which are advancing horizontally as the work progresses, great care shall be exercised to ensure adequate vibration, blending and mixing of the concrete between the succeeding layers.

v) The immersion vibrator shall penetrate the layer being placed and also penetrate the layer below with the under layer is still plastic to ensure good bond and homogeneity between the two layers and prevent the formation of cold joints.

vi) Care shall be taken to prevent contact of immersion vibrators against reinforcement steel. Immersion vibrators shall not be allowed to come in contact with reinforcement steel after start of initial set. They shall not be allowed to come in contact with forms or finished surfaces.

vii) Form attached vibrators shall be used only with specific authorization of Engineer.

viii) The surface vibrators will not be permitted under normal conditions. However for thin slabs vibration by specially designed vibrators may be permitted upon approval of Engineer.

ix) The formation of stone pockets or mortar bondages in corner and against faces of forms shall not be permitted. Should these occur, they shall be dug out, reformed and refilled to sufficient depth and shape for through bonding, as directed by Engineer.

p) Placement interval

Except when placing with slip forms each placement of concrete in multiple lift work, shall be allowed to set for atleast 24 hours after the final set of concrete and before the start of a subsequent placement.

q) Special provision in placing

When placing concrete in walls with openings and in floors of integral slabs and beam construction and other similar conditions, the placing shall stop when the concrete reaches the top of the opening in walls and bottom horizontal surface of the slab, as the case may be placing shall be resumed before the concrete in place takes initial set, but not until it has time to settle as determined by Engineer.

r) Placing concrete with reinforcement steel

When placing concrete through reinforced steel, care shall be taken to prevent segregation of the coarse aggregate. When the congestion of steel makes placing difficult it may be necessary to temporarily move the top steel aside to get proper placement and restore reinforcing steel to design position.

s) Bleeding

Bleeding of free water, on top of concrete being deposited in to the forms shall be caused to stop the concrete pour. The conditions causing this defect corrected before any further concreting is resumed.

Curing, protecting, repairing and finishing

a) **Curing**

i) All concrete shall be cured by keeping it continuously damp for the period of time required for complete hydration and hardening to take place. Preference shall be given to the use of continuous sprays or ponded water continuously saturated covering of sacks, canvas, Hessian or other absorbent materials, or approved effective curing compounds applied with spraying equipment capable of producing a smooth, even textured coat. Extra precautions shall be exercised in curing concrete during cold and hot water as outlined hereinafter. The quality of curing water shall be the same as that used for mixing concrete.

ii) Certain types of finish or preparation for overlaying concrete must be done at certain stage of the curing process and special treatment may be required for specific concrete surface finish.

iii) Curing of concrete made of high alumina cement and supersulphated cement shall be carried out as directed by Engineer.

iv) Fresh concrete shall be kept continuously wet for a minimum period of ten days from the date of placing of concrete following a lapse of 12 to 14 hours after laying of concrete. The curing of horizontal surfaces exposed to the drying winds shall however begin immediately the concrete has hardened. Water shall be applied uniformly to concrete surfaces within 1 hour after concrete has set. Water shall be applied to formed surfaces immediately upon removal of forms quantity of water applied shall be controlled so as to prevent erosion of freshly placed concrete.

v) Curing shall be assured by use of an ample water supply under pressure in pipes with all necessary appliance of hose, sprinklers and spraying devices. Continuous fine mist spraying or sprinkling shall be used, unless otherwise specified or approved by Engineer.

vi) Whenever, by the judgment of Engineer, it may be necessary to omit the continuous spray method, a covering of clean sand or other approved means such as wet gunny bags, which will prevent loss of moisture from the concrete, may be used. No type of covering will be approved which would stain or damage the concrete during or after the curing period. Covering shall be kept continuously wet during the curing period.

vii) For curing of concrete in pavements, sidewalks, floors, flat roofs or other level surfaces, the ponding method of curing is preferred. The method of containing the ponded water shall be approved by Engineer. Special attention shall be given to the edges and corners of the slabs to ensure proper protection to this area. The ponded area shall be kept continuously filled with water during the curing period.

viii) Surface coating type compounds shall be used only by special permission of Engineer, curing compounds shall be liquid type white pigmented. Other curing compounds shall be used on surfaces where future blending with concrete, water or acid proof membrane or painting is specified.

ix) All equipments and materials required for curing shall be on hand and ready for use before concrete is placed.

b) **Protecting fresh concrete**

Fresh concrete shall be protected from defacements and damage due to construction operation by leaving forms in place for an ample period as specified later in this specification. Newly placed concrete shall be protected by approved means such as tarpaulins from rain, sun and winds. Steps as approved by Engineer shall also be taken to protect immature concrete from damage by debris, excessive loading, vibration, abrasion or contact with other materials etc. that may impair the strength and/or durability of the concrete. Workmen shall be warned against and prevented from disturbing green concrete during its setting period. If it is necessary that workmen

enter the area of freshly placed concrete, Engineer may require that bridges be placed over the area.

c) **Repair and replacement of unsatisfactory concrete**

i) Immediately after the shuttering is removed, the surface of concrete shall be very carefully inspected and all defective areas called to the attention of Engineer who may permit patching of the defective areas or also reject the concrete unit either partially or entirely. Rejected concrete shall be removed and replaced by contractor at no additional expense to owner. Holes left by from bolts etc. shall be filled up and made good with mortar composed of one part of cement to one and half parts of sand passing 2.36mm IS sieve after removing any loose stones adhering to the concrete shall be finished as described under the particular items of work.

ii) Superficial honey combed surfaces and rough patches shall be similarly made good immediately after removal of shuttering in the presence of Engineer and superficial water and air holes shall be filled in. The mortar shall be well worked into the surface with a wooden float. Excess water shall be avoided. Unless instructed otherwise by Engineer the surface of the exposed concrete placed against shuttering shall be rubbed down immediately on removal of shuttering to remove fine or other irregularities and necessary care being taken to avoid damage to the surface. Surface irregularities shall be removed by grinding.

iii) If reinforcement is exposed or the honeycombing occurs at vulnerable positions e.g. ends of beams or columns it may be necessary to cut out the member completely or in part and reconstruct. The decision of Engineer shall be final in this regard. If only patching is necessary, the defective concrete shall be cut out till solid concrete is reached (or to a minimum depth of 25mm) the edges being cut out perpendicular to the affected surface or with small under cut if possible. Anchors, tees or dovetail slots shall be provided whenever necessary to attach the new concrete securely in place in an area extending several centimeters beyond the edges and the surfaces of the prepared voids shall be saturated with water for 24 hours immediately before the patching material is placed.

iv) The use of epoxy for bonding fresh concrete used for repairs will be permitted under approval of Engineer. Epoxy shall be applied in strict accordance with the instructions of the manufacturer.

v) Small size holes having surface dimensions about equal to the depth of the hole, holes left after removal of form bottom, grout insert holes and slots cut for repair of cracks shall be repaired as follows. The hole to be patched shall be roughened and thoroughly soaked with clean water until absorption stops.

A 5mm thick layer of grout of equal parts of cement and sand shall be well brushed into the surface to be patched, followed immediately by the patching concrete, which shall be well consolidated with a wooden float. The concrete patch shall be built up in 10 mm thick layers. After an hour or more, depending upon weather conditions, it shall be worked of flush with a wooden float and smooth finish obtained by wiping with Hessian, a steel trowel shall be used for this purpose. The mix for patching shall be of same material and in the same proportions as that

used in the concrete being repaired, although some reduction in the maximum size of the coarse aggregates may be necessary and the mix shall be kept as dry as possible.

Mortar filling by air pressure (guniting) shall be used for repairing of areas too large and/or too shallow for patching with mortar. Patched surfaces shall be given a final treatment to match the colour and texture of the surrounding concrete. While cement shall be substituted for ordinary cement, if so directed by Engineer, to match the shade of the patch with original concrete.

vi) The patched area shall be covered immediately with an approved non-staining water saturated material such as gunny bag, which shall be kept continuously wet and protected against sun and wind for a period of 24 hours. Thereafter, the patched area shall be kept wet continuously by fine spray of sprinkling for not less than 10 days.

vii) All materials, procedures and operations used in the repairing of concrete and also the finished repair work shall be subject to the approval of Engineer. All fillings shall be tightly bonded to the concrete and shall be sound, free from shrinkage cracks after the fillings have been cured and finished.

d) Finishing

i) The type of finish for formed concrete surface shall be as follows, unless, otherwise specified by the Engineer.

For surfaces against which backfill or concrete is to be placed, no treatment is required except repairing of defective areas.

For surface below grade, which will receive waterproofing treatment, the concrete shall be free of surface irregularities, which would interfere with proper application of the waterproofing material, which is specified for use.

Unless specified, surfaces which will be exposed when the structure is in service shall receive no special finish, except repairing of damage or defective concrete removal of fins and abrupt irregularities, fillings of holes left by form ties and rods and clean up of loose or adhering debris.

ii) Surfaces which will be exposed to the weather and which would normally be level shall be sloped for drainage. Unless the drawing specifies such as stair treads, walls shall be sloped across the width approximately 1 in 30 broader surface such as walkways, roads, parking areas and platforms shall be sloped about 1 in 50. Surfaces that will be covered by backfill or concrete sub floors to be covered either concrete topping, terrazzo or quarry tile and similar surfaces shall be smooth screened and leveled to produce even surfaces. Surface irregularities shall not exceed 6mm. Surfaces which will not be covered by backfill, concrete or tile toppings such as outside decks, floors of galleries and sumps, parapets, gutters, sidewalk floors and slabs shall be

consolidated, screened and floated. Excess water and laitance shall be removed before finishing. Floating may be done with hand or power tools and started as the screeded surface has attained a stiffness to permit finishing operation and these shall be the minimum required to produce a surface uniform in texture and free from screed marks or other imperfections. Joint edges panels and forms linings shall be of uniform size and be as large as practicable and installed with closed joints. Upon removal of forms the joint marks shall be smoothed off and all blemishes, projections etc. removed leaving the surfaces reasonably smooth and unmarred.

iii) Integral cement concrete finish

When specified on the drawings and integral cement concrete finish of specified thickness for floors and slabs shall be applied either monolithic or bonded as specified on the drawings as per IS 2571. The surface shall be compacted and then floated with a wood float or power-floating machine. The surface shall be tested with a straight edge and any high and low spots eliminated. Floating or toweling of finish shall be permitted only after all surfaces water has evaporated. Dry cement or a mixture of dry cement and sand shall not be sprinkled directly on the surface of the cement finish to absorb moisture or to stiffen the mix.

iv) Exposed concrete finish/Rendering

A rubbed finish shall be provided only on exposed concrete surfaces as specified on the drawings. Upon removal of forms, all fins and other projections on the surfaces shall be carefully removed, off-sets leveled and voids and damaged sections be immediately saturated with water and repaired by filling with a concrete or mortar of the same composition as was used in the surface. Then surface shall be thoroughly wetted and rubbed with carborundum or other abrasive. Cement mortar may be used in the rubbing, but the finished surface shall be brush coated with either cement grout after rubbing. The finished surfaces shall present a uniform and smooth appearance.

2.06 Providing and laying RCC of M 20 mix for structures up to plinth level

The general specification is same as per item no. 2.05 but for the design mix.

2.07 Providing and laying RCC of M 25 mix for structures up to plinth level

The general specification is same as per item no. 2.05 but for the design mix.

2.08 Providing and laying of RCC of M 30 mix for structures up to plinth level

The general specification is same as per item no. 2.05 but for the design mix.

2.09 Providing and laying M 15 concrete in super structure up to 12 M height from plinth level

The general specification is same as per item no. 2.0

2.10 Providing and laying M 20 concrete in super structure up to 12 M height from plinth level

The general specification is same as per item no. 2.05.

2.11 Providing and laying M 25 concrete in super structure up to 12 M height from plinth level

The general specification is same as per item no. 2.05.

2.12 Providing and laying M 30 concrete in super structure up to 12 M height from plinth level

The general specification is same as per item no. 2.05.

2.13 Providing and laying M 15 concrete in super structure above 12 M height

The general specification is same as per item no. 2.05.

2.14 Providing and laying M 20 concrete in super structure up to 12 M height

The general specification is same as per item no. 2.05.

2.15 Providing and laying M 25 concrete in super structure above 12 M height

The general specification is same as per item no. 2.05.

2.16 Providing and laying M 30 concrete in super structure up to 12 M height

The general specification is same as per item no. 2.05.

2.17 Providing and laying RCC for equipment/machine foundation

The general specification is same as item no. 2.05 but for the mix of the concrete, which shall be as specified in the item. The rate is exclusive of reinforcement steel but inclusive of centering and shuttering, providing number of holes, pockets (size and as shown in the drawings/directed) and grouting the same after the machine/equipment is erected with concrete of specified mix and finishing the same as specified.

2.18 **Precast concrete**

Precast concrete shall comply with IS 456 and with the following requirements:

viii) All precast units shall be cast on suitable bed or platform with firm foundation and free from wind. Contractor shall be responsible for the accuracy of the level or shape of the bed or platform. A suitable serial number and the date of casting shall be impressed or painted on each unit.

ix) Side shutters shall not be struck in less than 24 hours after depositing concrete and no precast unit shall be lifted until the concrete reaches a strength of atleast twice the stress to which the concrete may be subjected to at the time of lifting.

x) The lifting and removal of precast units shall be undertaken without causing shock, vibration or undue bending stresses to or in the units. Before lifting and removal takes place Contractor shall satisfy Engineer or his representative that the methods he proposes to adopt for these operations shall not over stress or otherwise affect seriously the strength of the precast units. The reinforced side of the units shall be distinctly marked.

xi) All precast work shall be protected from the direct rays of the sun for at least 7 days after casting and during that period each unit shall be kept constantly watered or preferably be completely immersed in water if the size of the unit so permits, otherwise curing practice as given in clause 20 shall be followed.

xii) Slots, openings or holes, pockets etc. shall be provided in the concrete work in the drawings or as directed by Engineer. Any deviation from the approved drawings shall be made good by contractor at his own expense, without damaging any other work sleeves, bolts, inserts, etc. shall also be provided in concrete work where so specified.

2.19 Providing and erecting Formwork for structures upto plinth level

a) The formwork shall consist of shores, bracing, sides of beams and columns, bottom of slabs etc. including ties anchors, hangers inters etc. complete which shall be properly designed and planned for the work. False work shall be so constructed that necessary adjustment can be made to compensate for take up and settlements. Wedge may be used at the top or bottom of timber shores but not at both ends to facilitate vertical adjustment or dismantling of the formwork.

b) Design of formwork

The design of formwork as well as its construction shall be the responsibility of the contractor. If so the drawings and/or calculation for the design for the formwork shall be submitted to Engineer for approval before proceeding with work, at no extra cost. Engineer's approval shall not however relieve contractor of the full responsibility for the design and construction of the formwork. The design shall take into account all the load vertical and lateral that the forms will be carrying live and vibration loadings.

c) Type of formwork

Formwork may be of timber, plywood metal, plastic or concrete. For special finishes the formwork may be lined with plywood, steel sheets oil tempered hard board etc. Sliding forms and slip forms may be used with the approval of Engineer.

d) Form work requirements

i) Forms shall conform to the shapes, lines, grades and dimensions including camber of the concrete as called for on the drawings. Ample studs, braces, ties, straps etc. shall be used to hold the forms in proper position without any distortion whatsoever until the concrete is set sufficiently to permit removal of forms. Forms shall be strong enough to permit the use of immersion vibrators. In special cases form vibrators may also be used. The shuttering shall be close boarded. Timber shall be well seasoned, free from sap, shakes, loose knots, wormholes, warps or other surface defects in contact with concrete. Faces coming in contact with the concrete shall be free from adhering grout, plaster, paint, projecting nails, splits or other defects. Joints shall be sufficiently tight to prevent loss of water or any fine material from concrete.

ii) Plywood shall be used for exposed concrete surfaces; where called for. Sawn and wrought timber may be used for unexposed surfaces. Inside faces of forms for concrete surfaces, which are to be rubbed finished, shall be planed to remove irregularities or unevenness in the face. Formwork with linings shall be permitted.

iii) All new and used form timber shall be maintained in a good condition with respect to shape, strength, rigidity, water tightness, smoothness and cleanliness of surfaces. Form timber

unsatisfactory in any respect shall not be used and if rejected by Engineer shall be removed from the site.

i) Shores supporting successive members shall be placed directly over those below or be so designed and placed that the load will be transmitted directly to them. Trussed supports shall be provided for shores that cannot be secured on adequate foundations.

ii) Formwork, during any stage of construction showing signs of distortions or distorted to such a degree that the intended concrete work will not conform to the exact contours indicated on the drawings, shall be repositioned and strengthened. Poured concrete affected by the faulty formwork, shall be removed completely and the formwork be corrected prior to placing of new concrete.

iii) Excessive construction camber to compensate for shrinkage, settlement may impair the structural strength of members and shall not be permitted.

iv) Forms shall be so designed that their removal will not damage the concrete. Face formwork shall provide true vertical and horizontal joints, conform to the architectural features of the structure as to location of joints and be as directed by Engineer.

v) Where exposed smooth or rendered concrete finishes are required the forms shall be constructed with special care so that the resulting concrete surfaces require a minimum finish.

e) Formwork for slope Surfaces

i) Forms for sloped surfaces shall be built so that the formwork can be placed board-by-board immediately ahead of concrete placement so as to enable ready access for placement, vibration inspection and repair of the concrete.

ii) The formwork shall also be built so that the boards can be removed one by one form the bottom up as soon as the concrete has attained sufficient stiffness to prevent sagging. Surfaces of construction joints and finished surfaces with slopes steeper than 4 horizontal: 1 vertical shall be formed as required herein.

f) Formwork for curved surfaces

i) The contractor shall interpolate intermediate sections as necessary and shall construct the forms so that the curvature will be continuous between sections. Where necessary to meet requirements for curvature, the form timber shall be built up of laminated splines cut to make tight, smooth form surfaces.

ii) After the forms have been constructed, all surface imperfections shall be corrected and all surface irregularities at matching faces of form material shall be dressed to the specified curvature.

g) Formwork For Exposed Concrete Surfaces

i) Where it is desired, directed or shown on the drawings to have original hair face finish of concrete surface without any rendering or plastering, form work shall be carried out by using wood planks, ply wood or steel plates of approved quality and as per direction of the Engineer.

ii) The contractor shall use one type of material for all such exposed concrete faces and the forms shall be constructed so as to produce uniform and consistent texture and pattern on the face of the concrete. Patches or forms for these surfaces will not be permitted. The formwork shall be placed so that all horizontal formworks are continuous across the entire surface.

iii) To achieve a finish, which shall be free of board marks, the formwork shall be faced with plywood or equivalent material in large sheets. The sheets shall be arranged in an approved pattern. Wherever possible, joints between sheets shall be arranged to coincide with architectural features, sills, window heads or change in direction of the surface. All joints between shuttering plates or panels shall be vertical or horizontal unless otherwise directed. Suitable joints shall be provided between sheets. The joints shall be arranged and fitted so that no blemish or mark is imparted to the finished surfaces.

iv) To achieve a finish which shall give the rough appearance of concrete cast against sawn boards, formwork boards unless otherwise stated shall be of 150 mm wide, securely jointed with tong and grooved joints if required to prevent grout loss with tie rods positions and directions of boards carefully controlled. Sawn boards shall be set horizontally, vertically or at an inclination shown in the drawings. All bolt holes shall be accurately aligned horizontally and vertically and shall be filled with matching mortar recessed 5mm back from the surrounding concrete face.

v) Forms for exposed concrete surfaces shall be constructed with grade strips (the underside of which indicated top of pour) at horizontal joints, unless the use of groove strips is specified in drawings. Such forms shall be removed and reset from lift to lift. Sheeting of reset forms shall be tightened against the concrete so that the forms will not be spread and permit abrupting irregularities or loss of mortar. Supplementary form ties shall be used as necessary to hold the reset forms tight against the concrete.

vi) For fair faced concrete, the position of through bolts will be restricted and generally indicated on the drawings.

vii) Chamfer strips shall be placed on the corner of forms for exposed exterior corners so as to produce 20 mm beveled edges except where otherwise shown in the drawings. Interior corners and edges at formed joints shall not be beveled unless shown on the drgs. Mouldings for grooves, drip courses and bands shall be made in the form itself.

viii) The wood planks, plywood and steel plates used in formwork for obtaining exposed surfaces shall not be used for more than 3 times in case of wood planks, 6 times for plywood and 10 times for steel plates respectively. However, no forms will be allowed for reuse, if in the opinion of the Engineer it is doubtful to produce desired texture of exposed concrete.

ix) In order to obtain exposed concrete work of uniform colour it shall be necessary to ensure that the sand used for all exposed concrete work shall be of approved uniform colour. Moreover the cement used in the concrete for any complete element shall be from single consignment.

vi) No exposed concrete surfaces shall be rendered or painted with cement or otherwise. Plastering of defective concrete as means of achieving the required finish shall not be permitted, except in the case of minor porosity on the surface, the Engineer may allow a surface treatment by rubbing down the cement and sand mortar of the same richness and colour as for the concrete. This treatment shall be made immediately after removing the formwork.

xi) The contractor shall also take all precautionary measures to prevent breaking and chipping of corners and edges of complete work until the building is handed over.

h) Bracing struts and props

i) Shuttering shall be braced, strutted, propped and so supported that it shall not deform underweight and pressure of the concrete and also due to the movement of men and other materials. Bamboos shall not be used as props or cross bearers.

ii) The shuttering for beams and slabs shall be so erected that the shuttering on the sides of the beams and under the soffit of slabs can be removed without disturbing the beam bottoms. Repropping of beams shall not be done except when props are to be reinstated to take care of construction loads anticipated to be in excess of the design load. Vertical props shall be supported on wedges or other measures shall be taken whereby the props can be gently lowered vertically while striking the shuttering. If the shuttering for a column is erected for the full height of the column, one side shall be left open and built up in sections as placing of concrete from the sides to limit the drop of concrete to 3M or as directed by Engineer.

j) Mould Oil

Care shall be taken to see that the faces of form work coming in contact with concrete are perfectly cleaned and two coats of mould oil or any other approved material applied before fixing reinforcement and placing concrete. Such coating shall be insoluble in water, non-staining and

not injurious to concrete. It shall not become flaky or be removed by rain or wash water. Reinforcement and/or other items to be cast in the concrete shall not be placed until coating of the forms is complete, adjoining concrete surface shall also be protected against contamination from the coating material.

k) Chamfers and fillets

All corner and angles exposed in the finished structure shall be formed with moulding to form chamfers or fillets on the finished concrete. The standard dimension for chamfers and fillets, unless otherwise specified shall be 20 mm* 20 mm. Care shall be exercised to ensure accurate mouldings. The diagonal face of the mouldings shall be planned or surfaced to the same texture as the forms to which it is attached.

l) Wall ties

Wire ties passing through the walls shall not be allowed. In their place bolts through sleeves are used.

m) Reuse of forms

Before reuse, all forms shall be thoroughly scraped, cleaned, nails removed, holes that may leak suitably plugged and joints examined when necessary, repaired and the inside retreated to prevent adhesion, to the satisfaction of Engineer. Warped lumber shall be resized. Contractor shall equip himself with enough shuttering material to complete the job in the stipulated time.

n) Removal of forms

i) Contractor shall record on the drawings and in a special register the date upon which the concrete is placed in each part of the work and the date on which the shuttering is removed therefore. The contractor shall remove the shuttering after obtaining the approval of the Engineer.

ii) In no circumstances shall forms be struck until the concrete reaches strength of atleast twice the stress due to self-weight and any construction/ erection loading to which the concrete may be subjected at the time of striking formwork.

iii) In normal circumstances (generally where temperatures are above 20 Deg. Cent.) forms may be removed after expiry of the following periods :-

	Ordinary Portland Cement Concrete	Rapid hardening Portland cement Concrete
a) Walls columns and Vertical sides of Beams	24 to 48 hrs as directed by Engineer	24 hrs.
b) Slabs left under	3 days	2 days
c) Beam soffits props Left under	7 days	4 days
d) Removal of props to slabs:		
i) Spanning upto 4.5 m	7 days	4 days
ii) Spanning over 4.5 m	14 days	8 days
e) Removal of props to Beams and arches:		
i) Spanning upto 6 m	14 days	8 days
ii) Spanning over 6 m	21 days	12 days

iv) Striking shall be done with utmost care to avoid damage to arises and projections and without shock or vibration, by gently easing the wedges. If after removing the formwork, it is found that timber has been embedded in the concrete, it shall be removed and made good as specified earlier.

v) Reinforced temporary openings shall be provided as directed by Engineer to facilitate removal of formwork which otherwise may be inaccessible.

vi) Tie rods, clamps, form bolts etc. which must be entirely removed from walls or similar structures shall be loosened not sooner than neither 24 hours nor later than 40 hrs. After the concrete has been deposited. Ties, except those required to hold forms in place, may be removed at the same time. Ties, withdrawn from walls and grade beams shall be pulled towards the inside face cutting ties back from the faces of walls and grade beams will not be permitted.

vii) For liquid retaining structures no sleeves for through bolts shall be used nor shall through bolts be removed as indicated above. The bolts, in this case shall be cut at 25 mm depth from the surface and then the hole shall be made good by sand, cement mortar of the same proportions as the concrete just after striking the formwork.

2.20 Providing and erecting Formwork for structures in super structure up to 12 M height from plinth level.

The general specification is same as per item no. 2.15.

2.21 Providing and erecting Formwork for structures in super structure above 12 M height from plinth level.

The general specification is same as per item no. 2.15.

2.22 Providing and erecting false staging for formwork

The additional height for which it is required shall be as specified in the item specification. This shall be measured and paid for in sq.m. The plan area of the structure shall measure for all members except RCC walls and gable ends. For RCC walls and gable ends the elevational area shall be measured for payment under this item.

2.23 Providing and Erecting shuttering for exposed RCC work

The specification of the nature of shuttering shall be as specified in the item 2.19 under the sub-head shuttering for exposed concrete works. Only the surfaces, which are given such finish, shall be measured in sq.m. and paid for.

2.24 Providing and laying DPC 25-50mm thick

This shall be of plain cement concrete of mix as specified in the item specification. The top surface of the masonry shall be leveled properly before laying the concrete. The side shuttering shall be vertical and strong. There should not be any honey combing. Curing shall be done for 7 days. After the curing period is over the surface shall be cleaned with brush and kerosene shall be applied over it. Then hot bitumen shall be applied @ 1.7 kg/sqm over the surface. It shall be applied uniformly without any blank space.

2.25 Supplying and mixing waterproofing compound

The water proofing compound may be Foss, Sika, Cico or of any equivalent make. It shall be added to cement concrete or cement mortar as instructed by the Engineer. The proportion of the compound to be added shall be as per the Manufacturer's specifications.

2.26 Providing, fabricating and placing in position Reinforcement steel

The quality of the steel shall be as mentioned in the materials section. The bars shall be fabricated as per the drawings. Laps and splices for reinforcement shall be as shown on the drawings. Splices in adjacent bars shall be approved by Engineer. The bars shall not be lapped unless the length required exceeds the maximum available lengths of bars at site.

Bending

a) Reinforcing bars supplied bent or in coils, shall be straightened before they are cut to size. Straightening of bars shall be done in cold and without damaging the bars. This is considered as part of reinforcement bending fabricating work.

b) All bars shall be accurately bent according to the sizes and shapes shown on the detailed working drawings/bar bending schedules. They shall be bent gradually by machine or approved means. Reinforcing bars shall not be straightened and rebent in a manner that will injure the material, bars containing cracks or splits shall be rejected. They shall be bent cold, except bars of over 32 mm in diameter which may be bent hot if specifically approved by Engineer. Bars bent hot shall not be heated beyond cherry red colour (not exceeding 845 deg. C.) and after bending shall be allowed to cool slowly without quenching. Bars incorrectly bent shall be used only if the

means used for straightening and rebending shall not injure the material. No reinforcement shall be bent when in position in the work without approval whether or not it is partially embedded in hardened concrete. Bars having kinks or bends other than those required by design shall not be used.

Fixing

a) Reinforcement shall be accurately fixed by any approved means and maintained in the correct position shown in the drawings by the use of block, spacers and chairs as per IS 2502 to prevent displacement during placing and compaction of concrete. Bars intended to be in contact at crossing points shall be strongly bound together at all such points with two no. 16 gauge unhealed soft iron wire. The vertical distance required between successive layers of bar in beams or other members shall be maintained by providing of mild steel spacer bars at such intervals that the main bars do not perceptibly sag between adjacent spacer bars.

Cover

a) Unless indicated otherwise in the drawings, clear concrete cover for reinforcement (exclusive of plaster or other decorative finish) shall be as follows :

i) At each end of reinforcing bar, not less than 25 mm nor less than twice the diameter of the bar which ever is less.

ii) For a longitudinal reinforcing bar in a column, not less than 40 mm, nor less than the diameter of the bar. In case of columns of minimum dimensions of 20 cm or under, with reinforcing bars of 12 mm and less in diameter, a cover of 25 mm may be used.

iii) For longitudinal reinforcing bars in a beam of 25 mm nor less than the diameter of the bar.

iv) For tensile, compressive, shear, or other reinforcement in slab or wall not less than 12 mm nor less than the diameter of such reinforcement.

v) For any other reinforcement not less than 12 mm nor less than the diameter of such reinforcement.

vi) For footings and other principal structural members in which the concrete is deposited directly against the ground, cover to the bottom reinforcement shall be 75 mm. If concrete is poured on a layer of lean concrete the bottom cover may be reduced to 50 mm.

vii) For concrete surfaces exposed to the weather or the ground after removal of forms, such as retaining walls, footing sides and top etc. , not less than 50 mm for bars larger than 16 mm dia and not less than 40 mm for bars 16 mm dia or smaller.

viii) Increased cover thickness shall be provided, as indicated on the drawings, for surfaces exposed to the action of harmful chemicals (or exposed to earth contaminated by such chemical, acid, alkali, saline atmosphere, sulphurous smoke, etc.

ix) For reinforced concrete members, totally or periodically immersed in sea water or subject to sea water spray, the cover of concrete cover shall be 50mm more than those specified in (i) to (v) above.

x) For liquid retaining structures the minimum cover to all steel shall be 40 mm or the diameter of the main bars, whichever is greater. In the presence of seawater and soils and waters of a corrosive character the covers shall be increased by 10 mm.

xi) Protection to reinforcement in case of concrete exposed to harmful surroundings may also be given by providing a dense impermeable concrete with approved protective coatings, as specified by the Engineer.

xii) The correct cover shall be maintained by cement porter cover blocks. Reinforcement for footings, beams and slabs on sub-grade shall be supported on precast concrete blocks as approved by Engineer. The use of pebbles or stones shall not be permitted.

Inspection

Erected and secured reinforcement shall be inspected, jointly measured and recorded and approved by Engineer prior to placement of concrete.

2.27 Providing and placing in position bitumen impregnated fibers

The bitumen impregnated fiber boards shall be placed in locations before concreting as instructed by the Engineer. The work shall be done at all levels without any extra cost.

The thickness of the board shall be as specified in the item specification.

2.28 Providing and laying bituminous mastic

This shall be of approved make and quality. This shall be filled in the expansion joints as directed by the Engineer/shown in the drawings. The joints shall be of uniform width and care shall be taken for proper bonding of the joints.

Clean-up

i) Upon the completion of concrete work, all forms, equipment, construction tools protective coverings and any debris resulting from the work shall be removed from the premises.

ii) All debris, i.e. empty containers, wooden pieces etc. shall be removed.

iii) The finished concrete surfaces shall be left in a clean condition satisfactory to Engineer.

3.0 MASONRY WORKS

Applicable codes and specifications

a) The following codes, standards and specifications are made a part of this specification. All standards, tentative specifications, codes of practices referred to herein shall be the latest edition including all applicable official amendments and revisions.

IS: 1077 - Common burnt clay-building bricks

IS: 3102 - Classification of burnt clay bricks

IS: 2180 - Burnt clay building bricks, heavy duty.

IS: 3495 - Method of sampling and testing clay building bricks

IS: 2691 - Burnt clay facing bricks

IS: 2221 - Code of practice for brick work

IS: 2185 - Load bearing hollow concrete blocks

IS: 5498 - Lime-cement-cinder hollow concrete blocks

IS: 3115 - Lime-cement-cinder solid blocks

IS: 1597 - Code of practice for construction of stone masonry (Part 1).

3.01 Providing and constructing brick masonry in CM in foundation and up to plinth level

a) Bricks used in works shall be bricks of specified crushing strength as described in the Schedule of Quantities. They shall have the following general properties :

They shall be sound, hard, and homogenous in texture, well burnt in kiln without being vitrified, table moulded, deep red, cherry or copper coloured, of regular shape and size and shall have sharp and square edges and paralleled faces. The bricks shall be free from pores, chips, flaws or humps of any kind. Bricks containing ungrounded particles and which absorb water more than $1/5^{th}$ of their weight when soaked in water for twenty-four hours shall be rejected. Overheated or under burnt bricks shall be liable to rejection. These bricks shall give a clear ringing sound when struck.

b) Samples of bricks shall be submitted before starting the brickwork to the Engineer for approval. Bricks supplied shall conform to these approved samples. Brick samples shall be got tested as per IS: 3495 by Contractor at no extra cost. Bricks rejected by Engineer shall be removed from the site of works within 24 hours.

(c) **Mortar**

i) Mix for cement mortar shall be as specified in the respective items of work. Gauge boxes for sand shall be of such dimensions that one complete bag of cement containing 50. kgs. Of cement forms one unit. The sand shall be free from clay shale, loam, alkali, and organic matter and of sound, hard, clean and durable particles. Sand shall be approved by the engineer. If so directed by the engineer sand shall be thoroughly washed till it is free of any contamination.

ii) 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. Cement mortar shall preferably be machine mixed, through mixing in a thorough manner may be allowed. The mortar so mixed shall be used within 30 minutes of mixing. Mortar left unused in the specified period shall be rejected.

iii) The Contractor shall arrange for test on mortar samples if so directed by the engineer retempering of mortar shall not be permitted.

(d) **Workmanship**

i) All bricks shall be thoroughly soaked in clean water for at least one hour immediately before being laid. The cement mortar for brick masonry work shall be as specified in the respective item of work. Brick work 230 mm thick and over shall be laid in English bond unless otherwise specified. While laying bricks shall be pressed in to the mortar and shoved into final position so as to embed the brick fully in mortar. Bricks shall be laid with frogs uppermost.

ii) All brickwork shall be plumb, square and true to dimensions. Vertical joints in alternate courses shall come directly one over the other and be in line. Horizontal courses shall be levelled. The thickness of brick courses shall be kept uniform. For walls of thickness greater than 230 mm both faces shall be kept in vertical planes. No broken bricks shall be used except as closers. Care shall be taken that the bricks forming the top corners and ends of the wall shall be properly radiated and keyed into position. Holes kept in masonry for scaffolding shall be closed before plastering. All interconnected brickwork shall be carried out at nearly one level (so that there is uniform distribution of pressure on the supporting structure) and no portion of the work shall be left more than one course lower than the adjacent work where this is not possible, the work shall be raked back accordingly to bond (and not saw toothed) at an angle not exceeding 45 deg.

iii) Bricks shall be so laid that all joints are well filled with mortar. The thickness of joints shall not be less than 6mm and not more than 10 mm. The face joint shall be raked to a minimum depth of 12mm by raking tools daily during the progress of work when the mortar is still green so as to provide a proper key for the plaster or pointing to be done. Where plastering or pointing is not required to be done the joints shall be uniform in thickness and be struck flush and finished at the time of laying. The face of brickwork shall be cleaned daily and all mortar droppings removed. The surface of each course shall be thoroughly cleaned of all dirt before another course is laid on top. If the mortar in the lower course has begun to set the joints shall be raked out to a depth of 12 mm before another course is laid.

iv) All brickwork shall be built tightly against columns, floor slabs or other structural member.

v) Where drgs. Indicate that structural steel columns are to be fireproofed with brick work the brick shall be built closely against all flanges and webs with all spaces between the steel and bricks works filled solid with mortar. Steel members partly embedded in brick work and not indicated to be fireproofed with concrete shall be covered with not less than 12mm thick mortar unless directed otherwise by engineer.

vi) The work shall be cured for 15 days.

(e) Miscellaneous inserts in masonry e.g. sleeves, wall, tiles, anchors, conduits, structural sheet, steel lintel etc. shall be installed by the Contractor. furnishing fixing of any of these inserts by the Contractor will be paid for separately under steel work. Openings arches etc. shall be provided as shown on the drawings, chasses, pockets etc. shall be provided as shown on the drawings to receive rain water pipes etc. Wall ties and flashings shall be built into the brickwork in accordance with the drawings and specifications.

Providing and brick work in CM in super structure at all levels

The general specification is same as per item no.3.02.

3.03 providing and constructing 115 mm brick masonry in partition for superstructure in CM

The bricks shall be laid with stretchers. The proportion of the mortar shall be as specified in the item description. The quality of the bricks shall be as specified in the item 3.01. the bricks shall be well soaked in water before using them. The brick work shall be plumb and square. Two nos. of 6mm dia ms bars or 25mm x 1.2 mm deep iron band kept at every fourth course of 115mm thick brickwork. This shall be provided by the contractor.

3.04 providing and constructing 75mm partition wall in CM

The general specification shall be same as per item 3.03.

3.05 providing and constructing hone comb brick work

The specification for the material and the workmanship shall be as specified in the items 3.10 or 3.03 depending on the thickness of the brick work. The proportion of the CM shall be as specified in the item description in the schedule of quantities.

3.06 Providing and constructing Facing brickwork

a) Facing bricks of the type specified shall be laid in the positions indicated on the drawings and all facing brickwork shall be well bonded to the backing bricks. No facing brickwork snail at anytime be more than 600 mm above the backing brickwork.

b) Facing work shall be pointed as the work proceeds and internal faces of the brickwork shall be pointed with neat joint to give a fair face.

c) Faced work shall be kept clean and free from damage, discoloration etc. at all times. The Contractor shall carefully plug all holes with bricks similar to the surrounding.

d) For facing brickwork double scaffolding shall be used and no holes in brickwork for scaffolding shall be permitted.

3.06 Providing and constructing Concrete block masonry

Concrete blocks (hollow or Solid) shall generally conform to IS:2135. Blocks shall be regular in size and shape and shall be of specified strength. Blocks shall be properly cured before they are brought to site. Half or three quarter size blocks are to be used wherever required to make up length of wall and broken blocks shall not be used. The texture of the blocks shall be such that plaster will adhere to it. The contractor shall supply samples for approval.

Blocks supplied shall conform to approved samples.

MORTAR

Mortar shall be similar to mortar in brickwork as given 3.3 herein before.

Workmanship

a) All block work shall be plumb, square and properly bonded. The joints shall be broken. The thickness of courses shall be uniform with courses horizontal. All connected work shall be carried out at nearly one level and no portion of the work shall be left more than one course lower than the adjacent work.

b) Blocks shall be so laid that all joints are well filled with mortar. The thickness of joints shall not be less than 6mm and not more than 8 mm. The face joints shall be raked to a minimum depth of 10 mm by raking tools daily during the progress of work when the mortar is still green, so as to provide a proper key for the plaster or pointing. When plastering or pointing is not required, the joints shall be struck flush. For pointed masonry without plaster, smooth textured concrete block shall be used. The face of blocks work shall be kept clean at all times.

c) Where block are to be used for load bearing walls, the uppermost layer of block masonry supporting slab or other structured members, shall be solid or treated as directed by the engineer.

Precast concrete screen blocks or Jali work be may used for decorative purposes. The contractor shall furnish samples for approval.

3.08 Providing and constructing Random rubble masonry uncoursed in foundation and up to plinth level

a) Stones for this work shall be hard. durable rock, close or fine grained and uniform in colour free from veins, flaws and other defects and shall conform IS:1597 (Part I). The stores shall be laid in mortar proportions specified or the particular item of work. Stones shall be got approved.

b) For all work below ground level the masonry shall be random rubble uncoursed with ordinary quarry dressed stones or hearting and faced with selected quarry dressed stones.

c) For all work above ground level the masonry shall be random rubble faced with hammer dressed stones with squared quoins at joints and corners.

d) No stones shall tail in to the wall, either with a point or to length less than 1 1/2 times its height. The thickness of the joints shall not exceed 12 mm.

e) Spauls and spinning shall not be allowed to show on the face of the wall. Two bond stones each of minimum area of 500 sq.cm for every 1.0 sq.m. of each wall face shall be provided. These shall be through stones in walls 600 mm thick and under, in walls thicker than 600 mm the length of bond stones shall *be* 2/3 times the thickness of walls. The stones for hearting of the wall shall not be less than 150 mm in any direction. Chips and spauls shall be wedged into avoid thick mortar beds and joints. The wall faces corners and joints or openings shall be truly vertical the quoins shall be of selected stones, neatly dressed with chisel to form the required angle and laid header and stretcher alternatively.

f) The exposed face of the work shall be carefully and neatly pointed with mortar in all joints on the other side the joints shall be neatly struck with trowel while the mortar is fresh.

MORTAR

The mortar for the work shall be as specified in the respective item of work. Curing or masonry shall continue for a minimum of ten days.

3.09 Providing and constructing Random rubble masonry uncoursed in superstructure

The specification shall be same item 3.08.

3.10 Providing and constructing coursed rubble masonry in foundation and up to plinth level.

a) The stones used shall be hard, durable rock, free from veins, flaws and other defects and shall conform to IS: 1597 (Part 1). Height of each course in the masonry shall not be 150 mm. The stones in each course shall be of equal height. All courses shall of the same height unless otherwise specified. All stones shall be set in full cement mortar of proportion specified for the respective items of work. Stone shall be got approved by the Engineer.

b) The face stone shall be squared in all joints and beds. The beds being hammer dressed or chisel dressed type and square for at least 75 mm from the face and the joint for at least 40 mm. The face of the stone shall be hammer dressed so that bushings shall not project more than 40 mm

c) No spauls or pinning shall be allowed on the face. All bed joints shall be horizontal and side joints vertical and no joints shall be more than 10 mm in thickness.

d) No face stone shall be less in breadth than in height or shall tail into the work to a length less than the height and at least 1/3rd the number of stones shall tail into the work to at least twice their height, or in walls over 600 mm in thickness 3 times their height.

e) Through stones shall be inserted every 1.5 meters to1.8 meters apart in every case and shall run right through when the wall is not more than 600 mm thick when the wall is more than 600 mm thick a line of two or more headers shall be laid from the face to face which shall overlap each other by at least 150 mm. A header shall have a length of at least thrice its height.

f) Stones shall break joint at least half the height of the course. Quoins shall be formed of stones at least 45 cm long laid stretcher and header alternately. They shall be laid square in their beds, which shall be fair dressed to a depth of at least 100 mm. The corner shall be chisel dressed for a width of 25 mm.

g) The Walk on the interior face shall be precisely the same as on the exterior face unless the work is to be plastered in which case the side joints need not be truly vertical.

h) Hearting shall consist of flat bedded stone carefully laid on their proper beds and solidly bedded in mortar chips and spauls of stone being wedged in wherever necessary so as to avoid thick beds or joints of mortar. Care shall be taken so that no dry work or hollow spaces shall be left anywhere in the masonry. The face and backing shall be brought up every bed. The backing should not be leveled lip at each course by the use of chips.

MORTAR

The mortar for the work shall be as specified in the respective item of work. Curing of masonry shall continue for a minimum of ten days.

4.0 WOOD WORK

Applicable codes

IS: 4021- Timber door, window and ventilator frames

IS: 2202- wooden flush door shutters (solid core type) part I

IS: 1003- Timber paneled and glazed shutter (part I & II)

IS: 4020- Method of tests for wooden flush doors type tests.

IS: 1761- transparent sheet glass for glazing and framing purposes.

IS: 3097- Specification for veneered particle boards (Exterior Grade).

4.01 Providing & fixing paneled or glazed or partly paneled & partly glazed door shutters of specified thickness with frame of specified size.

a) Wood used for all work shall be the best of the respective class specified, and properly seasoned, suitable for joiner work should be of natural growth, uniform in texture, straight grained, free from sapwood, dead knots, open shakes, rot, decay and any other defects and blemishes.

b) For joints following principles to be observed:-
At the joints the weakness of pieces must be minimum as far as possible. To place each abutting surface in a joint as neatly as possible, perpendicular to pressure. To form and fit accurately every pair of surface those come in contact.

c) All joining shall be wrought on all faces and finish off by hand with sand paper with slightly rounded arises.

d) The joints shall be pinned with hard wood pins and put together with white lead. Joining shall be by means of mortise and ten on or dovetailed joints as approved. For internal joints where there is no chance of moisture the joint shall be glued. Driving of screws with hammer is prohibited. The screws shall be soaked in oil before driving them home. The heads of the screws and nails shall be sunk and puttied.

e) Any joinery work which shall split, fracture, shrink or show flaws or other defects due to unsoundness, inadequate seasoning or bad workmanship, shall be removed and replaced with sound materials at the contractor's expense.

f) Door frames shall be riveted. All dimensions shall be as per drawings. The verticals of door frames shall project about 50 mm below finished floor, surface coming in contact with brick work shall be painted with bitumen or solignum as directed by the engineer. The door frame shall be provided with 3 nos MS 230x30x3mm flat split hold fasts on each side, respectively. These hold fasts shall be embedded in masonry or concrete work with concrete block of mix 1:2:4 and size 230x300x250. The work shall conform to IS: 4021.

g) The door shall be paneled or solid flush doors as described in the item of work. All doors shall be supplied with approved fittings such as hinges, mortise lock of approved make with handles on both sides, oxidized brass tower bolts and latch arrangements door stops, etc., and as shown in drawings. External flush doors shall be made of waterproof plywood as per item description in the schedule of Quantities.

h) The workmanship of all doors and window shutters shall conform to the requirements of IS: 1003 (Parts I & II) and IS: 2202 (Part I). Flush door panels shall be got tested as per IS: 4020 in standard laboratories.

i) Beading and architraves shall conform to the shapes shown on drawings or as approved and fixed by means of screws (counter sunk or otherwise) or bolts.

j) **Glass**

Sheet glass or plate glass shall be of Indian make as specified in the schedule of Quantities/ as directed. It shall be free from waves and bubbles and all defects. The thickness of the glass shall be as follows:-

2mm thick glass for panes up to 900 sqcm area.

3mm thick glass for panes from 900-5500 sqcm area.

4mm thick glass for panes from 5500-8400 sqcm area.

5.5mm thick glass or plate glass for panes above 8400 sqcm.

It should be clearly understood that glass which does not have uniform refractive index or which is wavy, will be rejected. The glazing shall be fixed with teak wood beading and putty.

It shall conform to IS: 1761.The putty shall be made up of one part of white lead, 3 parts of finely powdered chalk and adding boiled linseed oil to make a stiff elastic paste. No voids shall be left in the putty. Woodwork shall not be painted, oiled or otherwise treated before it has been approved by the engineer.

4.02 -Do- same as per item 4.01 but for 19 mm NOVA TEAK panelled or equivalent make board as filler material

The specification shall be same for item 4.01 but for NOVA TEAK or the board shall be of ISI approved make.

4.03 -Do- same item 4.02 but without frame

The specification shall be same as item 4.01 but the measurement of the actual size of the shutter shall be taken.

4.04 Providing and fixing Composite door and window partly openable, partly fixed with frame of specified size.

The specification for the door shutter shall be as per item 4.01. The specifications for the windows shall be as given below:-

The window frame shall be provided with 2 nos MS 230 x 30 x 3 mm flat split holdfasts on each side, respectively. These hold fasts shall be embedded in Masonry or concrete work with concrete block of mix 1:2:4 and size 230x300x250 mm. The type of windows shall be as specified. Each leaf of the shutter shall have one pair of hinges for a width of less than or equal to 2 feet, for width more than 2 feet extra nos of hinges shall be provided as directed by the Engineer at no extra cost. The glazed windows shall be provided with glass of thickness as specified in the item description. Architraves shall be provided as per drawing.

4.05 Providing and fixing windows and ventilators Fixed type

The specification for windows shall be same as given in item 4.04. Ventilators shall have two MS holdfasts. Ventilators shall be provided with glass of thickness as specified in the item description. Architraves for the ventilator shall be provided as per the drawing.

4.06 -Do- same as item 4.05 but for fully open able type

The specification shall be same as item 4.05 but with necessary hinges as per item description/drawing. The work shall be carried out as per the drawing/ as instructed by the engineer.

4.07 -Do- same as item 4.05 but for partly open able and partly fixed

The specification shall be same as item 4.05 but with necessary hinges as per item description/ drawing.

4.08 **Providing & Fixing mosquito/fly proof shutter**

The specification for frames and the shutter shall be same as item 4.05 and for the fly wire mesh the following specification shall be applicable:-

Fly/Mosquito proof netting of 100G or 140G (22 to 23 SWG), rust proof, galvanized as specified in the item description shall be used. Mosquito proof of 100 G (23 SWG), 0.60mm wire dia and 1mm average distance between the wire or fly proof of 140 G (22SWG) , .71mm wire dia and 1.40mm average distance between the wire shall be used.

4.09 **Providing & fixing fixed glass louvers in TW frame of specified size**

The frame shall be fixed to the masonry or RCC elements with 2 nos hold fasts. The louvre shall be provided with glass of thickness as specified in the item description. The glass shall be fixed at an angle in the frame as shown in the drawing. The frame shall be painted/polished as specified in the item description.

4.10 -Do- same as item 4.09 but with wired glass

The specification shall be same as per item 4.09. The thickness of the wired glass shall be as specified in the item description. -

4.11 Providing & Fixing built in cupboard

These shall be made of block board/particle board as specified in the item description. The shutter shall also be made of 19mm or 2Smm thick block board or particleboard or marine ply as specified in the item. 6mm thick and of suitable width teak wood lipping shall be provided on all edges. Horizontal partitions shall be provided as per the drawings /instructions. The size of the frame shall be as specified in the item description. The inside shall be painted with paint of ISI approved make and exterior shall be painted/polished as specified/directed.

4.12 Providing & fixing meter box cupboard on wall

The frame shall be of specified size and class of wood. It shall be fixed with 2 no. of holdfasts and the same may be grouted with CC 1:2:4 blocks of size 230x230x300. The shutter shall be of 19mm thick Nova teak. A slit shall be provided in the shutter as directed by the Engineer .3mm thick glass shall be fixed in the slit. Architrave shall be provided as directed by the Engineer. Fixtures as specified shall be provided. The shutter, frame and the architrave shall be painted with 3 coats of ISI approved enamel paint.

4.13 **Providing and fixing TW baluster (moulded hand rail)**

The handrail shall be of specified quality of teak wood. The size, shape and the design shall be as per the Architect's drawing. The rounding at the landing shall be made up of monolithic one piece. The handrail shall be fixed on HS flats with screws/anchor bolts as specified. It shall be applied with three coats of paint/polish as specified.

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4.14 **Extra for making vision panel/Venetian in flush door.**

These shall be provided as shown in the drawings. The inside of the opening shall be lipped. The glass shall be braced with beading and putty. The !ipping and the architrave shall be painted with 2 coats of approved paint or polished as directed. Opening upto 0.259 sqmn shall not be deducted from the shutter area for payment.

4.15 **Providing & fixing cupboard below platform**

TW frame of specified size and class of wood shall be provided. The shutter shall be of 19mm thick block board/ particle board/ marine ply shutter as specified. The frame and both the sides of shutter shall be duly painted as directed. Architrave shall be provided as specified and the same shall be painted as directed.

5.0 FINISHING WORK

Applicable Codes

IS: 2394 -Code of practice for application of lime plasters finish.

IS: 1477 -Code of practice for painting of ferrous metals in buildings and allied finishes (part -I &II)

IS: 427 -Distemper, dry colours as required.

IS: 2395 -Code of practice for painting concrete, masonry and plaster surfaces.

IS: 428 -Distemper, oil emulsion, and colour as required.

5.01 **Providing & Applying Cement plaster 12 mm thick**

The surface to be plastered shall be washed with fresh clean water free from all dirt, loose material grease etc. and thoroughly wetted for 6 hours before plastering work is recommenced. Concrete surfaces to be plastered will how ever be kept dry. The wall should not be too wet but only damp at the time of plastering. The damping shall be uniform to get uniform bond between the plaster and the wall. The junction between the brickwork and RCC should be fixed with chicken wire mesh/PVC strip as directed before plaster.

The proportion of the mortar should be as specified under the respective items of work. Cement shall be mixed thoroughly in dry conditions and then just enough water added to obtain a workable consistency. The quality of water, send and cement shall be as mentioned in the specification for concrete and allied works. The mortar thus mixed shall be used immediately and in no case shall the mortar be allowed to stand for more than 30 minutes after mixing with water. The plaster shall be laid in a single coat. The mortar shall be splashed on the prepared surface with a crewel and finished smooth by toweling. The plastered surface shall be rubbed with iron plate till the surface shows cement paste. The work shall be in the line and level. Curing of plaster shall be started as soon as the applied plaster has hardened so as not to be damaged. Curing shall be done by continuously applying water in a fine spray and shall be carried out for at least 7 days.

The plaster shall be carried out on jambs, lintel and sill faces top and undersides, etc. as shown in the drawing or directed by the engineer.

5.02 **Providing & Applying Cement plaster 19 mm thick**

The general specification is same as item 5.0l but for the thickness of the plaster. The plasterwork shall be carried out in 2 layers, the first layer being 12-14mm thick and the second layer being 6 -7mm thick. The proportions of the mortar for both the layers shall be as specified in the item specification. The first layer shall be splashed against the prepared surface with a trowel to obtain an even surface. The second layer shall then be applied and finished leaving an even and uniform surface, trowel finished unless otherwise directed by the engineer. The plastered surface shall be rubbed with the iron plate till the cement paste comes on the surface.

5.03 **Providing & Applying lime punning to the plastered surface**

The plastered surface shall be finished smooth by trowel ling on the surface with neeru (lime cream). Neeru shall be properly slaked fat lime. The neeru shall be applied at the rate of 2.2 kg per sqm.

5.04 Providing and Applying 19mm sand faced plaster

a) This shall be applied in 2 coats. The first coat or the base coat should be approximately 12 mm and shall be continuously carried out without break to the full length of wall or natural breaking

points such as doors, window etc. The base coat shall be splashed on to the prepared surface with heavy pressure, brought to true and even surface and then lightly roughened by cross scratch lines, to provide bond for the finishing coat. The mortar proportion for this base coat shall be as specified in the respective item of work. The base coat shall be cured for at least seven days.

b) The second coat shall be 6mm thick. Before application of the second coat, the base coat shall be evenly damped. This coat shall be applied from top to bottom in one operation and without joints, finish shall be straight, true and even. The mortar proportions of this coat shall be as specified under the respective item work. Sand to be used for the second coat and for finishing work shall be as specified in the item description. The second coat shall be finished with sponge. Grooves shall be made as per the drawings.

5.05 Providing & Applying rough cast plaster

This shall be carried out in two layers. The base plaster shall be of 12 mm thick and of specified proportion of CM. It shall be roughened to receive the top layer the top layer shall be 7mm thick. It shall be of 3 parts cement, 6 parts coarse sand & 4 parts of 6mm to 10mm single or crushed stone aggregate. The plaster shall be cured at least for 7 days.

5.06 Providing & Applying waterproof cement plaster

The plaster shall be of specified thickness and of mortar proportions. The contractor shall use approved waterproofing admixture made by reputed manufacturer in the mortar for plasterwork. The quantity to be used shall be in accordance with the manufacturer's instructions, however subjected to the approval of the Engineer. The use of Calcium chloride shall be prohibited unless specifically allowed by engineer and shall conform to IS:2645. The plaster shall be cured at least for 7 days.

5.07 Providing & Applying neat cement

The specification same as per item 5.03 except that neat cement is applied to the plaster surface in place of neeru.

5.08 Providing & Applying cement pointing

a) The dust shall be brushed out of the joints and the wall be washed with water.

a) The mortar shall consist of one part of cement to one part of fine sand. Mortar shall be filled into joints and well pressed with special steel trowels. The joints shall not be touched against after it has once begun to set.

c) The joints of the pointed work shall be neat. The lines of false joints shall be allowed.

d) The work shall be cured for a week after the pointing is complete. Whenever coloured pointing has to be done the colouring pigment of the colour required shall be added to cement in proportion as recommended by the manufacturer and as approved by the engineer.

5.09 PROVIDING & APPLYING WHITE WASHING ON NEW WORKS -3 OR MORE COATS

Walls to be thoroughly scrapped with sand paper before white wash is applied. White wash shall be prepared from a good quality fat lime. Lime shall be slaked with water to the consistency of a cream and allowed to remain under water for 2 days .If shall then be strained through a cloth and 2 kg of clean gum of approved make, as specified in the item specification or by the Engineer, shall be added for every cubic metre of lime and indigo up to 3gm per kg of lime dissolved in water shall then be added and stirred well.

Each coat to be applied with a brush. It shall be applied with a stroke of the brush from the top, downwards another from bottom upwards over the first stroke and similarly one stroke from the right and another stroke from left over the first brush, before it dries. Minimum three coats shall be applied on the plastered surface for desired finish. If the desired finish is not obtained extra coats shall be applied without any extra cost.

5.10 **Providing & Applying Plastic Emulsion paint**

Paint to be used for the various items of work should be of approved make viz. British, Asian, Jenson & Nicholson, ICI or Shalimar .The painting work shall be carried out as directed by the engineer, keeping however in view the recommendations of the manufacturer. Where painting with plastic emulsion is specified, all uneven surfaces shall thoroughly cleaned of all dust dirt and sand papered. One primer coat with cement putty and minimum 2 coats of emulsion paint shall be applied. It shall be applied with rollers. Workmanship shall conform to the requirements of IS:2395.

5.11 **Providing & Applying Cement paint**

This may be "SNOWCEM" or of equivalent make. The surface shall be prepared as specified in the specification for white wash. This shall be applied with brush on the plastered wall. The strokes shall be even and it shall be cured at least for 7 days. No patch or brush stroke shall be seen. Three coats shall be applied.

5.12 **Providing & applying silicon paint**

This shall be applied over the external plaster for rendering it waterproof. This shall be applied with brushes. The paint shall be of approved quality.

5.13 Providing & fixing chicken mesh

The wire mesh shall be of 24 gauges and it shall be fixed with nails at the junction of brick masonry and RCC elements. The chicken wire mesh shall not sag in between the nails. This shall be done before the application of plaster.

5.4 **Providing & Applying dry distemper**

Distemper shall be or approved make. It shall be applied by a broad stiff brush in two coats over a coat: of primer. The first and second coat shall be applied only after the primer coat has thoroughly dried .The first coat shall be of a lighter tint .The shade of the distemper shall De got

approved by the Engineer. Water bound and oil bound distemper shall conform to the requirements of IS:427 and IS :428 respectively.

5.4 Providing & Applying Colour Wash

Colour wash shall be applied the same way as white wash. Necessary and approved colouring chemicals shall be added to the white wash which has been strained. Only colour wash required for the day's work shall be prepared. If the finished surface is powdery and comes off easily or the general appearance is streaky, the work shall be rejected. The contractor has to redo the work at no extra cost.

6.0 FLOORING

Applicable codes.

IS: l443 -Code of practice for laying and finishing of cement concrete flooring tiles.

IS: 2ll4 -Code of practice for laying in site terrazzo floor -finish.

IS: 777 -Glazed earthenware tiles

6.01 Providing & fixing precast Mosaic tile flooring

The type, quality, size, thickness. colour etc. of the tiles for flooring shall be as per the item description given in the Schedule of Quantities and of best quality .The contractor shall provide the Engineer with necessary sample for approval.

Before the tiling work is commenced, the sub-surface shall be thoroughly cleaned and washed of all loose material, dirt and scum and then shall be wetted without forming water pools on the surface. The tiles shall be laid on cement mortar or lime mortar bedding of thickness and proportion as specified in the item description. The mortar shall be evenly spread on the sub-floor. Over this mortar bed, 4.4 kg of cement per sq.m of floor area shall be spread. The tiles shall be fixed on this bed one after another. 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 perfectly straight and uniform in thickness. The tiles shall be laid perfectly in level unless otherwise specified by the Engineer. After laying the tiles the joints shall be finished with white cement or ordinary cement as specified.

For lime mortar-bedding lime from burnt stone shall be used. It shall be free from ash and impurities and be in the form of lumps and not powder when brought to site, lime which is damaged due to rain, soaking moisture or air slaking shall be rejected.

Floor tiles laid adjoining the wall shall project 12mm or as specified under the plaster, skirting or dado as directed by the Engineer. Half tiles and pieces shall be avoided as far as possible. After laying the tiles, it shall be cured for at least 14 days. About a. week after laying the tiles each and every tile shill 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 a new title to proper line and level. The same procedure shall be followed again after the tiles are finally polished. For the purpose of ensuring that such replaced tiles match with those earlier laid it is necessary that the contractor order enough extra tiles from the factory to meet this contingency. The tiles shall finally be cleaned and polished by using dilute oxalic acid or any other method recommended by the manufacturer and approved the engineer.

After the joints have attained sufficient strength, the floors shall be machine polished to the desired finish approved by the Engineer. Sufficient quantity of water shall always be used during polishing to prevent scratches.

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6.02 **Providing & Fixing Precast Mosaic tiles in skirting dado and risers**

For dado and skirting work, the vertical surface shall be thoroughly cleaned and wetted. Thereafter it shall be evenly and uniformly covered with about 12 mm thick 1:3 cement mortar. For this work the tiles as obtained from the factory shall be of the size required and practically fully 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. This shall be done from the bottom of the surface upwards. The joints shall be as close as possible and the work shall be truly vertical and flush. The tiles shall be fixed flush with the plaster of projects as specified by the engineer. The junction of the plaster and the skirting or dado shall be neatly finished. The joints shall be filled with ordinary cement unless otherwise specified. After the tile has set, hand polishing with carborundum stones shall be done so that the surface attains a glossy finish. Corners and junctions be finished true.

6.03 **Providing & laying cast-in-situ Marble chips flooring**

The marble chips shall be of approved size, colour and shade. The cement used may be white cement or cement mixed with coloring pigments as directed by the engineer. The proportion of marble chips to cement shall be as specified in the item description, but in no case it shall be less than 2.5:1. Samples of terrazzo/mosaic work shall be prepared for approval of Engineer. The entire work shall conform to the approved samples. The terrazzo chips shall-be laid after placing the base. The base shall consist of a layer of 28 mm thick 1: 2: 4 cement

concrete (1 cement, 2 coarse sand, 4 19mm and down graded stone aggregate) spread and levelled. While laying the flooring dividing strips of glass/PVC/aluminum of specified thickness shall be inserted in the mortar bed according to the design of the floor. Care being taken to see that no panel exceeds 1.5 sq.m in area. The top of strips shall be 10mm above the surface of the underbed and shall conform to the finished level of the floor. Chips shall be thoroughly mixed dry and then white cement or cement of approved colour shall be added in specified proportion. Chips and cement shall be thoroughly mixed and evenly spread on the platform and not heaped. Water shall then be added to obtain a plastic mix of suitable consistency as directed by the Engineer. Terrazzo layer shall be placed as soon as the screed coat has set sufficiently but in no case than the day thereafter. The thickness of terrazzo topping shall not be less than 10mm. The surface shall be rammed to obtain the consolidation and a levelled surface. Additional chips shall

be sprinkled on the surface and rammed in until surplus cement is checked out and chips forced together so that the finished floor will show not less than 70% aggregate. The surface is finally trowelled lightly. The Contractor shall keep the floor moist for not less than seven days. The surfaces shall then be machine polished. Voids shall be filled with neat grouting of same kind and colour as matching. This grouting shall remain at least 72 hours before being removed for final cleaning. The floor shall be refinished wherever necessary to leave the work in first class condition.

6.04 Providing & laying cast-in-situ marble chips in skirting and dado

The height of the skirting/'dado shall be as per the drawing. The base layer shall be 12mm cement mortar of 1.:3 proportion (1 cement, 3 coarse sand) and top 7 mm thick layer shall be of approved marble chips in proportion 1:2 (1 cement, 2 marble chips) .While laying the skirting/dado glass strips of specified width shall be provided. The skirting/dado shall be flush with the plaster or projected as specified by the Engineer. The junction between the skirting/dado and the plaster shall be finished properly. The skirting/dado shall be hand polished.

6.05 Providing & laying polished green Kota stone flooring

Stones shall be of approved quality, size and uniform thickness, edges shall be chisel dressed and the top surfaces shall be machine polished with joints running true and parallel from side to side. Stones should be laid on a bed of cement or lime mortar. The pattern of the flooring shall be as per the Architect's drawing. Thickness of mortar bedding shall be as specified in the item specification. The stone slabs shall be thoroughly wetted with clean water. Neat cement shall be spread over the mortar bed and the slabs shall be placed one by one, keeping in check the level and line of flooring. The slabs are then gently tapped with wooden mallet till it is firmly and properly bedded. There should be no voids left. The joints should not be more than 2 mm thick. The joint should be struck smooth. If specified terrazzo filling of specified thickness shall be done in the joints between the Kota stone slabs. The floor should be kept covered with damp sand or water for a week. Slabs should of sizes as specified. The stone shall be machine polished and then cleaned with oxalic acid. If the contractor is asked to mop the floor with kerosene and water by the engineer, the same shall be done without any extra cost. This shall be carried out daily at least for 10 times for 7 days.

6.06 Providing & laying Kota stone in skirting and dado

The Stone shall be of required sizes and the thickness shall be as mentioned in the item specification. The stones shall be pre-polished and machine cut. The stone's edges shall be dressed fine true, straight and at right angles to each other. The stones shall be fixed over cement mortar bed 1:4 (I cement;4 coarse sand .The joints are filled with ordinary cement and hand and wax polished. The joint between the top of skirting/dado and plaster shall be finished properly. The joints in the flooring shall be continued in the skirting/dado also. The work shall be cured properly.

6.07 Providing & Laying pre-polished, machine cut Kota stone in treads

Polished green Kota stone of specified thickness with machine cut edges shall be fixed for treads of steps in single piece or on the kitchen platform or open shelves and windowsills as directed. The stones shall be hand and wax polished. The laying procedure is same as specified in the item 6.06 above. Curing shall be done properly.

6.08 -Do- as above for stones up to 1.5m in length in single piece

Same as per item 6.07.

6.09 **Providing & fixing kota stone shelves**

The stones shall be pre-polished on both the sides and the thickness shall be 25 to 30mm. The stones shall be placed in the brick masonry zarries and the same shall be finished properly.

6.10 **Providing & Laying rough chiselled kota stone Flooring**

The stones shall be of specified thickness and size. The stones shall be placed on 20 thick CM bedding or lime mortar bedding and the joints shall be with CM 1:2(1 cement,2 stone dust). The joints shall be finished flush or with "V" grooves of 5 to 8mm wide and 8mm deep. The slope shall be maintained as given in the drawing or as directed.

6.11 **Providing & Laying 40mm thick IPS flooring**

The mix shall be 1 part cement. 2 parts coarse sand 4 parts graded stone aggregate. The flooring shall be laid in panels of uniform sizes not exceeding 2 sq.m. They shall be laid in alternate panels on alternate days. The edges shall be protected properly. Glass/PVC /aluminium strips shall be provided to separate the panels, as per the item description in the Schedule of Quantities. The slope shall be maintained as directed by the Engineer.

The mix shall be prepared by volumes. Mixing shall be done in mIxers. The concrete shall be placed in position and leveled up with the help of wooden straight edge and trowel and beaten up well till slurry comes on top and holes filled up with concrete.

If IPS has to be laid directly on RCC slab, the surface of the RCC slab shall be roughened up with brushes while the concrete is green. Before laying the floor the laitance, loose materials, cake of mortar dropping shall be removed and the surface of the slab hacked and coat of cement slurry @2.75 kg of cement per sq.m. shall be

applied so as to get a good bond between the slab and IPS. IPS has to provided on lean concrete no slurry is required.

The flooring shall be finished with 12mm thick (1:1) cement-sand mortar and cement slurry @2.2kg of cement per sq.m. And water shall be applied on top with wooden float till the voids in the concrete are filled with mortar cream. The surface must be uniform and even in colour. Dry cement or cement sand mixer shall not t sprinkled to absorb excess moisture in the flooring. Colour pigments shall be added to the flooring if instructed by the Engineer. Curing shall be done for seven days. The, edges of the panels shall be protected from damage.

6.l2 P & L IPS flooring of 50 thick

-Do- same as item 6.11 but for 50mm thick.

6.13 Providing and laying l5-20 mm thick IPS in skirting/dado

The specification shall be same as the item (6.11 but for the work is to be done on vertical surfaces. It is of two layers the base layer shall be of l2mm thick RCC 1:2:4(l cement;2 sand; 4 graded stone aggregate of size 12mm and down). Then it shall be finished with 6mm thick plaster with CM 1:1.

6.14 Extra for providing. Mixing and laying of IRONITE

The ironite shall be consisting of uniformly grace iron particles, free from non-ferrous metal particles oil, grease, sand and soluble alkaline compounds. This shall be mixed with cement in proportion of 4 cement and 1. compound by weight. The laying procedure is same as per the specification for IPS flooring.

6.17 Providing & Laying Industrial tile in floorings skirting and dado.

The sizes of the tiles shall be 600mm x 600 mm or as directed, and the thickness shall be 19mm for flooring and 15-20mm for skirting and dado. The stone shall be acid and alkali resistance shall be approved by the Engineer.

The approved quality of acid and alkali preventive primer shall be applied uniformly in two coats over the slab or the concrete surface. The acid-alkali proof powder shall be mixed with the cement in the proportion 2:1 *(2* cement: powder) or as per the manufacturer's specification. The cement powder mix and the sand shall be mixed in the ratio 1:3 and the mortar shall be

prepared. The stones shall be laid on the mortar bed in level and line with even thickness of 6mm to 10 mm joints all around.

The joints shall be raked to 12-19mm deep and filled with epoxy based resin. The resin is mixed with quick dried and acid alkali proof powder. As the resin is an atmospheric hardening agent, it does not required curing. The work place shall be kept dry for the joint filling operation. The stone shall be either hand polished or machine polished cleaned with oxalic acid and wax combined.

6.13 **P&L Ceramic tiles in flooring. skirting and dado**

The ceramic tiles in flooring and dado shall be of first class quality as specified in the item specification and shall be approved by the Engineer. The tiles shall be of standard size with out warp and with straight edges, true and even in shape and size and of uniform colour. The tile surface shall be of fine grain texture, dense and homogenous. The thickness of the tile shall be as per the item specification. The tiles shall be submerge in the water till the bubbles cease.

They should be laid on a base of l2mm thick mortar bed (cement or lime 1:3 sand) and cement (3 kg/sqm) paste. They shall be laid truly vertical on walls and truly horizontal on floors or to slopes as directed. The joint shall be very thin, uniform and perfectly straight. The tiles in dado shall be finished in such a way that, only the tile thickness projects over the finished plaster or as specified otherwise. Where full tiles are not possible the same should be cut or sawn to the required size and their edge rubbed to ensure straight and true joints. After the tiles are laid extra cement grout shall be removed. The joint shall be cleaned with wire brush and then the joint shall be floated with white or gray cement as approved by the Engineer. The tiles shall be cleaned after the work is complete.

6.19 **Providing & Laying glazed tiles**

-do- same as item 6.19.

6.25 **Providing & Applying 115mm thick water proofing treatment**

First layer of about 20mm thick in CM 1:3 (1 cement, coarse sand) mixed with waterproofing compound of M/S.India Water Proofing Co., Bombay or equivalent shall be laid as instructed by the Engineer. Then brickbats shall be laid over this required slopes and levels as per the drawings and the instructions of the Engineer. The surface of the brickbats shall be finished smooth with another lay of waterproof plaster and the gaps between the brickbats shall also be filled with CM mixed with waterproof plaster. Finally

the surface is finished smooth and desired pattern are formed on the surface with thread. All opening sleeves, drains, pipes, etc. shall be specially treated and made sure that they are water tight.

6.27 **Providing & Laying Cast iron tile flooring**

The tiles shall be laid over a bed of 37 mm thick 1:2:4*;* 1 cement; 2 coarse sand; and 4 graded stone aggregate of nominal thickness 12mm and down. The tiles shall be fixed in line and level as per the drawing and as directed by the Engineer. The .joints shall be filled with 1:1 cement mortar, 1 cement and 1 sand. Curing shall be done at least for15 days. 7he tiles shall be hand/machine polished and the entire surface shall be smooth and all joints shall be filled properly.

7.0 STEEL WORK

Applicable Codes

IS: 4351 - Steel door frames

IS:1038 -Steel door, windows and ventilators.

7.01 **Providing & Fixing pressed steel frames for doors**

They shall be made of hollow metal pressed section of approved make such as “Perfect Industrial Products", TIL or of equivalent make. They shall be single/double riveted as per the architect’s drawing. It shall be made of CR sheet of size 65x125x1mm thick . It shall be provided with four hinges of 125x2 mm thick of friction type. Four hinges shall be provided per leaf of the door. The frame shall be provided with a hold fast size 150x20x3 mm for each size and the same shall be embedded in brick work with CC 1:2:4 blocks of size 300x23x230 mm. The hollow portion of the frame shall be fitted with CC 1:2:4 before it is fixed.

The frame shall be painted with red oxide primer. There shall be provision in the frame for fixing of tower bolts, aldrop, louvers, mortise lock, etc. The frame shall be painted with two or more coats of approved synthetic enamel paint to get a uniform finish.

7.02 Providing & Fixing pressed steel section windows for fully openable windows

The frame shall be of size 100x6x1mm thick and it shall be of perfect industrial Products. TIL Senharvic, Agew, or of any approved make. The frames shall be double riveted. The frame shall be provide with 3 holdfasts of 100x15x3 mm.

Long and the same shall be grouted with cc 1:2:4 in the brick work or to RCC member. Shutters shall be made of standard steel sections style f7d, sash bsr of t6 and locking ba4r of f4b section. The hollow portion of the frame shall be filled with cc 1:2:4 before fixing the frame.

Glass of 4mm or 5.5mm shall be fixed with beading as per the architectural drawing the beading shall be of aluminum or GI hollow square pipe of 10 sq mm and wall thickness 1.25mm.

The section shall be provided with arrangement for fixing the ms or aluminum oxidized handless and washers. The window section shall be painted with one coat of primer and two coats of synthetic enamel paint of approved make and shade

7.03 -do- same as item 7.02 party open able and partly fixed windows

-Do- same as item 7.01

7.04 -do- same as item 7.01.for fixed windows

-Do- same as per item 7.01

7.05 -do- same as item 7.01 but for louvered ventilators

-Do- same as above but provision shall be given for fixing 4/5.5 mm thick glass

7.06 providing &fixing fly proof shutter

This shall be fixed to the existing pressed steel frame. The wire netting shall be 22 to 23 SWG and galvanized. The beading shall be of MS flat 25x3 mm with screws. The shutter shall be provided with 4 nos. of friction type hinges. The section shall be provided with arrangement for fixing tower bolts and handles. It shall be painted with one coat of primer and 2 coats of approved synthetic enamel paint.

7.07 **Providing & Fixing GI BRC fabrics**

This shall have a GI rectangular or square shape 75, 50, 25 mm size as per requirement. The gauge of the wire shall be 8X10. The gap size shall be 75X25 mm in general unless be 8X10. The gap size shall be 75X25 mm in general unless specified otherwise. This shall be welded/bolted to the MS Frame made of angle iron 40x 40 x 6 and tee 40 x 40 x 40 x 6 mm with an ms beading of 30 x 3 or 12 x 6 mm or as specified in the item description in the schedule of quantities. This shall be painted with one coat of primer and 2 coats of approved synthetic enamel paint of first quality as specified in the item description.

7.08 **Providing & fixing rolling shutters**

The rolling shutters shall be of 18 gauge ms solid laths or grill with all the accessories such as top cover (conform to the size indicated in drawings and shall be of quality specified in the item specification. The rolling slats shall be in one piece and be made of heavy gauge steel sheets minimum 19 SWG in thickness. A cylindrical hood shall be provided on the top to enclose the shutter when it is open. The rolling shutters shall be provided with suitable locking arrangement and deep channel guides. In case galvanized rolling shutters are specified the rolling shutter shall be made of hot dip galvanized slats hood, deep channel guides all preferably in one louse. The channels guides shall be fixed with holding down bolts with pcc 1: 2: 4 (1 cement, 2 sand, 4 coarse aggregate of nominal size 12mm and down).

Incase of hand operated pull and push type rolling shutters and very large than 10 sq m in area, they shall be provided with ball bearing for smooth and efficient operation in case of large rolling Sutherlands depending upon local wind conditions the rolling shutters should be provided with special locking type of wider channel guides or it shall be provided with central wind pressures in the area.

7.09 providing &fixing mechanical operated rolling shutters

-Do- same item 7.08.

7.10 providing & fixing partly grilled rolling shutters

-Do- same as items 7.08.

7.11 providing & fixing in position grill, railing, steel ladder etc.

This work shall be carried out as per the detailed drawing of the architect. The ms sections shall be of approved quality .the welding shall be perfect and the junctions shall be ground properly. The frames shall be provided with holdfasts. And the same shall be grouted with cc blocks of 1: 2: 4 in brick work. It shall be painted with one coat of prime and 2 coats of approved synthetic enamel paint.

7.12 **Providing and fixing MS inserts in RCC and brick work**

a) Inserts, bolts, etc shall be provided in masonry and concrete works as indicated on the drawing .It is imperative that all Inserts, bolts fixtures and fittings shall be provided in their Position very accurately such inserts and bolts be fixed with necessary templates if due to negligence on the part of contractor the inserts bolts fixtures and fitting etc are out of alignment the contractor shall make arrangements to have the inserts and bolts removed and reaffixed in their proper position as directed by the engineer at no coat of primer and two coats of approved synthetic enamel paint.

7.13 providing & fixing ms gate

It shall be as per the drawing . the welding shall be perfect and the junctions shall be ground properly .the gate shall be provided with locking arrangements hinges and it shall be painted with one coat of primer and two coats of approved synthetic enamel paint.

7.14 Providing & fixing GI pipe railing

It shall be done with the specified class of GI pipe as per the item in the schedule of quantities. All necessary specials, bends, elbows tees and holdfasts or clamps shall be provided. If the pipe railing is to be fixed on ground or brick work it shall be done by embedding the holdfasts, as directed b the engineer, in concrete blocks Pcc 1: 2: 4 (1 cement 2 sand, 4 graded coarse aggregate of size 12 mm and down). If it is to be fixed to an Rcc member, the pipe shall be welding to the steel plate by embedding it in the Rcc member.

7.14(B) Providing & fixing SS pipe railing

It shall be done with the specified class of SS pipe as per the item in the schedule of quantities. All necessary specials, bends, elbows tees and holdfasts or clamps shall be provided. If the pipe railing is to be fixed on ground or brick work it shall be done by embedding the holdfasts, as directed b the engineer, in concrete blocks PCC 1: 2: 4 (1 cement 2 sand, 4 graded coarse aggregate of size 12 mm and down). If it is to be fixed to an RCC member, the pipe shall be welding to the steel plate by embedding it in the RCC member.

7.15 **Providing & Fixing MS door Frame.**

It shall be fabricated from structural steel as per the details and drawings. All the members shall be free from rust, flakes cracks and other fabrication defects. All holes for hinges, bolts, locking plates etc. shall be provided as per drawings/instructed. The welding shall be smooth. the frame shall be erected and fixed with ms holding 1: 2: 4 (1 cement , 2sand, 4 graded coarse aggregate

of nominal size 12 mm and down) the frame shall be painted with a coat of primer before erection and 3 coats of synthetic enamel paint of specified quality after erection.

7.16 **Providing & fixing ms sheet door**

The frame shall be of ms as specified above. The door shall be as per the architect, s design. The specified gauge ms sheet door shall be welded to the frame. It should have 3 to 6 hinges depending on the shutter size. It shall have fittings as specified in the item/ architect's drawings. The door shall be applied with a coat of primer and 2 coats of synthetic enamel paint of quality as specified.

7.17 **PROVIDING & FIXING GI BARBED WIFE FENCING.**

This fencing shall be either be made with RCC posts and struts or with MS posts and struts shall be of size and length as specified in the item description in the Schedule of Quantities. It shall be free from cracks, twists and honey combing.

MS posts and struts shall be of size and section as specified in the item description. One end of the angle shall be forked to have grip in the concrete and the other side shall have a hole to receive the fencing wire. It shall be applied with a coat of primer and 2 coats of synthetic enamel paints.

GI WIRE

It shall be 12 to 14 gauge with 4 points barb with two wires twisted together or as specified in the item description and other defects and uniformly galvanized. The type, length and standard weight of the GI wire shall be as specified below.

Nominal dia Of wire Line wire	Point wire	Nominal distance between two barbs	Length in Nominal	M/100kg Min.	Max.
2.5mm	2.24mm	75mm	1000	934	1066
2.5	2.24	150	1134	1066	1200
2.24	2.24	75	1576	1490	1668
2.24	2.24	150	1890	1778	2000

The GI barbed shall be well stretched in number of rows as specified with two diagonals. The spacing shall be equidistant. The posts and struts shall be embedded in PCC 1:2:4 or as specified. It shall be fixed in line. Level and plumb. The grouting concrete shall be cured for 7 days. The Barbed wire shall be held to posts by means of GI staples. U slips or GI binding wire as specified. Turn buckles and straining bolts shall be used at the ends. Two struts shall be provided at the corners and the every 28m. The length of the strut shall be 1.5 times the length of the post.

8.0 ROOFING

8.01 Providing, Fabricating & Erecting MS Structural steel work for trusses, purling, grinders columns, rafters, struts, wind ties, bracings etc.

All structural steel materials such as angles, RS joists flats, tees plants, channels etc. shall conform to the latest edition of IS 226. All structural steel shall be free from twist before fabrication. Cutting of members shall be cone by shearing, cropping sawing or gas cutting contact surfaces of plants and butt joints shall be accurately machined over the whole area so that the parts consecrate shall butt over the entire surface of contact. Welding of pieces shall be done with the approval of the Engineer.
The components parts shall be assembled in such a manner that they are not damaged in any way and specific cambers as snow in the drawing or as directed by the Engineer, shall be provided.
For polted connection, where necessary washers shall be tapered or otherwise suitability to give satisfactory bearing the treated portion of the bolt shall project beyond the nut by at leaser 1.5 threads.

Welding shall be done in accordance with the latest edition of 18 813 and 814, Code of Practice for use of Electric Arc welding for general Construction in mild steel. In welding it must be ensured that the base metal is in fused state when filler metal makes contact with it ; filler metal does not overflow upon any unfused base metal base metal is not cut along the weld edges. Flowing metal floats the slag, oxide and gas bubbles at the surface behind advance pole. For this current shall be adjusted or the electrode size is changes welding shall be free from cracks, discontinuity, under or over size welding thickness.
Surface to be welded shall be free from loose mill scale, rut grease, paints and the any other foreign materials. As far as possible avoid the welding at heights and at difficult positions. Generally fillet welding is preferred. The parts to be welded are brought in as close contact as practicable and rigidly clamped together.

Before erection, steel work shall be thoroughly cleaned of rust, loose scale, dust welding of approved make and one coat of synthetic enamel paint of approved make as specified in the item before erection and final coat of painting after the erection as directed

Steel members shall be hoisted and put in position carefully without any damage to the member and to the building and labour. The trusses shall be lifted at such points that they do not buckle or deform or be unduly stressed. The end of the truss which faces the steel members shall be hoisted and put in position carefully without any damage to the member and to the building and labour. The trusses prevailing wind shall be fixed and the other end may be kept free to move. the steel work shall be securely fastened wherever necessary, temporarily braced ,to provide for all load to be carried by the member during erection for all loads to be carried by the member during erection including the loads due to the erection equipment and its operation . No permanent bolting or welding is done until proper alignment has been obtained. The holes for the rivets shall be determined with the help of templates and drilled. Erection clearance of the cleared ends shall not be more than 1.5mm and without clearing end clearance shall not be more than 3mm. grouting or embedding of structural steel members done after the approval of the alignment level & position of the members by the engineer.

Important points

Before the actual execution of the job, the contractor shall prepare fabrication drawing for all structural steel work from the structural drawing s supplied to him and determine the exact cutting b marking out on a level platform to full scale.

Welding plant, electrodes and other equipments sufficient number of spare parts and staff shall be maintained by the contractor at site at his cost.

8.02 **-**do- as per item 8.01 but with ms b class pipes

-Do- same as item 8.01 but with ms b class pipes as per item description given in the schedule of quantities.

8.03 **Providing & fixing ms chequered plates**

The chequered plates shall be cut to the required shape with arc gas cutting machine. The cut edges shall be ground and finished properly. The plates shall be given a coat of primer and two coats of approved synthetic enamel paint.

8.04 **PROVIDING & FIXING MS HOLDING DOWN BOLTS**

The MS holding down bolts of specified dia. Length and shape shall be provided as per the drawings in line & level. These shall be fixed to RCC work of brickwork by grouting it with concrete. The bolt shall be provided with nuts and washers. The grease shall be applied to the thread portion with the help of templates. If the bolts need some adjustment it shall be provided with a wooden piece 75x75mm of 50mm dia GI pipe bolt shall be provided at the time of concreting and shall be removed after initial set.

8.05 **PROVIDING & FIXING GI/AC CORRUGATED SHEETS.**

AC/GI sheet and accessories shall be free from cracks, chipped edges and corners. The fixing shall be done as per the latest edition of IS 459. The spacing of the purlins shall not be more than 1.4m for 6mm sheets. The light shall not visible from the joints of the AC/GI sheets. The AC/GI sheets to be kept on ceiling shall be placed with smooth side upward and the AC/GI sheets to be put in cladding shall be placed with smooth side to side. The AC sheets shall have at sides a lap of half corrugation and an end lap of 150mm minimum. The free over hangs at ends shall not be more than 300mm.
Hole for 8mm dia L or J bolts shall be drilled and not to be punched in the ridge of the corrugation. The diameter of the hole shall not be galvanized J or L hooks with nuts and two nos. of bitumen washers. All AC sheets accessories shall be painted or white washed as specified in the item or directed by the Engineer.

8.06 **PROVIDING & FIXING AC ACCESSORIES.**

-Do- same as above but for North lighjt curve, AC ridges Curves, Corner pieces, Bargeboards, Eaves board etc.

8.07 **P & F ALIMINIUM FALSHING**

This shall be fixed between the RCC facia and the AC sheets with bitumen to prevent leakage. The work shall be carried out as per the item specification.

9.0 MISCLLANEOUS WORKS

9.01 Providing and fixing night latch of approved make such as godrej or equivalent as directed.

This shall be measured in no. The rate shall be quoted for providing night latch of approved quality and make fixing the same in the door shutters and finishing as per item schedule properly in case of damage.

9.02 providing & Fixing approved make 6 levers Mort ice lock with pair of brass oxidized/chromium plated handles.

This shall be measured is nos. The rate quoted shall be for providing mort ice lock with handles in doors and finishing as per item schedule.

9.03 Providing and fixing hydraulic door closer or approved size and make such as EVERITE/HYPER/GARNISH or equivalent as directed.

This shall be measured is no. This shall be fixed at places as directed by the Engineer.

9.04 Providing and Fixing PVC hand rail 50mm wide of approved colour to and make such as Caliplast or equivalent, including matching the joints as directed by Engineer.

This shall be measured in RM.

9.05 Filling the electrical zaris 250mm to 150mm wide and 50mm to 100mm deep with cement mortar 1:3 and finishing the same to match with the surrounding white wash or any other finish, etc. complete as directed.

This shall be measured in RM. No patch shall be seen after the zarries are filled up.

9.06 Dismantling brick masonry walls and partitions, paltered or unflustered as per instructions including finishing the broken surface to match with the surrounding. Removing the debris as directed within site cutting the reinforcements if any etc. complete as directed.

The work shall be measured in cum.

9.07 Dismantling the RCC beams, slabs lintel, columns, padre, walls platform etc. including finishing the broken surface to match the surrounding , removing the debris within site, including cutting the reinforcement if any etc. complete as directed.

This shall be measured in cum.

9.08 The zaris 25mm to 150 mm de and 50 to 100mm deep with PCC (1:2:4) and Finishing with plaster to match with surrounding including chiseling, scafolding, curing etc. complete as directed.

9.09 Making holes upto 30cms, in dia or 30 x 30 cms. In size in RCC works and filling the same with PCC (1:2:4) and finishing the same as per surrounding including Scaffolding. Curing etc. complete as directed scaffolding, cutting the reinforcement bars, curing etc. complete as directed.

This shall be measured in nos.

9.10 Providing and fixing approved quality and make such as everite or equivalent aluminum hydraulic floor door spring as directed.

This shall be fixed in floor. The floor shall be cut properly for the placing of the spring if necessary. The flooring near the spring location shall be redone matching the existing flooring. Nothing extra shall be paid for this.

This shall be measured no.

9.11 Providing and fixing 24 gauge aluminum kick plates including cutting to size as per details and fixing with aluminum screw etc. all complete as directed.

This shall be measured in sq.m.

9.12 Providing and fixing in RCC side wall or bottom or cover slab of sump the following size GI B class pipes maximum 300mm long with outside flanges/threaded end for connecting the inlet, outlet, washout and overflow pipes for 75 mm dia.

The specification of that GI pipe shall be as per the specification given in Section 11.00 of this Technical specification. It shall be placed during concreting the walls of the sump.

It shall be measured in nos. the rate quoted shall be for the providing and placing of the pipe with flange or threaded in line and level.

9.13 Providing and fixing in RCC side wall or bottom or cover slab of sump the following size GI B class pipes maximum 300mm long with outside flanges/treaded overflow pipes for 50mm dia.

-Do- same as item 9-15

9.14 Providing and fixing in RCC side wall or bottom or cover slab of sump the following size GI B class pipes maximum 300 mm long with outside flanges / threaded end for connecting the inlet, outlet, washout and overflow pipes for 38 mm dia pipe.

-DO- same as item 9.15.

9.15 Providing and fixing in RCC side wall or bottom or cover slab of sump the following size GI B class pipes maximum 300 mm long with outside flanges / treaded end for connecting the inlet, outlet, washout and overflow pipes for 25 mm dia. Pipe.

-Do- same as item 9.15

9.16 Taking the delivery of COLD STORE doors of maximum size 3m x 2.5m. from the project Authority site store and fixing the same in line and level, cutting the brick work, RCC and fixing with holdfast in cc 1:2:4 blocks including finishing the surface smooth , currying etc, all complete as directed.

This shall be measured in on.

9.20 Providing and fixing removable CI gratings of approved quality for rain water pipes including painting the same with two coats of approved enamel paint as directed for 1000mm dia.

This shall be measured in on.

9.21 Providing and fixing removable CI gratings of approved quality for rain water pipes including painting the same with two coats of approved enamel paint as directed for 150mm dia.

-Do- same as item 9.20

9.22 Fixing special CI drain in flooring

The taps shall be supplied by the Project Authority. It shall be fixed in position as shown in the drawing as directed. It shall be placed in brick chamber of size 300 x 300mm and 230mm thickness. The chamber shall be finished inside with 12mm thick plaster in CM 1:4 (1 cement, 4 coares sand). The base of the thick PCC 1:4:8 bed. The trap shall be fixed in the chamber and shall fibre as directed. The flooring at the 1:1 and jute fibre as directed. The flooring at the junction of the trap shall be finished properly so that it matches with the existing flooring.

9.23 **Providing and fixing vent Cowl**

The vent cowl shall be of CI or PVC as specification in the item description. It shall be of approved quality .

10.0 ROAD WORK

Materials

Murrum

It shall be got from approved quarries. It shall be granular and gritty. It shall be free from dust, all rubbish and any organic materials as well as clods of black cotton soils. The materials shall be got approved prior to its use in road construction.

The materials shall be stacked on a level ground. If the item is only for supplying of murrum, then it shall conveying with the lead and lift and stacking the same at site as directed by the Engineer. The rate shall also include all tools, duties, fees, royalties etc.

SAND

The sand shall be from a river or nala or sea. It shall be clear, sound properly grated, free from organic materials slit; clay etc. and it shall be well grated.

METAL

The stone metal be hard, sound, durable, stone of close texture as is locally available and reasonably free from decay and weathering. It shall be angular or cubical, and round elongated or flaky metals shall be rejected. No round or oblong pebbles or angular chips shall be allowed. The size of the metal shall be 40mm to 63mm. All disintegrated stone shall be rejected. The metals shall be tested for Abrasion value, Aggregate Impact value and Flakiness Index in standard laboratories before the materials is put to use and they shall conform to relevant is codes as given in page 4, 16 of this section. Metal shall be stacked at site on fairly level ground.

ROLLING

A power roller shall, as a rule, be not less than 10 tones but if at any time still heavier rollers are required on the works the contractor shall have to bring them as my be directed by the Engineer. A hand roller should not be less than a ton. Rolling shall progress from edges to the center of the road in strips parallel to the centerline of the road. Rolling shall be done by lapping uniformly each preceding near wheel track by at least one half width of the track.
On super elevations. Rolling shall be started at inner edge and shall progress towards outer edge. During and after rolling, the surface shall be checked for grade and camber, with camber plate. The roller shall be started, worked or stopped without jerks. Rolling shall not normally be done length less than 100 M.

10.01 SURFACE DRESSING INCLUDING PREPARATION OF SUBGRADE

The high portion of ground shall be cut down and/or hollows and depression shall be filled upto 500 mm. The gradient and camber / slope should be maintained as per requirement so as to give an even, neat and tidy look to the work. The measurement will be in sq.m. The area requiring cutting or filling more than 300 mm shall be paid

separately under relevant items of earth work and surface dressing item will not be applicable. Earth from cutting will be used for filling. The rate for the item shall also include jungle clearing viz plants, shrubs, grass etc. excluding trees.

PREPARATION OF SUBGRADE

The subgrade shall be leveled approximately to the proper level and camber by filling depressions with excavated material and cutting of protuberances. The subgrade shall be made to have as nearly as practicable, a uniform bearing layer and all hard spots therefore be properly excavated and refilled. All soft and spongy parts of the subgrade shall be excavated and refilled with approved materials of 15 cm layers for the same reason. The cost of this excavation will be paid under the item for excavation. The Subgrade shall be watered as directed at least 12 hours before a 10 MI roller is put on it.

Proper accesses should be prepared for the roller to get to the subgrade and all manholes frames and covers should be removed and replaced by plates of adequate strength free of cost whenever they interfere with the free rolling of the subgrade.

After rolling the camber, super elevation and longitudinal slope etc. of the subgrade shall conform in shape to those of the finished road surface. This should be checked with the help of level strings and camber board, if necessary. When subgrade consists of black cotton soil, a thin layer of murrum or coarse sand shall be provided below any base course, watered and rammed and rolled tightly.

10.01 a **Providing & Laying base course**

65 mm, nominal size or as specified, metal shall be spread over the prepared base to a thickness 0f 130mm in one or two layers as specified, the metal layer dry and wet shall then be rolled and consolidated by a 10 tone power roller. The thickness of the consolidated layer after completing all the operation described below shall be less than 100mm than blinding material like murrum or red bajri shall be laid and watered and rolled. Rolling shall start from edge of road and proceed towards the crown in longitudinal strips overlapping on successive strips by at least one half the width of the rear wheel of the roller. The operation shall continue till no visible settlement of the metal or movement under the roller is observed. The gradient and camber shall be checked from time to time by means of level, stackes, strings camber board etc. any depression or hump shall be corrected by removing completely the metal layer there at the spot and rolling the same satisfactorily.

After the dry rolling is completed, gift, stones, dust, sand etc. shall be spread. Moderate sprinkling of water and rolling shall be continued and stone dust shall again be spread if required till all the voids are completely filled and the movement of metal under the wheel ceases. If there is excess powder the same shall be removed lightly by brooms.

The surface shall be checked for camber etc. the unevenness or undulations shall be rectified as required. The whole surface shall be then watered, extra powder added if required, brushed and rolled to obtain a mosaic surface. This type of surfaces shall be

maintained till upper layer is laid.

10.02 Providing & laying wearing course

50 mm metal shall be spread, in one or two layers, over the prepared base to a thickness of 100mm consolidated and the prepared base to a thickness of 100mm consolidated and the rate of spreading grit shall not be less than 10 to 15 sq.ft/ 100 sq.ft. the other operations such as rolling watering etc. as item 10.02.

10.04 Providing and laying 20 mm thick layer of hot asphalt & aggregate over the wearing course.

The surface shall then be brushed free of any loose blinding material out of the voids into which it has set. The surface then shall be tested for depression, which shall be made up by remettaling and blinding with aggregate of a size equivalent to the depth of the depression.

Bitumen 80/100 of approved brand, heated to a temperature of 350 deg.F. shall then be applied evenly to the road surfaced by means of a pressure distributor at the rate of 25 kg per 10 sqm.

While the bitumen 80/100 is still hot the surface shall be laid evenly with premix aggregate of 20mm size well mixed with bitumen. The stone aggregate shall be hot and dry and contain not more than 2% moisture before use. It shall be first screened of dust, measured and heated. The rate of application of stone chips shall be 0.20 cum per 10 sqm or as specified in the Schedule of Quantities.

After spreading of the premix carpet the road shall be given a final rolling with 10 tonne power roller. Any soft spot or depression detected at a later date shall be made up as directed by the engineer.

10.05 **Providing and Laying Seal coat with hot bitumen**

Seal coat is applied to water proof road, to seal the surface, to prevent oxidation due to air circulation to strengthen bitumen surface or to improve texture, reduce porosity and tendency to disintegration.

Seal coat with hot bitumen: Treatment consists of applying a coat of hot bitumen 2.5 kg/sqm. On prepared surface, binding with stone grit 0.30 cu.m/10m. and consolidating with road roller of 10 tonne.

10.06 Providing & laying seal coat with bitumen emulsion

Seal coat with bitumen emulsion. Other details same as 10.05

10.07 Providing & laying seal coat with pre-mixed sand

Seal coat with pre-mixed sand: The type of treatment consists of laying sand coated with bituminous binder on a prepared surface and consolidating with road roller. Bitumen 96 kgs per 0.75 cu.m of coarse sand for 100 sq.m. road area shall be used.

10.08 Providing & laying RCC kerb

Road kerbing shall be cast-in-situ/precast cement concrete stone as per the item description in the Schedule of Quantities. In case of pre-cast kerb it shall be laid over Brick bat concrete 1:4:8 150 mm thick or as specified in the ground and the joint between the tow stone shall be filled up with cement mortar (1:6). The stones shall be cast with cement concrete of 1:2:4 proportion within the project premises. The stone shall be cured for at least days. Contractor shall have to make one tank at his own cost for curing the stones.

The whole work shall include excavation, cutting roads if necessary, laying of bed concrete, shuttering, excluding reinforcement, casting, exposed concrete finishing and curing the kerb stones. The item shall be measured in RM.

10.09 Providing & laying RCC pavements

The cement concrete pavement consists of cement concrete(1:2:4) 1 cement, 2 coarse sand, 4 graded stone aggregates, 20 mm nominal size or richer mix as specified laid on the prepared base, compacting and curing. Reinforcement shall be provided in the slabs as per drawings/directed.The surface shall be examined for existing of soft patches and suitably treated to have uniform bearing capacity. The prepared surface shall confirm to the line, cross section shown. The Mixing and placing of concrete and compaction and curing shall be as per RCC specifications. The top surface of the road slab shall be either floated finish or striped finish or brush finish or broom finish as directed.

10.10 **Providing & laying RCC roads**

Mixing and placing of concrete, compacting and curing shall be as per RCC specification. Before concreting the form work should be placed to exact alignment, line and level. The width of the panel shall not be more than 6M. Alternative panels should be cast to avoid cracking and cured. The top surface of the road slab shall be either floated finish or striped finish or brush finish or broom finish as directed. The entire work shall be cured for minimum 15 days.

11.0 WATER SUPPLY

11.01 Providing & laying underground GI pipeline for 75 mm dia.

The pipes shall be galvanized mild steel welded pipes and screwed and socketed tubes conforming to the requirements of IS: 1239, for medium grade. They shall be of the diameter (normal bore) specified in the description of the item. The sockets shall be designated by the respective nominal bores of the pipes for which they are intended. The pipes and sockets shall be cleanly finished well galvanized in and out and free from cracks surface flaws, laminations and other defects. All screws threads shall be clean and well cut. The ends shall be cut cleanly and square with the axis of the tube.

All screwed tubes and sockets shall have pipe threads conforming to the requirements of IS: 554 screwed tubes shall have taper threads while the sockets shall have parallel threads.

The fittings shall be of malleable cast iron or mild steel tubes complying with all the appropriate requirements as specified for pipes. The fittings shall be designated by the respective nominal bores of the pipes for which they are intended. The fittings shall have screw threads at the ends conforming to the requirements of IS: 554. Female threads on fittings shall be parallel and male threads (except on running nipples and collars of unions) shall be taper.

The pipes and fittings shall be inspected at site before use to ascertain that they conform to the specification. The defective pipes shall be rejected. Where the pipes have to be cut or rethreaded, the ends shall be carefully filed out so that no obstruction to bore is offered. The end of the pipes shall then be threaded conforming to the requirements of IS: 554 with pipe dies and taps carefully in such a manner as will not result in slackness of joints when the two pipes are screwed together. The taps and dies shall be used only for straightening screw threads which have become bent or damaged and shall not be used for turning of the threads so as to make them slack, as the latter procedure may not result in a water tight joint.

The screw threads of pipes and fittings shall be protected from damage until they are fitted.

The pipes shall be cleaned of all foreign matter before being laid in joining the pipes, the inside of the socket and the screwed end of the pipes shall be oiled and rubbed over with white lead and a few turns of spun yarn wrapped round the screwed end of the pipes. The end shall then be screwed in the socket, tee etc. with the pipe wrench. Care Should be taken that all pipes and fittings are properly jointed so as to make the joints completely water tight and pipes are kept at all times free from dust and dirt during fixing. Purr from the joint shall be removed after screwing. After laying, the open ends of the pipes shall be temporarily plugged to prevent access of water, soil or any other foreign matter. Any threads exposed after jointing shall be painted or in the case of underground piping thickly coated with approved anticorrosive paint to prevent corrosion.

If the galvanized iron pipes and fittings are laid in trenches, the widths and depths of the trenches for different diameters of the pipes shall be as in the table given below: -

TABLE

Dia of pipe	Width of trench	Dept of trench
15mm to 50mm	30cm	60cm
65mmto100mm	45cm	75cm

At joints the trench width shall be widened where necessary. The work of excavation and refilling shall be done true to line and gradient in accordance with general specifications for each work in trenches. The pipes shall be painted with two coats of anticorrosive bituminastic paint of approved quality. The pipes shall be laid on a layer of 7.5cm sand and filled up to 15cm above the pipes. The remaining portion of the trench shall then be filled with excavated earth. The surplus earth shall be disposed off as directed when excavation is done in rock the bottom shall be cut deep enough to permit the pipes to be laid on a cushion of sand 7.5cm minimum. In case of bigger diameter pipes where the pressure is very high thrust blocks of cement concrete 1:2:4(1 cement: 2 coarse sand: 4 graded stone aggregate of 20mm nominal size) shall be constructed on all bends to transmit the hydraulic thrust without impairing the ground sand spreading it over a sufficient area.

TEST

After laying and jointing, the pipes and fittings shall be inspected under working conditions of pressure and flow. Any joint found leaking shall be redone and all leaking pipes removed and replaced without extra cost. The pipes and fittings after they are laid shall be tested to hydraulic pressure of 6kg/cm^2 (60 MWC) the pipes shall be slowly and carefully charged with water allowing all air to escape and avoiding all shock or water hammer. The draw off takes and stop cocks shall then be closed and Specified hydraulic pressure shall be applied gradually. Pressure gauge must be accurate and preferably should have been recalibrated before the test. The test pump having been stopped the test pressure should maintain without loss for at least half an hour. The pipes and fittings shall be tested in the sections as the work of laying proceeds, keeping the joints exposed for inspection during the testing.

11.02 providing and laying underground GI pipeline 50mm dia

-Do- same as item 11.01

11.03 providing and laying underground GI pipeline 38mm dia

-Do- same as item 11.01

11.04 providing and laying underground GI pipeline 25mm dia

-Do- same as item 11.01

11.05 providing and laying underground GI pipeline 20mm dia

-Do- same as item 11.01

11.06 providing and laying underground GI pipeline 12mm dia

-Do- same as item 11.01

11.07 providing and laying GI pipe line 75mm dia for open line work the galvanized iron pipes and fittings shall run on the surface of the walls or ceiling (not in chase) unless otherwise specified. The fixing shall be done by means of standard pattern holder bat clamps. Keeping the pipes

about 1.5cm clear of the walls ceiling pipes may be fixed in the ducts or recesses etc. provided there is sufficient space to work on the pipes with the usual tools.

All the pipes and fittings shall be fixed truly vertical and horizontal unless unavoidable the pipes shall be fixed to walls with standard pattern holders bat clamps of required shape and size so as to fit tightly on the pipes when tightened with screwed bolts. The clamps shall be fixed at short length and near the fittings as directed by the Engineer. The pipeline shall be tested as specified in the item 11.01

11.08 providing and laying open GI pipeline 50mm dia

-Do- same as item 11.07

11.09 providing and laying open GI pipeline 38mm dia

-Do- same as item 11.07

11.10 providing and laying open GI pipeline 25mm dia

-Do- same as item 11.07

11.11 providing and laying open GI pipeline 20mm dia

-Do- same as item 11.07

11.12 providing and laying open GI pipeline 12mm dia

-Do- same as item 11.07

11.13 providing and laying concealed in structure GI line 75mm dia.

For internal work the pipes shall be concealed in the brick masonry. Chasses or zarries shall be cut in the walls and the pipes shall be laid. The pipes shall not ordinarily be buried in the solid floors. Where unavoidable pipes may be buried for short distances provided adequate protection is given against damage, but the joints in the pipes shall not be buried. Where directed by the Engineer MS sleeve shall be fixed at a place where a pipe is passing through a wall or floor for inspection of the pipe and to follow freedom for expansion movements and contraction and other. In case the pipe is embedded walls or floors it should be painted with anticorrosive bituminastic paint of approved quality. The pipe should not come in contact with line mortar or Lime concrete as the pipe shall be laid in layer of sand filling done under concrete floors or as directed by the engineer. The floor and wall shall be finished same as the surrounding surface after the completion of the work. The line shall be measurement.

GI pipes with fittings laid properly shall be measured along the centre line lengths. The rate shall include making zarries in the wall, cutting floor, making holes, painting the pipe line with anticorrosive bituminastic paint all complete.

11.14 providing & laying concealed in structure GI pipe line 50 mm dia

-Do- same as item 11.13.

11.15 providing & laying concealed in structure GI pipe line 38 mm dia.

-Do- same item 11.13

11.16 providing & laying concealed in structure GI pipeline 25 mm dia.

-Do- same as item 11.13.

11.17 providing & laying concealed in structure GI pipeline 20 mm dia

-Do- same as item 11.13.

11.18 providing & laying concealed in structure GI pipeline 12 mm dia

-Do- same as item 11.13.

11.19 providing and fixing sluice valve for 75 mm dia pipeline

It shall be of approved quality. It shall be measured in nos.

11.20 providing and fixing sluice valve for 50 mm dia pipeline

-Do- same as item 11.19.

11.21 providing and fixing sluice valve for 38 mm dia pipeline

-Do- same as item 11.19.

11.22 providing and fixing sluice valve for 25 mm dia pipeline

-Do- same as item 11.19.

11.23 providing and fixing sluice valve for 20 mm dia pipeline

-Do- same as item 11.19

11.24 providing and fixing sluice valve for 12 mm dia pipeline

-Do- same as item 11.19.

11.25 providing and fixing of wheel valve of approved quality for 75 mm dia pipe line

It shall be of approved ISI make. It shall be fixed in the pipe line at the place as directed by the engineer.

11.26 providing and fixing of wheel valve of approved quality for 50 mm dia pipe line

-Do- same as item 11.25.

11.27 providing and fixing of wheel valve of approved quality for 38 mm dia pipe line

-Do- same as item 11.25.

11.28 providing and fixing of wheel valve of approved quality for 25 mm dia pipe line

-Do- same as item 11.25.

11.29 providing and fixing of wheel valve of approved quality for 20 mm dia pipe line

-Do- same as item 11.25.

11.30 providing and fixing of wheel valve of approved quality for 15 mm dia pipe line

-Do- same as item 11.25

11.31 providing & fixing bib cock for 15 mm dia pipeline

A bibcock (biptap) is a draw off tap with horizontal inlet and free outlet. It shall be of specified size and shall be of the screw down type. The closing device should work by means of a disc carrying a renewable non-metal- seating at right angle to the axis of the threaded spindle, which operates it. The handle shall be either catch of butterfly type security fixed to the spindle. The cocks shall be open in anti- clockwise direction. When the bid cocks are required to be chromium plated the chromium plating shall be of grade b type conforming to IS: 1068. In finish and appearance, the

plated articles shall be free from plating defects such as blister, pits, and roughness and shall not be stained or discolored.

11.32 providing & fixing long body bib cock

-Do- same as item 11.19. The bib cock long body is generally provided for the kitchen sink.

11.33 P & F stop cock for 12 mm dia pipe line

A stopcock (stop tap) is a valve with a suitable means of connections for insertion in a pipe line for controlling or stopping the flow. It shall be specified size and shall be of the screw down type. The closing device should work by means of a disc carrying a renewable non-metallic washer which shuts against water pressure on a seating at right angle to the axis of the threaded spindle which operates it. The handle shall be either catch or butterfly type securely fixed to the spindle. Valve shall be of the loose letter seated pattern. The cocks shall open in anti-clockwise direction. When the stop cocks are required to be chromium plated the chromium plating shall be of grade B type plated articles shall be roughness and shall not be stained or discolored.

11.34 providing & fixing stop cock for 19 mm dia pipe line

-Do- same as item 11.21.

11.35 providing & fixing angle valve

The brass fittings shall be of heavy quality, CP and approved manufacture and pattern with screwed or flanged ends as specified. The fittings shall in all respects comply with the requirements of is: 781. The standard size of brass fittings shall be designated by the normal bore of the pipe to which the fittings are attached. a sample of each kind of fittings shall be got approved from the engineer and all supplies made according to the approved samples. All cast fittings both internal and external surfaces shall be clean, smooth and free from sand etc. Burring, plugging stopping or patching of the casting shall not be permitted. The or that when assembled the points shall be axial, parallel and cylindrical with surfaces smoothly finished. The area of the water way of the fittings shall not be less than the area of the normal bore. The fittings shall be fully examined and cleared of all foreign matter before being fixed. The fittings shall be fitted in the pipe line in the work man like manner. The joints between fittings and shall be made leak proof. The joints sure kg/sq .cm and the defective fittings and joints shall be replaced or redone.

11.36 providing & fixing shower rose

This shall be of approved make. This shall be properly as directed by the engineer

11.37 providing & fixing 25 mm dia GI hydrant for gardening

The work shall be carried out as per the drawing and as directed. It shall be provided with a wheel valve and a vertical piece of GI pipe to keep the hydrant level above the existing GL at a height as directed by the engineer. The hydrant shall be fixed in the brick chamber of size 450 x 450 mm and depth 230 to 500 mm to suit the site conditions. The bottom of the chamber shall be finished with PCC 1:4:8 100 mm thick and the walls shall be finished with 12 mm thick plaster in CM 1:4. An MS cover shall be provided for the chamber.

11.38 providing & fixing 6 mm thick asbestos string for 25 mm dia line

This shall be wound closely over the GI pipe concealed in structure.

11.39 providing & fixing 6 mm thick asbestos string for 12 mm dia line

-Do- same as item 11.26

11.40 providing & fixing towel rail

This shall be brass chromium plated or as specified and of approved make. The length shall be between 500 and 800 mm and the rod shall be of 20 mm dia. It shall be fixed as directed by the engineer.

11.41 providing & fixing CI manhole cover of 40 kg

This shall be of approved make. The cover shall be provided on a CI frame. The frame shall be properly fixed in the brick work/ RCC cover slab of the chambers.

11.42 providing & fixing ball cock for 38 mm dia pipe

This shall be of approved class and make. This may be of brass or PVC as specified in the item. It shall be fixed as directed y the engineer.

11.43 providing & fixing ball cock for 25 mm dia pipe

-Do- same as item 11.30.

11.44 providing & fixing ball cock for 12 mm dia pipe

-Do- same as item 11. 30.

11.45 providing & fixing cp brass water spout 12 mm dia

This shall be provided and fixed at places as directed by the engineer. The part of brickwork around the spout shall be finished to match the external finish. No patch shall be seen. The spout shall be of approved quality.

11.46 providing & fixing GI water spout of 75 mm dia

The spout shall be 200 to 450 mm in length as directed by the engineer. One end of the pipe shall be cut diagonally and tack welded at te bottom to facilitate the flow of water. It shall be fixed at places as directed by the engineer. The brickwork after the placement of the spout shall be finished properly to match the external finish. The spout shall e painted with paint of approved shade and make.

11.47 P & F GI water spout of 50 mm dia

-Do- same as item 11.34

11.48 P & F GI water spout of 38 mm dia

-Do- same as item 11.34

11.49 P & F GI water spout of 25 mm dia

-Do- same as item 11. 34

11.50 Fixing of geyser

The geyser shall be shifted from the site stores to the required place. Then necessary anchor bolts with nuts. CP brass pipes and cp brass angle valves for inlet and outlet.

11. 51 fixing of water coolers

The water cooler shall be shifted from the site stores to the required place. Then necessary coach / anchor. Bolts with nuts, CP brass pipes and CP brass angle valves for inlet and GI outlet pipe of 25 mm dia up to drain point shall be provided and fixed.

11. 52 Fixing PVC water tanks

The tanks shall be shifted from the site stores to the place as shall be fitted to the tanks and the tank shall be properly fixed. Pedestals for the tanks shall be constructed as directed by the engineer.

12.0 SANITARY WORKS

SCOPE OF WORK

The scope of work includes providing and fixing sanitary fixtures, providing and laying drainage lines and all items of work described in the schedule of quantities.

DRAWINGS

Checked and approved drawings showing location of sanitary and water supply fixtures will be furnished to the Contractor and all drawing so furnished shall form a part of this specification. The Contractor shall refer these drawings for all information contained thereon which pertains to and required for this work.

In the case of variations between the drawings and the specifications, or discrepancies in the information furnished by the Engineer, the Contractor shall refer such discrepancies to the Engineer before proceeding with such work.

All connected works will be measured and paid under respective items of work unless specifically mentioned otherwise.

12.01 Providing & laying 300 mm dia non-pressure Hume pipe

The pipe shall be with or without reinforcement as required and of the class as specified. These shall conform to IS: 458. The reinformeced cement concrete pipes shall be manufactured by centrifugal (or spun) process while unreinforced cement concrete pipes by spun or pressure process. All pipes shall be true to shape, straight, perfectly sound and free from cracks and flaws, the external and internal surface of the pipes shall be smooth and bard. The pipes shall be free form defects resulting from imperfect grading of the aggregate mixing or moulding. The unreinforced pipes (non pressure pipes) shall withstand a test pressure equivalent to 0.7 Kg/Sq. com (7m head) of water.

Concrete used for the manufacture of unreinformced and reinforce3d concrete pipes and collars shall not be leaner than 1:2:4 (1 cement: 2 coarse sand : 4 graded stone aggregate). The max size of aggregate should not exceed one third of the thickness of the pipe or 20 mm whichever is smaller. The reinforcement in the reinforced concrete pipes shall extend throughout the length of the pipe. The circumferential and longitudinal reinforcements shall be adequate to withstand the specified hydrostatic pressure and further bending stresses due to the weight of water when running full across a span equal to the length of pipe plus three times its own weight. The minimum cover for reinforcement of spun pipes and for all other pipes shall be as given below:

spun pipes	pipes other than spun pipes	Pipes thickness
	Mm	Mm
Less than 30 mm	9	12
30 mm to 75 mm	12	18
75 mm and over	18	18

Where the pipe shall be bedded directly on soil, the bed shall be suitable rounded to fit the lower part of the pipe. The cost of this Operation being included in the rate for ling the pipe.

Loading, transporting, and unloading of concrete pipes shall be done with care handling shall be as to avoid impact. Gradual unloading b inclined plane or b chain block is recommened. all pipe section and connection shall be inspected carefully before being laid. Broken or defective pipes or connections shall not be used pipes shall be lowered in to the trenches carefully. mechanical appliance ma be used. Pipes shall be laid true to the line and grade, as specified .lying of pipe shall proceed upgrade of a slope.

if the pipe have spigot and socket joints, the socket ends shall face up-streem,in the case of pipes with joints to be made with loose collar ,the collar shall be slipped on before the next pipe is laid. Adequate and proper expansion joints shall be provided where directly in case where the foundation condition are unusual such as in the proximity of trees or holes under existing or proposed tracks manholes etc. the pipe shall be encased all round in 15cm thick cement concrete 1:5:10 (1 cement :5 coarse sand 10 grades stone aggregate 40 mm nominal size)or compacted sand or graval.

In cases where the natural foundation is inadequate the pipes shall be laid either in concrete or cradle supported be laid either in concrete or cradle supported on proper foundation or on any other suitably designed structure. If a concrete cradle bedding is used the depth of concrete

below the bottom of the pipe shall be at least 1/4th of the internal dia of the pipe subject to a minimum of 10 cm and a max of 30 cm. The concrete shall extend up the sides of the pipes at least to a distance of 1/4th of the outside diameter for pipes 300 cm and over in diameter. The pipe shall be laid in this concrete bedding before the concrete has set pipes laid in trenches in earth stall be bedded evenly and firmly and as far up the haunches of the pipes as to safely transit the load expected from, the backfill through the pipe to the bed. This shall be done either by excavating the bottom of the trench to fit the curve of the pipe or by compacting the earth under the curve of the pipe to form an even bed. Necessary provision shall be made for joint wherever required. When the pipe is laid in a trench in rock, hard clay, shale or other hard material the space below the pipe shall be excavated and replaced with an equalizing bed of concrete sand or compacted earth. In no case shall pipe be laid directly on such hard material. When the pipes are laid completely above the ground the foundations shall be made even and sufficiently compacted to support the pipeline without any material settlement. Alternatively the pipeline shall be supported on rigid foundations at intervals. Suitable arrangements shall be made to retain the pipeline in the proper alignment such as by shaping the top of the supports to fit the lower part of the pipe. The distance between the supports shall in no case exceed the length of the pipe. The pole shall be supported as far as possible close to the joints. In no case shall the joint come in the center of the span. Care shall be taken to see that superimposed loads greater than the total load equivalent to the weight of the pipe when running full shall not be permitted. Suitably designed anchor blocks at change of directions and grades for pressure lines shall be provided where required.

Jointing of the pipes shall be done as described below:

a) Collar shall be space symmetrically over the two pipes and the space between collar and pipe filled with cement mortar 1:1 thoroughly rammed with caulking tools. The joint shall be finished with a fillet sloping at 45. Joints shall be protected and cured for about 10 days. If specified in the item specification wedge shaped groove in the end of the pipe shall be filled with a special bituminous plastic compound for bitumen soaked spunyarn. The collar shall then be slipped over the end of pipe and next pipe butters well against tee plastic compound by suitable appliances so as to compress the plastic compound in the grooves, care being taken not to disturb concentricity and level of the pipes.

12.02 Providing &laying 230 mm dia non pressure Hume pipe

-DO- same as item 12.01.

12.03 Providing &laying 150 mm dia non pressure Hume pipe

-DO- same as item 12.01.

12.04 Providing & laying stoneware pipe of 300 mm dia

All pipes with spigot and socket ends shall conform to IS 651 and shall be of grade 'A' as specified. These shall be sound free from visible defects such as fire cracks or hair cracks. The glaze of the pipe shall be free from crazing. The pipes shall give a sharp clear sound when struck with a light hammer. There shall be no broken blisters.

The approximate thickness of 60 cm long pipes shall be as given in the table:

Internal diameter of the pipe mm	Thickness of the barrel and socket mm	Weight of pipe per M Kg
100	12	14
150	16	22
200	17	33
230	19	44
250	20	52
300	25	79
350	30	100
400	35	128
450	38	147

The length of pipes shall be 60 cm exclusive of the internal depth of the socket. The pipe shall be handled with sufficient care to avoid damage to them.

All pipes shall be laid on a bed of 15 cm cement or lime concrete as specified, projecting on each side of the pipe to the width of the trench which shall be nominal dia of pipe + 400 mm. The pipes with their crown level at 1.20 m depth and less from ground shall be covered with 15 cm thick concrete above the crown of the pipe and sloped off to meet the outer edges of the concrete, to give a minimum thickness of 15 cm around the pipe. Pipes laid at a depth greater than 1.25 m at

crown shall be concreted at the side upto the level of the centre of the pipe and sloped off from the edges to meet the pipe tangentially. The concreting shall be done as per specifications for concrete. The pipes shall be carefully laid to the alignment levels and gradients show on the plans and sections great care shall be taken to prevent sand etc. from entering the pipes. The pipes between two manholes shall be laid truly in a straight the without vertical or horizontal undulation. The pipe shall be laid with socket up the gradient. The body of the pipe shall for its entire length rest on an even bed of concrete and places shall be formed in the concrete to receive the socket of the pipe.

Where pipes are not bedded on concrete the trench floor shall be left slightly high and carefully bottomed up as pipe laying proceeds, so that the pipe parrels rest on firm and undisturbed ground. If the excavation has been carried to low the desired levels shall be made up with concrete 1:5:10 (1 cement : 5 coarse sand : 10 graded brick bat of 40 mm nominal size for which no extra payment shall be made.

If the floor of the trench consists of nock very hard ground that cannot easily be excavated to a smooth surface the pipe shall be laid on a leveling course of concrete as desired. When SW pipes are used for strom water drainage, no concreting will normally be necessary. The cement mortar for jointing will be 1:3 (1 cement 3 fine sand) testing of joints will also not be done.

Tarred gasket of hemp yarn soaked in thick cement slurry shall first be placed round the spigot of each pipe and the spigot shall then be slipped home well: into the socket of the pipe previously laid. The pipe shall then be adjusted and fixed in the correct position and the gasket caulked tightly home so as to fill not more a 1/4th of the total depth of the socket.

The remainder of the socket shall be filled with stiff mixture of cement mortar in the proportion of 1:1 cement 1 line sand when the socket is filled, a fillet shall be formed round the joint with a trowel forming any angle of 45 with the barrel of the pipe. After a day's work any extraneous material shall be removed from the inside of the pipe. The newly made joints shall be cured.

Water test

a) Stoneware pipes used for sewers shall be subjected to a test pressure of 1.5m head of water at the highest point of the section under test. The test shall be carried out by suitably plugging the low end of the Drain and the ends of the connection if any and filling the system with water. A buckle bend shall be temporarily jointed in at the top end and a sufficient length of vertical pipe jointed to it so as to provide the required test head. Or the top may be plugged with a connection to a hose ending in funnel, which could be raised or lowered till the required head is obtained and fixed suitably for observation. Where leakage will be visible the defective part of the work shall be removed and made good.

In cases where sides are not bedded on concrete special care shall be taken in refilling trenches to prevent the displacement and subsequent settlement at the surface resulting in uneven street surfaces and dangers to foundations etc. The backfilling materials shall be packed by hand under and around the pipe, and rammed with a shovel and light tamper. The method of filling will be continued up to the top of pipe. The refilling shall rise evenly on both sides of the pipe continued up to 60 cm above the top of pipe so as not to disturb the pipe. No tamping should be done within 15 cm of the top of pipe. The remainder of the backfill shall not be done until 7 days have elapsed for brick sewers and 14 days of concrete sewers, unless local conditions or materials are suitable for the earlier placing of load on the pipes. The tamping shall become progressively heavier as the depth of the backfill increases.

In measuring the length of sewer pipes, laid length between faces of manholes shall only be measured omitting lengths of channels between inside faces of walls of manholes or chambers.

12.05 Providing & laying stoneware pipe of 230 mm dia

-Do- same as item 12.04

12.06 Providing & laying stoneware pipe of 150 mm dia

-Do- same as item 12.04.

12.07 Providing & Laying Stoneware pipe of 100mm dia

-Do- same as item 12.04.

12.08 providing & Laying CI WEE line concealed in structure 150 mm dia with cement joint

All cast iron pipes and fittings shall be approved ISI make, shall be of uniform thickness with strong and deep sockets, free from flaws, air holes cracks hand holes and other defects and conform to IS:1729. The pipes and fittings shall be true to shape smooth and cylindrical and shall ring clearly when struck over with a light hand hammer. All pipes and fittings shall be properly cleaned of all foreign materials before being fixed.

The annular space between the sockets and spigot shall be filled with a gasket of hemp or spun year soaked in nearest cement slurry. The joint shall then be filled with stiff cement mortal 1:2

(1cement: 2 fine sand) well pressed with caulking tool and finished smooth on top at an angle of 45 Deg. Cent. The joint shall be kept wet for not less than 7 days by tying a piece of gunny bag and kept moist joints shall be perfectly air and water tight.

The thickness of fittings and their socket and spigot dimensions shall conform to the thickness and dimension specified for the corresponding sizes of straight pipes.

The connection between the main pipe and branch pipes shall be made by using branches and bend with access doors for cleaning. Floor traps shall be provided with 25mm dia puff pipe where the length of the waste is more than 1800 mm or the floor trap is connected to a waste stack through bends.

All cast iron pipes and fittings including joints shall be tested by smoke test to the satisfaction of the Engineer and left in working order after completion. The smoke test shall be carried out as standard under:

a) Smoke shall pumped into the pipe at the lowest end from a smoke machine which consists of the bellow and burner. The materials usually burnet is fresh cotton waste which gives out a clear pungent smoke which is easily detectable sight as well as by smell if there is leaking at any point of the pipeline.

Water test and air test shall be conducted as satisfied in IS 5329

12.09 Providing & Laying CI waste water line concealed in structure 100mm dia with cement joint.

-Do- same as item 12.08

12.10 Providing & Laying CI waste water line concealed in structure 75mm dia with cement joint.

-Do- same as item 12.08

12.11 Providing &Laying CI waste water line open with cement joint 75mm dia.

The general specification of the pipe shall be as per item 12.08

Pipes shall be fixed to the wall by GI or MS holder back clamps, unless projection with fixing holder are vertical or to the line and slopes as indicated. The clamps shall concrete blocks (1:2:4) 10cm by making necessary holes in the walls at proper places. All holes and breakage shall be made good. The clamps shall be kept 25mm clear of the finished face of the walls to facilities cleaning and painting of pipe. CI pipe and fittings which are exposed shall be first cleaned and then painted with two coats of bitunastic paint.

The pipe shall be tested as specified in item 12.08

12.12 Providing & laying CI waste water line open with cement joint 100mm dia.

-Do- same as item 12.11

12.13 Providing & laying CI soil pipe line 100mm dia.

The general specification for the pipe shall be as per item 12.08. All plug points drainages pipes shall be provided with inception and cleaning caps. Covers for which shall be fixed nuts and screws.

12.14 Providing & Laying CI soil pipe line 150mm dia

-Do- same as item 12.13

12.15 Providing & Laying Ci soil pipe 100mm dia with lead joint.

CI pipe with socket and spigot shall be provided with lead caulked joints wherever specified and the joints shall conform to the requirements of IS : 3114

The general specification shall be same as per item 12:13

12.16. Providing & Laying CI soil pipe 150mm dia with lead joint

-Do- same as item 12.15

12.17. Providing & Laying CI soil pipe 100mm dia with cement joint in open

The general specification shall be same as item 12.11 and 12.13.

12.18 Providing & Laying CI soil pipe 150mm dia with cement joint in open.

-Do- same as item 12.17

12.19 Providing & laying concealed PVC rain water line 75 mm dia.

The strength of the pipe shall be 4kg.Sq.Cm It shall be of approved make. It shall be provided make. It shall joint with adhesive as per the manufacturers specification.

12.20. Providing & laying concealed PVC rain water line 100 mm dia.

-Do- same as item 12.19

12.21. Providing & Laying concealed PVC rain water line 150mm dia.

12.22 Providing & Laying CI 100mm dia RW line concealed in the structure.

It should be of approved ISI make. It shall be free from pain holes and defects and be neatly finishing form outside and inside, painted with two coats of bitumenastics paint. The joints of the pipe shall be filled with spun yarn soaked with cement slurry and then finished with CM 1:2 (1 cement, 2 coares sand). All necessary bends, plug bends. elbow grating, shoes fixing with holder bat clamps shall be provided pipe shall be cut to require lengths if the site condition demands so. The weight of the pipes of 1.83m long shall be as follows:

Description	75mm dia	100mm dia	150mm dia:
Plain singles socket pipe	14kg/no	19kg/no	34.5 kg/no

Plain double socket	15	20	37.20
Earned singles socket pipe	14.50	19.50	35.40
Eared double socket pipe	15.40	20.40	38.00
Plain short pipes	8.20 kg/m	10.40 kg/m	19.00 kg/m
Plain bend	3.20 kg/no	4.50 kg/no	9.10kg/no
Offsets 55mm projection	2.70	5.00	8.20
75mm projection	3.20	5.50	9.10
115mm Projection	4.10	5.90	9.50
225mm projection	5.00	7.30	11.80
300mm projection	6.00	8.60	12.70
Branches single Y	5.00	7.30	14.50
Branches double Y	6.80	10.00	19.10
Plain shoe	3.20	4.10	8.60
Head	6.40	6.80	11.30
For erosion door fitting	0.90	0.90	1.35
For inspection door	1.80	1.90	2.25

12.23 Providing & Laying CI 150mm dia rainwater line concealed in the structure.

-Do- same as item 12.22

12.24 Providing & Laying CI 100mm dia rain water line in open.

-Do- same as item 12.22 but in open.

12.25 Providing and Laying CI 150mm dia RW line open.

-Do- same as item 12.22 but in open.

12.26 Providing and fixing marble pardi.

It shall be of single piece of marble of approved quality and type and size as specified in the item description. The edges shall be measured cut to the required shape. Both the sides shall be well polished. The pardi shall be properly embedded in the wall with CM 1:2 (minimum 7.5 cm should be embedded)

12.27 Providing & Fixing European WC

Water closets shall be either of white glazed earthward. White glazed vitreous china or white glazed fire clay as specified and shall be of “wash down type”. The closets shall be of one pipe construction. Each water closet fixing have 4 holes having a minimum diameter of 6.5 mm for fixing to floor and shall have integral flushing rim of suitable type. it shall also have an inlet or supply horn for connecting the flush. The flushing rim inlet shall connecting the flush be of the self-draining type. The water closet shall have a weep hole at the flushing Intel. Each water closet shall have an integral trap with either “S” or “P” outlet with least 50mm water seal. Where required the water closets shall have an antisiphonage 50mm dia vent horn on the outset side of the trap. The inside surface of water closets and traps shall be uniform and smooth in order to enable an efficient flush. The narrated part of the outlet shall not be glazed externally. The water closed when sealed at the bottom of the trap in line with the back plate, shall be capable of holding not less than 10 litres of water between the normal water level and the highest possible water level of the water closet as installed.

12.28 Providing & Fixing Indian type WC/Orissa Pan

This shall be the long pan pattern with fortresses/ Orissa Pattern, as specified made of white glazed vitreous china or of white glazed fire clay. Each pan shall have an integral flushing rim of suitable type. It shall also have an inlet or supply horn or supply horn for connecting the flush pipe. The flushing rim and inlet shall be of the self draining type. It shall have a weep hole at the flushing inlet to the pan. The flushing inlet shall be in the front unless otherwise specified or ordered by the Engineer. The inside of the bottom of pan shall have sufficient slope from the front towards the outlet and the surface shall be uniform and smooth to enable easy and quick disposal while flushing. The exterior surface of the outlet below the flange shall be an unglazed surface which shall have grooves right angles to the axis of the outlet. Pans shall be provided with a trap “P” or “S” type horn etc. complete.

12.29 Providing & Fixing lipped urinal.

Urinals basins shall be a flat back of corner wall type lipped in front as specified in the item description in the schedule or Quantities. They shall be of white glazed earthenware, white glazed vitreous china or white glazed fire clay, and of size as specified. The urinals shall be provided with not less than two fixing holes of a minimum dia of 6.5mm on each side. Each urinal shall have an integral flushing rim of suitable type and inlet or supply horn for connecting the flush pipe. It shall have a weep hole at the flushing inlet of the urinal. At the bottom of the urinal, an outlet for connecting to an outlet pipe shall be provided. The exterior of the outlet horn shall not be glazen and the surface be provided with grooves at right angles to the axis of the outlet to facilitate fixing to the outlet pipe. The inside surface of the urinal shall be uniform and smooth throughout to ensure efficient flushing. The bottom of pan shall have sufficient slope from the front, towards the outlet such that there is efficient draining the urinal. The waste fittings shall be chromium plated. Also CP brass spreader and pipe of 100mm dia shall be provided.

12.30 Providing & Fixing wash basin

Wash basins shall be of white glazed earthenware, white glazed vitreous china or white glazed fire clay as specified. These shall be of the following type and sizes indicated against each type:

Types	**Sizes**
Flat back	530 x 450 mm
Flat back	550 x 400 mm
Flat back counter top with	
Antis plash rim	530 x 430 mm

a) Washbasins shall be of one-piece construction, including a combined overflow. All internal angles shall be designed so as to facilitate cleaning. Each basin shall have rim on all sides except sides in contact with the walls and shall have skirting at the back. Basins shall be provided with single or double top holes as specified. The tap holes shall be square. A suitable tap hole button shall be supplied if one top hole is not required in installation. Each basin shall have a circular waste hole to which the interior of basin shall drain. The waste hole shall be either riveted or be beveled internally with diameter of 63 mmaat top and a depth of 10 mm to suit a waste plug having 64 mm diameter. Each basin shall be provided with a non-ferrous 32 mm washer fitting. Stud bolts to receive the brackets on the underside of the wash basins shall be suitable for a bracket with stud not exceeding 13mm diameter 5 mm high and 305 mm from the back of basin to the entire of the stud. The stud slots shall be of depth sufficient to take 5 mm stud every basin shall have an integral soap holder recess or recesses which shall fully drain into the bowl. The position of the chain stay hole shall fully drain into the bowl. The position of the chain stay hole shall not be lower than the over flow slot. A slot type ov3rflow having an area of not less than 5 sq. cm. shall be provided and shall be so designed as to facilitate cleaning of the overflow. The specifications for waste plug, chain and stay shall be the same as given for sinks.

b) All the waste fittings shall be chromium plates bottle trap conform to IS: 5434 the chromium plating shall be of grade B type conforming to IS: 1068. Also CI brackets shall be provided with screws.

It shall be measured in nos. The rate shall be quoted for providing and fixing washbasin as specified above.

12.31 Providing & Fixing Kitchen sinks

a) The sinks shall be of white glazed earthenware, white glazed vitreous china or white glazed fire clay as specified and shall be of the following sizes.

450 x 300 x 150 mm
600 x 450 x 250 mm

b) They shall be of one piece construction including a combined overflow; the floor of the sink shall gently slope towards the outlet. The outlet shall in all cases be suitable for waste fittings having flanges of 64mm diameter and the waste hole shall have a minimum diameter of 65mm at the bottom to suit the waste fittings. The waste hole shall be either riveted or beveled having a depth of 10mm. Each sink shall be provided with non-ferrous 40mm dia waste fittings. The sink shall have over flow of the waste type and the inverts shall be 30mm below the top edge. Each sink shall be provided with a waste plug of suitable dia. Chain and stay. The plug shall be of rubber of other equally suitable materials and shall be watertight when fitted plug chains shall be of brass 13mm in length and shall be chromium plated.

c) It shall have an overall length from the collar the stay of not less than 300mm. There shall be a triangular or D shackle at each end, one of which shall be brazed to the plug and the other securely fixed to the stay. The 150mm long shank of the waste shall be threaded conforming to the requirements for IS: 2556 for sinks only. The waste fittings and plug fittings shall be chromium plated. The chromium plating shall be of grade B type conforming to IS: 1068.

12.32 Providing & Fixing Stainless Steel sink with drain board.

It shall be of approved make. It shall be provided with fittings and specials like CI brackets, overflow, rubber plugs, CP brass chain, 31mm dia CP brass waste of Synthetic enamel paint.

12.33 PROVIDING & CONSTRUCTING SW 100MM DIA GULLY TRAP

SW gully trap for 100/150mm dia pipe shall be fixed in a chamber of 230 thick wall of size 300 x 300mm, 12mm thick plaster in cm 1:4 inside,100mm thick PCC 1:4:8 bed shall be laid over that 38mm thick IPS flooring shall be provided weight a CI frame and cover.

12.34 PROVIDING & FIXING FLUSHING CISTERNS

a) The flushing cisterns shall be automatic or manually operated high level or low level as specified. For water closets and urinals high level cistern is intended to operate with minimum height of 125cm and a low level cistern with a maximum height of 30cm

between the top of the pan and the underside of the cistern. They shall with the requirements of IS:774

b) The body thickness of a cast iron cistern shall not at any place be less than 0.5 cm and that of an earthenware cistern 1.3 cm. The body of pressed steel cistern shall be of a seamless or welded construction, of thickness not less than 1.6 mm before coating, and shall be porcelain enameled or otherwise protected against corrosion by an equally efficient coating. The cistern shall be free from manufacturing faults and other defects their utility. All working parts shall be designed to operate smoothly and efficiently. Cisterns shall be mosquito proof a cistern shall be considered mosquito proof only if there is no clearance anywhere which would permit a 1.6 mm wire to pass through in the permanent position of the cistern, i.e. in the flushing position of filling position.

c) The breadth of a level cistern, from front to back, shall be such that the cover or seat, or both of water closets per shall come to rest in a stable position when raised. The cistern shall be supported on two cost iron or mile steel brackets of size as approved by the Engineer, These shall be properly protected by suitable impervious paint. Alternative, the cistern shall have two holes in the back, set above the overflow level, for screwing into the wall, supplemented by two cast iron or mild steel wall supports. A 5 liter cistern, however may be be supported by lugs or brackets cast on the body of the cistern.

d) Manually operated cisterns shall be of the curved siphon type and shall conform to the specifications given in is :2526. The cistern shall have a removable cover, which shall fit closely on it and be secured against displacement. In designs where the operating mechanism is attached to the cover, this may be made in two sections, but the section supporting the mechanism shall be securely bolted or screwed to the body.

e) The outlet fittings of each cistern shall be securely connected to the cistern. In case of high level cisterns, the outlet shall be of 32 mm nominal bore and in the case of low level cisterns; the outlet shall be of 40 mm nominal bore. Ball cock shall be of screwed type 15 mm in diameter and shall conform to is no. 1703. Ball valves (Horizontal plunger type) including, floats for water supply purposes. In the case of high level manually operated cistern, the level arm of the cistern shall have a suitable hole near the end through which a spilt ring of a (s) hook shall pass. A chain shall be attached to the ring or hook.

f) The chain shall be GTI and strong enough to sustain a suddenly applied pull of 10 KG or a dead load of 50 kg. Without any apartment or permanent deformation of the snipe of the link. The chain shall terminate in a suitable handle of “Pull” which shall be of pottery, galvanized iron non-ferrous metal, or a molding in any heat resisting and non-absorbent plastic.. The finish shall be smooth and free from burrs. In case of law level flushing cisterns, the handle shall be chromium plated.

g) The cast iron cisterns shall be painted with tow coats of black bituminastic paint of the inside and two coats of synthetic enamel paint on the outside. In the case of manually operated cisterns, the siphonic action of the flushing cistern shall be capable of being rapidly brought into action by the operation of level, but shall not self siphon of leak.

h) The discharge rate of the cistern shall be about 5 liters in 2 seconds when connected to an appropriate flush pipe, and there shall be no appreciable change in the force of flush during the period of discharge. The cistern shall have a discharge capacity of 5.10 or 12.5 liters as specified.

12.35 providing & Fixing Flush valve

It shall be of approved make

2.36 Providing & Fixing HCI NAHNI trap

The tap shall be painted with anticorrosive paint and fixed in position with PCC 1:2:3 (1 cement, 2 sand, 4 graded coarse aggregate of nominal size 20mm and down. The brass CP shall be placed over the trap, the flooring around the trap shall be properly finished.

12.37 PROVIDING & FIXING BOTTLE TRAP

It shall be of heavy duty approved quality and make. It shall be provided with necessary connecting pipe, wall flange etc.

12.38 PROVIDING & FIXING PAPER HOLDER

It shall be of approved quality. It shall be glazed with vitreous china recessed type.. It shall have a wooden roller or aluminum or a specified and a roll or paper

12.39 PROVIDING AND CONNECTING MANHOLES

Manholes of different types and sizes as specified shall be constructed in the sewer line at such places and to such levels and dimensions as shown in the drawings or as detected by the Engineer. The size indicate the inside dimensions of the manhole.

Excavation and back filling shall; be as per respective specification,.

Manhole shall be built on a bed of brickbat cement concrete 1:4:8: (1 cement 4 sand 6 brickbats of 40 mm nominal size). The thickness of the bed concrete shall be 150 mm unless otherwise specified.
Brick work shall be in cement mortar 1:6 (1 cement: 6 sand). The external joints of the brick masonry shall be finished smooth. The joints of the pipes with the masonry shall be made perfectly leak-proof with cement concerets 1:2:4.

The brick walls of the manholes shall be plastered inside with 12 mm thick cement plaster 1:4 1 (cement : 4 sand) finished smooth with a floating coat of neat cement.

Channels and benching shall be in cement concrete 1:2:4 (1 cement : 2 snad : 4 graded stone aggregate).

The depth of channels and benching shall be as indicated in the table give below:

Size of Drain Mm	Top of channel at the Centre above bed concrete cm	Depth of benching at side walls Above bed concrete cm
100	15	20
150	20	30
200	25	35
250	30	40
300	35	45
350	40	50
400	45	55
450	50	60

The frame of the manhole cover shall be firmly embedded to correct alignment and levels in plain cement concrete 100 mm thick 1:2:4 (1 cement : 2 sand : 4 graded stone aggregate on top of the brick masonry. After completion of the work, manhole covers shall be seared by means of thick grease.

12.40 Providing & Construction Soak Pit

The earth excavation shall be carried out to the exact dimensions as shown in the drawing. The soak pit shall be constructed of honeycomb dry brick work of 250 mm thick in cement mortar 1:6, filled with brick bat upto height as specified. RCC 1:2:4 precast or cast-in-citu slabs 150mm thick for top cover with reinforcement. CI manhole cover

500mm dia of 80 kg. Weight, 150 mm dia sw tee, outlet vent, 75 mm dia CI pipe, 2 m high fixed on masonry pedestal with cowl and bituminastic painting, refilling, watering, consolidating etc., all complete.

12.41 Providing and Construction Drop Connection

In case where branch sewer enters the manhole of main pipe sewer at a higher level than the main sewer, a drop connection should be provided. Pipes; and specials conforming to IS: 1729 shall be of the same size as the branch pipe sewer.

For 150mm and 250 mm main line, if the difference in level between the water line (peak flow level and the invert level of branch line is less than 60 cm, a drop connection may be provided within the manhole by giving a suitable ramp. If the difference in level is more than 60 cm, the drop should be provided externally.

The excavation shall be done for the drop connection at the place where the branch line meets the manhole. The excavation shall be carried up to the bed concrete of the manhole and to the full width; of the branch line excavation and backfilling shall be done as per respective specifications.

All manholes deeper than 1.0 m shall be provided with CI foot rest. These shall be embedded 20 cm deep with 20 x 20 x 10 cm blocks of cement concrete 1:2:4 (1 cement: 2 sand : 4 graded stone aggregate). The block with CI foot rest placed in its center shall be cast-in-situ along with the masonry and the surface finished with 12 mm thick cement plaster 1:4 (1 cement : 4 sand) finished smooth. Foot rests shall be fixed 30 cm apart vertically and staggered laterally and shall project 10 cm beyond the surface of the wall. The top foot rest shall be 45 cm below the manhole cover. Foot rests shall be painted with coal tar, the portion embedded in cement concrete block painted with thick cement slurry before fixing.

CI manhole cov3ers and frames shall conform to IS: 1726. The covers and frames shall be cleanly cast and they shall be free from air and sand holes and from cold struts. They shall be neatly dressed and carefully trimmed. All casting shall be free from voids whether due to shrinkage, gas inclusion or other causes. Cover shall have a raised chequered design on the top surfaces to provide an adequate non slip grip. The cover shall be capable of easy opening and closing it shall be fitted in the frame in workmanship like manner. The cover shall be gas tight and Water tight covers and frames shall be coated with a black bituminous paint. It shall not flow when exposed to a temperature of 63 Deg. Cent and shall not be brittle as to chip off at temperature of 0 Deg. Cent.

Manhole cover and frame shall conform to medium duty 500 mm internal diameter and shall weight not less than 75 kg unless otherwise mentioned in the item description (weight of cover 58 kg. And weight of frame 58 kg.).

Manholes shall be measured in numbers. The depth of the manhole shall be reckoned from top level of CI cover to the invert levels of channel. The depth shall be measured correct to centimeters.

Sewers of unequal sectional area shall not be joined at the same invert level in a manhole. The invert of the smaller sewer at its junction with main shall be, at a height at least 2/3 the diameter of the main, above and the invert of the main. The branch sewer should deliver sewage in the manhole in the direction of main flow and the junction must be made with care so that flow in the main is not impeded. No drains from house fittings e.g. GT, soil pipe etc., exceeding a length of 6 m shall be connected unless it is inevitable.

At the end of branch sewer line SCI tee shall be fixed to the line, which shall be extended through the wall of manhole by a horizontal piece of SCI pipe to form an inspection of cleaning eye. The open end shall be provided with chain and lid. The SCI drop pipe shall be connected to the tee at the top and to the SCI bend at the; bottom. The bend shall be extended through the wall of the manhole by a piece of pipe, which shall discharge into the channel. Necessary channel shall be made with cement concrete of grade M-150 and finished smooth to connect the main channel. The joint between SCI pipe and fittings shall be lead caulked. The joint between SCI tee and SW branch line shall be made with cement mortar 1:1 (1 cement: 1 fine sand) as for encased alround with minimum 15 cm thick concrete 1:5:10 (1 cement: 5 coarse sand: 10 graded stone aggregate 40 mm nominal size) and cured. For encasing the concrete around the drop connection, the necessary centering and shuttering shall be provided the holes made in the walls of the manhole shall be made good with brick work in cement mortar 1:5 (1 cement : 5 3 fine sand) on the inside of the manhole wall. The excavated earth shall be back filled in the trench in level with the original ground level.

12.42 Providing and Constructing Road gully chambers / Yard gully

The chamber shall be of brick masonry and shall have a CI grating with frame fixed in 150mm thick cement concrete of grade M-150 at the top. The size of the chamber shall be taken as clear internal dimensions of the CI frame. The chamber shall have a SW connection pipe, the length of which between road gully chamber and the point of discharge to drain or to open ground shall be measured separately. The chamber shall be built at the locations indicated in the drawings.

Bed concrete, brickwork, plastering RCC work. Excavation, backfilling etc., shall be as per details given on the drawing and in compliance with the requirements laid down in the specifications for the respective items.

The MS grating cover shall be hinged to the frame to facilitate its openings for cleaning and repairs. The weight of grating shall be 75 kg. Minimum.

After the completion of the work the exposed surfaces of the grating and the frame shall be painted with two coats of synthetic enamel paint.

12.43 Providing and Constructing Septic tank

Septic tanks shall be built as per the drawings. The cost of all works such as excavation backfilling, concrete, reinforcement etc., shall be paid under the respective items included in the specification.

SPECIAL CONDITION OF CONTRACT

PART – I For Plant Works

Item	Topic Number
1 .	Definitions
2.	Country of Origin
3.	Equivalency of standards and codes
4.	Performance Security
5.	Inspection and Tests
6.	Delivery and Documents
7.	Insurance
8.	Incidental Services
9.	Spare Parts
10.	Warranty
11.	Payment
12.	Resolution of Disputes
13.	Notices

The following Special 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.

Definitions

(a) The Project Authority is Odisha State Cooperative Milk Producers' Federation Ltd. and would include the term "Owner".

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

2. Country of Origin

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

3. 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 Purchaser's prior review and written approval. Differences between the standards specified and the proposed alternative standards must be fully described in writing by the Supplier and submitted to the Purchaser at least 30 days prior to the date when the Supplier desires the Purchaser's approval. In the event the Purchaser determines that such proposed deviations do not ensure equal or higher quality, the Supplier shall comply with the standards set forth in the documents.

Performance Security (Clause 7)

The Performance Security shall be in the amount of 5% of the Contract price.

Inspection and Tests

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.

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.

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.

Approved supplier's drawings shall not be departed from except as provided in the Bidding

Document.

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

The supplier 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

Before the goods and equipment are taken over by the Purchaser, the Supplier 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 Purchaser 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 Purchaser.

The goods will be accepted after inspection by the Purchaser, his representative or any inspection agency appointed by Purchaser and the costs for such Inspector/Agency shall be borne by the Purchaser.

6. Delivery and Documents

Upon shipment/dispatch, the supplier shall notify to the Purchaser by post or email or fax the full details of dispatch including Purchaser order no., description of the goods, quantity, mode of transport, place of loading, date of dispatch etc. The supplier will mail the following documents to the Purchaser with a copy to the Insurance Company:

The Supplier's invoice showing purchase order no. Goods description, quantity, unit price, total amount;

Delivery note/case-wise detailed packing list identifying contents of each package/ lorry receipt;

Manufacturer's/Supplier's guarantee certificate;

Inspection Certificate issued by the nominated inspection agency, and the Supplier's factory inspection report;

Certificate of origin;

Insurance policy;

Excise gate pass / octroi receipts/GST paid receipts wherever applicable, duly sealed indicating payments made; and

Any other document evidencing payment of statutory levies.

The supplier's certificate certifying that the defects pointed out during inspection have been rectified.

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 dispatch particulars including name of transporter, LR no. And date should also be mentioned in the invoice/s.

7. Insurance

a) The "marine / transit" insurance to be taken by the contractor / supplier 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 / supplier.

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 / supplier.

(c) Third Party Insurance : Before commencing the erection work the contractor / supplier 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 Bidder / Purchaser, or to any person including any employee of Bidder / Purchaser.

Such insurances shall be for an amount not less than Rs. 10.00 lakhs per occurrence with the number of occurrence limited to five.

8. Incidental services

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

(a) Furnishing of tools required for assembly and maintenance of the supplied goods;
(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 Purchaser's personnel (approx. for 4 man-weeks); at the Supplier'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.

9. Spare Parts

Supplier shall carry sufficient inventories to assure ex-spare parts and components shall be supplied as promptly as possible but in any case within six months of placement of order.

10. Warranty/Guarantee

The warranty/guarantee shall be as per provision under in General Conditions.

11.0 Payment

Payment for design and supply component follows as per Payment Terms Section:

12. Resolution of Disputes

In the event of any dispute in the interpretation of the terms of the order/contract or difference of opinion between the parties on any point in the order/contract arising out of or in connection with the agreement accepted order/contract or with regard to performance of any obligation hereunder by either party, the parties hereto shall use their best efforts to settle such disputes or difference of opinion amicably by mutual negotiations. In case no agreement is reached, either party may forthwith give to the other, a notice in writing of the existence of such question, dispute or difference of opinion and the same shall be referred to the adjudication of sole arbitrator to be appointed by Purchaser whose decision in the matter shall be final and binding on the parties.

The Arbitration proceedings shall be governed under the provisions of the Indian Arbitration and Conciliation Act, 1996 and the rules there under or any statutory modifications thereof for the time being in force. In the order/contract, the venue of such Arbitration shall be Bhubaneswar, Odisha and Courts at Bhubaneswar alone shall have jurisdiction regarding any matter arising out of order/contract.

Performance under the Contract shall, if reasonably possible, continue during the Arbitration proceedings and payments due to the Supplier by the Purchaser shall not be withheld, unless they are the subjects of the Arbitration proceedings.

All awards for claims equivalent to Rupees thirty thousand or more shall be in writing and state the reasons for the amounts awarded.

13 Notices

For the purpose of all the notices, the following shall be the address of the Purchaser and Supplier.

Purchaser – Odisha State Milk Co-Operative Federation Limited, Bhubaneswar-

751007

Supplier (To be filled in at the time of Contract signature.)

SPECIAL CONDITIONS OF CONTRACT

PART - III FOR ERECTION

Item	Topic Number
1.	Sufficiency of Tender
2.	Programme of installation and commissioning
3.	Preparation of drawings for approval
4.	Supplier's superintendence and employment of erection team and conduct of personnel
5.	Purchaser's instructions
6.	Right of the Purchaser
7.	Supplier's functions
8.	Duties of the supplier vis-a-vis the Purchaser
9.	Supply of tools, tackles and materials
10.	Protection of plant
11.	Unloading, transportation and inspection
12.	Storage of equipment
13.	Approvals
14.	Review and co-ordination of erection work
15.	Extension of time for completion

SPECIAL CONDITIONS OF CONTRACT FOR INSTALLATION PART II

SUFFICIENCY OF TENDER

The Supplier 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.

PROGRAMME OF INSTALLATION AND COMMISSIONING

As soon as practicable after the acceptance of the bid, the Supplier shall submit to the Purchaser for his approval a comprehensive programme in the form of PERT network/ bar chart and any other form as may be required by the Purchaser showing the sequence of order in which the Supplier proposes to carry-out the works including the design, manufacture, delivery to site, erection and commissioning thereof. After submission to and approval by the Purchaser of such programme, the supplier shall adhere to the sequence of order and method stated therein. The submission to and approval by the Purchaser of such programme shall not relieve the Supplier of any of his duties or responsibilities under the Contract. The programme approved by the Purchaser shall form the basis of evaluating the place of all works to be performed by the supplier.

PREPARATION OF DRAWINGS FOR APPROVAL

The Supplier should visit the site to acquaint himself in respect of existing site conditions and to know the details/information required for understanding the nature and type of civil construction works involved in the project. The Supplier shall submit to the Purchaser for approval:

a. Within the time given in the specification or in the program, 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 Purchaser may require such drawings of the general arrangement and details of the works as the Purchaser may require.

The specifications/ conditions concerning the submission of drawings by the Supplier are detailed as under:

Within four weeks from the date of receipt of the Notification of Award, Supplier shall furnish a list of all necessary drawings as briefly described below which the Supplier 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 Purchaser shall signify his approval or disapproval of all drawings or such drawings that would affect progress of the contract as per the agreed programme.

Brief list of drawings:

I. Equipment drawings for fabricated items.

II. Equipment layout for main feed plant, storage silo system and steam generation

plant.

III. Flow diagrams for main processing plant, storage silo system and various services.

IV. Service piping layouts in production, storage silo system and service blocks.

V. Electrical cable, conduit / cable tray / cable trench layout.

VI. Other miscellaneous drawings as required for erection work.

VII. Electrical single line diagram, PCC and MCC general arrangement drawing and wiring diagrams.

VIII. Automation system scheme, controls and network diagrams.

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

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

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

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.

All dimensions on drawings shall be in metric units.

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

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

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

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

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. Four sets of all the drawings finally approved for fabrication / execution of works along with their soft copy in AutoCAD on a CD/DVD shall be submitted to the Purchaser.

The Supplier shall furnish to the Purchaser before the works are taken over, Operating and Maintenance instructions together with four sets of hard & soft copy (on CD/DVD) of Drawings of the works as completed, in sufficient detail to enable the Purchaser 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 Purchaser.

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

The Supplier shall employ one or more competent representatives, whose name or names shall have previously been communicated in writing to the Purchaser by the Supplier, 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 Purchaser may give to the said representative of the Supplier shall be deemed to have given to the Supplier. The said representative shall have full technical capabilities and complete administrative and financial powers to expeditiously and efficiently execute the work under the contract.

The Supplier shall, execute the works with due care and diligence within the time for completion and employ Supplier'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 Supplier shall ensure adequate workforce to keep the required pace at all times as per the schedule of completion. Supplier shall also ensure availability of competent engineers during commissioning/start up, trial runs, Operation of the plant/ equipment till handing over of the plant.

The Supplier 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.

When the Supplier or Supplier'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 Purchaser 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 Purchaser shall be deemed to have been given to the Supplier.

The Supplier's employment records shall include any reasonable information as may be required by the Purchaser. The Supplier should also display necessary information as may be required by statutory regulations.

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

The Purchaser shall be at liberty to object to any representative or person, skilled, semi- skilled or unskilled worker employed by the Supplier in the execution of or otherwise about the works who shall, in the opinion of the Purchaser, misconduct himself or be incompetent, or negligent or unsuitable, and the Supplier shall remove the person so objected to, upon receipt of notice in writing from the Purchaser and shall provide in that place a competent representative at Supplier's own expense within a reasonable time.

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

PURCHASER'S INSTRUCTIONS

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

Any additional drawing and clarifications to exhibit or illustrate details.

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

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

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

Removal and/or re-execution of any work erected by the Supplier, which are unacceptable to the Purchaser.

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

Opening up for inspection of any work covered up.

Amending and making good of any defects

RIGHT OF THE PURCHASER

Right to direct works:

The Purchaser 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 Purchaser.

Whenever in the opinion of the Purchaser, the Supplier has made marked departures from the schedule of completion or when circumstances or requirement force such a departure from the said schedule, the Purchaser, 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 Supplier.

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

Right to order modifications of methods and equipment

If at any time the Supplier's methods, materials or equipment appear to the Purchaser 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 Purchaser may direct the Supplier to ensure safety, and increase their efficiency and adequacy and the Supplier shall promptly comply with such directives. If at any time the Supplier's working force and equipment are inadequate in the opinion of the Purchaser, for securing the necessary progress as stipulated, the Supplier 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 Purchaser shall not relieve the Supplier of Supplier's obligations to secure the quality, the safe conducting of the work and the rate of progress required by the contract. The Supplier alone shall be and remain liable and responsible for the safety, efficiency and adequacy of Supplier’s methods, materials, working force and equipment, irrespective of whether or not the Supplier makes any changes as a result of any order or orders received from the Purchaser.

Right to inspect the work

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

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

In the event the Purchaser's inspection reveals poor quality of work/materials, the

Purchaser shall be at liberty to specify additional inspection procedures if required, to ascertain Supplier's compliance with the specifications of erection work.

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

SUPPLIER'S FUNCTIONS

The Supplier 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 Supplier finds any discrepancy therein, Supplier shall immediately refer the same to the Purchaser whose decision shall be final and binding on the Supplier.

The Supplier 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 Purchaser.

VARIATIONS

The Purchaser 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 Supplier to do and the Supplier 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.

No such variations shall be made by the Supplier without an order in writing of the Purchaser. 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. Provided further that if the Supplier shall within seven days confirm in writing to the Purchaser and such confirmation shall not be contradicted in writing by the Purchaser within 14 days, it shall be deemed to be an order in writing by the Purchaser.

All extra or additional work done or work omitted by order of the Purchaser shall be valued at the rates and prices set out in the contract if in the opinion of the Purchaser, 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 Purchaser and the Supplier. In the event of disagreement the

Purchaser shall fix such rates or prices as shall, in his opinion, be reasonable and proper.

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 Purchaser, 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 Purchaser and the Supplier. In the event of disagreement the Purchaser 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 or variation of rate or price under tender condition 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 Supplier to the Purchaser of his intention to claim extra payment or a varied rate or price,

Or

b. By the Purchaser to the Supplier of his intention to vary a rate or price.

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 Supplier and the Purchaser or, failing agreement, fixed by the Purchaser having regard to all material and relevant factors, including the Supplier's site and general overhead costs of the contract.

The Supplier shall send to the Purchaser'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 Supplier may consider himself entitled and of all extra or additional work ordered by the Purchaser 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 PURCHASER shall be entitled to authorize payment to be made for any such work or expense, notwithstanding the Supplier's failure to comply with this condition, if the Supplier has, at the earliest practicable opportunity, notified the Purchaser in writing that he intends to make a claim for such work.

The work shall be carried out as approved by the Purchaser or his authorized representative/s from time to time, keeping in view the overall schedule of completion of the project. The Supplier's job schedule must not disturb or interfere with Purchaser's or other Suppliers' or Contractors' schedules of day- to-day work. The Purchaser will

provide all reasonable assistance for carrying out the jobs.

Night work will be permitted only with prior approval of the Purchaser. The Purchaser may also direct the Supplier 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 Supplier at no extra cost. The Supplier should employ qualified electricians and wiremen for these facilities. In case of Supplier's failure to provide these facilities and personnel, the Purchaser has the right to arrange such facilities and personnel and to charge the cost thereof to the Supplier.

The Supplier shall, in the joint names of the Supplier and the Purchaser naming Purchaser as the beneficiary, insure the received goods and equipment and so far as reasonably practicable the Works and keep each part thereof insured for the 110% of the Contract Sum or such other value as may be mutually agreed between the Purchaser and the Supplier 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 Purchaser, whichever is the earlier, until it is taken over by the Purchaser. The Supplier shall insure against the Supplier's liability in respect of any or damage occurring whilst the Supplier is on Site for the purpose of making good a defect or carrying out the Tests on Completion.

The Purchaser 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 Supplier or any sub-Supplier, save and except an accident or injury resulting from any act or default of the Purchaser, his agents, or servants. The Supplier shall indemnify and keep indemnified the Purchaser 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.

The Supplier shall insure against such liability with an insurer approved by the Purchaser, 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 Purchaser or Purchaser'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-supplier, the Supplier's obligations to ensure as aforesaid under this sub-clause shall be satisfied if the sub-supplier shall have insured against the liability in respect of such persons in such manner that the PURCHASER is indemnified under the policy, but the Supplier shall require such sub-supplier to produce to the Purchaser or Purchaser's representative, when required, such policy of insurance and the receipt for the payment of the current premium.

Whenever proper execution of the work under the Contract depends on the jobs carried out by some other supplier, in such cases the Supplier should inspect all such erection and installation jobs and report to the Purchaser regarding any defects or discrepancies. The Supplier's failure to do so shall constitute as acceptance of the other supplier's installation / jobs as fit and proper for reception of Supplier's works except those defects which may develop after execution. Supplier should also report any discrepancy between the executed work and the drawings.

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

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

The Supplier shall be permitted to substitute equipment of equal on better performance subject to approval by the Purchaser; which approval shall not be unreasonably withheld, provided however that the Supplier establishes to the Purchaser'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.

DUTIES OF THE PURCHASER VIS-A-VIS THE SUPPLIER:

The Goods, if any, to be supplied by the Purchaser for erection, testing and commissioning by the Supplier, shall be as listed in the Contract

Necessary temporary power for carrying out the installation shall be arranged by the Supplier at Supplier's own cost. The necessary authorization letter will be issued by the Purchaser on written request by the Supplier.

If the Supplier suffers delay from failure on the part of the Purchaser to give possession of the civil works in accordance with the mutually agreed schedule, the Purchaser shall determine any extension of time to which the Supplier is entitled under Clause 21 of GCC.

SUPPLY OF TOOLS, TACKLES AND MATERIALS

The Supplier 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.

PROTECTION OF PLANT

The Purchaser 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 Supplier or any of Supplier's sub- suppliers even though such tools and equipment may be furnished, rented or loaned to the Supplier or any of Supplier's sub-suppliers. The acceptance and/or use of any such tools and equipment by the Supplier or Supplier's sub- supplier shall be construed to mean that the Supplier accepts all responsibility for and agrees to indemnify and save the Purchaser from any and all claims for said damages resulting from the said use, misuse or failure of such tools and equipment.

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

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

The Supplier 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.

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

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 Supplier at Supplier's cost. The Supplier should adequately light the work area during night time also. The Supplier should also engage adequate electricians/wiremen, helper etc. to carry out and maintain these lighting facilities.

The Supplier 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 Supplier and to the satisfaction of the Purchaser. The Supplier shall also be liable for any loss of or damage to the works occasioned by the Supplier or the Supplier's Sub- Supplier in the course of any operations carried out by the Supplier or by the Supplier's Sub-Suppliers for the purpose of completing any outstanding work or complying with the Supplier's obligations.

UNLOADING, TRANSPORTATION AND INSPECTION

The Supplier shall be required to unload all the Goods from the carriers, received at site after Supplier's team arrives at site. The Supplier shall plan in advance, based the information received from the Purchaser, Supplier's requirement of various tools, tackles, jacks, cranes, sleepers etc. required to unload the material/equipment promptly and efficiently. The Supplier 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 Supplier's account. The Supplier shall be responsible for receipt at site of all Goods and Supplier's equipment delivered for the purposes of the Contract.

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

In case of turnkey contracts, the cost incurred on unloading of all the Goods received by the Purchaser prior to arrival of the Supplier at site shall be debited to the Supplier and all such goods shall be handed over to the Supplier when it reports at site and there upon the Supplier shall inspect the same and furnish a receipt to the Purchaser. The manner in which the inspection shall be carried out is enumerated below:

The materials/ equipment would be carefully unpacked by opening t h e wooden cases/ other modes of packing as the case may be.

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

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

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

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

STORAGE OF GOODS

The Supplier shall be responsible for the proper storage and maintenance of all Goods under Supplier's custody. Supplier 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 Purchaser. The following procedure shall apply for the same.

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

The Supplier'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.

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

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

Adequate security measures shall be taken by the Supplier to prevent theft and loss of Goods handed over to the Supplier by the Purchaser. The Supplier shall carry out periodical inventory checks of the Goods received, stored and installed by the Supplier and any loss noticed shall be immediately reported to the Purchaser. A proper record of these inventories shall be maintained by the Supplier. The Supplier 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 Purchaser

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

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 Purchaser whenever demanded

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

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 Clause 25 of the General Conditions of Contract, other than through a default of the Supplier, be such as fairly to entitle the Supplier to an extension of time for the completion of the works, the Purchaser shall determine the amount of such extension and shall notify the Supplier accordingly. Provided that the Purchaser is not bound to take into account any extra or additional work or other special circumstances unless the Supplier 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 Purchaser 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.

APPROVALS

The Supplier shall obtain the necessary approvals of the Factory Inspector, Boiler

Inspector, Electrical Inspector, Weights & Measures Inspector, Explosive Inspector 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 proformas will be furnished by the Supplier to the Purchaser for verification/ signature. The necessary application duly filled-in, together with the prescribed fees shall be submitted to the appropriate authorities by the Supplier on behalf of the Purchaser. However all the actual statutory prescribed fees paid by the Supplier shall be reimbursed by the Purchaser upon production of the receipt/vouchers.

Wherever necessary or required, the Supplier shall furnish the necessary test and/or inspection certificates etc. from the appropriate authorities as per IER and other statutory regulations and the cost for obtaining these certificates shall be included in the Contract Price.

REVIEW AND CO-ORDINATION OF ERECTION WORK

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

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 Clause 24 of the General Conditions of Contract, other than through a default of the Supplier, be such as fairly to entitle the Supplier to an extension of time for the completion of the works, the Purchaser shall determine the amount of such extension and shall notify the Supplier accordingly. Provided that the Purchaser is not bound to take into account any extra or additional work or other special circumstances unless the Supplier 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 Purchaser 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.

SPECIAL CONDITIONS OF CONTRACT FOR INSTALLATION

PART –IV MECHANICAL INSTALLATION

Item

Mechanical Installation

General Installation

Service Piping Installation

Special Instructions and specifications

Insulation of Piping and Equipment

Interconnections of Service and Electricals with equipment

Guidelines for expansion work

Clean up of Works Site

Cleaning chemicals and lubricants

Testing, commissioning and start-up

Painting

Training of personnel

General specifications for pipes and fittings

Annexure-1 Format of makes for bought out items

Code of practice for painting (Annexure-II)

SPECIAL CONDITIONS OF CONTRACT

PART III (MECHANICAL INSTALLATION)

MECHANICAL INSTALLATION

The installation work would comprise:

a. General installation i.e. positioning and installing all the processing, miscellaneous and service equipment as per approved layout drawings and as per the contract.

b. Supply and installation of structural platforms and tables.

c. Supply and installation of all service and product piping including ancillary items.

d. Insulation and cladding of piping and equipment including supply of materials.

e. Interconnections of services and electrical with equipment.

f. Guide line for expansion work.

g. Clean up of work site.

h. Supply of all cleaning chemicals and lubricants/Gas.

i. Testing, commissioning and start-up.

j. Painting including supply of paints as approved by Bidder.

k. Training of personnel.

Detailed specifications are given in the subsequent clauses.

GENERAL INSTALLATION

Positioning of Equipment

The work involves preparation of access for moving of the plant and equipment including their fittings from the work site godown or from the place within the site where they have been unloaded, to the place of erection, decorating and placing on the foundation wherever required. All the civil foundations as per the manufacturer/supplier's drawings shall be arranged by the Supplier. The Supplier shall place the equipment and carry out final adjustment of the foundations including alignment and dressing of foundation surface, embedding and grouting of anchor bolts and bedplates. The Supplier shall be responsible for obtaining correct reference lines for purpose of fixing the alignment of various equipment from master benchmarks provided by Bidder.

Tolerances shall be as specified in equipment manufacturers drawings or as

stipulated by Bidder's Engineer. No equipment shall be permanently bolted down to foundations or structure until the alignment has been checked by the Supplier and witnessed by the Purchaser. The Supplier shall carry out minor alterations in the anchor bolts, pockets etc., at no extra cost and set the equipment properly as per approved layout, drawings and manufacturer's instructions. The Supplier shall supply all the necessary foundation/ anchor bolts and bedplates if required without extra cost.

The Supplier shall supply, fix and maintain, at his own cost, during the erection work, all the necessary centering, scaffolding, staging required not only for proper execution and protection of the said work but also for protection of the surrounding plant and equipment. The Supplier shall take out and remove any or all such centering, scaffolding, staging planking etc., as occasion shall require or when ordered to do so and shall fully reinstate and make good all things disturbed during execution of the work, to the satisfaction of Bidder. The Supplier shall be paid no additional amount for the above.

StructuralPlatforms, Service Pipe Bridge and Tables

Box type structural platforms shall be required to provide access for various equipments. Pipe support bridges/gantry shall be required for supporting the pipes from the ground, including road crossings outside the buildings. These platforms, bridges / gantry shall be fabricated keeping stability and other functional as well as aesthetic requirements into consideration as approved by Bidder. The payment shall be made on the basis of the actual weight executed and the unit rates agreed upon or as per provisions made in the contract for such items.

The Purchaser shall arrange for any civil works required for the above works based on the drawings and load details provided by the bidder. Necessary templates and other accessories required by the civil shall be provided by the bidder.

SERVICE PIPING INSTALLATION

General Guidelines

All piping systems shall comply with the latest editions of the following regulations wherever applicable.

Regulations of explosives inspectorate.

Indian Boiler Regulations

All applicable Indian Standards.

All applicable State Government/ Central Government laws/acts.

The Supplier has to prepare all erection drawings of the proposed plant including equipment positions and service-piping positions (Isometric), spacing between pipes, all other relevant details and submit these drawings to Purchaser for approval.

Scope of Supply

The Supplier shall supply all piping materials like pipes, fittings, flanges measuring instruments and all other items as shown in the flow diagram/specifications and schedule of quantities. All the pipes & fittings and insulation material etc. should be of class and make as approved by Bidder. Prior approval of Bidder must be obtained by the supplier for the class and make of all materials. The Supplier should furnish the details of makes selected by him, in the proforma given in Annexure I.

Scope of Piping Erection

This to be performed by the Supplier as outlined below:

The scope of erection for piping, includes all system covered in the flow diagrams and specifications.

The Supplier's work commences / terminates at the pipe connections with valves or flanges as specified in flow diagrams.

The Supplier shall also install necessary piping and any specialties furnished with or for equipment such as relief valves, built-in-pass and other items of this type.

The Supplier shall install primary elements for flow measurements, control valves and on-line metering equipment.

The Supplier shall perform necessary internal machining of pipes f o r installing orifices, flow nozzles, control valves etc.

The Supplier shall install all pipes, valves and specialties being procured from other sources.

Testing of Piping

The Supplier shall test all piping systems mentioned below including valves and specialties and instruments as per procedure mentioned under 3.4.4.

a) H.P. & L.P. Steam piping
b) Furnace oil & diesel piping
c) Soft and raw water
d) Compressed Air Piping

All piping shall be internally cleaned and flushed by the Supplier after erection in a manner suited to the service and as directed by Bidder.

For hydrostatic testing and water flushing, the Supplier shall furnish necessary pumps, equipment, instruments and piping etc.

The details of testing pressures for various pipelines are mentioned below:

Sl. No.	Name	Test Pressure Kg/cm²	Test Medium	Duration of Test (Hour)	Allowable Pressure
1	Steam Pipelines				
1 a	H.P. Steam	27	Water	½	0
1 b	L.P. Steam	8	Water	½	0
2	Water Pipelines				
2 a	Raw Water, Soft water	8	Water	½	0
3	Furnace Oil/ LSHS	16	Water	½	0
4	Air Pipelines	12	Air	½	0.1

Other Guidelines

Colour code shall be used to identify pipe material. The Supplier shall be able to identify on request all random piping prior to field fabrication.

The Supplier shall be responsible for the quality of welding done by them and shall conduct tests to determine the suitability of the welding procedure by him.

All piping supports, guides, anchors, hangers, rollers with structural framework shall be supplied and erected by the Supplier. Only anchor fasteners of adequate size shall be provided for anchoring supports from RCC structures and Hilti Gun shall be used for fastening the anchors.

The kinds of pipe supports like CI clamps, PUF/wooden saddles, roller supports and support framework shall be as per the design approved by Bidder prior to taking up the work.

All piping shall be suspended, guided and anchored with due regard to general requirements and to avoid interference with other pipes, hangers, electrical conduits and their supports, structural members and equipment and to accommodate insulation and conform to buildings structural limitations. It is the responsibility to the piping Supplier to avoid all interference while locating hangers and supports.

Anchors and/or guides for pipelines or for other purposes shall be furnished, when specified, for holding the pipeline in position for alignment. Hangers shall be designed fabricated and assembled in such a manner that they cannot become disengaged by any movement of the support pipes.

All piping shall be wire brushed and purged with air blast to remove all rust, mill scale from inner surface. The method of cleaning shall be such that no material is left on the inner or on outer surfaces, which will affect the serviceability of the pipes. A thin coat of any lubricating oil shall be applied on entire inner surface of steel pipes (black) to prevent rusting.

Effective precautions such as capping and sealing shall be taken to protect all pipe ends against ingress of dirt and damage during transit or storage.

The outside of the steel pipes (black) shall be painted with two coats of red

oxide paint or as directed by Bidder.

All pipes in the corridor shall be supported from the sidewall.

MS box section pipe supports for services / process equipment shall be provided by the supplier. Box section pipe supports for services and cable trays in other areas shall be of steel of suitable thickness coated with rust preventive paints and finish coated with dark admiral grey of approved shade. Where pipes and clamps are of dissimilar material, gaskets shall be provided in between. Spacing of utilities pipe supports shall not exceed the following:

Pipe size	Spacing between supports
Up to 12mm	1.5m
15 to 25mm	2.0m
30 to 150mm	2.0m
Over 150mm	2.5m

Vertical risers shall be parallel to walls and column lines and shall be straight and in plumb. Risers passing from floor to floor shall be supported at each floor slab by clamps or collars attached to pipe and with a 15 mm thick rubber pad or any resilient material. Where pipes pass through the terrace floor, suitable flashing shall be provided to prevent water leakage. Risers shall have a suitable clean out at a lower point and air vent at the highest point.

Pipe sleeves at least 3 mm thick, 50 mm / 100 mm larger in diameter than the pipes shall be provided wherever pipe passes through walls and slabs. Annular space shall be filled with fibre glass and finished with retainer rings. No extra payment shall be made on account of providing the sleeves.

All piping works shall be carried out in a workman like manner, causing minimum disturbance to the services, buildings, roads and structures. The entire piping work shall be organized, in consultation with other agencies work, so that laying of pipe support, pipes and pressure testing for each area shall be carried out in one stretch.

Cutouts details in the floors and slabs for installing various pipes are to be provided by the contractor immediately after receipt of the purchase order, so as to make the cutouts ready by Civil.

The contractor shall make sure that the clamps, brackets, clamp saddles and hangers provided for pipe supports are adequate. Piping layout shall take due care for expansion and contraction in pipes and include expansion joints wherever required.

All pipes shall be accurately cut to the required size in accordance with the relevant BIS code and burrs removed before lying. Open ends of the piping shall be closed as the pipe is installed to avoid ingress of foreign matters. Where reducers are to be made in horizontal runs, eccentric reducers shall be used for piping to drain fully. In other locations concentric reducers may be used.

All buried pipes shall be cleaned and coated with zinc chromate primer and bitumen paint, then wrapped with three layers of fibre glass tissue, each layer laid in bitumen.

Tee-off connections shall be through equal or reducing tees. Otherwise ferrules welded to the main pipe shall be used. Drilling and tapping of the walls of the main pipe shall not be resorted to.

SPECIAL INSTRUCTIONS AND SPECIFICATIONS

Steam Piping

Steam piping work can be classified into two categories:

a) High-pressure steam piping when the working pressure of steam is more than 3.1 kg/sq.cm (50 psi).
b) Low-pressure steam piping when the working pressure of steam is below 3.1 kg/sq.cm (50 psi).

All the pipes and fittings used for high pressure steam piping work should conform to IBR and they should be IBR certified and also to be identified with number and mark showing that they are tested by the Boiler Inspector and supported with duly authentic certificates to this effect. ALL HIGH PRESSURE STEAM PIPES SHALL BE SEAMLESS TYPE, SCHEDULE 40.

The high pressure steam piping after installation should be hydraulically tested in presence of the Boiler Inspector for his approval.

The high-pressure steam piping work should also include fabrication and installation of pressure reducing stations strictly conforming to IBR.

Water Piping:

All the piping for water, soft & raw water, steam & condensate, furnace oil, and air shall be generally of welded construction. Whenever welding is done for pipes of smaller size special care should be exercised to avoid clogging of flow area with the welding material.

INSULATION OF PIPING AND EQUIPMENT

Insulation of Steam, condensate and Hot Water Pipe Lines

All the steam and hot water pipelines shall be insulated with mineral wool or

equivalent resin bonded pipe section of specified thickness. The insulation shall be carried out in the following manner and should be supplied in the form of properly required sizes.

Clean the surfaces to be insulated. Apply a coat of red oxide primer and fix glass wool / mineral wool / resin bonded pipe section of specified thickness, tightly to the pipes, butting all joints and tie with lacing wire.

It should then be covered with GI wire netting of 20 mm x 24 SWG.

In case the insulation does not have the desired insulation properties, the entire insulation will have to be redone at the Supplier's cost to give the desired results.

In case of condensate return piping all the steps mentioned above shall be executed except that thickness of the insulation shall be 25 mm.

Aluminum / GI Cladding

The ammonia accumulators, chilled water, ammonia, water, steam & hot water lines after insulations shall be covered by Aluminum / GI cladding as per the requirement and the payment will be made as per the executed items.

Aluminum cladding will be done with 22-gauge aluminum sheet with proper grooves and overlaps and screwed in position with 12 mm. self-tapping parker screws.

GI sheet cladding will be done with 22 gauge sheet with proper grooves and overlaps and screwed in position with 12 mm self tapping parker screw. The GI sheet cladding will finally painted with 2 coats of approved shade and quality of paint.

All the necessary materials of quantity and make approved by the Owner, required for carrying out insulation, cladding and other works mentioned above, shall be supplied by the Supplier.

INTER CONNECTIONS OF SERVICE AND ELECTRICALS WITH EQUIPMENT

The Supplier shall lay service piping and provide connections with the equipment complying strictly with the equipment manufacturers' instructions. The Supplier shall also carry out all the interconnecting service piping with the various items of plant/system. The work shall be complete with capillary piping if required and connections with instruments and controls supplied with the equipment.

The Supplier shall also carry out electrical connections for equipment with the control panels including equipment lighting as per the wiring diagrams of the equipment suppliers.

Connection shall be made for small electrically operated devices on equipment installed as accessories to, or assembled with equipment. Connections regarding instruments, float switches, limit switches, pressure switches, thermostats and other miscellaneous equipment shall be done as per manufacturers' drawings & instructions.

CLEAN UP OF WORKS SITE

All soils, filth or other matters of an offensive nature taken out of any trench, drain or

other places shall not be deposited on the surfaces, but shall at once be carted away by the Supplier from the site of work for proper disposal.

The Supplier shall not store or place the equipment, materials or erection tools on the drive ways and passages and shall take care that his work in no way restricts or impedes traffic or passage of men and materials during erection. The Supplier shall without any additional payment, at all time keep the working and storage area used by him free from accumulation of dust or combustible materials, waste materials rubbish packing, wooden planks to avoid fire hazards and hindrance to other works.

If the Supplier fails to comply with these requirements in spite of written instructions from Bidder, Bidder will proceed to clear these areas and the expenses incurred by the Owner in this regard shall be payable by the Supplier. Before completion of the work, the Supplier shall remove or dispose off in a satisfactory manner all scaffolding, temporary structures, waste and debris and leave the premises in a condition satisfactory to Bidder. Any packing materials received with the equipment shall remain as the property of Bidder and may be used by the Supplier on payment of standard charges to the Owner and with prior approval of Bidder. At t h e completion of his work and before final payment, the Supplier shall remove and shall restore the site to neat workman like conditions at his cost.

CLEANING CHEMICALS AND LUBRICANTS

The necessary quantities of cleaning chemicals and the first charge of oil and lubricants required for the installation, commissioning, testing and start-up of all the equipment till handing over are to be supplied by the Supplier and nothing extra would be paid for these.

TESTING, COMMISSIONING AND START-UP

The Supplier shall operate, maintain and give satisfactory trial run of the plant in such manner and for such periods as has been specified in Section IV (Technical Specifications). All rectification of damages / defects during the trial period should be carried out by the Supplier.

The commissioning shall also include the following for each equipment:

Field disassembly and assembly of equipment, instruments and controls where required for access to fixing or adjustment.

Clean out of lubrication system including chemical cleaning wherever required.

Circulation of lubricant to check flow.

Clean out and check out of all the service lines.

Check out and commissioning of instruments, equipment and plants, filtering of transformer and other oils so that if deteriorated, they shall attain the required properties /standards, specified tests in this regard must be carried out by approved authorities and their satisfactory reports submitted to Bidder before start-up.

Recharging or make-up filling of lubricant oil up to the desired level in the lubrication system of individual machine.

Operation in empty condition to check general operation details wherever required and wherever possible.

Closed loop dynamic testing with water wherever required.

Operation under load and gradual load increase to attain maximum rated output.

Trouble shooting during the trial period.

The Supplier shall demonstrate proper working of all mechanical and electrical controls; safety and protective device, in presence of Bidder's engineer and the same should be duly recorded.

Commissioning of automation system:

The supplier should provide a detailed schedule of testing all automation and control systems.

All controlled or monitoring devices on the plant should be tested from the relevant control centre and recorded to be operating as designed, including feedback detection.

A log of these operations is to be maintained, and each completed group of tests to be signed by the supplier's commissioning engineer.
The Purchaser reserves the right to witness as much of these test procedures, as he may feel necessary.

Testing procedures and commissioning period will be as specified in Section IV.

After conducting testing, in case, a particular equipment is not working properly or not giving rated output the Supplier will furnish a detailed report to Bidder stating therein the detailed account on the performance of the equipment with possible reasons for improper or not working of the same and will arrange the visit of the representative of original manufacturers to get the same commissioned satisfactorily.

After satisfactory commissioning and start-up, the Supplier shall keep/depute his representatives at the plant in the manner, for the duration and for the performance of such tasks as specified in Section III. During this period the Supplier shall ensure proper working of complete plant and equipment and attend any works required to be done for proper operation of the complete plant and equipment.

PAINTING

All the equipment / machineries like motors, pumps, HT / LT panel, transformer, switch boards, starters, junction boxes, isolators, storage tanks, supporting structures, pipe supports and MS/GI pipes and all exposed and visible iron parts included in the scope of erection / commissioning shall be given double coat of paint of approved shade over a double coat of anti- corrosive primer wherever necessary irrespective of the condition of original paint of

equipment/machineries/ structures/supports. All surfaces, wherever required, must be properly cleaned from scale, dirt and grease prior to painting. Spray painting must preferably be used on all the equipment /machineries and wherever practicable. Suitable and necessary cleaning / wiping of sight / dial glasses, other non-metallic parts, flooring, walls and other surfaces which have been spoiled by paint during painting must also be carried out by the Supplier.

Lettering and other markings, including capacity and flow direction markings, shall also be carried out by the Supplier on the tanks, pipe lines, starters and wherever else necessary, as directed and as per the standard practice of installation. BIS colour codes and colour charts as mentioned in Annexure - II must be adhered to.

Supply of all paints and all other materials required for painting is included in the scope of supply of the Supplier under this contract/order.

TRAINING OF PERSONNEL

Necessary staff as may be deputed by the Owner shall be trained by the Supplier for operating the plant. The personnel will be associated for the training during the installation; testing, commissioning and start-up period and the training tenure shall be extended for a minimum period of one month from the date of commissioning and start-up. This training will be a continuous process during commissioning and stand by period and as described in the Technical Specifications.

- **GENERAL SPECIFICATIONS FOR PIPES AND FITTINGS**

- Flanges shall be of good make. The supply of flanges shall also include supply of bolts, nuts, washers and suitable asbestos fibre/rubber insertion food grade gaskets (minimum 3mm thick).

- The above specifications for valves are general specifications. However, pipes and valves shall be required to be supplied as per details mentioned in Section III - the technical specifications of plant and equipment.

- **LIST OF APPROVED MAKES FOR MAJOR COMPONENTS**

A table of makes of various major components is given under Technical Specifications Section I I I . The supplier will adhere to makes of items as per this list only. For an item not mentioned in the table or item having more than one preferred / approved make, supplier will obtain approval of the Purchaser for the make before initiating actual procurement.

Piping			
Service	Material	Specification	Ends
HP Steam (IBR Approved)	Heavy duty, seamless Cast Steel	Schedule 40, ASTM A 53	Piping to be welded type

LP Steam	ERW, Heavy duty (C-class)	BIS: 1239, 3601	Piping to be welded type
Air	ERW, Heavy duty (C- class)	BIS, 1239, 3601	Piping to be welded type
Water Supply, bleeds, drains, etc.	Galvanised steel (ERW) medium duty class B	BIS:1239/BIS:3589	Piping to be welded type
SS Duct	TIG welded, annealed and decaled, outside mirror polished & inside pickled as per dairy standards	AISI 304	We;ded corci;ar During with Flanged joints
MANUALLY OPERATED VALVES:			
Hp Steam (IBR Approved)	Cast steel body Globe / Piston Valve & NRY with SS working parts		Flanged > 25 Screwed< 25 NB
LP Steam	Cast steel/GM body Globe/ Piston Valve & NRV with SS working parts		Flanged > 25 NB Screwed< 25 NB
Air	Cast steel / GM body Globe/ Piston Valve & NRV with SS working parts rubber (Inert to moisture & oil traces)		Flanged> 25 NB Screwed<25 NB
Soft / Raw water: Over 75 mm Upto 75 mm	CI, butterfly Cs ball valve	IS: 778, 1703	Flanged> 25 NB Weldable up to 25 NB
Water supply, bleeds, And drain	Cast steel ball valve	IS:778	Flanged> 25 NB

ANNEXURE - I

FORMAT OF MAKES OF BOUGHT OUT ITEMS SELECTED BY SUPPLIER:

Sr.	Name of the item	Make Selected by Supplier		
		1st Preference	2nd Preference	3rd Preference
1	Steam Piping			
1 a	MS Ç'class pipes			
1 b	Cast Steel globe valves			
1 c	Bronze globe valves			
1 d	Cast Steel Non- return valves			
1 e	Gun metal Non- return valves			
1 f	Pressure reducing valves, safety valves, strainer, moisture separator, steam trap, expansion joints & other steam fittings.			
1 g	Pressure & temp. gauges			
2	Furnace oil piping/air piping			
2 a	MS Ç'class pipes (Seamless)			
2 b	Cast Steel globe/ Bronze globe valves/ Gun metal gate valves			
2 c	Gun metal NRV			
2 d	Pressure gauges			
3	Water piping			
3 a	GI 'B' Class Pipe			
3 b	CI globe valve			
3 c	Gun metal gate valve			
3 d	Gun metal globe valves/ strainers / non- return valves			
3 e	Water Pump			
3 f	Foot vavle			
3 g	Water meter			
4	Insulation materials			
4 a	Expanded polystyrene			
4 b	Glass/ mineral wool			
4 c	Resin bonded mineral wool			
4 d	Polyurethane foam			
5	Cables			
5 a	Powder Cables			
5 b	Control Cables			
5 c	Instrumentation & Signal cables			

Important note:

The make of all bought out items / components should be got approved at one instance only and the makes thus approved shall only be supplied

ANEXURE - II

CODE OF PRACTICE FOR PAINTING OF SERVICE PIPE LINES, EQUIPMENT AND STRUCTURAL WORK

PAINTING OF SERVICE PIPE LINES

On Non-insulated Pipe Line

Ground colour to be applied throughout the length of the pipeline.

Colour bands to be applied, over the ground colour, near every valve and branch connections as well as in every room near the entry.

The relative proportional widths of the 1st colour band to the subsequent bands shall be 4:1. The minimum width of colour band shall confirm to the following table:.

Nominal Pipes Size	Width of 1st Colour band	Width of 2nd Colour band
80 NB and below	100 mm	25 mm
100 NB to 150 NB	200 mm	50 mm
200 NB to 300 NB	300 mm	75 mm
350 NB and above	400 mm	100 mm

On the 1st band a white arrow to be put to indicate the direction of flow.

The arrows should be put on the bottom of the pipelines so that the same are visible from below in case of horizontal bank of pipes and on sides in case of vertical bank of pipes.

The valves should be painted with the same colour as the ground colour of the pipeline.

On Insulated Pipeline but without Aluminum Cladding Procedure same as above.

On Insulated Pipeline with Aluminum Cladding

Ground colour to be applied in a minimum length of 1000 mm of the pipe all round near every valve and branch connections as well as in every room near the entry. The complete length of the pipeline should not be painted.

Colour bands should be applied in the middle of every ground colour strip. The relative proportional widths of the 1st colour band to the subsequent bands shall be 4:1. The minimum width of colour band shall confirm to the following table:

Nominal Pipes Size	Width of 1st Colour band	Width of 2nd Colour band
80 NB and below	100 mm	25 mm
100 NB to 150 NB	200 mm	50 mm
200 NB to 300 NB	300 mm	75 mm
350 NB and above	400 mm	100 mm

For insulated pipes, nominal pipe size means the outside diameter of pipe with insulation.

On the 1st band a white arrow is to be put to indicate the direction of flow of the fluid.

The arrows should be put on the bottom of the pipelines, so that the same are visible from below in case of horizontal bank of pipes and on sides in case of vertical bank of pipes.

The valves should be painted with the same colour as the ground colour.

The ground colours and the colours of the 1st and 2nd colour bands have been indicated on the enclosed list for the pipe lines carrying various types of fluids and gases. The list also indicates the shade nos. of the colours to be used. In case the exact shade is not available, the nearest possible shade in the same colour may be selected.

Only synthetic enamel paint should be used for the painting and band markings on the pipelines and it should be ensured that the finish should be glossy.

Where no colour bands have been recommended, only the ground colour is to be applied as per the above procedure. If only one colour band is recommended the width of the same should be as per the first band and applied on the ground colour. In case of 2 nos. colour bands, the 1st band and second band of width as per above table should be applied on the ground colour.

To avoid mixing of colours, it is recommended to apply the bands only after the ground colour paint is dry and subsequently to apply the arrow only after the 1st band paint is dry.

PAINTING OF EQUIPMENT & STRUCTURAL WORK

M.S. platforms/pipe supports/ Pipe bridges and any oth Structures	Dark admiral grey shade No.632 of BSI
Feed water tank, Water softening plant.	Dark admiral
grey shade no. 632 of BIS	
Hot water set, vacuum heating set,	Original colour
Water pumps, geared motor of	
Tanks and vats, Gearbox and supports	
Coal handling equipment	Black
HWG chimney and	Aluminum paint
Generator exhaust	

Air Compressors	Original colour
Weigh scales	Original colour
HT & LT panels	Original colour
LT distribution switchboards	Original

COLOUR CODE FOR PIPELINES AS PER IS2379-1963

Sr. No.	Services	Application	Ground colour Colour Shade No. per BSI	First Band Colour Shade No. as per BSI	Second Band Colour Shade No. as per BSI
1	HWG Feed Water	HWG feed water piping	Sea Green 217		
2	Drinking Water	Water lines For water coolers	Sea Green 217	French 166 Blue	Signal 537 Red
3	Treated Water	Soft water lines	Sea Green 217	Light 557 Orange	
4	Cold Water	Chilled Water supply & return	Sea Green 217	French 166 Blue	Canary 309 Yellow
		lines			
5	Untreated Water	Raw water lines	Sea Green 217	White	
6	Boiler Feed Water	Boiler	Sea Green 217	Gulf - Red	
7	Condensate	Steam Line	Sea Green 217	Light 410 Brown	
8	Compressed Air	All compressed air pipelines	Sky Blue 101		
9	Instrument air	Instruments	Sky Blue 101	French 166 Blue	
10	Soft Water Equipment	All plant and	Sea Green 217	Light 410 Brown	Signal 537 Red
11	Steam	HP steam lines	Aluminum to IS 2339	French 166 Blue	
		LP steam lines	Aluminum to IS 2339	Canary 309 Yellow	
12	Furnace Oil	Boiler & Furnaces	Light 410 Brown	French 166 Blue	
13	Diesel	Diesel generating set	Light 410 Brown		
14	Light Diesel Oil	Hot Water Generator & Boiler	Light 410 Brown	Brilliant 221 Green	
15	Drainage	All drain lines from Equipment building & OH water Tank	Black		

SPECIAL CONDITIONS OF CONTRACT FOR INSTALLATION

PART – V ELECTRICAL INSTALLATION

Item	Topic Number
1.	Scope
2.	Standards
3.	Equipment and accessories - Specifications
4.	Erection of Equipment
5.	Installation of Cable Network
6.	Earthing Network
7.	Two/Four Pole Structure
8.	Bureau of Indian standards for electrical
9.	Recommended cable sizes for Industrial wiring

SPECIAL CONDITIONS OF CONTRACT

PART - V ELECTRICAL INSTALLATION

The intent of this specification is to define the requirements for the installation, testing and commissioning of the electrical system like high tension switchyard with accessories and equipment, transformers, HT panel vacuum circuit breakers, LT panels and power control centres, motor control centers, distribution boards, capacitor banks & panels, power, control & instrumentation cables, remote push button stations, motors, earthing network, etc. Requirement of a particular project shall be as specified in schedule of quantities/approved drawings or as per the battery limits fixed in the contract.

STANDARDS

The work shall be carried out in the best workmanlike manner in conformity with this specification, the relevant specification/codes of practice of the Bureau of Indian Standards, approved drawings and the instructions issued by the Engineer-in-charge or his authorized representative, from time to time. Some of the relevant Indian Standards are listed in Annexure-III.

In addition to the standards as mentioned in 2.1, all works shall also confirm to the requirements of the following:

a). Indian Electricity Act and Rules framed

there under. b). Fire Insurance Regulations.

c). Regulations laid down by the Chief Electrical Inspector of the State / State

Electricity Board.

d). Regulations laid down by the Factory Inspector of the State.

e). Any other regulations laid down by the local authorities.

f). Installation & operating manuals of original manufacturers ofequipment.

EQUIPMENT AND ACCESSORIES – SPECIFICATIONS

This defines specifications and requirements mainly for the equipment and accessories which are generally supplied by the erection agency and do not cover the specification of main electrical equipment such as Transformers, HT and LT panels, switch boards and motors etc., which may be supplied by Bidder.

All materials, fittings and appliances to be supplied by the Supplier shall be of best quality and shall conform to the specification given hereunder. The

equipment shall be manufactured in accordance with current Bureau of Indian Standard Specifications wherever they exist or with the BS or NMA specifications, if no such BIS are available. In the absence of any specification, the materials shall be as approved by the Owner or his authorized representative.

All similar materials and removable parts shall be uniform and interchangeable with one another.

Makes of bought out items selected by the Supplier must be furnished by him.

Power Cables (HT)

Three core, Aluminium conductor, screened, XLPE insulated, armored shielded and PVC sheathed cables suitable for 11 / 22 / 33 KV, earthed system, conforming to IS 7098 (Part
II) - 1988 amended upto date.

Power Cables (LT)

Power cables for use on 415 V system shall be of 1100 volt grade, aluminum conductor, XLPE insulated, PVC sheathed, armoured and overall PVC sheathed, strictly as per IS: 7098 (Part I) / 88. Conductor of cable shall be solid type .

Cable Trays

Functional requirement: Cable trays are used (based on the site condition) for laying the power and control cables inside the plant from PCC to the MCC & MCC to all motors/sub panels and wherever required.

Fabrication: These shall be perforated type, heavy duty, return flange or inward bend shape, manufactured from mild steel conforming to IS-2062 and hot dip galvanized as per IS 2629/BS-729. Width of cable tray shall be as per the requirement. Height to be minimum 50 mm and thickness of plate to be 1.5 mm up to 300 mm cable tray width. For cable trays having width more than 300 mm, height to be 75mm and thickness of plate to be 2.0 mm. Cable trays to be supplied to site in standard lengths of 2.5 M. Necessary accessories of cable trays such as coupler side plates for joining cable trays, bends, riser, inside riser, tee etc. must also be factory fabricated. Plain cable tray covers 1.5 mm thick to be supplied if specially required. Sample of cable tray to be got approved from Purchaser before supply. Cable tray for automation network /instrument /signal cables shall be separate from power & control cables.

Cable Glands

These shall be provided at both ends of armoured/ unarmoured electrical cables. Cable glands to be manufactured as per performance requirements of BS-6121 & IP 65 as per IS 13947 (Part I) amended as on date, with BRASS material accurately machined and NICKEL finish. These shall be of heavy-duty single compression type for cable conductor sizes above
35 sq.mm and weather proof double compression type for cable conductor sizes upto 35 sq.mm. Single compression cable glands to be complete with check nut, gland body, 3 nos. metal washers, and outer seal rubber ring and

compression nut. Double compression glands to be complete with check-nut, gland body, neoprene inner ring, armour clamping cone, armour- clamping ring, armour clamping nut, neoprene outer ring, skid washer & outer seal nut. Sample of cable gland to be got approved from the Site In charge before supply.

Cable Connectors

Cable connectors, lugs/sockets, shall be of copper/aluminum alloy, suitably tinned solderless, crimping type. These shall be suitable for the cable being connected and type of function (such as power, control or connection to instruments, etc.). The current rating of the lugs shall be the same as that of the respective cable conductors. If the aluminum lug is terminated on a brass stud or copper bus bar then bimetallic washer shall be used.

Cable Route Markers

These shall be galvanized Cast Iron plate with marking (LT/HT) and of diameter 150 mm with 600 mm long 25x25 mm MS angle riveted/bolted with this plate. Sample to be got approved before use.

Cable Indicators

These shall be self-sticking type and of 2 mm thick lead Strap for overall cable. PVC identification numbers, Ferrule shall be used for each wire.

Pipes for Cables

For laying of cables under RCC floor, GI class 'A' pipes shall be used. For laying cable in air where cable trays are not being used, GI 'A' class pipe shall be used. Size of pipe shall depend upon the overall outer diameter of cable to be drawn through pipe. NO PIPE LESS THAN 40 MM DIA SHALL BE USED FOR THIS PURPOSE. To determine the size of pipe, assume that 40% area of pipe shall be free after drawing of cable. If length of pipe is more than 30 M, free area may be increased to 50%. All cable (power / control / instrument / signal) drops shall be in conduit pipe. The open ends of power/control cables at termination shall be protected through suitable conduit. Instrument/signal cable/wire drops upto termination point shall be also routed through conduits. The automation cables (plant/system/field bus, instrument/signal cables/wires shall be laid in cable trays through GI conduit.

Motor Isolators

These shall be in Aluminum cast housing, completely dust, vermin and weather proof (IP 65), suitable for 30/25 A, 415 volts, 50 Hz with rotary type switch complete with cable gland for incoming and outgoing cables. Final finish of housing to be buffer mirror or powder coated grey. Instead of AL cast housing, thermoplastic housing with IP 55 / 65 protection can also be used. From isolator to motor, adequately sized flexible copper wire in suitable heavy duty (wire ribbed) PVC flexible conduit to be used. Sample of isolator housing and conduit to be got approved before supply. Isolators shall be used for all on

line started motors receiving single cable.

Motor Junction Box/Control Junction Box

These shall be in Aluminum cast housing or unbreakable, self extinguishing thermoplastics of high quality, completely dust, vermin and weather proof (conforming to minimum IP 65 class of protection), suitable for 25A, 415 volts, 50 Hz, with heavy duty bakelite /equivalent connector, complete with cable/conduit gland. These junction boxes are required on all floors near equipment for final connection of multi core control cables/signal cables to various field devices. They may also be used for star delta started motors for final connection to motor, through adequately sized flexible copper wire in suitable heavy duty (wire ribbed) PVC flexible conduit. Sample to be got approved before supply.

Remote Push Button Stations

These shall be used for remote ON-OFF for motors, away from MCC. These shall be suitable for surface/structure mounting in Cast Aluminum housing having IP-65 class of protection i.e., completely weather proof. For each motor, one ON, one OFF red mushroom half turn to lock button, one LED type indication lamp to be provided with a heavy duty connector inside the housing to receive control cables. If more than one motor is nearby, a common ON-OFF station can be used of suitable size made from SS 304 2thk. Indication lamp can be combined with 'ON' (Green) push button in place of providing separate indication lamp and push button. Riveted type plastic nameplate to be provided for each feeder. If functionally required Ammeter also can be located in such ON-OFF station.

ERECTION OF EQUIPMENT

The Supplier shall make his own arrangements for safe transportation of all the items to the erection site and also carry out complete loading/unloading during transportation. Equipment shall not be removed from packing cases unless the floor has been made ready for installing them. The cases shall be opened in presence of the Engineer-in- charge or his authorized representative. These empty packing cases shall be returned to the stores and any document if found with the equipment shall be handed over to the Engineer-in- charge. Any damage or shortage noticed shall be reported to the Engineer-in-charge in writing immediately after opening of packing cases.

Transformer Erection

Transformer complete with radiators, bushings, conservator and miscellaneous accessories shall be thoroughly inspected and any damage noticed shall be reported to the Engineer-in-charge. Before erection of transformer the level of rails on foundation shall be checked and minor corrections if necessary shall be carried out. After the completion of erection, necessary stoppers shall be provided at the wheels. All loosely supplied fittings/accessories shall be cleaned and mounted on the transformer and connections made. If the transformer oil is supplied in drums by the

manufacturer, the same shall be tested for dielectric strength etc. and only approved oil "on test" shall be filled into the tank through filtration system. While filling in transformer with oil, samples shall be taken from the bottom and conservator and tested for dielectric strength. Fresh silica gel shall be filled in the breather. After complete assembling installation, filling and topping the transformer with oil, the transformer shall be cleaned and touch- up paint supplied by the manufacturer applied wherever necessary. All tank cover bolts shall be checked for proper tightness.

Testing

For testing of the dielectric strength of insulating oil in oil-immersed equipment, test samples of oil shall be drawn from equipment after filling. In case oil is supplied in separate containers for filling or topping up at the site, a test also shall be made with samples drawn from such oil container before the equipment is filled.

Minimum acceptable values for each test will be indicated by the Engineer- in-charge. However, dielectric strength of oil should be about 40 KV (RMS) for one minute.

By measuring the dielectric strength of the oil in the transformers, if tests indicate the presence of undue amount of moisture, the insulation oil shall be filtered by steam line filter. No extra charges shall be paid for filtration and the supplier shall arrange his own filtration machine, oil testing kit and other accessories.

Winding insulation resistance shall be measured from primary and secondary to ground and between primary and secondary.

Test the operation of Buchholz relay in accordance with the manufacturer's instructions.

Test the operation of the tap changer. Measure primary and secondary voltage ratios are as per nameplates.

Check the polarity of terminals and the phase's sequence.

Performa for Transformer Tests

1. Transformer nameplate

2. Insulation resistance test with 1000 V Megger

a. between primary to earth .... Mega ohm
b. Between secondary to earth .... Mega ohm
c. Between primary and secondary .... Mega ohm

3. Dielectric strength of oil in the transformer (test Voltage 40 KV for one minute).

4. Operation of Buchholz relay as per manufacturers Instructions.

5. Operation of the tap

changer Operation of the

tap at

tap no.1
tap no.2
tap no.3
tap no.4
tap no.5

6. Polarity marking and phase sequence.
7. Condition of silicated crystals.
8. Earth resistance: Neutral / tank

(This proforma shall be jointly signed by the Engineer-in-charge and the supplier).

Power control centres, MCC, Distribution Boards, Control Panels & Bus Ducts

Erection

Electrical panels and bus duct shall be delivered in convenient shipping section by the manufacturers. The Supplier shall be responsible for final assembly and inter-connection of busbars/wiring. Foundation channel shall be grouted in the flooring by the Supplier. Switchgear Panels shall be aligned and leveled on their base channels and bolted or tack welded to them as per the instructions of the Engineer-in-charge. The earth bus shall be made continuous throughout the length. Loosely supplied relays and instruments shall be mounted and connected on the switchgear. The contacts of the draw-out circuit breakers shall be checked for proper alignment and inter- changeability.

After erection the switchboard shall be inspected for dust and vermin proof. Any hole, which might allow dust or vermin etc. to enter the panel, shall be plugged suitably at no extra cost.

If the instrument transformers are supplied separately they shall be erected as per the direction of the Engineer-in-charge. The Supplier shall fix the cable glands after drilling the bottom / top plates of all switchboards with suitable holes at no extra cost.

Range of overload relays/timers etc. shall be checked with requirement of motor systems actually to be connected at site and if the same is under- sized/over-sized, it shall be brought to the notice of Engineer-in-charge, who shall arrange procurement of correct rated components. However, the supplier shall not charge anything extra for labour for such replacements.

The bus duct shall be suitably supported between Power Control Centre and transformer. The opening in the wall where the duct enters the switchgear room shall be sealed to avoid rainwater entry. The foundation of the Power Control Centre shall be raised suitably for minor adjustment to ensure proper alignment and connection of the bus duct at no extra cost. Expansion joints,

flexible connection, etc. supplied by the manufacturer of the bus duct shall be properly connected.

Testing

Before electrical panel is energized, the insulation resistance of each bus shall be measured from phase to ground. Measurement shall be repeated with circuit breakers in operating positions and contact open.

Before switchgear is energized, the insulation resistance of all DC control circuits shall be measured from line to ground.

Before switchgear is energized, the test covered above shall be repeated with each breaker in its normal operating position.

Capacitor banks in capacitor control panel shall be tested as per manufacturer's instructions. In addition test for output and/or capacitance, insulation resistance test and test for efficiency of discharge device shall be carried out.

All electrical equipment alarm s shall be tested for pr oper oper ation by causing alarms to sound under simulated abnormal conditions.

The Supplier shall arrange testing and calibrations of relays. The testing equipment including primary and secondary injection sets (if required) etc. shall also have to be arranged by the Supplier. Payment for above work shall be deemed to have been included i n t h e e r e c t i o n o f s w i t c h boards/control panels.

Proforma for PCC, DB, Motor Control Centres test

1. Circuit (breaker or Supplier module designation/ bus no.).

2. Insulation resistance test (contacts open, breaker racked in position).

a. Between each phase of bus ---------: Mega ohm b. Between each phase and earth ---------: Mega ohm c. DC and AC control & auxiliary Circuits ---------: Mega ohm d.

Between each phase of CT/PT & between CT & PT circuit, if any ---------: Mega ohm

3. CT checks:
a. CT ratio
b. CT secondary resistance
c. CT polarity check
4. Check for contact alignment and wipe.

5. Check/test all releases/relays.

6. Check mechanical interlocks.

7. Check electrical interlocks.

8. Check switchgear/control panel wiring.

9. Checking breaker/Supplier circuits for

a. Closing- local and remote (wherever applicable)
b. Tripping-local and remote (wherever applicable)

10. Opening time of breaker/contactor.

11. Closing time of breaker/contactor.

(The Engineer-in-charge and the Supplier shall jointly sign this proforma.)

Sealed Maintenance Free Batteries & Battery Charger

Batteries shall be erected on powder coated MS stands and insulators supplied by the manufacturer of the batteries. Inter connectors shall be made with leads supplied by the manufacturer. Charging discharging and recharging shall be carried out under the supervision of the Engineer-in- charge or his authorized representative Erection of battery charger and DC board will be carried out by the Supplier under the supervision of the Engineer-in-charge or his authorized representative. The Supplier shall also offer such facilities as may be required for carrying out tests on the complete battery charger and DC board/AC board.

Battery charger shall be tested for proper operation and to verify the charger delivers its maximum rated output. The Supplier shall supply skilled /unskilled labour for carrying out the test by the engineer-in-charge.

Batteries shall be given a boost charge in accordance with the manufacturer's instructions and adjusted for float operation before being placed in regular service.

GEARED MOTORS AND GEAR BOXES:

These are required in feed plant for driving various slow speed machines. All slow speed machines to be run by geared motors only unless gear boxes have been specified in individual machines specification. The geared motor should use helical gears. The electric motor and helical gear box should be built as one unit. The geared motors / gear boxes should be suitable for minimum 15 start/stops per hour without undue heating, for continuous duty and minimum safety factor of 1.4.

The electric motors used for geared motors / gear boxes should be TEFC, degree of protection IP-55, squirrel cage, induction type, with class `F' insulation suitable for 415 V, 50 Hz, 3 phase AC supply.

Geared motors / boxes to be c o m p l e t e including key in t h e driven shaft, oil level indicator, oil filling plug, oil breather and drain plug. Suitable grade gear oil for first charge of geared motor / boxes should not be filled but should be packed separately in a drum and sent along with geared motor/boxes. Gear oil would be filled at site.

Electric Motors

All electric motors shall be energy efficient motors and shall comply with the following:

a) All poly phase motors of 0.375 kW or more shall have a minimum acceptable nominal full load motor efficiency not less than shown in Table below or as per the IS 12615 – 2004(Rev 1) for Eff1 energy efficient motors.

Table for Minimum Acceptable Motor Efficiencies

	Efficiency (%)	
Motor Size (KW)	2 Pole	4 Pole
0.37 (0.5 hp)	70.2	69.4
0.55. (0.75 hp)	74	72
0.75. (1 hp)	78.5	74.6
1.1(1.5 hp)	82.2	83.8
1.5 (2 hp)	84.1	85.0
2.2 (3 hp)	85.6	86.4
3.0(4 hp)	86.7	87.4
4.0(5.5 hp)	87.6	88.3
5.5 (7.5 hp)	88.6	89.2
7.5(10 hp)	89.5	90.1
11.0 (15 hp)	90.6	91.0
15.0 (20 hp)	91.3	91.8
18.5 (25 hp)	91.8	92.2
22.0 (30 hp)	92.2	92.6
30.0 (40 hp)	92.9	93.2
37.0 (50 hp)	93.3	93.6
45.0(60 hp)	93.7	93.9
50.0 (75 hp)	94.0	94.2
75.0 (100 hp)	94.6	94.7
90.0 (120 hp)	95.0	95.0
110.0 (150 hp)	95.0	95.0
132.0 (180 hp)	95.3	95.5
160.0 (215 hp)	95.5	95.8
180.0 (240 hp)	95.5	95.8
200.0	95.8	96.0
225.0		96.0
250.0		

b) Motor nameplates shall list the nominal full-load motor efficiencies and the full-load power factor.

c) Certificates shall be obtained and kept on record indicating the motor efficiency.

Erection and testing

Erection and coupling of motors with machines will be done under the

mechanical erection. However, earthing, cable termination, testing and commissioning are covered under this section. Before starting the alignment and coupling of motors with machines, the insulation resistance of the motors will be measured and recorded by the Supplier. Wipe, brush or blow accumulated dirt from the frame and air passages of the motor. Feel for air being discharged from the cooling air ports. If the flow is weak or unsteady then clean it. Dry the motor before installation if it motor has been lying in the store for a long time. Motors having low meager readings because of contamination by moisture, oil or conductive dust should be thoroughly cleaned and dried. The direction of the rotation of the motor shall also be checked before the driven equipment is finally coupled. Motor bearings are to be checked and rectified including supply and changing of grease (if required), checking of fans coupling with bodies etc. The Supplier shall take adequate precaution and care while executing the work.

For all damage due to negligence etc. the Supplier shall be responsible to replace/repair at his own cost.

Before connecting power cables to motors the insulation resistance of all motor windings shall be measured. Measurement shall be repeated after power cable terminations are completed and before first charging.

Motors shall be operationally tested together with the starting gear and auxiliary apparatus such as push button stations, the contactors, level and pressure controls, signal and alarm apparatus, power and control circuits etc.

- Check the anti-condensation heater and its circuit (if installed)

- Check the setting of the thermal overload protection / single-phase preventer. Testing of these devices is to be done wherever required as per the instructions of the Engineer-in- charge.

All motors shall run uncoupled for a maximum period of 4 hours before the driven equipment is placed in regular service.

Proforma for motor testing

1. Name plate details: Voltage.... HP.... KW....
   Mounting.... Current.... RPM.... Frame size...
   Make.... S No..... Others.....

2. Insulation test (before cable connection).

a. Between phase and earth ... Mega ohms.

b. Between each phase ... Mega ohms.

3. Insulation test (after cable connection).

a. Between phase and earth. .. Mega ohms.

b. Between each phase ... Mega ohms.

4. No load current: R Phase
…..Amps. Y Phase
…..Amps. B Phase
…..Amps.

5. Full load current:

6. R Phase …..Amps.

7. Y Phase …..Amps.

8. B Phase …..Amps.

9. Temperature rise after 4 hours run: On no load ^{0}C.
10. On full load ^{0}C .
11. Ambient temperature during test ^{0}C .

12. Operation of thermal overload relay:

i. At normal FL current of motor

ii. At twice FL current of motor : trip in Seconds.

(This proforma shall be jointly signed by the Engineer- in-charge and the Supplier.)

DG Sets

Erection & Testing

The preassembled DG Set shall be placed over the foundation and aligned properly. Before termination of cable to the alternator, the insulation resistance of the alternator will be measured and bearings shall be checked. All pipe connections etc of the engine shall also be checked. Also, the level of lubricant & coolant in the engine. The setting of various protection & releases, power and control circuits of the DG set panel shall be checked before switching on the DG Set.

Proforma for Alternator testing

1. Name plate details: Voltage.... HP.... KW....
Mounting.... Current.... RPM.... Frame size... Make....
SNo..... Others .....

2. Insulation test (before cable connection).

a. Between phase and earth ... Mega ohms.
b. Between each phase ... Mega ohms.

3. Insulation test (after cable connection).

a. Between phase and earth. .. Mega ohms.
b. Between each phase ... Mega ohms.

4. No load current:	R Phase	…..Amps. …..Amps. B Phase	…..Amps.
5. Full load current:	R Phase	…..Amps. …..Amps. B	…..Amps.

6. Temperature rise after 4 hours run: On no load ^{0}C. On full load ^{0}C . Ambient temperature during test ^{0}C .

7. Operation of thermal overload relay: At normal FL current of motor

8. No load & full load regulation :

Proforma for Diesel Engine testing

1. Speed regulation from no load to full load

2. Frequency at no load, 50% load & 100% load

3. Safety controls & protective devices

4. Specific fuel consumption:

INSTALLATION OF CABLE NETWORK

Cable network shall include power, control, signal & instrumentation and lighting cables which shall be laid in underground trenches, Hume pipes, open trenches, cable trays, GI/ SS pipes, or on building structure surfaces as detailed in the relevant drawings, Cable schedules or as per the Engineer- in-charge's instructions. Supply & installation of cable trays, GI / SS pipes/ conduits, cable glands sockets at both ends, isolators, junction boxes, remote push buttons stations, etc. shall be under the scope of the Supplier.

General requirements for handling of cables.

Before laying cables, these shall be tested for physical damage, continuity, absence of cross phasing, insulation resistance to earth and between conductors. Insulation resistance tests shall be carried out with 500/1000 volt Megger.

The cables shall be supplied at site, wound on wooden drum as far as possible. For smaller length and sizes, cables in properly coiled form can be accepted. The cables shall be laid by mounting the drum of the cable on drum carriage. Where the carriage is not available, the drum shall be mounted on a properly supported axle, and the cable laid out from the top of the drum. In no case the cable will be rolled on, as it produces kinks, which may damage the conductor.

Sharp bending and kinking of cables shall be avoided. The bending radius for PVC insulated and sheath armoured cable shall be as per IS 1255-1983 and shall not be less than 10 D Where `D' is overall diameter of the cable.

While drawing cables through GI / SS pipes, conduits, RCC pipe, ensure that size of pipe is such that, after drawing cables, 40 % area is free. After drawing cable, the end of pipe shall be sealed with cotton/bituminous compound.

High voltage (11 KV and above), medium voltage (230 V and above) and other control cables shall be separated from each other by adequate spacing or running through independent pipes/trays.

Armoured cables shall never be concealed in walls /floors /roads without GI pipes, conduits / RCC pipes.

Joints in the cable throughout its length of laying shall be avoided as far as possible and if unavoidable, prior approval of site engineer shall be taken. If allowed, proper straight through epoxy resin type joint shall be made, without any additional cost.

A minimum loop of 3 M shall be provided on both ends of the cable, or after every 50 M of unjointed length of cable and on both ends of straight through cable joint. This additional length shall be used for fresh termination in future. Cable for this loop shall be paid for supply and laying if the contract awarded is on item rate basis.

Cable shall be neatly arranged in the trenches/trays in such a manner so that criss-crossing is avoided and final take off to the motor/switchgear is facilitated. Arrangement of cables within the trenches/trays shall be the responsibility of the Supplier.

All cable routes shall be carefully measured and cable cut to the required lengths and undue wastage of cables to be avoided. The routes indicated in the drawings is indicative only and the same may be rechecked with the Engineer-in-charge before cutting of cables. While selecting cable routes, interference with structures, foundations, pipeline, future expansion of buildings, etc. should be avoided.

All temporary ends of cables must be protected against dirt and moisture to prevent damage to the insulation. For this purpose, ends of all PVC insulated cables shall be taped with an approved PVC or rubber insulating tape. Use of friction type or other fabric type tape is not permitted. Lead sheathed cables shall be plumbed with lead alloy.

Wherever cable rises from underground/concrete trenches to motors/switchgears/push buttons, these shall be taken in G.I. Pipes of suitable size, for mechanical protection upto 300 mm distance of concerned cable gland or as instructed by the Engineer-in-charge.

Where cables pass through foundation/walls of other underground structures, the necessary ducts or openings will be provided in advance for the same. However, should it become necessary to cut holes in existing foundations or structures the electrical Supplier shall determine their location and obtain approval of the Engineer-in-charge before cutting is done.

Laying of Cables (underground system)

Cables shall be so laid in ground that these will not interfere with other underground structures. All water pipes, sewage lines or other structures, which become exposed by excavation, shall be properly supported and protection from injury until the filling has been rammed solidly in places under and around them. Any telephone or other cables coming in the way are to be properly shielded / diverted as directed by Bidder.

Cables shall be laid at minimum depth of 750 mm in case of LT & 1200 mm in case of HT, from ground level. Excavation will be generally in ordinary alluvial soil. The width of the trench shall be sufficient for laying of required number of cables.

Sand bedding 75 mm thick shall be made below and above the cables. A layer of bricks (full size) shall be laid on the edge, above sand bedding on the sides of cables and a flat brick to cover cable completely. More than one cable can be laid in the same trench by providing a brick on edge between two cables. However the relating location of cables in trench shall be maintained till termination. The surface of the ground after back filling the earth shall be made good so as to conform in all respects to the surrounded ground and to the entire satisfaction to the Engineer-in- charge.

For all underground cables, route markers should be used.

a. Separate cable route markers should be used for LT, HT and telephone cables.
b. Route markers should be grouted in ground with 1:2:4 cement concrete pedestal size 230 x 230 x 300 mm

c. Cable markers should be installed at an interval not exceeding 50 M along the straight routes of cables at a distance of 0.5 M away from centre of cable with the arrow marked on the cable markers plate indicating the location of cable. Cable markers should also be used to identify change in direction of cable route and for location of every joint in underground cable.

RCC Hume pipe for crossing road in cable laying shall be provided by Owner. No deduction shall be made for cable laying in Hume pipe for not providing bricks, sand and excavation. RCC Hume pipe at the ends shall be sealed by bituminous compound after laying and testing of cable by electrical Supplier without any extra charge.

Laying of Cables Under Floors

GI class ‘A’ pipe shall be used for laying of outgoing cables from distribution boards to motors, isolators/junction boxes of motors, starter of motors and push button stations under floors. Preferably one cable shall be drawn through one pipe. Size of pipe shall be such that after drawing of cable 40 % area is free. If

length of pipe is more than 30 M, free area may be increased to 50%.

Uses of elbows are not allowed at all and number of bends shall be kept minimum. Instead of using bends with sockets, pipe-bending machine shall be used for making long radius smooth bends at site.

Ends of pipe shall be sealed temporarily while laying with cotton/jute/rubber stopper etc. to avoid entry of building material.

Exact location of equipment motor/isolator/push buttons etc. shall be ascertained prior to laying of pipe.

Laying of Cable in Masonry Trenches

Masonry/concrete trenches for laying of cable shall be provided by Owner.

However steel members such as MS angles/flats etc. shall be provided & grouted by electrical Supplier to support the cables without any extra charge. Cables shall be clamped to these supports with aluminum saddles/clamps. More than one tier of cables can be provided in the same trench if the numbers of cables are more. If required, cable trays can also be provided in trenches.

Entry of cables in trenches shall be sealed with bituminous MASTIC compound to stop entry of water in trenches.

Laying of Cables in Cable Trays

Cable trays and supporting steel members such as MS angle/channel/flats etc. shall be provided and fixed by the Supplier.

Cables shall be laid in cable trays in single tier formation and cables shall be clamped with aluminum flat clamps and galvanized bolts & nuts. Cables from cable tray to individual drive, control panel, remote push button station and other miscellaneous equipment shall be dropped in GI /SS conduit.

Earthing flat/wire can also be laid in cable tray along with cables.

After laying of cables minimum 20 % area shall be spare.

Laying of Cables on Building Surface/Structure

Such type of cable laying shall be avoided as far as possible and will be allowed only for individual cables or small group of cables, which run along structure.

Cables shall be rigidly supported on structural steel/ masonry using individual cast/ malleable iron galvanized saddles and these supports shall be approximately 400 to 500 mm for cables upto 25 mm overall diameter and maximum 1000 mm for cables larger than 25 mm. Unsightly sagging of cables shall be prevented. Only aluminum/GI clamps with GI bolts/nuts shall be used.

If drilling of steel structure must be resorted to, approval must be secured from the Engineer-in-charge and steel must be drilled where the minimum weakening of the structure will result.

Termination and Jointing of Cables

Use of Glands

All PVC cable upto 1.1 KV grade, armoured or unarmoured shall be terminated at the equipment / junction boxb /isolators/push buttons / control accessories/instruments, etc by means of suitable size compression type cable glands. Armour of cable shall be connected to earth point. The Supplier shall drill holes for fixing glands wherever necessary. Wherever threaded cable gland is to be screwed into threaded opening of different size, suitable galvanized threaded reducing bushing shall be used for approved type.

In case of termination of cables at the bottom of the panel over a cable trench having no access from the bottom, close-fit holes should be drilled in the bottom plate for all the cables in one line, then bottom plate should be split in two parts along the centre line of holes. After installation of bottom plate and cables with glands, it shall be sealed with cold sealing compound.

Use of Lugs/Sockets

All cable leads shall be terminated at the equipment terminals, by means of crimped type solder less connectors unless the terminals at the equipment ends are suitable for direct jointing without lugs/sockets.

The following is the recommended procedure for crimped joints and the same shall be followed:

a. Strip off the insulation of the cable ends with every precaution so as not to severe or damage any strand. All insulations to be removed from the stripped portion of the conductor and ends of the insulation should be clean and square.

b. The cable should be kept clean as far as possible before assembling it with the terminal/socket. For preventing the ingress of moisture and possibility of re-oxidation after crimping of the aluminum conductors, the socket should be filled with corrosion inhibiting compound. This compound should also be applied over the stripped portion of the conductor and the palm surface of socket.

c. Correct size and type of socket/ferrule/lug should be selected depending on size of conductor, and type of connection to be made.

d. Make the crimped joint by suitable crimping tool.

e. If after crimping the conductor in socket/lug, some portion of the conductor

remains without insulation the same should be covered sufficiently with PVC tape.

Dressing of Cable Inside the Equipment

After fixing of cable glands, the individual cores of cable shall be dressed and taken along the cable alleys/wiring trough (if provided) or shall be fixed to the panels with polyethylene straps. Cable shall be dressed in such a manner that small loop of each core is available inside the panel.

For motors of 20 HP and above, terminal box if found not suitable for proper dressing of aluminum cables, the Supplier shall modify the same without any additional cost.

Cables inside the equipment shall be measured and paid for if the contract awarded is on item rate basis.

Identification of Cables/Wires/Cores

After laying & pulling cable, the contractor shall provide the cable identification tags to be tied by GI wire at each end of the cable. Power cables shall be identified with red, yellow & blue PVC tapes for trip circuits identification, additional red ferrules shall be used only in the particular cores of control cable at the termination points in the switchgear/control panels and control switches.

In case of control cables all cores shall be identified at both ends by their wire numbers by means of PVC ferrules or self - sticking cable markers, wire numbers shall be as per schematic /connection drawing. For power circuit also wire numbers shall be provided if required as per the drawings of switchgear manufacturer.

Cablebetween Isolators/Junction Box & Motors/Controls.

Wherever possible Copper Conductor Armoured cables with glands shall be used between isolator/junction box (installed near motor/controls) and motors/ controls. However, if terminal box of the motor or control switch is not suitable for accepting armoured cable or it is difficult to lay, multi strand copper conductor, multi-core, unarmoured flexible cable in PVC flexible conduit (steel reinforced) with flexible conduit glands shall be used.

Termination of cables of 6.6 kV and above shall be carried out using heat shrinkable sleeves. This termination must be no-tracking and weatherresistant.

Testing of Cables

Before energizing, the insulation resistance of every circuit shall be measured between conductors and between each conductor and ground. This requires 3 measurements if one side is grounded and 6 measurements for 3 phase circuits. Continuity test on each lead of cable shall also be tested.

Where splices or terminations are required in circuits rated above 650 volts, measure insulation

resistance of each length of cable before splicing and/or terminating. Report measurements after splices and/or terminations are complete.

DCHigh Voltage test shall be made after installation on the following:

All 1100 Volts grade cables in which straight through joints have been made. All cables above 1100 V grade.

For record purposes test data shall include the measured values of leakage current versus time.

The DC High Voltage test shall be performed as detailed below:

Cables shall be installed in final position with the entire straight through joints complete. Terminations shall be kept unfinished so that motors, switchgear transformer etc. are not subjected to test voltage.

The test voltage and duration shall be as per relevant codes and practices of Indian Standards Institution.

Performa for Testing Cables DATE OFTEST

a. Drum No. From which cable taken
b. Cable from to
c. Length of run of this table meter
d. Insulation resistance test:

Voltage of Megger ..... Volts

between core-1 to earth..... Mega-ohm
between core-2 to earth..... Mega-ohm
between core-3 to earth..... Mega-ohm
between core 4 (neutral) to earth…Mega-ohm
between core-1 to core-2..... Mega-ohm
between core-2 to core-3..... ……..Mega-ohm
between core-3 to core-1..... ……..Mega-ohm
between core 4(neutral) to core 1..Mega-ohm
between core 4(neutral) to core 2..Mega-ohm
between core 4(neutral) to core 3..Mega-ohm

a. High voltage test Voltage Duration

between cores and earth

between individual cores

(This proforma shall be jointly signed by the Engineer-in-charge and the Supplier).

Earthing Network

The entire earthing installation shall be done in accordance with the earthing drawings, specification and instructions of the Engineer-in-charge. The entire earthing system shall fully comply with the Indian Electricity Act and Rules framed thereunder. The Supplier shall carry out any changes desired by the electrical inspector or Bidder in order to make the installation conform to the Indian Electricity Rules, at no extra cost. The exact location of the earth pits, earth electrode and conductors and earthing points of the equipments shall be determined at site, in consultation with the Engineer-in-charge. Any change in the methods, routing, size of conductor etc shall be subject to approval of Bidder/engineer-in-charge before execution.

Earth Pit with Electrode

Plate or pipe type earth electrode with earth pit shall be provided for this work unless otherwise advised by the Engineer-in-charge due to typical site conditions. Earthing electrode and pit shall be as per IS : 3043-1987 (reaffirmed 2001) - code of practice for Earthing). All earth electrodes shall preferably be driven to a sufficient depth to reach permanent moist soil.

For plate type earth pit, size of earth electrode for body earthing of equipment/ electrical panels (LT/MCC/ Switch Board) shall be 600 mm X 600 mm X 6 mm GI plate whereas that for the neutral earthing of transformer, DG Set, PLC & instrumentation earthing shall be 600 mm X 600 mm X 3 mm Copper plate. For pipe type earth pit, size of earth electrode shall be 100 mm NB GI pipe. For ready reference, sketches for pipe and plate type earth electrode earthing pits have been shown in Annexure – III.

PRIOR APPROVAL OF THE ENGINEER-IN-CHARGE SHALL BE TAKEN FOR SELECTING TYPE OF EARTH ELECTRODE (PIPE OR PLATE).

Earth pit centre shall be at a minimum distance of 3m from nearest building, unless otherwise advised. The minimum 3 m distance shall be maintained between centres of 2 earth pits.

Earthing electrodes for Main plant lighting panel shall be plate type with double earthing.

Earth Bus, Earthing Lead and Earth Wire/Strip

All electrical equipment is to be doubly earthed by connecting two-earth strip/wire conductor from the frame of the equipment to an earthing pit/main earthing ring. The earthing ring will be connected via links to several earth electrodes. The cable armoured will be earthed through the cable glands. Conductor size for connection to various equipment shall be as specified in the drawing / as instructed by the Engineer-in-charge. However, the length of the branch leads from equipment to earthing grid/ring shall not be more than 10 to 15 meters.

All hardware for earthing installation shall be hot dip galvanized. Spring washers shall be used for all earthing connections of equipment having vibrations.

Size of earthing lead / wire shall be as specified in schedule of quantities/drawings.

Following may be considered as general guidelines: Sizing of earthing lead/wire

Sr. No.	Item	Size
1	Control switches/ glands	PVC insulated 4 sq. mm copper conductor wire .
2	Motor /Isolators up to 10 HP	PVC insulated 4 sq. mm copper conductor wire.
3.	Motor /Isolators above 10 HP	PVC insulated 4 sq. mm copper up to 40 HP conductor wire upto Cable tray & GI strip 25 X 3 mm
4.	Motor above 50 HP upto 125	GI strip 40 X 3 mm HP
5.	Motor above 125 HP	GI strip 25 X 6 mm
6.	Switch Board / Motor Control	GI strip 50 X 6 mm Centre
7.	Earthing main in trenches	GI strip 50 X 6 mm
8.	Power Control Centre / LT mm Panel Of Sub Station	GI strip 50 X 6

When earthing wire is to be drawn under floor / in underground, Copper conductor wire of 4 sq mm with PVC insulation shall be used.

However, while deciding type & size of earth lead, the resistance between the earthing system and the general mass of the earth shall be as per IS code of practice. The earth loop impedance to any point in the electrical system shall not be in excess of 1.0 ohm in order to ensure satisfactory operation of protective devices.

Copper wire shall be connected to the equipment by providing crimping type socket / lug.

Wherever earthing strip to be provided in cable tray, it shall be suitably clamped on cable tray and electrically bonded to the cable tray at regular interval.

Excavating & refilling of earth, necessary for laying underground earth bus loops, shall be responsibility of the Supplier.

Wherever earth leads/strips/wire are laid in cable trenches, these shall be firmly and suitably cleated to the walls/supporting steel structure on which cable is clamped.

The neutral of the transformer shall be connected to earth pit independently and earth pit shall have copper earth plate of 600 mm X 600 mm X 3 mm.

Long runs of GI strip shall be connected at each end with lap type welding to ensure continuity.

The following selection table shall be followed for starters of motor feeders unless otherwise specified:

Sr. No	415 V Motor HP	Contactor Rating Amps	MCCB Rating Amp.	MPCB Rating Amp.	Type of Starter
1	Up to 3 HP	9	-	9	DOL

2	5 to 10 HP	16	-	16	-Do-
3	12.5 to 15 HP	25	-	25	Star Delta
4	20 to 25 HP	-	-	40	-
5	30 to 35 HP	-	-	50	-Do-
6	40 HP	-	63	-	-Do-
7	45 HP	-	100	-	-Do-
8	50 to 60 HP	-	125	-	Soft Starter
9	65 to 70 HP	-	200	-	-Do-
10	75 to 90 HP	-	200	-	-Do-
11	100 to 125 HP	-	250	-	-Do-
12	150 to 180 HP	-	400	-	-Do-
13	200 to 250 HP	-	400	-	-Do-
14	275 to 400 HP	-	630	-	-Do-

For capacitors, either special capacitor duty contactors shall be used or the rating of contactors / MCCB shall be double of rated current of capacitor.

- The above selection table provides the general guideline. However, technical requirement / specifications, if any mentioned under Section V, will supersede the table given above.

TWO / FOUR POLE STRUCTURE

ISMB 200 x 100 mm to be grounded in concrete 1:2:4 for at least 1/5th length i.e. 2 meters size of concrete pedestal 500x500mm. All necessary civil works such as excavation, centering, concreting and back filling is included in supplier's scope of work.

Interconnecting by aluminum conductor jumpers with connectors/PG clamps etc.

Installation, testing and commissioning of complete two/four pole structure including ISMB & cross channels, G.O. switch, insulators and other items mentioned under equipment supplied for two pole structure.

Complete structure to be provided with two coats of aluminum paint.

ANNEXURE - III

BUREAU OF INDIAN STANDARDS TO BE FOLLOWED FOR ELECTRICAL ERECTION

1. PVC insulated cables (light duty) for Working voltage up to 1100 V Part I & II	-	694-1990
2. PVC insulated cables (heavy duty) for Voltage up to 1100 volts Part I	-	1554-1988
3. -- do -- for voltage 3.3 KV to 11 KV Part II	-	1554-1988
4. Specification for polyethylene insulated PVC duty electric cables, voltage not exceeding 1100 V Part I	-	5959-1970 Sheathed heavy
5. -- do -- voltage 3.3 KV to 11 KV	-	5959-1970 Part II
6. Guide for marking of insulated conductors	-	5578-1970 or 5575
7. Code of practice for installation and Maintenance of power cables up to 33 kV	-	1255-1983
8. Code of practice for earthing	-	3043-1987
9. Guide for safety procedures and practices in electrical work	-	5216-1982
10. Code of practice for installation and Maintenance of AC induction motor starters	-	5214-1969
11. Code of practice for installation and Maintenance of induction motors	-	900-1992
12. Code of practice for installation and Maintenance of switchgears Part I, II, III, IV	-	10118 - 1982
13. Code of practice for installation and Maintenance of transformers Part I	-	10028 - 1981
14. Code of practice for electrical wiring Installation, voltage not exceeding 650 V	-	732-1989
15. Code of practice for electrical wiring Installation (system voltage exceeding 650 V)	-	2274-1963
16. Guide for testing three-phase induction	-	4029-1967

Motor

17. Guide for safety Procedures & Practices - electrical works 5316- In

18. XLPE Cables for working voltage up to And including 1100 Volts - 7098 – 1988 Part I

19. --- Do --- up to 33 kV-7098 – 1988 Part II

20. Boxes for enclosures of electrical -

21. Electric Power connectors - 5561-

22. HRC Cartridge Fuse Link up to 650 V - 2208-

23. Code of Practice for Selection. & Maintenance of Fuse up to 650 V -3108-

24. Cables methods of testing - 10810-

25. Danger / Lattice Boards -3551-

26. National Electric Code - SP :30

ANNEXURE – IV

RECOMMENDED CABLES SIZES FOR INDUSTRIAL WIRING

The following selection table shall be followed for cables of motors unless otherwise specified:

3 Phase 415 V Motor H.P	Aluminum Conductor Cable Size- Sq. mm			
	DOL Starter/Soft starter		Star- Delta Starter	
	Supply side	Motor side	Supply side	Motor side
Up to 7.5	4	4	4	2X4
10	6	6	6	2X4
15	10	10	10	2X4
20	16	16	16	2X6
25	25	25	25	2X10
30	25	25	25	2X10
40	35	35	35	2X16
50	50	50	50	2X25
60	70	70	70	2X35
75	95	95	95	2X50
100	120	2X70	120	2X70
125	185	2X95	185	2X95
150	240	2X1200	240	2X120
180	300	2X150	300	2X150
200	2X150	2X150	2X150	2X150
250	2X185	2X185	2X185	2X185
275	2X240	2X240	2X240	2X240
300	2X240	2X240	2X240	2X240
425	2X400	2X400	2X400	2X400
3 Phase 415 V Motor H.P	Copper Conductor Cable Size- Sq. mm			
	DOL Starter/Soft starter		Star- Delta Starter	
	Supply side	Motor side	Supply side	Motor side
Up to 7.5	2.5	2.5	2.5	2X2.5
10	4	4	4	2X2.5
15	6	6	6	2X2.5
20	10	10	10	2X4
25	16	16	16	2X6
30	16	16	16	2X6
40	25	25	25	2X10
50	35	35	35	2X16
60	50	50	50	2X25
75	70	70	70	2X35
100	95	95	95	2X50
125	150	150	150	2X70
150	185	185	185	2X95
180	240	2X120	240	2X120
200	2X120	2X120	2X120	2X120
250	2X150	2X150	2X150	2X150
275	2X185	2X185	2X185	2X185
300	2X185	2X185	2X185	2X185
425	2X240	2X240	2X240	2X240
In case LAPP/Concab / Equi design of steel braided Copper Cables are used then Minimum size for various rating of motors to be laid between MCC & motors shall be as given in the table below				

Sr. No	Motor ratubg HP	Full Load Current (Amp.)	Type of Starter	Power cable rating (At Amb. Temp. of 45 sq.mm.
1	0.5	1	DOL	3 C or 4 C x 1.5 sq. mm
2	0.75	1.3	DOL	3 C or 4 C x 1.5 sq. mm
3	1	1.9	DOL	3 C or 4 C x 1.5 sq. mm
4	1.5	2.6	DOL	3 C or 4 C x 1.5 sq. mm
5	2	3.7	DOL	3 C or 4 C x 1.5 sq. mm
6	3	4.8	DOL	3 C or 4 C x 1.5 sq. mm
7	4	5.2	DOL	3 C or 4 C x 1.5 sq. mm
8	5	7.8	DOL	3 C or 4 C x 1.5 sq. mm
9	7.5	11.2	DOL	3 C or 4 C x 2.5 sq. mm
10	10	16	DOL	3 C or 4 C x 2.5 sq. mm
11	12.5	19	Star delta starter	3 C pr 4 C x 4 sq. mm (2 runs)
12	15	20.8	Star delta starter	3 C pr 4 C x 4 sq. mm (2 runs)
13	20	28	Star delta starter	3 C pr 4 C x 6 sq. mm (2 runs)
14	25	34	Star delta starter	3 C pr 4 C x 10 sq. mm (2 runs)
15	30	40	Star delta starter	3 C pr 4 C x 10sq. mm (2 runs)
16	40	53	Star delta starter	3 C pr 4 C x 16 sq. mm (2 runs)
17	50	65	Soft starter	3 C pr 4 C x 25 sq. mm
18	60	78	Soft starter	3 C pr 4 C x 35 sq. mm
19	75	96	Soft starter	3 C pr 4 C x 50 sq. mm
20	100	131	Soft starter	3 C pr 4 C x 70 sq. mm
21	125	156	Soft starter	3 C pr 4 C x 120 sq. mm
22	150	189	Soft starter	3 C pr 4 C x 150sq. mm
23	180	227	Soft starter	3 C pr 4 C x 185sq. mm
24	215	271	Soft starter	3 C pr 4 C x 240sq. mm
25	250	325	Soft starter	3 C pr 4 C x 300 sq. mm
26	275	360	Soft starter	3 C or 4 x 185 sq. mm-2 runs
27	300	390	Soft starter	3 C or 4 C x 185 sq. mm- 2 runs
28	335	400	Soft starter	3 C or 4 C x 240 sq. mm- 2 runs
29	375	NA	Soft starter	3 C or 4 C x 300 sq. mm- 2 runs

Note: Cables for motors above 20 HP have been indicated considering soft starters.

For motor rating, 200 HP and above, suitable rating of Bus Duct shall have to be provided depending upon the site requirement / as per the Site Engineer's direction.

Section - 6
Design Basis

Schedule I : Introduction and Design Basis

OMFED envisages to establish complete Greenfield project having integrated dairy plant of 05 LLPD capacity with all required utilities at Arilo-Govindpur, Cuttack, Orissa. The Proposed plant shall have the facility for manufacturing of following products :.

	Sr. No.	Products to be made		Quantity	
	1	**Market Milk**			
		Toned		200000	LPD
		FCM		25000	LPD
	2	UHTMilk		60000	LPD
	3	Paneer		3000	TPD
	4	Pouch Curd		25000	LPD
	5	Cup Curd		3000	LPD
	6	Flavoured Milk in cartoon packs		4000	LPD
	7	Sweet Curd		3500	LPD
	8	Butter Milk		10000	LPD
	9	Lassi		5000	LPD
	10	Ice cream		10000	LPD
	11	SMP		20	TPD
	12	Ghee		8	TPD
	13	Butter		3	TPD

OMFED Dairy Plant shall receive pasteurized/raw chilled milk in tankers. The tankers (either filled or empty) shall be weighed with .two weigh bridges. After weighment, the tankers would be unloaded at any two unloading bays on acceptance of the raw milk through the system, based on measurement of Fat / SNF/Temp. / acidity etc. Chilling of raw milk would be done during unloading process through chillers & stored in any of 3 x 100KL RMSTs.

Stored milk would be processed (pasteurized/skimmed/ auto standardized) & stored in 3 x 100 KL, 4 x 40 KL PMSTs. From the PMSTs the milk shall be either transferred to pouch filling section/ Buttermilk section! Curd section / Paneer section/ UHT section and Ice cream section or at other locations through tanker dispatch. Excess cream shall be stored in aging/ storage tanks after pasteurization.

The Dairy process and product plant, l1KV sub-station shall be designed, engineered, supplied, installed, tested and commissioned. The major area covered under the scope of work shall be milk reception &

processing, cream processing and storage, pouch packing, rinse milk recovery, milk reconstitution section, buttermilk manufacturing and packing, curd manufacturing and packing, Paneer manufacture & packing, UHT milk processing and packing and Ice cream process and packing, CIP (tankers, Process, fermented product processing equipment, pipelines and for product manufacturing plants), allied works of utilities and complete automation of the plant including utilities i.e. refrigeration plant, boiler plant, electrical substation, air compressor etc.

The Dairy shall have one tanker dispatch line for dispatching through tankers after re-chilling raw / processed milk.

Milk reconstitution with chilling facility shall be required for make up of SNF in milk with proportionate blending system before pasteurization.

11 KV Electrical Sub-station covering overhead structures, HT panel, transformers, bus ducts, LT panels, APFC panels, SCADA, auxiliary equipments and accessories shall be designed, engineered, manufactured, supplied, installed, tested and commissioned for the Dairy plant. Ix1000KVA DG sets with allied equipments are required for power backup and uninterrupted operation of Dairy Plant. SCADA of DG sets and 11KV substation shall be interfaced with centralized computer system.

The brief of processing requirement and equipment details are mentioned hereunder.

1.0 TANKERMILKRECEPTION SECTION(30000 LPH x 2 Lines)

The OMFED Dairy Plant shall receive pasteurized / raw chilled milk in road tankers (cap.15000 L to 25000 L). The tankers shall be weighed at weigh bridges.

Milk received in tankers shall be weighed at the weigh bridge (60 MT) provided at the entry of tanker reception bay. The operator shall manually enter tanker ID/select relevant tanker details in the weighbridge PC and the weighment shall be taken automatically. After completion of milk unloading & CIP, the empty tankers would be weighed at the weigh bridge (60 MT) provided at the exit of tanker reception bay The data would be transmitted through network to automation/ETP system for record /MIS/ printing of truck slip & payment purpose.

During tanker unloading operation, milk would also be measured through mass flow meters in each unloading line for inventory/material balancing/functional requirement.

The pasteurized /raw chilled milk received and unloaded at **10°C** shall be chilled to 4°C through a plate type chiller and stored in 3x I00 KL Raw milk storage silos.

Milk samples from the tankers shall be Milk samples from the tankers shall be taken manually for measurement of fat, SNF, acidity/pH and temperature etc. through rapid test instruments. Based on the acceptable parameters and actual results, the tanker consignment shall be accepted or rejected automatically by the system. The *test* results shall be transferred through the automation network to the automation system for acceptance of raw milk/inventory purpose. The communication from milk analyzer and acidometer (these machines to be provided by the purchaser) to the central automation system shall be established by the bidder.

No substandard milk shall be accepted at the Dairy. The automation system will provide indication for rejection of milk having fat, SNF, temperature & acidity/pH etc. not conforming to acceptable range (to be set by the Dairy management). However, the Dairy manager will have authority to override the logic and accept any tanker as per his discretion.

Tanker shall be connected manually to the unloading line. Each tanker shall be emptied to the selected raw

milk silo. The milk reception capacity of the each line shall be designed for **30000** LPH. The average fat & SNF percentage in the raw milk shall be 4% and 8.0 % respectively.

The tankers reception bay shall receive two tankers at a time. There shall be two independent raw milk reception lines through which the milk shall be emptied out from the tankers simultaneously and milk shall be transferred to anyone or two raw milk silos (3 x 100 KL) through 30KLPH PHE chillers & valve battery system. The two tanker unloading lines would have one hose per unloading bay. After milk unloading operation, tankers would be moved forward for CIP. Third tanker bay near CIP bay shall be used for processed milk dispatch (1 line of 20 KLPH for processed milk). The same tanker bay shall be used for bulk chemical tanker reception (1 line each for acid & lye). Accordingly, piping, automation software and tanker CIP lines shall be provided.

The tanker unloading system shall have provision to de-aerate any entrapped air by deaeration vessel and ·to filter the milk by online pipe in pipe type simplex strainer. Immediately after unloading operation, pressurized water flushing facility of milk tankers with soft water shall be provided to recover milk solid particles from the vessel & transfer the same to raw milk silos. For the flushing purpose, predetermined quantity (minimum) of water shall be used to prevent dilution of raw milk in storage silos. Each tanker reception lines shall have timer controlled two hose arrangement for the purpose. CIP of each tanker reception line / hose would be carried out through a flow plate.

Automatic soft water purging/pushing of reception ~ilk lines as p'~r pre-set interval & rinse recovery system shall be provided. Water purging -of all other milk transfer lines shall also be provided. The water purging system shall be magnetic flow meter & timer based. Rinse water flushing of pipelines/ tanks/equipment & recovery of the same in rinse milk collection tank shall also be provided before CIP operations, .

Valve manifold shall be designed to ensure the flexibility in operation & secured (full proot) against mixing of two different flows / CIP fluids in case of malfunctioning in system/equipment or power failure. Pasteurized milk transfer facility from PMSTs to RMSTs for re-pasteurization shall be provided. The lateral beaders of the valve battery shall have independent water flushing & CIP facility without affecting any other operation except that particular silo.

Pneumatically operated drain valves would be provided -at all lowest points/suitable locations in the piping system to ensure complete draining .of entrapped water/very diluted mixed phase from the system.

All equipment, valves, pipes, fittings, instruments shall be sanitary type. Welded connections should be provided wherever practical, to minimize the use of fittings. Sampling valves (easy to operate/easy clean type) to be provided at required points. Necessary controls and instrument including flow meters, level transmitters/sensors, pressure/ temperature sensors/ transmitters, flow switches, proximities etc. shall be provided as per functional requirement.
All reception operations shall be normally performed, controlled & monitored from reception field HMIs/control room. However, there should be a facility to carry out these operations from the central control room also.

SS platform fabricated from chequered plate, box section and staircase with skirting & pipe railing shall be provided for all tanker milk reception & tanker CIP/ dispatch bays. Necessary supports for the tanker bays platform shall be taken from the RCC columns/ beams/ slab in tanker bays. SS collapsible type platform extension with SS railing shall be provided in each bay to approach the tanker man way(s).

Easy approach and safe access to equipments/components/instruments shall be designed in layout and provided, for routine/preventive maintenance. Suitable working platform shall be provided for attending instruments/line components at higher elevation.

2.0 MILK PROCESSING SECTION (20000 LPH x 2 Sets)

The raw milk at 4^0c (max.) shall be drawn from any of the three raw milk silos to balance tank of the any

of the two milk pasteurization plants for pasteurization, cream separation and auto standardization.

It shall be possible to unload milk from any one silo to both the milk processing lines simultaneously. One homogenizer has been considered to use with any of the MPLs.

The capacity of the each Milk Processing Line (MPL) along with Tri-purpose Centrifuge and homogenization system in one of the MPLs with auto standardization unit shall be 20000 LPH. The Dairy plant shall be designed to run either with both the pasteurizers simultaneously or one at a time. The milk separator shall be self-cleaning type with auto flush & auto standardizing unit. Separator bypass arrangement is included in the scope.

The pasteurized milk at 4^0c shall be stored in any processed milk outdoor silos (3x100 L , 4x40KL). This includes silo for storage of standardized milk for milk pouch packing/Buttermilk / Curd / Lassil / UHT plant/Ice cream plant and paneer plant.

Milk pasteurizers would have a re-generative cream chilling section designed for cream outlet temperature at 8°C through a separate plate pack. Sanitary design control valve shall be provided to control the milk flow for cream pre chiller. A separate hot water generator (PHE) shall be provided for having accurate control of hot water temperature with suitable automatic pumping type condensate trap (APT) for complete recovery of condensate ensuring minimum steam consumption to maintain steady temperature as per process requirement to be provided.

Volumetric type flow meter to be provided in each milk processing lines, other transfer lines/other places inside the plant for inventory/ material balancing! functional requirement. Magnetic flow meter shall be provided for tanker dispatch lines & Milk transfer to pouch packing section / Buttermilk Curd / UHT sections and other section. The milk transfer pumps from RMSTs to balance tank of both the MPLs shall be VFD operated.

Piping & automation system shall be provided as per the requirement.

The standardized milk shall be transferred to Milk packing HMSTs and Butter milk /Curd/UHT Plant/paneer plant from PMSTs. For inter silo transfer facility necessary mix proof self cleaning type valves (one row) shall provided/installed in PMST valve battery for processed milk transfer to any of the PMSTs without affecting any other operation except the silo to which it is being transferred. All the transfer lines shall have water push / flushing for TS recovery & CIP facility. Facility to carryout CIP of the lateral header independently shall be provided.

There shall be one pasteurized bulk milk tanker dispatch -Iine of 20 KLPH capacity through road tankers to other dairies. The pump and header available for intersilo transfer of PMST and PMST to RMST transfer shall be used for this purpose. The milk would be deep chilled up to 3°C before dispatch through a chiller. Arrangement for pushing milk lying in dispatch line into tanker through water push & rinse milk recovery is included in the scope. Weighment (tare & gross) of the milk tankers would be carried out in the weigh bridges to measure the outgoing milk quantity accurately for billing purpose & transfer the data through network to automation system! MIS/ ERP. The milk analyzer/acidometer would measure fat! SNF/ Temp/ Acidity/ pH etc. of milk & the data would also be transferred through the network to automation system for recording, printing of truck slip & billing purpose.

The water purging/pushing of all milk transfer lines & solid recovery system shall be provided. The water purging system shall be volumetric flow meter & timer based. Rinse water flushing of pipelines/tanks/equipment & recovery of the same in rinse milk collection tank shall also be provided before CIP operations.

There shall be facility for separate online proportionate blending of chilled rinse milk/Sweet Butter Milk Reconstitued milk/pasteurised cream from CRTs with milk in the balance tank of both pasteurizers shall be

provided with VFD operated pumps and flow meters. All the dosing lines shall have soft water push/flushing arrangement for TS recovery & CIP facility.

Facility for inter silo transfer of milk, Past. milk transfer facility from PMSTs to RMSTs for re-pasteurization and dispatch of pasteurized milk shall be provided by a separate common header. A common VFD operated pump may be used for the purpose. In the event of automation failure, suitable simple and quick manual system to be provided to clear the stored milk from the storage silos/tanks through tankers.

Pneumatically operated drain valves would be provided at all lowest points/suitable locations in the piping system to ensure complete' draining of entrapped water/very diluted mixed phase from the system. .

All equipment, valves, pipes, fittings, instruments shall be sanitary type. Welded connections should be provided wherever practical, to minimize the use. of fittings. Sampling valves (easy to operate/easy clean type) to be provided at required points. Necessary controls and instrument for safety of the product and system including flow meters, level transmitters/ sensors, pressure/ temperature sensors/ transmitters, flow switches, proximities etc. shall be provided as per functional requirement.

Valve manifolds to be designed to ensure the flexibility in operation & secured (full proof) against mixing of two different flows/CIP fluids in case of malfunctioning in system/equipment or power failure. The. lateral headers of the valve battery shall have independent water flushing & CIP facility without affecting other operations except that silo.

The PMST valve battery shall consist of self cleaning type mix proof valves.

All milk processing & inter sectional transfer/dispatch' operations shall be normally performed, controlled & monitored from central control room.

CREAM PROCESSING SECTION (5,000 LPH x 1 unit).

The cream shall be collected at 8^0C in cream buffer tank (1.x 2KL) from both cream separators though cream chillers and shall be pasteurized in cream pasteurizer of 5 KLPH capacity. The raw cream feed pump (5 KLPH) to cream pasteurization unit balance tank shall be VFD operate.

The cream buffer tank valve battery shall consist of self cleaning type mix proof valves. The valve battery shall also receive cream from cream storage/ripening tank for re- processing. The valve battery shall have a SS-304 tray below the valves. The lateral headers of the valve battery shall have independent water flushing & CIP facility without affecting any other operation except that tank. For future expansion of one cream processing line, distance piece is to be kept in the valve battery.

The plate pack for cream pasteurizer shall be for 5 KLPH. Pasteurized Cream shall be stored in 2X15 KL insulated and jacketed cream storage tanks.

Cream pasteurizer would have a separate hot water generation unit (PHE type with both side SNAP/CLIP ON EPRO/viton gaskets) having accurate control of hot water temperature with suitable automatic pumping type condensate trap for complete recovery of condensate ensuring minimum steam consumption to maintain steady temperature as per process ,requirement to be provided.

Piping & automation system shall be provided as per the requirement. The water purging/flushing of all cream transfer lines & solid recovery system shall be provided. The water purging system shall be volumetric flow 'meter & timer based. Rinse water flushing of pipelines/tanks/equipment & recovery of the same in rinse milk collection tank shall also be provided (to be done before CIP operations). The rinse cream recovery system shall be volumetric flow meter/timer/CT based.

Mass flow meters to be provided in cream processing & dispatch lines inside the plant for inventory/ material

balancing/ functional requirement. Necessary mix proof self cleaning type valves to be provided /installed in CRT. valve battery to meet the functional requirement.

One 5 KLPH lobe type/Positive displacement type cream pump shall be installed with mass flow meter at the outlet of 2 x 15 KL cream storage tanks. This pump shall be either used for dosing cream proportionately inany of the two balance tanks of milk pasteurizers. All the cream transfer lines shall have water push! flushing for TS recovery
& CIP facility.

Suitable capacity centrifugal pump .shall be .provided in parallel to all lobe type cream transfer pumps for effective CIP with required flow rate.

Pneumatically operated drain valves would be provided at all lowest points/suitable locations in the piping system to ensure complete draining of entrapped water/very diluted mixed phase from the system. .

All equipment, valves, pipes, fittings, instruments shall be sanitary type. Welded connections should be provided wherever practical, to minimize the use of fittings. Sampling valves (easy to open/easy clean type) to he provided at required points.
.Necessary controls and instrument including flow meters,- level transmitters/sensors,
pressure/ temperature sensors/ transmitters, flow switches. proximities etc. shall be provided as per functional requirement.

The CRT valve battery shall consist of self cleaning type mix proof valves.

All cream processing & transfer/dispatch operations shall be normally performed, controlled & monitored from central control room.

3.0 MILK RE-CONSTITUTION SECTION (Capacity: 0.5 TPH milk powder)

Milk reconstitution with chilling facility shall be required to make .up SNF level of milk with proportionate blending system before pasteurization.

It would be used for reconstituting milk from soft water and whole milk powder or skim milk powder continuously at a temperature of around 30-35 deg C using long funnel fitted with special dry material liquid blending pump. A PHE of 5 KLPH capacity for heating of water/reconstituted milk up to 35-40 degree for effective reconstitution of powder shall be provided. A separate PRE for chilling of the reconstituted milk up to 4
Deg C shall be provided. Facility for the addition of rinse milk shall also be provided. Powder bags would be shifted manually to a SS-304 platform (under the scope of this
tender) & poured into turbo blender hopper. Capacity of turbo blender shall be suitable to reconstitute 0.5 Ton powder per hour. Two RCM 'preparation cum storage tanks of 2 X 5
KL capacity shall be used for preparation of RCM through a 5 KLPH circulation pump, 5KLPH PRE heater, 5 KLPH chiller & a duplex filter with manual changeover facility.
Water addition shall be based on level transmitter as well as magnetic flow meter.

Independent proportionate reconstituted milk dosing system shall be provided (one header) for both the MPLs and one header for BM / curd milk pasteurizers. Each dosing system shall have a VFD operated pump of 05 KLPH capacity and a flow meter. Reconstituted milk shall be dosed proportionately in the balance tanks of respective pasteurizers.

The RCM valve battery shall consist of self cleaning type mix proof valves. The system shall also utilize rinse milk for RCM preparation. The valve battery shall have a SS-304 tray below the valves .. The lateral headers of

the valve battery shall have independent water flushing & CIP facility without affecting any other operation except that tank.

The milk reconstitution operations shall be normally performed from the central control room also. One no HMI shall be provided for 10'cai operation/control of the entire milk reconstitution activity,

4.0 MILK POUCH PACKING

Total packaging requirement considered is 3 LLPD in two shift operation. At present there shall be maximum four variants to be packed in different pack sizes as mentioned below:

Variant	Market	Small Pack 500ml	1 Ltr	
Premium milk	OMFED	20000	5000	25000
Tonned milk	OMFED	150000	50000	200000
Total				**225000**

The pasteurized and standardized milk at 4°C (max.) shall be drawn at the rate of 20KLPH from any of the 03xl00 KL & 4x40KL PMSTs to any of 3X15 KL Horizontal Milk Storage Tanks (HMST) through 3 independent transfer headers. PHE for deep chilling of milk from 7 deg C to 3 deg C in each of the transfer header shall be provided. HMSTs shall be kept at one floor above the pouch filling section. Standardized milk from HMSTs shall be fed by gravity to the insulated balance tanks of FFS pouch filling machines.'

There shall be 2 unloading headers from HMSTs. Each header shall be connected to 3 nos of high speed FFS milk pouch packing machines. -Three HMSTs shall feed milk to any/two at a time unloading headers through valve matrix.

HMSTs shall have milk inlet nozzle at the top with no-foam arrangement and outlet nozzle at the bottom to facilitate simultaneous loading and unloading of the HMSTs. Effective cleaning/CIP of top loading line with no foam inlet shall be provided.

Piping & automation system shall be provided as per the functional requirement.

There shall be facility to transfer balance milk of HMST to rinse milk recovery tank through anyone leaky pouch tank. All the unloading and transfer lines shall have Clp· facility.
.

Valve manifold to be designed to ensure the flexibility in operation & secured (full proof) against mixing of two different flows/CIP fluid in case of malfunctioning 10 system/equipment or power failure. .

The HMST valve battery shall consist of self cleaning type mix proof valves.

Pneumatically operated drain valves would be provided at all lowest points/suitable locations in the piping system to ensure complete draining' of entrapped water/very diluted mixed phase from the system.

Required facilities shall be provided for handling leaky pouches and recovery of milk of the same, There shall be 01 set of leaky pouch milk recovery system. Milk collected from leaky pouch shall be stored in these tanks and pumped through pumps, inline simplex strainer and one 5 KLPH chiller to rinse milk recovery tank.

Water used for jaw cooling of packing machines shall be used after chilling in close loop. Necessary VFD Driven pump(lW+1S), chiller, balance tank with level control and temperature control, Pressure transmitter shall be provided.

The CIP of HMSTs, pipelines and pouch filling machines .after milk solid recovery shall be done from the central CIP system, Necessary CIP hose adaptors, CIP return lines and pump shall also be provided for carrying out CIP for pouch packing machines.

All equipment, valves, pipes, fittings, instruments shall be sanitary type. Welded connections should be provided wherever practical, to minimize the use of fittings. Sampling valves (easy to operate/easy clean type) to be provided at required points. Necessary controls and instrument including flow meters, level transmitters/ sensors, pressure/ temperature sensors/ transmitters, flow switches, proximities etc. shall be provided as per functional requirement.

All milk transfer and unloading operations shall be normally performed, controlled &monitored from central control room.

MILK POUCH PACKING - CRATE WASHING - EMPTY CRATE CONVEYING- CRATE FILLING - FILLED CRATE TRANSFER TO COLD

Double head, high Speed, mechanically operated pouch filling machines (Total 6 nos Double head for 200/500/1000 ml) shall be provided for packing of liquid milk in pouches. These 6 machines shall have a packing capacity of 9000-9500 pouches /hr on 500 ml pouch. The machine shall be PLC operated and shall have modem facility for interfacing/communication with main plant CPU and SCADA / HMI station. Each pouch filling machine shall be provided with SS chute with suitable stopper for the falling pouches. SS tray shall be provided for manually collecting of milk pouches during initial start up. Packed milk pouches shall be conveyed to crate filling area through belt conveyors.

Necessary SS platforms with SS railing for operation & maintenance of the packing machines and suitable approach to filling machine balance tank shall be provided. SS cross over wherever required in the pouch packing section shall also be provided.

Required SS stand/platform to place pouch weighing machine shall also be provided. The suitable no of sitting table for each machine shall be provided for pouch filling machine labors.

SS crate conveyors shall be provided for transfer of both empty and filled milk pouch crates right from reception up to cold store. Dirty crates shall be loaded manually to the fully SS construction crate washer and the washed crates from the crate washer to be conveyed up to the pouch filling area through a set of SS crate conveyors by automatic traffic management system. Each crate washer shall feed crate to one row of packing line consisting of three packing machine

Crate washing shall be done with single track crate washers each having capacity 1200 crates per hour with pre rinsing, washing, after rinse, drying and to ensure proper cleaning. The washed crates shall be fed to crate filling area through suitable conveying system with automatic traffic management system.

Crate conveying from the outlet of crate washer up to the bottom of the hopper for pouch filling shall be automatic based on traffic management system. Packed pouches from the machines falling on the belt conveyor shall be transferred in to the hopper. Once the preset counter for number of pouches is achieved the hopper bottom shall open automatically and the pouches shall fall in the crate below the hopper. Filled crates shall be further transfer to the filled crate conveyor and then to the cold store after manual dressing of the pouches in the crates through automatic crate conveying system and traffic management system. Stacking and further transfer of the crates to the cold room shall be manual.

Required number of crate handling trolleys of SS having sturdy construction shall be provided for internal

handling of crates and dispatch of crates.. Required number of trolleys for handling of filled can of 40 liters having SS construction shall be provided for internal handling of loose milk in packing area.

5.0 CURD, BUTTER MILK, LASSI MAKING & PACKING

Curd shall be manufactured and packed in pouches and" cups in 200 ml / 400 ml pack size. Total volume of curd shall be 28 MTPD. Total packaging requirement in different pack size as mentioned below:

Variant	Pack size	Quantity
Pouch	250/500 ml	25000 Kgs
Cup	200/400 gm	3000 kgs

The pasteurized and standardized milk at 3.5% Fat and 11.0% SNF at 4 deg C (max.) shall be drawn from any of3X100 KL & 4x40KL.PMST.This standardized milk of 3.5% Fat and 11% SNF shall be transferred to balance tank of curd milk processing line of 05KLPH (Common line for curd / Butter milk and Lassi manufacturing). Standardized milk for the curd shall be pasteurized at 90 Deg C with holding of min S min and further chilled up to 4/42 Deg C.

This pasteurized milk shall be stored in to 2 X IS KL vertical intermediate storage tanks at 4 Deg C. The Milk from these tanks shall be further transferred to 2 X 2 KL inoculation tank for pouch curd and 2XSOOL inoculation tank for cup curd through PHE heater of 3 KLPH capacity to heat milk up to 42 Deg C. The culture is inoculated in these tank and then milk shall be packed continuously either in pouches or cups within 1 hour.

Cultured milk from inoculation tank shall be fed to the balance tank of FFS pouch filling machine/ cup filling machine for packing of cultured milk in pouches/cups of 200 mll400ml.

There shall be one unloading headers from 2 X 2 KL buffer tank. One header shall be feeding to 3 no mechanical FFS pouch packing machines and another header to 1 nos rotary cup filling machine.

Piping & other system shall be provided as per the enclosed P&ID diagram.

Water for jaw cooling of curd packing machine shall be taped from facility provided for buttermilk packing machines.

The CIP of tanks, pipelines and curd pouch/cup filling machines after solid recovery shall he done from the separate ClP system. Necessary CIP hose adaptors, CIP return lines and pump shall also be provided.

All equipment, valves, pipes, fittings, instruments shall be sanitary type. Welded connections should be provided wherever practical, to minimize the use of fittings. Sampling valves (easy to operate/easy clean type) to be provided at required points. Necessary controls and instrument including flow meters, level transmitters/ sensors, pressure/ temperature sensors/ transmitters, flow switches, proximities etc. shall be provided as per functional requirement.

CURD POUCH/CUP PACKING - CRATE WASHING· - EMPTY CRATE CONVEYING - FILLED CRATE TRANSFER:

Three double head pouch filling machines shall be provided for packing of cultured milk in pouches for manufacturing of curd in 200 gms and 400 gms. These machines shall have a packing capacity of *S000* pouches/hr. The machine shall be PLC operated. Each pouch filling machine shall be provided with SS chute with suitable stopper for the falling pouches. SS tray shall be provided for.' manually. collecting of

cultured pouches during initial startup. Packed cultured milk 'pouches shall be conveyed to manual crate filling area through belt conveyors.

Necessary SS platforms for operation & maintenance of the packing machines and suitable approach to filling machine balance tank shall be provided. Required SS stand/platform to place pouch weighing machine shall also be provided. The required no. of sitting table for each machine shall be provided for pouch filling machine labours.

Motorized conveyors for empty curd crate transfer' up to the curd section. The filled crates/cartoons to Incubation room, from incubation room to blast room and from blast room up to cold store shall be done manually.

Equipment required for incubation room like electrical heaters with hot air circulation fans to maintain temperature of cultured milk pouches/cups across the room at 42 Deg C shall be provided.

BUTTERMILK MANUFACTURING AND PACKING

Buttermilk manufacturing capacity shall be 10 KLPD. Buttermilk shall be manufactured and packed in 500 ml pouches only. The pasteurized and standardized milk at 1.6% Fat and 9.2% SNF at 4°C (max.) shall be drawn either from any of 3XIOO KL, & 4x40KL PMST. This standardized milk shall be pasteurized in curd milk pasteurizer of 05 KLPH capacity and heated up to 90 Deg C with holding time of min 5 minutes and outlet temperature of either 4 Deg C or 42 Deg C.

This standardized and pasteurized milk shall be stored in a 2X l0 KL vertical curd setting -tank at 37-42 Deg C. At temperature of 37 Deg C culture shall be added manually for the given quantity in the tank and kept for 5-6 hrs to increase acidity up to 0.7 LA. Once desired acidity is achieved and curd is set, it shall be broken with help of specially designed agitator fixed in the curd setting tank. Facility of adding pasteurized water in measured quantity (with flowmeter) to the curd tank shall be provided to facilitate proper breaking of curd and standardization of buttermilk to achieve 1.0% fat and 5.5% SNF of the final product. A dedicated header to dose water from pasteurized water tank to curd setting tank shall be provided. Broken curdlButter Milk shall be chilled in recirculation with the buttermilk hiller and shall then further processed 'through 05 KLPH buttermilk processing line (thermizer). The shear pump shall be provided for smoothing effect of buttermilk. Butter milk shall be thermized to 65 deg C and then chilled to 4 deg C in the PHE. This processed buttermilk shall then be transferred to 2XIO KL horizontal storage tanks (HMSTs) for pouch filling.

Standardized butter milk from HMSTs shall be fed by gravity to the insulated balance tanks of FFS pouch filling machine. Once HMST shall be loaded it can be unloaded for packing after laboratory verification..

There shall be one unloading header from HMST to 1 nos FFS buttermilk pouch packing machiries. Both HMSTs shall feed butter milk to packing machines.

Required facilities shall be provided for handling, of leaky butter milk pouches and recovery of butter milk of the same. There shall be circular insulated open type of tank with suitable cover and perforated SS screen for decaping of pouches shall be provided. Butter milk collected from leaky pouch stored in this tank and pumped through inline strainer and chiller to the vertical insulated butter milk storage tank of 2 KL. Butter milk stored in this tank shall be transferred with pump to the balance tank of buttermilk processing line.

Water used for jaw cooling of packing machines shall be used after chilling in close loop. Necessary balance tank, pump, chiller with level switches and temperature control system shall be provided. The same system shall provide jaw cooling water to curd pouch filling machines as per requirement.

The CIP of HMSTs, pipelines and butter milk pouch filling machines shall be done from the separate CIP system. Necessary CIP hose adaptors, CIP return lines and pump shall also be provided.

All milk/buttermilk transfer and unloading operations shall be normally performed, controlled & monitored from central control room.

BUTTER MILK POUCH PACKING - CRATE WASHING - EMPTY CRATE CONVEYING - CRATE FILLING - FILLED CRATE TRANSFER TO COLD STORE:

One Nos double head mechanically operated pouch filling machines shall be provided for packing of butter milk in pouches. This machines shall have a packing capacity of 5000 pouches/hr (Average speed of 4500 Pouches/Hr). The machine shall be PLC operated. The pouch filling machine shall be provided with SS chute with suitable stopper for the falling pouches. SS tray shall be provided for manually collecting of butter milk pouches during initial startup. Packed milk pouches shall be filled in the crates and then transfer to the cold storage through the twin type motorized chain conveyors.

Necessary SS platforms for operation & maintenance of the packing machines and suitable approach to filling machine balance tank shall be provided. Required SS stand/platform to place pouch weighing machine shall also be provided. The suitable no. of sitting table for machine shall be provided for pouch filling machine labors.

Crate conveyors shall be provided for transfer of both. empty and filled buttermilk pouch crates right from reception up to cold store. Dirty crates shall be loaded manually to the crate washer and the washed crates from the crate washer to be conveyed.up to the pouch filling area through a set of conveyors.

Crate washing for butter milk packing shall be done with one single track SS construction crate washers with poly acetyl chain of 1200 crates per hour with pre rinsing, washing. The washed crates shall be fed to automatic crate filling line through suitable conveying system.

LASSI MAKING AND PACKING

Lassi shall be manufactured and packed in pouches. Total volume of lassi shall be 5 MTPD.

The curd shall be prepared in the curd settling tank as the process described in the buttermilk section.

The sugar syrup shall be prepared in 3 KL tank through turbo blender in recirculation and then stored in the ready syrup tank. The sugar syrup shall be transfer to the curd settling tank and the after thermized the lassi is transferred to the HMST for filling. The lassi is filled in buttermilk pouch packing machine.

The packed lassi is filled in crate and then transfer to the cold storage till dispatch.

SWEET DAHI MAKING AND PACKING

The pasteurized and standardized milk at 3.5% Fat and 11.0% SNF at 4 deg C (max.) shall be drawn from curd milk storage tank. This standardized -milk of 3.5% Fat and 11% SNF shall be transferred to 1.5 KL mix preparation tank.

The batch shall be prepared in mix preparation jacketed tank by adding sugar and stabiliZer and then ,transfer to misti doi jacketed tank. The mix is heated up to 90 deg C and then cooled upto 42 deg C through cooler and then. transfer to the 2X300 L inoculation tank. The cultured is added manually it and filled in cups. The filled cups shall be kept in the CBB and then transfer to the

incubation room where the room temperature shall be maintained at 42 deg C. Once the acidity is. reached, CBB transfer to the blast room for cooling ann then transfer to the cold storage.

6.0 RINSE MILK RCOVERY SYSTEM

Rinse milk recovery system would consist of an un-insulated tank of capacity 1 KL. The rinse milk recovered from various sections shall be first taken in un-insulated tank of capacity 1 KL then subsequently pumped via plate chiller at. the rate of 5 KLPH and stored in insulated rinse milk storage tank of capacity 5 KL.

The recovery of rinse milk to minimize product loses is designed as under :

Road Milk Tankers: The quantity of flush water shall be controlled by timer/flow based operation of the supply valve for soft water. The flushings 'shall be taken in raw milk silos. The water from these flushing shall not be coming to rinse water section.

Equipment handling milkiCreamlRCM: The flush water tanks provided in process CIP systems shall be used for the first pre rinse cycle. Soft water shall initially be pushed to the equipmerit and the rinse shall continue to be diverted to rinse milk recovery till the conductivity sensor activates to divert the stream to drain. Flow meter input will not be of relevance in this case.

Pipe Line Flushes: The milk pipe lines shall be flushed with soft water to push the product and rinse the lines. The quantity of soft water for flushing shall be regulated by flow meter input.

Dosing of Rinse Milk: Rinse milk shall be dosed to the raw milk silo.

Facility for Rinse milk tanks CIP has been provided and CIP process is controlled from PLC as per the pre-programmed operational/cleaning cycles/scheme.

Transfer routes for transferring rinse milk from various sections and transfer lines selected and controlled from PLC as per the pre-programmed operational scheme.

There shall be common CIP return pump for rinse milk balance tank 1 KL and 5 KL Rinse milk storage tank for pumping back the CIP solution back to the central CIP kitchen.

7.0 BUTTER SECTION

Pasteurized and chilled cream from 2x 15 KL cream storage tanks shall be transferred to the balance tank of CBMM in Ghee Section. This cream is then pumped to the 1x800KglHr Continuous Butter Making Machine (CBMM) through VFD driven lobe type or positive displacement type screw pump. White butter obtained from CBMM is collected in Butter trolley. Sweet buttermilk from CBMM collected in a 100 L buffer tank. Sweet butter milk is pumped through 05 KLPH pump, chilled in a 05 KLPH plate type chiller and stored in a 1x 10 KL storage tank. From buttermilk storage tank it shall be transferred to the raw milk silo.

8.0 The butter churn IXl KL shall be used for making table butter. The cream shall be filled in the butter churn and then rotate for butter manufacturing. The butter shall be taken in trolley and fed to the butter packing machine.

GHEE SECTION

The white butter from butter silo through augur screw.shall be fed to a butter pump. The pumped butter shall be melted in spiral-heater IX TPH wherein white butter is melted & heated to 70 deg C by providing heat indirectly by hot water. Hot water shall be generated by plate type heat exchanger using steam. *r* .′

Melted butter is collected in a 2KL melted butter storage tank. Melted butter from Storage tank is passed through serum separator. Concentrated melted butter from serum separator is transferred to 5KL concentrated melted butter tank. Serum separated is collected in 100L buffer tan k and transfer to the 2KL serum storage tank.

If it is transferred to the serum separator, the concentrated molten butter shall then be transferred to the concentrated fat storage tank and then to the ghee boilers.

However, if it is taken to the PSTs it shall then be pumped to ghee kettles (boilers) for ghee manufacturing in a normal way during which residual moisture is evaporated at 113^0C. the ghee recidue is collected in the ghee residue tank for further fat recovery. The suitable fat recovery system shall be provided for fat recovery.

From ghee boiler the ghee shall be transferred to any of the 2 X 2KL ghee settling tanks to settle down the ghee residue by gravity. After some holding, the settled ghee shall be taken from the side outlet of the ghee settling tank then shall be pumped to the lX2KLPH ghee clarifier. The ghee from clarifier shall be collected to the ghee collection balance tank and then n:ansferto 2 X 5 KL Ghee storage jacketed tanks.

The ghee from ghee storage tank shall be send for ghee packing in pouch! jars/ tins and bulk packing.

Piping work for utilities such as air, water, chilled water and steam including supply of piping is in the scope.

Ladders, platforms shall be provided for easy access, operation and maintenance of ghee plant equipments.

The suitable fume extraction system shall be provided for above the ghee boiler.

9.0 CIP SECTION

The CIP System shall be designed for the entire dairy plant.

The CIP systems shall clean all the milk handling equipment storage tanks and pipe line network including milk transfer lines to various sections.

Necessary controls and instrument viz. level sensor, conductivity probes, temperature sensors, transmitters shall be provided to achieve the required CIP operations.

Bulk Storage: 15,000 Litres x 2 Nos.
(One each for Acid & Lye)

Acid and lye shall be received in bulk in road tankers and shall be unloaded into bulk Storage tanks. There shall be chemical unloading ·pump suitable, for the acid and lye application, for unloading of acid and lye. The unloading pump capacity shall be 10, 000 LPH at suitable head.

Two numbers of bulk storage tanks (one for acid and one for lye) having capacity of 15,000 Litres each shall be provided.

The acid and lye solution from the bulk storage tank shall be transferred to the respective dosing tanks through the chemical dosing pump to Process CIP section, tanker CIP section and fermented CIP section. The Lye flakes dissolving tank shall be provided to dissolve the lye flakes when the liquid lye is not available. The acid carbouy tank of capacity 500 L shall be provided when the acid received in the carbouy.

Automated four circuit CIP system

Functional Requirement: The CIP system shall be four circuits, automatic type, suitable to meet the CIP requirement of the milk processing. All circuits of the CIP system shall be capable of functioning

independently and simultaneously. In the CIP System, the cleaning media of desired temperature and concentration shall be prepared and the cleaning process/cycle shall be initiated, controlled & monitored from a central location through a PLC control panel. However the operator will connect the field level connection/distribution and return of the CIP piping manually in product section.

The sequence of operation of CIP system shall generally have the cleaning program listed below

a) Water pre-rinse
b) Hot detergent circulation (Lye Circulation)
c) Hot/ cold water rinse
d) Hot Acid circulation e) Hot/cold water rinse
f) Hot water Sterilization
g) Final drain.

The system shall facilitate bypass of any operation from the above sequence of programs. At the end of detergent and acid cleaning, the solution shall be recovered with the help of conductivity meter provided in the each return line and substandard solutions shall be automatically diverted to the drain.

Between each successive cleaning 'cycle the conductivity meters installed on return lines shall measure the strength of the cleaning solution. If the strength is found less, dosing shall be done through dosing pump controlled by PLC. Suitable numbers of conductivity meters, pneumatic valves and other necessary fittings/instruments 'shall be provided for guiding CIP solutions to the respective tanks or drain. Intermediate rinse shall be with plain hot/cold water. This shall be recovered and reused in initial flushing. The alkaline/acidic traces shall be removed with the .help of cold/hot water. Hot water rinse shall ensure satisfactory cleaning of the lines and equipment. Final rinse water shall be recovered in the recuperation tank. The completion of ClP of every circuit shall be suitably signaled.

The system shall ensure effective cleaning of 'product handling/storage tanks and interconnection product piping, as per standards and norms applicable for dairy plant.

Also, consumption of CIP chemicals and water shall be optimized' by automation. The system shall ensure maintenance of critical parameters for effective CIP, i.e. time temperature and concentration of cleaning solution through the PLC system.

Design Requirement

Capacity: Three circuits' crp system for Process, two circuit CIP system for tanker and two circuit CIP system for fermented product. (Automatic, operating independently) as per requirement.

Controls: The controls shall be comprising of programmable logical controllers (PLC) for executing, controlling and recording pre-programmed cleaning cycles for cleaning and flushing, including LCD display for viewing and programming the PLC operation, as well as depict dynamic display of the CIP system's Flow diagram. The system shall execute each step of the cleaning cycle as per the pre-set parameters such as temperature, time during and concentration ofCIP solution etc. Also, fault conditions shall be recorded
by ,t\J,e system in addition to alerting the plant operator through visual alarm.

The system should be suitable for auto and manual operations. In case of' auto, PLC will execute the programs from first step to last step. In case of 'manual' operation, all the output signals will be controlled manually (by passing processor) through hard-wired toggle switches but without interlocks.

Operation: Human Machine Interface (HMJ): The CIP' system shall be operated with the help of suitable user friendly HMI. The HMI shall provide on-line real-time data regarding plant status, performance information, and operation. The HMI software shall be developed on a Microsoft Windows XP professional or later platform. The HMI shall use suitable graphical user interface (GUI), which shall be designed specifically

for CIP plant operation. The GUI shall consist of pull down menus, pop-up windows, dialogue boxes and icons so that operators can easily control the selection of information displayed. This shall be of Rockwell Automation (Allen Bradley) / Siemens or approved equivalent make. The operations could be in program mode, test mode or runmode.

Program Mode: The system shall be 'user programmable'. A set of cleaning cycles programs required for cleaning of various equipment and pipelines would be worked out and fed into the processor during this mode. Programs· should include different combinations of cleaning sequence requirements. It, shall be possible to set the cleaning temperature and duration of the each cleaning solution to be circulated for the selected cleaning cycle program.

Selection of step/sequence and the set points for 'each step can be set / decided by the operator and can be stored in the PLC as recipes. The stored CIP recipes shall be possible to alter by the authorized person as per the requirement with respect to program sequence, time, temperature etc.

Once started command is given, the processor will execute the following:

Parameter Check: all parameters as given below will be checked and controlled automatically with audio-visual fault alarm.

Levels in concentrated chemical Dosing tanks: Level in concentrated acid and concentrated lye dosing tanks should be checked. In case of low-level audio-visual signal should be available. The level shall be corrected manually.

Level in CIP Tanks: This level should be checked and controlled automatically by operating pneumatic valves (with SS working parts) on mains water supply line.

Concentration of acid /Iye solution in crp Tanks: Concentration of acid and lye solutions in CIP tanks should be maintained through timer based logic. If the measured concentration of cleaning solution is lesser than the preset value, the same shall be corrected by dosing requisite quantity of concentrated acid / lye from concentrated chemical dosing tanks.

Steam and air pressure: Steam and air pressures will be checked and 'if they ate not at the set values then audio-visual fault signal should be given. The pressure should be corrected manually.

Heating of solutions: The CIP solutions kept in respective tanks will be heated in PHE with the help of steam. The temperature shall be controlled through PLC (PID controller). The cleaning solution shall be re-circulated through the respective tank and PHE until the desired set temperature is achieved. Once the temperature of cleaning solution is achieved, it shall be re-circulated through the respective tank, PHE and the selected milk handling equipment and pipeline. The heating loop shall be completed with condensate removal assembly consisting of float type condensate. trap and isolating and bypass valves.

Cleaning cycle: The cleaning solution shall be supplied to the designated equipment or pipe circuit after the set temperature and concentration 'is achieved. The counting duration of each program, in a set of selected cleaning programs, shall begin after the temperature and concentration 'of the' returned CIP solution has reached a preset value, and the cleaning process shall continue till end of the set time and completion of selected program.

The hot water after rinse should go to recuperation tank for two minutes each time at beginning of hot water rinse, which should be used as pre-rinse solution.

Each CIP unit return lines from each CIP Circuit shall be equipped with a conductivity probe and a temperature transmitter. The conductivity probes shall detect the interface between detergent/acid solution and rinse water, and shall be used to control various routing valves in each circuit return

line. These probes shall also detect substandard solutions and divert them to drains. The temperature transmitter shall monitor temperature of water returning during hot water sterilization cycle.

Within each CIP unit, appropriate valve manifolds shall be provided for the CIP circuit to operate independently and for routing of various cleaning fluids to the required section of the process plant.

Additional manifolds shall be provided to allow cleaning fluids to be recovered re- circulated or drained. The equipment/pipelines/tanks being cleaned under each circuit and the number of circuits being used in each system shall be indicated.

The flow in each CIP rerun line is sensed by flow switch to ensure that false connections or leakages in the return line.

The cleaning programs shall have safety interlocks to ensure isolation of the relevant circuit in a section before a cleaning cycle starts. Operation of each CIP unit shall be controlled from the PLC in Auto mode. The operator shall select individual cycles/circuit and cleaning initiated from the control panel. Initiation of CIP program shall be done from the control panel after field return piping is done by operator: manually.

Any system fault shall initiate the following actions:

- The fault shall be logged
- The cleaning solution diverted into the respective tank
- The CIP return pump shall be stopped
- The plant operator shall be alerted through an visual alarm
- The system shall be reset to run mode so as to continue the cleaning program from the point of interruption after the fault is repaired. .

(The CIP system shall supply complete power / control / instrumentation/ communication cables, power points inside the control panel for the above).

Suitable nos. of CIP return pump to pump the CIP solution back to the.centralized CIP circuits at following locations are included in scope of supply

10.0 POWDER SECTION

The proposed milk powder plant shall be designed 'to manufacture agglomerated skimmed milk /WMP powder at 20 MTPD capacity. The plant shall also be able to produce the agglomerated dairy whitener (OW) of suitable capacity at 20 hours continuous operation.

The scope of supply for powder plant mainly shall comprise of the following sections:

- Milk Formulation
- Evaporation Plant
- Multiple pass/stage falling film evaporation plant using one o
- MVR system and suitable TVR system to achieve 48% TS
- Condensate recovery System
- Concentrate Recovery and dilution system
- Spray Drying Plant
- Three Stage Drying Plant o
- Air Heating System
- Powder Conveying & Bulk Storage
- Bulk & Consumer Packing, Storage and Conveying System

- CIP System and bulk conc. acid and lye storage tanks
- Compressed Air System
- Instrumentation & Automation
- Electrical Distribution System
- Services & Utilities
- UPS for Powder Plant controls and automation

Plant Capacity:
As per the requirement skim milk is considered as the principal product and hence designed the evaporator and spray dryer for a capacity of 20 tons per day of agglomerated and non agglomerated SMP based on 20 hours working as per the standard design practice.

MILK FORMULATION

This section shall comprise of milk intake silos, sugar handling & syrup preparation including vitamin! minerals blending unit. Milk shall be made available at the outlet of PMST valve battery in LMP. The milk line from LMP shall be connected to two nos. 40
KL (for new powder plant) level controlled milk silos of evaporating plant for storage, blending and transfer to evaporation balance tank. The CIP for milk supply line & returnline shall be done by the dairy plant CIP system and shall be in the scope of present bid. Milk feed line with CIP line from evaporation plant balance tank in powder plant has to be extended upto inlet of two 40 KL milk silos' proposed for powder plant. Suitable valve battery shall be provided for filling and emptying of the silos in, powder plant.

Sugar bags shall be made available in the storage .room by the bidder. The sugar handling scheme shall comprise of transfer of sugar bags, syrup preparation in vats, filtration of syrup and blending of sugar syrup with the milk storage tanks. Sugar arriving in the storage room shall be transferred by means of overhead electric hoist and taken to the sugar hopper, where the sack shall be cut open manually for unloading the sugar into the hopper for the preparation of sugar syrup in the' sugar vat. Suitable structural platform with staircase has to be provided for the sugar dissolving vats. The sugar shall be dissolved and stored in two sugar solution vats.' After proper dissolving of sugar, the syrup is forwarded to milk silo through duplex filter as per the requirement. An arrangement shall be made for blending of ingredients viz. vitamins & minerals with milk in silos of new evaporation section as·per the requirement. Two nos. of metering pump for dosing of vitamins ill each silo together with water push arrangement shall be provided.

Evaporation Plant

The evaporation plant shall be four effect falling film evaporation plant built up with thermo compression over the first and the second effects and in self-supporting design.

The pre heating temperatures have been kept to 45 Deg. C for avoiding thermophilic bacteria zone to' be achieved in tubular pre heater of straight tube design attached to condenser.

Further heating shall be carried out through regenerative heater by direct mixing with vapour. Further heating shall be done in an indirect heater receivingheat from the flash vapours for regeneration. After two stage regenerative heating a simplex DSI shall be used for heating to ultimate temperature. After DSI two stage flash vessel is provided for heat regeneration.

A holding tube arrangement is provided for product holding times of 1,2 and 3 minutes to be selected by swing over bend / Flow plate arrangement.

Milk from here shall go to multi effect calendria for evaporation. The concentrate from the evaporator shall go to dryer feed tanks.

The sealing cooling of concentrate and condensate pumps as also the sealing water of vacuum pumps has been

drawn from the UG sump provided adjacent to the evaporation plant and circulated through a closed loop. The water collected from Vacuum pump is to be returned to cooling tower.

A plate heat exchanger shall be provided with ice water connection as the cooling medium to further improve the efficiency of vacuumization. This 'would mean close loop circulation of water with better efficiency and no drift losses through cooling tower.

SprayDrying Plant

A special configuration spray drying plant based on multi nozzle atomization with three stage drying through a specially designed fluid bed.

The design of air heaters and dehumidifiers and the related utility consumptions specified in the performance parameters are based on the following input conditions as given below.

Air Ambient air temperature 30°C & moisture mixing ratio
25gmlkg of dry air (dryer size on 16 gm /kg of dry air)
Steam Min 98 % dry, free from foreign matter/Chemicals
. Water Soft water only
Electricity 415 V+5%, 50+3% Hz AC Supply.

The drying chamber shall be cylindrical with specially designed air disperser and cone beneath. The cylindrical and the conical portions are separated and exhaust air is taken out through a duct. An integrated fluid bed have to be incorporated at the end of the drying chamber.

The insulation of drying chamber shell is included in the scope of supply. The insulation of drying chamber top portion shall be included in-the scope ofthis tender.

The fluid bed will be built in three sections namely well mixed section, plug flow drying 'sectron and powder cooling section. It needs to be recognized that the well mix section provided in the fluid bed really helps in keeping the contact temperatures of powder lower and delivers results even better than integrated fluid bed suggested by other manufacturers for sugar rich powders. It forms' the basic reason for our principals to recommend not going in for integrated fluid bed section.

The. air supply units for the fluid bed and a bag filter for powder recovery and heat recuperation unit is in the scope of supply.

One cyclone on one side of the chamber and one fines recycling line is provided. The outlet of the cyclone shall terminate in one blow through valve.

The design is suitable for incorporating lecithination system at a later date

.A suitable bagging arrangement is in the scope of supply. **Condensate Recovery System**

The suitable condensate collection System shall be provided under this tender scope.

The first effect condensate shall be transferred to 5, KL condensate tank to be installed at ground level. This tank will also receive condensate from steam radiator of SD, SFB, fine return radiator, dehumidified air heaters of VF section and other steam condensate from all the PHE's. PHE's shall be mounted at raised RCC platfotm to facilitate gravity transfer of condensate to condensate tank. The condensate shall be transferred to boiler feed water tank through a dedicated pump.

Condensate from main radiator shall be pumped directly to boiler feed water tank.

The condensate from the remaining effect shall be taken to condensate recovery tank proposed on terrace level of the evaporation plant. The clean condensate from the tank shall be transferred to the various point of use and excess shall be used as CfP make up water or during plant start up water or for floor cleaning. Over flow shall go to the UG sump.

CIP System:

A well-designed typical dairy standard automated Clean-In-Place System shall be provided for entire plant. CIP station shall have minimum two numbers of circuits. All the pipe lines and storage equipment shall be cleaned on each emptying if the gap is more than one hour before handling of next product. Each route shall have different flow, temperature and time duration set point and operator can change this recipe configuration from man-machine interface with use of password facility.

It shall be designed for maximum recovery of CIP solution, milk and water using conductivity transmitter on CIP return lines. CIP chemicals shall be dosed in CIP tanks automatically from the bulk concentrated acid and lye storage tanks as per set points given by operator. All CIP operations shall be carried out from control station. Status of each program for particular route is available on Human- Machine Interface. All the drains from CIP system shall be taken outside the room and terminated in the drain/manhole chamber. CIP station shall have CIP tanks, plate heat exchangers, filters, pumps, valves and fittings etc. The system shall be operated and controlled from control station. The details of the on-going CIP program shall be displayed in the control station.

The system shall be totally secured against the mixing of cleaning solutions with the products in case of malfunction in the system or power failure. The system shall be fully automatic and pre-programmed. However, it shall be possible to select/modify the cleaning sequence and duration from the control station. Suitable arrangement with balance tank and pump shall be provided by the bidder for unloading of concentrated acid and lye from road tankers.

Necessary pumps for transfer of concentrated acid and lye to CIP tanks, tanker unloading hoses, SS pipes & fittings with manual and pneumatic valves shall be provided.

EVAPORATION PLANT

The various instrumentation and control loops considered in the supply are as under:

a) Density measurements/controls

Concentrate density Control - 1 no.

Maintain a constant concentrate density at the evaporator by modulating the set point of the thermo compressor steam pressure control loop

b) Flow measurements/controls

1. Product flow to the evaporator - 1 no.

Maintain a constant product flow to the evaporator by modulating the control valve in the product line. The measurement of flow shall be through an electromagnetic flow meter.

2. Seal water flow monitoring - 1 no.

Safe guarding the seal water flow to the pump seals. Alarming in case of too low. .

c) Level measurements/controls

1. Balance tank level control 1 no..

Detection and alarming at low level. On/off control of water supply to the tank at low level. Although not required in our design, we are giving a level transmitter in balance tank for flow control.

d) Pressure measurements/controls

1. Thermo compressor steam pressure control 1 no.

Maintain a constant steam pressure to the thermo-compressor by modulating the steam pressure control valve in the steam line.

2. 1 lot. pressure/vacuum gauges shall be locally provided on equipment like calendria 1, vapour separators, direct steam injection heater, steam to thermo compressor and vacuum pumps. The gauges shall be analogue type.

e) Temperature measurements/controls

1. Product temp. control loop - 1 no.

Maintain a constant product temperature during thermophilic heating and pasteurization/high heating respectively by regulating steam control valve.

2. Last effect temp. Control - 1 no.

Maintain a constant boiling temperature in the last effect by modulating the cooling water control valve in the cooling water supply line. The same control shall effect vacuum monitoring in the last effect.

3. Temp.Iindication - 1 lot

Indication of process temperature on continuous basis for thermophilic heating, pasteurizer, flash vessels, vapour separators, jacket of calendria 1, cooling water inlet/outlet and concentrate outlet.

4. Locally mounted temperature gauges for cooling water inlet/outlet temperature and calandria I and II effect shall be provided. (Total.8 nos. dial type temperature gauges considered). Local pressure indication for steam header, steam to VRC, DSI and vacuum at vacuum pumps shall also be provided.

f) Conductivity sensing of condensate lines

Conductivity sensing loop complete with 3way pneumatically actuated divert valve is included to be provided in discharge line of condensate pump from first effect to detect and monitor murky condensate.

g) Steam Flow measurement

Steam flow meter shall be provided in the main steam line of the entire powder plant

SPRAY DRYING PLANT

Various instrumentation and control loop in the spray drying plant has been provided as per the. requirements of the tender and the scope is described hereunder:

1 no. Temperature control loop with PID control for concentrate pre heating temperature.

2 nos. Drying air temperature control loops for supply of .drying air at constant temperature to the spray drying chamber from steam air heater .

The plant is designed to produce 10000 LPD of ice cream with all standard parameters in one day considering three shift operations. .

Ice Cream Mix Preparation: The high fat milk shall 'be transfer from the pasteurized milk silo. The high fat milk shall be mixed with Sugar, Skim milk powder/ whole milk powder, stabilizer/ emulsifier, flavors etc shall be of best quality.

Mixing & Standardization of various Ice-Cream Mix ingredients shall be done by using Turbo Blender, a PHE type mix heater and mix recirculation pump in Mix preparation tanks. Water/ milk shall be heated to 50 deg C by ice.cream mix heater in order to have efficient mixing of various ingredients. The High Fat milk shall be added directly into the tank and recirculated. After standardization and proper mixing of SMPIWMP, sugar, stabilizer and emulsifier the ice cream mix will be pasteurized in a.continuous ice cream mix pasteurizer. Ice cream mix shall also be homogenized during pasteurization where mix at a temperature of about 65 deg. C shall pass through homogenizer inline with the pasteurizer, for dispersion and disintegration of fat globules added into the mix in the mix preparation tank. Finally the mix shall be regeneratively cooled and then chilled to a temperature of 4 deg. C in the same HTST pasteurizer.

Ice Cream Production: Chilled Pasteurized mix shall be stored in Mix Aging Vats for aging. Flavors as per requirement shall be added into the Flavor mixing tank before the mix is passed through continuous ice cream freezer. Flavored mix shall then go through continuous ice cream freezers followed by fruit feeder and finally to cup '/ cone filling machines to be produced to final cup and cone.ice cream products. Bulk products shall be filled manually at the outlet of ice cream freezer. Products here onwards shall be taken to the hardening room before transferring to the deep freeze for storage till dispatch.

12.0 PANEER SECTION

Plant is designed to manufacture 3TPD of Paneer in three-shift operations. Pre- pasteurized standardized Chilled milk shall be taken from the Pasteurized milk silo to the open type Paneer vats. It shall be heated to 90^0C by milk heater and then cooled to 75 degree by natural cooling. Then citric acid is added to coagulate the milk.

The process of Paneer manufacture involves following steps.

1. Milk standardization, Pasteurization and storing Method.
2. Heat Treatment: Milk is heated to 90^0C by milk heater and then cooling it to 75degree C by natural cooling.
3. Coagulation: Milk is coagulated in Paneer vat by the addition of food grade coagulant (Citric acid).
4. Whey Drainage: whey shall be transferred to the whey storage tank via whey chiller.
5. Hooping: Coagulated mass is transferred manually to the hoops and pressed under the prieumatic press.
6. Pressing: Paneer hoops are placed one above other and pressed by the pneumatic press. Moisture content, strength and P?rosity of paneer depends on the applied pressure.
7. De-Hooping and Cooling of Paneer blocks; Pressed Paneer blocks are cooled to about 4 degree C for better texture and firmness of Paneer (Springy and rubber Body) as well as to facilitate easy cutting and extended shelflife. For cooling Blocks are immersed in cold pasteurized chilled water (4 deg. C).

8. After Cooling Paneer shall be diced and packed in vacuum packing machine.

13.0 APS SECTION

It shall be designed to produce the UHT milk 60000 LPD and 4000 LPD flavoured milk. The sterilizer shall be of capacity 6000 LPH. The milk shall be transfer from pasteurized milk silo to the flavour milk storage tank. The 1 X3KL and 1 xIKL flavoured milk tank,
1 x2 KL lassi tank and 1 x3KL buttermilk tank shall be in the scope of supply for storing the respective product. The transfer pump shall be used to fed the milk / other product to the sterilizer.
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The sterilizer shall be as per the following UHT sterilizer of 6000 LPH with
1) 200/ 500 ml aseptic pouch filling machine for plain milk
2) 200 ml x 9000 PPH Tetra Brick packing machine .for flavoured milk / butter milk & lassi

The plant is designed to process and pack market milk on the basis of three shifts operation involving complete intermediate cleaning between two production runs and considering packing in 500ml and 200ml pouches through two packing machines.

Product & Package mix

Product - Pasteurized Milk TonedMilk. Other milk beverages including viscous products and products with particulate matter up to 1 Cub.Cm can. be processed by suitably designing the plant. The plant shall be design is to be .suitable for liquid milk products and beverages

Processing Temperature - 138°C for 4 seconds or other temperature combinations as required her holding times as may be required.

Package Type - Flexible aseptic pouch Package Mix & Composition .

Two Packaging machine hooked up to a sterilizer and operating with frame size suitable
'to various combinations of package sizes for 200 to 500ml and '200ml respectively. It shall be possible to operate one machine with the sterilizer at turndown capacity by taking accessories offered under option.

Secondary Package - The product can be distributed through long distances and hence disposable card board boxes are proposed for secondary packaging. Pre-formed cardboard boxes shall' be available for manual packing of pouches and manual strapping, if required. For city supplies plastic crates can be employed and crate handling system can be offered if desired.

Throughput Capacities

The sterilizer is state of the art and can be operated up to 33 percent capacity which change can be made on line without stopping production.

The above throughput capacities are subject to packaging machine line efficiencies. Process Description.

The Processing shall be generally as per enclosed the following PID enclosed with this Offer

Product Pre Processing

The pre-pasteurized and standardized milk of required composition shall be taken from pasteurized milk silo and transferred to the milk storage silo ofUHT processing section.

Product Sterilization

The process of sterilization considered is a helical tubular heat exchanger based process with the homogenizer in the non aseptic version..

The helical design provides resonance during cleaning;

A continuous coiled tube without sharp corners, welded seams, joints or seals. This minimizes product accumulation and contamination;

Short CIP and SIP times. Since corners, seams, joints and seals are not present, the cleaning requires significant less (down) time than a conventional straight tube configuration;

Longer life times. Since continuously coiled tubes are being used, a superb resistance to heat stress is ensured. As well as a constant product flow and low resonance during cleaning.

- A turbulent product flow (the scientific .Dean effect) results into an optimum mixing effect, ensuring a superior uniform heat distribution throughout the product. Improvement of up to 20% compared to a conventional straight tube configuration;
- Shorter processing times, resulting in a better preservation of flavour, colour and vitamins. When using straight tubes the product is not heated while passing through the numerous bends, which is lengthening the processing time and resulting in a less constant product flow;
- Due to the substantial reduced shear value when using coiled tubes, less starch is needed to obtain the required degree of viscosity. For example, when processing gelatine less starch is needed;
- Relatively lesser floor space and plan area;
- thermal regeneration percentage of up to 86%;
- processing a wide variety of both low and high viscosity products:
- Minimal product losses at start-up and shut-down of production run, thanks to the single pass product channels. When using the bends of the conventional straight configuration more mixing will occur during product/water change overs, since the bends have one big passage. Coming from a multi tube, bending in a single tube, fmding its way into a multi tube straight pipe' results in a substantial bigger mixing zone.
- Second-stage aseptic homogenization. For special products, e.g. evaporated milk, rec-ombinedmilk, whipping creams etc., a second stage homogenization valve can be connected downstream from the main heater, due to' the high pressure resistance of the tubes.

PROCESS DESCRIPTION

The sterilizer shall have the automatic control system initiates and terminates each phase(Sterilize In Place

(SIP), UHT processing and CIP) and ensures automatic synchronization with the filling machines.

All phases of the process start and stop automatically, except where a program selection (production, intermediate cleaning, main cleaning stage has to be made. The operator should activate this selection. The control- and process settings (times, temperatures, capacities) are adjustable in a simple way.

One operator can operate several U'HT systems. Switching to manual experimental purposes or to optimize the process is possible.

The process features various safety devices. When a safety device is triggered, an alarm message is to be displayed on the control panel.

The process has the following four main phases:.

- .Pre-sterilization
- Production
- Intermediate cleaning operation
- Main cleaning stage

Product Packaging

Double Head Automatic Aseptic Filling Machine for pouch is designed to meet the high requirements for aseptic form, fill and seal type of pouch filling machines. The machine is equipped with H202 treatment and UV lights for film. The machine is equipped for hermetic sealing of pouches and cutting of sealed pouches. The machine is entirely automatic and works on electro-pneumatics. All mechanical pieces together with parts in contact with milk, are of stainless steel, and are mounted on a stainless steel chassis. Plastic Film sterilization is obtained by its passage in a hydrogen peroxide bath and dried by sterile air. The aseptic cabinet is sterilized through atomization of hydrogen peroxide.

Due to the highly aseptic process a shelf life as indicated can be reached. The advanced continuously heated sealing device guarantees strong and reliable seam. The sealing device is service friendly and enables long and smooth operation.

Pouch & Packaging System:

The milk pouches coming from the filling machine shall go to a pouch belt conveyor and shall terminate on to packaging table where an operator shall stack them manually into card board boxes. It is envisaged to transfer the packed cases through portable trolleys to the store.

Manually driven case transporters/ Palleting can be used to stack the .cases in the store.

14.0 CIP SECTION for fermented product

It consist of 3X5KL for lye/acid/hot water tank. and lX6 KL. recuperation tank, 2X20KLPH CIP PHE, duplex strainer etc. The two circuit CIP system shall be used for fermented product. The CIP process as described in the section 9.0.

15.0 SS PIPING AND FITTINGS

SS Pipes, Bends, Support Pipes

The pipe shall be made of AISI 304 confirming to the standards of ASTM A-312. Pipe is outside polished and inside pickled as per dairy standard. . . .

The piping shall be done in welded execution conforming to sanitary design.

SS supporting pipe of square cross section shall be used to support the pipe lines both on horizontal and vertical plains. .

SS support clamps with nipples shall be used for supporting the pipes and fittings.

SS floor plates of standard design shall be employed for vertical supporting and the entire piping shall be executed at two or three levels. .

SS piping shall be generally done as per the tender specifications.
SS Fittings Such as Butterfly Valves, NRV, 3 Way Plug Valves (Manual Valves), flow plates etc.

15.01 AUTOMATION AND INSTRUMENTATION

PROCESS AUTOMATIION

The proposed system to build the control system using DCS or Higher end PLC system. The Proposed system would be built on any of two reputed DCS / Higher end PLC platform which are commonly available in Indian market viz. M/s. Rockwell and M/s. Siemens.

System configuration

We are proposing 1 no DCS or equivalent high end PLC system with I/O in a distributed configuration. Conceptually, there will be a Central controller which will house the main CPU with Communication processors. The Input and Output modules *(*I/O modules) are housed separately in the field panels and away from the main processor. Signals from the field sensors and command from the processor to final control element viz. control valves etc: is exchanged through the *VOs* /communication mode, on a communication link.

The entire Control & Automation System (C&A) shall be "A Totally Integrated Process Control. System" (DCS or equivalent high end smart PLC system. having standard features of DCS) with communication bus connectivity to field *VO* stations, various field equipment/instruments or third party (DCSIPLC) integration for two way handshaking of Signals (viz. Profibus DP, Ethernet VP, Ethernet, ASI etc.)

We have considered Pneumatic valve clusters on ASI communication bus. All flow meters (magnetic; Mass & vortex flow meters), Conductivity meters and field proces3 transmitters (Level transmitters, Temperature transmitters, Pressure Transmitters etc.) are hard wired (4-20mA).

The I/O will be grouped on the basis of number of product processing section and the physical location of sensors and control elements in each processing section. Each group of I/O will form a remote I/O station which will be located close to cluster of field sensors and control elements. The number of I/O modules to' be used in each station will also depend upon the number' 0f field sensors and -control elements. In the proposed configurations, each remote I/O station can have 8/12nos I/O modules of any combination. However, depending upon the I/O in a particular location the number of remote I/O stations can be increased /decreased.

The Proposed Automation system will exchange I/O signals with available communication protocol with help of either direct communication module or gateway converter module as per maximum allowable data exchange between Automation systems.

The system shall support stand-alone architecture for ES/OS/MIS PC with Ethernet as a backbone. High degree of System availability and reliability with necessary spare as per standard are considered. Hot swappable (online replaceable) I/O modules/cards are considered for all Remote 10 panels. Redundancy for power supply is not considered for any RIO & Asi panel.

Main CPU should be compatible for Project requirement with graphics animation. SCADA package should be with license of require tags. The MIS license shall also be with required tags as per plant architecture. The hardware units shall be installed inside suitable wall/rack mounted water tight cabinets. The software development should be as
per standard in accordance to approved process write up.

All the personnel computers (PC) shall have latest configuration at the time of ordering. The specifications 'of PC are considered as per the' tender .document received for bidding and the same shall be supplied.

There will be basically two categories of communication networks -

Control level and Supervisory level (operating in parallel and independently)

The Control level Network is meant for communication between the CPU and I/O modules and the field instruments on communication located remotely in the field. This communication will be through Communication processors installed in the Main Controller rack and Communication Adapter modules/devices installed with each Remote I/O station or Field devices through Profibus /Ethemet/Ethemet I/P.

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The Control level networks will be of following sub-types

1. It is envisaged that all field instruments will communicate with the Central controller on hard wire through field I / O panels (RiO).
2. All flow meters like magnetic, -vortex & IJlMS flow meters will communicate the central controller 'on hard wire through field I/O panel(RIO).
3. Sanitary valves, pneumatic valves etc. will communicate on ASI protocol.
4. The IMCC panel's motors & agitators feeders are on Profibus/Modbus/Ethemet I/P communication with Central controller through Remote I/O station.

MIS reports are shall be required for the process arid the utility plants

At the Supervisory level, there will be a network for communication between Central Controller and PC based OS stations, Engineering Station, and other MIS PC via Ethernet TCPIIP. The quantity of PC considered is as per tender document.

SrNo	Description	Quantity
1	OS / ES PC.	1
2	OS PC.	1
3	MIS Server PC	1

Operational Features

The automation system offered will have facility to control all the operations of the plant from the central control room.

Process can be controlled from any of the located areas OS & ES/OS in main control room. There

will not be any distribution of Control areas between the stations.

The sequence for a process will be started from the OS station through a Screen Menu. All the available options for parameter selection by the operator before starting a particular sequence will be displayed on the screen of OS statioris. Operator will be prompted to make an entry into the menu. If the sequence is started without making a proper entry, the control system will not start the sequence and a message will be displayed on the screen to inform operator about the mistake. .

Once the command for starting a sequence is given to the system from OS the control function will be taken over by the DCS/PLC. The necessary interlock required for a sequence will be built into the DCS software. If the inter-lock for a particular sequence, prior to starting that sequence, is not 'satisfied the system will not start the sequence and a message will be displayed on the OS station stating the type of interlock fault that has occurred. If interlocks get satisfied the system will actuate all valves and pumps which come in the path of that sequence.

Sequence once started will get terminated under the pre-defined process conditions for that sequence like - any interlock fault, high level in the target vessel, low level in the source vessel etc.

Interlocks will also be built into the system to take care of any contention for a particular valve or pump which are used in more than one sequence as per approved process write up. If a sequence is using a set of valve or motor and if an attempt is made to start any other sequence which also uses the same set of valves and motors, then the sequence started later will get terminated and a message will be displayed on the OS. The central automation system shall be located in the main control room of the plant.

16.0 REFRIGERATION SYSTEM

As required for different process operations & milk reception section, Centralized refrigeration system of 180 TR X3 (2W+ IS) nos. screw Compressor. Shall be provided. The Ammonia based system is complete with Screw compressors, evaporative condenser, economizer and chiller with Ice silo & pumping system, and other ancillary equipment with chilled water pipes & fittings. The cold store for milk storage, buttermilk storage, Dahi blast room and cold storage, paneer cold storage and butter cold storage and deep 'freeze for butter and ice cream is in the scope of supply.

17.0 STEAM GENERATION SYSTEM

The scope of work for steam starts from the supply of 2 x 8000 Kg/hr steam boilers. These boilers shall be connected to a HP steam distribution header to be installed in the boiler house. The boiler should be operated wthcoal and LPG.

After HP steam distribution header a pressure reducing station shall be installed and low pressure steam line shall be taken to the process and product section.

All steam pipelines would be insulated. Maximum recovery· of condensate generated would have to be ensured and collected in a condensate recovery tank installed adjacent to the dairy block. The condensate so collected would have to be pumped to an overhead condensate storage tank from where condensate would be used for CIP or for use in boiler as required. All steam and condensate pipelines would be insulated and cladded.
The HP and LP steam piping shall be in the scope of supply. The suitable PRS shall be consider as per the requirement of the plant is in the scope on supply.

The feed water tank, coal and ash handling system, chimney. and all the other accessories required is in the scope of this tender.

18.0 WATER HANDLING SYSTEM

Raw water received from surface source shall be collected in a underground sump tank. This sump shall have two compartment each having capacity of 1 Lac litre.

First compartment shall be used to store the water from surface source. Raw water from 1st compartment shall be pumped to raw water filtration unit and stored in 2nd compartment of underground sump.

A raw water hydro flow system shall be provided to supply water to required locations. This location shall be following:

1. Water softening Plant
. 2. Washing points.in dairy plant

The water storage tank (RCC construction) shall be used to store the soft water and treated RO water shall be stored in 50,000 Litre water storage tank.

A water softening plant of capacity 30 KLPH shall be supplied to cater the soft water requirement of plant. The water shall be store in the lst compartment of overhead tank.

Soft water from the overhead shall be distributed to following point:

1. CIP section
.2. Boiler Feed water Tank
3. Refrigeration plant
4. Can washers
5. Crate Washer
6. Refrigeration plant IBT

A RO treatment plant of 25 KLPH capacity shall be supplied to generate RO water as per requirement of the plant. RO water shall be stored in 50KL water storage tank.

RO water hydro flow system shall cater the requirement of following locations:

1. Reconstitution section
2. Milk Line flushing points
3. Drinking water point

19.0 COMPRESSED AIR HANDLING SYSTEM

The VFD driven non-lubricating screw air compressor in acoustic enclosure & with after cooler & automatic moisture separator (2 W + IS) .of 55.0CFM' *is* required to be supplied, installed and commissioned along with suitable air dryer; air receiver etc. and with all accessories.

Compressed air pipe to all the consumption points is included in the scope of work.

20.0 STRUCTURAL BRIDGESIPLATFORMS

The required pipe bridge between utility and plant building shall be in the scope of supply. The support for these platforms shall be taken from the civil building beams and *I* or columns. Approach to these platforms

would be provided from the nearest building floor level through suitable walk way and *I* or ladders. Railings -:- up to 1 M height, shall be provided, wherever required.

The structural platform shall be included as following:

- Pipe supports - SS in side process areas and MS in other areas
- Pipe Bridge as per the equipment layout
- Interconnecting Platform for silos with necessary supports including one no. Spiral ladder for access top of silo from the terrace.
- Railing and collapsible platform to reach tanker top in reception
- CIP tank platform all CIP station: CAT walk platform in packing room.

21.0 INDUSTRIAL ELECTRICAL LT

Tender scope starts from downs tream of Main supply 11 KV HT line.

4- Pole structure, Vacuum Circuits Breakers, Transformers, PCC, Intelligent MCC shall be considered and digitally connected with main control system. Cable laying from 11KV HT Line to MCC through PCC and MCC to all motors & points wherever required are included in scope of supply.

HT & LT Power distribution including controls to all the motors of equipment is included in the scope of work. PCC and Motor control centres (MCC) along with power factor improvement panel also included in scope of supply.

HT power shall be made available at the two pole structure by the purchaser. The new substation shall be supplied. HT power shall be 11 KV, 50 Hz, 3 Phase.

The outgoing feeder from HT panel will go to the 1 No 1500 KVA 11 KV/440 V step down transformer. Transformer should be of oil type with on-load tap change arrangement.

Power from the transformer shall be fed to PCC Panel.PCC Panel shall be having two incoming feeders:

a. From Transformer
b. From DG set

A DO set of suitable capacity shall be supplied and installed in the dairy plant. Followings shall be the outgoing

feeders of the PCC Panel:

1. Reception Section MCC
2. Process & CIP Section MCC
3. Utility Section MCC
4. Refrigeration Section MCC
5. Street Lighting and Internal electrification
6. ETP Plant

LT power to the all motors shall be distributed. Local control panels shall be supplied in the plant wherever required.

22.0 LABORATORY EQUIPMENT

The reception 'and main laboratory shall be equipped with full set of instruments, equipment, utensils, glass ware, computer and furniture required to carry out tests required below. Instruments shall incorporate latest technology and be of the electronic type wherever relevant.

The following laboratory equipments have been considered in the scope of supply:

Sr.No.	Equipment name	Qty
1	Gerber Test Equipment	1
2	MBR Test kit	1
3	Sediment Analyser	1
4	Phospatase Test kit	1
5	Raw milk density meter	1
6	Acidimeter	1
7	Sampling Kit	1
8	Plate count test kit	1
9	Swab test kit	1
10	Advance range electronic pH meter	1
11	Chlorine Sanitiser strength analyser	1
12	Majonnier Fat tester	1
13	Water examination test kit	1
14	Infra red milk analyser	1
15	Electric autoclave	1
16	Polarimeter	1
17	Microscope	1
18	Magnetic stirrer	1
19	Causticity / acidity test equipment	1
20	Coliform bacteria test equipment	1
21	Colony counter	1
22	High precision weighing balance	1
23	Heavy duty hot air even	1
24	Incubator	1
25	Distilled water unit	1
26	Antibiotics test kit	1
27	Anaerobic count analysis equipment	1
28	Microwave even	1
29	Laboratory equipment	1

Laboratory test and analysis result shall be transmitted to automation system for data legging, analysis and reports wherever such facilities are available with the instruments. Computer and printers shall be installed in reception' and main laboratories for this purpose but the result from instruments having interface ports shall be direct to the automation system if it is specified in the scope of supply.

23.0 FIRE FIGHTING EQUIPMENT

Quantity: 1 Lot

Smoke detection & alarm system in' main centro I rooms and fire extinguishers in the plant as per statutory requirement is included in the scope.

24.0 WEIGHING EQUIPMENT

The suitable weighing scale shall be provided at pouch packing machine
1. 1-5Kg 5Ne. .
2. 200Kg 2NO.

25.0 Elec. **Weigh bridge**

Weighbridge 60 MT shall be generally used for the following purposes

- For weighing of incoming filled Raw milk tankers
- For weighing of incoming filled tankers of lye and acid
- Any other tankers/vehicles bringing in material to the dairy and requiring to be weighed

Communication of data from weighbridge to central system is included in the scope of supply.

26.0 SPARES

The spares for 2 year normal operation shall be in the scope of supply.

27.0 MISCELLANEOUS ITEMS

The suitable size and no. of steam water mixing battery shall be in the scope of supply at the wash point.

Section - 6

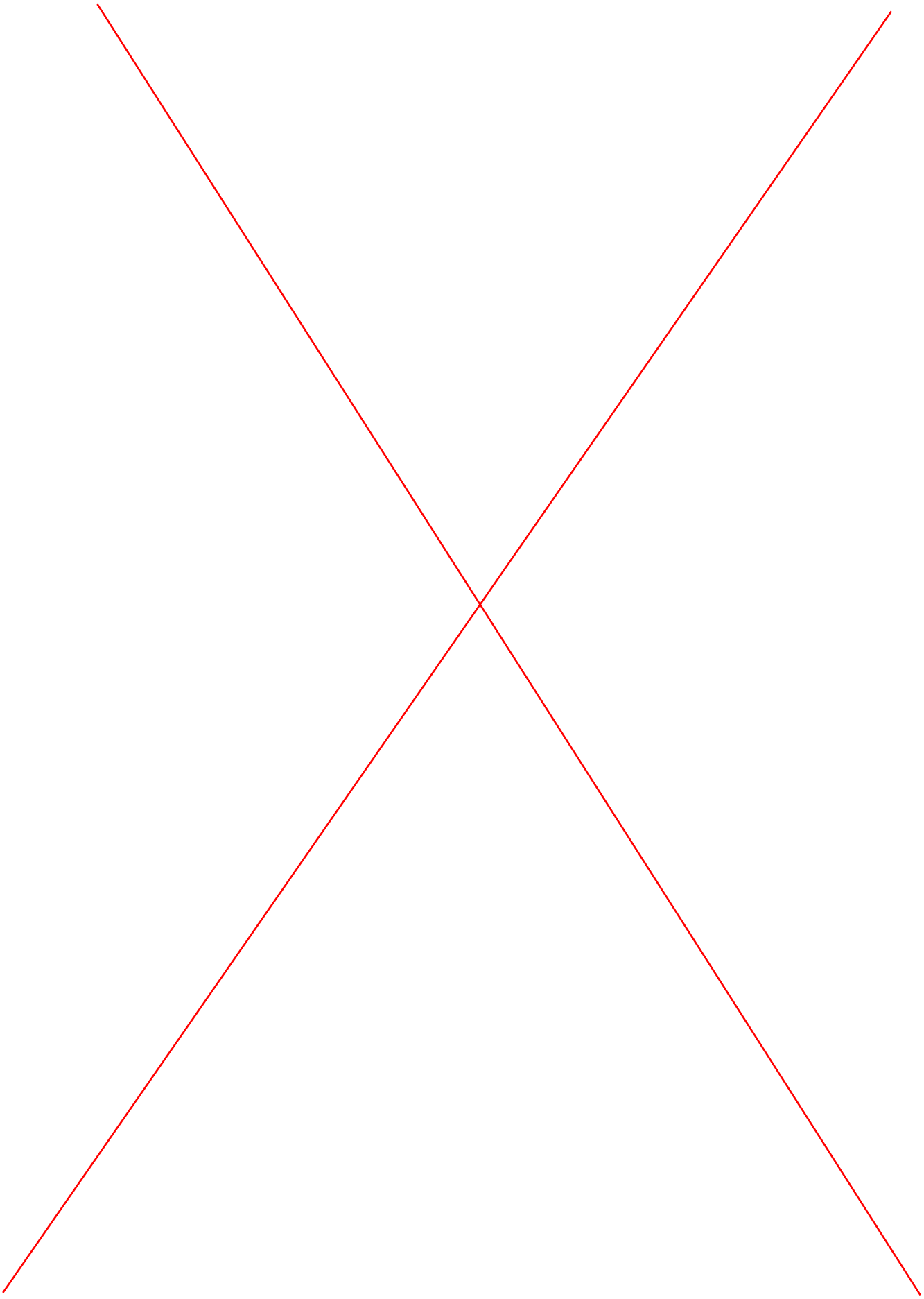
Technical Specifications

Part - I
SCHEDULE OF QUANTITY

Part - I -Technical Specifications – civil Works

Sl No.	DESCRIPTION	UNIT	AREA IN SQM
1	MILK RECEPTION AND PROCESSING BLOCK	SQM	5000.00
2	MILK PACKING AND PROCESSING BLOCK	SQM	6000.00
3	PRODUCT PACKING AND PROCESSING BLOCK	SQM	3500.00
4	SERVICES AND UTILITY BLOCK	SQM	1100.00
5	ICE-CREAM PLANT	SQM	1500.00
6	LT , HT, DG AND TRANSFORMER	SQM	300.00
7	CENTRAL STORE /GODOWN	SQM	8000.00
8	POWDER PLANT BLOCK	SQM	3200.00
9	ADMINISTRATIVE BUILDING	SQM	700.00
10	SHED FOR AIR COMPRESSOR, DG AND OTHER UTILILTY	SQM	500.00
11	02 NOS MAIN ENTRANCE GATE AND 02 NOS SECURITY CABIN	SQM	40.00
12	WEIGH BRIDGE AND SCALING ROOM	SQM	20.00
13	WORKERS REST SHED, CONTROL ROOM , FIRST AID ROOM AND LABOUR CHANGING ROOM	SQM	450.00
14	CANTEEN BLOCK	SQM	450.00
15	LABORATORY BLOCK	SQM	200.00
16	MACHINE FOUNDATION, MS STRUCTURAL PLATFORM AND SUPPORTS AS PER REQUIREMENTO F ENTIRE PLANT (CIVIL FOUNDATION FOR MILK SILO, MECHANIM , GROUTING, WALL CUTTING AND HOLES AND FINISHING ETC.)	LOT	1 LOT
17	SCRAP YARD	SQM	2000.00
18	CYCLE STAND	SQM	1100.00
19	UHT PLANT	SQM	2000.00
20	TOILET BLOCK(FOR ADMINISTRATIVE BUILDING,PLANT SIDE AND COMMON TOILET)	SQM	100.00
21	SHED PARKING FOR TANKER	SQM	4000.00

22	HARD PARK(INTER CONNECTING ROAD /CONCREATE HARD PARK)	SQM	6000.00
23	COAL YARD	SQM	3000.00
24	BOUNDARY WALL FOR Ac 51.0 Dec	RMT	2100.00
25	LAND DEVELOPMENT FOR Ac 51.0 Dec	SQM	105000.00
26	LAND SCAPPING FOR Ac 51.0 Dec	SQM	200000.00
27	WATER SUPPLY ,DEEP BORE WELLS(3 NOS) ,WATER SUMP,PIPE LINE AND DRAINAGE SYSTEM	LOT	
28	SANITARY	L.S.	1.00
29	CIVIL STRUCTURAL WORK OF EFFULENT TRATMENT PLANT – 15lakh ltr /day	L.S.	1 SET
30	4 POLE STRUCTURE , TRANFORMER AND CONNECTION FROM GRID INCLUDING VCB, LT PANEL, MCC PANEL	L.S.	1.00
31	INTERNAL ELECTRIFICATION FOR ALL THE BUILDING AND STREET LIGHTING FOR THE TOTAL PLANT BUILDING AREA	L.S.	1.00
32	FURNITURE AND FIXTURES	L.S.	1.00
33	AMC FOR ONE YEAR AFTER HANDING OVER	L.S.	1.00
34	FIRE FIGHTING EQUIPMENTS	L.S.	1.00



Sl. No.	Item Description	AREA IN SQM / LOT/ CAPACITY	Units/ QTY.
1	2	3	4
1	**Civil Works**		
2	MILK RECEPTION AND PROCESSING BLOCK	5000	SQM
3	MILK PACKING AND PROCESSING BLOCK	6000	SQM
4	PRODUCT PACKING AND PROCESSING BLOCK	3500	SQM
5	SERVICES AND UTILITY BLOCK	1100	SQM
6	ICECREAME PLANT	1500	SQM
7	LT , HT, DG AND TRANSFORMER	300	SQM
8	CENTRAL STORE	8000	SQM
9	POWDER PLANT BLOCK	3200	SQM
10	ADMINISTRATIVE BUILDING	700	SQM
11	SHED FOR AIR COMPRESSOR DG AND OTHER UTILITY	500	SQM
12	02 NOS MAIN ENTRANCE GATE AND 02 NOS SECURITY CABIN	40	SQM
13	WEIGH BRIDGE AND SCALING ROOM	20	SQM
14	CANTEN	450	SQM
15	WORKERS REST SHED, EMG. CONTROL ROOM AND FIRST AID ROOM	450	SQM
16	LABORATORY BLOCK	200	SQM
17	MACHINE FOUNDATION	1	L.S.
18	SCRAP YARD	2000	SQM
19	CYCLE STAND	1100	SQM
20	UHT PLANT	2000	SQM
21	TOILET BLOCK	100	SQM
22	SHED PARKING FOR TANKER	4000	SQM

23	HARD PARK	6000	SQM
24	COAL YARD	3000	SQM
25	INTERNAL ROAD	18000	SQM
26	BOUNDARY WALL FOR Ac 51.0 Dec	2100	RMT
27	LAND DEVELOPMENT FOR Ac 51.0 Dec	105000	SQM
28	LAND SCAPPING FOR Ac 51.0 Dec	200000	SQM
29	OVER HEAD WATER TANK	2	NO
30	UNDER GROUND WATER TANK	2	NO
31	3 NOS BOREWELL AND WATER SUPPLY	3	NO
32	SANTITARY	1	L.S.
33	EFFLUENT TRATMENT PLANT	1	L.S.
34	UNDER GROUND DRAIN AND EFFLUENT DRAINAGE SYSTEM	1	L.S.
35	4 POLE STRUCTURE , TRANFORMER AND CONNECTION FROM GRID	1	L.S.
36	OUT DOOR ELECTRIFICATION AND STREET LIGHTING	1	L.S.
37	UNDER GROUND CABLEING AND HUME PIPING	1	L.S.
38	INTERNAL ELECTRIFICATION	1	L.S.
39	FURNITURE AND FIXTURES	1	L.S.
40	AMC AFTER HANDED OVER	1	L.S.
41	FIRE FIGHTING EQUIPMENTS	1	L.S.
42	**PROCESS & PRODUCTION EQUIPMENT**		
43	**RECEPTION EQUIPMENT**		
44	**RECEPTION EQUIPMENT INCLUDING STORAGE**		
45	Tanker uploading hose with fittings(2 Nos. for unloading 2 nos. for CIP and 1 no. extra)	5	Suitable

46	Tanker uploadng pump	2	30 KLPH
47	Simplex pipe in pipe Inline strainer	2	30 KLPH
48	SS Deaeration vessel	2	30 KLPH
49	Reception & tanker CIP Control panels	1	LS
50	Self supported hot dip galvanised Steel platforms for approach of tanker with SS railing	1	LS
52	Raw Milk Chiller (10-4 Dec.C)	2	30 KLPH
53	Raw Milk Silo	5	60 KL
54	CIP Return Pump	3	20 KLPH
55	Mass Flow meter	2	Suitable
56	**CHILLING & PROCESSING EQUIPMENT FOR MILK AND CREAM**		
57	Milk Trtansfer pump from RMST to Pasteurizer	2	20 KLPH
58	Inter silo Mil Transfer/ Raw Milk despatch pump	1	20 KLPH
59	Magflow Meters	3	20 KLPH
60	Raw/ Pateurized Milk Despatch Chiller	1	20 KLPH
61	Milk Pasteurizer with all accessories	2	20 KLPH
62	Self cleaning Tripurpose centifuge with Autro Fat Standardisation Unit	2	20 KLPH
63	Operating water system for separator	1	Suitable
64	Sludge treatment & disposal system	1	Suitable
65	Sludge Transfer Pump	2	Suitable
66	Sludge storage tank	1	500 L
67	DSI	1	Suitable
68	Electric hoist with mono rail structure fpr separators	1	3 Ton
69	Milk Homogenizer	2	20 KLPH

70	Pasteurized Milk Silo (PMST)	3	100 KL
71	Pasteurized Milk Silo (PMST)	4	40 KL
72	Pasteurized Milk Transfer to HMST	2	20 KLPH
73	Past Milk Inter Silo. Repasteurization/despatch pump	1	20 KLPH
74	Milk transfer pump to Ice cream & Paneer section	2	10 KLPH
75	CIP Return Pump	1	20 KLPH
76	Milk transfer pump to Curd making & APS Plants	2	10 KLPH
77	Milk Despatch (Tanker loading) hose food grade	1	Suitable
78	Cream balance tank	1	2000 L
79	Cream Transfer pump (Screw) with VFD	1	5 KLPH
80	Cream Pasteurizer	1	5 KLPH
81	Cooling Tower ith pumps for Cream Pasteurizer	1	Suitable
82	Cream Storage cum Ripening Tank	2	15 KL
83	CIP Return Pump for Cream Tank	1	20 KLPH
84	Cream Pump (Screw) with VFD for transfer of Cream to Butter section and dosing to Milk silo for Fat correction)	2	5 KLPH
85	**RECONSTITUTION EQUIPMENT**		
86	**MILK RECONSTITUTIN SECTION**		
87	Turbo Blender	1	500 Kgs./Hr.
88	Water heater PHE with Water flow meter	1	5 KLPH
89	Duplx Pipe in Pipe Fillters	1	5 KLPH
90	Reconstitution Milk Tank	2	5 KL
91	CIP Return Pump	1	20 KLPH
92	Milk Recirculation-cum-Transfer Pump	1	5 KLPH

93	Reconstitution Milk Chiller	1	5 KLPH
94	**MILK POUCH PACKING SECTION**	1	3 LLPD
95	Milk Filling Tanks (HMST)	3	15 KL
96	Crate Washer	2	1200 CPH
97	Crate Conveyors for Empty & Filled Crates	2	LOT
98	Pouch Filling Machines	6	10000 CPH
99	SS Chute and Collectin Trays	12	Suitable
100	Electronic Weigh Scale	4	0-2 Kg.
101	Cooling Water Balance Tank	1	Suitable
102	Cooling Water Circulation Pump	1	Suitable
103	Cooling Water Chiller	1	Suitable
104	Leaked pouch dump tank	1	Suitable
105	Inline Strainer	1	Suitable
106	Leaked pouch milk pump	1	Suitable
107	CIP Return Pumps	2	20 KLPH
108	Pouch Deep Milk Chiller	2	20 KLPH
109	Cat walk platform, SS stool, cross overbridge etc.	1	Suitable
110	**CURD, BUTTER MILK, LASSI MACKING & PACKING**		
111	**CURD MAKING & PACKING**		
112	Curd Milk Pasteurizer with accessories: Outlet 42 deg.C/ 4 deg.C	1	5 KLPH
113	Curd Milk Storage Silo	2	15 KL
114	CIP Return pump for Curd milk silo	1	20 KLPH
115	Curd milk transfer pump to balance tank of curd milk heater	1	3 KLPH

116	Balance tank for Curd milk heater	1	200 L
117	Curd milk transfer pump from balance tank of curd milk heater to innoculation tank	1	3 KLPH
118	Curd milk heater	1	3 KLPH
119	Innoculation tank	2	500 L
120	Cup filling machine Linear	1	4000 CPH
121	Incubation room	1	Suitable
122	Inkjet printing machine	1	Suitable
123	Belt Conveyor	1	Suitable
124	SS Table for Cup packing	1	Suitable
125	Innoculation tank	2	2000 L
126	Pouch Curd cup filling machine	3	5000 PPH
127	**BUTTER MILK AND LASSI SECTION**		
128	Curd setting cum Butter Milk preparation tanks (jacketted) for Butter milk/ Lassi	2	10 KL
129	Recirculation cum transfer pump	1	10 KLPH
130	Shear Pump	1	10 KLPH
131	Butter milk chiller	1	10 KLPH
132	Pasteurized water tank	1	15 KL
133	Pasteurized water transfer pump	1	10 KLPH
134	Butter milk Thermizer	1	5 KLPH
135	Butter milk/ Lassi Horizontal Storage tank Insulated	2	10 KL
136	Butter milk filling machine	1	5000 PPH
137	CIP Return pump for Curd setting cum Butter milk/ Lassi Preparation & Storage tanks	2	20 KLPH
138	Sugar syrup Preparation tank	1	3 KLPH

139	Turbo blender	1	1 TPH
140	Recirculation cum transfer pump	1	Suitable
141	Ready Sugar Syrup Storage Tank	1	3 KL
142	Sugar Syrup Transfer Pump	1	5 KLPH
143	Twin filter for Curd and Butter Milk	1	10 KLPH
144	Crate washer with drier and conveyor	1	1200 CPH
145	Two tier crate conveyor	1	Suitable
146	SS Packing Table & Cross over bridges	1	Lot
147	Electronic Weigh Scale	2	0-2 Kgs.
148	Cooling Water balance tanker with float & accessories	1	1000 Ltrs.
149	Cooling water recirculation pump (SS)	1	10 KLPH
150	Cooling water PHE Chiller	1	10 KLPH
151	Trolly mounted leaky pouch collection tank	2	50 L tank
152	Leaky pouch dump tank	1	1 KL
153	Inline duplex Strainer	1	5 KLPH
154	Leaky pouch milk PHE	1	5 KLPH
155	Leaky pouch milk transfer pump	1	5 KLPH
156	Lassi Storage tank	1	5 KL
157	Butter milk transfer pump to thermizer balance tank	1	5 KLPH
158	**Sweet Curd**		
159	Mix Preparation Tank for Misti Doi	2	1.5 KL
160	Turbo blender for Misti Doi	1	500 Kg./Hr.
161	Centrifugal Pump for circulation	1	5 KLPH

162	CIP Return Pumps	2	20 KLPH
163	Milk Transfer Pump to Misti Doi tank	1	2 KLPH
164	Misti Doi Storage Tank	1	1.5 KL
165	Milk Transfer pump to Innoculation tank	1	2 KLPH
166	Chiller for Misti Dahi Milk cooling	1	2 KLPH
167	Innoculation tank	2	300 L
168	Cup filling machine Rotary	1	2000 CPH
169	CIP Return Pump	1	20 KLPH
170	Cup conveyor	1	Suitable
171	Inkjet Printer for Cup printing	4	Suitable
172	**RINSE MILK RECOVERY SYSTEM**		
173	SS Balance tank for rinse milk recovery	1	1 KL
174	Rinse Milk transfer pump	1	5 KLPH
175	Rinse Milk chiller	1	5 KLPH
176	Insulated vertical SS store tank for rinse milk	1	5 KL
177	CIP Reutrn Pump	1	20 KLPH
178	Milk transfer pump to RMST	1	20 KLPH
179	**BUTTER MAKING EQUIPMENT**		
180	**CONTINUOUS BUTTER MAKING SECTION**		
181	Cream balance tank	1	Suitable
182	Cream Transfer pump (Screw) with VFD	1	2 KLPH
183	Continuous Butter making Machine for White Butter	1	800 Kg./Hr.
184	Butter Milk balance tank	1	100 L

185	Wash Water Balance tank	1	100 L
186	Butter hopper with auger, covers, level sensors, controls	1	1 T
187	Butter Trolleys	3	600 Kgs.
188	Butter Churn with VFD for Table Butter	1	1 KL
189	Butter Wrapping Machine for 100 gm. Pack(indigenous/ Imported)	1	2 TPD
190	Butter Packing Table	2	Suitable
191	**BUTTER MILK HANDLING SECTION**		
192	Buttr Mix Transfer Pump	1	5 KLPH
193	Buttr Milk/Wash water Recirculation pump to CBMM	2	Suitable
194	Butter Milk chiller (4 deg.C)	1	5 KLPH
195	Butter Milk Storage Tank	1	10 KL
196	Butter Milk Transsfer Pump	1	10 KLPH
197	**FAT RECOVERY SECTION**		
198	Butter Melting Vat	1	1000 L
199	Molten Butter Transfer Pump	2	10 KLPH
200	Fat Recovery Tank	1	2000 L
201	**GHEE MAKING EQUIPMENT**		
202	**GHEE MAKING & PACKING EQUIPMENT**		
203	Continuous Butter Melting System	1	1 TPH
204	Molten Butter Storage Tank	1	2 KL
205	Molten Butter Transfer Pump	1	2 KLPH
206	Serum Separator	1	2 KLPH
207	Conc. Fat Storage Tank	1	5 KL

208	Serum Collection tank, pump & chiller	1	Suitable
209	Serum Storage tank	1	2 KL
210	Conc. Fat Transfer pumps	1	2 KLPH
211	Ghee Boiler	2	2 KL
212	Ghee Transfer Pump	1	3 KLPH
213	Ghee Settling tank	2	2 KL
214	Ghee Clarifier	1	2 KLPH
215	Ghee Balanced Tank	1	200 lts.
216	Fume extraction system for Ghee making section - SS ducting & hood with Industraial Fan	1	Suitable
217	Ghee storage cum granulation jacketted tanks	2	5 KL
218	Preformed tin packing machine suitable for 1000 ml pack	1	600 TIN/H
219	Preformed tin packing machine suitable for 200 ml /500 ml pack	1	600 TIN/H
220	Ghee Check weighing scale	2	1 - 2 Kg.
221	SS Platform weigh scale for tins	3	30 KG.
222	Ghee residue trolley with tank	1	100 L
223	SS Packing Tables	3	Suitable
224	Ghee leaky pouch collection sysem	1	Suitable
225	Ghee Tin filler for 15 Kgs. Semi-automatic	1	2-3 Tins/min.
226	Ghe Tin Lid sealer	1	LS
227	Ghee Tin Coder	1	LS
228	**CLEANING IN PLACE EQUIPMENT**		
229	**CIP COMMON FACILITY**		
230	Bulk Acid Storage Tank	1	15 KL

231	Bulk Lye Storage Tank	1	15 KL
232	Chemical unloading pump (for acid & lye_	2	10 KLPH
233	Tanker unloading hose	2	10 KLPH
234	Acid carbouys unloading tank	1	500 L
235	Kye flake dissolving atnk with agitator	1	2 KL
236	Acid Transfer pump	1	40-500 LPH
237	Lye Transfer Pump	1	40-500 LPH
238	SS tray for bulk tanks and pumps	1	Suitable
239	**PROCESS CIP - 3 Circuits**		
240	Lye tank	1	8 KL
241	Acid tank	1	8 KL
242	Hot water tank	1	8 KL
243	Recuperation tank	1	10 KL
244	Flush water tank	1	5 KL
245	Acid Service tank with dosing arrangement	1	500 Ltrs.
246	Lye Service tank with dosing arrangement	1	500 Ltrs.
247	Plate Heat exchangers	1	30 KLPH
248	Plate Heat exchangers	2	20 KLPH
249	Duplex Inline Filters	1	30 KLPH
250	Duplex Inline Filters	2	20 KLPH
251	CIP Forward Pumps	1	30 KLPH
252	CIP Forward Pumps	2	20 KLPH
253	Recirculation pump for acid & lye solution tanks	2	Suitable

254	**TANKER CIP - 2 Circuits**		
255	Lye Tank	1	5 KL
256	Hot water tank	1	5 KL
257	Recuperation tank	1	6 KL
258	Flush water tank	1	3 KL
259	Acid Service tank with dosing arrangement	1	500 Litrs.
260	Lye Service tank with dosing arrangement	1	500 Ltrs.
261	Plate Heat exchangers	2	20 KLPH
262	Duplex Inline Filters	2	20 KLPH
263	CIP Forward Pumps	2	20 KLPH
264	Recirculation pump for acid & lye solution tanks	2	Suitable
265	**POWDER PLANT**		
266	Powder Plant 20 MTPD with provision of Baby Food & WMP production and Semi-automated Bag filling and consumer packing equipment	1	20 TPD
267	**ICE CREAM PLANT - 10000 LPD - SUITABLE TO MANUFACTURE FOLLOWING VARIETIES CUPS, CONES, FAMILY/ PARTY PACKS/ STICK VARIETIES- 10000 LPD**		
268	Mix Preparation Tanks	2	2 KL
269	Turbo Blender	1	1 TPH
270	Mix Recirculation cum Transfer Pump	1	10 KLPH
271	Ice Cream Mix Heater	1	10 KLPH
272	Ice Cream Mix Pasteurization Module	1	1 KLPH
273	Ice Cream Homogenizer	1	1 KLPH
274	Ice Cream Mix Ageing Tanks	3	3 KL
275	Kulfi Mix Preparation Tank	1	500 L

276	Mix transfer pump to flavour mixing tank	1	5 KLPH
277	Flavour Mixting tank	4	500 L
278	Inline Type Strainer	3	Suitable
279	Continuous Ice cream Freezer	3	600 LPH
280	Cup filling machine	1	3000 CPH
281	Cone filling machine	1	3000 CPH
282	Furit feeder	2	Suitable
283	Ice Cream Reprocessng/ Reworking Tank	1	1 KL
284	Hot water bath for CAN	1	Suitable
285	Inkjet Printer for family & bulk pack cartoon	1	Suitable
286	Lid Printing Machine	1	Suitable
287	SS Catering/ Working Table	1	Suitable
288	Chocolate Preparation Tank	1	500L
289	Electronic Weigh scale	1	0-2 Kg
290	Skid mounted CIP tank & Pump	1	Lot
291	Nuts & Dry Fruit Oven	1	Suitable
292	Nut Cutting machine	1	Suitable
293	Candy Machine	1	Suitable
294	Chilled water generation unit	1	Suitable
295	Hot Water generation unit	1	Suitable
296	Paneer Plant- 3TPD		
297	Standardized milk storage tank	1	15KL
298	Past.Water storage tank	1	10KL

299	Citric Acid Preparation tank (insulated, jacketed, agitated)	1	1KL
300	Vertical Milk Coagulation Vat	3	1KL
301	Whey Storage tank (Double walled, insulated Agitated)	1	10KL
302	Paneer blocks Cooling Vat (Capacity Changed) (insulated)	2	2KL
303	Paneer Milk Heater(It comprises of Plate Pack, Balance tank, hot water pump & expansion tank	1	5KLPH
304	Whey chiller double stage cooling with cooling water & chilled water	1	5 KLPH
305	Cooling water Chiller	1	5KLPH
306	Milk transfer Pump to paneer milk heater	1	10KLPH
307	Whey pump	2	10KLPH
308	Chilled Water circulation pump	1	5KLPH
309	Trolley for Paneer	2	Suitable
310	Citric Acid dosing tank	1	100L
311	Citric Acid dosing pump	1	1KLPH
312	Pneumatically Operated Press	2	300kg/batch
313	Hoops for paneer filling	100	10kg
314	Paneer Cutting Table	2	Suitable
315	Whey Collection trough	3	Suitable
316	Whey Collection tank	1	200L
317	SS packing tables	3	Suitable
318	Thermoforming packing machine 200/500 gram	1	Suitable
319	Block Cutter	1	Suitable
320	Waste Paneer shredder	1	Suitable
321	**APS PLANT FOR Plain milk in flexible aseptic pouchs FLAVOURED MILK, BUTTER MILK & LASSI**		

322	Flavour Mixing storage tank (Double walled, insulated Agitated)	1	5KL
323	Flavour Mixing tank (Double wall, insulated Agitated)	1	3KL
324	Flavour Mixing tank (Double wall, insulated Agitated)	1	1KL
325	Lassi tank	1	2KL
326	Buttermilk tank	1	3KL
327	Buttermilk/Lassi transfer pump to sterilizer	1	6KLPH
328	Flavoured Milk transfer pump to sterilizer	1	6KLPH
329	Milk transfer pump to Flavour milk tank (New added)	1	10KLPH
330	UHT sterilizer of 6000 LPH with		
331	1) 200/500 ml aseptic pouch filling machine for plain milk	2	Upto 6KLPH
332	2) 200mlx9000 PPH Brick packing machine for flavoured milk/ butter milk & lassi	1	Upto 6KLPH
333	Rinse Milk handling system	1	Suitable
334	**CIP FOR FERMENTED PRODUCT**		
335	Lye tank	1	5000L
336	Acid tank	1	5000L
337	Hot water tank	1	5000L
338	Recuperation tank	1	6000L
339	Flush water tank	1	3000L
340	Lye & Acid dosing system		
341	Acid transfer pump	1	5000 LPH
342	Lye Transfer pump	1	5000 LPH
343	Acid Service tank	1	500 Ltrs
344	Lye Service Tank	1	500 Ltrs

345	Plate Haet Exchangers	2	20 KLPH
346	Duplex Filters	2	20KLPH
347	CIP forward pumps	2	20 KLPH
348	MILK PIPING & FITTINGS	1	LS
349	SS Pipes, fittings, flow plates, SS supports, imported Mix proof and single seat valves, SS trays for valve batteries etc.	1	LS
350	**INSTRUMENTATION & AUTOMATION**		
351	**CONTROL & INSTRUMENTS, AUTOMATION**		
352	Controls & Instrumentation	1	Lot
353	DCS Automation system with HMIs	1	Lot
354	MIS system	1	Job
355	REFRIGERATION SYSTEM		
356	Refrigeration Compressor Units (2 W + 1 S) suitable for operating at - 2 Deg C suction and + 40 Deg C condensing Temp. for ice silo & CW pre chiller	3	180 TR w/o economizer
357	Refrigeration Compressor Units (1 W + 1 S) suitable for operating at - 15 Deg C suction and + 40 Deg C condensing Temp. for butter deep freeze	3	20 TR w/o economizer
358	Motors for main Compressors	3	Suitable
359	Motors for main Compressors	3	Suitable
360	Motors for main Compressors	3	Suitable
361	VFD Starters for high stage compressor	3	Suitable
362	Economizer for - 2 Deg C compressors	3	Suitable
363	Economizer for - 15 Deg C compressors	3	Suitable
364	Pre-Chiller working at - Deg C complete with Anti-freeze temprature controller & CIP arrangement	5	300 Cum/hr
365	Evaporative type codenser imported	2	Suitable

366	Liquid ammonia pump (3 for -2deg C, 2 for - 15 deg C)	2	Suitable
367	HP liquid ammonia Receiver with standard fittings	1	6000L
368	Ice Silos with Ice thickness controllers	1	4000M
369	Refrigerant line controls	2	Lot
370	Priority vessel	2	No.
371	Interstage cooler	3	No.
372	Liquid accumulator, one each for system working at -2 deg C and - 15 deg C	3	No.
373	Oil Cooler - refrigerant cooled type	2	No.
374	Oil Rectifier for -2 deg C, -5 deg C & -25 deg C systems	4	No.
375	Chilled water pumps for PHE (1W +1S)	4	300 Cum/hr
376	Chilled water pumps to process (3W + 1S)	1	90 Cu.m/Hr
377	Defrost water supply & return pump (1W + 1S)	1	30 Cum/hr
378	Automatic air purger	1	No.
379	Motor Control Centre for Refrigeration & cold rooms	1	Lot
380	PLC / DCS based Plant Central Automation	1	Job
381	Copper Power and control cables	1	Lot
382	Earthing materials and electrical accessories	1	Lot
383	Local instruments on all vessels / pipelines	1	Lot
384	Ammonia Piping, valves & fittings	1	Lot
385	Condenser water piping, valves & fittings	1	Lot
386	Chilled water Piping / drain, valves and fittings for process upto the outlet of the pump NRV.	1	Lot
387	Insulation of refrigerant and chilled water lines with PUF sections and cladding	1	Lot
388	Galvanised MS Structural supports for piping including supports for piping outside the building	1	Lot

389	Spares for 2 years operation	1	Lot
390	First Charge of ammonia Gas	1	Lot
391	First Charge of compressor oil & Lubricants	1	Lot
392	**COLD STORAGE/DEEP FREEZERS INSULATION**		
393	**USING PUF SANDWICHED PANEL & FDC UNITS**		
394	Butter Milk, Lassi, Curd Cold Storage	1	50 KL
395	Dahi Blast Cooler	1	3500 L
396	Dahi Cold storage	1	5000 L
397	Chaach/Lassi Cold storage	1	100000 L
398	Panner Cold Storage	1	10000 T
399	Butter CoLd Store	1	50 KL
400	Butter Deep Freeze	1	150 T
401	Curd Incumbation room	1	20 T
402	Cold store & deep freeze safety system	1	Lot
403	**STEAM GENERATION SYSTEM**		
404	**STEAM RAISING PLANT**		
405	Steam Boiler with ESP, auto blow down, Air preheating and Economiser Hybrid Mode	2	8 TPH
406	Chimney & Ducting	1	Set
407	Feed Water tank insulated & water piping	1	10KL
408	HP Steam & Codensate pipes & fittings IBR	1	Lot
409	Steam Pressure Reducing Station IBR	1	Set
410	LP Stream Pipes & Fittings	1	Lot
411	Condensate collection and pumping system	1	Set

412	Coal & Ash handling system	1	Lot
413	Insulation and steam piping	1	Lot
414	**WATER HANDLING SYSTEM**		
415	**WATER SYSTEM**		
416	Raw filtered water hydroflow system with vertical pumps(2W+1S)	1	60 KLPH
417	Automatic duplex Water softening plant	1	30 KLPH
418	Soft water hydrowflow system with vertical pumps(2W+1S)	1	50 KLPH
419	Automatic RO Plant	1	25 KLPH
420	RO Wter buffer storage tank	1	50 KL
421	RO water hydrowflow system with vertical pumps(2W+1S)	1	20 KLPH
422	Raw, Soft, RO, Chilled water pipes, valves & fittings	1	Lot
423	**COMPRESSED AIR HANDLING SYSTEM**	3	Lot
424	**AIR HANDLING SYSTEM**	1	Lot
425	VFD driven non-lubricating screw air compressor in accoustic enclosure & with after cooler & automatic moisture separator (2W+1S)	3	550 CFM
426	Air Receiver with accessories	1	Suitable
427	Air Dryer refrigerated type	2	Suitable
428	Compressed air pipes & fittings	1	Lot
429	**STRUCTURAL BEIDGES/PLATFORMS**		
430	SS structural platforms in tanker ways/CIP tanks/ghee equipment/silos spiral ladders, pouch filling machines, cross over bridge for crate conveyors etc.	1	Lot
431	**INDUSTRIAL ELECTRICAL LT**	1	Lot
432	11 KV, 3 panel VCB with numerical relays etc	1	No.
433	11 KV/440 V, 1500 KVA on -load transformers	1	No.

434	Power control centre (PCC)	1	No.
435	Intelligent MCC's for production, CIP, ICP and boilers	1	Lot
436	HT power cables	1	Lot
437	LT Power & Control cables	1	Lot
438	Instrumentation cables	1	Lot
439	RCPs, Frequency drive pannel	1	Lot
440	Earthing (Power & Instruments/automation)	1	Lot
441	Capacitor Panels with APPCER & Capacitors	1	Lot
442	DG Set with AMP Panel	1	1000 KVA
443	DG Set with AMP Panel	3	500 KVA
444	Miscellaneous items	1	Lot
445	- GI & SS cable trays	1	Lot
446	- Isolators(withEmergency push buttons)	1	Lot
447	- Rubber Mats	1	Lot
448	- SS Conduits	1	Lot
449	Erection material	1	Lot
450	Installation / Testing/ Commissioning/ Trail run	1	Lot
451	**MISCELLANEOUS EQUIPMENT**		
452	**LABORATORY EQUIPMENT**		
453	Gerber Test Equipment	1	Standard
454	MBR Test Kit	1	Standard
455	Sediment Analyser	1	Standard
456	Phosphate Test Kit	1	Standard

457	Raw milk density meter	1	Standard
458	Acidimeter	1	Standard
459	Sampling Kit	1	Standard
460	Plate count test kit	1	Standard
461	Swab test kit	1	Standard
462	Advance range electronic pH meter	1	Standard
463	Chlorine Sanitiser strength analyser	1	Standard
464	Majonnier Fat tester	1	Standard
465	Water examination test kit	1	Standard
466	Infra red milk analyser	1	Standard
467	Electric autoclave	1	Standard
468	Polarimeter	1	Standard
469	Microscope	1	Standard
470	Magnetic stirrer	1	Standard
471	Causticity /acidity test equipment	1	Standard
472	Coliform bacteria test equipment	1	Standard
473	Colony counter	1	Standard
474	High precision weighing balance	1	Standard
475	Heavy duty hot air oven	1	Standard
476	Incubator	1	Standard
477	Distilled water unit	1	Standard
478	Antibiotics test kit	1	Standard
479	Anaerobic count analysis equipment	1	Standard

480	Microwave oven	1	Standard
481	Laboratory equipment	1	Lot
482	**FIRE FIGHTING SYSTEM**		
483	Firefighting system for ghee, powder & general store and fire exingushers for control rooms , LMP & offer	1	Lot
484	**WEIGHING EQUIPMENT**		
485	Elec. Weigh scale	3	100-200 Kg
486	Elec. Weigh bridge	1	60 MT
487	**SPARE PARTS**		
488	Spare for 2 years operation	1	Lot
489	**MISCELLANEOUS ITEMS**		
490	Steams & Water Mixing batteries	20	No.

PART – II SPECIFICATION OF CIVIL WORK

(Subject to change during Design/Drawing with valid reasons)

Brick work:- All brick work will be of 1st class bricks in cement mortar (1:6).

RCC Work/PCC work: All concrete Work will be in M 20/M 30mix

Plaster work:- All internal plaster will be 12mm thick (1:4) in wall and 6mm thick in C.M.(1:4) in ceiling External plaster will be in two layers 15mm thick with cement motor (1:6) and top layer spatter dash plaster in cement mortar (1:3) mixed With stone grits.

Glazed tiles: - White glazed/colored Mandana/Kotah dado/ tiles in walls of dairy building in process hall, product/ packing/ corridor etc. up to 7 ft height.

Flooring work:-Red Mandana flooring/ CT tiles/Kotha stone/ Marbonite floor/ Marble stone over 5" thick RCC M 20 concrete over brick flat soling in dairy building and kota stone flooring in office/labour/workers amenity building.

In utility section the flooring will 5" thick RCC M 20 with 25 mm thick IPS mixed with iron dust (Ironite).

Roofing work: All roofs will be RCC M 20 Except boiler House including water proofing course.

Doors/ Windows: All doors & windows will be of ACP/ Aluminum frame and glass panes of suitable thickness.

Finishing /Painting Work - Weather coat painting on external plastered surface and Emulsion paint on internal surface.

Painting- To be done over wall Putty. Cement used to be Birla/Lafarge/ ACC

Water Proofing on Roof - APP (Ataetic Polypropylene) Make of Tiles- Kajaria/ Johnson/Somani

Road & Hard Park - 0'8"Thick RCC M 20 road over 6" thick stone metal duly compacted with roller over and one brick on edge soling and sand filling for all blocks separately.

***N.B**

1) **Specification for the civil works to be followed as per OPWD norms.**

2) **The area mentioned above is Tentative which may likely to be vary depending upon site condition, requirement and design/Drawing by the bidder.**

Part -III
Technical specification
Mechanical equipments

Technical Specifications – mechanical equipments

Note:

- **Instrumentation for the equipments are as shown in P * I and logic of operation as per process requirement:**

1.1 Tanker Unloading Hose with SS Fittings

76mm-crush proof hose with vulcanized end connection and SS 304 fittings ~ 6 M. Each

Type: Wire braided high density polyethylene hose, food grade.

The hose pipe assembly shall be complete with end connections. Tanker unloading hose (Size: 76 mm X 6 m) shall be provided for unloading of the tanker.

1.2 Tanker Unloading Pump

Capacity 30KLPH
Type Centrifugal Monobloc

Function: The pump shall be used for transfer of milk from tankers to raw milk silos through the Raw Milk Chiller.

Design: The pump shall be sanitary design and centrifugal mono block construction.

Finish: All stainless steel surfaces shall be polished to 150 grits. Scope of Supply:

The Pump: Product contact parts shall be made from stainless steel conforming to AISI 316.

Drive: The pump shall be provided with flanged motor with hygienic sealing arrangement. The motor shall be squirrel' cage TEFC with IP55 protection suitable for 415 V 50 HZ AC supply. The pump and drive shall be integrated together. The pump shaft end for fixing the impeller shall be of stainless steel. The motor shall be efficiency Class 1.

Accessories:

Inlet/Outlet: Stainless steel (AISI 316) inlet and outlet shall end in stainless' steel complete union. The inlet shall be 230 mm above the finished floor level.

Motor Shroud: The motor part of the pump shall be SS shrouded.

shroud shall be easily removable. It shall have provisions for air circulation and entry of electric cable.

Legs: The pump with drive shall be supported on legs with SS ball feet. The ball feet shall have provision for height adjustment of SOmm.

Simplex Inline Strainer

Capacity : 30 KLPH

Material : SS 304

Function: The strainer shall be used for online filtration of tanker milk.

It shall be provided in standard execution with ready to dismantle clamp design.

1.4 De-aeration vessel

Capacity : 200 L
Type: Closed SS vessel
MOC: SS 304

Function: It would be used in the unloading line as a buffer and for De-aeration

It shall be plain vessel in SS304- construction built to design with necessary nozzle connections and in self-standing execution. The vessel shall be provided with all required instrumentation and required automation in order to have precise process control.

Accessories; Tangential inlet, bottom outlet, airway with valve, low level and high level probes.

1.5 Reception & Tanker CIP Control Panel

Type: Wall Mounted, lockable water proof enclosure

MOC: SS 304

Controls: As per mentioned in Design Basis
Tanker, process and fermented products CIP control panel included under electrical section.

1.6 Self Supported Hot Dip Galvanized Steel Platforms

Self supported hot dip galvanized steel platforms for approach of tanker man ways with SS railing.

1.7 **Raw Milk Chiller**

Capacity: 30 KLPH
Function: The single section plate' heat exchanger shall be used for chilling raw /whole milk with chilled water. -

Design Requirements:
Milk feed temperature: 10 degree C
Milk discharge temperature: 4 degree C
Chilled water feed temperature: 1.5 degree C
Maximum permissible chilled Water flow rate: 1.5 times the milk flow rate.

The equipment shall confirm to Technical Datasheet enclosed.

Finish: All welding joints shall be ground smoothly. All stainless steel surfaces shall be polished to 150 grits.

Scope of Supply:

Plate Pack:

Plates: The plates shall be made from stainless steel conforming AISI 316 and shall be of sanitary design. All milk contact and exterior, surfaces shall be easily accessible or readily removable for cleaning and inspection.

Gaskets: The sealing gaskets shall ensure complete sealing and prevent any cross leakage between product and service liquids. Gaskets shall be of sanitary' type (SNAP IN TYPE). It shall be continuously bonded to the heat transfer surface.

The gasket material shall be of food grade rubber and shall withstand a water sterilization temperature of 100 degree C and 2% caustic solution at 80 degree C. Gasket material shall be non toxic, fat resistant, non absorbent and shall have smooth surface. The MOC of gasket shall be NBR.

Supporting frame: The supporting frame for the plate pack shall be of a self supporting design made of MS cladded with AISI 304 SS sheet with a manually operated tightening device.

The frame and tightening device shall prevent the plates from deflecting under pressure differential of maximum 4 kg./cm sq.

Inlets/Outlets: The inlets and outlets for chilled water and product shall be provided with complete stainless steel (AISI 304)SMS unions.

Thermo-well: Stainless steel CAISI 304) pockets for thermometer on all the "inlets and outlets. Each pocket shall be' complete with stainless steel (AISI 304) guard for mounting glass thermometers PT 100 sensors.

Ball feet: The frame shall be provided with adjust 'able stainless steel ball feet with provision for height adjustment of jqmrri.

1.8 Raw Milk Storage Silo

Capacity : 100 KL
Type : S-uitable for Out Door Installation
Function: To store the raw milk.

Functional Requirements

The milk silo shall be used to store chilled raw milk at 4-6 °C temperature and shall be installed outside.

1.9 CIP Return Pump

Capacity : 20KLPH
Type : Self Priming
Head : Suitable
Mounting: Free standing with adjustable ball feet
Shaft seal : Mechanical
Gasket: EPDM
Shroud: AISI 304
Product contact parts: AISI 316

Motor: 415 V AC, 3 phase, 50 Hz, squirrel cage induction motor with TEFC/IP 55 enclosure.
The pump shall be of self priming design and shall be similar in design and construction of sanitary pumps.

1.10 Mass Flow meter

These shall be used for online mass flow measurement of tanker milk being unloaded.

CHILLING & PROCESSING EQUIPMENT FOR MILK AND CREAM

2.1.1 Milk Transfer Pump from RMST to Pasteurizer

Capacity: 20KLPH
Head : Suitable
Type: Centrifugal Monobloc

Function: The pump shall be used for transfer of raw milk from raw miJk silos to pasteurizer. It shall be provided with VFD.

Design: The pump shall be sanitary design and- centrifugal mono block construction.
-

Finish: All stainless steel surfaces shall be polished to-150 grits.

Other details shall be similar in design and construction to Item A 4.0

2.1.2 Inter Silo Milk Transfer/Raw Milk dispatch pump

Capacity: 20 KLPH
Head : Suitable
Type: Centrifugal Monobloc

Design: The pump shall be sanitary design and .centrifugal mono block construction.

Finish: All stainless steel surfaces shall be polished to 150 grits. Other details shall be similar in design and construction to Item 1.2.

2.1.3 Magnetic Flow Meters

Magnetic type flow meter shall 'be provided for online measurement of milk flow.

2.1.4 Raw / Pasteurized Milk Dispatch Chiller .

Capacity: 20 KLPH

Function: The'single section plate heat exchanger shall be used for chilling raw /whole milk with chilled water.

Design Requirements:
Milk feed temperature : 10 degree C
Milk discharge temperature : 4 degree C
Chilled water feed temperature : 1.5 degree C
Maximum permissible chilled Water flow rate: 1.5 times the milk flow rate.

The equipment shall confirm to Technical Datasheet enclosed.

Finish: All welding joints shall be ground smoothly. All stainless steel surfaces shall be polished to 150 grits.

Other details shall be similar in design and construction to Item 1.7.

2.1.5 Milk Pasteurizer with all accessories

Capacity : 20 KLPH

Function: This shall be used forpasteurization ofmiik which shall be used for standardization of Pasteurized Milk in Past. Milk Silo.

Design Parameters:

Milk consistency: 6.0 % fat and 9.0 % SNF
Raw milk feed temperature : 4 Deg. C for Milk
Milk take-off temperature to Centrifuge : 50 Deg. C
Milk take-off temperature to homogenizer : 65 Deg, C
Milk pasteurization temp. : 76 Deg. C
Holding time for pastn. : 20 Sees.
Pasteurized milk discharge temp. : 4 Deg. Centi.
Heat regeneration : 93%

Please note that Regeneration efficiency of Pasteurizer shall be 93 % in case of whole milk operation only. Please note that we have also .included separator inlet temperature correction loop to have an additional safety in order to correct the in-feed temperature of separator.

No of Sections : Heating I & II/ RI/RII/RIII/Chilling
(Heater II is separator heater correction loop) .
Chilled water flow rate : 1.5 times
Chilled water feed temp. : 1.5to 2 Deg. C

Finish: All welding joints shall be ground smoothly. All stainless steel surfaces are to be polished to 150 grits.

Technical specifications and scope of supply

Plate Heat Exchanger - Milk Pasteurizer (HTST) with SS316 plates.

Plates: The plates shall be made from stainless steel (SS 316) in sanitary design. All the product contact and exterior surfaces shall be easily accessible or readily removable for cleaning and inspection.

Gaskets: The sealing gaskets must ensure complete sealing and prevent any cross - leakage between product and service liquids. Gaskets shall be of sanitary type and shall be continuously bonded to the heat transfer surface. The gasket material shall be food grade, non-toxic, fat resistant, non-absorbent and shall have smooth surface . .The material shall withstand a water sterilization temp. of 100 *deg.* C. and 2% caustic solution and 1% acid solution at 80 Degree Centigrade. It shall be SNAP IN or LOCK IN type. The MOC of gasket shall be NBR.

Supporting Frame: The supporting frame for the plate pack shall be of a self supporting design made of stainless steel (AISL304) clad mild steel with a manually operated stainless steel (AISI 304) tightening device. The tightening device shall be able to exert uniform pressure on all the parts of heat transfer plates to prevent any leakages *from* Pasteurizer.

Accessories

Inlets/Outlet: The inlets and outlets in each section of the heat exchanger for products as well as services shall be provided with complete stainless steel (AISI 304) unions. .

Thermo-wells: SS (AISI 304) pockets for thermometer on required ports for Product and service inlet and .outlet connections. Thermo-well locations as per P *1.

Ball Feet: The frame shall be provided with adjustable SS ball feet with provision for height adjustment of 50 mm.

Holding Section: It shall be designed for continuous holding of the product at pasteurization temp in SS tubes.

Balance Tank: The balance tank of capacity 350 L shall be fabricated from 2 mm thick SS sheet conforming to AISI 364. The tank shall be provided with cover, Product inlet, cup type outlet, return Product inlet, inlet for water, over flow and adjustable SS ball feet and provision for level probes. The balance tank shall be provided with a Level Transmitter along with pneumatic flow regulating valve, Low Level Probe & High Level Probe for control of level of liquid in balance tank. The Feed Pump shall be interlocked with level transmitter and High Level Probe to avoid the dry running of pumps. The balance tank shall also be provided with manual butterfly valve at the outlet.

Feed Pump & Booster Pump: The Pasteurizer stainless steel feed pump shall be of sanitary steel shroud with louvers for air-cooling and suitable design as per dairy standard. Its capacity shall be adequate to facilitate efficient CIP. The TEFC drive motor shall be fitted with stainless arrangement for cable connection.

Booster Pump shall also be provided to maintain the positive pressure on the Pasteurized Milk Side.

The pumps shall also Fe suitable for CIP flow rate in closed loop.

Flow Transmitter & Variable Frequency Drive: Pasteurization Module shall be supplied with suitable size Flow Transmitter - Volumetric Type make along with Variable Frequency Drive working in tandem with flow transmitter will automatically control the flow, as per requirement of process.

Pressure Transmitter: Pressure Transmitters shalf be supplied to measure pressure of the working fluids during operation. The system will measure the differential pressure between the Pasteurizedmilk side & Utility Side to ensure the positive pressure and to avoid mixing of chilled water and hot water in milk in case of accidental damage of plates.

Heating Device/Hot Water Generation System:

Hot water system shall be PHE based and will house an expansion chamber and other safety device to take care of, volume expansion. The hot water generation system shall be skid mounted.

Expansion Chamber: with Safety" Valve (Audco),
Air Vent, Steam trap By-pass assembly (Spirax Marshall Make)

Pneumatically operated Steam Control Valve (Samson Make - Size 2.5") with positioner along with IIP Convertor (Toshniwal) and By-pass assembly

Water Make up valve - Standard make

Automatic Water Make up facility of Expansion Vessel based on level sensing.

Hot Water Generation PHE- Technical Details

As per the attached data sheet.

Safety Device: A safety device shall be provided in the hot water side of heating section to avoid damage to "the heat exchanger caused by excessive' pressure. It shall be of sanitary design.

Hot water Pump: One number of Hot water pump will be supplied which will be used for hot water circulation for heating of Milk up to 76 deg C. It shall be vertical multi stage type with all wetted parts in SS. It shall have capacity and rating of 36000 LPH @ 25 MWC. It shall be Grundfoss make.

PID Control Loops

Hot Milk (Pasteurized) Temperature Control

One no of PID Temperature control arrangement for control of pasteurization temperature together with Pneumatic Type Steam Regulating and control valve is included.

Chilled Milk Temperature Control

One no of PID Temperature control arrangement for control of chilled milk temperature together with Pneumatic Type control Valve for Chilled Water flow Control & Regulation is included.

Separator outlet Temperature Control

One no of PID Temperature control arrangement for control of separation temperature of milk together with Pneumatic Type control Valve is included in scope of supply. The loop shall be used to control the separation temperature inlet by controlling hot water flow.

Instrumentation& Controls - as per process logic - Pasteurizer shall have following facilities;

Automatic Pasteurization Temperature control arrangement & having the provision to download data on Computer

Automatic Flow Control arrangement

PLC controlled automatic flow diversion arrangements for hot milk as well as chilled milk having provision of forward as well as backward flow Indication of differential pressureb/w Milk & Hot water Flow in heating section & also b/w Milk & chilled water in chilling section and ensuring that the alarm is activated in case of 'negative differential pressure and Pasteurizer is automatically switched off.

Level Control of balance tank/Controlled Operation of Pumps

Provision of CIP loop - PLC operated

Pipes and Fittings (SS 304): All inter connecting pipes with necessary fittings for product as well as service shall be supplied within the specified battery limits and exclusions.

Product: The supply shall include all the necessary SS 304 pipes and fittings from float balance tank to the finished pasteurized product outlet as required inter-connecting the above equipment.

Hot Water: The supply shall also include necessary SS pipes and fittings for pumping hot water to the heating section of the Pasteurizer and return to the hot water set.

Constant Pressure Valve: Constant Pressure Valve (Mechanical Type) shall be supplied at the outlet of Chilled Milk Discharge line to maintain constant pressure of the system during the operation of plant.

A suitable size pressure reducing valve is included in the scope of supply to limit the steam pressure up to 1.5 Kg/cm^2.

All Pipes & fittings shall be designed & conceived to acquire minimum floor area and mounted on SS SKID.
"

Instrumentation as shown in P * I and logic of operation as per process requirement.

2.1.6 Self Cleaning Tripurpose Centrifuge

Capacity: 20 KLPH
Bowl: Self ejecting bowl with hydraulic operation
Product discharge: Closed discharge with double centripetal pump
Frame : Cast iron, stainless steel cladded
Drive system : Direct drive with 55KW Motor
Product connections : DIN 1 1851 or Tri Clamp
Feed pressure: 1.0 Bar required
Useful discharge Pressure: 2.5 bar maximum after back pressure control (skim)
Useful discharge Pressure: 2.5 bar maximum after cream flow control(cream)
Starting type: Frequency converter
Documentation: 1 set of documentation in English

Accessories - The accessories for the separator shall be generally in line with the tender requirement.

Milk fat control : 0.5% - max. 0.2 % below raw milk fat
Cream fat control : 28 to 45 %
Control accuracy : Milk 0.02 %
Control accuracy: Cream 0.2 %

Control Panel for Separator:

1 MCC dimensions (preliminary) W 800 mm x H 1.200 mm x D 500 mm
+ 100 mmn base design stainless steel
Motor starter 45 kW, frequency converter

1 Profibus DP connection for transmission of, signal exchange and operation parameters

1 MCC dimensions (preliminary) W 800 mm x H 1.200 mm x D500 mm
+ 100 mm base design 'stainless steel
Motor starter 55 kW, frequency converter

We watch evaluation unit the control system is prepared for vibration data evaluation, logging and transmission via LAN 1 internet for remote condition monitoring wewatch
The required communication has to be provided ~y the customer.
Note: The technical specifications of OEM- shall prevail over the tender specifications.

Auto-Standardization Unit for Self Cleaning Tripurpose Centrifuge

Capacity : 20KLPH

Standardising unit standomat MC for milk fat and cream fat control at full skimming, standardising or whole milk production standardising capacity up to 35.000 IIh separator feed flow.

Assembly preassembled unit in a stainless steel rack with complete internal piping, wiring and pneumatical installation -
Dimensions : L 1.400 mm x W 1.400 mm x H 2.100 mm
Product connections: DIN 11851
Control features milk fat control : 0.5% - max. 0.2% below raw milk fat cream fat control 28% - 45%
Measuring principle evaluation of the cream fat content from the density measured via a mass flow meter
Control accuracy milk: *+1-'0.025%*
Cream *+1-0.25%*

Average values at continuous. and steady operation included separator control flow meter for feed flow control giving a signal for the supply pump speed
Skim milk back pressure control
Operator panel : SCU 8
Display 6" monochrome touch screen Keyboard membrane keyboard, 32 keys Communication digital I/Os or Profibus DP
Control cabinet W 800 mm x H .1.200 mm x D 300 mm including valve cabinet stainless steel, mounted on the rack.
Documentation 1 set of documentation in English.

Note: The technical specifications of OEM shall prevail over the tender specifications.

2.1.7 Common Operating water System for both separators

SLUDGE TREATMENT & DISPOSAL SYSTEM
This shall be as follows

2.1.9 Sludge Transfer Pump

Capacity: Suitable
Type: Centrifugal, Mono-bloc Open Impeller Type
HEAD : Suitable
MOC: Contact Parts in SS 316

Function: The pump shall be used to transfer sludge as collected from Cream Separators to main balance tank included in the main sludge treatment system.

The pump shall be similar in design and construction to Item 1.2

2.1.10 Sludge Storage Tank

Capacity: 500 L
Construction: Single Walled, Welded construction of Sanitary design.
MOC: SS 304

Provided with High Level & Low Level Probes. Complete with all standard accessories.

2.1.11**Direct Steam Injection Unit**

Capacity: Suitable

Function: The unit shall be used to reduce the bacterial load of sludge generated by direct injection of

saturated steam at around 120 deg C.

MOC: SS 304
Simplex design direct steam injection system utilizing saturated Steam at 120 deg C through a Steam injection-mixing nozzle.

Necessary insulation with SS 304 cladding of suitable thickness is included.

Temperature Treatment Holder: It shall be used to hold the sludge for suitable holding time.

Suitable arrangement shall be provided for mixmg of raw water for cooling of treated sludge. Compressed air supply line shall also be provided in case of choking takes place.

2.1.12 Electric hoist with mono rail structure for separators

Capacity: 3MT.
Type: Stationary with traveling trolley.
MOC : MS painted execution.

Accessories: MS girder duly grouted on the ceiling. shall be provided by The bidder. An electrical hoist of suitable design shall be provided.

2.1.13 Milk Homogenizer

TECHNICAL SPECIFICATIONS Capacity: 20,000 LPH

Homogenizing Valve Assembly: Two-stage design. Adjustments for both the stages pneumatically actuated.

Product: Milk
Viscosity: Max 200 cPs

Maximum Particle Size: Up to 500 micron
Operating Temperature < 90°C Execution: Sanitary

Capacity: 20,000 lph
Homogenizing Stage: Two
Maximum working pressure 180 Bar
Max Back Pressure: 5 bar
Min in Feed Pressure: Range 4 - 5 bar

Electrical Supply: 3ph/415V *150Hz* Auxiliary Circuits: 24V DC

Water Supply minimum : 2 bar
Air Supply (Pneumatic) : minimum 6 bar
Cleaning Temperature :90°C

Cleaning Time: 30 min

Lubricating System: Forced type with electro-pump, including pressure

Note: The technical specifications of OEM shall prevail over the tender specifications.

2.1.14 **Pasteurized Milk Silos (PMST)**

Capacity: 100.KL
Type: Suitable for Out Door Installation.
Function: To store the pasteurized milk.

Functional Requirements
The milk silo shall be used to store chilled pasteurized milk at 4-6 °c temperature and shall be installed outside

2.1.15 **Pasteurized Milk Silos (PMST)**

Capacity:40KL
Type : Suitable for Out Door Installation.
Function: To store the pasteurized milk.

Functional Requirements

The milk silo shall be used to store chilled pasteurized milk at 4-6 °C temperature and shall be installed outside

2.1.16 Pasteurized Milk transfer pump to HMST

Capacity : 20 KLPH
Type : Centrifugal Monobloc

Function: The pump shall be used for transfer of milk from Pasteurized milk silo to HMST.

Design: The pump shall be sanitary design and centrifugal mono block construction.

Finish: All stainless steel surfaces shall be polished to 150 grits. The pump shall be similar in design and

construction to Item 1.2

2.1.17 Past Milk Inter Silo/re-pasteurization/despatch pump

Capacity : 20KLPH
Type : Centrifugal MonobIoc

Function: The pump shall be used for transfer of milk from Pasteurized milk silo (PMST) to Raw milk silo (RMST) for re-pasteurization/tanker dispatch/intersilo.

Design: The pump shall be sanitary design and centrifugal mono block construction.

Finish: All stainless steel surfaces shall be polished to 150 grits.

The pump shall be similar in design and construction to Item 1.2

2.1.18 **Milk transfer pump to Ice cream and paneer section**

Capacity 10 KLPH
Type Centrifugal Monobloc

Function: The pump shall be used for transfer of milk Ihigh fat milk from PMST to paneer/ice cream section ..

Design: The pump shall be sanitary design and centrifugal mono block construction.

Finish: All stainless steel surfaces shall be polished to 150 grits. The pump shall be similar in design and construction to Item 1.2

2.1.19 CIP Return Pump

Capacity:20KLPH
Type: Self Priming
Head : Suitable
Mounting: Free standing with adjustable ball feet
Shaft seal : Mechanical
Gasket : EPDM
Shroud: AISI 304

Product contact parts: AISI 316

Motor: 415 V AC, 3 phase, 50 Hz, squirrel cage induction motor. With *TEFC /IP* 55 enclosure.

The pump shall be of self-priming design and shall be similar in design and construction of sanitary pumps.

2.1.20 Milk Transfer Pump to Curd Making & APS Plants

Capacity : 10KLPH
Type : Centrifugal Monobloc

Function: .The pump shall be used for transfer of milk from PMST to curd/APS section.
Design: The pump shall be sanitary: design and· centrifugal mono block construction.

Finish: All stainless steel surfaces shall be polished to 150 grits.

The pump shall be similar in design and construction to Item 1.2

2.1.21 **Milk Dispatch (Tanker Loading) Hose Food Grade**

Crush proof hose with vulcanized end 'connection and SS 304 fitting- 6 M. 63.5 mm

Type: Wire braided high density polyethylene hose, food grade.

The hose pipe assembly shall be complete with end connections.

2.1.22 **Cream Balance Tank**

Capacity: 2000L
Type: Double Walled, Insulated.
MOC: SS 304

Functional requirement: To store chilled cream for processing.

2.1:23**Cream Transfer Pump (screw) with VFD**

Capacity: 5 KLPH
Head: Suitable

Function: The pumps shall be used for transfer of cream.

2.1.24 Cream Pasteurizer

Capacity: 5 KLPH

Function: This shall be used for pasteurization of Cream and subsequently chilling it. Raw Cream shall be pasteurised to a temperature of 90 deg c and subsequently cooled to 8 deg C for storage/further processing.

Design Parameter

Cream consistency: 40% fat and 5.5 % SNF.
Cream feed temperature: 8 Deg. Centi.
Cream pasteurization temp.: 90 Deg. Centi.
Finished Cream Discharge temp. : 8 Deg. Centi.
Heat regeneration: 85%
No of Sections : Heating/Regeneration I & Chilling
Chilled water flow rate 1.5 times
Chilled water feed temp. I .5 to 2 Deg. C

Finish: All welding joints shall . be ground smoothly. All stainless steel surfaces are to be polished to 150 grits.

Technical specifications and scope of supply

Plate Heat Exchanger - Cream Pasteurizer (HTST).

Plates: The plates shall be made from stainless steel (SS 316) in sanitary design. All the product contact and exterior surfaces shall be easily accessible or readily removable for cleaning and inspection.

Gaskets: The sealing gaskets must ensure complete sealing and pre-vent any cross - leakage between product and service liquids. Gaskets shall be of sanitary type and shall be continuously bonded to the heat transfer surface. The gasket material shall be food grade, non-toxic, fat resistant, non-absorbent and shall have smooth surface. The material shall withstand a water sterilization temp. of 100 Deg. C. and 2% caustic solution and 1 % acid solution at 80 Degree Centigrade. It shall be SNAP IN or LOCK IN type. The MOC of gasket shall be NBR.

Supporting Frame: The supporting frame for the plate pack shall be of a self supporting design made of stainless steel (AISI 304) clad mild steel with a manually operated stainless steel (AISI 304) tightening device. The tightening device shall be able to exert uniform pressure on all the parts of heat transfer plates to prevent any leakages from Pasteuriser.

Accessories

Inlets/Outlet: The inlets and outlets in each section of the heat exchanger for products as well as services shall be provided with complete stainless steel (AISI 304) unions.

Thermo-wells: SS (AISI 304) pockets for thermometer on required ports for Product and service inlet and outlet connections. Thermo-well locations are shown in P * I.

Ball Feet: The frame shall be provided with adjustable SS ball feet with provision for height adjustment of 50 mm.

Float Balance Tank: The balance tank of suitable capacity shall be fabricated from 2 mm thick SS sheet conforming to

AISI 304. The tank shall be provided with cover, Product inlet, cup type outlet, return Product inlet, inlet for water, over flow and adjustable SS ball feet and provision for level probes. The balance tank shall be provided with a Level Transmitter along with pneumatic flow regulating valve, High Level & Low Level Probes for control of level of liauid in balance tank. The Feed Pump shall be interlocked with high level & Low Level Probes to avoid the dry running of pumps. The balance tank shall also be provided with manual butterfly valve at the outlet. .

SS Feed Pump with VFD:

Capacity : 5 KLPH
Head : Suitable
Type: Centrifugal Monobloc

Function: The pump shall be used for feeding of cream from balance tank to the Pasteurizer. It shall be provided with VFD.

Design: The pump shall be sanitary design and centrifugal mono block construction.

Finish: All stainless steel surfaces shall be polished to 1S0 grits. Other details shall be similar in design and

construction to Item 3.2

Flow Transmitter: Pasteurisation Module shall be supplied with suitable size Flow Transmitter - Volumetric Type make along with Variable Frequency Drive working in tandem with flow transmitter will automatically control the flow as per requirement of process. The Variable frequency drive shall be mounted on Feed Pump.
•

Pressure Transmitter: Pressure Transmitters shall be supplied to measure pressure of the working fluids during operation. The system will measure the differential pressure between the Pasteurised Cream Side & Utility Side to ensure the positive pressure and to avoid mixing of chilled water and hot water in milk in case of accidental damage of plates.

Heating Device/Hot Water Generation System:

Hot water system shall be PHE based and will house an expansion chamber and other safety device to take care of volume expansion. The hot water generation system shall be skid mounted.

PHE with SS 316 plates with EPDM gaskets

PHE frame shall be of MS cladded with SS 304 (Instead of CS as mentioned)

Expansion Chamber: to take care of Volume increase Safety Valve (Audco), Air Vent, Steam trap By-pass assembly

Pneumatically operated Steam Control Valve (Samson Make - Size 2") with positioner along with lIP Convertor (Toshniwal) and By-pass assembly.

Water Make up valve - Standard make

Automatic Water Make up facility of Expansion-Vessel based on pressure sensing

Hot Water Generation PHE

Safety Device: A safety device shall be provided in the hot water side of heating section to avoid damage to the heat exchanger caused by excessive pressure. It shall be of sanitary design.

Hot water Pump: One number of Hot water pump will be supplied which will be used for hot water circulation for heating of Cream up to 90deg C. It shall be SS Centrifugal Mono-bloc type with all wetted parts in SS .. It shall have capacity and rating of 6000 LPH @ 25 MWC

PID Control Loops

Hot Cream (Pasteurised) Temperature Control

One no of PID Temperature control .arrangement for control of pasteurization temperature together with Pneumatic Type Steam Regulating and control valve is .included.

Chilled Cream Temperature Control

One no of PID Temperature control arrangement for control of chilled Cream temperature together with Pneumatic Type control Valve for Chilled Water Control & Regulation is included.

Instrumentation & Controls - as per process logic - Pasteuriser shall have following facilities

Automatic Pasteurization Temperature control arrangement & having the provision to download data on Computer

Automatic Flow Control arrangement

PLC controlled automatic flow diversion arrangements for hot Cream as well as chilled Cream having provision of forward as well as backward flow

Indication of differential pressure b/w Cream & Hot water Flow in heating section & also b/w Cream & chilled water in chilling section and ensuring that the alarm is activated in case of negative differential pressure and Pasteuriser is automaticallv switched off.

Level Control of balance tank/Controlled Operation of Pumps . Provision of CIP loop - PLC operated

Pipes and Fittings (SS 304): All inter connecting pipes with necessary fittings for product as well as service shall be supplied within the specified battery limits and exclusions .

Product: The supply shall include all the necessary SS 304 pipes and fittings from float balance tank to the finished pasteurized product outlet as required inter-connecting the above equipment. .

Hot Water: The supply shall also include necessary SS pipes and fittings for pumping hot water to the heating section of the Pasteuriser and return to the hot water set.

Constant Pressure Valve: Constant Pressure Valve (Mechanical Type) shall be supplied at the outlet of Chilled Cream Discharge line to maintain constant pressure of the system during the operation of plant.

A suitable size pressure reducing valve in included in the scope of supply to limit the steam pressure up to 1.5 K:g/cm2

All Pipes & fittings shall be designed & conceived to acquire minimum floor area and mounted on SS SKID.

Note: Instrumentation as shown in P * I and logic of operation as per process requirement.

CIP Pump Parallel to Lobe Pump In Cream Pasteurizer

Capacity: Suitable
Type : Self Priming
Head : Suitable
Mounting: Free standing with adjustable ball feet
Shaft seal : Mechanical
Gasket : EPDM
Shroud: AISI 304
Product contact parts: AISI 316

Motor: 415 V AC, 3 phase, 50 Hz, squirrel cage induction motor with TEFC/IP 55 enclosure.

The pump shall he of self priming design and shall be similar in design and construction of sanitary pumps.

2.1.25 Cooling Tower with pumps for cream Pasteurizer

A Suitable capacity of cooling tower (for cream pasteurizer) along with 2nos centrifugal pumps (one.working and one standby operation) shall be supplied.

2.1.26 **Cream Storage cum Ripening Tank**

Capacity: 15 KL
Type: Vertical, Cylindrical, Double walled, insulated

Function: Cream having a fat content of 40-45% after getting pasteurization shall be stored and used subsequently.

Other specification shall be as per the tender document.

2.1.27 **CIP Return Pump for cream tank**

Capacity:20KLPH
Type : Self Priming
Head: Suitable
Mounting: Free standing with adjustable ball feet
Shaft seal: Mechanical
Gasket: EPDM
Shroud: AISI 304
Product contact parts: AISI 316

Motor: 415 V AC, 3 phase, 50 Hz, squirrel cage induction motor with *TEFC/IP* 55 enclosure.

The pump shall be of self priming design and shall be similar in design and construction of sanitary pumps.

2.1.28 **Cream Pump (Screw) With VFD (or Transfer of Cream to Butter Section & Dosing to Milk Silos for Fat Correction**

Capacity : 5 KLPH

Type: Positive displacement screw pump
Head : Suitable
MOC: Product contact parts in AISI 316

The pump shall be used for transfer of ripened cream from cream balance tank to the inlet of continuous butter making machine through the cream temperature correction system and to the balance tank of both the pasteurizer.

These pumps shall have mechanical seals. The gasket shall be made of long lasting type food grade rubber and the pump shall be provided with SS base frame, motor and adjustable .speed unit of frequency variator.

A suitable SS 304 cover shall be provided to meet the hygienic requirement. The motor shall be suitable for 440 V AC, 3 Phase, and 50 Hz supply and would be squirrel cage induction motor, TEFC IP-55.

3.1 Milk RECONSTITUTION SECTION

3.1.1 Turbo blender

Tri-blender for Mixing Water & Sugar

Capacity: 500 Kg/Hr
Application: Mixing of sugar with water, Basic Operation

The turbo blender consists of a centrifugal pump head and impeller mounted in such a fashion so that the normal suction port (inlet) is pointed upward. The inlet piping consists of a tube within a tube arrangement. This allows the liquid and dry ingredients separated until they are in the mixing chamber. This arrangement eliminates one of the major problems of wet drying mixing i.e. pre-wetting. .

The natural suction of centrifugal pump helps to pull the powder from the hopper through the diffuser tube. The outer tube is used to direct the liquid into the impeller tangentially. The liquid entering the blender is accelerated outward until it strikes the Blender screen. This creates a natural backpressure that causes the liquid to flow down wards and back towards the eye of the impeller. The hollow envelope created helps to suck the powder.

The mix is then transferred to the RCM preparation tank for storage and further transfer.

Scope of Supply

The scope of supply includes blending chamber assembly, manual butterfly valve, motor, base, hopper, powder and liquid inlets and mix outlet. The blender capacity is 500 Kg/Hr and the hopper as such would be at a convenient height.

Factors affecting Mixing

Temperature of the mix should not exceed 60 degree C. Higher temperatures result in the problem of cavitation i.e. Evaporation of liquid at high vacuum.

The total solids of the mix shall not exceed 15% of Total Solids. For concentration in excess of 15% solids up to 30% Total Solids one supply pump is required to achieve necessary flow. For concentrations up to 50% solids one supply pump and one discharge pump is required to achieve necessary flow.

Powder characteristics like flow-ability; moisture, bulk density, fat content and texture are various variables involved in determining the powder addition rate

Vacuum formation in blender depends upon the flow achieved at various temperatures. Improper vacuum form_ationresults in pre wetting of powder

3.1.2 Water heater PHE with water flow meter

Capacity : 5 KLPH

Functional requirements: The single section plate heat exchanger shall be used for heating the reconstituted milk by hot water. The hot water shall be generated by the steam at 3.0 bar.

Design Parameters:

Temperature Program: 20 Deg. C

Finish: All welding joints shall be ground smoothly. All stainless steel surfaces shall be polished to·150 gri,ts.

3.1.3 Duplex Pipe in Pipe Filters

Capacity : 5KLPH
Type : Duplex
Material: SS 304

Constructional Features: The general design shall he of tubular design with a concentric cylindrical filter made from SS screen of 1.5mm pitch. All welding joints shall be ground smooth. All stainless steel surfaces shall be mirror polished.

Scope of supply:

Strainer Casing: The casing shall be made from AISI 304 SS pipe

Filtering Element: The filtering element shall be cylindrical element made from SS AISI 304 18 G screen of 1.5 sq.mm pitch having SS ring at both the ends.

Blank & Clamp: AISI 304 SS grooved blank fitted by means of SS clamp shall be provided at opposite to the inlet end for easy removal of filtering element. The thickness of plank shall be minimum of 15mm. **O** ring shall be provided between casing and blank.

Inlet/Outlet: 51mm dia shall be provided. The inlet and outset shall be manufactured from SS pipe of AISI 304 quality. Both inlet and outlet shall

be complete with SMS unions and shall be integrated parts of outer casing.

3.1.4 Reconstitution milk tank

Function: It shall be used for the storage of the RCM.

Capacity: 5,000 Litres
Type : Vertical, insulated, Single Walled
MOC: SS 304

The volume of the tank shall be such that after filling it upto the rated capacity, the level would be 100

mm below the line where cylindrical shell joins the conical top so that spray ball should not touch the product in any case when the level is 5,000 Liters.

3.1.5 CIP return pump

Capacity: 20KLPH
Type : Self Priming
Head: Suitable
Mounting: Free standing with 'adjustable ball feet
Shaft seal : Mechanical
Gasket : EPDM
Shroud: AISI 304
Product contact parts: AISI 316
Motor: 415 V AC, 3 phase, 50 Hz, squirrel cage induction motor with *TEFC/ IP* 55 enclosure.

The pump shall be of self priming design and shall be similar in design and construction of sanitary pumps

3.1.6 Milk Recirculation-cum-transfer Pump

Capacity: 5KLPH
Type: Centrifugal Monobloc

Function: The pump shall be used for recirculation as well as transfer of RCM.

Design: The pump shall be sanitary design and centrifugal mono block construction.

Finish: All stainless steel surfaces shall be polished to 150 grits. The pump shall be similar in design and

construction to Item 1.2

3.1.7 Reconstitution Milk chiller

Capacity: 5 KLPH

Function: The single section plate heat exchanger shall be used for. chilling of reconstituted milk with chilled water.

Design Parameters:

Milk feed temperature:30 degree C
Milk discharge temperature : 4 degree C
Chiller water feed temperature: 1.5 degree C
Maximum permissible chilled: 1.5 times of milk flow rate

Other details shall be similar in design and construction to Item 1.7

Note: Instrumentation as shown in P * I and logic of operation as per process requirement.
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4.0 Milk Pouch packing Section

Milk filling t a nks (HMST) Capacity : 15 KL

Type : Horizontal Storage tanks.
Horizontal, Double walled, Insulated

Function: To store the pasteurized and standardized milk for packing

4.2 Crate Washer

Functional Requirements: Crate washer shall be designed for washing crates

Technical Specifications: Capacity (Crates / Hr): 1 200

Configuration: Straight through.

Washing Sequence: The pumping and jetting arrangements shall apply sufficient washing liquid to the inside and outside surfaces of the crates.

Pre-rinse: This section shall be provided before the first rinse in order to clean the dirty crates before being passed on to the first rinse section. The water for the pre rinse section shall be drawn from the first rinse pump/ sump.

First rinse: Part of, hot water after rinse, shall be collected in the SS tank for first rinse, which shall be pumped and jetted through nozzles at approximately 45 Deg C. Water shall be pumped at a nozzle pressure of "3.5Kg Cm-2 @ 15000 LPH and continuously drained after use.
Hot detergent rinse:

Hot detergent at 75 Deg C and 2% strength pumped from detergent sump and jetted through nozzles. Pump capacity 20000 LPH/48 MWC. Hot detergent solution re-circulated and drained off as per requirement.

Hot water after rinse: At nozzle pressure of 1.8 Kg Cm-2, 75 Deg C, @20000 LPH re-circulated and partly fed to pre-rinse section. The re- circulated hot water to be drained off whenever required. Make up water will be made available continuously from the mains water header.

Finish: All welding joints are to be ground smooth and polished to 150 grits.

Temperature Control: It shall have temperature controller for detergent solution. This shall consist of pneumatically operated steam valve for ON/OFF, solenoid valve, temperature sensor, temperature controller etc as per requirement.

SCOPE OF SUPPLY

Main Enclosure:

The main enclosure which houses washing & sterilizing sections shall be made from 2mm thick stainless steel sheet conforming to AISI 304. For easy accessibility it shall contain inspection doors (hinged or sliding type) all along the length on both sides. Crates guides shall. be provided through the length of detergent section of crate washer.

Under frame:

Under Frame: The complete under frame shall be made from SS 304 pipe section. The assembly shall have sufficient number of SS 304 legs with the stainless steel ball feet having 50 mm vertical adjustment.

Conveyor Chain and drive:

Chain shall be made of poly acetyl chain link with stainless steel connecting pins. The operation of chain system shall ensure proper spacing between the individual crates. Drive motor; drive transmission shaft and idler shaft shall have adequate provision for adjustment and tensioning. The motor shall be 3 phase, 415V, 50Hz, TEFC, squirrel cage induction motor of IP65 protection. The drive shall be provided with SS 304 shroud. The shroud shall be easily dismountable. It shall have provisions for air circulation and entry of electric cable. Suitable flexible coupling shall be provided between the drive motor and a gearbox. The transmission from the gearbox to the driving shaft shall be by means of a duplex chain. SS 304 safety guard shall also be provided for the driving chain.

Washing Stations:

The pumping and jetting arrangements shall ensure supply of sufficient washing liquids on the outer and inner surfaces of the crates

SS sump tanks (three sets):

Balance tanks having suitable capacity in SS 304 (2mm thick minimum) shall be provided for first rinse / detergent rinse / hot water after rinse cycles. All the three tanks shall have SS304 float valve assembly to maintain the liquid level automatically. All sumps shall be provided with over flow cum drain connection ending with ball valves. A common header shall be provided connecting all the drains from the sump tanks.

Pumps (three sets):

Centrifugal mono block pumps shall be provided for first rinse / detergent rinse / hot water after rinse cycles. The pumps shall be CI body and impeller, SS shaft etc.

The motor shall be of flanged type with gland packing sealing arrangement. The motor shall be 3 phase, 415V, 50Hz, and TEFC squirrel cage induction motor of IP55 protection. All the motor shall be provided with SS304 shroud.

Pre rinse:

The dirty crates shall be jetted through nozzles and rinsed with water at 2
Kg Cm-2. The dirt shall be collected in to a collection chamber, which shall be accessible for cleaning.

Filter: SS plate type filter for the first rinse and drum type SS cylindrical pressure filter for hot detergent re-circulation line shall be provided to prevent choking of pump impeller and stainless steel adjustable nozzles. The filters shall be fabricated from AISI 304 SS material.

Water Heating Arrangements:

For hot water, direct steam injection system shall be providing using steam water ejector for mixing steam with water. In case of detergent heating, indirect steam heating coil shall be used. Condensate from the heating coil shall be discharged into. sump tank for heat recovery. Necessary steam traps, isolation / by pass valves, strainers etc are also included in the scope of supply.

Jet Nozzles: Adjustable angle type nozzles made of stainless conforming to AISI 316 shall be provided. The jet nozzles removable type for easy cleaning.

Sprinkler Header: These shall be made -of SS pipes with SMS unions for easy locking! unlocking of sprinkler header _

Instrumentati on:

The temperature of detergent solution and hot water after rinse section shall be monitored and controlled automatically.

Duplex type RTD temperature probes to sense the temperatures of detergent and hot water.

Digital temperature indicator cum controllers _to control the opening and closing of s team valves for detergent and hot water.

Pneumatically operated steam valves for ON!OFF for detergent and hot water sections. The required isolation and by-pass valves shall be provided.

Solenoid valves along with isolatio~ valves for pneumatic operation of the steam valves. Necessary air tubing shall be carried out.

Pressure gauges to indicate pressure at the delivery side of each of the pumps:

SS instrumentation -panel: The temperature controllers ! pressure gauges shall be mounted on an instrumentation panel located on the main enclosure. Instrument panel shall be fabricated from SS 304, 14SWG sheet with double rebated SS cover (dust & vermin proot). The panel shall be fully pre-wired.

Electrical Control Panel (IP 53)
Main Enclosure: SS 304 panel made of 14SWG with double rivetted cover / rubber gasket shall be moisture, dust and vermin proof.

Push Buttons and Indicating Lamps: It shall contain ON/OFF push buttons and indicating lamps of LED type for all the motors.All indicating lamps shall contain related inscriptions. The panel shall also have an emergency lockable switch to stop total operation of the crate washer in case of emergency.

Wiring: The control panel shall be completely pre- wired. The wiring shall be done by lSI quality copper cables and shall be dressed in accordance with the standard practice. The complete panel shall be pre-wired as per

Termination Points: All distribution piping shall be pre- assembled and terminated at· a single flange .on the body of the crate washer. Interconnecting piping and fittings are to be supplied complete as per approved drawings.

Note: The technical specifications of OEM shall prevail over the tender specifications.

4.3 Crate conveyors for Empty and Filled Crates

Functional Requirement

The conveyors shall be used to transport washed HDPE crates upto the pouch filling machines and crates filled with milk (in polythene pouches) from the packing table to the Milk Cold Store. The washed crates shall be loaded onto empty crates conveyor automatically after crate tilting and filled crates shall be manually loaded on to the conveyor, which is passing adjacent to pouch-crating table.

Capacity: 1200 Crates per hour

DESIGN REQUIREMENT:

Type: Floor mounted, self standing, chain conveyor with suitable drive

Crate Size: Customer shall be provided by the bidder.

Drive
Geared motor (IP55) of suitable rating, complete with sprockets, idlers etc.
An SS protection cover shall be provided for the drive, chain etc.

CHAIN & TRACK

The chain shall be Poly-acetyl moving in a track of suitable material and type

ACCESSORIES

Trough for chain dip cleaning: An SS 304 trough of suitable size to hold the water for the chain dipcleaning with drain valve (Audco make ball valve) shall be provided.

Lubrication:Suitable lubrication arrangement for the Poly-acetyl chain is to be provided. The bidder shall furnish the details.

4.4 Pouch Filling machines

FEEDING Gravity Filler

SYSTEM DOSAGE: Upto 1006 ml. .

ACCURACY : ± 0.5% i.e ±5ml for 1000 ml. under ideal Working condition.

SPEED : 60 TO 85 FOR UPTO 1000ML pouches / min /head.

PACKING MATERIAL : Virgin Film: Any' Impulse sealing material like co-ex LDPE

1) Film Width - 324 mm ± 2mm
2) Thickness: 45-80 micron
3) Maximum weight offilm roll 20 TO 100 Kgs.
4) Film Roll dia - 400 mm.Core dia 76 mm

TYPE OF SEAL : Vertical -Overlap Horizontal - Seal & Cut Impulse Type

SUPPLIES TO THE MACHINE : A) Electrical

1. 415 ± 1%, 3 Phase, 50 *c/s*. ,Neutral & Ground.
2. Connected Load 6 KW
3. Power Consumption 4 *KW/hr.*

4. Electrical supply connected by 2.5 mm^2, 4 core armored cable.

B) Compressed Air: Not required for the machine.

C) Cooling Water: Pressure-2 kg/cm^2
Flow Rate-400 *ltr/hr*
Temperature: 7^0C to 10^0C

D) Utility for Actuation ofInjection System: Electromagnetic coil actuation system

DESCRIPTION OF THE MACHINE BODY :

The components, which form, fill seal the pouches/sachets are enclosed in a stainless steel cabinet. All major items are of stainless steel or treated with Aluminum protected by a weatherproof paint. All parts in contact

with the product are of AISI-304 stainless steel with smooth finish.

SPOOL BEARER ASSEMBLY:

The Roll of heat sealable films is mounted in a compartment at the rear bottom of the machine. They are supported on the idler rollers in sliding drawers with bottom opening machine cabinet doors, which enables to charge the rolls quickly. The Film layers passes in each head via different idler rollers, film loosening takes place through positive film unwinding AC drive mechanism and moves in front of the ultra violet sterilization tube before it is engaged in the forming device. The . specially designed former converts this layer in to a tube.

VERTICAL SEAL

The film is overlapped and sealed into a tube on each head by impulse heated elements known as vertical electrodes. The sealing jaws are water- cooled and are mechanically operated by link mechanism through the drive shaft. The formed film tube surrounds the injection or filling tube through which the products to be filled flows in the film tube.

INJECTION SYSTEM

The filling system is as follows:
A constant level tanks are mounted on top of the machine
A filling tube leading down froin the tank and
inside tube of film
A liquid injection electromagnetic coil is mounted on top of the injection tube
A gate at the lower end of the injection tube opens when injection switch is turned ON. This allows the liquid to be packed in the surrounding formed film tube. The gate opens by electromagnetic coil actuation system of the piston' in the injection cylinder assembly when injection switch is made ON

FILM FEED

Rubber nip rollers below each vertical sealer control downward movement of the film tube. Vertical overlapped sealed film tube is pulled down by nip rollers directly coupled with drive shaft. The length of the film tube pulled down is controlled by PLC.

HORIZONTAL SEALING AND CUTTING

The sealed tube then arrives at the bag making point. Here when the horizontal presses close on the film tube, the horizontal assembly mounted on one of the presses seals and cuts the horizontal portion of toe film tube. The flow ofthe liquid in the film tube is continuous and adjustable. The horizontal jaw simultaneously seals the upper horizontal sealed band of the lower filled pouch and the lower horizontal sealed band of the upper film tube. The other horizontal press on which there is only silicon back up rubber and a Teflon magazine is called a counter electrode.

COOLING

Both horizontal and vertical electrode holders are water-cooled .

DRIVE

The drive of each head is through a SERVO MOTOR coupled with horizontal sealing assembly, vertical sealing assembly and film pulling assemblies. The Home position of the cycle of operation is· communicated to PLC through proximity switches aligned with the drive mechanism.

ELECTRICAL CONTROL PANEL

TOUCH SCREEN IN CENTRE OF THE MACHINE IS OPERA TED THROUGH PLC, electrical Switches, control relays, solid state variac, pouch counters are mounted on this panel. The electric control panel is located on center of the machine. .

WEIGHT OF THE MACHINE

950 KGS approx.

SALIENT FEATURES

- Compressed Air is not required for its operational
  - Better Accuracy: ±5ml per 1000 ml.
- Better Speed- Speed virtually double compare to conventional machines available in the market.
- Individual Head Operation: The machine head can run independently with different dosage of the liquid.
- End of film Indication: Audiovisual alarm gets operated when the film roll gets exhausted.
- Less noise and vibration compared to conventional machine.

Salient Features of Machine

- The machine does not require AIR for any of its operation.
- Auto operation of the machine will stop with Audio-visual alarm.
- Machine body is in SS 304 construction.
- All contact parts are of SS 304.
- Machine motion is controlled through separate SERVQ Motors for each head
- Machine Operations are electronically controlled with PLC.

- Machine has an integral settable Batch Counter to produce SET number of bags per batch.
- Digital Setting Control for all Setting Timings ..
- Individual Head operation possible.
- Positive unwinding for each Head.
- Nip rollers are controlled by SERVO DRIVE/MOTORS.
- Rooftop in SS maintaining Hygiene.
- 3 preset program to run different bag size.
- Separate control for sealing voltage & timer for handling different film.
- Jaw movement through servo motors directly coupled to horizontal & vertical sealing assemblies.
- Jaw Jog switch available
- Adjustable cooling time.
- Minimum number of mechanical parts resulting into less wear and tear and thereby reducing the maintenance drastically.
- Isolated electrical Fitments from mechanical components.
- Electrical control circuit in 24V thereby ensuring safety.
- Bank ofUV tube for Sterilization of film
- SS Nozzle for CIP system
- Door glass will be toughened type
- Emergency switch to stop the machine will be provided at the front side of the machine.
- Static Charge Eliminator will be fixed on both the heads of the machine.
- Machine will stop, if front or back door is open.
- In case of short circuit of electrodes, particular head will stop with. indication of alarm.
- Necessary interlocks will be provided in the machine.
- The manual weight adjustment knob will be provided on near to approachable height.
- No film no fill provision will make to stop the machine with indication of alarm.
- Suitable provision will be made for dropping of condensed water. (Heaters will be provided near confirmator assembly)

- Suitable milk pouch collection tray will be provided.
- Three position selector switch will be provided.
  1) Product Request (from filling machine)
  2) CIP request (From filling machine)
  3) Off (No signal)
- Two indicating lamps will be provided - Production (Signal from PLC), CIP (Signal from PLC) .
- Two signals each from one filling machine .: for (Pouch Quantity)
- Filling valve will be electromagnetic operation"
- We will provide IFM make Proximity switches on the machine.
- The balance tank is suitable to sustain the liquid pressure upto 3 kg / cm ' during CIP
- Provision will be made for protection ring with CIP nozzle.
- Balance tank inlet will be 51 mm.
- Balance tank overflow will be 38mm.
- Cleaning nozzle hole will be 25 mm - that is 1"

Additional Features which will be incorporated in above m/c

1. Modified Injection Nozzle is provided to avoid the film sticking problem (reduce friction)
2. SS door openings spool bearer assembly of SS with modified Door openings are provided.
3. Extra stiffeners are provided on backside of the doors.
4. Machine roof is having Single Point Drain arrangement with proper level.
5. Input of24 V to electrical circuit is through SMPS.
6. Unwinding of the film is motorized.
7. Sealing cable with flexible conduit, fixed properly on back side of the machine.
8. Vertical seal safety.
9. Separate tank for each head is provided to run different product on each head.
10. Electronic Pressure locking arrangement is provided to reduce mechanical breakdown in the machine.

Note: The technical specifications of OEM shall prevail over the tender specifications.

4.5 SS Chute and Collection trays

Function: It shall be used for collecting the milk pouches coming out from the FFS machine.

MOC: SS 304

4.6 Electronic weigh scale

Function: It shall be used for the offline weighing of milk pouches.

Capacity: 0-2 Kg

4.7 Cooling Water balance tank

Function: It shall be used as a balance tank for the jaw cooling system. Capacity: Suitable

MOC: SS 304

Design: Single walled, Uninsulated, 2 mm Thick AISI 304

4.8 Cooling water circulation pump

Capacity: Suitable
Head : Suitable
Type: Centrifugal Monobloc

Function: The pump shall be used for transfer of milk from raw milk silos to pasteurizer.

Design: The pump shall be sanitary design and centrifugal mono block construction.

Finish: All stainless steel surfaces shall be polished to 150 grits. Other details shall be similar in design and construction to Item 1.2

4.9 Cooling water Chiller

Function: It shall be used for the chilling of the water for the jaw cooling of pouch packing machine with chilled water.

Capacity : Suitable for Packing Machine

Design Parameters:

Cooling Water feed temperature : 15 degree C

Cooling Water discharge temperature : 10 degree C

Chilled water feed temperature : 1.5-2 degree C

Maximum permissible chilled :1.5 times the water flow rate

Other details shall be similar in design and construction to Item 1.7.

4.10 Leaked pouch dump tank

Capacity: Suitable.

Function: It shall be used to collect .the milk from leaky pouches and to act as a balance tank before pumping the milk to process section.

Construction Features: The tank shall be of single walled

4.11 Inline Strainer

Functional Requirement: It will be installed in butter milk pipelines for removing floating impurities from butter oil.

Capacity: Suitable
Type: Simplex
Material: SS 304

4.12 Leaked pouch milk pump

Capacity : 5 KLPH
Type : Centrifugal, Mono-bloc
Head: Suitable

Function: The pumps shall be used for transfer of leaky pouch milk from leaky pouch dump tank to raw milk storage tank.

4.13 CIP Return Pumps

Capacity :20KLPH
Type : Self Priming
Head : Suitable
Mounting: Free standing with adjustable ball feet
Shaft seal : Mechanical
Gasket : EPDM
Shroud: AISI 304
Product contact parts: AISI 316

Motor: 415 V AC, 3 phase, 50 Hz, squirrel cage induction motor with *TEFCΛP* 55 enclosure.

The pump shall be of self priming design and shall be similar in design and construction of sanitary pumps.

4.14 Pouch Deep milk chiller

Function: It shall be used for the chilling of milk transfer to HMST for packing.
Capacity : 20 KLPH .

Design Parameters:

Milk feed temperature : 6 degree C
Milk discharge temperature : 4 degree C
Chilled water feed temperature : 5-2 degree C
Maximum permissible chilled : 1.5 times the water flow rate

4.15 Cat walk platform, SS stool, cross over bridge etc

The suitable cat walk platform, cross over bridge, SS stool for worker shall be provided in the packing room

MOC: SS 304

5.1 CURD MAKING & PACKING

Curd Milk Pasteuriser with Accessories: outlet 42 deg C / 4 Deg C Capacity : 5 KLPH

Function:This shall be used for pasteurization of curd milk and subsequently cooling it up to 40-45/4 Deg C.

Design Parameters:

Milk/RO feed temperature: 4 Deg. Centi.
Milk pasteurization temp. : 90 Deg. Centi.
Homogenization take off temperature : 60-65
Holding time for pastn.: 5 Minute,
Finished milk discharge temp. : *40-45/4* Deg. Centi.
No of Sections: Heating / Regeneration I / Regeneration II /Chilling
Chilled water flow rate: 1.5 times
Chilled water feed temp: 1.5 Deg.C

Finish: All welding joints shall be ground smoothly, All stainless steel surfaces are to be polished to 150 grits.

Technical specifications and scope of supply

Plate Heat Exchanger - Milk Pasteuriser (HTST) with SS316 plates.

Plates: The plates shall be made from stainless steel (SS 316) in sanitary design, All the product _contact and exterior surfaces shall be easily accessible or readily removable for cleaning and inspection.

Gaskets: The sealing gaskets must ensure complete sealing and pre-vent any cross - leakage between product and service liquids. Gaskets shall be of sanitary type and shall be continuously bonded to the heat transfer surface. The gasket material shall be food grade, .non-toxic, fat resistant, non-absorbent and shall have smooth surface. The material shall withstand a water sterilization temp. of 100 Deg. C. and 2% caustic solution and 1% acid solution at 80 Degree Centigrade. It shall be SNAP IN or LOCK IN type. The MOC of gasket shall be NBR.

Supporting Frame: The supporting frame for the plate pack shall be of a self supporting design made of stainless steel (AISI 304) clad mild steel with a manually operated stainless -steel (AISI 304) tightening device. The tightening device shall be able to exert uniform pressure on all the parts of heat transfer plates to prevent any leakages from Pasteuriser.

Accessories

Inlets/Outlet: The inlets and outlets in each section of the heat exchanger for products as well as services shall be provided with complete stainless steel (AISI 304) unions. .

Thermo-wells: SS (AISI 304) pockets for thermometer on required ports for Product and service inlet and outlet connections.

Ball Feet: The frame shall be provided with adjustable SS ball feet with provision for height adjustment of 50 mm.

Holding Section: It shall be designed for continuous holding of the product at pasteurization temp in SS tubes for 5 inin.

Float Balance Tank: The balance tank of suitable capacity shall be fabricated from 2 mm thick SS sheet conforming to AISI 304. The tank shall be provided with cover, Product inlet, cup type outlet, return Product inlet, inlet for water, over flow and adjustable SS ball feet and provision for level probes. The balance tank shall be provided with a Level Transmitter along with pneumatic flow regulating valve & High Level Probe for control of level of liquid in balance tank. The Feed Pump shall be interlocked with level transmitter and High Level Probe to avoid the dry running of pumps. The balance tank shall also be provided with manual butterfly valve at the outlet.

Feed Pump & Booster Pump: The Pasteurizer stainless steel feed pump shall be of sanitary steel shroud with louvers for air-cooling and suitable design as per dairy standard. Its capacity shall be adequate to facilitate efficient CIP. The TEFC drive motor shall be fitted with stainless arrangement for cable connection.

Booster Pump shall also be provided to maintain the positive pressure on the Pasteurised Milk Side.

Feed Pump - 5 KLPH @ Suitable MWC

Booster Pump - 5 KLPH @ Suitable MWC

The pumps shall also be suitable for CIP flow rate in closed loop,

Flow Transmitter & Variable' Frequency Drive: Pasteurisation Module shall be supplied with suitable size Flow Transmitter - Volumetric Type make along with Variable Frequency Drive working in tandem with flow transmitter will automatically control the flow as per requirement of process.

Pressure Transmitter: Pressure Transmitters shall be supplied to measure pressure of the working fluids during operation. The system will measure the differential pressure between the Pasteurised milk side & Utility Side to ensure the positive pressure and to avoid mixing of hot water in milk in case of accidental damage of plates.

Heating Device/Hot Water Generation System:

Hot water system shall be PHE based and will house an expansion chamber and other safety device to take care of volume expansion. The hot water generation system shall be skid mounted.

PHE with SS 316 plates with EPDM gaskets

PHE frame shall be of MS cladded with SS 304 (Instead of CS as mentioned)

Expansion Chamber: to take care of Volume increase

Safety Valve (Audco), Air Vent, Steam trap By-pass assembly

'.

Pneumatically operated Steam Control Valve : Size 2.5") with positioner along with I/P Convertor and By-pass assembly

Water Make up valve - Standard make
Automatic Water Make up facility of Expansion Vessel based on pressure Sensing

Hot Water Generation PHE - Technical Details

Safety Device: A safety device shall be provided in the hot water side of heating section to avoid damage to the heat exchanger caused by excessive pressure. It shall be of sanitary design.

Hot water Pump: One number of Hot water pump will be supplied which will be used for hot water circulation for heating of Milk up to 90 deg C. It shall have capacity and rating of 6000 LPH 25 MWC.

PID Control Loops

Hot Milk (Pasteurised) Temperature. Control

One no of PID Temperature control arrangement for control of pasteurization temperature together with Pneumatic Type Steam Regulating and control valve is included.

Chilled Milk Temperature Control

One no of PID Temperature control arrangement for control of chilled milk temperature together with Pneumatic Type control Valve for Chilled Water Control & Regulation is included.

Instrumentation & Controls - as per process logic - Pasteurizer shall have following facilities

Automatic Pasteurization Temperature control arrangement & having the provision to download data on Computer

Automatic Flow Control arrangement

PLC controlled automatic flow diversion arrangements for hot milk as well as chilled milk having provision of forward as well as backward flow

Indication of differential pressure b/w Milk & Hot water Flow in heating section & also b/w Milk & chilled water in chilling section and ensuring that the alarm is activated in case of negative differential pressure and Pasteuriser is automatically switched off.

Level Control of balance tank/Controlled Operation of Pumps

Provision of CIP loop - PLC operated

Pipes and Fittings (SS 3041:. All inter connecting pipes with necessary fittings for product as well as service shall be supplied within the specified battery limits and exclusions

Product: The supply shall include all the necessary SS 304 pipes and fittings from float balance tank to the finished pasteurized product outlet as required inter-connecting the above equipment.

Hot Water: The supply shall also include necessary SS pipes and fittings for pumping hot water to the heating section of the Pasteurizer and return to the hot water set.

Constant Pressure Valve: Constant Pressure Valve (Mechanical Type) shall be supplied at the outlet of Chilled Milk Discharge line to maintain constant pressure of the system during the operation of plant.

A suitable size pressure reducing valve in included in the scope of supply to limit the steam pressure up to 1.5 Kg/crrr' ..

All Pipes & fittings shall be designed & conceived to acquire minimum floor area and mounted on SS SKID.

Note: Instrumentation as shown in P * Land logic of operation as per process requirement.

5.1.2 Curd Milk Storage Silo

Capacity : 15 KL
Type : Vertical, Insulated, Double Walled
MOC: SS 304

5.1.3 CIP Return Pump for Curd Milk Silo

Capacity :20KLPH
Type: Self Priming
Head : Suitable
Make :Reputed make
Mounting: Free standing with adjustable ball feet
Shaft seal: Mechanical
Gasket : EPDM
Shroud: AISI 304
Product contact parts: AISI 316

Motor: 415 V AC, 3 phase, 50 Hz, squirrel cage induction motor with TEFC/IP 55 enclosure.

The pump shall be of self priming design and shall be similar in design and construction of sanitary pumps.

5.1.4 Curd Milk Transfer Pump to Balance Tank of Curd Milk Heater

Capacity : 3 KLPH
Type : Centrifugal, Mono-bloc
HEAD : Suitable
MOC: Contact Parts in SS 316

Function: The pump shall be used for transfer of curd milk to balance tank of curd milk heater from storage tank.

5.1.5 Balance tank for curd milk heater

Capacity: 200 Ltr
Type: Single Walled
MOC : SS 304

Other specification shall be as per the Tender document.

5.1.6 Curd milk transfer pump from balance tank of curd milk heater to inoculation tank

Capacity: 3 KLPH
Type : Centrifugal, Morio-bloc
HEAD : Suitable
MOC: Contact Parts in SS 316

Function: The pump shall be used for transfer of curd milk from balance tank of curd milk heater to curd inoculation tank.

5.1.7 Curd Milk Heater

Capacity : 3 KLPH

Functional requirements: The double section plate heat exchangers shall be used for heating the Dahi milk by hot water. The hot water shall be generated by the steam at 3.0'bar.

Design Parameters:

Dahi Milk feed temperature : 4 degree C
Dahi Milk discharge temperature : 40 degree C

Finish:All welding joints shall be ground smoothly. All stainless steel surfaces shall be polished to 150 grits.

Scope of Supply: Plate Pack:

Plates: The plates shall be made from stainless steel conforming AISI 316 and shall be of sanitary design. All milk contact and exterior, surfaces shall be easily accessible or ~eadi!y removable for cleaning and inspection.

Gaskets: The sealing gaskets shall ensure complete sealing and prevent any cross leakage between product and service liquids. Gaskets shall be of sanitary type (SNAP IN TYPE). It shall be continuously bonded to the heat transfer surface.

The gasket material shall be of food grade rubber and shall withstand a water sterilization temperature of 100 degree C and 2% caustic solution at 80 degree C. Gasket material shall be non toxic, fat resistant, non absorbent and shall have smooth surface. The MOC of gasket shall be EPDM.

Supporting frame: The supporting frame for the plate pack shall be of a self supporting design made of MS cladded with AISI 304 SS sheet with a manually operated tightening device:

The frame and "tightening device shall prevent the plates from deflecting under pressure differential of minimum 4 kg.lcm sq.

Inlets/Outlets: The inlets and outlets for chilled water and product shall be provided with complete stainless steel (AISI 304) SMS unions.

Thermo-well: Stainless steel (AISI 304) pockets for thermometer on all the inlets and outlets. Each pocket shall be complete with stainless steel (AISI 304) guard for mounting glass thermometers/PT 100 sensors.

Ball feet: The frame shall be provided with adjustable stainless steel ball feet with provision for height adjustment of *50mm.*

Hot Water Generating PHE

Hot water generation system shall be PHE based and will house an expansion chamber and other safety device to take care of volume expansion. The hot water generation system shall be skid mounted.

PHE with SS 316 plates with EPDM gaskets

PHE frame shall be of MS cladded with SS 304

Expansion Chamber: to take care of Volume increase
Safety Valve, Air Vent, Steam trap By-pass assembly

Pneumatically operated Steam Control Valve with positioner along with IIP Converter and By-pass assembly

Water Make up valve - Standard make

Automatic Water Make up facility of Expansion Vessel based on pressure Sensing

Safety Device: A safety device shall be provided in the hot water side of heating section to avoid damage to the heat exchanger caused by excessive pressure. It shall be of sanitary design.

Hot water Pump: One number of Hot water pump will be supplied which will be used for hot water circulation for heating of Milk up to 76 deg C. It shall have capacity and rating of6000 LPH@ 20 MWC.

One no of PID Temperature control arrangement for control of temperature together with Pneumatic Type Steam Regulating and control valve is included.

Note: Instrumentation as shown in P * I and logic of operation as per process requirement,

5.1.8 Inoculation tank

Capacity : 500 Ltr
Type: Vertical, Insulated, Double Walled
MOC:SS316

Other details shall be similar in design and construction to attached data sheet.

5.1.9 Cup Filling Machine

All contact parts are made of SS304 or food grade material.

Application	:Curd
Filling quantity	:200 gm cups
Accuracy	:± 1% depending upon product
Filling	:By gravity .
Output	:2000 cupslhr. Fix speed for 200/400 gm cups
Type	:Rotary single track
Machine body	:Made up of S.S. rectangular pipe base and powder coated M.S. with S.S. Cladding

Round cup diameter:Maximum 95-mm
Round cup height:Maximum 125-mm

Power requirement	:0.5 HP motor and 1200-Watts heater
Air supply	:Approximately 1000-liter/minute at 6 kg at machine main header

Machine is equipped with the following stations.

Cup release station
With a cup stacking capacity of approx 100 No' s cups

Filling station with No cup No fill
(Product balance tank is equipped with level float. Filling will be by gravity. Product from the balance tank will be filled in cups from pneumatically operated filling nozzle. Filling capacity per stroke is adjustable from 100 to 400 gm.)

Lid placing station with No cup No lid & with No lid No Seal (Single foil placing on each cup)

Heat sealing station with No cup No seal
Heat Sealing temp: 250 deg.C adjustable. For different size of cup diameter, heater bottom plate will hav~ t0' be changed.

Ejecting station
(In case of empty cups due to no product in tank or IQW product level, filling, lid placing and lid heat sealing will not take place and the machine will not stop. The empty cups will be ejected.)

5.1.10 Incubation Room

One set of incubation room has been considered, which shall be used for incubation s of inoculated milk in cups, till the curd is formed and subsequently cooling the curd cups. It shall be with following details.

Product to be freeze:	Curd
Product inlet temperature:	(+) 42°C
Product outlet temperature:	(+) 2°C
Ambient temperature:	40°C
Pull Down time:	4 - 5 hrs

5.1.11 Ink Jet Printing Machine

A suitable capacity ink jet type printer shall be provided for on line printing of curd cups.

5.1.12 Belt Conveyor

A suitable size belt conveyor shall be provided with curd cup filling machine.

5.1.13. SS Table for Cup Packing

Suitable size SS curd working table shall be provided.

5.1.14 Innoculation Tank

Capacity : 2000 Ltr
Type : Vertical, Insulated, Double Walled
MOC: SS 316

Other details shall be similar in design and construction to attached data sheet.

5.1.15 Pouch Curd Filling Machine

Capacity of Machine 5000 Pouches/hr. of sizes 200 ml & 500 ml, 1000 ml Accuracy of filling at 200ml, 500 ml and 1000 ml +4 /-0 ml .>-'-'-~.~

Leakage % on 200 ml, 500 ml & 1000 ml pouches 0.3 to 0.5 % under normal condition
Weight & dimension of Pouch filling machine
Min. pack size:125mmWx70mmL
Maximum pack size : 125mmWx250mmL

Utility Consumption 415V,3phase
a Electrical Power: Connected 6 KW During Operation 5kW
b Cooling Water"200 LPH@10-12 deg C 120 ~PH @ normal water

5.2 BUTTERMILK AND LASSI SECTION

5.2.1 Curd Setting cum Butter Milk Preparation Tanks

Capacity : 10KL
Type : Triple Walled, Insulated, Jacketed
MOC: SS 304

Functional requirement: This tank shall be used for curd setting for Chhas manufacturing.

This tank shall be supplied with standard accessories.

5.2.2 Recirculation cum Transfer Pump

Capacity : 10 KLPH
Head : Suitable
Type: Centrifugal Monobloc

Function: The pump shall be used for recirculation during mixing of sugarlSMP in turbo blender.

Design: The pump shall be sanitary design and centrifugal mono block construction.

Finish: All stainless steel surfaces shall be polished to 150 grits. Other specifications shall be as per OEM.

5.2.3 Shear Pump

Capacity: 10 KLPH
Head : Suitable
Type: Shear

Function: The pump shall be used for recirculation during mixing of sugar/stabilizer in turbo blender.

Design: The pump shall be sanitary des!gn and centrifugal mono block construction.

Finish: All stainless steel surfaces shall be .polished to 150 grits. Other specifications shall be as per OEM. .

5.2.4 Buttermilk Chiller

Capacity: 10 KLPH

Function: The plate heat exchanger shall be used for chilling Buttermilk before being transferred to filling machine.

Design Requirements:

Milk feed temperature: 10 degree C
Milk discharge temperature: 4 degree C

Other specifications shall be as per Standard.

5.2.5 Pasteurized Water Tank

Capacity: 15 KL
Type: Vertical, Double Walled, Insulated, without agitator
MOC: SS 304

Functional requirement: To store pasteurized water. Other Specification shall be as per Standard

5.2.6 Pasteurized Water Transfer Pump

Capacity: 10KLPH
Type : Centrifugal, Mono-bloc
Head : Suitable
MOC: Contact parts in SS 316
Shroud: SS 304

Function: The pump shall be used for transfer of pasteurized water.

5.2.7 Buttermilk Thermizer

Capacity : 5 KLPH

Function: This shall be used for pasteurization of butter milk and subsequently chilling it.

Design Parameters:

Butter milk feed temperature	6 Deg. Centi
Buttermilk pasteurization temp.	65 Deg. Ceriti.
Finished milk discharge temp.	4 Deg. Centi.
Chilled water flow rate	1.5 times
Chilled water feed temp.	1.5 Deg. C

Finish: All welding joints shall be ground smoothly. All stainless steel surfaces are to be polished to 150 grits.

Technical specifications and scope of supply

Plate Heat Exchanger - Milk Pasteuriser (HTST) with SS 316 plates.

Plates: The plates shall be made from stainless steel (SS 316) in sanitary design. All the product contact and exterior surfaces shall be easily accessible or readily removable for cleaning and Inspection.

Gaskets: The sealing gaskets must ensure complete sealing and pre-vent any cross leakage between product and service liquids. Gaskets shall be of sanitary type and shall be continuously bonded to the heat transfer surface. The gasket material shall be food grade, non-toxic, fat resistant, non-absorbent and shall have smooth surface. The material shall withstand a water sterilization temp. of 100 Deg. C. and 2% caustic solution and 1% acid solution at 80 Degree Centigrade. It shall be "SNAP IN or LOCK IN type. The MOC of gasket shall be NBR.

Supporting Frame: The supporting frame for the plate pack shall be of a self supporting design made of stainless steel (AISI 304) clad mild steel with a manually operated stainless steel (AISI 304) tightening device. The tightening device shall be able to exert uniform pressure on all the parts of heat transfer plates to prevent any leakages from Pasteurizer.

Accessories

Inlets/Outlet: The inlets and outlets in each section of the heat exchanger for products as well as services shall be provided with complete stainless steel (AISI 304) unions of size 76.5 mm.

Thermo-wells: SS (AISI 304) pockets for thermometer on required ports for Product and service inlet and outlet connections.

Ball Feet: The frame shall be provided with adjustable SS ball feet with provision for height adjustment of 50 mm.

Float Balance Tank: The balance tank of suitable capacity shall be fabricated from 2 mm thick SS sheet conforming to AISI 304. The tank shall be provided with cover, Product inlet, cup type outlet, return Product inlet, inlet for water, over flow and adjustable SS ball feet and provision for level probes. The balance tank, shall be provided with a Level Transmitter along with pneumatic flow regulating valve & High Level Probe for control of level of liquid in balance tank. The Feed Pump shall be interlocked with level transmitter and High Level Probe to avoid the dry running of pumps. The balance tank shall also be provided with manual butterfly valve at the outlet.

Feed Pump & Booster Pump: The Pasteurizer stainless steel feed pump shall be of sanitary steel shroud with louvers for air-cooling and suitable design as per dairy standard. Its capacity shali be adequate to facilitate efficient CIP. The TEFC drive motor shall be fitted with stainless arrangement for cable connection.

Booster Pump shall also be provided to maintain the positive pressure on the Pasteurised Milk Side.

Feed Pump - 5 KLPH @ Suitable head
Booster Pump - 5 KLPH @ Suitable head

The pumps shall also be suitable for CIP flow rate in closed loop.

Flow Transmitter & Variable Frequency Drive: Pasteurization Module shall be supplied with suitable size Flow Transmitter - Volumetric Type make along with Variable Frequency Drive working in tandem with flow transmitter will automatically control the flow as per requirement of process. The Variable frequency drive shall be mounted on both Feed Pump and Booster Pump.

Pressure Transmitter: Pressure Transmitters shall be supplied to measure pressure of the working fluids during operation. The system will measure the differential pressure between the Pasteurised milk side & Utility Side to ensure the positive pressure and to avoid mixing of chilled water and hot water in milk in case of accidental damage of plates.

Heating Device /Hot Water Generation System:

Hot water system shall be - PHE based and will house an expansion chamber and other safety device to take care of volume expansion. The hot water generation system shall be skid mounted.

PHE with SS 316 plates with EPDM gaskets

PHE frame shall be of MS cladded with SS 304
(Instead of CS as mentioned)

Expansion Chamber: to take care of Volume increase

Safety Valve (Audco), Air Vent, Steam trap By-pass assembly Pneumatically operated Steam Control Valve (Samson Make - Size1.5") with positioner along with lIP Convertor (Toshniwal) and By-pass assembly . .

Water Make up valve - Standard make
Automatic Water Make up facility of Expansion Vessel based on pressure Sensing

Hot Water Generation PHE

Safety Device: A safety device shall be provided in the hot water side of heating section to avoid damage to the heat exchanger caused by excessive pressure. It shall be of sanitary design.

Hot water Pump: One number of Hot water pump will be supplied which will be used for hot water circulation for heating of Milk up to 78 deg C. It shall have capacity and rating of 12000 LPH @ 25 MWC.

PID Control Loops

Hot Milk (Pasteurised) Temperature Control

One no of PID Temperature control arrangement for control of pasteurization temperature together with Pneumatic Type Steam Regulating and control valve is included.

Chilled Milk Temperature Control

One no of PID Temperature control arrangement for control of chilled milk temperature together with Pneumatic Type control Valve for Chilled Water Control & Regulation is included.

Instrumentation & Controls - as per process logic :- Pasteuriser shall have following facilities
Automatic Pasteurization Temperature control arrangement & having the provision to download data on Computer

Automatic Flow Control arrangement

PLC controlled automatic flow diversion arrangements for hot milk as well as chilled milk having provision of forward as well as backward flow Indication of differential pressure b/w Milk & Hot water Flow in heating section & also b/w Milk & chilled water in chilling section and ensuring that the alarm is activated in case of negative differential pressure and Pasteurizer is automatically switched off.

Level Control of balance tank/Controlled Operation of Pumps

Provision of CIP loop - PLC operated

Pipes and Fittings (SS 304):- All inter connecting pipes with necessary fittings for product as well as service shall be supplied within the specified battery limits and exclusions

Product: The supply shall include all the necessary SS 304 pipes and fittings from float balance tank to the finished pasteurized product outlet as required inter-connecting the above equipment.

Hot Water: The supply shall also include "necessary SS pipes and fittings for pumping hot water to the heating section of the Pasteurizer and return to the hot water set.

Constant Pressure Valve: Constant Pressure Valve (Mechanical Type) shall be supplied at the outlet of Chilled Milk Discharge line to maintain constant pressure of the system during the operation of plant.

A suitable size pressure reducing valve in included in the scope of supply to limit the steam pressure up to 1.5 Kg/cm2

All Pipes & fittings shall be designed.ez conceived to acquire minimum floor area and mounted on SS SKID.

Note: Instrumentation as shown in P * I and logic of operation as per process requirement.

5.2.8 Buttermilk / Lassi Horizontal Storage Tank Insulated

Capacity : 10KL
Type : Horizontal Storage tanks ..
MOC: SS 304

Horizontal, Double walled, Insulated

Function: To store the Buttermilk/Lassi for packing.

5.2.9 Buttermilk filling machine

Capacity: 5000 PPH (Pouches per Hour)
Product: Butter milk
Product feeding System : Gravity assisted filling system working under Constant Head
MOC for product contact parts : SS 304
Fill Quantity options . : 200ml , 500ml & 1000 ml
Pack style : Centre seal pillow pack

5.2.10 CIP Return pump for curd setting cum Butter Milk / Lassi

Preparation & storage tanks

Capacity : 20KLPH
Type : Self Priming
Head: Suitable
Mounting: Free standing with adjustable ball feet
Shaft seal: Mechanical
Gasket: EPDM
Shroud: AISI 304
Product contact parts: AISI 316

Motor: 415 V AC, 3 phase, 50 Hz, squirrel cage induction motor with *TEFC/IP* 55 enclosure.

The pump shall be of self priming design and shall be similar in design and construction of sanitary pumps.

5.2.11Sugar Syrup Preparation tank

Capacity :3KL
Type : Vertical, Single Walled
MOC : SS 304

Function: To dissolve the sugar for preparation of sugar syrup.

5.2.12 Turbo blender

Capacity: 1000 *Kg/Hr*
Application: Mixing of sugar with water

Basic Operation

The turbo blender consists of a centrifugal pump head and impeller mounted in such a fashion so that the normal suction port (inlet) is pointed upward. The inlet piping consists of a tube within a tube arrangement. This allows the liquid and dry ingredients separated until they are in the mixing chamber. This arrangement eliminates one of the major problems of wet drying mixing i.e. pre-wetting.

The natural suction of centrifugal pump helps to pull the powder from the hopper through the diffuser tube. The outer tube is used to direct the liquid into the impeller tangentially. The liquid entering the blender is accelerated outward until it strikes the Blender screen. This creates a natural backpressure that causes the liquid to flow down wards and back towards the eye of the impeller. The hollow envelope created helps to suck

the powder.

The mix is then transferred to the ReM preparation tank for storage and further transfer.

Scope of Supply

The scope of supply includes blending chamber assembly, manual butterfly valve, motor, base, hopper, powder and liquid inlets and mix outlet. The blender capacity is 1000 Kg/Hr and the hopper as such would be at a convenient height. ..

5.2.13 Recirculation cum Transfer Pump

Capacity : Suitable
Type : Centrifugal, Mono-bloc
HEAD : Suitable
MOC: Contact Parts in SS 316

Function: The pump shall be used for recirculation and transfer of sugar syrup.

5.2.14 Ready Sugar Syrup Storage Tank

Capacity : 3 KL
Type : Vertical, Insulated, agitated, Double walled, Suitable for Indoor Installation.
MOC :SS 304

Function: Shall be used to store chilled RCM at 4 degree centigrade temperature.

5.2.15 Sugar Syrup Transfer Pump

Capacity : 5 KLPH
Type : Centrifugal, Mono-bloc
HEAD : Suitable
MOC: Contact Parts in SS 316

Function: The pump shall be used for transfer of sugar syrup.

5.2.16 Twin Filter for Curd and Butter Milk

Capacity : 10KLPH
Type : Duplex
Material: SS 304

Constructional Features: The general design shall be of tubular design with a concentric cylindrical filter made from SS screen of 1.5mm pitch. All welding joints shall be ground smooth. All stainless steel surfaces shall be mirror polished.

5.2.17 Crate washer with drier and conveyor

Functional Requirements: Crate washer shall be designed for washing of crates.

Technical Specifications: Capacity (Crates / Hr): 1200 . Configuration: Straight through.

Washing Sequence: The pumping and jetting arrangements shall apply sufficient washing liquid to the inside and outside surfaces of the crates.

Pre-rinse: This section shall be provided before the first rinse in order to clean the dirty crates before being passed on to the first rinse section. The water for the pre rinse section shall be drawn from the first rinse pump/ sump.

First rinse: Part of, hot water after rinse, shall be collected in the SS tank for first rinse, which shall be pumped and jetted through nozzles at approximately 45 Deg C. Water shall be pumped at a nozzle pressure of
3.5Kg Cm-2 @ 15000 LPH and continuously drained after use.

Hot detergent rinse:

Hot detergent at 75 Deg C and 2% strength pumped from detergent sump and jetted through nozzles. Pump capacity 20000 LPH/48 MWC. Hot detergent solution re-circulated and drained off as per requirement.

Hot water after rinse: At nozzle pressure of 4.8 Kg Cm-2, 75 Deg C, @20000 LPH re-circulated and partly fed to pre-rinse section. The re- circulated hot water to be drained off whenever required. Make up water will be made available continuously from the mains water header.
Finish: All welding joints are to be ground smooth and polished to 150grits.

Temperature Control: It shall have temperature controller for detergent solution. This shall consist of pneumatically operated steam valve for ON/OFF, solenoid valve, temperature sensor, temperature controller etc as per requirement.

5.2.18 Two Tier Crate Conveyor

Capacity: 1200 CRA *TESJ* HR.

Functional requirement: The conveyor shall be used to transport HDPE crates filled with milk (in polythene pouches) from the' packing table to milk cold store. The filled crates shall be manually loaded on to the conveyor, which is passing below a pouch-crating table.

Other specifications are same as item no. 4.2

5.2.19 SS Packing Table & Cross Over Bridges

Suitable size packing table & cross over bridges shall be provided. Electronic weigh scale

Function: It.shall be used for the offline weighing of milk pouches.

Capacity: 0-2 Kg

5.2.21 Cooling Water balance tank with float & accessories

Function: It shall be used as a balance tank for the jaw cooling system.

Capacity: 1000 Ltrs

MOC: SS 304

Design: Single walled, Uninsulated, 2 mm Thick AISI 304

5.2.22 Cooling Water Recirculation Pump

Capacity : 10 KLPH

Head : Suitable
Type: Centrifugal Monobloc

Function: The pump shall be used for transfer of milk from raw milk silos to pasteurizer.

Design: The pump shall be sanitary design and centrifugal mono block construction.

Finish: All stainless steel surfaces shall be polished to 150 grits.

5.2.23 Cooling Water PHE Chiller

Function: It shall be used for the chilling of the water for the jaw cooling of pouch packing machine with chilled water.

Capacity : Suitable for Packing Machine

Design Parameters:

Cooling Water feed temperature : 15 degree C
Cooling Water discharge temperature : 10 degree C
Chilled water feed temperature : 1.5-2 degree C
Maximum permissible chilled : 1.5 times the water flow rate

5.2.24 TrolleyMounted Leaky Pouch Collection Tank

Capacity: Suitable

MOC: SS 304

Functional requirement: To transfer leaky pouch milk.

5.2.25 Leaky Collection tank

Capacity: 1000 L with at least 100mm allowance in depth.

Function: It shall be used to collect the milk from leaky pouches and to act as a balance tank before pumping the milk to process section.

Construction Features: The tank shall be of single walled

5.2.26 Inline Duplex Strainer

Functional Requirement: It will be installed in pipelines for removing floating impurities from butter oil.

Capacity Type Material
:5KLPH
: Pipe in Pipe
: SS 304

5.2.27 **Leaky Pouch Milk PHE**

Function: It shall be used for the chilling of the leaky pouch milk with chilled water.

Capacity : 5 KLPH Design Parameters:

Cooling Water feed temperature: 30 degree C
Cooling Water discharge temperature : 4 degree C

Chilled water feed temperature : 1.5-2 degree C
Maximum permissible chilled: 1.5 times the water flow rate

5.2.28 Leaky Pouch Milk Transfer Pump

Capacity : 5 KLPH
Type: Centrifugal, Mono-bloc
Head: Suitable

Function: The pumps shall be used for transfer of leaky pouch milk from leaky pouch dump tank to raw milk storage tank. .

General Design and specifications shall be similar to other centrifugal pumps mention above in this document

5.3 Sweet curd

5.3.1 Mix Preparation Tank for Misti Dahi

Capacity : 1.5 KL
Type : Triple Walled, Insulated, Jacketed
MOC: SS 304

Functional requirement: for caramelization of Misti Doi mix
The tank shall be jacketed insulated and fitted with sweeping type agitator. Provision for Steam and water circulation in jacket shall be provided.

Other Specification shall be as per Standard.

5.3.2 Turbo Blender for Misti Dahi

Capacity: 500 Kg/Hr
Application: Mixing of SMP with milk

Other details and specifications shall be similar to item no. 5.2.13

5.3.3 Centrifugal Pump for Circulation

Capacity: 5 KLPH
Head : Suitable
Type: Centrifugal Monobloc

Function: The pump shall be used for circulation ofMisti Dahi mix.

Design: The pump shall be sanitary design and centrifugal mono block construction.

Finish: All stainless steel surfaces shall be polished to 150 grits.

5.3.4 CIP Return Pumps

Capacity :20KLPH
Type : Self Priming
Head : Suitable
Mounting : Free standing with adjustable ball feet
Shaft seal : Mechanical
Gasket: EPDM
Shroud: AISI 304
Product contact parts: AISI 316

Motor: 415 V AC, 3 phase, 50 Hz,' squirrel cage induction motor with TEFC/IP 55 enclosure.

The pump shall be of self primingdesign and shall be similar in design and construction of sanitary pumps.

5.3.5 Milk Transfer Pump to Misti Dahi tank

Capacity : 2KLPH
Head : Suitable
Type: Centrifugal Monobloc

Function: The pump shall be used for transfer of Misti Dahi mix to Misti Dahitank.

Design: The pump shall be sanitary design and centrifugal mono block construction.

Finish: All stainless steel surfaces shall be polished to 150 grits.

5.3.6 Misti Dahi Storage Tank

Capacity : 1.5 KL
Type : Triple Walled; Insulated, Jacketed
MOC: SS 304

5.3.7 Milk Transfer Pump to Inoculation tank

Capacity: 5 KLPH
Head: Suitable
Type: Centrifugal Monobloc

Function: The pump shall be used for transfer of Misti Dahi mix to inoculation tank.

Design: The pump shall be sanitary design and centrifugal mono block constructi on.

Finish: All stainless steel surfaces shall be polished to 150 grits

5.3.8 Chiller for Misti Dahi MUk Cooling

Capacity : 2 KLPH

Function: The double section plate heat exchanger shall be used for cooling of misti Dahi mix.

Design Parameters:

Misti Dahi mix feed temperature : 65 degree C

Misti Dahi mix discharge temperature :42 degree C

5.3.9 Innoculation Tank

Capacity : 300 L
Type : Triple Walled, Insulated, Jacketed
MOC: SS 304

Functional requirement: the tank shall be used for inoculation and feed to the packing machine.

5.3.10 Cup Filling Machine Rotary

Capacity : 2000 CPH
Type: Rotary type
MOC: SS 304

Functional requirement: The machine shall be used for cup filling of misti Dahi/set yoghurt.

Other Specification shall be as per Standard

5.3.11 CIP Return Pump

Capacity : 20KLPH
Type : Self Priming
Head : Suitable
Mounting: Free standing with adjustable ball feet
Shaft seal : Mechanical
Gasket : EPDM
Shroud : AISI 304
Product contact parts: AISI 316
Motor: 415 V AC, 3 phase, 50 Hz, squirrel cage induction motor with TEFC/IP 55 enclosure.

5.3.12 Cup conveyor

Capacity: Suitable
Type: Belt type

Functional requirement: The belt conveyor shall be used for conveying filled cup for printing.

5.3.13 Inkjet Printer for Cup Printing

Suitable inkjet type printer shall be provided for printing of dahi cups.

6.0 RINSE MILK RECOVERY SYSTEM

6.1 SS Balance Tank for Rinse Milk Recovery

Capacity: 1,000 Liters.
Type: Vertical, Uninsulated
MOC: SS304

Function: The tank shall be used for intermediate storage of rinse milk. Note: Instrumentation as shown in

P * I and logic of operation as per process requirement.

6.2 Rinse Milk Transfer Pump

Capacity : 5 KLPH
Type: Centrifugal, Mono-bloc
Head : 30MWC
MOC: Contact parts in SS 316
Shroud: SS 304
Function: The pumps shall be used for transfer of rinse milk through rinse milk 'Chillerto rinse milk storage tank.

6.3 Rinse Milk Chiller

Capacity : 5 KLPH

Function: The single section plate heat exchanger shall be used for chilling milk! rinse milk with chilled water.
Design Parameters:

Milk feed temperature : 35 degree C
Milk discharge temperature : 4 degree C
Chilled water feed temperature : 1.5 to 2.0 degree C
Maximum permissible chilled water flow rate - 2.0 times the milk flow rate.

Finish: All welding joints shall be ground smoothly, All stainless steel surfaces shall be polished to 150 grits.

6.4 Insulated Vertical SS Storage Tank for Rinse Milk

Capacity: 5 KL
Type: Vertical, Insulated
MOC : SS304

Function: The tank shall be used for storage of rinse-milk.

Note: Instrumentation as shown in P * I and logic of operation as per process requirement.

6.5 CIP Return Pump

Capacity : 20KLPH
Type : Self Priming
Head : 25 MWC
Mounting: Free standing with adjustable ball feet
Shaft seal: Mechanical
Gasket: EPDM

Motor: 415 V AC, 3 phase, 50 Hz, squirrel cage -induction motor with TEFC/IP 55 enclosure.
Shroud: AISI 304
The pump shall be of self priming design. The pump shall be similar in design and construction of sanitary pumps.

6.6 Milk Transfer Pump to RMST

Capacity : 5 KLPH
Type : Centrifugal, Mono-bloc.
HEAD : Suitable
MOC: Contact Parts in SS 316

Function: The pump shall be used for transfer of rinse milk from rinse milk storage tank to raw milk storage tank.

The pump shall be similar in design and construction of sanitary pumps.

7.0 BUTTER MAKING EQUIPMENT

7.1 CONTINUOUS BUTTER MAKING SECTION

7.1.1 Cream Balance Tank

Capacity: 450 Liters
MOC: AISI 304

The balance tank shall be fabricated from 2 mm thick stainless sheet and provided with part removable hinged cover & spray ball connection, cream inlet, cup type outlet, return cream inlet, inlet for water, overflow,high & low level probes, temperature probe for indication in HMI and adjustable stainless steel ball feet."

7.1.2 Cream Transfer Pump with VFD

Capacity: 2 KLPH
Type: Positive displacement screw pump
Head : Suitable
MOC: Product contact parts in AISI 316

The pump shall be used for transfer of ripened cream from cream balance tank to the inlet of continuous butter making machine.

These pumps shall have mechanical seals .. The gasket shall be made of long lasting type food grade rubber and the pump shall be provided with SS base frame, motor and adjustable speed unit of frequency variator.

A suitable SS 304 cover shall be provided to meet the hygienic requirement. The motor shall be suitable for 440 V AC, 3 Phase, and 50Hz supply and would be squirrel cage induction motor, TEFC IP-55.

7.1.3 Continuous Butter making Machine for White Butter

Capacity Butter output: raw/ripened cream fat should be 38-42% for capacity up to 800 kg/h.

Sturdy framework on adjustable feet, designed to reduce vibrations. Satin polished stainless steel AISI 316 L

cladding.

One rear door allows access inside of the machine.

Churning unit, direct driving of the beater by a motor with frequency variation, power: 22 KW. This concept makes easy the maintenance operations and allows a large speed. variation range. Working section motor shall be of7.5 KW.

AISI 316 L stainless steel working unit consisting of:

One motor-reducer connected with a gear box for driving the augers of the working section.

One separation section with buttermilk filtration device. A door allows following easily the butter grain formation.

One extraction section/washing section. made of 2 Archimedes screws with draining device of the residual buttermilk and the washing water.

An outlet nozzle with CIP junction. The nozzle can be connected with to a butter pump to feed directly a butter feeding system; .

Independent control board including the remote control of the frequency inverters and the speed indicators of churning, working and possibly' cream pump.

7.1.4 Butter Milk Balance Tank

Capacity: 100 L
MOC: SS304

Function: This tank shall be used to receive butter milk from CBMM.

7.1.5 Wash Water Balance Tank

Capacity: 100 L
MOC: SS304

Function: This tank shall be used to receive pasteurized water from the pasteurized water storage tank and pump the water to CBMM for butter washing, through a wash water chiller.

The tank shall be in SS 304 construction un-insulated with level controls. The balance tank shall be complete with cover; SS ball feet, inlet and outlet, over flow, high/ low level & temp. probe etc.

7.1.6 Butter Hopper with auger, covers, level sensors, controls

Capacity : 1 Ton

The butter silo shall be in SS 304 construction complete with inside of the product contact surfaces specially sand/shot blasted and chemical treated to ensure excellent anti sticking properties.

The outside shall be polished to 150 grit and the silo provided with large diameter slow speed driving augers driven by a motor having a VFD. The surface of the auger shall also be especially sand/shot blasted for desired anti-sticking properties. The whole of the equipment to be floor rested with CIP cleaning ball, vacuum breaker, inside lighting fixture. The butter silo would be provided with level and temperature sensors to continuously indicate the level of butter and temperature for monitoring purpose.

7.1.7 Butter Trolley

Capacity : 600 kg

Butter trolleys would be required for transportation of butter from one section to other within the dairy.

Dimensions

Overall height (from ground level) and width of trolley should not exceed 800 mm and 900 mm respectively.

Finish: All welding joints to be ground smooth. All stainless steel outer and inner surfaces are to be shot blasted. Generous slope should be provided towards the outlet.
Joint curvature: All inside corners should have minimum radii of25 mm. The main body should be made from minimum 2 mm thick stainless steel sheet confirming to AISI 316.

The frame should be made of 50 mm NB 'C' class GI pipe. The handle and pipe support for handle should be made from 25 mm NB, SCH 10AISI 304 pipe.

2 pairs of 200 mm dia. nylon wheels, of which front pair should be swivel type

1 no. AISI 316 drain nipple of 51mm dia and 75 mm length ending in a stainless steel blank.

7.1.8 Butter Churn with VFD for Table Butter

1.0 FUNCTIONAL REQUIREMENTS

The churner shall be fed with approximate 400 L of cream having 40-45%fat. The output of butter per batch shall be approximately 0.1 metric tones.

DESIGN REQUIREMENTS Capacity: 1,000 Liters

Finish:
Internal Surface : Original 2B Mill Finish *1150* Grit Finish.
External Surface : Original 2B Mill Finish with all burs removed.
Weld-joint: Ground smooth & finished to 150 Grits.
MS Stiffener: Two coats of epoxy primer after proper de-rusting.

Joint curvatures:
The inside radii of all welded and permanent attachment joints shall be at least 6mm. where the coneportion or the dished end joints the cylindrical portion of the drum of butter chum, the radii shall not be less than 25mm.

3.0 SCOPE OF SUPPLY:

Churning Barrel & Beaters:
The churning barrel and beaters shall be fabricated .from stainless steel conforming to AISI 316. The Beaters shall ensure uniform distribution of salt and moisture during the working phase.

Drive:
The drive arrangements shall consist of reduction gear box for a speed ranging from 5 to 30 rpm. The chum shall be able to rotate at least at four different speeds in clockwise as well anti clockwise directions. The different speeds are 5,10,17 & 30 rpm.

The drive arrangement shall be complete with electric motor with VFD, belts, electric push buttons panel to operate the chum in forward, reverse and off positions, speed changing levers, clutch and brake to stop the chum at any desired position.

Drive Housing & Support:
The complete drive shall be housed in a drip proof enclosure which can be placed on R.C.C foundation. The other end of the chum shall be supported on mild steel legs made from pipes which shall rest on 300mm high R.C.C. pedestals.

Accessories: Spray Pipe:'
Stainless steel CAISI 304) spray pipe over the churn for spraying chilled
water when the chum is in operation. The inlet to the spray pipe shall be in complete stainless steel CAISI304) union.

Safety Guard Pipe:
Stainless steel CAISI 316) safety guard pipe with frame. Safety switch shall be provided to prevent the operation of motor when the guard rail is lifted.

Manhole / Door:
Leak-proof hinged stainless steel CAISI 316) 550mm size Manhole of standard design with proper locking arrangements. It shall be lockable in both open and closed positions. The manhole shall be provided with EPDM gasket of food grade quality.

Sight glass:
Stainless steel CAISI 316) sight glass assembly of diameter 140mm shall be provided with toughened glass.

Butter milk drain:
50mm diameter stainless steel CAISI 316) butter milk drain with drain valve ending in complete stainless steel union.

Air release cock:
It shall be press openable type.

CIP spray ball:
Cleaning device for lcosed circuit in place cleaning. The location of the spray ball shall be such that effective cleaning can be obtained by a single spray ball only. The spray ball shall be fixed on the shell opening with the help of wing nuts and gasket. When the churn is in operation a stainless steel blank plate with gasket shall be used to close the opening after removing the spray ball.

End flanges:
It shall be MS cladded with SS 304 with proper strengthening pads for coupling to the gear box on one side and to the bearing on other side.

Balance Tank:
Stainless steel (AISI 316) balance tank of 1OOLcapacity for butter milk. The balance tank shall be provided with three rios. Nylon wheels, stainless steel (AISI 316) handle at top and cup type outlet at a height of 230mm from the ground level. The tank shall also have a removable stainless steel (AISI 316) cover with two handles and a removable type strainer which can be placed on the frame provided at nearly 50mm below the top. The strainer shall be made from perforated stainless steel sheet.

Vacuum system:
Comprising vacuum pump, drive and accessories. Suitable arrangement shall be provided for vacuum control.

Butter milk pump:
Stainless steel (AISI 316) butter milk pump .of sanitary design of 5000LPH and head 20 MWC shall be provided .

Chiller:
Stainless steel (AISI 304) plate type chiller of capacity suitable to the requirement of chilled water sprinkling on the butter churn.

Shovels:
Stainless steel (AISI 316) sand blasted shovels complete with handle shall be provided - 2 Nos.

Paintings:
All the mild steel parts of the butter churn shall be painted with a coat of epoxy primer by two coats of epoxy paint after de-rusting.

Control panel:
SS 304 control panel to house the VFD and feeders for Vacuum pump and butter milk transfer pump.

6.0 TESTS

The following tests shall be conducted by the the bidder at works only.

- Dye penetration test for weld joints..
- Water fill-up test of inner vessel for water tightness.
- Final inspection prior to dispatch.

7.1.9 Auto Butter Packing / Wrapping Machine for 100 g / 50gm / 10gm Pack size (Indigenous / Imported)

Filling weights: 100 g / 50gm / 10gm

Machine: Intermittent operation, volumetric dosing system with piston and dosing valve. Vertical four pocketed folding wheel. The extruded blocks are separated from the dosing nozzle by a cutting wire and placed onto the precut wrapping material.

Product: Not aerated butter or butter spreads of homogeneous quality and suitable consistency.

Product feed: Via stainless steel worm trough with two feeding augers, md. spring-loaded compensating piston.

Dosing unit: Hand cleanable dosing system with rotary valve and piston. Driven by servo-motors.

7.1.10 Butter Packing Table
MOC :SS 304
Suitable size of SS tables as per requirement shall be provided.

7.2 BUTTER MILK HANDLING SECTION

7.2.1 Butter Milk Transfer Pump

Capacity: 10 KLPH

Type : Centrifugal Monoblock
MOC : SS-304 body with SS- 316 working parts
Mounting : Free standing with adjustable ball feet
Shaft seal: Mechanical
Gasket : Nitrile rubber
Motor : 440 V AC, 3 Phase, .50Hz, squirrel cage Induction motor, TEFC, with IP 55 enclosure
Shroud : AISI 304

7.2.2 Butter Milk/wash water recirculation Pump through CBMM

It shall be used to transfer butter milk and shall be in SS construction sanitary design complete with SS motor shrouding. The pump shall be provided with adjustable SS ball feet.

Capacity: 5 KLPH

Type : Centrifugal Mono block
MOC : SS-304 body with SS-316 working parts
Mounting : Free standing with adjustable bail feet
Shaft seal: Mechanical
Gasket : Nitrile rubber
Motor : 440 V AC, 3 Phase; 50 Hz, squirrel cage Induction motor, TEFC, with IP 55 enclosure
Shroud : AISI 304

It shall be used to pump butter milk from butter milk buffer tank to CBMM through the butter milk chiller and shall be in SS construction sanitary design complete with SS motor shrouding. The pump shall be provided with adjustable SS ball feet.

7.2.3 Butter Milk Chiller

Capacity: 5 KLPH

Function: The single section plate heat exchanger shall be used for chilling butter milkwith chilled water.

Design Requirements:

Butter milk feed temperature : 10 degree C

Butter milk discharge temperature : 4 degree C

Chilled water feed temperature : 1.5 degree C

Maximum permissible chilled Water flow rate : 2.0 times the milk flow rate
.

The equipment shall confirm to Technical Datasheet enclosed.

Finish:All welding joints shall be ground smoothly. All stainless steel surfaces shall be polished to 150 grits.

Scope of Supply: Plate Pack:

Plates: The plates shall be made from stainless steel conforming AISI 316 and shall be of sanitary design. All milk contact.and exterior, surfaces shall be easily accessible or readily removable for cleaning and inspection.

Gaskets: The sealing gaskets shall ensure complete sealing and prevent any cross leakage between-product

and service liquids. Gaskets shall be of sanitary type (SNAP IN TYPE). It shall be continuously bonded to the heat transfer surface.

The gasket material shall be of food grade rubber and shall withstand a water sterilization temperature of 1OO,degree C and 2% caustic solution at 80 degree C. Gasket material shall be non toxic, .fat resistant, non absorbent and shall have smooth surface. The MOC of gasket shall be NBR.

Supporting frame: The supporting frame for the plate pack shall be of a self supporting design made of MS cladded with AISI 304 SS sheet with a manually operated tightening device.

The frame and tightening device shall preverit the plates from deflecting under pressure differential of minimum 4 kg.zcm sq.

Inlets/Outlets: The inlets and outlets for chilled water and product shall be provided with complete stainless steel CAISI304) SMS unions.

Thermo-well: Stainless steel CAISI 304) pockets for thermometer on all the inlets and outlets. Each pocket shall be complete with stainless steel CAISI304) guard for mounting glass thermometers / PT 100 sensors.

Ball feet: The frame shall be provided with adjust able stainless steel ball feet with provision for height adjustment of 50mm.

7.2.4 Butter Milk Storage Tank

Capacity: 10KL
Type : Horizontal, Insulated, Double Walled
MOC: SS 304

Function: To store butter milk at 4 deg C for further processes.

7.2.5 Butter Milk Transfer Pump

Capacity : 10KLPH
Type : Centrifugal Monoblock
MOC : SS-304 body with SS- 316 working parts
Mounting : Free standing with adjustable ball feet
Shaft seal: Mechanical
Gasket : Nitrile rubber
Motor : 440 V AC, 3 Phase, 50 Hz, squirrel cage Induction motor, TEFC, with IP 55 enclosure
Shroud : AISI 304

It shall be used to transfer butter milk and shall be in SS construction sanitary design complete with SS motor shrouding. The pump shall be provided with adjustable SS ball feet.

7.3 FAT RECOVERY SECTION

7.3.1 Butter Melting Vat

Capacity: 1000 Litres
MOC: AISI 304

Function: The butter melting tank shall be used to melt residual butter from reject packages.

Constructional features: The vat would be having rectangular cross section, bottom jacketed, insulated, cladded and welded construction of sanitary design.

Slope: 1:15 towards the outlet at the bottom of the tank.

Metal contact: The only metal to metal contact between the inner and outer shells shall be at the places where fittings for the tank are provided. At the places where mild steel stiffeners are provided, insulated padding shall be fixed between the inner stainless steel shell and stiffeners.

Finish: All welding joints shall be ground smooth. All stainless steel surfaces shall be polished to 150 grits.

Joint curvatures: The radii of all welded and permanent attachment joints shall be at least 6 mm. where the conical top and flat bottom join the cylindrical shell and radii shall not beless than 25 mm.

Scope of supply:

Inner rectangular body: the inner body and bottom jacket shall be fabricated from 2 mm thick SS 304 sheet.

Outer cladding: the outer cladding shall be fabricated from 2 mm thick SS304 sheet. The inner vessel should bend over the outer vessel and come down to about 50 mm from the top edge, over lapping with the outer vessel.

Insulation: the tank inner shell shall be provided with 50 mm thick resin bonded fibreglass insulation of24 kg per cu m density.

Accessories:

Perforated tray: The tank shall be provided with perforated tray to be installed at the bottom of the tank. The tray shall prevent any packing material to escape to the outlet of the tank. The tray shall be in three pieces made out of 1.6 mm thick SS 304 sheet and shall have 15 mm dia. holes at sq. pitch.

Outlet: The vat should be provided with a 51 mm molten butter! butter oil cup type outlet of stainless steel with a butterfly valve, union & a strainer of SS-304 construction.

Drain: Drain made 'of SS 304 pipe shall be provided with suitable SS 304 butterfly valve.
.
Overflow: It should be of 38 mm diameter stainless steel pipe.

Top Cover: Removable top cover in three piece design made of 1.6 mm thk. SS 304 material shall be provided with handles.

Agitator: Stainless steel (AISI 316) agitator with geared motor should be provided on the melting vat. The stirrer assembly should be mounted on a suitable MS structure cIaded with stainless steel (AISI 304) structure and the same should be supported on the vat.

Thermowell : 300 mm long Stainless steel (AISI 304 inclined pocket suitable for mounting stem type dial thermometer/sensor.

Level probe: 2 nos. of level probes fot high level and low level shall be provided.

Legs: Conical mild steel legs with stainless steel (AISI 304) sheet cladding and stainless steel ball feet (6 nos.) provided at the bottom of the tank. The stainless steel ball feet shall have provision for height adjustment of 50 mm.

Paintings: All the mild steel stiffeners used in the construction of the milk storage tank shall be painted with two coats of epoxy primer.

The tank would be manually cleaned.

7.3.2 Molten Butter Transfer Pump

Capacity : 10KLPH
Type: Centrifugal Mono-block
MOC: SS-304 body with SS-316 working parts
Mounting : Free standing with adjustable ball feet
Shaft seal : Mechanical
Gasket : Nitrile rubber
Motor: 440 V AC, 3 Phase, 50 Hz, squirrel cage Induction motor, TEFC,
with IP- 55 enclosure
Shroud: AISI 304

It shall be used to pump the molten butter from the butter melting tank to fat recovery tank. It shall be SS construction sanitary design complete with motor duly SS shrouded.

7.3.3 Fat Recovery Tank

Capacity: 2000 litres
MOC: AISI 304

It shan be used to collect hot water flushing of butter manufacturing and packing equipment for recovery during first step of CIP. The tank shall be insulated with agitator and accessories.

Constructional features: Vertical double walled, insulated and welded construction of sanitary design.

Slope: 1:15 towards the outlet at the bottom of the tank.

Metal contact: The only metal to metal contact between the inner and outer shells shall be at the places where fittings for the tank are provided. At the places where mild steel stiffeners are provided, insulated padding shall be fixed between the inner stainless steel shell and stiffeners.

Finish: All welding joints shall be ground smooth. All stainless steel surfaces shall be polished to 150 grits.

Joint curvatures: The radii of all welded and permanent attachment joints shall be at least 6 mm. where the conical top and flat bottom join the cylindrical shell and radii shall not be less than 25 mm.

Scope of supply:

Inner Cylindrical body: the inner shell and conical ends shall be fabricated from 2 mm thick stainless steel sheet confirming to AISI 304.

Outer Cylindrical body: the outer shell and conical ends shall be fabricated from 2 mm thick stainless steel sheet confirming to AISI 304.

Insulation: The entire inner stainless steel shell, top and the conical ends shall be insulated with Al foil and 50 mm thick resin bonded fibreglass having 24 kg per Cll m density.

Accessories:

Inlets: Two nos. inlets at the tank top made of SS 304 material shall be provided complete with SMS union.

Outlets: Outlet at the tank top made of SS 304 material shall be provided complete with butterfly vale.

Air vent: 150 mm dia air vent to prevent formation of partial vacuum during CIP and pressure during filling.

Manway: Round stainless steel (AISI 304) manway of dimensions 450 mm dia at the tank top and provided with leak proof hinged insulated stainless steel (AISI 304) cover with tightening and locking device. The manway over shall open outward but at the same time it can be of taken when necessary. The gasket provided shall be of neoprene or nitrile rubber of good quality. .

Sight glass: Stainless steel (AISI 304) sight glass. assembly shall be provided with toughened glass.

Light glass: Stainless steel (AISI 304)light glass assembly shall be provided with toughened glass and stainless steel lamp shade for mounting 24 V, 100Watt bulb. The lamp holder shall be made from brass.

Spray ball: Removable Stainless steel (AIS! 304) cleaning device located at the top of shell to provide flooding of liquid over the interior surface during CIP. It shall have stainless steel unions at the outer end.

Sampling Cock: This shall be provided on the outlet and shall be in stainless steel (AISI 304) construction of sanitary design.

Thermowell: 300 mm long Stainless steel (AISI 304) inclined pocket suitable for mounting stem type dial thermometer/sensor.

Level probe: 2 no. of level probe for high level and low level shall be provided.

Level transmitter: Only provision for level indicator having accuracy of +/-0.50% and shall be of sanitary type.

, Legs: legs made of stainless steel pipe and stainless steel ball feet provided at the bottom of the tank. The stainless steel ball feet shall have provision for height adjustment of 50 mm.

Ladder: A Stainless steel (AISI 304) ladder fabricated from SS pipes of 25 mm dia shall be provided.

Drain Hole: The outer shell shall be provided with one or more drain holes at the lowest point. Any aperture in the shell shall be designed so as to prevent ingress of moisture.
Lifting lungs: Stainless steel cladded lifting lungs shall be provided at top. Paintings: All the mild steel stiffeners used in the construction of the milk storage tank shall be painted with two coats of epoxy primer.

8.0 GHEE MAKING EQUIPMENT

8.1 GHEE MAKING & PA~KING EQUIPMENT

8.1.1 Continuous Butter Melting System

A complete butter melting system comprising of Butter trolley with .augur, Butter transfer pump, Spiraflow butter melting heater, skid mounted hot water generation unit, CIP pump, operating/control panel and all interconnecting piping, fittings etc, shall be considered .in the scope of supply.

8.1.2 Molten Butter Storage Tank

Capacity:5KL

Type: Insulated
MOC: SS304

8.1.3 Molten Butter Transfer Pump

Capacity : 2KLPH
Type : Centrifugal Mono-block
MOC : SS-304 body with SS-316 working parts
Mounting: Free standing with adjustable ball feet
Shaft seal : Mechanical
Gasket: Nitrile rubber
Motor: 440 V AC, 3 Phase, 50 Hz, squirrel cage Induction motor, TEFC, with IP- 55 enclosure
Shroud: AISI 304

It shall be used to pump the molten butter from the butter melting tank to fat recovery tank. It shall be SS construction sanitary design complete with motor duly SS shrouded.

8.1.4 Serum Separator

Capacity: 2 KLPH
Type: Self cleaning type (auto desludging)

8.1.5 Concentrate Fat Storage Tank

Capacity :5KL
Type: Jacketed, Insulated
MOC: SS304

8.1.6 Serum Collection Tank, pump & chiller

Capacity : Suitable
Type: Insulated
MOC: SS304

8.1.7 Serum Storage Tank

Capacity :2KL
Type: Insulated
MOC : SS304

8.1.8 Concentrate Fat Transfer Pump

Capacity :2KLPH
Type: Centrifugal Mono-block
MOC : SS-304 body with 8S-316 working parts
Mounting : Free standing with adjustable ball feet
Shaft seal : Mechanical
Gasket : Nitrile rubber
Motor: 440 V AC, 3 Phase, 50 Hz, squirrel cageInduction motor, TEFC, with IP- 55 enclosure
Shroud : AISI 304

It shall be used to pump the molten concentrate fat. It shall be SS construction sanitary design complete with motor duly SS shrouded.

8.1.9 Ghee Boiler

Capacity: 2000 L

Functional Requirements:

Ghee boiler (steam heated kettle) would be used for the manufacture of ghee from melted butter.

Design Requirement:

Inner Shell : The inner shell with cylindrical body, hemispherical bottom and reinforced brim shall be fabricated from stainless steel plate of 6 mm thickness conforming to AISI 304. - 1 no.

Intermediate Shell : The intermediate shell with cylindrical body & hemispherical bottom shall be fabricated from SS 304 sheet of 6 mm thickness.
- 1 no.

Outer Shell : The outer shell with cylindrical body and hemispherical bottom shall be fabricated from stainless steel sheet of 2 mm thickness and 3 mm thickness respectively conforming to AISI 304.
- 1 no.

Insulation : 100 mm Crown 150 resin bonded fibre glass wool applied with chicken wire netting shall be provided in between the outer and intermediate shell. The insulating material shall withstand the steam temperature .

.Surface scraper type agitator with suitable RPM shall be provided for effective scraping of ghee residue.

The only metal-to-metal contact between the inner and outer shells shall be at the places where fittings for the tank are provided. All welding joints shall be ground smooth. All stainless steel surfacesshall be polished to 150 grits. The radii of all welded and permanent attachment joints shall be at least 6mm.

The kettle shall be provided with thermowell, steam inlet valve, floate trap, safety valve, pressure guage etc.

8.1.10 Ghee Transfer Pump

Capacity: 3KLPH
Type : Sanitary design centrifugal
MOC: SS304

8.1.11 Ghee Settling Tank

Capacity :2KL

Vessel Capacity : 2,000 Ltrs. Working

Design Condition	**Shell**	**Jacket**
Design Temperature	95 Deg. C	95 Deg. C
Working Pressure	Atmospheric	Atmospheric
Design Pressure	Atmospheric	Atmospheric
Hydro Test Pressure	Water fill up	Water fill up

NDT Testing
Dye Penetration testing : 100% of All welding joints.

DT Testing
Material chemical testing : Yes as.per Material Heat No.

Material Physical / Mechanical testing: Yes as per Material Heat

No. Vessel Configuration

Type : Vertical, Cylindrical, Jacketed, bottom conical end and top openable cover, with steam sparging and water sprinkling arrangement.

Material of Construction

Inner Shell: SA240-304
Inner / *outer* Top cover : SA240-304
Inner Bottom cone: SA240-304
Jacket Shell: SA240-304
Jacket Bottom cone: SA240-304
Sprinkler pipe:SA312 TP 304 ERW Pipe, 25.4mm.
Nozzle connection : SA IS2 / 240 - 304 Plate flange / Union

Lifting Lug :SA240-304
Leg Support SA312 TP 304 .ERW Pipe
Bolts / Nuts:SA 193 BS/SA 193 Gr8

Thickness : 2.0 mm
Inner Shell : 2.0 mm
Inner/outer Top cover : 2.5 mm
Inner Bottom cone : 2.0 mm
Jacket shell : 2.0 mm
Outer Bottom cone: : 2.0 mm

Vessel Supports/Attachment

Supports : Round Leg from the ERW quality pipe with

Base plate and ball feet:

Leg Size: 80NB·Sch. 10S
No. of Legs: 4.0 No.
Lifting lug on top: 2 Nos. x 12mm thick

Surface Finish
Internal : Original 2B Mill Finish or Matt. Polished to 1.06 Ra (150 Grit)
External : Original 2B 'Mill Finish or Matt. Polished to 1.06 Ra (150 Grit)
Inside Weld Joint : To be Ground smooth & Flushed and finish to 1.06 Ra (150 Grit)
Outside Weld Joint : To be Ground smooth finish to 1.06 Ra (150Grit)

8.1.12 Ghee Clarifier
CAPACITY 2000 LPH

APPLICATION Clarification of Ghee

WORKING PRINCIPLE:
Ghee from the settling tank is fed through the inlet placed at the top of Ghee Clarifier. Separation takes place in a solid wall bowl where the Ghee residue, under the influence of centrifugal force, separates from Ghee and is collected in the sludge space of the bowl. The clear Ghee comes out through an outlet connection.

BASIC UNIT:

Ghee clarifier comprises a frame containing in its lower part a horizontal drive shaft with friction clutch and brake, work gear and a vertical bowl . spindle. The worm gear is placed in an oil bath. The bowl is fixed on the top of the spindle.

All parts coming in contact with Ghee such as bowl body, bowl hood, disc and distributor are made of stainless steel. The machine frame is cast iron and lock ring is of tinned carbon steel. The frame is painted in Epoxy enamel of Alfa-blue colour. A set of standard tools is supplied with the machine along with a set of standard spare parts.

TECHNICAL DATA

Capacity: Rated Hydraulic capacity 2,000 LPH. Throughput for clarification of Ghee will depend on viscosity, density and temperature and solids percentage.

Motor: A standard electric motor suitable for operation on 440 volts 50 Hz 3 phase AC supply.
Drive: Motor drives the spindle via friction clutch
Lubrication: Gears are immersed in oil bath Outlet open flanged

8.1.13 Ghee Balance Tank

Capacity : 200 L
Type : Un-Insulated
MOC: SS304

8.1.14 Fume Extraction System for Ghee Making Section - SS Ducting & Hood with Industrial Fan

This shall comprises SS ducting (vapor hood) & exhaust fan, which shall be suitable for ghee making section.

8.1.15 Ghee Storage cum Granulation Jacketed Tank

Capacity :5KL
Function : The Ghee storage tank shall be used for storage of final product.
MOC : Inner/Intermediate/Outer SS 316/SS304/SS304

Joint Curvatures: The radii of all welded and permanent attachment joints shall be at least 6mm. Where the .conical top and reverse conical bottom join the cylindrical shell the radii shall not be less than 2Smm.

Accessories; Inlet/outlet/drain nozzles, manhole, sight glass, sand blasted level marks, light glass, spray Ball, overflow, sampling, Cock, Thermo- well, nozzles for high level switch Legs, ladder, railing with toeguard, lifting lugs etc.

8.1.16 Pre-formed Tin packing machine suitable for 1ltr tin.

8.1.17 Pre-formed Tin packing machine suitable for 200ml / 500ml tin.

Auto Induction Sealing Machine with 3 Mtr Conveyor

Sealing Mode :- Automatic Online Induction Cap Sealer

Designed for easy setup. Configured as a single unit for hassle-free mounting over a conveyor.

- Water Re-circulator sits underneath the machine on the same support mobile trolley for one piece shifting from one production line to another.
- User-friendly front panel membrane controls.
- Digital sealing power indicator with retention of last setting in memory.
- IGBT based power and intelligent controls circuits for maximum efficiency.
- Built-in monitor circuit ensures safe working parameters (e.g. temperature, water, line voltage drops). IIi case of malfunction machine shuts off and fault is indicated on the front panel-
- Efficient sealing head design available in various types e.g. flat head, tunnel head, deep tunnel head, to suit different applications.
- Potential free contacts provided for alarm circuit in case sealing power drops below preset value.
- Output rating: 2 KW.
- Input Supply : 230V +/- 10% single phase 50Hz. A.C.

Shrink Tunnel

A shrink tunnel suitable to accept the unit jars horizontally duly wrapped manually in appropriate shrink film shall be provided.

It shall be fabricated from heavy duty MS structural frame and streamlined by MS paneling duly primed and painted.

The electrically heated shrink tunnel zone shall comprise of a thermostatically controlled induction heater section and hot air blower for controlled air flow within the shrinkage zone.

This hot zone of the shrink tunnel shall be adequately insulated by means of a 75 mm thick glass wool jacket, augmented with additional 25 mm thick calcium silicate blocks and a polished aluminum lining on the inside.

The tunnel openings shall be provided with heat resistant silicon rubber .
Constructional Features:

Vertical with conical bottom, triple walled, insulated jacketed and welded construction of sanitary. design.

Finish: All welding joints shall be ground smooth. All stainless steel surfaces shall be polished to 150 grits.

curtains for hot air conservation thus saving electrical energy cost

The entire system shall be linked by a DC driven variable speed conveyor.

This conveyor shall be fabricated from heavy duty chain coupled with 1"dia SS Rollers. The whole shall be

properly strengthened by adequately spaced stay-bars and shall be provided with suitable tensioning devices.

A suitable cooling zone at the exit end of the shrink tunnel shall provide adequate quick cooling of the shrink film after shrinkage, to set the film in its new shape, before the packs are disturbed by handling.

CONTROLS

Well designed & aesthetic control panel shall be provided with all necessary control Instruments pre-wired and flush panel mounted.

The panel shall be fabricated from MS .sheeting. It shall consists of electronic temperature indicator cum controller, control switches, etc., for fullest control of all machine operation parameters.

The control panel shall be designed for safe, trouble free and consistent working and shall be provided with necessary interlocking controls and arrangement to safeguard the machine as well as the operator.

8.1.18 Ghee Check Weighing Scale

Capacity.: 1 Kg &2 Kg
Duty :These shall be, used for weight measurement of ghee pouches

8.1.19 SS Platform Weigh Scale for Tins

Capacity.: 30Kg
Duty :These shall be, used for weight measurement of ghee pouches

8.1.20 Ghee Residue Trolley with Tank

Capacity Suitable for handling of ghee residue up to 100 litres
MOC SS 304 construction of hygienic design
Duty These shall be used for shifting and loading of ghee residues

8.1.21 SS Packing Tables

Capacity: Suitable
MOC : SS 304 construction of hygienic design

8.1.22 Ghee Leaky Pouch Collection System

This shall comprise of a suitable capacity leaky pouch collection tank & a pump.

8.1.23 Ghee Tin Filler for 15 Kgs - Semi-automatic

Pneumatic Piston Filler - Single Nozzle

Filling Range :- 250ml ,500ml to I liter
Product to be filled:- Ghee
Speed:- The estimated filling speeds are :-250ml @ 5-6 fills per minute
500ml @ 5-6 fills per minute
1000ml @ 2-3 fills per minute
Number of Nozzles : 1
Nozzle Type :- Positive Cut off Drip free (non diving)
Contact parts:- SS-304
Volume Adjustment:- on graduated hand wheel

Filling Mode:- Semi Automatic

Product to be filled shall be in liquid state while filling,
Piston Drive :- Pneumatic Cylinder
Power :- Compressed Air @ 6Kg pressure
Electricity :- No ElectricityRequired

Machine Description: -

Semi Pneumatic piston filler is ideal machine for small-scale production of liquid or semi viscous products. The operator places container below the filling head and gives "fill start" signal by pressing Foot operated switch. As soon as "Fill Start" Signal is received the pneumatic cylinder actuated and completes the set stroke length. The set volume will be dispensed in the container.

An easy setting hand wheel is provided for adjustment of volume. The wheel has graduated dial/read out for the reference.

The machine works on compressed air pressure and does not require electricity hence it has many applications where flameproof machines are required.

8.1.24 Ghee Tin Lid Sealer

Machine Type :- Semi Automatic
Application :- For seaming of I litre round open mouth tins
Speed :- Maximum 25 - 30 Tins per Minute

Machine operations: -

The Filled Tins received from the filler are picked up by the operator and placed on the seaming machine platform. The operator-keeps the lid on the tin mouth and then presses foot lever to activate the.seaming operation.

The platform will get lifted and the seaming jaws will tighten the Lid.

Being a manual machine the speed is function of operators speed but generally production speed of 30 tins/min is practical on these machines.

8.1.25 Ghee Tin Coder

Offline Printer for printing on Tin

9.0 CLEANING IN PLACE EQUIPMENT

9.1 CIP COMMON FACILITY

9.1.1 Bulk Acid Storage Tank

Capacity : 15 KL
Type: . Vertical - Single walled
MOC: SS 316

This tank shall be supplied with standard accessories.

9.1.2 Bulk Lye Storage Tank

Capacity: 15 KL
Type: Vertical - Single walled
MOC: SS 316

This tank shall be supplied with standard accessories.

9.1.3 Chemical Unloading Pump (for Acid & Lye)

Capacity : 10KLPH
Head : Suitable
Type: Centrifugal Monobloc

Function: The pumps shall be used as unloading of CIP chemicals. It shall be provided with VFD.

The design & construction shall be same as standard sanitary pumps.

9.1.4 Chemical Unloading Hose

Size: 51mm x 4M

Crush proof hose with vulcanized end fittings

Type: Wire braided flexible rubber/polypropylene hose, food grade:
Size: 51 mm
Length: 4 meters -2 Nos. (One for Lye and one for acid)

The hose pipe assembly shall be complete with end connections.

9.1.5 Acid Carbuoy Unloading Tank

Capacity : 500L
Type : Vertical - Single walled, uninsulated.
MOC: SS316

This tank shall be supplied with standard accessories.

9.1.6 Lye Flake Dissolving Tank with Agitator

Capacity:2KL
Type: Vertical- Single walled

This tank shall be supplied with standard accessories.

9.1.7 Acid Transfer Pump

Capacity: 5 KLPH
Head: Suitable
Type: Air operated diaphragm type

Function: The pumps shall be used for transfer of Cone. Acid from Bulk Chemical Tanks to Service Tanks.

9.1.8 Lye Transfer Pump

Capacity : 5 KLPH
Head : Suitable
Type: Air operated diaphragm type

Function: The pumps shall be used for transfer of Cone. Lye from Bulk Chemical Tanks to Service Tanks.

9.1.9 SS Tray for Bulk Tanks and Pump

MOC : SS 304

Suitable size of SS tray as required shall be provided.

9.2 PROCESS CIP - 3 Circuits

9.2.1 Lye Tank

Capacity: 8 KL
Type: Vertical Double walled Insulated
MOC: Inner shell in SS 316, Outer Shell in SS 304

This tank shall be supplied with standard accessories.

9.2.2 Acid Tank

Capacity: 8KL
Type: Vertical Double walled Insulated
MOC: Inner shell in SS 316, Outer Shell in SS 304

This tank shall be supplied with standard accessories.

9.2.3 Hot Water Tank

Capacity: 8KL
Type: Vertical Double walled Insulated
MOC: Inner shell in SS 304, Outer Shell in SS 304
This tank shall be supplied with standard accessories.

9.2.4 Recuperation Tank

Capacity: 10KL
Type: Vertical, Single walled
MOC: SS 316

This tank shall be supplied with standard accessories.

9.2.5 Flush Water Tank

Capacity : 5 KL
Type : Vertical Single walled
MOC: SS 304
This tank shall be supplied with standard accessories.

9.2.6 Acid Service Tank.with Dosing Arrangement

Comprises of a 500 L acid dosing tank & acid dosing pump

Acid Dosing Tank

Capacity: 500 L
Type: Single Walled
MOC: SS 316

This tank shall be supplied with standard accessories. Acid Dosing Pump

Capacity: 40-500 LPH
Type: Air Operated Diaphragm
MOC: Product contact parts in SS 316

9.2.7 Lye Service Tank with Dosing Arrangement

Comprises of a 500 L lye dosing tank & lye dosing pump

Lye Dosing Tank

Capacity: 500 L
Type: Single Walled
MOC: SS 316

This tank shall be supplied with standard accessories.

Lye Dosing Pump

Capacity: 40-500 LPH
Type: Air Operated Diaphragm
MOC: Product contact parts in SS 316

9.2.8 CIP PHE

Capacity : 30 KLPH

Functional requirements: The plate heat exchangers shall be used for heating the CIP supply solution by steam.

Design Parameters:

CIP solution difference temp. - 20 degree C
Type of steam- Dry saturated at 1.5 bar press.

Scope of supply: Plate Pack:

Plates: The plates shall be made from stainless steel conforming AISI 316 and shall be of sanitary design. All- milk contact and exterior, surfaces shall be easily accessible or readily removable for cleaning and inspection.

Gaskets: The sealing gaskets shall ensure complete sealing and prevent any cross leakage between product and service liquids. Gaskets shall be of sanitary type (SNAP IN TYPE). It shall be continuously bonded to the heat transfer surface.

The gasket material shall be of food grade rubber and shall withstand a steam temperature of 100 degree C and 2% caustic solution at 80 degree C. Gasket material shall be non toxic, fat resistant, non absorbent and shall have smooth surface. The MOC of gasket shall be EPDM.

Supporting frame: The supporting frame for the plate pack shall be of a self supporting design made ofMS cladded with SS 304.

Inlets/Outlets: The inlets and outlets for CIP solution, steam shall be provided with complete stainless steel (AISI 304) SMS unions.

Thermowells: Stainless steel (AISI-304) pockets for thermometer/sensing probe on all the inlets and outlets. Each pocket shall be complete with stainless steel (AISI 304) guard for mounting glass thermometers/PT 100 sensors.

Ball feet: The frame shall be provided with adjustable stainless steel ball feet with provision for height adjustment of 50mm.

Note: Instrumentation as shown in P * I and logic of operation as per process requirement.

9.2.9 CIP PHE

Capacity : 20KLPH

All technical detail as per the item 9.2.8

9.2.10 Duplex Inline Strainer with auto Changeover

Capacity: 30KLPH
Type : Pipe in pipe
Material: SS 304

Constructional Features: The general design shall be of tubular design with a concentric cylindrical filter made from SS screen of 1.5mm pitch.

All welding joints shall be ground smooth. All stainless steel surfaces shall be mirror polished.

Scope of supply:

Strainer Casing: The casing shall be made from AISI 3.04 SS pipe

Filtering Element: The filtering element shall be cylindrical element made from SS AISI 304 18 G screen of 1.5 sq.mm pitch having SS ring at both the ends.

Blank & Clamp: AISI 304 SS grooved blank fitted by means of SS clamp shall be provided at opposite to the inlet end for easy removal of filtering element. The thickness of blank shall be minimum of 15mm. **O** ring shall be provided between casing and blank.

Inlet/Outlet: 51mm dia shall be provided, The inlet and outset shall be manufactured from SS pipe of AISI 304 quality. Both inlet and outlet shall be complete with SMS unions and shall be integrated parts of outer casing.

The duplex Pipe in pipe type strainer shall be provided with pneumatic valves and auto change over facility.

9.2.11 **Duplex Inline Strainer with auto Changeover**

Capacity : 20 KLPH
All technical detail as perthe item 9.2.10

9.2.12 **CIP Forward Pump with VFD**

Capacity : 30KLPH
Type : Centrifugal, Mono-bloc
Head: Suitable

Function: The pumps shall be used for transfer of CIP solution from CIP tanks to equipment / circuit being cleaned. It shall be provided with VFD

9.2.13 CIP Forward Pump with VFD
Capacity : 20KLPH

9.2.14 **Recirculation Pump for Acid & Lye Tanks**

Capacity : 5 KLPH
Type: Centrifugal, Mono-bloc
Head: Suitable

Function: The pumps shall be used for circulation of solutions in CIP tanks in closed circuit during topping up for concentration.

9.3 TANKER CIP - 2 Circuits

9.3.1 Lye Tank

Capacity :5KL
Type : Vertical Double walled Insulated
MOC : Inner shell in SS 316, Outer Shell in SS 304

This tank shall be supplied with standard accessories.

9.3.2 HotWater Tank

Capacity : 5KL
Type : Vertical Double walled Insulated
MOC : Inner shell in SS 304, Outer Shell in SS 304

This tank shall be supplied with standard accessories.

9.3.3 Recuperation Tank

Capacity : 6KL
Type : Vertical, Single walled
MOC : SS 316

This tank shall be supplied with standard accessories.

9.3.4 Flush Water Tank

Capacity :3 KL
Type : Vertical Single walled
MOC : SS 304

This tank shall be supplied with standard accessories.

9.3.5 Acid Service Tank with Dosing Arrangement

Comprises of a 500 L lye dosing tank &, lye dosing pump

Acid Dosing Tank

Capacity: 500 L Type: Single Walled MOC: SS 316

This tank shall be supplied with standard accessories.

Acid Dosing Pump

Capacity: 40-500 LPH
Type: Air Operated Diaphragm
MOC: Product contact parts in SS 316

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9.3.6 **Lye Service Tank with Dosing a rrangement**

Comprises of a 500 L lye dosing tank & lye dosing pump

Lye Dosing Tank

Capacity: 500 L
Type: Single Walled
. MOC: SS 316

This tank shall be supplied with standard accessories.

Lye Dosing **Pump**

Capacity: 40-500 LPH
Type: Air Operated Diaphragm
MOC: Product contact parts in SS 316

9.3.7 CIP **PHE**

Capacity : 20 KLPH

Functional requirements: The plate heat exchangers shall be used for heating the CIP supply solution by steam .

Design Parameters:
CIP solution difference temp. – 20 deg. C
Type of steam – Dry Saturated at 1.5bar pressure

Plates: The plates shall be made from stainless steel conforming AISI 316 and shall be of sanitary design. Ali milk contact' and exterior, surfaces shall be easily accessible or readily removable for cleaning and inspection.

Gaskets: The sealing gaskets shall ensure complete sealing and prevent any cross leakage between product and service liquids. Gaskets shall be of sanitary type (SNAP IN TYPE). It 'shall be continuously bonded to the heat transfer surface.

The gasket material shall be of food grade rubber and shall withstand a steam temperature of 100 degree C and 2% caustic solution at 80 degree C. Gasket material shall be non toxic, fat resistant, non absorbent and. shall have smooth surface. The MOC of gasket shall be EPDM.

Supporting frame: The supporting frame for the plate pack shall be of a self supporting design made ofMS cladded with SS 304.

Inlets/Outlets: The inlets and outlets for CIP solution, steam shall be provided with complete stainless steel (AISI 304) SMS unions.

Thennowells: Stainless steel (AISI-304) pockets for thermometer/sensing probe on all the inlets and outlets. Each pocket shall be complete with stainless steel (AISI 304) guard for mounting glass thermometers/P'T 100 sensors.

Ball feet: The frame shall be provided with adjustable stainless steel ball feet with provision for height adjustment of 50mm.

Note: Instrumentation as shown in P * I and logic of operation as per process requirement.

9.3.8 Duplex Inline Strainer

Capacity :20KLPH
Type: Pipe in pipe
Material: SS 304

Constructional Features: The general design shall be of tubular design with a concentric cylindrical filter made from SS screen of 1.5mm pitch. All welding joints shall be ground smooth. All stainless steel surfaces

shall be mirror polished.

Scope of supply:

Strainer Casing: The casing shall be made from AISI 304 SS pipe

Filtering Element: The filtering element shall be cylindrical element made from SS AISI 304 18 G screen of 1.5 sq.mm pitch having SS ring at both the ends.

The equipment shall conform to Technical Datasheet enclosed. Scope of supply:

Plate Pack:
Blank & Clamp: AISI 304 SS grooved-blank fitted by means ofSS clamp shall be provided at opposite to the inlet end for easy removal of filtering element. The thickness of blank shall be minimum of 15mm. O ring shall be provided between casing and blank.

Inlet/Outlet: 51mm dia shall be provided. The inlet and outset shall be manufactured from SS pipe of AISI 304 quality. Both inlet and outlet shall be complete with SMS unions and shall be integrated parts of outer casing.

The duplex Pipe in pipe type strainer shall be provided with pneumatic valves and auto change over facility.

9.3.9 CIP Forward Pumps

Capacity : 20KLPH
Type : Centrifugal, Mono-bloc
Head: Suitable

Function: The pumps shall be used for transfer ofCIP solution from CIP tanks to equipment / circuit being cleaned. It shall be provided with VFD

9.3.10 Recirculation Pump for Lye Tank

Capacity : 5KLPH
Type : Centrifugal, Mono-bloc
Head: Suitable
Function: The pump shall be used for circulation of solutions in CIP tanks in closed circuits during topping up for concentration.

POWDER PLANT

10.0 MILK EVAPORATION PLANT

10.1 MILK PRETREATMENT

10.1.1 Milk transfer pump at process section

Capacity : suitable for evapoartor

The pump shall be used to feed milk from process milk silo to balance tank of evaporator.
A mono block sanitary design milk silo to balance tank of the evaporator. The pump shall be completely with drive motor and SS shroud and is provided with single mechanical seal.

10.1.2 Feed Balance Tank

Capacity : Suitable

MOC : AISI304

Type:The tank shall be provided with level protection through high and low level switches.

Un-insulated, circular, closed milk balance tank in SS 304 construction complete with low level float switch, outlet, top cover provided with inlet connections terminating in unions for re-circulation, water flushing, CIP and concentrate pot. The valves provided at the inlet and outlet is pneumatic.

10.1.3 Feed Pump

Capacity - Suitable for Evaporator

The pump shall be used to feed milk from feed balance tank to evaporator.

A mono block sanitary design milk pump with product contact parts in SS 304 is included to transfer milk from feed balance to the evaporator calandrias through pre-heaters. The pump shall be complete with' drive motor and SS shroud and is provided with single mechanical seal. The pump shall be provided with frequency drive to take care additional duty during CIP operation of evaporators.

10.1.4 Shell and tube type pre heater

Capacity: Suitable for optimum preheating of milk as per design to a temperature not above 45 Deg. C.

Un-insulated spiral type individual vertical design pre-heaters attached to barometric condenser made out of SS 304 are included in the scope supply.

10.1.5 Pre heater

Type: Plate Heat Exchanger (Not required in our design)

10.16 Thermophillic Vessel

Capacity: For heating the feed up to 70 Deg.C to cover thermophilic zone.

The evaporation plant milk treatment section shall be designed such a way that the product contact with metal surface at the thermophilic bacteria zone shall be avoided and a suitable direct contact pre-heater with steam economy based design shall be incorporated. Low thermophilic bacteria powder is an important requirement *f0J* export .quality powder. This vessel shall be used for the treatment of thermophillic bacteria.

In the main bid we have included a direct contact heater utilizing the vapours from regenerative flash cooling vessel after final heating. This is an SS 304 vessel with integrated vapour mixing arrangement, CIP spray connections, product vapour outlet, product outlet terminating in suction of the pump.

In optional bid we have considered a direct contact type heater utilizing thermo compressed vapour.

The product heater included in the optional bid comprises

Steam injection-mixing nozzle in sanitary design.

SS strainer in the steam line shall be provided for arresting dust/dirt from steam before it's mixing into milk.

1 lot. Pneumatic product butterfly valves shall be provided to complete the heating battery. The fittings shall be complete with product sight glass with illumination also to facilitate visual inspection during operation

Necessary insulation with SS cladding ofO.8mm thickness is included. The provision of bypassing the DSI is not

required in the design.

10.1.7 . Culinary Steam Filter (Duplex Type)

A common culinary steam Filter shall be provided for generation of clean quality steam for injection into the product.

In the main bid it shall serve the direct contact heater provided at the end of the heating cycle. In the optional bid the filters shall be sized to provide steam at two termination points - one for thermophilic heating and the other for final heating

10.1.8 Direct Contact Regenerative Heater

MoC : AISI304
Type : 2 Stage

In the main bid we have two stage regenerative heating. The first stage regenerative heating through flash cooled vapours is done under item 1.1.6 above and the second stage heating is done in the regenerative indirect heater where the temperature of the product is raised to 90 degrees using flash cooling vapours after final heating.

In the optional bid this shall be used to pre-heat the milk coming from the pre-heater by the vapour generated from flashing. The heater is integrated in the heating section of the unit. It is also used for flash cooling of the pasteurized product provided with specially constructed tangential inlet connected to the regenerative heater of the heating section, inclusive of CIP ring.

10.1.9 **Milk Pasteurizer- Direct Steam Tangential Swirl Heater**

MOC - AISI304

Capacity: Heating pre heated feed to any pre selected temperature up to 120Deg.C.

A direct steam injection system is included and it shall be connected to the header emerging from culinary steam filter. The unit shall consist of Steam injection mixing nozzle in sanitary design:

It shall be used to heat the milk to the required pasteurization temperature by tangential injection of steam in an on-line piping system.

10.1.10 Temperature Treatment Holder

MOC - AISI 304
Capacity- Up to 3 minutes.

It shall be used to hold the milk for a required holding time and executed as holding tube of required length with change over bends / flow plate connections for selecting the required holding time based on type of powder to be produced and as per design requirement. This shall be provided with necessary mineral wool insulation and AISI 304 cladding.

It would be made out of SS sheet of 1.5/2.0mm thickness with inlets and outlets terminating in unions and provided with a flow plate arrangement/distance pieces to ensure desired time holding. Arrangement shall be made to by pass /provide desired holding manually when employing high stage heating, if required.

10.1.11 Hydro Cyclone

MOC AISI304

As per our principal's recommendations this is not required in the design of our main bid

This is included in the optional bid .It shall be used for removing any solid particles due to coagulation of proteins from the pasteurized feed before entering into the calandria. It shall be a cyclone shape vessel with tangential entry and top outlet. The sediments accumulated shall be made to drain during the CIP generally .

10.2 MULTIPLE EFFECT EVAPORATOR

Five effect evaporator .

10.2.1 Calandria- falling film type

MOC - AISI304

The calandrias shall be used in the circuit when running skim milk or whole milk as per design for reasons of energy economy.

The calandrias shall be complete with top cover, distribution plate, bottom surge vessel, sight and light glass assembly, tube stack and shell.

The calandrias are of indoor design and shall be manufactured in SS 304 construction with ERW SS tubes.

Calandria - 1 shall be insulated and cladded with SS 304 sheet.

The calandria shall be provided with necessary split as per design to ensure equal product distribution and uniform wetting rates.

The calandrias shall be self-supporting design facilitating easy dismantling and assembly of top and bottom. Necessary provision for CIP with the help of spray balls mounted at the bottom of calandria is provided.

10.2.2 Vapour Separator

MOC - AISI304

The vapour separators are proposed to be calandria supported design.

The vapors separator shall be complete with manhole cover, sight and light glass assembly, CIP arrangement and shall be designed for best separation of milk from vapors. It shall have a tangential inlet and top outlet (for vapors) terminated in flanged connections. CIP spray balls at proper locations shall be provided to ensure proper CIP of the equipment.

10.2.3 Product Transfer Pumps

Capacity - suitable

The pump shall be used to transfer the milk within calandrias and shall be suitable for operation under vacuum

duty, The pump shall be complete with drive. motor and SS shroud. The pump shall be complete with double sealing and provided with water flushing arrangement. The pump shall be foot mounted to be put up on a raised pedastal in the evaporator plant area.

MOC: All product contact parts in AISI 304

10.2.4 Concentrate Discharge Pump

Capacity As per design

MOC: All product contact parts in AISI304.

It shall be a centrifugal type with open impeller equipped with mechanical seal-box with sealing water connection for pumping concentrate from the last effect to the concentrate feed tanks.

10.2.5 Condensate Pumps

Capacity - Suitable

The pump shall be used to extract condensate from various pre heaters and calandrias. One pump shall be used for condensate from first effect and other one from balance effects.

Mono block design pumps with open impeller and equipped with water flush mechanical seal is included to transfer condensate. The pump shall be complete with drive motor and SS shroud and shall be provided with mechanical seal with water sealing. The. impeller shall be in SS 316 construction.

The pumps shall be used for pumping clean product condensate to the condensate recovery tank (10 KL capacity) and from it shall be drawn for various uses.

10.2.6 Thermo Vapour Re-compressors (TVR)

The thermo-compressors shall be supplied complete with inlet and outlet throats and nozzles. The inlet and outlet connections shall be of flange design and the unit shall be provided in horizontal/vertical execution as per site condition.

The thermo compressor shall be insulated and cladded with SS sheet to prevent thermal loss as well as provide acoustic protection.
MOC: AISI 304

10.2.7 Vacuum Pumps

Water ring type vacuum pump with cast iron body and SS impeller complete with drive coupling and drive motor is included in the scope of supply. The drive coupling. shall be guarded and motor shall be shrouded with SS cover.

The supply shall be complete with base frame, foundation bolts, inlet and outlet manifold, sealing water arrangement and flush seal.

Two nos. pumps shall be supplied with both of them working during starting for rapid evacuation and during operation one would be acting as standby. .

10.3 VAPOUR CONDENSING & SEAL COOLING

10.3.1 Surface Condenser

MOC: AISI 304
Capacity: Suitable

It shall be used for condensing discharge vapour from last effect separator using cooling water.

10.3.2 Vapour Ducting

The supply shall be for complete vapour ducting to inter connect the equipment of evaporation plant. The vapour ducting made out of 3 mrn SS
304 sheet provided with necessary bracing and reinforcements wherever required. The ducting shall be of welded execution to the extent possible and such welding shall be carried out at site.

10.3.3 Seal Water Tank

Capacity - 100 L.

Plain un-insulated tank in SS 304 construction complete with mechanical float inlet valve connected to the inlet line of the water coming from UG sump through pump and Plate heat exchanger. Level protection and alarm in case of no/low water level is provided and included.

Seal water piping to individual product pumps (supply line) shall be executed in SS 304 construction. The outlet from all the pumps shall be taken out through flexible approved grade rubber pipes into drain funnel and drains made out in GI painted construction.

The drain shall terminate into UG Sump, which will also receive the sealing water of vacuum pumps.

Sealing Water Pump
Mono block centrifugal pumps with CI body and bronze impeller complete with motor of suitable capacity is considered

Plate Heat Exchanger

The plate heat exchanger shall be provided with glued plates in SS 316 construction assembled on an MS painted frame in industrial design.

ON/OFF control shall be provided for regulation of the temperature of sealing water.

10.3.4 Water Circulation Tank for Vacuum Pumps

Capacity : Suitable
MOC : AISI30

It is a water circulation tank for the vacuum pump. The vacuum pump shall receive water from the sealing water circuit. .

Cooling Tower

Type: Induced draught cooling tower made in FRP casing with adequate capacity complete with, inlet, outlet, necessary louvers, fan with motor, nozzles etc. is included in the scope ot:supply.

The cooling tower shall be located on the terrace of the evaporation plant area. The basin shall be in masonry construction to be built by the bidder. Separate hot and cold wells shall be made available by the bidder.

Cooling Water Pumps in Circuit

Capacity Suitable

2 Nos. (1W+IS) Pumps for cooling water supply

1 no. Pump to connect UG sump with seal water tank, plate heat exchanger and water circulation tank of vacuum pump.

Mono block centrifugal pumps with CI body and bronze impeller complete with motor have been considered.

10.4 PRODUCT VAPOUR & STEAM CONDENSATE HANDLING

10.4.1 Condensate from Product Vapour Recovery System

Capacity - 10 KL.

A condensate tank in MS painted execution complete with manhole, inlet and outlet, safety valve, air vent etc, The condensate tank shall be self standing type considered as located on the terrace of Evaporation Plant area.

The tank shall be insulated and cladded with 24 gauge aluminum sheet and is designed to receive condensate from the balance calandrias. The pump seal cooling water shall also be taken into this tank if required.

The tank is proposed at the terrace level of the evaporation plant

Insulation: 50 mm thick glass wool and cladding with SS sheet. This tank shall be used as a collection tank from various stages condensate, and vapour condensate from other calandrias.

10.4.2 Condensate (steam radiators & PHEs) recovery tank

Capacity: 5 KL
MOC: Inner and outer shell should be SS304 / SS302

Insulation: 50 mm thick glass wool and cladding with Al sheet. This tank shall be used as a collection tank from various steam radiators & CIP PHEs & others. Condensate from main steam radiator shall be pumped directly to the boiler house and along with it condensate from this tank shall also be pumped to feed water tank at boiler house.

The steam condensate from the air dehumidification and the air heating batteries of FBD and IFB shall be taken to a 5 KL condensate tank at one point at ground floor in the powder plant area. The condensate from the first transfer condensate to feed water tank of the boiler through dedicated condensate transfer pump. The overflow of the tank shall be connected to the sump.

The bidder shall leave the condensate from the main air heater battery at atomizer level at the inlet of main feed water tank in the boiler house.

The condensate from the balance effects shall be pumped by the bidder to the condensate recovery tank of capacity 10 KL to be installed on the terrace of the evaporation plant. The bidder shall connect the overflow pipe of this tank to the underground sump. The condensate recovery tank shall be connected to floor washing points and CIP section by the idder. Murky condensate as detected by turbidity sensor shall be left to drain by the bidder.

10.4.3 Condensate transfer pump

Capacity: as per functional requirement

Condensate transfer pump shall be used for transfer of condensate of good quality from condensate collection

tank to feed water tank of boiler. Product process condensate first effect shall also be sent along with above condensate.

Product process condensate from other effects shall. be used in the plant for tanker wash, CIP, & floor wash. If found murky, it would be drained. The bidder shall provide adequate and required size of pumps.

10.5 EQUIPMENT ATTENDING

10.5.1 Electrical Hoist & Monorail

The electric hoist and monorail for calandria top cover removal shall be provided. The mono rail shall be grouted and put in position as a part of civil works by the bidder

10.5.2 Working/ Service Platforms for Access & Maintenance

MOC - Galvanized MS

Access platforms with necessary railings shall be supplied to provide access to calandrias, vapour separators and thermo compressors. The platforms shall be executed from spray galvanized structural material since wet area is involved in the evaporation plant. Bidder shall provide all necessary structural foundations and support from surrounding RCC structure to take the load of these platforms and ladders. As specified in the tender an RCC staircase shall be provided throughout the evaporation area for access to various levels.

10.6 MILK CONCENTRATE HANDLING

10.6.1 Milk Concentrate Recovery Tank

Capacity - 3500 L

It shall be an un-insulated storage tank in vertical execution with SS 304 construction.

The tank shall be complete with specially designed agitator, manhole, air-vent, inlet, outlet, CIP spray ball etc.

10.6.2 Milk Concentrate Transfer Pump Capacity - 3500 LPH,

It shall be sanitary design pump similar to milk transfer pump.

It shall be centrifugal pump for transferring concentrate product from concentrate storage tanks to process section after on line dilution.

10.6.3 Mixing Valve

An on line soft water dosage system . .in SS 304 construction shall be provided to dilute the concentrate. The arrangement of dilution is proposed to be manual without any controls. .

10.6.4 Concentrate Chiller

Capacity - 3500 LPH

It shall be plate type heat exchanger for chilling by chilled water. It shall be a standard dairy chiller in SS cladded frame and SS 316 heat transfer plates with standard accessories. It shall be designed to cool diluted concentrate milk to below 10 Deg.C with the help of ice'water.

10.7 FEED SYSTEM

10.7.1 Feed Concentrate Tanks

Capacity - 1000 Ltrs.

The tank will be in SS 304 execution with all welding joints finished to 150 grit. The tank shall be fabricated from 2mm sheet and shall be leg supported.

Closed, un-insulated, covered concentrate tank complete with:

- No foam inlet and outlet
- 1 no. Eccentric SS agitator with geared motor (around 20 RPM)
- Hinged inspection hatch and cleaning nozzles
- Supported on legs with standard ball feet arrangement.
- High and low level switches

10.7.2 Water Balance Tank

Capacity - 200 Ltr.

The supply shall be complete with low and high level switch, and pneumatic water on/off valve at the inlet and outlet for feeding water during starting/stopping operation.

10.7.3 Booster Feed Pump

Booster pump complete with motor, in mono block execution and product contact parts in SS 316 shall be provided to ensure a positive pressure at the inlet of high-pressure pump. The booster pump shall take the concentrate from the feed balance tank and pump it through the concentrate pre heater and filter to the suction of high-pressure pump cum homogenizer.

10.7.4 Concentrate Pre-heater

Capacity: Up to 2125 LPH of milk concentrate from 50 to 70 Degree Centigrade.

The concentrate pre-heater shall be generally as per specification of our principals.

The concentrate pre-heater included by us shall comprise of the following;

a. Concentrate Pre-heater - Tubular shell and tube type unit in AISI 304 construction. Product shall be in tubes and direct steam injection in water bath on shell side for heating medium. The product pipes are 25 mm OD of adequate length to provide necessary heat transfer area. The pre-heater is equipped with pressure gauge, relief valve and shall be insulated and cladded with stainless steel confirming to AISI 304.

b. Vacuum pump: Water ring vacuum pump with SS impeller complete with motor is provided to maintain vacuum for gentle heating. Condensate extraction arrangement shall be provided.

c. One lot of Mild steel C class pipes and fittings to complete connections of vacuum and condensate extraction.

We have provided a simplex unit for concentrate pre heater. It is recommended to go in for duplex construction with CIP arrangement after every eight hours operation in view of prevailing milk quality. In case you require duplex unit we agree to provide the same and you will have to pay additionally for one more identical unit.

10.7.5 Feed Filter

Capacity - Suitable

The duplex strainer shall be pipe in pipe type of tubular design with concentric cylinder filter of required design filter element, SS blank and quick removal type clamp. Strainers with necessary 3 way manual plug valves, inlet and outlet duly terminated in SMS unions shall form the complete filter.

10.7.6 High Pressure Feed Pump cum homogenizer

Capacity: Up to 2125 LPH of milk concentrate at 100 CP viscosities-
maximum 400 bar operating pressure.

High pressure pump cum homogenizer type Sanitary with abrasive resistant . product contact parts 'are included. Single stage homogenization. shall be provided .

The pump body shall be manufactured with whole spheroidal cast iron equipped with necessary bearings to grant stability to the whole machine. The pump block shall be complete with SS pumping pistons, valve seats, guides with necessary gaskets.

The drive motor shall be provided with frequency converter for variation of speed and therefore feed to the spray dryer.

The supporting casing and frame is manufactured in thick steel plate suitably painted. The solid frame is totally covered with AISI 304 SS panels which can be easily dismounted.

A sanitary type of pressure gauge shall be provided in AISI 316 execution for continuous display of product pressure.
The high pressure pump cum homogenizer shall be meeting with necessary sanitary standards and specifications.

The frequency variator associated with the high pressure pump would receive signal from the PID controller installed in the outlet air duct and accordingly vary the. feed. '

10.7.7 Feed Pipes

The supply includes SS pipes and fittings of AISI 304 construction from concentrate tank to booster pump, high-pressure pump; concentrate pre- heater, nozzle atomizer, and return CIP line. The pipelines including fittings from high-pressure pump to nozzle atomizer shall be in standard specifications meeting to the requirement of high pressure.

10.7.8 Nozzle Atomizer

Capacity: Suitable for atomization to a pressure up to 250 bars. The detailed specifications are enumerated below:

The high pressure nozzle atomizer system shall comprise of the following;

a) Necessary nozzle lances with blended tip in AISI 304 construction complete with positioning arrangement.

b) Two sets of nozzle inserts comprising of orifice plates and swirl chambers shall be provided for each concentrate nozzle to select and use proper nozzle combination for various products.

c) Special coupling t? be fitted on the base plate on the top of the chamber

d) Fines return pipe which shall be a central air cooled powder re-circulation pipe, central nozzle lance with straight tip, nozzle head, orifice and swirl complete with mounting arrangement

e) Flexible high pressure food grade hoses with necessary couplings to connect lances to valves and return header.

f) Spring closing type three way high pressure valves with necessary connections for concentrate inlet, concentrate -outlet to nozzles and compressed air. The valves considered by us are specially designed and tested units as chosen by our principals. When switching over, these valves either allow concentrate or water to pass through or in other position allow for an air purge to quickly evacuate all concentrate from the nozzle lance to avoid burning of concentrate on that lance.

g) Compressed air vessel of closed ' type in hot dip galvanized steel construction equipped with air supply and discharge connection. The vessel shall be designed for **11** bar gauge pressure.

h) For leakage detection visual checking of leakage from the nozzles through dryer sight glass provided at nozzle level should be done, It is considered important more so owing to the chances of leakage leading to explosion in the chamber.

i) Set of tools necessary for servicing of nozzle atomization system covered under item 2.1.9 below.

Spares for nozzle atomizers are covered under the head of spare parts for two years operation.

j) Lances cleaning system: The system comprising of cleaning vessel in SS 304 construction with manual drain valve and over flow. The system is complete with holders for each lance and circulation pump with piping to circulate cleaning solution, hand valves and flexible connection to lances.

The circulation pump shall be a centrifugal- mono block pump with product contact parts in SS 316 construction designed for CIP operation complete with motor and single shaft seal. The pump capacity shall be as required approx. 10000 LPH of CIP solutions at 35 MWC.

The nozzle atomizer shall be built locally with imported components

10.7.9 Tools for Atomizer

These shall be special tools for assembly of the nozzle atomizer & changing the nozzle orifice inserts.

10.7.10 Electric Hoist with trolley for atomizer unit

Capacity: Adequate for lifting and shifting of nozzle atomizer head

It shall comprise of a traveling trolley with electrically operated lifting hoist. The girder to be suspended with the ceiling above the atomizer is excluded being a part of roof construction work. The roof truss members could be designed to take the load of atomizer which will not be substantial.

10.7.11 Nozzle rods CIP Stand and Nozzle Stand

Mounted on the air disperser housing and used during cleaning of nozzles which is covered under Item 2.1.8 above

10.7.12 Cooling System (Neck cooling)

Roof cooling system generally provided as per design and is complete with following:

a) Cooling air filter: Static type of suitable capacity.

b) Cooling air fan of radial type complete with drive of suitable capacity with static head of 300mm WG.

c) 1 lot of inter connected SS ducting and a small air heater to supply air of proper temperature

A mixture of cold air and some hot air drawn from main supply fan is envisaged for ceiling cooling and hence no separate air heater is envisaged.

10.8 HOT AIR SYSTEM FOR DRYING OF CONCENTRATED MILK

10.8.1 Supply Air Filter

Capacity: Suitable for main air filtration at temperature of20 deg. C.

The air filter is generally as per specifications.

It would be designed for a suitable pressure drop in clean and chocked condition.

We have included the air filter with following detailed specification:

Flange type air filter with self mounted pre filter with locking arrangement having automatic drainagesystem to flush out the dirt complete with casing in galvanized mild steel frame.

The filter assembly is generally in galvanized iron construction complete with stiffeners, flanges, and accessories like wing nuts, washers, bolts and ceiling arrangements. The filter assembly shall be painted with aluminum paint and shall be generally working for one month with out cleaning in normal industrial environment.

Necessary number of filter panels built up typical HDP 72 x 32 washable type filtering units each suitable for 2000 CFM air flowrate, The size of each filter panel shall be 610-x 610 x 305mm flange type.

10.8.2 Spray Drying Supply Air Fan (MS)

Capacity: Suitable of air at ambient "temperature 15 to 40 deg. C with static head of200mm WG.

The air supply fan included shall be radial type in reinforced steel construction suitably painted. The impeller shall be in painted execution. The impeller shall be statically and dynamically balanced and fan shall be complete with housing, inspection hatch, drain, heavy duty bearings duly mounted on a base frame provided with suitable vibration absorbers.

The fan shall be complete with V belt drive and motor of suitable rating.

The fan shall be complete with flexible connections at inlet and outlet duly flanged.

The supply fan motor shall be provided with frequency drive to maintain required quantity of hot air in the drying chamber.

10.8.3 Air Ducting MS

Generally as per required specification to inter connect air supply fan to main air heater .

The air ducting shall be fabricated out of galvanized mild steel sheet duly painted. It shall be provided with necessary flexible connections and manual dampers.

HOT AIR GENERATION EQUIPMENT

10.8.4 Steam Radiator for main supply

Capacity -Suitable

MOC: SS AISI316 Seamless tubes with AL fines

The steam air heater shall be generally as per tender specifications.

Steam radiator shall be used for generation of process hot air required for drying of the condensed milk in to powder in the Drying plant. The proposed hot air generation system shall be coupled with independent steam generation plant. Hot air temperature monitoring and steam flow regulation, system for steam radiator shall be provided. A condensate temperature measuring and recording systern, and condensate flow meter for measurement and recording of flow rate shall be provided The steam air heater considered by 'u~is SS tube with aluminum fins. The design shall be suitable for a test pressure of 30 Kg./Cm2 gauge and tubes shall be 20 NB nominal seamless tubes.

The air heater shall be built in two sections with air pre heating through condensate for steam economy to the extent feasible and shall be insulated and cladded with 24 gauge aluminum sheet. Pressure drop shall be within permissible limits.

The steam air heater shall be equipped with condensate trap at the steam outlet and shall be designed to be air tight against an over pressure as per design. WG.

10.8.5 Electric hoist and monorail

It shall be used for shifting of steam or condensate blocks from the steam radiator.

10.8.6 Supply Air Duct SS

Generally as per specification to inter connect the air heater with air distributor.

The hot air duct shall be a typical connection piece changing the cross section from rectangular to circular meeting to the tangential inlet of the air distributor.

The air duct shall be in SS 304 construction duly insulated and cladded with aluminum sheet. Inspection manhole shall be provided at suitable location

Hot Air System for Static Fluid Bed (SFB)

10.8.7 Supply air filter

MOC: GI housing and AISI 304 frame for filter mat. It shall be for cleaning of the drying air prior to the heating. The filter is of the dry cell type, and is provided with a panel having number of cells arranged for easy access and removal for cleaning, inclusive of filter mats.

10.8.8 Air Duct SS

Generally as per specification to inter connect the air filter, air fan to static
Fluid bed via the steam heater to generate hot air as required for SFB

The air duct shall be in SS 304 construction and the piece after the steam heater shall be duly insulated and cladded with aluminum sheet.

Necessary flexible connections at the SFB end and dampers shall be provided to isolate and adjust the flow as may be required during operation.

10.8.10 Supply air fan for SFB

MOC:MS
Capacity: suitable as per requirement'
The fan shall be provided with variable frequency drive.

10.8.11 Steam Heater for SFB

Capacity - Suitable with heating medium of dry saturated steam available at the inlet of steam air heater at 3.5 bar gauge pressure.

The steam air heater considered by us is galvanized finned tube type with material construction as per IS 2062. The design shall be suitable for a test pressure of 10 Kg./Cm2 gauge and tubes shall be 20 NB 14 gauge nominal ERW.

The air heater shall be built in two sections with air pre heating through condensate for steam economy to theextent feasible and shall be insulated and cladded with 24 gauge aluminum sheet: Pressure drop shall be within permissible limits.

The steam air heater shall be equipped with condensate trap at the steam outlet and shall be designed to be air tight against an over pressure as per design. WG. .

MOC: SS cladding and SS seamless tubes with aluminium fins.

10.9 DRYING CHAMBER ASSEMBLY

10.9.1 Air Disperser

The air disperser shall be generally as per specifications of our principals built indigenously in AISI 304 construction.

Air disperser is of special design equipped with adjustable round skirt, adjustable perforated plate around the inlet and is also provided with a man hole for access to the interiors. A top platform equipped with mild steel hand rails, kick plates, drain valves, man hole at top gives access to top of the distributor. The space-between the top platform and air distributor is filled with insulation material.

10.9.2 Drying Chamber

The general features are as per our principal's specification. However the drying chamber is of specially designed configuration and proposed to be configured fabricated and welded at site. Some of the components

like chamber door etc. shall be factory fabricated.

The drying chamber shall comprise of

a. Cylinder portion of the chamber

b. Cone shall have top angle of 43 deg and suitable opening with flexible connection to integrated fluid bed.

The chamber shall be complete with chamber .service door, necessary explosion doors, sight and light glass assembly, necessary exhaust duct opening etc. The explosion doors are suitably located venting within the plant area in case of explosion.

One set of cleaning turbines and cleaning nozzles .at various points in the plant as per Stork recommendations is included under the Section of CIP System.

Cleaning Bridge Suitable designed light weight cleaning bridge meeting with the configuration of drying chamber shall be provided.

It comprises of a platform system that' can be shifted into the drier and then rotated from where the majority of drier inside can be manually cleaned at chamber door level. The offered system avoids any obstacles in the drying systems like in case of winch system

The chamber shall be suspended from the RCC cut out support structure to be provided by the bidder as a part of RCC platform

It shall be generally as per tender specifications

10.9.3 Insulation of drying chamber

It shall be generally as per specifications laid down in the tender. The drying chamber shall be suitably insulated wherever required to prevent heat loss and conducive working environment.

10.9.4 Integrated Fluid Bed

For secondary drying of product, integrated fluid bed mounted on the conical part of the drying chamber.

The provision for inspection and cleaning doors, Cleaning nozzles and product outlet arrangement, transparent window for inspection and insulation, specified as above, shall be provided. It shall be made from SS.

It shall be for secondary drying of the product, designed and mounted on the conical part of the drying chamber.

The fluid bed shall consist of a. housing divided. in. two parts, an upper product part and a lower air plenum by a special flex/bubble perforated sheet. The dividing sheet shall' be self-supporting and provided with
inclined perforations providing an even powder flow and a fluidised powder layer.

The fluid bed shall be made of stainless steel, prepared for installation as specified above, and furnished with inspection and cleaning doors, cleaning nozzles, and a specially designed powder outlet arrangement. Transparent inspection window shall be provided for viewing the powder fluidisation.

10.9.5 Rotary Valve

This valve will form an air lock with the passage of powder and shall be a standard design rotary valve in SS housing and rotor with its own drive provided with VFD to control the layer height in static fluid bed. The rotor shall be easily removable for cleaning.

10.9.6 Duct for discharge of powder from dryer

It shall be a duct piece made out of SS304 construction and terminating in flexible coupling to interconnect the discharge of integrated fluid bed

10.10.7 Electro-magnetic Hammers

Electromagnetic hammers complete with mounting arrangement and sequential timer control panel to govern the operation of the hammers have been included.

10.11 AIR EXHAUST SYSTEM

10.11.1 Ducting between dryer and main cyclone/bag filter

Generally as per the requirement to convey powder laden air from drying chamber to cyclone separators.

Geometrically typical air outlet duct in SS 304 construction as per special design is provided to inter connect the bustle portion of the drying chamber with 1 sets of cyclone separator is provided.

10.11.2 Main Cyclone / Bag filter

1 no of cyclone separators shall be provided as per the design given in the tender.

The cyclone separators are designed for maximum separation efficiency from the drying air and are complete with typical tangential inlet, cone, centre tube and top specially designed with detachable covers for easy - inspection and cleaning. The hammers are provided on the conical portion at strategic location to quick flush the separators and prevent powder build up.

The cyclone separators have a suitable throat diameter with adequate inlet air velocity. The powder outlet has a flexible connection. The air outlet is provided with a hand adjustable baffle.

The discharge of the cyclone shall be taken to a vibrating tube terminating in a blow through valve.

Outlet from blow through valve shall get transferred to fines recycling system.

As per the recommendation of our principals we have offered a bag filter assembly with accessories instead of cyclone separator in the main bid

10.11.3. Electro-magnetic Hammers

Electromagnetic hammers complete with mounting arrangement and sequential timer control panel to govern the operation of the hammers have been included.

10.11.4 Air Ducting between main cyclone and exhaust fan

SS 304 air duct is provided inter connecting the cyclone separator with exhaust air fan. A typical designed air collection box of cylindrical section is provided as equipped with one inspection man hole and air outlet to exhaust fan.

10.11.5 Exhaust Fan

Generally as per the requirement and similar to air supply fan. It shall be provided with frequency drive to

control vacuum level and air quantity in the drying chamber.

10.11.6 Air Exhaust Ducting

MOC: SS 304

The ducting between exhaust fans to stack is provided right above the exhaust fan outlet with a flexible connection and terminating up to at least 2M above building roof. The exhaust duct shall be complete with weather cap and shall derive support from the roof truss and shall be in mild steel galvanized painted construction.

10.11.7 Fine collection system

MOC: SS 304

The bdder shall provide a system to recover fines by providing a SS chamber with necessary filter at the end exhaust hood. The design of the exhaust SS duct shall be such that it can be wet Cleaned during CIP of Spray Dryer. Alternatively SS chamber could be provided before exhaust fan with by- pass arrangement. The bidder shall submit the complete scheme. Platform and ladder shall made out of SS pipes. .

The fines collection system is not required in the.main bid where a bag filter has been offered.

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10.12 FINES RETURN SYSTEM

It shall be for continuous transport of fines from the cyclone into the drying chamber or vibro fluidizer for agglomeration. The fines return system shall comprise of:

10.12.1 Fines Return Air Filter

Generally as per design specification to filter the air required for fines recycling.

The design pressure drop and capacity shall be suitable for the application. The air filter is generally as per

following specifications.

Flange type air filter with self mounted pre filter with locking arrangement having automatic drainage system to flush out the dirt complete with casing in galvanized MS frame construction ..

The filter assembly is generally in galvanized iron construction complete with stiffeners, flanges, and accessories like wing nuts, washers, bolts and ceiling arrangements .. The filter assembly shall be painted with aluminum paint and shall be generally working for one month with out cleaning in normal industrial environment.

1 no. of filter panel built up HDP 72 x 32 washable type filtering unit suitable for required air flow rate. The size of filter panel shall be suitable to the requirements

It shall be used for cleaning of fines return conveying air. The filter is of dry cell type and shall be a part of the roots blower.

10.12.2 Roots Blower

Capacity: suitable for ambient air duly filtered

The blower shall be designed for a maximum 'air pressure of 6500 rnrn WG and a working pressure of 4500 rnmWG.

The roots blower shall be in MS construction complete with silencer, motor and drive and provided with necessary accessories like safety valve, non return valve, pressure gauge etc.

10.12.3 Air Dehumidifier for fine returns

Capacity - To cool and de-humidify air for fines blowing with the help of chilled water at 2 Deg. and steam at 3 bar gauge pressure dry saturated

The dehumidifier shall be generally as per standard specifications

The de-humidifier considered by us is with hot dip galvanized finned tube type with material construction as per IS 2062. The design shall be suitable for a test pressure of 10 *Kg.ICm2* gauge and tubes shall be 20 NB 14 gauge nominal ERW.

The dehumidifier shall be built in two section one with chilling and other heating section to complete the dehumidification process.

10.12.4 Blow Through Valves

As per design, rotary blow through valves at the bottom of the cyclone separators to facilitate blowing through the powder into a specially designed fines return system.

The blow through valve shall be generally in meeting with the functional requirement of tender.

The blow through valve is of cast iron body and end cover. The inlet and outlet along with the body and end covers are internally chromium plated. The rotor is in SS 316L construction and the blades are chamfered to give the desired results. The drive comprises of chain transmission, chain guard and a drive motor.

The blow through valve is adequately over sized to ensure smooth feeding of fines into the fine recycling line. Necessary air purge seals shall also be provided.

10.12.5 Conveying Piping (fine return)

Clean air ducting: The supply shall include necessary pipes and fittings for fines return/recycling and it shall be generally as per specifications.

The piping shall inter connect the, discharge of blow through valves, roots blower, diverter valve and up to fines injection nozzle entry at spray dryer.

The piping shall be in AISI 304 complete with necessary unions and sight glass. The piping shall be inside acid pickled and outside' mirror polished in SMS standards.

Breach Duct: The design includes diversion of fines into the inlet stream of fluid bed dryer to ensure uniform quality of powder at.the packing point. All ducting / piping required for completing the connection for the purpose is included and the specifications are similar to item above.

10.12.6 Diverter valve for diversion either to drying chamber or to VF end

Capacity: suitable

The valve shall be suitable to the functional requirement specified in the tender.

We have included pneumatically operated two way diverter valve in close grain cast SS construction comprising housing with connecting flanges, tunnel/plug type routing rotor to direct product flow and pneumatic to actuate routing rotor. The supply is complete with necessary solenoid valve, actuating cylinder, electrical and pneumatic connection.

10.13 VIBRO FLUIDIZER ASSEMBLY

The offered fluid bed design envisages necessary plenum section to ensure smooth flow of product through the fluid bed with or without lecithination system in operation.

10.13.1 Vibro Fluidizer Air Filters

Generally as per design specification to filter the air required for fluid bed cooling and drying section.

Capacity: Suitable for drying and cooling section.

The design pressure drop shall be kept appropriate for clean and chocked condition. We have included the air filter with following detailed specification:

Flange type air filter with self mounted pre filter with locking arrangement having automatic drainage system to flush out the dirt complete with casing in galvanized MS construction,

The filter assembly is generally in galvanized iron construction complete with stiffeners, flanges, and accessories like wing nuts, washers, bolts and ceiling arrangements. The filter assembly shall be painted with aluminum paint and shall be generally working for one month with out cleaning in normal industrial environment.

One lot of filter panels (both for drying and cooling) built up HDP 72 x 32 washable type filtering units. The size of each filter panel shall be 610 x

610 x 150mm flange type.

MOC: SS housing and frame for filter mats
It shall be used for filtering drying air and cooling air to the vibro fluidiser.

It shall be of the high efficiency dry cell type. The filters (individual filter cell) shall be mounted on SS frame fiiter mats shall be removable for inspection and cleaning.

10.13.2 Air Supply Fan for VF

The air supply fans are generally as per standard specifications, The supply fan included by us shall be radial type in mild steel construction in painted execution. The impeller shall be statically and dynamically balanced and fan shall be complete with housing, inspection hatch, drain, heavy duty bearings duly mounted on a base frame provided with suitable vibration absorbers.

The fans shall be complete with V belt drive and drive motors of adequate rating. The fans shall be complete with flexible connections at inlet and outlet duly flanged.

10.13.3 Steam Air Heaters for VF

Capacity - Suitable with heating medium of dry saturated steam available at the inlet of steam air heater at 3.5 bar gauge pressure.

The steam air heater considered by us is galvanized finned tube type with materia] construction as per IS 2062. The design shall be suitable for a test pressure of 10 Kg./Cm2 gauge and tubes shall be 20 NB 14 gauge nominal ERW.

The air heater shall be built in two section with air pre heating through condensate for steam economy to the extent feasible and shall be insulated and cladded with 24 gauge aluminum sheet. Pressure drop shall be within permissible limits.

The steam air heater shall be equipped with condensate trap at the steam outlet and shall be designed to be air tight against an over pressure as per design. WG.

MOC: SS tubes with al. fins

10.13.4 Air Dehumidifier for VF

Capacity: To cool and dehumidify air for cooling air for fluid bed with the help of chilled water at 2 Deg C.
The heating of chilled air through, condensate from vaporation section/elsewhere could be provided as an alternate arrangement, if feasible.

The de-humidifier considered by us is with SS finned tube type. The design shall be suitable for a test pressure of 10 Kg./Cm2 gauge and tubes shall be ERW.

10.13.5 Ducting

We have considered supply of ducting in AISI30-4 construction for interconnecting the heating and cooling batteries with the individual sections of fluid bed. The ducting shall be fabricated out of 2/2.5mm

SS sheet duly provided with necessary bracing wherever required. The supply shall be complete with necessary bends, flanges and hand dampers as per requirement. GI ducting has been considered to interconnect air filter, supply fan and dehumidifier.

10.13.6 Vibro Fluidizer

The supply shall be generally conforming to functional requirements for the product manufacture.

It is low frequency high amplitude cylindrical body supported on frame by means of special springs. The equipment is complete with inspection doors in upper part well mixed section and cooling section. Flex sieve plate supplied with directional holes shall, be imported. The fluid bed unit is complete with air inlet box with tubes for drainage and inspection covers.

The connection for lecithin nozzle lance as well as necessary patented vibration system is provided as a part of optional items.

Necessary protection for safe operation is also included. All product contact surfaces shall be finished to 120 grits.

The exhaust from fluid bed is connected to the main exhaust manifold of the drying chamber to provide the required suction.

MOC: AISI 304

10.13.7 Ducting

SS ducting has been considered to interconnect fluidizer and cyclone

10.13.8 **Powder Sifter**

Capacity -Suitable to through put of the dryer for included products.

The powder sifter shall be generally as per the functional requirement.

The powder sifter considered by us will have single screen unit with a separation grade deck and equipped with flexible in/out connections, motor drive, support and removable cover.

The powder sifter shall be indigenously built with powder contact parts in AISI304.

All bulk bagging is envisaged to be through powder sifter. Two outlets shall be provided for automatic powder bagging.

Fire Extinguishing System

The fire extinguishing system for the drying plant shall comprise of wet system for the spray drying chamber and fluid bed.

The bidder shall provide a DO sump of30KL capacity at about 7to 10 meters away from the plant building and one over headwater tank of 10KL capacity at the top of drying building.

The system shall include the following.

a) Over headwater tank of 10KLcapacity to be provided by the bidder.

b) Two centrifugal water pump capacity 20000 LPH at40 MWC. The pump shall be mono block type in cast iron body and bronze impeller complete with 7.5 HP motor. One pump shall be used to pump the water from DO sump to OHT and other one is to pressurize the headers. The powder plant shall be put in operation mode only when 30KL DG sump and 10KL over head tank are filled with water.

c) One set of GI 'B' class pipes and fittings complete with water ring main header to interconnect water tank, water pump and three way solenoid water valve. One set of SS nozzles with removable end connections for cleaning which are to be mounted on chamber ceiling and fluid bed are also included.

d) The audio visual control arrangement for the fire extinguishing system is included in instrumentation and control system.

The fire extinguishing system (water jet operation in dryer) shall be initiated automatically. For this purpose, necessary alarm' and PID control for temperature monitoring in the dryer along with control valve operation

Service Platform for Access &Maintenance

As mentioned intender all access platforms and ladders shall be in RCC construction to be built by the bidder. Only one access platform at appropriate level shall be provided for access to hammers on drying chamber and disperser.

POWDER BULK PACKING AND CONVEYING SYSTEM

The system shall consist of one electronic gross weigher for accurate filling, weighing and bag holding, a impulse heat sealing machine and stitching machine.

10.14.1 **Electronic gross weigher**

The Gross Weigher accurately and continuously weighs pre-selected quantities of bulk material. The main components area housing, two load cells, bag spout, bag spout suspension, load cell interface unit and the electronic measuring and control module. A bag holder is specially provided for sewith electronic gross weigher for all type of open mouth bags.

The gross weigher shall comprise of: Screw feeder, Gross weigher having a housing, load cell, and the electronics measuring and control modules,

10.14.2 **Packed bag conveying system**

Packed powder conveyor with wooden slot or any suitable holding mechanism, electrical drive unit & sensors of shall be provided for following functions:

- For conveying bag from filling station to stitching station.
- From stitching station to conveying belt, for transfer to across to length of powder store.

10.14.3 **Impulse heating machine**

The Heat Sealer has been designed to close heavy-duty plastic bags at speed. It will seal all thermo weldable materials and because of the long heating zone is suitable for sealing poly lined multiwall paper sacks.

Comprising of

- Single sealing element
- Foot pedal for operation
- 1.Omidler

10.14.4 Stitching machine

The filled bag is placed manually on the feeding end of the conveyer and when it approaches the stitching head of the stitching machine the stitching head starts working. The bag is guided manually though the stitching head and then after the bag is stitched, the thread chain is pushed in to the nibbler knife, which cuts it after which only the sewing head is stopped. The conveyor continues running, advancing the subsequent bags for stitching.

Sewing unit, complete with Sewing Head mounted on a Pillar unit for adjusting height of the stitching head above the conveyor and fitted with a electro pneumatic cutter for double thread interlock stitching. The machine is also complete with motor, a V-belt drive and an-Electrical Control circuit.

The Control panel is mounted on the Head Bracket of the stitching machine.

10.14.5 Belt conveyor across the length of powder store

10.14.6 Suitable system is to be provided for conveying the bags across the length of the go down so that powder can be stacked at appropriately at both sides of the centrally driven bag conveyor. The conveyor shall be made of SS and belt of suitable material.

Down Conveyor for bringing powder bag FF to GF Quantity: 1set

The suitable down conveyor power driven shall be provided to bring down the filled bags from first floor to GF near despatch dock for despatch.

We have conceived as cissor lift powered platform conveyor, which would vertically traverse between ground floor and first floor. The pallets shall be manualy loaded on the first floor which shall be brought in the scissor lift to ground floor where a fork lift truck or similar device will take the pallet and load on to a truck. The fork lift truck or similar loading device is
excluded from the scope of the tender.

COLD ROOM UNITS

1.**0** Star coolers **&** condensers / Equi make forced draft coolers for cold stores having following specifications,

GENERAL DESCRIPTION OF FORCED DRAFT COOLERS

Construction:

Forced draft coolers shall be supplied by a specialist manufacturer as fully assembled units.
The manufacturer shall warrant 'performance.

The coolers required are of ceiling suspended cross- draft type specifically intended to operate with pumped liquid supply. -

Cooling coils shall be made of stainless steel tubes with aluminium fins.

Fin spacing shall be min 7 mm Parallel coils shall be supplied with refrigerant liquid through fixed metering orifices from the liquid supply header to ensure even distribution. The casing shall be of powder coated heavy gauge galvanized steel, cross broken to prevent drumming. Refrigerant coils and defrost piping shall be fixed to substantial bearers. The manufacturer is responsible, through the Supplier, to ensure that no rattles occur when the unit is operating.

Induced draft fans shall be axial, direct coupled to motors. Belt drives are not acceptable. Fans and motors shall be

dynamically balanced. Fans made of Polyamide glass fiberre in forced material are acceptable. Fan and motor assemblies shall be resiliently mounted and effectively guarded. Motors and bearings shall be suitable for operation at an ambient temperature of minus 20DegC.Further,motorsshallhavedegreeofprotectionIP55orbetter.

The drain tray shall be of heavy gauge SS 304 sheet, cross broken to provide falls, and arranged to intercept condensation from the casing. The drain tray shall be suitably insulated. The outlet from the drain tray shall be vertical.

COLD ROOM INSULATION AND ANCILLARIES

Lloyds/JindalMectec/ Beardsell/ Equivalent make 100mmthick PCGI PUF Insulation for walls and ceiling of Curd Blast, incubation and buffer room having following specifications:

Insulation Matrl. PUF
Density: 42±2kg/m3

Lamination: 0.6 mmthickPPGIsheetwith275GSM Coating
Thickness: 100mm
Thermal conductivity: 0.023W/m/K
Operation temp. range: (-)5.0DegCto(-)10.0DegC

Lloyds /Jindal Mectec/ Beardsell/ Equivalent make 100mm thick PUF Insulation(twolayers,each50 mm thick) for floor of Curd Blast, incubation and buffer room having following specifications:

Insulating Matrl. : PUF
Density : 38±2kg/m3

Procedure of floor insulation:

Coat of bituminous primer shall be applied over finished PCC floor after thorough cleaning and drying. .

Tarfeltof2.4 mm thickness shall be applied on the concrete surface below the insulation as vapour barrier with bitumen as adhesive. The joints shall be staggered having minimum 100mm overlap thoroughly sealed to make it perfect vapour barrier. The ends shall be turned up the outer wall above the height of protective curb and completely sealed with silicone sealant.

A coat of bitumen shall be applied on the outer surface of Tar felt and fix the first layer of rigid poly urethane foam insulation slabs with the joints staggered. All joint shall be completely sealed using hot bitumen.

A coat of bitumen shall be applied on the first layer of insulation and fix a second layer of rigid poly urethane foam insulation slabs with cross-wise joints staggered. All joint shall be completely sealed using hot bitumen.

Provide Tarfeltof2.4 m thickness above the insulation layer using bitumen as adhesive. The joints shall be staggered having minimum 100mm overlap thoroughly sealed to make it water proof barrier. The ends shall be turned up the outer wall above the height of protective curb and completely sealed with silicone sealant.

Meta flex/Gandhi Automation/ Equi. Make manual sliding type doors for cold rooms.

The doors shall be manually operated, horizontal sliding type, easy to mount, mechanically reinforced for heavy duty usage complete with all required fittings, sliding rails, bottom guide, rollers, etc mounted on a suitable frame. Necessary heavy duty handle for easy opening and closing of doors shall be provided. Door pad locking arrangement, emergency exit lock release knob shall be provided.

The doors shall be PUP insulated with both sides covered with impact resistant stainless steel (SS304) complete with all accessories. The foam density shall be40Kg/m3 minimum. Kick plate made of SS chequered plate shall be provided up to a height of 900 mm from bottom shall be provided.

Protection guard: A set of metallic guard made out of GI heavy duty 'C class pipe of 150NB dia. and 50NB 'C" class pipe for brazing the stand pipe shall be provided for each sliding door to protect the doors from external damages (Site fabrication, shall be done by refrigeration contractor)

Russel/Equivalent make air curtain for cold room doors. The materials of construction shall be all stainless (SS304).

Specification:
Motor rating: 1.5 HP
No. Of motors per unit: 01No.
Power supply: 230V,50Hz,1 phase

The blower fan shall be made of stain less steel and dynamically balanced to prevent vibration. The bearing shall be pre - lubricated sealed for life and maintenance free,suitable for lowt emperature application.

There shall be a limit switch with required accessories, contactor, etc in weather proof enclosure for ensuring automatic operation of blowers whenever the door is opened. Electrical cabling shall be carried out from the cold room MCC.

PVC strip curtain having flaps of minimum 3 mm thickness with 50% overlap between adjacent flaps.The strip curtain shall be complete with all accessories made of material suitable for low temperature application.

Specification
Size of Strip: 200mm wide3 mm thick
Grade: Flat Freezer grade
Color: Transparent
Mounting Hardware: Aluminium hardware fabricated specially' to hold PVC

1Lot Internal lighting- the cold rooms shall be provided with suitable moisture proof fittings.

7.0 **1Lot Cold room safety system**.
ICE SILO

1.0 1No. Ice Silos having following specification.

Design: The detailed design of the Ice silo, all components, coil arrangements etc is responsibility of the supplier. Drawing shall be approved by the purchaser.

Constructional features: Double walled insulation &welded construction of good engineering design &Practice. The only metal to metal contact between the inner & outer shell be at the places where fitting for the tanks are provided. At the Places where mild steel stiffeners are provided insulated padding shall be fixed between the inner stainless steel shell & the Stiffeners.

Finish: All welding joints are to be ground smoothly. All stainless steel surfaces are to be polished to 150 grits. The radial of all welded &permanent attachment joints shall be at least 6rnrn.Atthe bottom plate joint with the cylindrical shell. The radial shall not be less than 25mm.

Installation: It shall be Suitable for outdoor installation. The accessories mounted shall be weather proof.

Inner cylindrical body :The inner Shell top cover &Flat bottom shall be Fabricated from stainless steel plates of

Suitable thickness conforming to AISI-304 Quality.

Outer Cylindrical body :The Outer Shell top cover &Flat bottom shall be fabricated from stainless steel plates of suitable thickness conforming to AISI-304 Quality.

Insulation :The entire inner shell, top cover& flat bottom should be insulated with 150 mrn thick expanded polystyrene in two layers each 75 mm thick or equivalent.

150 mm heavy density expanded polystyrene having an average 1.35 kg/sq.cm compressive strength for the bottom, in two layers each of75 mm.

150 mm normal density expanded polystyrene having mean density 16 kg/cu.m for the shell & top in two layers each of75 mm.

Test certificates from authorized laboratories shall be provide in support of all physical properties of insulating material for each batch supplied. Alternatively, insulation with high pressure injection ofPUFof40Kg/cu.mt .density ofequivalent thickness would be acceptable.

Accessories : Flanged outlet ,Flanged inlet, drain nozzles, return water connection, ladder, railing, over-flow, sight glasses, 200 dia. (08 Nos.), equalizer provisions between the two silos, Quick-fill &make-up water inlets on the header shall be provided. The sizes of the accessories are to be decided by the supplier. Air vent of suitable size shall be provided to prevent formation of partial vacuum during unloading & pressure during filling. The air vent shall be vermin proof.

Stainless steel cleats shall be provided near top for fixing &hanging rope ladder required during inspection of inner shell.

Man-way, inspection glass, light glass, thermo wells, lifting lugs, anchor Points, stainless steel ladder etc. shall be provided as per standard design &requirement.

Suitable structural members shall be provided as stiffeners to the inner shell walls. These shall be adequate to prevent perceptible bulging of walls. All mild steel surfaces shall be sand blasted to bare metal &spray galvanized.

All nozzles provide on silo shall be of stainless steel AISI-304 quality.

ICE accumulation arrangement: The coil shall be of stainless steel seamless pipe of given thickness conforming to AISI-304 quality. The coils are divided into several sections. The evaporator coils shall be designed to suit the operation with pumped liquid refrigerant (overfeed system). Each section of coil is supplied from the liquid header through a fixed metering orifice to ensure even distribution of liquid Feed. The coils shall have positive grade from the top supply to the bottom. The suction riser incorporating a lift fittings.

Suitable type ice thickness sensors shall be provided in the ice silo. Each evaporating coil shall have 2 sensors. These sensors shall be connected to the separate ice thickness controlling system for auto operation of the solenoid valves in the inlet ammonia lines. The ice thickness controlling system shall have seamless integration with the PLC SCADA for smooth operation.

Determination of pipe sizes number of feed in each section &number of sections in each silo is the responsibility of the supplier. Drawings shall have to be provided to the purchaser. Pipe velocities shall be such as not to cause unreasonable pressure loss or noise &in refrigeration lines shall ensure effective liquid &oil entrapment. Internal supports &guides for fixing the coils shall have to be provided.

Tank TopCover:TheSS304topcovershallbe removable type it shall be suitable for outdoor location. It shall be water-tight & air-tight.

Agitator: An agitator fitted to each silo shall comprise a stainless steel impeller on a vertical spindle with direct drive from a vertical spindle motor. The geared motor shall be imported SEW make. The impeller shall be placed inside the circulation pipe (rising flow) provided in the middle of the coil. The agitator & motor shall be properly supported. The motor shall be weather proof with degree of protection IP-55, EFF-l & the motor assembly shall be fitted with a removable protective cowl. The agitator capacity shall be suitable to perform for uniform building & building of ice over the ice accumulation coils.

It's connection given at panel. Agitator push button station & run pilot lights in the main switch board.

Access: Stain less steel ladder & walk-way shall be provided giving access to the top of silos, interconnecting platform in SS 304 between the silos, 900 mm high hand rail on top. A drawing shall be approved.

Control system:

The silos shall be equipped with an automatic ice thickness device (range 0 to50mm) of make TANKKI / TH Witt / LABKO / ASABA. This device shall show the thickness of ice on a digital display both during loading & unloading. The desired thickness of ice layer shall be set at the control panel and also from the main SCADA &it shall be regulated continuously without stages. The control panel shall have a facility to regulate the operation of the ice silo system by means of a minimum ice thickness level & maximum ice thickness level.

The ice thickness control system shall also be connected to central process computer which shall monitor &record the functions of ice thickness control system.

Operation of the ice silos is entirely automatic based on Ice thickness controller.

17.2 STEAM GENERATION SYSTEM

17.3 STEAM RAISING PLANT

17.4 Steam Boiler with ESP, auto blow down, Air pre heating and Economizer

Basis of Design
Capacity- 8000kg/h
Quantity-(1W+1S)

Maximum Operating pressure should be designed to meet the requirement of milk powder plant, UHT plant , milk processing, CIP, milk product manufacturing.

Fuel Details and Specifications

The boiler should be designed to be operated with coal and LPG. The firing system should be designed for hybrid mode of operation as and when required. LPG storage facility and coal storage facility shall be created nearer to boiler house.

Fuel Composition

1)LPG as per standard specification of HPCL / IOCL.

2)Briquette

GCV----------4300Kcal/Kgmin.
Ash----------35%byweightmax.
Moisture-------8%byweightmax.

Block size------Dia.2-4inch
Unless otherwise specified, the performance parameters of the Boiler under this Offer are based onthefollowingcriteriaforwater.Filteredandtreatedwatershouldbeusedasper
British
StandardBS-2486-1978.

The recommended quality of Feed Water to Boiler:
Hard nessasCaC03 :5max.
pH:8.5to9.5
O2:Nil
Oil:Nil
Total dissolved solids: minimum possible to reduce blow down

Boiler Water:

Hardness asCaC03 :Not detectable
Sodium Phosphate asNa3P04 : 50-100ppm
Caustic alkalinity asCaC03 : 350ppm (min.)
Total alkalinity asCaC03 :1200ppm (max.)
Silica asSi02 :less than 0.4oftheCaustic alkalinity
Sodium Sulphite asNaS03 :30to70ppm
Hydrazine N2H4 :0.1to 1.0ppm
Suspended Solids: 50ppm
Dissolved solids: 3500 ppm (max.)

Supply Voltage: 415 V(+/- 10%), 50Hz.

17.2 Chimney & Ducting

MS chimney suitable.
Height-32mtsDiameter-to be designed by the bidder

17.3 Feed Water Tank insulated & Water piping

Capacity: 10 KL
MOC: MS
Type: Vertical single walled with standard accessories

17.4 HP Steam & Condensate Pipes & Fittings IBR

HP Steam line shall be MS seamless, Heavy duty, scheduled 40 pipe with insulation and aluminium cladding. .

Complete condensate piping from the respective generation points to storage and from storage to boiler house shall be from SS316 and insulated. All condensate pipe supports inside the plant/corridor & tanker bay shall be of SS-304 box section. Pipe supports outside the plant shall be of GI.

17.5 Steam Pressure Reducing Station IBR

Material: CI Steel body

Type: Pneumatically operated, manually controlled

17.6 LP STEAM PIPES & FITTINGS

LP steam line shall be of -ERW, MS heavy duty (C Class) pipe with insulation and aluminium cladding.

17.7 CONDENSATE COLLECTION AND PUMPING SYSTEM

Condensate shall be collected from all the pumping traps within the process area and shall be transferred to balance tank of boiler through on steam operated pressure powered pump. .

STEAM OPERA TED PRESSURE POWER. PUMP FOR CONDENSATE

Capacity: Suitable size
Type: Steam operated mechanical Pressure Powered Pump

Accessories : Steam operated mechanical pressure powered pump with receiver having isolation valve, Y - type strainer, Disc check valve at pump inlet, Disc check valve at pump outlet, Piston valve with strainer &Float trap at motive line having maximum motive pressure of2.5Bar and back pressure of 1Bar g

OVERHEAD CONDENSATE STORAGE TANK
Capacity :10KL
Material :MSEP
Finish : 150 grit

Type sheet:Verticaltank,Insulatedandcladdedwith2mmthickMS

Accessories :Inlet/outlet, breather for steam vent, High & low level switches, level and temp. transmitters & top man way & other accessories like staircase, railing etc.

CONDENSATE TRANSFER P U M P (VFD OPERATED)

Capacity : suitable
Type pump: Centrifugal/High efficiency Ground foss vertical in line

Material : Body & working parts SS304 with cast iron base
Duty :Top unfiltered water from condensate collection tank to boiler house.

Auto diversion valve to drain condensate in case the condensate is found to be murky shall be provided.

FLOWMETER FOR CONDENSATE (VORTEX)
Capacity
Capacity : Suitable
Type : Vortex type flow meter
Duty: These shall be used for online flow measurement of Condensate being transferred to boiler house.

CONDENSATE COLLECTION & TRANSFER PIPING, VALVES, FITTINGS AND SUPPORTS

Quantity : 1 LOT

As per general description given in basis of design. Complete condensate piping from the respective generation points to storage and from storage to boiler house shall be from SS316 and insulated. All .condensate pipe supports inside the plant/corridor &tanker bay.shall.be ofSS-304 box section. Pipe supports outside the plant shall be of GI.

17.8 Coal &Ash handling system

Manual ash and coal handling equipment shall be provided as per requirement of plant.

17.9 Insulation of Steam Piping

All steam transfer lines shall be suitably insulated and cladded.

18 WATER HANDLING SYSTEM

18.1.1 Raw filtered water hydro flow system with vertical pumps 60KLPH (2W+IS)

Type : Hydro flow system with Hydro Pneumatic tank of 500Ltrs capacity, MOC-FRP and multistage vertical In-line type GRUND FOSS make pumps

PUMP DETAILS
Capacity : 60KLPH
Type : Centrifugal/High efficiency Grund foss vertical inline pump
Material Body & working parts SS304 with cast iron base
Duty :To pump filtered water from UG storage tank to the plant
Motor :Efficiency- 1(IE2)
Pressure : 60MWC .
Instruments: Pressure Gauge -02Nos

18.1.2 Automatic duplex water softening plant 30KLPH

Capacity: 30KLPH

Type: Duplex type with manual changeover/re-generation facility based on flow meter (Output) with alarm system

Duty: To soften raw water for process application / boiler requirement

The softener shall be of regenerating type with NaCI(common salt) as regenerate.

The entire regeneration sequence such as opening and closing of valves, brine injection, beginning of next regeneration etc., shall be Manual.
Design requirement:

Mild steel pressure vessel with inlet and outlet connection, resin charging and withdrawl connection and supports,..The vessel shall be internally rubber lined and painted externally with anticorrosive' paint. Filter nozzles shall be provided at bottom and to portion of the softener vessel.

Water distribution system shall be Inverted Bell Mouth and water collection system Strainer Plate Design.

Brine solution/dosing tank of FRP/MS rubber lined (outer epoxy coated) construction to store and measure salt solution for regeneration of the softener complete with brine level indicator is included in scope of supply. A separate brine dissolving/preparation tank(FRPIHDPE tank of 10KL-2Nos) shall also be supplied with air agitation. Brine piping shall be of suitable grade PVC. Brine transfer from preparation tank to dosing tank shall be through gravity &brine injection from dosing tank to softener would be through ventury / injector.

Accessories:
Hydraulically operated brine injector -1no.
Initial charge of ion exchange resin for the softener vessel -1lot
Hardness test kit -1set
Inlet and outlet pressure gauges -1set
Inlet and outlet sample valves -1set
Water flow meter with totaliser and audio visual alarm for changeover -1no.
Instruments as per requirement -1Set

Other details as per general description given in basis of design.

18.1.3 Soft water hydro flow system with vertical pumps (2W+IS) 50KLPH

Type : Hydro flow system with Hydro Pneumatic tank of 500Ltrscapacity, MOC-FRP and multistage vertical In-line type GRUND FOSS make pumps

PUMPDETAILS
Capacity :50KLPH
Quantity : 3nos(2W+lS)
Type : Centrifugal/High efficiency Grund foss vertical inline pump
Material:Body&workingpartsSS304withcastironbase
Duty:To pump filtered water from UG storage tank to the plant
Motor : Efficiency- I(IE2)
Pressure :60MWC

Instruments Pressure Gauge -02Nos

18.1.4 Automatic RO plant 25KLPH

Capacity: 25KLPH
Duty: To generate treated water with Reverse Osmosis (RO)process
Type: Fully automatic RO plant with second stage for maximize recovery upto90%. Complete SS construction including skids and piping.

OPERATING DATA FOR 1ST STAGE CSRO SYSTEM:

Operating hours:22hrs
Recovery: 75%
Type: Automatic

OPERATING DATA FOR 2ND STAGE CSRO SYSTEM:

Operating hours :22hrs
Recovery :60%
Type :Automatic

SCOPE OFSUPPLY

1. pH Correction Dosing System Automatic with PID action

Dosing Pump :01No Electronic Diaphragm Type
Capacity-0to6 LPH
MOC of pumps-PP

DosingTank:01No,
Capacity-100Liters
MOC : HDPE

Instruments :Level Switch-01No

2. Antiscalant dosing system

Dosing Pump·: 01No-Electronic Diaphragm Type
Capacity--0to6LPH
MOC of pumps-PP

Dosing Tank :01No,
Capacity-100Liters
MOC: HDPE
Instruments :LevelSwitch-01No

3. Micron Cartridge Filter

Quantity : 01 No
Capacity : 25 M3/hr
Cartridge length : 30”
MOCof Housing : SS 304
MOC Cartridge :PP
Type : Double open End

Instruments :PressureGauge-01No
Sampling valve -02Nos

4. SMBS Dosing

Pump :01No-ElectronicDiaphragmType
Capacity- 0to6LPH
MOC of pumps-PP

DosingTank :01No,
Capacity-100Liters

MOC: HDPE

Instruments :
LevelSwitch: -01No

ORP Analyzer: -01 NoOne
AutoDumpValve: -01Nos

5. High Pressure Pump (For 1st Stage RO)

Quantity:2nos(IW+IS)
Type :Centrifugal/High efficiency Grund foss vertical Inline pump
Material:Body&workingpartsSS316
Duty:Topumpfilteredwaterto1ststageRO membrane
Motor: Efficiency- 1(1E2)
Instruments
Pressure Gauge -02Nos
PressureSwitches~04Nos.

6. RO system (1ststage)

No. Of Stream : One no
Recovery of System;75%
RO interconnecting piping;MOCSS316
Welding Type; Orbital
Pipe Type; OD TUBE.
Internal Surface Finish: Internal Electro-polished
MEMBRANE Type;ChemicalSanitisable,Spira1Wound
MOC ;SS304
Type: Side Port
RO Skid MOC : SS304
Instruments :
Flow Transmitter- Vortex type -01 Nos
flow Transmitter- Magnetic type 01 No
Flow Indicator (Rota meter) -02 Nos
Pressure Gauge 03 Nos
Conductivity Analyzer 01 No
pH Analyzer- 01No
PLC : HMI Inch 5.5ColorScreen, Make: Allen Bradley/ Siemens,
Panel SS304

7. RO reject water Storage Tank

Dosing Tank : 01No
Capacity -2KL
MOC-HDPE

Instruments :
Level Switch -01No

8. RO Feed pump (For 2nd stage RO)

Quantity: 2nos(lW+1S)
Type: Centrifugal/High efficiency Grundfoss vertical In line pump- CRN series

Material :: Body &working parts SS316
Duty : To pump filtered water to RO membrain
Motor : Efficiency - 1(IE2)
Pressure: 2Bar
Instruments: Pressure Gauge -02Nos

9. High Pressure Pump (For 2nd Stage RO)

Quantity: 2nos(1W+IS)

Capacity: 6KLPH
Type: Centrifugal/ High efficiency Vertical Inline pump
Material: : Body &working parts SS316
Duty: To pump filtered water to 2nd stage RO membrane
Motor :Efficiency -1(IE2)
Pressure :16Bar
Instruments: Pressure Gauge -02Nos
Pressure Switches -04Nos.

10. RO System (2nd Stage)

No. Of Stream : one no
Recovery of System ; 60%
RO interconnecting piping : MOC SS 316
Welding Type : Orbital
Pipe Type : OD TUBE
Internal Surface Finish : Internal Electro polished
MEMBRANE : Chemical sanitisable, Spiral Wound
MOC : SS 316
Type : Side port
RO Skid : MOC SS 304
Instruments : Flow Transmitter- Vortex type – 01 Nos
Flow Transmitter- Magnetic type-OlNos
Flow Indicator (Rota meter)- 02No
Pressure Gauge - 03Nos

Conductivity Analyzer - 0l No
pH Analyzer- 0l No

Note: Complete RO plant shall be factory assembled and shipped as single unit.

11. Chemical Cleaning system for RO

Duty: Chemical cleaning of both 1ststage and second stage RO with Skid mounted close loop system
.

Skid based cleaning system shall comprise of following:

Chemical Cleaning Tank
Quantity :01No
Capacity :500Liters
MOC :HDPE
Instruments : Level Switch - 01No

Chemical Cleaning Pump
Quantity :01No
MOC :SS304
Flow :Suitable
Discharge Pressure : 2.5Kg/cm2
Instruments :
Pressure Gauge - 01No

Micron Cartridge Filter
Quantity : 01 Set
Capacity : Suitable
MOC of Cartridge :PP
HOUSING : 01Lot, MOC- SS304
Instruments :Pressure gauge - 01No
Sampling valve - 01No

18.1.5 RO water buffer storage tank 50KL

Capacity : 50 KL
MOC : SS 316
Configuration : Vertical, Single walled with standard accessories.
Suitable for outdoor installation

18.1.6 RO water hydro flow system with vertical pumps (1W+ IS) 20KLPH

Type : Hydro flow system with Hydro Pneumatic tank of 500 Ltrs capacity, MOC-FRP and multistage' vertical In"-line type GRUNDFOSS make pumps

PUMP DETAILS
Capacity 20KLPH
Quantity 2nos(1W+1S)
Type Centrifugal /High efficiency Grundfoss vertical inline pump
Material Body & working parts SS304 with cast iron base
Duty To pump filtered water from UG storage tank to the plant
Motor Efficiency- 1(IE2)

Pressure 60MWC
Instruments: Pressure Gauge -02Nos

18.1.7 Raw, soft, RO, Chilled Water pipes, valves & fittings 1 Lot

As per general description given in basis of design. Raw &soft water pipe line shall be of GI and that of RO water lines shall be of AISI-316. All water pipe supports inside the plant/corridor & tanker bay shall be of SS-304 box section. Pipe supports outside the plant shall be of Galvanized MS section.

19.0 COMPRESSED AIR HANDLING SYSTEM
19.1 AIR HANDLING SYSTEM

19.1.1 VFD driven non-lubricating screw air compressor in accoustic enclosure & with after cooler & automatic moisture separator (2W+IS) 550CFM

TECHNICAL SPECIFICATIONS:

Free Air Delivery	CFM	542
Operating / Working Pressure	Barg	7
Capacity Range	CFM	628-426
Pressure Range	Barg	4.5-10.3
Motor Rating	kW	90
Fan Motor Rating	KW	4.8
Main Motor Efficiency	%	95.4
Total Package Input power, including fan motor and invertor efficiency	KW /CFM	02
Number of stages		Two
Type of motor		Hybrid permanent magnet motor
Number permissible motor		
Starts/Stops	Infinite	
Type Of Regulation	Variable Frequency Drive	

19.1.2 Air Receiver with accessories - 1

Vertical Air Receiver: $4M^3$

Design Basis:
1)Material of Construction- Shell & Dish end: IS2062GrB
2) Working Pressure(Maximum): 12.3*KglCm2* (g)
3)Corrosion Allowance: 1.5mm
4)Radiography/ Heat Treatment: NIL
5)Code of construction: IS2825-1969 Class-II

6)Paint: IR Beige color

Standard Fittings Include:
A)Safety valve with connection-Spring loaded, Open Bonnet, Pop type.
B)Pressure gauge with connection & cock; 4" Dial, Drain Pipe with connection & Isolation valve.
C)Auto Drain Valve

19.1.3 Air Dryer refrigerated type

Technical Specifications
Air Dryer Type : Refrigerated Type, Rated capacity 1112CFM
Refrigerant :R-407c(Eco-Friendly Refrigerant Gas)

Rated Pressure : 7.0BarG

Pressure Dew Point : 3-5Deg*C
Maximum Working Pressure : 14 Bar G
Inlet Air Temperature :50Deg*C(Max.60Deg*C)
Ambient Temperature :40Deg*C (Max.55Deg*C)
Electric Power Supply :415V/3Ph/50Hz
Air Connection (IN/OUT) :ANSI3"/3"#150LBS
Weight :315KG
Nominal Power :4.1KW
Dimensions LxWxH(mm) :925x1198x1468

19.1.4 Compressed air pipes & fittings

The compressed air transmission from compressed air room to the SS receivers to be installed in the plant area shall be from Gl- 'C' Class-Heavy duty piping. Further distribution to the individual consumption points (Except the main header) shall be from SS304 piping.

All compressed air pipe supports inside the plant /corridor & tanker bay shall be of SS~304 box section. Pipe supports outside the plant shall be of Galvanised MS section.

20.0 STRUCTURAL BRIDGESIPLATFORMS

SS structural platforms in tanker ways / CIP tanks / ghee equipment/ silos spiral ladders, pouch filling machines, cross over bridge for crate conveyors etc.

We have considered following SS / Gl platforms considering requirements of the plant.

Sr No	Description	MOC	Qty
1	Spiral Ladder For approach to Silos	GI / MS	1No.
2	CIP platform for Tanker Reception / CIP bay with collapsible platforms for approach to man way tank	SS304.	1Lot
3	Cross over platforms for Crate Conveying lines	SS304	1Lot
4	Platform for approach to CIP tanks .,	SS304	ILot
5	Platform including sitting stools for pouch packing machines ..	SS304	1Lot
7	Platform for Turbo Blender Platform for inoculation tanks	SS304	2No
8	SS table for cup packing	SS304	1No

9	Butter packing tables	SS304	2No
10	SS ducting for ghee boilers	SS304	1No
11	SS packing tables for Ghee section	SS304	3No
12	SS tray for bulk tanks and pumps	SS304	1No
13	Plat form for tanker, Process and IP CIP	SS304	2No
14	Platform for Ice cream mix preparation tanks	SS304	1No
15	SS tables for Ice cream section	SS304	1No
16	Working tables for paneer section	SS304	3No

21 INDUSTRIALELECTRICAL LT

Specifications shall be generally as per the requirement of plant and as explained in Design Basis of our offer.

2101 11KV,3panelVCBwithnumerical relays etc.

.Specifications shall be generally as per the requirement of plant and as explained in DesignBasisofouroffer.

21.2 11*KV/440* V,1500KVAon-load transformers

Specifications shall be generally as per the requirement of plant and as explained in Design Basis of our offer.

21.3 Power control centre (PCC)

Specifications shall be generally as per the requirement of plant and as explained in Design Basis of our offer.

Intelligent MCC's for production, CIP ,ICP and boilers INTELLIGENT MOTOR CONTROL CENTRE (IMCC)

Motor control centre (sheet steel) detailed specification FUNCTIONALREQUIREMENTS:

IT SHALL BE USED TO RECEIVE, CONTROL AND DISTRIBUTE ELECTRICAL POWER AT 415 V, 50 HZ, ACIN SHEETSTEELHOUSING AND COMMUNICATEREALTIME OPERATING PARAMETERS TO MAIN PLANT *DCSI* PLC AND

SCADA. THE SPECIFICATIONS DESCRIBE THE REQUIREMENTSFOR THE LOW VOLTAGE INTELLIGENT MOTOR CONTROL CENTER·(IMCC), WHICH SHALL FUNDAMENTALLY PROVIDE FOR THE FOLLOWING:

XIV) Achieve controls through microprocessor based systems

Replace hardwiring by using network technology
Provide enhanced degree of diagnostic and protective functions.

THE IMCC SHALL PROVIDE COMPREHENSIVE PROTECTION ON MOTORS BY INTEGRATING INTELLIGENT MOTOR PROTECTION RELAYS (IMPR) OR INTELLIGENT PROTECTION DEVICES (IPD) INSIDE THE SWITCH BOARD. THE IMCC SHALL ALSO BUNDLE THE BUS COMMUNICATION WITH THE MOST COMMON PROTOCOLS FOUND IN THE INDUSTRIAL NETWORKS (MODBUS SL IMODBUS TCP/PROFIBUS DP /DEVICE NET).

OPERATINGTEMPERATURES -40DEGC/+75DEGC.

Design Requirement and Scope of Supply:

Statutory Requirements:

Motor Control Centre shall be manufactured/ assembled as per the latest applicable Indian Standards, Indian Electricity Rules, Indian Electricity Act, Fire Insurance Regulations and comply with all currently applicable statutory requirements of concerned State Electricity Inspector and safety codes in the locality where the equipment will be installed and as per the detailed specifications mentioned below. The manufacturer of the panel must possess a Type Test Certificate from CPRI.

The IMCC shall be manufactured at international company (SIEMENS/ Rockwell/ Schneider), approved panel builders having IMCC manufacturing experience which owns the complete range of major switch board components and intelligent devices used in the IMCC. The IMCC shall provide the flexibility to choose different solutions in motor protection and monitoring functions according to the requirements of critical motors and non-critical motors and relevant loads.

The switch board manufacturer shall be the original designer of IMCC (like SIEMENS/Rockwell /Schneider) or a panel builder with a formal license from the original IMCC designer. All switchgear used in the switch board shall be of the same manufacturer to allow better inter-operability, seamless integration and installation.

Housing Details:

The switchboard shall be 'fabricated using pressed 'and shaped cold rolled steel sections structure of adequate thickness. The sheet steel used for panel shall be minimum 14 SWG sheet except that the partition plates, inter-panel barriers and cubical doors may be made of 16SWG. The switchboard shall consist of free standing front and back open able panels arranged to form a continuous line-up of wardrobe type cubicles of uniform height. Cold rolled sheets shall be used for doors and front covers. Front doors shall be hinged type with quarter turn fasteners and bus bars and cable alleys covers shall be bolted type; Each wardrobe type cubicle shall house 8 to 9 feeders or as per design' requirement of shipping lengths.

Switch Board shall be extensible at both the ends by addition of vertical sections. Ends of the bus bars shall be suitably drilled for this purpose. Panels at extreme ends shall have openings, which shall be covered with plates screwed to the panel. The switchboard shall be provided with
.integral base frame. The cable gland plate shall be2.5mmthick.

The switchboard shall be totally enclosed, dust, weather and vermin proof and shall conform to degree of protection not less than IP44asper IS 2147. Gaskets of durable material shall be provided all round the perimeter of adjacent panel, panel and base frame, removable covers, doors and other openings.

All hardware shall be corrosion resistant. All joints and connections shall be made by galvanized zinc passivated or cadmium plated high tensile strength steel bolts &nuts. Spring washers shall be provided to secure against loosening.

The switch board shall be non-drawout wardrobe type design except for the individual ACB cubicles used, if any, for incoming, outgoing and bus coupler. Each wardrobe shall contain 8 to 9 feeder components as per design. The IMCC shall be suitable for indoor installation. Suitable cable & bus bar alleys shall be provided if required. All components of the switch board shall generally be approachable from front. However, IMCC can be in double front execution also if specifically asked for. The maximum and minimum operating handle/push button height of any feeder shall not be more than 1900 mm or less than 300 mm with reference to panel bottom. Supporting arrangement and saddles for dressing of power and control cables shall be provided. Maximum shipping length of MCC shall be as per the IEC design. IMCC shall be extendable both sides. Space heaters with toggle switches, fuses and thermostat shall be provided in each cable alley.

The maximum height of the panel shall generally be restricted to 2300 mm and maximum length of a shipping section shall be 2500mm. Each shipping section shall be provided with suitable lifting hooks. These hooks when removed shall not leave any opening in the board.

Supporting arrangement for dressing of power and control cables in cable alleys also shall be provided. .

Minimum depth of cubicle for installing ACB shall be 1000mm. Minimum width of cable and bus bar alleys shall be300mm.

Internal arc features: The switchboard shall be designed to minimize the risks of occurrence of internal arc and whenever such an arc occurs it shall prevent its effect on operators and material/equipment surrounding the switchboard. The short-circuit withstand capacity of the panel with bus bar and supports shall be minimum 50KAII sec.

Painting

All metal surfaces shall be thoroughly cleaned and degreased to remove all scales, rust, grease and dirt. Fabricated structures shall be pickled and treated to remove any trace of acid. The under-surface shall be prepared by applying a coat of phosphate paint and a coat of yellow zinc chromate primer. The under surface shall be made' free from all imperfections before undertaking the final coat.

After preparation ofthe under surfaces, the panel shall be spray painted with final two coats of approved shade of powder coating (RAL 7035 Siemens grey). Thickness of powder coating shall not be less than 60 microns.

The finished panels shall be dried in stoving ovens in dust free, atmosphere. Panel finish shall be free from imperfections like pin holes, orange peels, run-off paint, etc.

All unpainted steel parts shall be cadmium plated or suitably treated to prevent rust, corrosion, etc.

Nameplates:

Apart from panel nameplate highlighting the operating voltage, the nameplates for all incoming &outgoing feeders shall be provided on doors of each compartment. Nameplates shall be fixed by screws only and not by adhesives. Engraved name plates shall preferably be of 3-ply (Black-White-Black) acrylic sheets or anodized aluminum. Special dangerplatesshallbeprovidedasperrequirement.Letteringsizeshallbe 5mmor15mmasdirected.

Inside the panels, stickers shall be provided for all components giving identification no. As per detailed wiring diagram.

Cooling Fan & filter assembly, lighting of panels, heater:

Each section of the panel shall be provided with a set of cooling fan, filter assembly and 2' long T5 tube light fitting operating through a SP MCB and door limit switch.

Each section of the panel shall also be provided with' heating plate and a suitable thermostat.

Bus bar Sizing Connection and Supports:

The bus bars shall be made from high purity &high conductivity copper. The bus bars and supports shall be capable ·of withstanding the rated and short circuit current stated in the single line diagram/feeder details. Minimum size of power (phase) bus bars shall not be less than 200Amps rating. Maximum current density permissible for Copper Bus Bars shall be 1.2. A suitable section aluminium earthing bus bar shall be provided in the panel at bottom throughout the length of the panel. Minimum cross section of AI earth bus shall be300sq.mm. Provision shall be made to connect the earthing bus bar to the plant earthing grid at two ends. All doors shall be earthed using flexible copper connections to the fixed frame of the switchboard. The bus bars shall be tinned to protect against oxidation.

The bus bars shall be provided with heat shrinkable PVC insulating sleevesof1100Vgrade. Red, yellow and blue colour shall be used for phase bus bars and black colour shall be used for neutral bus bars. The sleeves shall be non-inflammable and self-extinguishing type. All joints in main horizontal bus bars and all tap-off connections from the main horizontal bus bars shall be suitably shrouded. Supports for' bus bars shall be made of suitable size non-hygroscopic and non- inflammable epoxy compound SMC/DMC blocks and these shall be adequate in number so as to avoid any sag in the bus bars.

Minimum clearance between bus bars phase to phase shall be25mm and that between phases to neutral /earth shall be 20mm.

Power Connection:

For power inter connection within the panel board;

Copper conductor PVC insulated cables of adequate cross section shall be used. However, for current rating above 100 Amps, Copper bus bar strips of adequate rating shall be used. Minimum size of copper conductor shall not be less than as specified below.

(a) Minimum size of Steel braided Copper Conductor power / Control cable(Lapp/ Concab make) shallbe1.5Sq.mm.
(b) Size of Instrument signal cable Steel braided screened flexible CopperConductorshallbe1sq.mm.

Cable lugs / sockets of suitable size and type shall be used for all interconnections and cable terminations.

For incoming feeders of the MCC, aluminium conductor cable will be used and hence the panel is shall be designed for receiving these and wherever required cable boxes with bus bar extensions for receiving more no. Of cables, shall be provided in panel.· .

For all outgoing motor feeders, the suitable size terminal blocks shall be provided in cable alleys and wiring up to these from contactors shall be done by panel Supplier. These terminal blocks shall be heavy-duty type to withstand high starting currents. The cable entry shall be either from top or bottom as specified in feeder details. Removable gland plates of minimum 12 gauge thickness shall be provided on top / bottom of panel (as required), for cable entries. The cable alleys shall also be totally isolated from switch gears by suitable partition plates.

To prevent accidental contacts, all junctions of interconnecting cables and bus bars also shall be shrouded suitably using coloured PVC insulation tape.

Standard colour code of red, yellow and blue for phases and black for Neutral shall be followed for all bus bars/conductors. Auxiliary wiring and terminals:
Wiring for all controls, protection, metering, signalling etc. Inside the switchboard shall be done with 1'100VgraycolourPVC insulated FR copper conductors. Minimum size of these conductors shall not be less than 1.5mm'. However, CTcircuitwiringshallbedonewith2.5rnm'. Control wiring to components fixed on doors shall be flexible type.

10%spareterminals shall always be available in each terminal block. Control wiring up to these terminal blocks shall be done.

15% spare feeders of various ratings completely prewired shall be supplied in each of the IMCC

All conductors shall be terminated using compression type cable sockets/lugs at both the ends.

Each control wiring termination shall be identified at both the ends by PVC ferrules. The identification termination numbers shall match with those on drawings, Suitable size SP MCB shall be used for tapping power for control circuit wiring.

.For all motor starter feeders, provision for control wirmg to remote ON/OFF control shall be made. The auxiliary wiring for the same shall be brought up to terminal block in the feeder's cubicle

Switchgears:

Air Circuit Breakers (ACBs):

These shall be (4 pole MDO ACB), fully draw out type with built-in microprocessor based programmable protection, and suitable for 415 V,
50Hz supply. Microprocessor based programmable protection unit shall

have settings for overload, short circuit, instantaneous and earth fault currents with time delay and LED indicators to show various conditions such as power ON, overload, short-circuit, instantaneous earth fault, percentage load, self-diagnostic test etc.

Mechanical spring charging mechanism stored energy type shall be provided with mechanical indicators to show 'Open', 'Closed', 'Service' & 'Test' positions. The circuit breaker shall be provided with mechanically
Operated emergency tripping device. This device shall be available on the front of the panel.

The control supply shall be 240V At .6NO+6NC auxiliary contacts shall be provided.

The interlocks shall be as under:

It shall not be possible to plug in a closed circuit breaker or to draw out a circuit breaker in closed position. It shall not be possible to operate a circuit breaker unless it is in fully plugged-in, 'test or fully isolated position. In test position, the breaker shall be tested without energizing the power circuit. The ACB feeder cubical door can not be opened when ACB is "ON". However, it shall be possible to defeat this inter lock for inspection purpose. Closing and trip coils shall work under the following voltage variation conditions:

Closing coils- 85% to 110% of rated voltage
Trip coils- 50% to 130% of rated voltage

For series tripping, overload, short circuit and under voltage/shunt trip release shall be provided.

Built-in relays for overload, short circuit, instantaneous and earth fault protection shall be provided for incoming feeders ACB. Suitable port like RS485 shall be available in ACB for transferring/ communicating data pertaining to operation parameters, to main PLC / DCS system.

Current rating, short circuit current, protection relays etc. shall be as specified in feeder details._

Moulded Case Circuit Breakers (MCCB)

MCCBs shall always be provided with separate rotary operating handle mechanism with door interlocking. The MCCBs shall be of three / four pole construction (as required in the feeder details) arranged for simultaneous three /four pole manual, closing oropening and automatic
_instantaneous tripping on short circuits. MCCBs 'shall be provided with adjustable type tripping device with inverse. time characteristics for over loadprotection.

Closing mechanism shall be quick make, quick break &trip free type. Operating handle shall give a clear 'ON', 'OFF' &'TRIP' indications. Control voltage forMCCB shall be240 volts. The MCCBs shall berated for continuous maximum duty as specified. The rating of the MCCBs shall beasperthe feeder details. .
Minimum rated breaking capacities shall beasunder:

MCCBs up to 200Amps : 35KA
MCCBs above 200Amps : 50KA

Note: All feeders having 3pole MCCB shall be provided with neutral link complete with isolating link. However, the MCCBs for incoming and non-motor outgoing feeders shall beof4pole construction, unless stated otherwise.

Motor Protection Circuit Breaker (MPCB):

All motors below 40 HP shall be protected by Motor Protection Circuit Breakers (MPCB) having suitable rating thermal overload relays. These' shall be used along with contactors as specified in feeder details.

The MPCB will have motor protection tripping characteristics, current limiting and shall have low let through energy. It shall have bi-metallic overload protection and electromagnetic release for short circuit protection. MPCB shall have inbuilt single phase protection and adjustable overload settings.

In the MPCB, it shall be possible to. have accessories like auxiliary contacts, trip alarm contacts, shunt release, as required for motor control and protection. The breaking capacity of MPCB shall not be less than 50KA.

Switch Disconnector fuse units

The load break switches shall be heavy duty, air break type suitable for continuous maximum rating with manual quick make/ break mechanism. These shall have positive isolation with positive indication of contact separation. They shall have high short circuit making and withstanding capacities. Breaking capacity shall correspond to AC 23A utilization category. Mechanical interlock shall be provided to prevent opening of' door in switch 'closed' position and prevent closing of switch in door' 'open' position. However, it shall be possible to defeat this arrangement for testing purpose. Live terminals of the switch shall be shrouded.

Fuses

These shall be non-deteriorating HRC cartridge link type with operation indicator which will be visible without removing fuses for the service. These shall be complete with moulded phenolic fuse base and cover. The fuse base shall be so located in the-modules to permit insertion of fuse pullers and removal of fuse links without any problem. One set off use pullers to cover entire range of fuses used in the pane / shall also be provided.

Contractor

The rating of the power contactors shall be as required depending upon the feeder rating indicated in the specifications and as per the feeder details table provided in this specification below. Contactors coils shall be suitable for 240volts,50Hz.unless otherwise specified. All contactors shall be supplied with minimum 2 NO + 2 NC auxiliary contacts. Additional contacts if required for interlocking etc. shall also be provided. Minimum contactor rating for power shall be 9Amp. All the three contactors of Star Delta Starter shall be of same rating. Rating of contactors shall be based on feeder rating.

All contactors of motor starters shall be suitable forAC3 duty unless specified otherwise.

Protective Devices:

Intelligent Motor protection relays are required for DOL,S tar- Delta and soft starter feeders instead of bimetallic overload relay or other special relays for incoming & outgoing feeder. These shall be fixed on DIN rails or on mounting boards.

A local representative office with qualified support staff to provide training, technical support and service.

The IMPR shall provide the communication ports for the connection to the communication network. It shall be easily integrated into the communication architecture with remote information access.

It shall be an open communications system v which means that it shall be directly connected to the main industrial network protocols, listed below:

-ModBus/ Ethernet
-Profibus DP
-Device Net

The IMPR shall embed the relevant network protocol inbuilt-in (native) mode.

The IMPR Supplier shall provide user-friendly software running in a Windows. environment to ease' the IMPR on-relay configuration. The software shall have menus and icons for easy access to the data required, guided navigation to go through all the data of the same function in one screen and with a file management system.

Timers:

The timers shall be continuously adjustable &electronic type, suitable for.
240 V, 50 Hz supply. The timers for Star Delta automatic starters shall have time delay of0to60seconds between changeover of contacts.

Push Buttons (PBs):

Push buttons shall be complete with actuator and contact block and shall be generally mounted on doors of the cubicles. Colours shall be as
follow:

Stop/open/emergency - Red
Start/ close - Green

It shall have minimum 1NO + 1NC contacts. Push buttons shall conform toIP-65protections against dust and water ingress.

Indication Lamps:

All outgoing &incoming feeders shall be provided with 'ON' indication lamps.
Colours shall be as under:
Phases: Red,Yellow&Blue
ON :Red
OFF :Green T
RIPPED :Yellow

Indicating lamps shall be of LED (cluster of high intensity light emitting diodes) type, suitable or240VACsupply. These shall be provided with translucent covers of red, green and amber colours as required. These lamps shall be of minimum 22.5mmdia.Indication laps shall be provided for all feeders.

Current Transformers (CTs):

CTs. shall be cast resin insulated type. Primary and secondary terminals shall be marked indelibly. CTs shall. preferably be mounted on stationery parts. These shall be capable of withstanding momentary short circuit and symmetrical short-circuit current for 1 second and shall have a minimum rating of 10:VA.Neutral side of CTs shall be earthed.

Protection CTs shall be of low reactance, accuracy class "SP" and an accuracy limit factor greater than "10". Instrument CTs shall be of accuracy class "1.0" and accuracy limit factor lessthan "5.0".

Separate CT's shall be provided for protection and metering purpose.

Measuring Instruments:

These shall be of square pattern having approximate dimensions 96 mm X96 mm, flush mounting type. Necessary auxiliary instruments like CTs etc. are also included in the scope of supply.

All AC meters shall be of Digital type for displaying three phases reading. Suitable selector switch shall be provided if the digital meter does no thave provision for simultaneous display of three phase readings.

Voltmeter shall be suitable for direct line connection. Voltmeters shall be connected through MCBs only.

Intelligent Panel Meter shall be provided with incoming feeder of the MCC for the measurement and digital display of Multifunctional Electrical Parameters such as voltage, current, active power, reactive power,frequency,powerfactor,activeenergy,reactiveenergy,etc.Data port will be provided to communicate all these parameters to Main PLC Panel through suitable data bus / signal communication cable which shall be further transferred to central MIS system.

An motor feeders of 15 HP and above shall be provided with ammeter. Ammeter shall also be provided for all incoming & outgoing ACB/ MCCB / switches of rating 100A&above.
Ammeters s h a l l always be CT operated.

Special Requirments:

Feeder details for incoming and outgoing for this project as per battery limit has been worked out for design requirements of the plant. All motor feeders shall have soft starters and VFD wherever specified and required as per the process requirements. Variable Frequency Drive (VFD)Unit will be provided for a motor feeder irrespective of its rating, only if specifically mentioned by the Purchaser. Suitable Line Chokes will be provided in VPD feeders. Load side chokes wherever required are also included.

Each motor feeder shall consist of an MPCB/ MCCB, an IMPR (Intelligent Motor Protection relay or intelligent controller), auxiliary relay, start &stop pushbuttons, ON/OFF/TRIP indicating lamps and SPMCB for control circuit protection. All the motorized feeders shall have communication capable IMPR which shall be communicating to the plant PLC/DCS through bus.

Separate 24V DC power source for controlled power supply shall be of suitable rating from UPS shall be provided and logically distributed.

For incoming feeder of rating upto630A;4poleMCCB&forrating higher than 630A,4pole ACB shall. Be provided unless otherwise stated in the feeder details.

MCCB, 4 pole shall be provided (unless stated otherwise) for outgoing feeders of rating 63Amps and above and preferably these shall be located at the lower portion of the panel. These feeders shall have isolating link for neutral in case 3 pole. MCCBs shall be supplied as per the requirement given in feeder details.

Electrical interlocking shall be provided between various feeders as required by the process and' specified in feeder details. Interlocking will also be provided in software programme of Main PLC Panel.

ON/OFF operation of all motor feeders shall be possible in both Auto mode (PLC signal operation) as well as Manual mode (Push Buttons) from MCC through A/M selector switch. Indication for ON/OFF / TRIP for all motor feeders shall be provided.

Each incoming feeder shall have independent instrumentation, protection relays, APFC relays etc.

Provision shall be made to communicate operational parameters / data from all incoming/outgoing feeders to main PLC/ DCS Panel through suitable data bus/ signal communication cable. Operation parameters of motor feeders like ON/OFF status, actual current, trip status etc. shall be communicated.

GA, control &power circuit drawing for approval' shall be given to purchaser before starting manufacturing of MCC.

All the major components of an MCC shall be of approved make.

Note: Suitable derating factor of cables as per manufacturer's guidelines shall be applied where more than one cables. feeding to various motors/drives shall be laid in parallel:

Feeder details for incoming and outgoing for this project, as per battery limit and shall be as per design requirements of the plant.

Wherever desired distributed I/O , Swith Communication adaptors or linking devices shall be installed in each shipping split or shipping section and factory wired to each starter unit. MCC shall be connected to remote controller/SCADA via one network of high bandwidth. Network connection from remote controller wherever required shall be made to the communication adaptor/linking devices installed in each shipping unit. However in general it is preferred that all the intelligent relays on Soft Starters and VFD provided in the panels for electrical equipment shall be interfaced to the Central. PLC through open protocol communication cable (open networks) for control action and data acquisition/diagnostic information directly at device level. The VFD shall be dynamically controlled from the PLC depending on the program and feedback system from field. These VFD shall have communication port. The routing of network cables in IMCCs may be through horizontal and vertical wire ways. However more optimized approaches such as use of Trunk lines and drop lines isolated behind barriers or Independent, easy- connect ports on drop lines -are preferred. These configurations would provide independent, readily accessible ports to simplify installing, withdrawing, relocating and adding plug-in units. the configuration is preferable to daisy-chain architecture, in which moving or adding an MCC unit requires interrupting the chain and disabling downstream units. The open networks shall be such as Ethernet, Mod bus, Device Net and PROFIBUS.

The specifications of the Intelligent motor control relay (Intelligent motor management relay) shall be as given below:

A. GENERAL

The motor management device shall confirm toiec60947-4-1, 60947-5-5 &60947-8 for overload and thermistor protections. The device shall be suitable for operation at ambient temperature up to 60 deg C. The components in the main circuit shall have rated operation voltage of up to 690v.

The device shall offer comprehensive motor management functions .including protection, monitoring, control and diagnostics functions as detailed subsequently in this .specification

B. Construction

The motor management & control device shall be of the latest technology available. The device shall be compact and preferably modular in construction the device shall have integrated communication port for direct link to higher level, with open protocol bus system.

The protection system shall be independent/autonomous of the automation system. i.e. motor protection & control shall continue to be available for operation in the event of a communication or automation system failure.

Thedeviceshallhaveacontrolvoltageofeither24vdeorawideband controlvoltagefrom**110**to240vac/dc,asapplicable.

The basic unit shall have the following minimum status display

- Device readiness
- Status of control supply
- Feeder fault indication
- Status of communication with pIc

Thedeviceshallhavefacilitytotest/resetasstandard.Itshallbepossible to select between manual reset (at the device) or remote reset(through plc/scada from control room)

C. Functional requirements

Protection functions

Thedeviceshallincorporatethefollowingprotectionfunctionasstandard o Overloadprotectionwithtripadjustmentthe-deviceshallhaveanin-Built thermal motor protection(thermistor)

- It shall be possible to adjust the reset time after an overload
- Provision for connecting thermistor inputs
- Phase failure protection
- Unbalance protection with adjustable time delay
- Stall protection with adjustable time delay

Monitoring functions

The device shall incorporate the following monitoring function as standard

Over current monitoring with adjustable time delay Under current monitoring with adjustable time delay Earth fault monitoring with adjustable time delay

When threshold value of above settings exceed, it shall be possible to set the type of response(warning, tripping, signalling and disable)

- Motor operating hours monitoring
- Motor stop time monitoring
- No. Of starts monitoring

When threshold value of above protection setting exceeds, it shall be possible to set the type of response (warning, signalling and disable)

Additionally, the following monitoring functions shall be possible as an option and shall be provided for feeders wherever specifically asked for.

- Under voltage monitoring
- Power factor monitoring
- o Active power monitoring
- Phase sequence monitoring
- o Temperature monitoring via ptl00 /pt1000, ntc, kty83/84 inputs
  - Recording the curves of measured values like current, voltage, power
  - Monitoring of analog values using analog i/o modules

Control functions

In order to minimize the wiring & inter locks, the device shall have built-in software logics to achieve the various control functions

Standard function blocks

The intelligent motor control and protection device shall have standard control function control blocks.

Diagnostics, service & operating functions

The motor management system shall make available the following diagnostics, service and operating data on the bus system for further processing by the higher level control system.(e.g.plc/scada)

Operating data

The following shall be available at the plc as part of the cyclic end data Motor switching state (on, off, direction of

rotation, right, slow fast etc.)

Current(maximum of the 3phases)

The "cyclic send data" shall consist of a minimum of 16 bits for communicating status of various aspects of the feeder like current limit exceeded, motor operating hours exceeded etc.

Diagnostic & service data

The device shall be capable of signalling /warning in case of overload of 115%ofsetcurrent.
It shall be possible to set "warning" or "trip" as response for current limits exceed, unbalance incurrent, earth fault, operating hours exceeded. It shall be possible to read from the device the value of last trip current.

In case of a device fault or a trip, the device shall send the diagnostic data to the pIc for the user to analyse. The diagnostic information shall consist of status information on fault type, status information on limits exceeded, status information on warnings, device healthiness, bus fault, cooling down period (in case of overload fault), no. Of starts, motor operating hours.

Event log with a capacity to record last 20 events, shall be accessible whenever required.

Measured values:

The device shall by default transmit the current value (maximum of the 3 phases).

However, it shall be possible to access from the plc other related
.parameters like percentage of unbalance, power factor, current in the 3 phases, last trip current, time to trip (for a feeder undergoing overload), cooling down period (after an overload trip), active power, apparent power.

Optionally where power/voltage monitoring is specified the following additional data shall be available

- Voltage in the three phases (line-to-line) in volts
- Consumed energy in kwh
- Active power in watts
- Apparent power in VA
- Phase voltages in V
- Power factor
- Phase sequence

Configuring &communication

Standard software for configuring the device. It shall be possible to configure a device either individually or over a communication network. For this purpose, provision for connecting a laptop shall be available at the motor

management device.

The device shall have integrated communication facility to communicate directly on a bus system without any additional components.

The device shall be able to transmit cyclic as, well as acyclic data to higher-level automation. It shall be possible to define each bit in the cyclic and acyclic data sent to the plc. The data defined as cyclic shall be fetched by master plc in a sequential manner. i.e. one slave after other. The critical events like tripping of device or alarm shall be sent to master plc on priority basis(acyclic transfer) irrespective of the slave sequence.

In order to achieve minimum response time, the device shall be capable of transmitting data at a speed of 12mbps,suitable for operation with high-speed bus systems.

The following selection table shall be followed for earthing of electrical loads: all earthing shall be made with two runs.

- Control switches/glands-copper wire 14swg
- Motor/ isolators up to 40hp- copper wire up to cable tray & gi strip of required size in cable tray up to earth pit.
- Motor above 50hp up to125 hp-gi strip of 40x3mm.
- Switch board/motor control center-gi strip 50x6mm
- Earthing main in trenches-gi strip50x6mm
- Nos of earth pits shall be as per the system requirements.

21.5 HT POWER CABLES LOT 1

Specifications shall be generally as per the requirement of plant and as explained in Design Basis of our offer

21.6 LTPOWER &CONTROL CABLES LOT 1

1.0 LT POWER CABLES

Power cables for use on 415 V system shall be of 1100 volt grade, Aluminium conductor XLPE insulated from PCC to individual IMCCs.

Power cables from IMCCs to individual motor shall be multistrandflexibleinsulatedarmoured/shieldedcoppercable(LAPP/CONCAB)

The size of copper cable shall be as specified in cable selection chart.

2.0 LT CONTROL CABLES

Control cables foruseon415V system shall beof 1100volts grade, copper conductor, PVC insulated, PVC sheathed armoured and overall PVC seathed, strictly as per IS: 1554(Part I) - 1976.The minimum conductordiametershallbe1.5sq.mm.

21.7 INSTRUMENTATION CABLES LOT 1

Specifications shall be generally as per the 'requirement of plant and as explained in Design Basis of our offer.
Accessories of cable trays such as coupler side plates for joining cable trays,

21.8 RCPS, FREQUENCY DRIVE PANEL. LOT 1

Specifications shall be generally as per the requirement of plant and as explained in Design Basis of our offer. . .

EARTHING (POWER &INSTRUMENTS/AUTOMATION)LOT I

EARTHINGCOPPERIGI WITH EARTH PITS

Earthing for automation and instrumentation shall be of copper & independent of power earthing. Earthing of individual motors shall be provided with PVC insulated upto10sqmm flexible. copper wire up to 10HPmotors.Formotorratingabove10HP,GIearthstripofsuitable cross-section shall be provided.

GIplateearthingshallbefrom600X600XIOmmandcopperearthingshallbefrom600X600XIOmmplate.

CAPACITORPANELS WITH APFCR &CAPACITORS LOT

Specification sh all be generally as per the requirement of plant and as Explained in Design Basis of our offer.

21.11 **DGSETWITH AMFPANEL 1OOOKVA 1**

Specifications shall be generally as per the requirement of plant and as explained in Design Basis of our offer.

21.12 MISCELLANEOUS ITEMS

As per the requirement of plant and as explained in Design Basis of our offer.

21.13 GI & SSCABLE TRAYS

Functional requirement: Cable trays are used (based on the site condition) for laying the power and control cables inside the plant from PCC to the MCC & MCC to all motors/sub panels and wherever required.

Fabrication: These shall be perforated type ,heavy duty, return flange or inward bend shape ,manufactured frommildsteelconformingtoIS-226and hot dip galvanised as per IS-2629/BS-729. Width of cable tray shall be as per the requirement. Height minimum50mmandthickness of plate 1.5 mmupto300mm cable tray width. For cable trays having width more than300mm,height75mmandthicknessofplateto be2.0 mm. Cable trays shall be supplied to site in standard lengths of 2.5 M. Necessary bends, riser, inside riser, tee etc. must also be factory fabricated. Plain cable tray covers J.5 mm thick to be supplied if specially required.

The detailed specifications for various electrical items are provided in the special conditions of contract- Electrical installation.

1.0 CABLE GLANDS

These shall be provided at both ends of armoured/ unarmored electrical cables. Cable glands shall be manufactured as per performance requirements of BS6121, amended as on date, with brass material accurately machined and nickel-plated. These shall be of heavy duty single compression type for cable conductor sizes above 35 Sq.mm and weather proof double compression type for cable conductor sizes upto35 Sq.mm. Single compression cable glands will be complete with check nut, gland body, 3 nos. metal washers, outer seal rubber ring and compression nut. Double compression glands shall be complete with check nut, gland body, neoprene outer ring, armour clamping cone, armour clamping ring, armour clamping nut, skid washer &outer seal nut.

2.0 **CABLE CONNECTORS**

Cable connectors, lugs/ sockets, shall be copper/ Aluminium alloy, suitably tinned, solder less crimping type.

3.0' **CABLE ROUTE MARKERS**

These shall be galvanized Cast Iron plate with marking (LTIHT) diameter 150 mm with 600 mm long 25x25 mm HS angle riveted/bolted with this plate.

4.0 **CABLE INDICATORS**

These shall be self-sticking type and of2mm thick lead strap for overall cable. PVC identification numbers, ferrule shall beused foreach wire.

21.**14** **ISOLATORS (WITH EMERGENCY PUSH BUTTONS) LOT 1**

MOTOR ISOLATORS/EMERGENCY PBS (SS-304)

These isolators shall be installed inside the main plant oroutside asperthe site conditions forisolating thepower tothe motor. This shall be of metal clad plug &socket (IP 65protection) type ofisolator

1.1 General requirement:

The plug &socket/isolator boxshallbeofSS-304plate,dust,verminand weather proof suitable for wall/structural. mounting. All external hardware used must also be of stainless steel. All the mating surface shall be provided with round rubber gasket (min 6mm) in the groove so as to make it effectively dust and vermin proof.

1.1.2 The enclosure box shall beofIP65class and the minimum size must be210 x 125 x 75 mm. Each plug &socket/isolator must be provided with emergency push button. One no. hole of required dia. At the bottom for the cable entry must be provided. Connection to motor shall be through flexible copper cable. 30 amps 6way terminal block shall be provided inside the isolators. All wires /cables must be terminated using suitable crimping type tinned copper lugs. Two nos. brass screws with washers must be provided on either side of box for earthing.

-RUBBER MATS,SSCONDUITS

The suitable size rubber mat shall be in the scope of supply as per the requirement.

21.16 **CONDUITS**

For laying of cables under floor, 01class 'B' pipes shall be used. For laying cable in air where cable trays are not being used, GI'B' class pipe shall be
used. Size of pipe shall depend upon the overall outer diameter of cable shall be drawn through pipe. No pipe less than 40mm dia shall be used for this purpose. In Dairy's process area, all cable
(power/control/instrument/signal) drops shall beofSS-304 conduit/pipe, 1.6
mm thick shall be used. The open ends of power/control cables at termination shall be protected through SS conduit. Instrument/signal cable/wire drops up to termination point shall be through SS conduits. The automation cables (plant/system/field bus, instrument/signal cables/wires shall be laid in cable trays through 01conduit.

MISCELLANEOUSEQUIPMENT

22 LABORATORY EQUIPMENT

The laboratory shall be equipped with full set of instruments, equipment, utensils, glass ware, computer and furniture required to carry out tests required below. Instruments shall incorporate latest technology andbeofthe electronic type wherever relevant.

The following laboratory equipment have been considered in the scope of supply:

22.1 OERBERTESTEQUIPMENT

22.2 MBR TESTKIT

22.3 SEDIMENTANALYSER

22.4 PHOSPATASE TEST KIT

22.5 Raw MILK DENSITY METER

22.6 ACIDIMETER

22.7 SAMPLINGKIT

22.8 PLATECOUNTTESTKIT

22.9 SWABTESTKIT

22.10 ADVANCE RANGE ELECTRONIC pH METER

22.11 CHLORINESANITISERSTRENGTHANALYSER

22.22 MAJONNIERFATTESTER

22.13 WATEREXAMINATIONTESTKIT

22.14 INFRAREDMILKANALYSER

22.15 ELECTRICAUTOCLAVE

22.16 POLARIMETER

22.17 MICROSCOPE

22.18 MAGNETIC STIRRER

22.19 CAUSTICITY/ACIDITYTESTEQUIPMENT

22.20 COLIFORMBACTERIATESTEQUIPMENT

22.21 COLONYCOUNTER

22.22 HIGHPRECISIONWEIGHINGBALANCE

22.23 HEAVYDUTYHOTAIROVEN

22.24 INCUBATOR

22.25 DISTILLEDWATERUNIT

22.26 ANTIBIOTICSTESTKIT

22.27 ANAEROBICCOUNTANALYSISEQUIPMENT

22.28 MICROWAVE OVEN

22.29 LABORATORYEQUIPMENT

Laboratory test and analysis result shall be transmitted to automation system for data logging ,analysis and reports wherever such facilities are available with the instruments. Computer and printer shall be installed in reception and main laboratories for this purpose but the result from instruments having interface ports shall be direct to the automation system if it is specified in the scope of supply.

23 FIREFIGHTINGSYSTEM

Smoke detection &alarm system in .main control rooms and fire extinguishers inthe plant as per statutory requirement is included in the scope.

24 WEIGHING EQUIPMENT

The suitable weighing scale shall be provided at pouch packing machine

1. 1-5Kg 5No.
2. 50Kg. 2 No
2. 200Kg 2NO.

25 WEIGHING EQUIPMENT
Elec. Weighbridge 60MT

Capacity : 60 MT
Type : Load cell Pit (pit less)

Accessories: Computer, Interfacing facility with main computer. Functional Requirements: It would be used to weigh the milk tankers.

The weigh bridge system shall be complete with the following items:

Welded steel platform with reinforced structure in MS execution.
b) Load cells
c) Standard dusk mounted micro processed based jumbo display unit with interconnecting special cable.
Specialized software shall be provided for interfacing and to meet the operational requirement.

26 SPAREPARTS

The spares for two years normal operation as per manufacturer's recommendation are included. It may be noted that the spares shall be available for consumption as soon as the plant is commissioned and the commercial production is commenced. This includes the operation during warranty period of one year as well.

MISCELLANEOUS ITEMS

Steam &Water Mixing batteries

Steam water mixing battery with temperature control arrangement consisting of regulator ,temp .gauge, hose & nozzle/gunwith15Mhose.LP steam shall be used from the nearest header .Details shall be finalized during detail engineering.

LIST OF PREFERRED MAKES OF BOUGHT OUT ITEMS

We have considered makes of major bought out items as given in the table below, and shall follow the same.

DESCRIPTION	MAKES
MILK & CREAM RECEPTION, PROCESSING, CURDMANUFACTURING SS Milk & CIP	
Supply & Hot water Pump	*Reputed make*
CIP Return pump	*Reputed make*
PHEs	*Reputed make*
Milk /CIP Hoses	MTGIEQUIVALENT
Tri-purpose Centrifuge(Self Cleaning)with auto standardization unit	Andritz Frautech/Westfalia/tetrapak
Homogenizers	GEANIROSOAVIIFBF/Tetrapak
Milk Silo Agitator(Side Mounted)	*Reputed make*
Turbo Blender	*Reputed make*
CIP spray balls	*Reputed make*
CIP spray turbines	*Reputed make*
Milk pouch packing machine	SAMARPAN/NICHROMEIRMC

Curd packing machine	PWS /RMC/Tool master
Pouch filling system including conveyors	SWASTIKIEQUIVALENT
Insulation(Hot & Cold)	BEARDSHELL/LLOYD/EQUIVALENT
Ghee Tin Filling Machine	PRECIAMOLEN(NOVA*WEIGH)I* EQUIVALENT
Ghee Pouch Filling Machine	RCM/ Equivalent
BUTTERTROLLEYWITH	*Reputed make*
TUBULAR HEATERFOR	*Reputed make*
BUTTER MELTING AND GHEE COOLING	
BUTTERPUMP	NETZCH/FQUIVALENT
CBMM	*Reputed make*

INSTRUMENTATION, CONTROLS &AUTOMATION

Automation system	ROCKWELL /Siemans
VFD	SIEMENS /ROCKWELL! DANFOSS .
Level Transmitter &indicator	E&H/Equivalent
Temperature /Pressure Transmitter.	E & H/Equivalent
Conductivity &pH Transmitter	E&H/ Equivalent
Density transmitter	E&H/EMERSON /YOKOGAWA/SIEMENS RTD
RADIX/Equivalent	
EMERSON /YOKOGAWA/ FOXBORO /TATAHONEYWELL /FORBES MARSHAL /REDIX	
DANFOSS /IFM/HONEYWELL JOHNSON	
Level Switch (float type &vibrating fork type)	E&H/ Equivalent
Vortex /Magnetic Flow meter	E&H/Equivalent
Mass Flow meter	E&H/Equivalent
Control Valve	SAMSON /ARCA
Pressure switch /Temp. switch/	DANFOSS /ALCO /HANSEN /PARKER /
AMERICAN SPECIALITIES, USA/ SWITZER / INDFOSS/	
Temp .recorders	E&H /ABB/HONEYWELLNOKOGAWA
Pressure &Temperature Gauge	FIEBIG /PRICO /GIC/WIKAI WAREE
Dual type Pressure /temp gauges	FIEBIG /PRICOL /GIC/WIKAIWAREE
Load Manager /Power /Energy	ROCKWELL /SIEMENS /ABB/L&T/ Monitor
CONZERV/SCHNEIDER	
COMPAQ/HEWLETT -PACKARD/IBM LENEVO/ ACER/DELL	
Network Switch	CISCO

ELECTRICALS

Electric Motors	SIEMENS /ABB
Air Circuit Breaker	L&T/ SIEMENS
MCCB	L&T/ SIEMENS

Contactors	L&T/ SIEMENS
Starter Overload Relays	L&T/ SIEMENS
Intelligent Motor Protection Relays	SIEMENS/ROCKWELL
Timers Electronic	L&T/ SIEMENS
Switch Fuse Units	L&T/ SIEMENS
MCBs	L&T/ SIEMENS/HAGER·
Push Buttons	TEKNIC/L&T/ SIEMENS
Indicating Lamps(LED)	TEKNIC/L&T/ SIEMENS
Digital Ammeter &Voltmeter	CONZERV/MECO/ HPLSOCOMEC/RISHABH
Analog Ammeter & Voltmeter	RISHABH/IMP/ MECO/AE
Digital Energy Meter	CONZERV/L&T /HPLSOCOMEC/SIEMENS
PVC Conduit& accessories	PRECISION/CLIPSAL /P-PLAST/POLYCAB
Power Factor Meter	RISHABH/IMP/MECO/AE/CONZERV
Programmable Protection Relay	MINILECICONZERV
Current Transformer	KAPPA/MECO/AE/IMP /INDCOIL/BHARTI
LT aluminium power cable	CCLGLOASTERITORRENTIUNIVERSALIHAVELL S
LT COPPER Power Cables	LAPP/CONCAB/ESBEE
LT Copper Control Cables	LAPP/COCAB/POLYCAB/ESBEE
Signal & Instrument cable	LAPP/CONCAB/POL YCAB/ESBEE
APFC/ Harmonic filters	APCOS/ MEHER
APFCRelay	BELUKE/EPCOS /L&T /PHASITRON
Cable tray	INDIANA/MEK/PILCO/ELCON/METALICA PRESSINGS/POWERCONTROLS/SILVERLINE
Isolating Switches	SIEMENS/L&T
L&T /SIEMENS/EE/C&S/BUSW,ANN/GE POWER	
Plug & Socket	LEGRAND/CLIPSALISCHNEIDER/BCH/ HENSEL
Terminal Blocks	WAGO/ CONNECTWELL/ELMEX
Rotary Selector Switch	KAYCEE/SALZER/L&T/SIEMENS
Cable Glands	COMMET/EX-PROTECTA/DOWELS/BRACKO Cable Lugs DOWELS/COMMET
Mechanical Interlock	L&T /SCHNEIDER/ABB
DANFOSS /SIEMENS /ROCKWELL (ALLEN BRADLEY)	
Servo Voltage Stabilizer	SUVIK/APLAB /NEEL /CRYCARD /DB ELECTRONICS
UPS	APC/DB Electronic/Tata Libert /Emerson /Hl-REL AMCO/YUASA/EXIDE/PANASONIC

VALVES &PIPES (MS&GI)

Water Valves (Butterfly /Ball)

Water Valves (Diaphragm)
AUDCO-L&T/SAUNDERS/ITERVALVE/BDK

SAUNDERS/BDK

Non-return Valve for water AUDCO-L&T/INTERVALVE/BDK

Water Foot Valve

GI Pipes for water

KIRLOSKAR/GG/LEADER TATA/JINDAL

MS Pipes for air,steam,condensate TATA/JINDAL/KALYANI/MST

NRV for Air/Oil Line INTERVALVE/AUDCO-L&T/LEADER

Solenoid Valve for Water line DANFOSS/AVCON/ROTEX/BURKERT/FESTO

Hot Water pipe/Globe Valves AUDCO-L&T /SPIRAX/ARMSTRONG,USA / .
BDK!
RmLiSAIL/TISCO

SS Tubes/pipes APEX/ BHANDARI FOIL S & TUBES/HEAVY METALS/NlKA TUBES/RATNAMANI

Process valve (Manual) Reputed make

.Process valve (Pneumatic) Reputed make

NRVS-in product& CIP lines Reputed make

BOILER EQUIPMENT

Coal fired steam boiler Thermax/Equivalent

Chiminy and other accessories Reputed /Make

WATER TREATMENT PLANTEQUIPMENT

MGF, Activated carbon filter, IONEXCHANGE/DOSHION/THERMAX

Softening plant ,RO plant

Multi pump type hydrow flow system GRUNDFOSS/KSB Water pumps GRUNDFOSS/KSB

AIR COMPRESSORS &AIR LINE FITTINGS

Air compressor INGERSOLLRAND/Equivalent

Air dryer-refrigerated INGERSOLLRAND/Equivalent

. Auto drain valve JORC/PURIFLAIR

Air lines accessories SHAVONORGEN/FESTO/ LEGRIS/NUCON

Auto Drain Valve ULTRAFILTER/ZANDERIHYDINT

Pneumatic fittings FESTOIJANATICS/SMC

REFRIGERATION PLANT

Screw compressor GEA Grasso/Equivalent

Refrigerant liquid pumps Hydrodyne/Equivalent

Auto air purger Hansen /Parker/Equivalent

Evaporative condenser BAC/EVAPCO/ Equivalent

.Chilled water pumps Grundfos /KSB/ Eqvt

Refrigerant valves and controls Danfoss/Superfreeze/Equivalent

Lubrication oil	KluberSummit/equivalent
Forced draft coolers	Star coolers & condensers/Equivalent
Sliding type doors for cold rooms,	Metaflex/Gandhi Automation! Equivalent
Air curtain for cold room doors	Russel /Equivalent
Ice Silos	Reputed make

MISCELLANEOUS ITEMS

Fabricated items	Reputed make
Hoist	CONSOLIDATEDHOIST/*INDEFI* MORRIES
Control room/LAB furniture	GOVARDHANDAS/PYROTECH/Mark
Cooling tower	PAHARPURIMIHIR
INK JET Printer	DOMINO/IMAGE
TTO Printer	MARKEMIDOMINO
Geared Motor / Gear Box	PBL/POWERMASTER/ELECON/ICBAUER! BONFIGLIOLIIEURODRIVES
Hot Water-Water Mixing Battery	SPlRAX/EQUIVALENT
Structural Steel.	SAIL/TISCO
Condensate Pump	SPIRAXMARSHALL/ARMSTRONG
DG set Engine	CUMMlNS/CATERPILLARIPERKINS
*IMITSUBISHI/W*ARTSHILA	
DG Set Alternator	STAMFORD /LEROYSOMER
Air Circuit Breaker	L&T-OMEGAU-*Power*/SIEMENS3WT
MCCB	L&TD'*SINE/MDS-LEGRAND/* SIEMEN S3VL
HT VCB Panel	*SIEMENS/*ABB/AREVAT*&DI*ALSTOM
Distribution Transformer (Oil Filled) Type)	SIEMENS/BHARATBIJLEE/AREVAT*&DI* VOLTAMP / KlRLOSKAR
HT XLPE Power Cables	GLOSTER / CCI/RPGASIAN/FINOLEX/NICCO
LT XLPE Power Cables	GLOSTER!*CCII* RPGASIAN/FINOLEXNICCO
LT Copper Control Cables	LAPPKABEL/CONCAB/CCI/RPGASIAN/ FINOLEX/RRKABELS(UNILAY)/GLOSTER/ POLYCAB
Signal & Instrument cable	CONCAB/*POLYCAB/* FINOLEXDIGILINK
Power Capacitors	*SIEMENS/*EPCOS/MEHER/KHATAUJANKAR/
APFC Relay	SIEMENS/EPCOS/*L&T/*ABB/SCHNEIDER
Cable Tray	INDIANA/MEK/SUNRISE/SUPER/PILCO
Isolating Switches	SIEMENS/L&T/SCHNEIDER
HRC fuses	L&T/SIEMENS/EE/ GE
Terminal Blocks	WAGO/LAPPINDIA/CONNECTWELL/ELMEX
Potential Transformers	KAPPA/JYOTI / IMP/AE/ASHMORE
Mechanical Interlock	L&T /SCHNEIDER/ABB
XLPE cable jointing / terminating kit	RAYCHEM*1M-SEAL*

Programmable Protection Relay MINILEC
LT Sandwich Bus duct L&T/*GEI* C&S/SIEMENS/SCHNIEDER
Steel Structure SAIL/ ESSAR/ TlSCO/ JINDAL

Spray Drying Plant SPX-Anhydro *REPUTE MAKEI* Equivalent
Evaporator Plant SPX-Anhydro *REPUTE MAKEI I* Equivalent While execution, choice of make shall be made from the preferred list.

3.0 CIP SYSTEM

A centralized CIP station is a part of this tender. The bidder will provide two supply and return headers duly terminated in the end where the bidder shall connect the CIP supply pump, Plate heat exchanger and CIP return connection to the return headers provided by the bidder. There shall be a communication link between PLC and the CIP PLC provided by the bidder for exchange of signals and operation. The bidder will arrange to incorporate CIP recipe suggested in the CIP PLC for smooth operation. The CIP operation shall be carried out by the control room of Milk Powder plant.

3.1 CIP Forward Pump

Capacity: Suitable
A mono block sanitary design CIP pump with product contact parts in SS 316isincluded to transfer CIP solutions to various circuits. The pump shall be complete with drive motor and SS shroud.

Plate Heat Exchanger (Double section) Capacity: Suitable
MOC: plates ofSS316 and frame in MS with SS cladding.

One double section plate heat exchanger complete with. glue free gasket platesarrangedonanSSc1addedframe.

Each section shall have a suitable capacity with temperature duty of 20deg. C. with steam as heating medium. The PHE shall be complete with accessories.

3.3 CIP Return Pump

Capacity-Suitable

Self priming special designed CIP pumps with product contact parts SS 316 shall be provided .This pump is for the CIP of milk preparation section.

The other ClP 'return pumps are included with the individual sections

3.4 Cleaning Turbine

We have considered cleaning turbine for the cleaning of spray drying chamber as per the design of our principals.

The cleaning nozzles for the evaporator are included under various item heads of the evaporator.

Type: rotary type with hose and manual winch-retractable type

CIP Nozzles for cyclone, Vibro and ducting (Retractable Type)MOC: 304

Various configuration nozzles as per the approved design of our principals shall be provided in position at strategic locations for proper cleaning of spray drying plant and its components.

3.6 **Safety Shower/Face Wash**

It shall be a safety device. It shall be pedal operated shower with proper water flow arrangement for use by operators in case of exigency.

3.7 **Pig Tanks for Cyclone and Vibro**

Moc : AISI304,

1. no .Balance tank of 600Lcapacity along with one no. Milk transfer pump of suitable capacity is proposed and included.

During wet cleaning of spray drying plant and first flushing of the evaporator, the solids generated are proposed to be collected and taken to the concentrate recovery tank after chilling.

After checking the quality, it shall be transferred to process section for re processing.

It shall also be used for collection of CIP solution and returning to CIP tanks/drain depending upon the contaminati on level.

4.0 **INSTRUMENT AIR**

Compressed air generation for instrumentation and controls

The capacity of the plant shall be for meeting the requirement of LMP, PP and CIP. The LMP contractor shall tap the connection from the discharge header. We have considered a compressed air module of capacity 200CFM.

It shall be packaged type, non-lubricating air compressor of reciprocating type to generate dry, clean and oil free compressed air at required pressure in requisite quantity. The air compressor system shall bed esigned to meet the peak demand. The system shall be provided with 100% stand by capacity of the compressor (One working and one stand by).The system also shall be supplied with necessary controls and instruments, air drier, filter, air receiver and with all other accessories. Compressed air for the entire pneumatic and instrumentation operation of evaporation , drying ,conveying and packing shall be generated and distributed by the bidder.

4.1 **Non-Lubricating type air compressor complete with accessories**

Capacity:200CFM (to be designed by the bidder)

Type: Air cooled - closed type, reciprocating type Air Compressor, Lubricated type.

Controls: Microprocessor based localized controls.

Purity of Air: The purity of air after filters set and refrigerated air dryer shall be 0.01mg/m3@21DegC.

Drive: suitable capacity Sq. Cage Induction motor ,TEFC type suitable for operation on415V+or-6%,3phase,50Hz+or- 3%,ACsupply,F classinsulationconformingtoIS6875andIP55degofoperation.

Accessories :Automatic star delta starter panel, air regulation system, compressor motor, Pre-Filter; to remove moisture upto1micron, Fine - Filter to remove moisture upto 0.0! micron and Carbon Filter to remove oil upto0.003 micron, etc, shall be supplied.

4.2 **Air receiver with accessories**

Capacity :Suitable
Material :Mild Steel

Type :Vertical Cylinder
Mounting:Self-Supporting

Ports ,Fittings & accessories: Standard such as inlet &out let nozzles, Auto drain valves, Pressure transmitter ,etc.

4.3 **Air dryer**

Capacity :Suitable
Ambienttempwith100%relativehumidity..

Material: Mild Steel
Type: Refrigerated
Pressure Dew Point: 2to4DegC
Pressure Drop: : 0.2Bar.

Ports, Fittings & accessories: The system shall be complete with necessary filter sand auto drain valve,moisture separator,etc.

5.0 **INSTRUMENTATION ANDAUTOMATION**

5.1 **AUTOMATION**

5.1.1 **DCSHardware**

This shall be comprise of controller cabinet with main CPU ,DCS system shall be provided in standard sheet steel cabinets of reputed make equipped with following necessary modules:

Processor Module
Power Supply Module
Ether Net Module
Input /Output Module mounting racks
Analog input Modules
Analog Output Modules
Digital Input Modules
Digital Output Modules
Communication Cables

5.1.2 Operator Stations, MIS Server along with Software and Network Hardware

Each operating station shall be minimum Pentium IV with HT (Hyper Threading) Technology with latest available configuration with FDD, DVD writer/ Drive, Serial, Parallel, USB ports along with minimum 80GB hard disk with 21" inch monitor.
Operating Station at Central Control R60m (CCR)

MIS at CCR
INo.
Desk Jet Printer (A4) for report generation - 1No.
Dot Matrix Printer foralarm/ event printing 1No.
Dot Matrix Printer for Despatch Section 1No.

The PC/ DCS system shall be supplied with necessary system software and MIS server/ Software. The MIS software shall be based on RDBMS like with suitable front end.

The system shall also include the following:

Networking Hardware like switches, hubs, RJ45connectors, cables etc. MMI &Development Software for above

Automation system shall record and report all production parameter as detailed below:

Milk intake to powder plant and Evaporation Data log
Dryer Data Log
CIP Data Log

(Automatic sampling of Evaporator, Dryer and CIP operating parameters every halfhourly basis foramonth andthen transferred to CD)

UTILITY Data Like

Steam Consumption (Total) Power Consumption (Total)
Soft Water Consumption (Total)
Chilled Water Consumption in terms of TR(Ton of Refrigeration) Compressed Air Consumption Lab reports for products, packing material and other utilities if implemented.

The following transducers for utilities to be provided for Automation Management System reports:

All the above signals shall be integrated in the automation system to yield the q-uantityconsumption figures.

Apart form above the system will generate &provide

Inventory status of Entire Plant (Manually Fed)
30daysData Storage &backup through DAT drive
Preventive maintenance program for all equipment with on screen alarm facility

System details given above is minimum requirement, however, bidder shall offer higher end module based ontheautomation and DCS requirement and the same shall be detailed in the offer.

5.2 INSTRUMENTATION

5.2.1 Field Instruments

The field instrumentation considered for this plant shall be generally of electronic type and suitable for .interface with DCS. It shall consist of various types of flow, temperature and level, Conductivity, Density, Pressure Instruments as per the plant requirement.(AII instruments are communication type with field bus technology Smart type with connectivity
To DCS on communication network).

Mass Flow Meters shall be based on the Coriolis Principle and accuracy for all Electronic Transmitters shall be as under:

Electronic Transmitters	+/-0.15% of FSD
Conductivity Analyser	+/-0.25% of FSD
Magnetic flow transmitter	+/-0.5% of Flow rateor better
Mass Flow meter	0.2% of Flow rate or Better

The Temperature elements (RTD) shall be supplied with Head Mounted Transmitters shall be duplex type, MgO filled, SS 316 sheath with minimum Class A accuracy as per IEC 751.
Dial Size fo rall pressure and temperature gauges will be 150mm and any lower size selection specific to the application will be subject to the Customer approval.

Die Cast aluminium or Steel casting will be used as case material in general.

5.2.2 Control valves (With Electro Pneumatic Positioner)

The Control Valves for various process requirements shall be with Electro pneumatic Positioner. The leakage class for control valve shall be minimum Class IV.

All control valves will have sufficient overload range. At maximum operation,thecontrolvalveswillbeat75-80%open.Valvebodieswillbe no more than two line sizes smaller than the pipe in which they are installed.

5.2.3 Control Cables

Control cables shallbe suitable for1100volts,1.5mm2,copper conductor, PVC insulated, PVC sheathed ,as per IS: 1554(part- 1)-1976.Shielding shall be provided for signal cables.
Control Voltage shall be 230VAC.

5.2.4 Cable Trays

These shall be perforated type, heavy duty, inward bend shape, manufactured from mild steel conforming to IS-226and hot dip galvanized as per IS-2629/BS-729.width of cable tray shall be as per the requirement. Height to be minimum 50 mm and thickness of plate shall be1.5mm up to 300 mm cable tray width .For cable trays having width more than 300 mm, height to be 75 mm and thick ness of plate shall be 2mm .Cable trays shall be of standard length of 2.5M. Necessary accessories of cable trays such as coupler side plates for joining cable trays ,bends ,rise ,inside riser, tee etc. Shall also be supplied.

5.2.5 UPS System

A UPS of suitable capacity (Min10KVA with back up time of 30 minutes) shall be also be considered by bidder along with necessary By-pass and distribution panel for providing supply to PC's, PLC and critical instruments.

6.0 ELECTRICAL DISTRIBUTION SYSTEM

6.1 Motor Control Center

6.1.1 MCC-I for Drying Section

Qty.-1lot.

The motor control centre covering the feeders for all the equipment included in scope of supply is included. The material of construction, selection of switch gears and the arrangement, ,generallay out, component sizing and wiring shall be in conformity to standard Specifications

MCC panel shall be designed in intelligent type design with all MCC feeders shall be directly communicate and operate through communication network.(necessary wodroubhy type construction for design of MCC panel

6.1.2 MCC-II for Evaporation Plant

The motor control centre covering the feeders for all the equipment included in scope of supply is included. The material of construction, selection of switch gears and their arrangement, general layout, component sizing and wiring shall be in conformity to standard Specifications

6.2 Electrical

Power Cables (LT),Control Cables, Cable Trays, Cable Glands, Cable Connectors, Cable Route Markers, Cable Indicators, Conduits, Motor Isolators ,Remote Push Button Stations(For Evaporation Plant & CIP), UPS, Rubber Mats, Fire Extinguishers, Frequency Drives &Other Panel shall be generally as per specifications in the tender.

SS perforated cable trays shall be provided within the evaporation plant area and drop pipes in the plant area shall be SS. All these will be as per standard design.

The cable trays ,conduits etc. coming out side the evaporation plant process area shall be standard non SS material. All concealed conduits etc. within the process plant shall also be of non SS material.

7.0 PIPING ANDMISCELLANEOUS

7.1 PIPING

7.1.1 SS Pipes, Valves & Fittings

SMS standards. The pipes shall be outside mirror polished and inside acid pickled .Standard SS clamps shall be used for SS pipe supports.

Pneumatic valves single seat type are considered for the product piping. Pneumatically operated ball valves shall be provided for CIP lines.

The SS pipes, valves and fittings shall be generally in meeting with the tender specifications. The design of pneumatic valves shall be in meeting with manufacturers specifications of approved make.

7.1.2 Steam pipes and fittings

IBR Piping

Seamless, MS heavy duty, scheduled 40pipes 'with insulation and cladding.
All fittings will be of CI steel body with SS working parts.

Non-IBR Piping

Generally as per standard specifications. ERW,. MS 'C' class pipes and fittings for high/low pressure application shall be provided. The steam pipe lines shall be insulated and cladded with aluminium sheet.

Steam shall be drawn from battery limit point to be provided by the bidder.

Necessary pressure reducing stations to generate requisite pressure steam for use in the evaporation and spray drying plant shall be provided.

7.1.3 Piping for chilled Water, Raw Water, Soft Water, Cooling Water

Generally as per standard specifications.

GI 'B' class pipes and fittings conforming to specifications shall be provided. T
he supply shall be within specified battery limits and exclusions.

Valves: CI Butterfly / ball valves

7.1.4 Condensate Piping

One lot of condensate pipes and fittings in MS' C' class painted execution shall be provided.

The piping and its execution shall be done as per prevailing IBR regulation & specifications within specified battery limits and exclusions.

MS 'C' class pipes and fittings to inter connect vacuum pumps with condenser and condensate pipes and fittings from the outlet of the condensate pumps to condensate recovery tank. The condensate piping to boiler house shall be insulated with asbestos rope and cladded with aluminium sheet.

GI'B' class pipes and fittings to interconnect the condenser outlet, the cooling tower supply and return pumps.

7.1.5 Compressed Air Piping

Qty. -1lot.

Type : MS 'C' class welded type piping butter fly valves with diaphragm/
Supporting tender : In mild steel painted execution generally as per

Accessories: Pipe sleeves, support clamps,· arrangement of flow measure

The compressed air piping shall be generally as per tender specifications.

8.0 MISCELLANEOUS EQUIPMENT

8.1 MISCELANEOUS

8.1.1 Steam and water mixing batteries

Shall be provided at various level in the plant room for floor and general cleaning. The steam and water mixing batteries shall be complete with chromium plated mixing chamber, steam and water side valves, mounting bracket and 10mtr.of good quality rubber hosepipe is included in the scope of supply for each battery.

8.1.2 SS Shrouds for motors in wet areas

SS shrouds have been considered with individual pumps for locations, which are falling under evaporation plant ,concentrate-feeding area of the dryer and CIP system.

8.1.3 Steam Pressure Reducing Station

Standard pressure reducing station complete with PRY, strainer, moisture separators, safety valve, bypass valve, pressure gauge and stop valves etc. As required inconformity to IBR regulations has been considered. One centralized PRS station has been considered for reduction of pressure from 17 bar gauge to the requirement in the powder plant.

8.1.4 **Decorative type fan coil unit**

Quantity:4No. (2No.in control room & 2 No. In IMCC room)

Capacity: Suitable

The unit shall be of decorative split type AC unit suitable for ceiling / wall mounted in the control room.

The unit shall be heavy duty industrial type with copper tubes , Aluminum fins, power coated galvanized sheet steel casing, centrifugal fanes),direct driven air inlet filter (removable) type (for cleaning purpose)drain tray with outlet pipe etc,

The flow of chilled water through the coil shall be controlled in response to a room temperature. Temperature sensor shall be provided at approved locations. Solenoid valve and a thermostat in the return air steam shall be provided

8.1.**5** **Jet cleaning equipment**

Quantity: 1No.

This shall be of a mobile high-pressure jet cleaning equipment used for cleaning of tubes (approx16-18metre long) of calandrias,

9.0 **Supporting Structure**

The structural material shall be hot dip galvanized and the joints shall be painted after fabrication at site. The supporting structure has been included under individual plant areas as apart of specifications and bill of material.

The complete powder plant is considered on RCC building. Main approach staircase for both evaporator and dryer section shall be in RCC as part of civil building. Only evaporator section main levels have been considered in steel structures. Other maintenance platforms and ladder for access, maintenance in MS structural material shall be provided by the bidder.
The structural material shall be hot dip galvanized. After site fabrication the joints shall be painted with primer.
The structure also includes platforms, ladders, and railings -upto1mhtwherever required.

Civil works required for earth pits shall be in bidder's scope. Bidder shall do powder store and internal lighting.

10.0 **Spares for two years operation**

Spares for two year normal operation shall be provided.

11.0 **ICE CREAM PLANT**

11.1 **Mix Preparation Tanks**

Capacity:2KL
Type:Vertical, Jacketed, Insulated
Tyes :Inner/Jacket/Outer
MOC SS304/SS 304/SS304
Functional Requirement: The mix preparation tank shall be used to prepare .ice cream mix and also be used for pasteurization 'of ice cream mix in same tank. .

The volume of the tank shall be such that after filling it upto the rated capacity ,the level of mix shall be at least100 mm from top.

Constructional features: Triple walled ,insulated and welded construction of sanitary design. 1:15 slope towards the outlet at the bottom of the tank.

Metal contact: The only metal-to-metal contact between the inner and the outer shell shall be at the places where fittings for the tank are provided. At the places where mild steel stiffeners are provided insulated padding shall be fixed between the, inner stainless steel shell and stiffeners.

The tank shall be with agitator , and standard accessories

11.2 **Turbo Blender**

Capacity - 1TPH

This shall be used for inline mixing of sugar, SMP, stabilizer and emulsifier etc.

The motor is driven by a V belt drive between mixer shaft and motor . The motor and mixer unit are mounted on foundation with 4 adjustable legs.One powder hopper with manual butterfly valve will be included in the scope of supply.

11.3 **Mix Recirculation cum Transfer Pump**

Capacity : 5KLPH
Type : Centrifugal
Head : suitable

Function:Thepumpshallbeusedforrecirculationandtransferoficecream mix through turbo blender for preparation of ice cream mix.

Design: The pump shall be sanitary design, and centrifugal mono block construction

11.4 **Ice Cream Mix Heater**

Type : Plate heater Exchanger
Capacity: 5000 LPH
MOC of Plates: SS 316
Temp. Program: 30-80 Deg C
Mix consistency:40-45 % TS

Basis of operation:

The heater shall be of single section type plate heat exchanger for heating ice cream mix.

11.5 **Ice Cream Mix Pasteurization Module**

Suitable for Ice Cream Mix ,Kulfi Mix and Candy Syrup
Type: Wide Gap Free Flow type PHE

Capacity: 1 KLPH for Ice Cream Mix and Candy Syrup, 5KLPH for Kulfi Mix

ProductTS% :Upto45%
Sections : 5 Sections (Reg II : Reg I : Heating : Cooling I (Cooling Tower Water):Cooling**II** (Chilled Water)

Temp.Prog : 45-70-86-6 for Ice cream Mix
30-80-6' for 25% Sugar Syrup
85-6 for Kulfi Mix

(For Kulfi Mix, only Cooling I and Cooling **II** sections shall be functional)
Mix pasteurization temp. :86Deg.C
Holding time for pastn. :20 Sec /40 Sec
(Switch over with Flow Plate)

Product Outlet temp :6 Deg. Centi.

Chilled water flow rate: 1.5 times for Candy Syrup,3times for Ice Cream Mix and Kulfi Mix
Chilled water feed temp :1.5Deg.C
Finish: All welding joints shall be ground smoothly. All stainless steel surfaces are to be polished to150 grits.

Technical specifications and scope of supply

Plate Heat Exchanger -Ice cream Mix Pasteurizer with SS 316 plates. Plates: The plates shall be made from stain less steel (SS 316)in sanitary design. All the product contact and exterior surfaces shall be easily accessible or readily removable for cleaning and inspection.

Gaskets: The sealing gaskets must ensure complete sealing and prevent any cross-leakage between product and

service liquids .Gaskets shall be of sanitary type and shall be continuously bonded to the heat transfer surface. The gasket material shall be, food grade, non-toxic, fat resistant, non-absorbent and shall have smooth surface. The material shall withstanda water sterilization temp. of 90Deg. C .and 2% caustic solution and 1% acid solution at 80 Degree Centigrade. It shall be SNAP IN or LOCKIN type .The MOC of gasket shall be NBR.

Supporting Frame: The supporting frame for the plate pack shall be of a self supporting design made of stainless steel (AISI304) clad mild steel with a manually operated stainless steel (AISI304) tightening device. The tightening device shall be able to exert uniform pressure on all the parts of heat transfer plates to prevent any leakages from Pasteurizer.

Accessories

Inlets/Outlet: The inlets and outlets in each section of the heat exchanger for products as well as services shall be provided with complete stainless stee (AISI 304)unions.

Thermo-wells: SS(AISI304) pockets for thermometer on required ports for Product and service inlet and outlet connections. Thermo-well locations as per P&1.

Ball Feet: The frame shall be provided with adjustable SS ball feet with provision for height adjustment of 50mm.

Holding Section: It shall be designed for continuous holding of the product at pasteurization temp in SS tubes.

Balance Tank: The balance tank of suitable capacity shall be fabricated from 2 mm thick SS sheet conforming to AISI 304. The tank shall be provided with cover, Product inlet, cup type outlet, return Product inlet, inlet for water, over flow and adjustable SS ball feet and provision for level probes. The balance tank shall be provided with a Level Transmitter along with pneumatic flow regulating valve, Low Level Probe &High Level Probe for control of level of liquid in balance tank. The Feed Pump shall be interlocked with level transmitter and High Level Probe to avoid the dry running of pumps. The balance tank shall also be provided with manual butterfly valve at the outlet.

Feed Pump & Booster Pump: The Pasteurizer stainless steel feed pump shall be of sanitary steel shroud with louvers for air-cooling and suitable design as per dairy standard. Its capacity shall be adequate to facilitate efficient CIP. The TEFC drive motor shall be fitted with stainless arrangement for cable connection.

Booster Pump shall also be provided to maintain the positive pressure on the Pasteurized Milk Side. .
"

The pumps shall also be suitable for CIP ' flow rate in closed loop.

Flow Transmitter & variable Frequence draive: Pasteurization module shall be supplied with suitable size flow transmitter along with variable frequency drive working in tendem with flow transmitter will automatically control the flow as per requirement of process.

Pressure Transmitter : Pressure Transmitters shall be supplied to measure pressure of the working fluids during operation. The system will measure the differential pressure between the Pasteurized milk side & Utility Side to ensure the positive pressure and to avoid mixing of chilled water and hot water in milk in case of accidental damage of plates.

Heating Device/Hot Water Generation System:

Hot water system shall be PHE based and will house an expansion chamber and other safety device to take care of volume expansion. The hot water generation system shall be skid mounted.

Expansion Chamber: with Safety Valve, Air Vent

Pneumaticaly operated Steam Control Valve: Samson Make with positioner along with I/P Convertor . By-pass assembly not envisaged for Steam Valve since complete operation shall be automatic

Water Make up valve- Pneumatic Angle Seat Valve

Automatic Water Make up facility of Expansion Vessel based on level sensing.

Hot Water Generation PRE

Safety Device: A safety device shall be provided in the hot water side of heating section to avoid damage to the heat exchanger caused by excessive pressure. It shall be of Sanitary design.

Hot water Pump: One number of Hot water pump will be supplied which will be used for hot water circulation for heating of Ice cream Mix up to86 deg C. It shall be vertical multistage type with all wetted parts in SS.

Pipes and Fittings (SS304): All interconnecting pipes with necessary fittings for product as well as service shall be supplied within the specified battery limits and exclusions.

Product: The supply shall include all the necessary SS304pipes and fittings from balance tank to the finished pasteurized product outlet as required inter-connecting the above equipment.

Hot Water: The supply shall also include necessary SS pipes and fittings
for pumping hot water to the heating section of the Pasteurizer and return to the hot water set

11.6 **Ice cream Homogeniser**

Suitable for Ice Cream Mix and Kulfi Mix
Product *Ice Cream Mix
Viscosity *Up to 500 cPs
Maximum Particle Size *Up to 200 micron
Operating Temperature *<90°C
Execution Sanitary
Version ENERGY
Capacity 1000lph Homogenizing Stage Two
Maximum Working Press 210Bar
Max Back Pressure *5bar
Min in Feed Pressure Range 3-4bar
Motor Kw 75
Electrical Supply *3ph/415V/ 5*0Hz*
Auxiliary Circuits *24V DC
Water Supply minimum 2bar
Air Supply(Pneumatic) minimum 6bar
Cleaning Temperature*<90°C
Cleaning Time *30min
Local Conditions Temperature*+5/+40* °C-R.H.max90%-Height
Above sea level :1000m
Number of plungers: 3
Stroke :80mm
Lubricating cooling water : 90I/ h
Lubricating oil ISPO VG 150: 30L
Gear box oil EP 220(NS 3075) : 18L

The machine ,manufactured according to the directive *98/37/CEE* and following updates, includes:

Compression Block with:
-chrome coated stainless steel pumping pistons
-Stellite pump valves suitable for the product
-sanitary design analog pressure gauge
-safety over pressure relief valve

Homogenizing valve with :pneumatic adjustment of the pressure

Special heavy duty cast-iron body housing transmission parts.

Lubrication System Forced. type with electro pump and pressure switch
Transmission Drive with AC motor
Frame with stainless steel removable panels

11.7 **Ice Cream Mix Ageing Tanks**

Capacity :3KL
Types: Vertical, Jacketed, Insulated
MOC: Inner/Jacket/Outer SS*304/SS 304/SS 304*

Functional Requirement: The mix aging tank shall be used to store ice cream mix at a suitable temperature for aging.

The volume of the tank shall be such that after filling it up to the rated capacity, the level of mix shall be at least 1.00 mm from top.
Constructional features: Triple walled construction of sanitary design. Bottom of the tank.
insulated and welded
1:15slope towards the outlet at the

Metal contact: The only metal-to-metal contact between the inner and the outer shell shall be at the places where fittings for the tank are provided. At the places where mild steel stiffeners are provided insulated padding shall be fixed between the inner stainless steel shell and stiffeners.

The tank shall be with agitator ,and standard accessories.

11.8 **Kulfi Mix Preparation Tank**

Capacity:500L
Type: Vertical, Triple walled ,Insulated, Jacketed for Hot Water Circulation
MOC: Inner Shell and Jacket shall be in SS 316,Outer shell shall be of SS 304.

11.9 **Mix transfer pump to flavour mixing tank**

Capacity :5KLPH
Type :Lobe type
Head: Suitable

Motor : 415 VAC , 3phase, 50Hz, squirrel cage induction motor with *TEFCI/IP* 55enclosure.The motor shall be Efflmotor.

Function: The Pump shall be used for transfer of Ice cream mix from ageing tanks to the Flavor mixing tanks.

11.10 **Flavour mixing tank**

Capacity :500L
Type: Vertical, Triple walled, Insulated, Dimpled Jacketed for Chilled Water Circulation
MOC: SS 304 for inner shell, jacket and outer shell

Design : As per Repute Make
Function: The tank shall be used for flavour addition & rnixing in the ice cream mix, before freezing.

11.11 **In line Type Strainer**

Capcity: Suitable
Type : Pipe in Pipe
MOC: SS 304

11.12 **Continuous Ice Cream Freezer**

Single barrel automatic continuous freezer for the production of approx. 600 l/h of ice cream up to 100% over run, with mix inlet temperature of + 4°C and ice cream outlet temperature of -5°C.

Freezing Cylinder: The insulated freezing cylinder shall be made of stain less steel AISI 304 .The inside surface shall be hard chromium plated nickel having mirror finish. The cylinder shall have suitable surface scrapper to continuously scrap off thin film of ice which forms on the inner wall of the cylinder and at the same time thoroughly mix the ice cream as it is formed.

Mix Pump: A special piston pump system with one chamber, with compressed air feeding and sterile air filter.

Air System:The air connection shall be provided for 6bar air pressure

Refrigeration System: The refrigeration system of the ice cream freezer shall be built-in R404, water cooled condenser and necessary controls.The unit shall have automatic defrosting arrangement and suction and discharge pressure gauges.

Control System: All functions of the freezer including the refrigeration system of the freezer shall be operated by PLC through the control panel.

Touch screen panel for:

- Diagnostics(alarms and warnings)and machine parameters.
- Program/save different recipes and automatic cycles.

Automatic cycles:
-Mixing (production preparation)
-Production START
-Stand-by(short time stop-production)
-Production end

Storage of up to 99 recipes
Automatic controls:

Main controls:

Over run monitoring (air pressure)
Viscosity control (dasher-wattmeter)
Mix flow control (inverter mix pump)
Barrel pressure control (outlet valve)
Outlet ice cream temperature (thermometer)

Recipes parameters available: Mix flow (Iiters l hour)
Viscosity (percentage)
Overrun (percentage)

Utility Details:
Beater power: 7.5kW

Compressor power 11kW
Mix pump power 0.75 kW

11.13 Cup Filling Machine

PLC Operated with Servo Drive and Manifold Cam Indexing
Freezer capacity required : 600 lit lhr- Qty: 2No's
Basic specifications: .

-Filling-Plain/with ripple/with fruit/2in1flavor
-Out put speed;3,000cups/hour
-Rotary1track machine
-With any 1 size of cup attachment.75/95 /l00ml cup and lid diameter will be same
-Electrical load:1.25hp
-Air consumption: 1500lit/min at6kg
-Ripple on/off valve: 2no's
-Single ripple nozzles:2no's
-No cup: No ripple ,no foil ,no heat sealing facility

11.14 Cone Filling Machine

PLC Operated with Servo Drive and Manifold Cam Indexing
Freezer capacity required: 600lit/hr-Qty:2No's
Basic specifications: .

-Filling-Plain/with ripple/2in1flavor
-Output speed; 3,000cones/hour
-Rotary1track machine
-With any1size of cup attachment, 50 / 120ml cone and lid diameter will be same
-Electrical load:1.25hp
-Air consumption:1500lit/min at 6kg
-Ripple on/off valve: 2no's
-Single ripple nozzles: 2no's
-No cone: No ripple, no foil , no heat sealing facility

11.14 Fruit Feeder

Multifruit feeder for feeding fruits and into a pressurized flow of fluid product at controlled dosing.

Composed of:

- Dosing device operated bya0.37 kW motor injecting the fruits into the ice cream and by a beater for mixing the fruits
- Total installed power -0.65 kW
- Max. Capacity of fruits to introduce into the ice cream -40Kg/hr.
- Capacity of Hopper - 19L

All parts in contact with the product are made of stainless steel of plastic food grade material.

11.16 Ice Cream Reprocessing/Reworking Tank

Capacity :1000LTR
Type : Vertical, triple walled, Jacketed for1-Iot Water and Chilled Water Circulation, Insulated
MOC :SS304

Function: To collect the product for reprocessing

11.17 Hot Water Bath for CAN

MOC: SS304

The water bath shall be of suitable capacity given for melting product in cans for reprocessing

11.18 Ink Jet Printer for Family & Bulk Pack Carton

Suitable inkjet printer shall be provided for printing of family & bulk pack carton.

11.19 Lid Printing Machine

Suitable printer shall be provided.

11.20 SS Cartoning/Working Table

Suitable Size cartooning/working table shall be provided.

11.21 Chocolate Preparation Tank

Capacity: 500 L

Types : Vertical, Triple walled, Insulated, Jacketed for Hot Water and Cooling Tower Water Circulation.
MOC:SS316 for inner shell and jacket, SS304 for outer shell
Design :As per Standard to be designed by the bidder
Function :The tank shall be used as balance tank near Candy Machines for dosing of chocolate slurry of Frostik filling.

11.22 Electronic Weigh Scale

Function: It shall be used for the off line weighing of milk pouches.

Capacity: 0-2Kg

11.23 Skid mounted CIP tank &pump

The system comprises of following items.

1. CIP Solution Tank- 1KL
2. CIP Solution Heater - 1KLPH
3. Funnel - 1No.
4. CIP Circulation Pump - 10KL one no.
5. Duplex Strainer-1 No.
6. Control Panel - 1No.
7. SS Pipe Fittings - 1Lot

11.24 Nuts & Dry Fruit Oven

Suitable Capacity oven shall be provided for drying of dry fruits &Nuts.

11.25 Nut Cutting machine

Suitable Capacity of cutting machine shall be provided for cutting of dry fruit &Nuts.

11.26 Candy Machine

I.BASIS OF DESIGN FOR ICE CANDY

1 Tank Temperature -20°C to-25°C
2 Product incoming temperature -10°C
3 Product Ice Cream
4 Mould capacity 24pieces @60ml
5 No of Moulds 20Moulds capacity

II.TECHNICAL SPECIFICATIONS FOR ICECANDY

1 Candy Tank Size outer L126"xW40"x H36"
2 Tank Inner /outer Stainless Steel 304G
3 PUF Insulation thick 100mm @38kgdensity /ill3.
4 Compressor make Danfoss /Bitzermake
5 Condenser Water cooled Condenser
6 Power Supply 440volts, *50*Hz,3phase, *7.5*KW

III.SCOPE OFSUPPLY FOR ICECANDY

1 Ice candy Tank Inner and outer S.S with PUF insulation
2 Agitation re-circulation system Mono block centrifugal Pump
3 Refrigeration unit Consist of Compressor with Water Cooled Condensers, Electrical Controls and Refrigeration Controls.

11.27 **Chilled water generation system**

This system shall consist of the following equipment and shall be used for circulation through condensers of Freezers.

I. 100LtrTank: Vertical, Insulated, MOC: SS304
II. Circulation Pump: Suitable
Ill. Chiller: Suitable, 10DegCinsingle pass, Chilled Water Flow Rate: *1.5*times

11.28 Hot water generation system

The Hot Water System shall be used for circulation of hot water through Chocolate Prep. Tanks, Reprocess Tanks and Ripple Preparation Tanks and shall consist of the following equipment:

1. 100LtrTank: Vertical, Insulated, MOC: SS304
2. Circulation Pump: Suitable
3. PHE Heater: Suitable, 20DegCinsingle pass

12.0 PANEER PLANT

12.1 **Standardized Milk Storage Tank**

Capacity: 15 KL
Types: Vertical, Insulated, Double Walled
MOC: SS 304

Function: To store standardized milk at 4deg C for further processes.

12.2 Pasteurized Water Storage Tank

Capacity: 10KL
Type: Vertical, Double Walled, Insulated, without agitator

MOC: SS304

Functional requirement: To store pasteurized water. This tank shall be supplied with standard accessories.

12.3 **Citric Acid Preparation Tank (insulated .jacketed. agitated)**

Capacity:1KL
MOC:AISI316

Citric acid is being prepared in 1KL tank (vertical, insulated tanks with agitators). Centrifugal circulation pump helps dissolving of loose matter in soft water and also keeps circulation of a solution through tubular or plate heat exchanger (SS 316) to achieve specified temperature (85degree C).

Citric acid is dosed into the coagulation vats in the appropriate temperature. Temperature of acid solution in the tanks is controlled by PLC. The amount of dosed liquid is measured by a volumetric flow meter.

Acid solution is dosed through the special spread heads installed on the top of coagulation vats.

12.4 Vertical Milk Coagulation Vat

Functional Requirements:

General Description: Paneer vat shall be used for manufacturing of Paneer.
Capacity:1000Ltrs.
Design Requirements:

Inner vat shall be rectangular with semi-circular ends of 3mm thk. AISI 304.
Inner bottom is made from 5mm thk. SS304

Outer vat is rectangular with semi-circular ends are fabricated from 2mm AISI304.

Entire inner shell is insulated with 50 mm thick resin bonded crown 150 grit glass wool using chicken wire netting.

1\suitable agitator shall be provided to facilitate proper mixing of coagulant and subsequently coagulated mass.

SS Cup type inlet cum outlet with flanged plug valve of 101.5mm IS provided at height of 250 mm from floor level.

-Sliding type strainer made from perforated SSAISI 304 sheet is provided.

SS water inletof38 mm dia. with flange and Counter flange is given.

Four numbers of adjustable legs are provided.

Accessories:

Resistance thermometer

Discharge valve on outlet, 101mm

Antifoam top inlet for milk

12.5 **Whey Storage Tank**

Capacity : 10Kl
Type: Double walled, insulated Agitated
MOC: SS 304

Function: The whey storage tank shall be used to store whey for onward transfer.

Other specification shall be same as per other milk storage tank (vertical)

12.6 **Paneer Block Cooling Vat**

Capacity :2000 Litres
Type: Double walled insulated, SS304 Construction

Functional requirements:

Pressed Paneer Blocks shall be cooled to 4 Degree C in the chilled water.

Scope of supply:

Inner Body: The inner shell shall be fabricated from 2 mm thick stainless steel sheet conforming to AISI 304respectively.

Outer Body: The outer shell shall be fabricated from 2mm thick mm thick stainless steel sheet conforming to AISI 304.

Suitable insulation shall be provided.

This shall be as per the standards design and shall be m SS 304Construction.

12.7 **Paneer Milk Heater**

Capacity : 5klph
Type : PHE
Temp. Prog. : 4-90-80 deg .C in single pass

Function: Heater shall be used to heat the milk from 4-90 degree C in single pass and second section milk shall be cooled with cooling tower water.

The plate heat exchanger shall be used for heating standardized milk with hot water for Paneer manufacturing. .

Finish: All welding joints shall be ground smoothly. All stainless steel surfaces shall be polished to150grits.

A suitable plate type hot water generation system shall be provided. The specification for hot water arrangement shall be same as used in the milk pasteuriser.

12.8 **Whey Chiller Double Stage**

Capacity :5KLPH

Function: The Double section plate heat exchanger shall be used for chilling whey with chilled water and well water. In first section whey shall be chilled from 70 degree to 40 degree C and in second section it shall be chilled from 40degree to 4degree C.

Design Requirements:

Design Parameters:

Whey feed temperature :70degreeC
whey discharge temperature : 4degree C
Chilled water feed temperature : 1.5-2 degree C
Maximum permissible chilled product flow rate. : 3 times the Water flow rate

All other specification shall be same as per the milk chiller.

12.9 **Cooling Water Chiller**

The chiller shall be used to maintain temperature of pasteurized water during Paneer cooling process.

Capacity: 5KLPH
Temp Program: 20-4 degree C
Type: PHE
Plates - SS316

All other specifications shall be same as per the milk chiller.

12.10 **Milk Transfer Pump to Paneer Milk.-Heater**

Capacity:10KLPH
Head:Suitable

Function :The pump shall be used for transfer of paneer milk to paneer milk heater.

Design :The pump shall be sanitary design and centrifugal mono block construction.

Finish :All stainless steel surfaces shall be polished to 150grits.

Scope of Supply:

The Pump: It shall be made from stainless steel conforming to AISI 316.

The Drive: The pump shall be provided with flanged motor with hygienic sealing arrangement. The motor shall be squirrel cage TEFC with IP55 protection suitable for 415 V 50 HZ AC supply.The pump and drive shall be integrated together. The pump shaft end for fixing the impeller shall be of stain less steel.
Accessories

Inlet/Outlet: Stain less steel (AISI316)inlet and out let shall end in stain less steel complete union . The inlet shall be 230 mm above the finished floor level.

Motor Shroud: The motor part of the pump shall be stainless steel shrouded. The shroud shall be easily removable.It shall have provisions for air circulation and entry of electric cable.

Legs: The pump with drive shall be supported on legs with stain less steel ball feet.The ball feet shall have provision for height adjustment of 50mm.

12.11 **WheyTransfer Pump**

Capacity:10KLPH
Type:Centrifugal Monobloc

Function: The pump shall be used for transfer of whey from Paneer vat through a plate type chiller for chilling.

All other features shall be same as per the milk pump mentioned above.

12.12 **ChilledWater Circulation Pump**

Capacity : 05 KLPH
Type : centrifugal manobloc

Function: The pump shall be used for:recirculate cooling water inpaneer cooling vatthrough aplate type chiller.

Design: The' pump shall be sanitary design and centrifugal mono block construction.

Allother features shall besame asperthemilk pump mentioned above

12.13 **Trolley for Paneer**

Capacity: Suitable

This shall beused forconveying thepaneerblock tothecold room.

12.14 **Citric Acid Dosing Tank**

Capacity: 100L
MOC: SS316

This shall be used for in dosing of the Citric acid into the open paneerVat.

12.15 **Citric Acid Dosing Pump**

Capacity : 1 KLPH
Type: Centrifugal Monobloc

Function: The pump shall be used for dosing of citric acid in paneerVat.

All other features shall be same as per the milk pump mentioned above.

12.16 **Pneumatically Operated Paneer Press**

Pneumatic Press Capacity: 300kg/batch.

A SS whey collection tray of AISI 304, 5mm thick isprovided below the hoops. Tray have cup type outlet with a SS ball cock. Tray has suitable slope towards outlet.

The necessary air inlet with valves, filter and lubricator. for piston are provided.

The inside of cylinder is fine finished.

The piston has hard working self-tightening rubber gaskets and stuffing box with double jacket.

12.17 **Hoops for Paneer Filling**

Hoops: 10Kg.

This shall be used to make the Paneer blocks. Curd is filled in the hoop and is pressed by the pneumatic press.

The hoops are made of 2mm AISI 304. Hoops are rectangular in shape.

This shall be in SS 304 Construction provided with necessary cover and holes to facilitate easy drainage of whey while pressing.

·12.18 **Paneer Cutting Table**

This shall be used for cutting the paneer blocks for.vacuum packing.

12.19 **Whey Collection Trough**

Capacity: Suitable
MOC: SS304

It shall be used for collection of whey from paneerVat.

12.20 **Whey Collection Tank**

Capacity:200L
Type: Singlewalled
MOC:SS304

It shall be fabricated from 2 mm thick stain less steel sheet conforming to AISI 304 respectively.

12.21 **SS Packing Tables**

Capacity:Suitable
MOC:SS304

This shall be used for packing of cut paneer blocks.

12.22 **Thermo forming Machine**

This shall be used for paneer packing.

12.23 Block Cutter

This shall be used for cutting of paneer blocks.

12.24 **Waste Paneer Shredder**

This shall be used for shredding of paneer blocks.

" APS PLANT FOR PLAIN MLK IN FLEXIBLE ASEPTIC POUCHES FLAVOURED MILK, BUTTER MILK & LASSI"

1.0 **Standardized Milk Storage Tank**

Capacity:5KL
Type: Vertical, Insulated, Double walled, Agitated

Function :To store standardized milk for flavoured milk preparation.

2.0 **Flavor Mixing Tank**

Capacity:3KL
Type:Vertical, Insulated, Double walled, Agitated

Function : To use for mixing of milk, sugar and flavor.

3.0 **Flavor Mixing Tank**

Capacity : 1 KL

Type: Vertical, Insulated, Double walled, Agitated

Function : To use for mixing of milk, sugar and flavor.

4.0 **Lassi Tank**

Capacity : 2KL
Type : Vertical ,Insulated, Double walled , Agitated
Function: To store the standardized milk for setting of curd.

5.0 **Butter Milk Storage Tank**

Capacity: 3KL
Type: Vertical, Double Walled, Insulated
MOC: SS304

Functional requirement: To store butter milk

6.0 **Butter Milk/LassiTransfer Pump to Sterilizer**

Capacity : 6KLPH
Type :Centrifugal, Mono-bloc
Head :Suitable -
MOC :Contact parts in SS316
Shroud : SS304
Function: The pumps shall be used for transfer of butter milk to sterilizer.

7.0 Flavor Milk Transfer Pump to Sterilizer

Capacity : 6 KLPH
Type : : Centrifugal,
Head : suitable
Moc : Contact part in SS 316
Shroud : SS 304

Function: The pumps shall be used for transfer of flavour milk to sterilizer.

8.0 **MilkTransfer Pump to Flavor MilkTank**

Capacity:10KLPH
Type:Centrifugal,Mono-bloc
Head:Suitable
MOC :Contact parts in SS316
Shroud:SS304

Function: The pumps shall be used for transfer of milk to flavour milk tank

14.0 **"UHT Sterilizer of 6000 LPH with Packing Machine**

Packing machine consists offollowing

1)200/ 500 ml aseptic pouch filling machine for plain milk
2)200mlx9000 PPH Tetra Brick packing 'machine for flavoured milk /Butter milk & lassi".

1.0 **UHT Sterilizer**

STERIDEAL ST 6.5 C

Product & Process Data

Product Milk/ Flavoured Milk Drinks upto 20% TS
(please note that quoted system is suitable for homogenous products, i.e. plain milk without anysuspended solids , as discussed . For products containing particulates /fibres etc., a counter wash arrangement will be required and the same can be quoted optionally , if required)

In feed temperature[DC] : 5
Type of installation : ST6 . c
Capacity[LPH] : 25 % to 100% up to 6500 LPH

Regenerative percentage : 86%
Temperature range [Deg C] : 5- 70 – 122 – 139 – 88 -24
Holding time[sec] : 2fixed at full capacity
Homogenizing pressure [bar]: Max 25 0first stage
Max 50 second stage

Introduction

The attached flow scheme TCS - 001331 displays the process flow diagram of the Sterideal®, including:

- Process andcontrol Module
- Coiled Tubular Heat Exchanger
- Homogenizer

Theprocess andcontrol module comprises of:

01- A closed single-walled stainless steel tank and a group of valves. The tank is equipped with product infeed, product discharge, product return, spray ball, overflow pipe, and level control.

05- Product pump

03- A frequency controlled metering pump supplies the cleaning agents for the CIP Steps of the Sterideal®.

The supply of the concentrated cleaning agents is up to the hand operated valves from the metering unit

.

10- An IPC process and control system which monitors and controls the phases, as described, and takes care of the signal exchange with the filling machine(s) / aseptic tank. This system includes:

An IPC controller links the remote I/O of the process and control module, the CTHE, and homogenizer and aseptic tanks via ETHER CA T

11- A motor control system comprises:

A main switch with main fuse
Material for the power current distribution
Material for the control voltage provision
Starting equipment for the drive motors and pumps, including metering pump.
Frequency controller for the main drive of the homogenizer is to be placed separately.

Coiled TUBULAR HEAT Exchanger (CTHE)

The CTHE (see picture) consists of a number of tubular heat exchangers (coils), each with its own specific function. Each coil has two or more tubes put together concentrically. The coils are made of high-grade anti-corrosive material; AISI 316 (4VA).

The CTHE is placed in a jacket with removable covers.

The CTHE comprises of:

Module 07.1 - 1st regenerativesection
Module 09.1 -2nd regenerative section
Modulre 10.1 - Main heater
Moudule 18.1 - Holding section
Moudule 18.2 - Minicooler
Moudule 12.1 - Heater / cooler

Module 07-1st regenerative section

The 1st regenerative section is a double tube heat exchanger in which the sterilizer product heats the incoming product**.**

Module 09-2nd regenerative section

The 2nd regenerative section consists of a three-tube heat exchanger .In the 2nd regenerative section the sterilized product cools down where as the incoming product heats. The inner tube functions as a dummy by which the surface transferring the heat is enlarged.

Module 10-Main heater

The main heater is a three tube heat exchanger.
The product is indirect heated by steam to the sterilization temperature desired.The sterilizing temperature of the product is regulated by a temperature control. The temperature controller has been configured as a cascade control. This offers the advantage that changes in the steam pressure may he· compensated quickly, so that this will not affect the ultimate product temperature.

Module 18-Holding section

After the mainheater is the holding section. In the holding section maintained at sterilization temperature for a fixed period of 2 seconds.

Module 12-Heater/cooler

The heater/cooler is a two-tube heat exchanger and is used as heater during SIP and as cooler at the end of the SIP step.The back pressure valve is located down stream the cooler and it ensures the pressure reuired in the installation.

Jacket and frame

The tubular heat exchangers are mounted on a stain less steel frame with adjustable
Stain less legs and a stain less steel jacket and cover.

A stainless steel panel is attached to this jacket and contains the control air distribution equipment and auxiliary valves controlled by remote *I/O.*

HOMOGENIZER TYPE 3HL-IO, indo2nd Homogenisation device in down stream

The homogenizer (EM08) homogenizes the product, pumps the product through the tubular heat exchangers and product piping to the fillers/Aseptic. Tank and back to the supply unit.The strokes of the homogenizer (being a very accurate positive pump) represent the capacity of the Sterideal. The homogenizer is equipped with an AC motor with frequency control and has a variable capacity to meet the demand of the fillers with or without an aseptic tank.

The homogenizer has 3 pistons with a maximum homogenizing pressure of 250 bar.

The homogenizer has the following components:

- frame/transmission
- drive with belt transmission
- pump block
- homogenizing device(s)
- internal product piping.
- Enclosure

THE MOTOR CONTROL SYSTEM

The motor control system comprises:

- a main switch with main fuse
- material for the power current distribution
- material for the control voltage provision

- starting equipment for the drive motors and pumps
- frequency controller for the main drive of the homogenizer.
- the control system is provided with a ventilation/cooling and anti-condense heating

ENGINEERING SERVICES / DOCUMENTATION

Engineering includes the information required to install and operate the Sterideal ® being:

Installation drawings
- Process and Instrumentation diagram.
- Preliminary and final lay-out design.
- Load/weight distribution drawings.
- Locations of drainagepoints.
- Locations and sizes of utility connections.

Electric drawings
- Electrical distribution scheme.
- Electrical cable lay-out.
- Electrical connection diagram.
- Electrical material specifications.

Documentation
- Operation and service manuals for the Sterideal®.
- Spare parts list.
- Certificates as far as required.

Notes:

Drawings, documentation, operation manual and service manuals will be supplied in one hard copy and one CD inthe English language. This includes all required information for the operation and maintenance ofthe delivered equipment. The spare parts books contain allinformation fororderingthespare parts.

STERIDEAL PROCESS DESCRIPTION

The Sterideal® pasteurizes or sterilizes liquid products like soy milk and juices with particles and delivers these products to a single orseveral filling units an aseptic tank.
The attached illustration TCS - 001331 displays the process flow diagram of the Sterideal®.

PROCESS DESCRIPTION

The Sterideal® is equipped with a Stork control system.This automatic control system initiates and terminates each phase (Sterilize In Place (SIP), processing and CIP) and ensures automatic synchronization with the filling machines.

All phases of the process start and stop automatically, except where a program selection (production,intermediate cleaning and main cleaning stage) has to be made . The operator should activate this selection . The control-and process settings (times,temperatures, capacities) are adjustable in a simpl eway.

One operator can operate several systems. Switching to manual control for experimental purposes or to optimize the process is possible.
The process features various safety devices. When a safety device is triggered, an alarm message is displayed on the control panel.

The process has the following four main phases:
- pre-sterilization
- production

- intermediatecleaningoperation
- maincleaningstage.

Pre-sterilization

Prior to the production phase, all product contact parts, upto the aseptic interface at the filling machine or aseptic tank,are sterilized to make the entire product circuit sterile.

This pre-sterilization process (SIP) is done by hot water that circulates through the installation inaclosed circuit and is heated by the main heater and heat exchanger which during this phase acts as a heater.

Pump *(M5*.1.1)delivers sufficient pressure in the closed loop. The direction of the flow is via the first-stage regenerator to the homogenizer. The homo-genizer delivers the water via second-stage regenerator to main heater, product cooler/circuit sterilizer and filling line back tothesupply unit.

The entire Sterideal® will be running at the desired sterilization temperature for a period of at least 20 min.

Production phase

After the SIP the Sterideal® is cooled under aseptic conditions to the required filling temperature. When at the desired operating temperature, and the filling machine, and or aseptic tank are ready for production, the production phase may be started.

The change-over fromwater toproduct is initiated autorriatically.

The incoming product pushes away the water in the circuit and, after the preset timer has lapsed, the product is at the filling machine(s) or the aseptic tank upon which the filling starts.

The homogenizing device is hydraulically activated.

The homogenizer pumps the product through the circuit and also ensures avery accurate capacity. After homogenizing the product is heated further inthe 2nd regenerative section and subsequently sterilized in the main heater.

The product is heated very quickly due to:

- indirect heating by means of saturated steam in the main heater
- effective and efficient heating Induced by regeneration in the heat exchangers.
- intense turbulence thanks to the high product speed in the heat exchangers.
- Dean effect in the coiled heat exchangers

Moreover, the turbulence flow during results in a minimal deposit on the heat exchangers and prolongs operation time.

After the holding tube,the product is cooled quickly, initially in the 2nd and 1st regenerative section and, if needed, in the product cooler.

To ensure proper functioning of the filling machine(s) it is essential that there is a slight overpressure in the product circuit to the filling machine(s). This isobtained by controlling the throttle valve in the product return pipeline.

When the minimum level in feed the balance tank is reached or if, for any reason, the production run is interrupted the product displacement phase initiates, allowing water to displace the product. Water enters the installation and pushes out the product. The time.to move the product isaccurately set asafunction of the speed of the homogenizer and the volume of the system. '..

The filling valves of the filling machine sand or aseptic tank close automatically just before the mixing zone arrives at the valves. .

In case of a too low sterilization temperature, the filling valves are closed instantly.And the Sterideal ® switches from product to water.

Due to the fouling of the main heater the heat transfer reduces, resulting in gradually increasing of steam pressure.Once the steam pressure reaches the preset level the operator has to decide and select one of the following options:

- intermediate aseptic cleaning
- " stop production by activating the main cleaning phase
- ignore the alarm message and continue the production for a short period of time to empty the upstream product tanks

Intermediate aseptic cleaning

An aseptic intermediate cleaning is effected, maintaining the sterility of the installation. After an intermediate cleaning operation,the production can be resumed immediately.

The intermediate cleaning operation starts by rinsing the circuit with water. This is followed by an alkaline and an acid cleaning step.This acid cleaning is effected at a lower concentration for a shorter period of time then in the main cleaning stage. Due to the higher temperature the cleaning operation is done at a lower concentration and for a shorter period of time,compared with the acid cleaning process in the main cleaning stage.

By means of the metering pump the detergents are dispensed directly in the circuit for a preset period of time and flow,after which the cleaning operation starts. The alkaline and/or acid cleaning process is followed by a rinsing phase with water.
The fully turbulent flow and the nature of the coiled heat exchanger without any obstacles guarantee an effective CIP. After the intermediate cleaning operation, the program changes over to sterile circulation with water upon which the production can be restarted.

Main cleaning stage

The main cleaning stage is an intensive cleaning process.After the main cleaning stage,the installation should be pre-sterilized again prior to another production run.The sequence of the cleaning program and the number of cleaning phases may be set by means of the control unit.

The cleaning procedure always starts by rinsing the circuit with water followed by an alkaline cleaning phase.This can be a single or duplicate alkaline step depending on the fouling characteristics of the product.Then acid cleaning phase follow this.The detergents are directly inserted in the product circuit by metering pump during a preset time,upon which the cleaning process starts by circulation of the' cleaning liquids.

The alkaline cleaning iseffected inthe main heater and the holding tube, whereas the rest ofthe installation iscleaned at±140[°C]. The acid cleaning iseffected at± 80[°C]. Each phase isfollowed byawater rinsing phase.

During the cleaning process the cleaning liquids flow at a high speed through the tubular system ensuring thanks tothe turbulent flow aneffective cleaning. After the main cleaning stage, the installation iscooled down thereby completing theprogram.

Final cleaning stage

When themain cleaning stage has been completed, itispossible tokeep the installation at 0.2% alkaline. The installation canbestopped, forinstance, during theweekend.

PROCESS VALUES:

Sterilization temperature [0C] : 137. 8 at nominal speed
Holding time inseconds : 2 fixed at full capacity
Fovalue : 8.0
Lactulose value [mg/l] : 196

CONSUMPTION DATA

Steam [kg/h]

- Pre-sterilizing : 488

- Production : milk 210 (110 at 3,250 1/ hr)

Cooling water [kg/h]

- Cooling after pre-sterilizing :6500during 10minutes

O – Air (Nm3/h) : 1

Electricity [kW]

- Product pump : 5.5
- Homogenizer (250 bars) : 55 (35 at 3250 1 /h)
- .Metering pump : 1.5
- Control panel ; 2

Alkaline detergent 33% [ltr/fase]

- Main cleaning : 28.0
- e Intermediate cleaning : 28.0

Acid 53% [ltr/fase]

- Main cleaning 14.1
- .. Intermediate cleaning: 5.3

The technical data stated above show approximate values only, not taking in to account the additional volumes from the product piping to and from the filling machines and or a septic tank.

The consumption figures, regenerative effect and temperature range are based on a low- viscosity product processed in a clean and properly adjusted installation.

The figures change if the inlet, sterilization and outlet temperatures change.

Consumption figures are subject to the product, the recipe and the time-temperature profile.

2.0 **Aseptic Pouch Filling Machine**

1.0 **Automatic Aseptic Soft Packaging Machine:**

Double Head Automatic Aseptic FillingMachine for pouch is designed to meet the high requirements for aseptic form, fill and seal type of pouch filling machines. The machine is equipped with H202 treatment and UV lights for film. The machine is equipped for hermetic sealing of pouches and cutting ofsealed pouches. The machine is entirely automatic and works on electro-pneumatics. All mechanical pieces together with parts in contact with milk, areofstainless steel, and aremounted onastainless steel chassis.

Plastic Film sterilization isobtained- by itspassage inahydrogen peroxide bath and dried by sterile air. The aseptic cabinet is sterilized through atomization ofhydrogen peroxide.
Due to the highly aseptic process a self life as indicated can be reached. The advanced continuously heated sealing device guarantees strong and reliable seam. The sealing device is service friendly and enables long and smooth operation.

The machine is capable to produce approx. 6000-8000 PPH of 100ml & 500ml. The detailed specification of packing machine is provided as follows.

The Aseptic Pouch Filling Machine including the following systems:

1) Main unit frame
2) Film pre-transfer system
3) Thermo coding device
4) Film running system

5) Main driving and hot sealing system
6) Filling system
7) Aseptic air system
8) Hydrogen peroxide system
9) CIP system
10) SIP system
11) Centered lubricating system
12) Electrical control system

Full Automatic Aseptic Soft Packaging Machine

Technical Parameter

General parameter

Nominal capacity 6000-8000*p/h* (100ml)
Filling volume 100ml-500mL Upon request for volume above180 ml

Filling material Low viscosity liquid without solid particle :fresh milk,fruit juice etc.
Filling temperature (20-25)
Fillingerror ±1.5%(100-250mllpouch) , ±1.0%(500mllpouch) -

Productivety Not less than 90%(Productivity and capacity are subject to material, material, power supply,equipment maintenance.)

Packaging type PiIlow pouch
Pouch length 80 mm -220mm
Cutting method Melt cutting
Totalpower 43kW
Operationpower (approx.) 26kW
Air source pressure (0.6-0.7)MPaOil less and waterless
Airconsumption 800L/min
Power source *3+N+PE 50Hz380/220Y±10%* (three-phase five-wire)
Subject to adjustment according to the end-use.
Overall dimension Main unit:3600 mmx1850mmx3460mm (LxWxH)(approx.)
Peroxidetank:850mmx700mmxll00mm (LxWxH)

Rinsing tank:<D540mmx1280mm(Dia.xl-I)

Output transfer machine:980mmx900mmx580mm (LxWxH)
Weight(approx.) 3.4Tons

General parameters of applicable material

Packaging material 3layers (or 5 layers)complex film (oxygen and light barrier film)
Material melting point Approx.130 c
Applicable material width (260-320)mm±lmm(Customized upon request)
Material thick ness 0.09mm-O.lSmm
Inner diameter of material rollsØ 76 mm

Mx outer diameter of film roll

Cip Rinsing

CIP rinsing time	Approx. 70min
Water inlet pressure	(0.1-0.2) MPa
Water consumption (approx.)	800L/cycle
Alkali (NaOH)	Approx. 1.8kg/cycle for solid, orapprox. 3.6kg /cycle for 50%solution
Acid (HN03)	Approx. 0.9kg /cycle for 98% solution, or approx. 1.8kg/cycle for50% solution
	Considering integration with central CIPkitchen, wehave not included anyseparate CIPsystem forthepacking machine.

SIP Sterilization

SIP sterilization time	Approx. 100min (incl. peroxide dipping offilling pipe)
Hydrogen peroxide	Concentration 30%-35% CPT class (food class)
Peroxide consumption	1.2L/cycle forsterilization, 0.6LIh for production
Saturated steam of culinary quality	->0.5M Pa,40kg /cycle

Equipment description

Main technique process: Air filtering and heating

1

Fill roll input – Date printing—Packaging film dipping for sterilization -- Packaging film drying – Pouch forming --Vertical sealing --Material filling --Cross sealing and cutting-- Product output

Unitcomposition:

Main frame, film pre-transfer system, thermo coding system, film running system, main driving and hot sealing system, filling system, aseptic air system, peroxide system, CIP system, SIP system, centered lubricating system, electrical control system, etc.

Main unit frame:

Main unit frame and all parts of body are made of stainless steel or material that conforms to food standard.

Transmission box is made of high intensity material welded together, plastic sprayed on the surface to protect from rust.

Film pre-transfer SYSTEM

Film roller rack, placing and positioning film roller and forward- backward position adjustable with manual wheel adjustment

Damp of the film deploying controlled by damp structure via screw

With the function of film changing indicating and film absent machine stop alarm

Thermo melt film connecting device, pneumatically controlled, realizing fast film connecting without machine stop

The master roller of pre-traction mechanism driven by motor, controlled by timing signal cam and printing color code, fulfilling the effective opening of film roll with the passive rubber roller and multipoint film roll.

Balance roll driven bygear bar,controlling the tension of film roll

Film roller rack, placing and positioning film roller and forward- backward position adjustable with manual wheel adjustment Damp of the film deploying controlled by damp structure via screw with the function of film changing indicating and film absent machine stop alarm Thermo melt film connecting device, pneumatically controlled, realizing fast film connecting without machine stop

The master roller of pre-traction mechanism driven by motor, controlled by timing signal cam and printing color code, fulfilling the effective opening of film roll with the passive rubber roller and multipoint film roll.

Thermo coding device:	Adjusting the printing head positions through guiding bar slide
	Equipped with printing head, easy and fast changeover
	Controlled by color code detecting signal, accurately printing the date on the specified position on the packaging film.
Film running	Film dragging and film ejecting mechanisms, driven by cylinder,ensuring system: the transfer from dipping station to the drying station to prepare for the Next film d r a gging.
	Pouch forming mechanism, with the method of triangle forming, film running forming curve analysed by3-Dimension software, ensuring the pouch forming stable, reliable
	Correcting mechanism, directly adjusting the tension on both sides of the film via the adjusting button on the touch screen to correct the deviated film
	Film dragging mechanism, driven by servo motor and associated with long distance color code detection, controlled coordinately with longitude/transversal sealing mechanism, ensuring the complete ness of packaging pattern
	Film dragging mechanism fixed by pin shaft method, quick opening and easy for maintenance and service
Main driving and hot sealing system:	Driven by servo motor, accurately controlling themain shaft and cam mechanism, with reliable transmission, accurate movement and PRECISE graduation
	Hot sealing mechanism. Longitude, transversal sealing devices controlled bycam wheel, with stable movement, adjustable sealing force, ensuring the quality of hot sealing
	Optimized design for longitude, transversal sealing cam curve, with rational and reliable· graduation. Lowering the motion noise to minimum on the premise of remaining the sealing time to great extent.

Front-back clamping type hot sealing cutter, heated by electric heating tube, heat compensating control performed by PID temperature control system

Hot sealing cutter surface coated.with Teflon, and covered by heat- resistant material,ensuring the hot sealing-quality, avoiding the damage to the film roll surface

Longitude sealing mechanism fixed by pin shaft method,quick opening and easy for maintenance and service

Filling system

Aseptic valve control, ensuring the effective connecting and disconnecting between filling machine and the material main pipe control, ensuring the effective connecting and disconnecting between filling machine and the material mainpipe

Aseptic top tank and liquid level control system, consisting of capacitor liquid level gauge, PID controller and pneumatic diaphragm valve, accurately controlling the liquid level in the top tank

Filling volume control system, filling volume setting onthe touch screen, accurately adjusting the filling volume through the opening degree of flow valve controlled byhigh precision stepmotor

Sleeve type structure for filling tube, effectively simplifying the rinsing circuit
Top tank backpressure device, avoiding negative pressure in the top tank to influence the filling accuracy

Aseptic air filtering system:

Aseptic air filtering system, three-grade filtering, primary, medium efficiency filters recycling after many cleaning, lowering product cost, with Hl3 efficiency for the high efficiency filter

Aseptic air system, with temperature monitoring and feedback function

Input/output system for aseptic air, with separated variable frequency controlled fan, with optimized pipeline design, reducing air volume loss and ensuring the positive pressure in aseptic compartment Hydrogen peroxide
Film dipping sterilizing mechanism, completely and effectively cleaning and system killing all microorganism on the packaging film through dipping

Pressing roller driven by cylinder, avoiding the ventilation of peroxide in the dipping box during the stopping of the machine

Closed design of peroxide box,double-deck structure,heating device equipped in the interlayer with peroxide temperature controllable and ensuring the reliable sterilization effect

View lens in the peroxide circulating system, monitoring there turn condition

Peroxide scraping plate device, effectively scraping the peroxide attached on both sides of the packaging film and improving the drying effect

Peroxide spraying device, sterilizing treatment before production,

atorruzm

the peroxide and filling to all space in the compartment, killing the residue microorganism

Dipping device for filling pipe,.sterilizing treatment before production, dipping and sterilizing the filling pipe, killing the potential residue microorganism on the filling pipe mouth

CIPsystem:Rinsing circuit consisting of cleaning tank, cleaning pump, cleaning pipe, aseptic cleaning valve, return angle seat valve, etc.

Rinsing program automatically controlling the whole rinsing process

Customized system up on CIP request, cleaning procedures accomplished by factory CIP center
Consisting of manual air valve, filter; reducer valve, pressure gauge, safety valve, one way valve, air angleseat valve and steam trap, etc.

SIPsystem:

SIP program automatic control, maintaining the stable pressure in the pipeline, draining condensation water and ensuring the sterilizing temperature

Centered lubricating system : Lubricating center

Oil pipe, oil nozzle, distributing connector

Automatic quantities lubricating forallmotive parts

Electrical control system: High_Performance PLC

Humanized interface operating terminal, displaying feed back of all control information, status detection information, alarm information in real time, displaying alarm information in real time

Protection alarm circuit for phase sequence, phase absent detection of integral unit

Running status alarm circuit of related stations

Ultra-low, ultra high, temperature alarm circuit for hot sealing

Control panel for heating

Separated production control components for A, B position

Variable frequency speed regulating control system for fan

Emergency stop button for necessary parts

10.0 Rinse Milk handling system

The suitable rinse milk handling system shall be in the scope of supply for collecting rinse milk from UHT sterilizer, packing machine etc.the bidder shall be consider all the required handling equipment for rinse milk.

14 CIP FOR IP BLOCK

14.1 Lye tank

Capacity :5KL
Type : Vertical Double walled Insulated
MOC: Inner shell inSS316, Outer ShellinSS304

Other specification shall be same as standard CIP Tank.

14.2 AcidTank

Capacity:5KL
Type:Vertical Double Walled Insulated
MOC:Inner shell in SS316,Outer Shell inSS304

Other specification shall be same as standard CIPTank.

14.3 Hot water tank

Capacity ; 5KL
Type : : Vertical Double walled Insulated
MOC: : Inner shell in SS 304, Outer Shell in SS 304

Other specification shall be same as standard CIPTank.

14.4 Recuperation tank

Capacity : 15 KL
Type : Vertical single walled
MOC : SS 316

Other specification shall be same as standard CIP Tank.

14.5 Flush water tank

Capacity : 5KL
Types:Vertical Single walled
MOC :SS304

Other specification shall be same as standard CIP Tank.

14.6 Lye &AcidDosingSystem

14.7 AcidTransfer Pump

Capacity :5KLPH
Head:Suitable
Type:Air operated diaphragm type·

Function:The pumps shall be used for transfer of Cone. Acid from Bulk ChemicalTanks to ServiceTanks.

14.8 LyeTransfer Pump

Capacity:5KLPH
Head:Suitable
Type:Air operated diaphragm type

Function:The pumps shall be used for transfer of Lye from Bulk Chemical Tanks to Service Tanks

14.9 Acid Service Tank

Capacity:500·Ltr
Type:Vertical-Singlewall

Other specification shall be as per theTender document

14.10 Lye Service Tank

Capacity:500Ltr
Type:Vertical-Singlewall

Other specification shall be as per the Tender document

14.11 Plate Heat exchangers

Capacity :20KLPH

Functional requirements: The plate heat exchangers shall be used for heating the CIP supply solution by steam.

Design Parameters:

CIP solution difference temp. -20 degree C
Types of system- Dry saturated at 1.5 bar press.
The equipment shall conform toTechnical Data sheet enclosed.

Other details are as per the above specification.

Note: Instrumentation as shown inP*I and logic of operation as per process requirement.

14.12 Duplex Filters
Capacity:20KLPH
Type:Duplex
Material :SS304

Constructional Features: The general design shall be of tubular design with aconcentric cylindrical filter made from SS screen of 1.5mm pitch. All welding joints shall be ground smooth. All stainless steel surfaces shall be mirror polished.

Other details are as per the above specification.

14.13 CIP forward pumps
Capacity:20KLPH
Type:Centrifugal,Mono-bloc
Head:Suitable

Function:The pumps shall be used for transfer of CIP solution from CIP tanks to equipment/circuit being cleaned. It shall be provided with VFD

The pump shall confirm to data sheet enclosed and shall besimilar in design and construction to Item above.

1.0 SSPIPING AND FITTINGS

The SS pipes and fitting shall be a as per the process requirement.

1.0 Type: TIG welded, annealed and de-scaled tubes shall be manufactured as per the standard ASTM-A270. Outer surface of the tubes shall be mirror polished / dairy finish and inner surface shall be pickled as per dairy standard

2.0 Material of construction and thickness:

All the pipes unless otherwise stated shall confirm to AISI304. The average wall thickness of tubes shall be 1.6mm up to 63.5 mm diameter and 2.0 mm for diameters above 63.5.The wall thickness at any point shall not vary more than 12.5% over and under from the average wall thickness specified.

Pipesupports: RHS sections shall have wall thickness of 2.5 mm.

3.0 **Testing**: All the process tubes shall be hydraulically tested at the manufacturer's works at1500PSI for pipes up to

38.1mm diameter and 1000PSI for tubes size 50.8 and above. All the tubes shall be arthehe at mark. All the test certificate of the tubes with respect to chemical composition, tensile test and mechanical test shall be provided.

VALVES:

Sanitary **pneumatic** seat valves

Type: Twoway/three way pneumatically operated sanitary valves of mix-proof (self cleaning), ON-OFF seat valves, flow diversion valves, butterfly valves etc. Shall be provided with ASI connectivity. All the valve. Battery valves shall be of self cleaning type mix proof valves.

Material: AISI316
Sealing : Positive
Controls:Electrically/electronically operated

The Pneumatic valves shall have the following features to cater to fulfil the above functional requirements:

Housing shall be ball shaped for the ideal flow characteristics to ensure 100% cleanability by CIP. Housing closed by cover plates shall not create a sump or dead corners. Housing interconnections shall be by detachable type clamp connection. The seals such as housing seals,stem seals and disc seals shall be flush mounted. .

1.0 **Plug** Valves: The plug valve shall be in 2 way or 3way configuration with SMS end connection as specified. The valve body and plug shall be made out of investment casting using AISI304 material.The inner.side of the valve body and the contact surface of the plug shall be ground smooth and the nlapped to get full metal-to-metal contact. The outer visible surface of the valve body and the plug shall be mirror polished/ dairy finish.

2.0 **Manual Butterfly** Valve: The butter fly valve shall be of sanitary design and all liquid contacting parts shall confirm to AISI316. The valve sealing gasket shall be EPRO/ Nitrile rubber material suitable for hot water sterilization temperature of 100 Deg. Celsius and hot acid and lye solution of 2% concentration at 85Deg. Celsius. The valve shall be provided with SS handle. The valve shall be with plain ends shall be suitable for direct welding on the pipes.

3.0 **Non Return Valve:** The non return valve shall be of sanitary design and all liquid contacting parts shall confirm to AISI304. The valve sealing gasket shall be EPRO /Nitrile rubber material suitable for hot water sterilization temperature of 100Deg. Celsius and hot acid and lye solution of 2% concentration at 85 Deg. Celsius. The non return valve shall be with plain ends shall be suitable for direct welding on the pipes.

4.0 Unions: All the parts unless other wise specified shall be made out of investment casting using AISI304 material. The union shall be complete with liner, male part, nut and sealing ring (neoprene food grade rubber gasket); The liner and male parts shall be suitable for expansion joints. All the inside as well as outside surface of the union shall be mirror polished/ dairy finish:

5.0 In-line Sight Glass: The in-line sight glass shall be complete with SMS unions at both ends having toughened heat resistant glass and protective stain less steel cover. It shall have quick replacing arrangement for replacement of glass by flange and bolts. The material of construction shall be AISI304 unless other wise specified. All the inside as well as outside metal surfaces shall be mirror polished/ dairy finish.

6.0 Crush proof Hose Pipe for Tanker Unloading: The flexible hose shall be food grade, crush proof rein forced plastic spiral construction with vulcanized end connection and SS-304 fittings. The hose pipe shall be resistant to CIP cleaning liquid and shall with stand a hot water sterilization temperature of 100 Deg C and hot acid and lye solution of 2% concentration at 85Deg.C.

7.0 Bend, Tee, Elbow: These fittings shall be made out of AISI304 unless otherwise specified, process tube, TIG welded, annealed, de-scaled having outer surface mirror polished and inside pickled, manufactured as per ASTM A270. The thickness of the fittings made from the tube section shall not be less than 1.6mm up to 63.5 mm dia and shall not be less than 2.0mm for above 63.5mmdia.The wall thickness at any point shall not vary more than 12.5% over and under from the average wall thickness specified.

Bends and elbows shall be free from wrinkles.Tee shall have uniform flaring on the branch connection. The ovality on the open ends shall be within the permissible limit specified in the ASTM 270.

8.0 Pipe Clamp: Shall be quick openable type of sturdy design.

Other details as per general description given in basis of design. List of manual valves would be finalized during detail engineering.

15.01 AUTOMATION AND INSTRUMENTATION

PROCESS AUTOMATION

The proposed system to build the control system using DeSor Higher end PLC system. The Proposed system would be built on any of two reputed DCS/ Higher end PLC platform which are commonly available in Indian market viz. M/s. Rockwell and M/s.Siemens.

System Configuration

We are proposing 1no DCS or equivalent high end PLC system with I/O in a distributed configuration. Conceptually, there will be a Central controller which will house the main CPU with Communication processors. The Input and Output modules (I/Omodules) are housed separately in the 'field panels and away from the main processor. Signals from the field sensors and command from the processor to final control element viz. control valves etc: is exchanged through the lIOs /comrnunication mode,on a communication link.

The entire Control &Automation System(C&A) shall be."A Totally Integrated Process Control System" (DCS or equivalent high end smart PLC system having standard features of DCS) with communication bus connectivity to field lIO stations, various field equipment/instruments or third party (DCS(PLC) integration for two way hand shaking of Signals (viz. Profibus DP,Ethernet IIP,Ethernet,ASI etc.)

We have considered Pneumatic valve clusters on ASI communication bus. All flow meters (magnetic; Mass & vortex flow meters), Conductivity meters and field process transmitters (Level transmitters,Temperature transmitters, Pressure Transmittersetc.) are hard wired (4-20mA).

The I/O will be grouped on the basis of number of product processing section and the physical location of sensors and control elements in each processing section. Each group of I/O will form a remote I/O station which will be located close to cluster of field sensors and control elements. The number of I/O modules to be used in each station will also depend up on the number of field sensors and control elements. In the proposed configurations, each remote I/O station can have 8/12nos I/O modules of any combination. However, depending up on the I/O in a particular location the number of remote I/O stations can be increased/decreased.

The Proposed Automation system will exchange I/O signals with available communication protocol with help of either direct communication module or gateway converter module as per maximum allowable data exchange between automationsystems.

The system shall support stand-alone architecture for ES/OSIMISPC with Ethernet as a back bone. High degree of System availability and reliability with necessary spare as per standard are considered. Hot swappable (online replaceable) I/O modules/cards are considered for all remote 10 panels. Redundancy for power supply is not considered for any RIO & Asi panel.

Main CPU should be compatible for Project requirement with graphics animation. SCADA package should be with license of require tags. The MIS license shall also be with required tags as per plant architecture.The hardware units shall be installed inside suitable wall/rack mounted watertight cabinets. The software development should be as per standard in accordance to approved process write up.

All the personnel computers (PC) shall have latest configuration at the time of ordering. The specifications of PC are

considered as per the tender document received for bidding and the same shall be supplied.

There will be basically two categories of communication networks-
Control level and Supervisory level (operating.in parallel and independently)

The Control level Network is meant for communication between the CPU and I/*O* modules and the field instruments on communication located remotely in the field. This communication will be through Communication processors installed in the Main Controller rack and Communication Adapter modules/devices installed with each RemoteI/*O* station or Field devices through Profibus/*Ethemet/EthemetI/P.*

The Control level networks will be of following sub-types-

1. It is envisaged that all field instruments will communicate with the Central controller on hard wire through field I/O panels *(RIO).*

All flow meters like magnetic, vortex & mass flow meters will communicate the central controller on hard wire through field 110 panel *(RIO).*

3. Sanitary valves, pneumatic valves. etc. will communicate on ASI protocol.

The IMCC panel's motors & agitators Profibus/Modbus/Ethernet I/P communication controller through Remote I/O station.
MIS reports are shall be required for the process and the utility plants.

At the Supervisory level, there will be a network for communication between Central Controller and PC based OS stations, Engineering Station, and other MIS PC via Ethernet *TCP/IP.* The quantity of PC considered is as per tender document.

SiNo	Description	Quantity
1	OSIES PC.	1
2	OS PC.	1
3	MIS Server PC.	1

Operational Features

The automation system offered will have facility to control all the operations of the plant from the central control room.

Process can be controlled from any of the located areas OS &*ES/OS* in main control room. There will not be any distribution of Control areas between the stations.

The sequence for a process will be started from the OS station through a Screen Menu: All the available options for parameter selection by the operator before starting a particular sequence will be displayed on the screen of OS stations.
Operator will be prompted to make an entry into the menu. If the sequence is started without making aproper entry, thecontrol system will not start thesequence and amessage will bedisplayed onthescreen toinform operator about themistake.

Once the command for starting a sequence is given to the system from OS the control function will be taken over by the DCS/PLC. The necessary interlock required for a sequence will be built into the DCS software. If the inter-lock for a particular sequence, prior to starting that sequence, is not satisfied the system will not start the sequence and a message will be displayed on the OS station stating the type of interlock fault that has occurred. If interlocks get satisfied the system will actuate all valves and pumps which come in the path of that sequence.

Sequence once started will get terminated under the pre-defined process conditions for that sequence like-any interlock fault, high level in the target vessel, low level in the source vessel etc.

Interlocks will also be built in to the system to take care of any contention for a particular valve or pump which are used in more than one sequence as per approved process write up.If a sequence is using a set of valve or motor and if an attempt is made tostart anyother sequence which also uses the same set of valves and motors, then the sequence started later will get terminated and a message will be displayed on the OS.The central automation system shall be located inthe main control room of the plant.

16.1 SERVICE EQUIPMENT

16.1.1 REFRIGERATION SYSTEM

REFRIGERATION PLANT

Technical Specifications

1.**0 GEA Grasso / Equi make High stage fully imported Ammonia Twin Screw**

Compressor Package, adapted with variable Vi and continuous capacity control, on skid complete with all accessories for Ice Silos & Pre-Chillers.

This unit is inclusive of all internal piping and electric Wiring and inclusive of the following main connections:

Suction and discharge lines top valves with hand wheels. Suction and discharge line check valves and stop valves. External suction filter with filter fineness 120 micron.
Dual safety relief valve with change over valve at the oil separator. Automatic 100% unloaded starting.
Steplessautomatic capacity control system from 100%to 10%basedon
Suction pressure with transmitter.

The pre-chiller shall be suitable for ammonia pump feed system.
Suction port for economizer mounted on screw compressor package consisting of suction filter, closable non return valve and thermometer.
Vertical oil separator cum reservoir with-fine separation stage and oil level indicator. The oil separator vessel should be provided with safety valve branch with two position change over valve and 2·nos. safety valves. Simultaneous closing of both the branches must not be possible.
Sump oil heater provided with automatic temperature control device. Lubricating oil system with pump if required.
Float switch to detect a low oil level in oil separator ..**If** a low level occurs the float switch shall shunt the compressor down through microprocessor. Dual oil filters consisting of fine filters with fineness 25 microns with isolation valves to provide servicing one of the filters while the unit is running. Necessary piping and fittings are included in the scope of work. Thermo-siphon based oil cooling system (shell evaporation) complete with suitable shell & tube heat exchanger, thermo siphon liquid vessel, instruments and controls for maintaining proper temperature of oil returning to compressor with necessary control valves, isolation valves, interconnecting pipelines, safety features, oil drain arrangement, etc complete as required.
Wear free compressor motor coupling and guard.
Mounting base for completely assembled compressor package with foundation bolts.
Controls and accessories as per requirement.
Discharge and suction gas thermometer pockets with sensor and digital temperature indication in control panel.
.

ABB/ Siemens/ Equimake IEC standard TEFC, insulation class-F, IP55 degree of protection motor for above compressor.

Common economizer, flooded shell and tube type suitable for simultaneous operation of the High Stage Compressors operating at(-)2.0DegCSST/
(+)40.0DegCsor.

The fabrication of the economizer shall be carried out as per IS Code 2825 " Unfired Pressure Vessel", All joints shallbe100%radiographicallytested and report shall be submitted to the purchaser.

The drawing shall be approved by the purchaser. Fittings and mountings:

Suction gas outlet shall be doom type provided with mist eliminator. The gas outlet shall be valved.
Liquid inlet with valves.· Liquid outlet with valves.

Liquid level control tappings, 2Nos. valved, the liquid level manifold shall be provided for mounting level transmitter and low and high level electronic float switches.
Liquid level gauge tappings, 2nos. valved. The branches to the gauge shall include isolation valves and automatic shut off for gauge breakage.
Mounting pads for2nos. level switches, high and low safety.
Dual safety valve connection with 2position change-over valve and 2Nos. safety valves.
Pressure gauge tapping valved, with pressure gauge.

Common economizer, flooded shell and tube type suitable for simultaneous operation of High Stage Compressors operating at(-) 15.0DegCSST /(+)
40.0DegCSDT.

The fabrication of the economizer shall be carried out as per IS Code 2825 "Unfired Pressure Vessel". All joints shall be 100% radiographically tested and report shall be submitted to the purchaser.

The drawing shall be approved by the purchaser. Fittings and mountings:

Suction gas outlet shall be doom type provided with mist eliminator. The gas outlet shall be valved.
Liquid inlet with valves. Liquid outlet with valves.
Oil drain connection with valves
Plugged bottom drain.
Liquid level control tappings, 2Nos. valved, the liquid level manifold shall be provided for mounting level transmitter and low and high level electronic float switches.
Liquid level gauge tappings, 2nos. valved. The branches to the gauge shall
include isolation valves and automatic shut off forgauge breakage. Mounting pads for2nos. level switches, high and low safety.
Dual safety valve connection with 2position change-over valve and 2Nos. safety valves.
Pressure gauge tapping valved, with pressure gauge.

5.0 Sondex make PHE Type Pre-Chiller, model fabricated from SS316, 0.6mm thick plate semi-welded cassettes complete with necessary fittings and mountings.
Specifications shall be as below:
Type : Semi welded
MOC of Plate : SS 316 , 0.6 mm thick
MOC Frame : IS 2062 Gr. B

The pre- chiller shall be equipped 'with suitable automatic control instruments such as, anti- freeze thermostat, ammionia back pressure valve in the suction line with attachment of two constant pressure regulation valves and a *ON/*OFF pilot valve. Necessary local pressure and temperature gauges, pressure / temperature transmitters to central PLC for monitoring and auto control.

6.0 Hydrodyne / Equivalent make refrigerant liquid pumps suitable for (-) 5.0 Deg C liquid ammonia pumping to Ice silos and cold room units complete with all accessories.

Each pump shall be provided with strainer and pressure differential control system.

7.0 Hydrodyne / Equivalent make refrigerant liquid pumps suitable for(-) 15.0 Deg C liquid ammonia pumping

to Ice silos and cold room units complete with all accessories. .

Each pump shall be provided with strainer and pressure differential control system.

Priority Vessel for thermo- siphon oil cooling system including piping, controls, instruments and fittings common for all high stage and low stage compressors.

High pressure liquid ammonia receiver ofsuitable capacity, fabricated from IS 2062 plates of suitable thickness, complete with the following fittings and mountings:

- Liquid inlet with weld able valve.
- Dippipe for liquid outlet with valve.
- Drain pocket with bottom- plugged socket, with valved oil drain connection. A receiver of suitable capacity shall be provided with level indicator and all accessories at the bottom for collection of oil with drain &transfer facility to oil rectifier.
- Dual safety valve branch with 2 position change-over valve and 2 Nos. safety valves. Simultaneous closing of both the valves must not be possible.
- Gauge glass having branches incorporating glass failure shut off and isolation valves. Provide secure and substantial protection to the gauge glass.
- System charging valve.
- Pressure gauge tapping with valve and pressure gauge.
- Purge connections, valved- 2Nos.
- Valved and plugged pump-out connection.
- Saddle supports.
- Equalization connection tappings with valve for both liquid and vapour phases.

The fabrication shall be carried out as per IS Code 2825" Unfired Pressure Vessel".Alljointsshallbe100%radiographicallytestedandreportshallbe submitted to the purchaser.

Liquid ammonia charging system:

The system shall be located outside the plant room suitable to charge ammonia from tankers as well as from cylinders and shall consist of following items:

Two set of quick mounting attachment each with valve, flexible piping and end connection suitable for the cylinder and tanker and charging port of ammonia loading station.
Ammonia pressure gauge
Filter

1No. Hansen / *Park* /Equivalent make imported multi point, 230V Automatic air Purger with solenoid valves for removal of non- condensables, suitable for the system.

1No. Low pressure liquid accumulator.

Dimension should be suitable for maximum upward vapour velocity 0.7*m/s* as well as adequate volume to accommodate liquid drained by gravity from all the evaporators and wet return line.

It shall be insulated with Polyurethane foam of suitable thickness,40*kg/m3*
Density and cladded with 22SWG aluminium.

The fabrication shall be carried out as per IS Code 2825 "Unfired Pressure Vessel".Alljointsshallbe100%radiographicallytestedandreportshallbe submitted to the purchaser.

Fittings and Mountings:

- Doom type suction gas outlet with valve, provided with mist eliminator.
- Suction gas inlet(Wet return)with valves.
- Liquid outlet to circulating pumps with valves, including one spare for future connection.
- Oil drain connection with valve and suitable receiver at the bottom. The receiver of approximate capacity 50Liters shall be provided for collection of oil with oil drain facility, with a level indicator, oil heater for oil rectification with necessary safety valve and accessories as per requirement.
- Plugged bottom drain.
- Liquid level control tappings, 2Nos. valved. The liquid level manifold shall be provided for mounting level transmitter and high and low level electronic float switches, it shall have provision to drain oil through oil drain valve. Liquid level gauge tappings, 2Nos. valved. The branches to the gauge shall include isolation valves and automatic shut off for gauge breakage.

1. Mounting pads for 2Nos. Level switches, high and low safety.
2. Vapors vent connection from circulating pumps, with valves.
3. Dualsafetyvaiveconnectionwith2-positiohchangeovervalveand2Nos. Safety valve.
4. Pressure gauge tapping valved, with pressure gauge.
5. Manual fill connection with valve.
6. Pressure stat connection with valve.
7. Pump-out connection, valved and plugged.
8. Suitable spurge pipe arrangement to receive discharge gas from low stage
9. compressor with valve.
10. Two nozzles shall be extra for gas returns from pressure differential
Switches and oil vessel.

BAC / EVAPCO Make evaporative type condenser with pump and all accessories having specification as follows:

Design WBT :287/28DegC Condensing Temp. :40.0DegC

It shall be factory assembled, evaporative type, induced draft counter flow design with vertical discharge.

The evaporative condenser supplied by a specialist manufacturer as fully assembled units. The capacity and performance of the evaporative condensers shall be warranted by the manufacturer.

Factory Testing: The manufacturer shall be capable of testing the operation of the condenser in the manufacturer's own test facility. Test facilities shall be capable of simulating design conditions, including but not limited to design wet-bulb, air flow, refrigerant mass flow rate, refrigerant condensing temperature and total heat rejection.

Quality Assurance: The manufacturer shall have a Management System certified by an accredited registrar as complying with the requirements of ISO-9001:2000 to ensure consistent quality of products and services.

Construction:

General: All steel panels and structural elements shall be constructed from heavy-gauge, hot-dip galvanized steel, with cut edges given a protective coating of zinc-rich compound.

The basin and casing shall be constructedofG-235/Super Dynma hot-dip galvanized steel for long life and durability. Standard basin accessories shall include overflow, drain, type 304 stainless steel strainers.

Coil Casing Assembly:

The evaporative condenser shall include a coil casing section consisting of refrigerant condensing coil, spray-water ' distribution system, drift eliminators, and air plenum with fan assemblies.

The refrigerant condensing coil shall be fabricated of continuous lengths of all prime surface and hot-dip galvanized after fabrication. The refrigerant condensing coil shall be tested at400PSIG.

The refrigerant condensing coil shall be designed for low-pressure drop with sloping tubes for free drainage of liquid refrigerant and pneumatically tested at400 PSIG. The refrigerant condensing coil shall be ASME B 31.5 /JBT 7658.5 (Equivalent code of ASME B31.5 Bin China) compliant.

Water distribution system shall provide a water flow rate of 6GPM over each square foot of unit face area to ensure proper flooding of the coil. Watershallbedistributedevenlyoverthecoiltoensurecompletewettingof the coil at all times

The spray header shall be constructed of schedule 40polyvinyl chloride pipe for corrosion resistance. Heavy-duty molded nylon ZM Large- diameter, non-clog, distribution spray nozzles with large1-5/16"diameter opening and internal sludge ring to eliminate clogging. Nozzles shall be threaded into spray header to provide easy removal

for maintenance.

Nozzles and spray branches shall be observable and accessible for cleaning from the outside of the evaporative condenser during condenser operation without removal of other components. It shall be possible to allow quick removal of individual nozzles or complete branches for cleaning or flushing.

PVC drift eliminators shall be provided to prevent moisture from entering the air plenum. The drift eliminator shall be removable.

Wet deck Surface:

The heat transfer section shall consist of wet deck surface with integral drift eliminators for cooling the spray water leaving the coil to optimize the thermal performance of the evaporative condenser. The wet deck surface and integral drift eliminators shall be resistant to rot, decay, fungus, and biological attack.

The eliminators shall be constructed entirely of inert polyvinyl chloride (PVC) in easily handled sections. The eliminator design shall incorporate three changes in air direction to assure complete removal of all entrained moisture from the discharge airstream. Maximum drift rate shall be less than0.001%ofthecirculatingwaterrate

The louvers shall be constructed from polyvinyl chloride (PVC). The louvers shall be mounted in easily removable sections for access to the pan
for maintenance. The louvers shall have a minimum of two changes in air direction to prevent splash out and block direct sunlight.

Fan:

Fan(s) shall be heavy-duty, axial type-with aluminium alloy blades driven by a one-piece, multi-groove neoprene/polyester belt designed for a minimum of 150%ofthe motor nameplate horsepower. Fan(s) and shafts shall be supported by heavy-duty, self-aligning, grease-packed. ball bearings with moisture-proof seals and integral sealer rings, designed for very long life. Fan and motor sheaves shall be fabricated from corrosion resistant materials.

Fan motor(s) shall be inverter duty, totally enclosed type with a1.15service factor and shall be mounted on an easily adjusted, heavy-duty motor base. The motor shall be furnished with double-sealed, permanently lubricated bearings and special moisture protection on windings, shafts and bearings. Air plenum shall provide adequate clearance under the motor base to provide comfortable working space for service personnel. The motor shall be provided with VFD drive for automation and energy saving.

The fan drive shall be a multi groove, solid back V-belt type with taper lock bushings designed for 150% of the motor nameplate horsepower. The belt material shall be neoprene reinforced with polyester cord and specifically designed for evaporative condenser service. Fan and motor sheaves shall be aluminium alloy construction. The fans and fans heaves shall be mounted on the shaft with a specially coated bushing to provide maximum corrosion protection. Belt adjustment shall be accomplished from the exterior of the unit. Bearing lube lines shall be extended to the exterior of the unit for easy maintenance.

Fan shaft bearings shall be heavy duty self-aligning ball type with grease fittings extended to the outside of the unit. Bearings shall be designed for a minimum L-IOlifeof75,000 hours.

Pan Assembly:

The evaporative condenser shall include a pan assembly consisting of cold water basin with pump assembly, heat transfer section for spray water cooling with integral drift eliminators, and air inlet louvers. The cold water basin shall be constructed of heavy-gauge stainless steel (SS304) panels and structural members. Basin shall include a depressed section with drain/cleanout connection. The basin area under the wet deck surface shall be sloped toward the depressed section to facilitate cleaning.

The cold water basin shall include: a drain/clean-out connection; a steel strainer; a brass make-up valve; over flow connection; and a water re- circulation pump assembly. Cold water basin 'shall be designed so that the

strainer, makeup valve and float, and pump assembly are easily accessible without removing any of the unit panels or other components. .

The strainer shall be designed with integral anti-vortexing hood to prevent air entrainment.

Pump:

Water re-circulation pump shall be a close-coupled, bronze-fitted centrifugal pump equipped with a mechanical seal, mounted on the basin and piped from the suction strainer to the water distribution system. The pump shall be installed with adequate drains so that it may drain freely when the basin is drained. The pump assembly shall include an integral metering valve and bleed line to control the bleed rate from the pump discharge to the over flow connection. The pump motor shall be totally enclosed fan cooled (TEFC), energy efficient (EFF-l) type.

Finish: All basin and casing materials shall be constructed ofG-235 /Super Dynma heavy gauge mill hot-dip galvanized steel. During fabrication, all panel edges shall be coated with a 95% pure zinc-rich compound for superior protection against corrosion.

Accessories:

1. Necessary make-up float valve assembly, float valve, strainer.
2. Hinged door access for maintenance.
3. Electronic water level control system in the basin with a solenoid activated valve in the Make-up water line.
4. Gas/ liquid inlet and outlet valve.
5. Dual safety valve.
6. Isolating valve for pump out.
7. Air purge connection.
8. Pressure gauge with valve.
9. Make-up water connection with necessary fittings.

13,0 Grundfoss /KSB /Eqvt. Make chilled water pumps for chilled water return to ice silos & PHE Pre- Chiller.

Actual Flow: 300 m3/h
Motor Data : Class-I
Efficiency:
No. Of Poles: 2
Frequency: 50Hz
Material of Construction
Casing: CI
Impeller: Bronze
Shaft & mechanical Seal; SS

The pumps shall be close coupled back pullout type split casing pumps.

14.0 4Nos. Grundfos /KSB/Eqvt. Make chilled water pumps for chilled water supply

Actual Flow: 90m^3/h
Motor Data
Efficiency: Class-I Enclosure: IP55
Insulation class: F
Material of Construction

Casing : CI
Impeller: Bronze
Shaft & mechanical Seal: SS

The pumps shall be Close coupled back pullout type split casing pumps.

15.0 Oil rectifier, horizontal type complete within let valves, outlet valves, gauge glass, pressure gauge, safety valve (single), electric heater and hot gas heating arrangement.

The fabrication of the rectifier shall be carried out as per IS code 2825, "Unfired Pressure Vessel - All welded joints shall be 100% radio graphically tested. The radiographic test report from authorized agent shall be submitted to the Purchaser and shown to the Purchasers' Inspection engineer at the time of final inspection before dispatch of the equipment.

Drawing shall be submitted for Purchasers' approval.

16.0 Grundfos / KSB / Eqvt. Make chilled water pumps, for defrost waters upply withflow30*m31h.*

17.0 ISMT / Kalyani/ MSL/ Eqvt make Seamless SA106GeB Pipes complete with fittings and accessories for refrigerant, oil lines etc.

18.0 1 Lot Danfoss / Super freeze Equivalent make refrigerant valves and controls for refrigerant, oil lines, etc.

19.0 ILot TATA /Jindal /Zenith /Eqvt make GI 'B' Class Pipes, valves, fittings and accessories for cooling water, chilled water, make-up water, drain, etc. Suitable for the system.
20.01Lot Audco /BDK/Eqvt make valves for chilled' water, cooling water, drain water lines, etc as per requirement.

21.0 1Lot Lloyds/Beards ell Equivalent make Insitu PUF Insulation for pipes, vessels, equipment, etc as per requirement.

The insulating materials hall be insitu PUFofdensity40kg/m3.

22.0 1Lot Rockwell / Siemens make MCC. Panel for entire plant including VFD's for compressor motors, condenser fan motors, chilled water pumps, condenser fan motors, etc

23.1Lot CCI/POL YCAB / Finolex /Eqvt make Power cables as per requirement.

24.1Lot LAPP Kabel/ CCI / Finolex Eqvt make Control, signal and instrumentation cables as per requirement.

25.1Lot Cable trays, clamps, cable glands, lugs, cable route markers, identification tags, GI conduits, flexible conduits, chequered plates, etc. as per requirement.

26.1Lot Rockwell / Siemens Make Automation / Control system as per requirement.
27.0 1Lot Earthing pit, Earthing conductors and all Earthing. accessories,

28.0 1 Lot Instrumentation as per requirement. .

29.0 1 Lot Safety accessories as per requirement.

30.0 1Lot etc. First charge of ammonia, oil and other consumables, charging hose,

Lubrication oil shall be Kluber Summit/equivalent make.
31. 1Lot GI structure for platforms, mounting arrangement etc.

SECTION - 7

COMMERCIAL BID

COMMERCIAL BID

As per BOQ

SECTION - 8

SECURITIES AND OTHER FORMS

(to be filled by Bidder/Employer)

BID SECURITY (BANK GUARANTEE)

WHEREAS,_____ [name of Bidder] (hereinafter called "the Bidder") has submitted his Bid dated _____[date] for the construction of _____[name of Contract hereinafter called "the Bid"].

KNOW ALL PEOPLE by these presents that We_____ _____ [name of Bank] of_____ _____ [name of country] having our registered office at_____(hereinafter called "the Bank") are bound unto_____[name of Employer](hereinafter called "the Employer") in the sum of_____*for which payment well and truly to be made to the said Employer the Bank itself, his successors and assigns by these presents.

SEALED with the Common Seal of the said Bank this____day of_____,20_ .

THE CONDITIONS of this obligation are :

(1) If after Bid opening the Bidder withdraws his bid during the period of Bid validity specified in the Form of Bid;

OR

(2) If the Bidder having been notified to the acceptance of his bid by the Employer during the period of Bid validity :

(a) fails or refuses to execute the Form of Agreement in accordance with the Instructions to Bidders, if required; or

(b) fails or refuses to furnish the Performance Security, in accordance with the Instruction to Bidders; or

(c) does not accept the correction of the Bid Price in tender Clause.

We undertake to pay to the Employer up to the above amount upon receipt of his first written demand, without the Employer having to substantiate his demand, provided that in his demand the Employer will note that the amount claimed by him is due to his owing to the occurrence of one or any of the three conditions, specifying the occurred condition or conditions.

This Guarantee will remain in force up to and including the date_____** days after the deadline for submission of Bids as such deadline is stated in the Instructions to Bidders or as it may be extended by the Employer, notice of which extension(s) to the Bank is hereby waived. Any demand in respect of this guarantee should reach the Bank not later than the above date.

DATE_____ SIGNATURE _____

WITNESS _____ SEAL_____

_____

_____ [Signature, name and address]

* The Bidder should insert the amount of the guarantee in words and figures denominated in Indian Rupees. This figure should be the same as shown in tender Clause of the Instructions to Bidders.

** 180 days after the end of the validity period of the Bid. Date should be inserted by the Employer before the Bidding documents are issued.

PERFORMANCE BANK GUARANTEE

To

_____[name of Employer]

_____[address of Employer]

_____

WHEREAS _____ [name and address of Contractor] (hereafter called "the Contractor") has undertaken, in pursuance of Contract No. _____ dated _____ to execute _____ [name of Contract and brief description of Works] (hereinafter called "the Contract").

AND WHEREAS it has been stipulated by you in the said Contract that the Contractor shall furnish you with a Bank Guarantee by a recognized bank for the sum specified therein as security for compliance with his obligation in accordance with the Contract;

AND WHEREAS we have agreed to give the Contractor such a Bank Guarantee :

NOW THEREFORE we hereby affirm that we are the Guarantor and responsible to you on behalf of the Contractor, up to a total of_____ _ [amount of guarantee]*_____ (in words), such sum being payable in the types and proportions of currencies in which the Contract Price is payable, and we undertake to pay you, upon your first written demand and without cavil or argument, any sum or sums within the limits of _____[amount of guarantee] as aforesaid without your needing to prove or to show grounds or reasons for your demand for the sum specified therein.

We hereby waive the necessity of your demanding the said debt from the contractor before presenting us with the demand.

We further agree that no change or addition to or other modification of the terms of the Contract or of the Works to be performed there under or of any of the Contract documents which may be made between your and the Contractor shall in any way release us from any liability under this guarantee, and we hereby waive notice of any such change, addition or modification.

This guarantee shall be valid until 90 days from the date of expiry of the Defect Liability Period.

Signature and Seal of the guarantor_____

Name of Bank_____

Address _____

Date _____

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* *An amount shall be inserted by the Guarantor, representing the percentage the Contract Price specified in the Contract including additional security for unbalanced Bids, if any and denominated in Indian Rupees.*

BANK GUARANTEE FOR ADVANCE PAYMENT

To

_____[name of Employer]

_____[address of Employer]

_____[name of Contractor]

Gentlemen :

In accordance with the provisions of the Conditions of Contract, sub-clause 51.1 ("Advance payment") of the above-mentioned Contract,_____ _____[name and address of Contractor] (hereinafter called "the Contractor") shall deposit with _____ [name of Employer] a bank guarantee to guarantee his proper and faithful performance under the said Clause of the Contract in an amount of _____[amount of Guarantee]*_____ [in words].

We, the_____[bank of financial institution], as instructed by the Contractor, agree unconditionally and irrevocably to guarantee as primary obligator and not as Surely merely, the payment to _____ _____[name of Employer] on his first demand without whatsoever right of obligation on our part and without his first claim to the Contractor, in the amount not exceeding _ _____ [amount of guarantee]*

_____[in words].

We further agree that no change or addition to or other modification of the terms of the Contractor or Works to be performed there under or any of the Contract documents which may be made between _____ [name of Employer] and the Contractor, shall in any way release us from any liability under this guarantee, and we hereby waive notice of any such change, addition or modification.

This guarantee shall remain valid and in full effect from the date of the advance payment under the Contract until_____ [name of Employer] receives full repayment of the same amount from the Contractor.

Yours truly,

Signature and Seal :_____

Name of Bank /Financial Institution_____

Address :_____

Date :_____

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* *An amount shall be inserted by the Bank or Financial Institution representing the amount of the Advance Payment, and denominated in Indian Rupees.*

INDENTURE FOR SECURED ADVANCES

(for use in case in which the contract is for finished work and the contractor has entered into an agreement for the execution of a certain specified quantity of work in a given time)

This indenture made the_____day of_____, 20 BETWEEN _____ _ (hereinafter called the contractor which expression shall where the context so admits or implies be deemed to include his executors, administrators and assigns) or the one part and the Employer of the other part.

Whereas by an agreement dated_____(hereinafter called the said agreement) the contractor has agreed.

AND WHEREAS the contractor has applied to the Employer that he may be allowed advanced on the security of materials absolutely belonging to him and brought by him to the site of the works the subject of the said agreement for use in the construction of such of the works as he has undertaken to executive at rates fixed for the finished work (inclusive of the cost of materials and labour and other charges)

AND WHEREAS the Employer has agreed to advance to the Contractor the sum of Rupees_____ on the security of materials the quantities and other particulars of which are detailed in Accounts of Secured Advances attached to the Running Account bill for the said works signed by the Contractor on_____and the Employer has reserved to himself the option of making any further advance or advances on the security of other materials brought by the Contractor to the site of the said works.

Now THIS INDENTURE WITNESSETH that in pursuance of the said agreement and in consideration of the sum of Rupees_____ on or before the execution of these presents paid to the Contractor by the Employer (the receipt where of the Contractor doth hereby acknowledge) and of such further advances (if any) as may be made to him as a for said the Contractor doth hereby covenant and agree with the President and declare as follows :

(1) That the said sum of Rupees_____ so advanced by the Employer to the Contractor as aforesaid and all or any further sum of sums advanced as aforesaid shall be employed by the Contractor in or towards expending the execution of the said works and for no other purpose whatsoever.

(2) That the materials details in the said Account of Secured Advances which have been offered to and accepted by the Employer as security are absolutely the Contractor's own propriety and free from encumbrances of any kind and the contractor will not make any application for or receive a further advance on the security of materials which are not absolutely his own property and free from encumbrances of any kind and the Contractor indemnified the Employer against all claims to any materials in

respect of which an advance has be made to him as aforesaid.

(3) That the materials detailed in the said account of Secured Advances and all other materials on the security of which any further advance or advances may hereafter be made as aforesaid (hereafter called the said materials) shall be used by the Contractor solely in the Execution of the said works in accordance with the directions of the Engineer.

(4) That the Contractor shall make at his own cost all necessary and adequate arrangements for the proper watch, safe custody and protection against all risks of the said materials and that until used in construction as aforesaid the said materials shall remain at the site of the said works in the Contractor's custody and on his own responsibility and shall at all times be open to inspection by the Engineer or any officer authorized by him. In the event of the said materials or any part thereof being stolen, destroyed or damaged or becoming deteriorated in a greater degree than is due to reasonable use and wear thereof the Contractor will forthwith replace the same with other materials of like quality or repair and make good the same required by the Engineer.

(5) That the said materials shall not be any account be removed from the site of the said works except with the written permission of the Engineer or an officer authorized by him on that behalf.

(6) That the advances shall be repayable in full when or before the Contractor receives payment from the Employer of the price payable to him for the said works under the terms and provisions of the said agreement. Provided that if any intermediate payments are made to the Contractor on account of work done than on the occasion of each such payment the Employer will be at liberty to made recovery from the Contractor's bill for such payment by deducting there from the value of the said materials that actually used in the construction and in respect of which recovery has not been made previously, the value for this purpose being determined in respect of each description of materials at the rates at which the amounts of the advances made under these presents were calculated.

(7) That if the Contractor shall at any time make any default in the performance or observance in any respect of any of the terms and provisions of the said agreement or of these presents the total amount of the advance or advances that may still be owing of the Employer shall immediately on the happening of such default be repayable by the Contractor to be the Employer together with interest thereon at twelve per cent per annum from the date or respective dates of such advance or advances to the date of repayment and with all costs, charges, damages and expenses incurred by the **Employer** in or for the recovery thereof or the

enforcement of this security or otherwise by reason of the default of the Contractor and the Contractor hereby covenants and agrees with the **Employer** to reply and pay the same respectively to him accordingly.

(8) That the Contractor hereby charges all the said materials with the repayment to the Employer of the said sum of Rupees_____ and any further sum of sums advanced as aforesaid and all costs, charges, damages and expenses payable under these presents PROVIDED ALWAYS and it is hereby agreed and declared that notwithstanding anything in the said agreement and without prejudice to the power contained therein if and whenever the covenant for payment and repayment here in before contained shall become enforceable and the money owing shall not be paid in accordance there with the **Employer** may at by time thereafter adopt all or any of the following courses as he may deem best :

(a) Seize and utilise the said materials or any part thereof in the completion of the said works on behalf of the contractor in accordance with the provisions in that behalf contained in the said agreement debiting the contractor with the actual cost of effecting such completion and the amount due to the contractor with the value of work done as if he has carried it out in accordance with the said agreement and at the rests thereby provided. If the balance is against the contractor, he is to pay same to the **Employer** on demand.

(b) Remove and sell by public auction the seized materials or any part there of and out of the moneys arising from the sale retain all the sums aforesaid repayable or payable to the **Employer** under these presents and pay over the surplus (if any) to the Contractor.

(c) Deduct all or any part of the moneys owing out of the security deposit or any sum due to the Contractor under the said agreement.

(9) That except in the event of such default on the part of the contractor as aforesaid interest on the said advance shall not be payable.

(10) That in the event of any conflict between the provisions of these present and the said agreement the provisions of these presents shall prevail and in the event of any dispute or difference arising over the construction or effect of these presents the settlement of which has not been here-in-before expressly provided for the same shall be referred to the Employer whose decision shall be final and the provision of the Indian Arbitration Act for the time being in force shall apply to any such reference.

Letter of Acceptance

(Letterhead paper of the Employer)

_____(Date)

To

_____ (Name and address of the Contractor)

_____

_____

Dear Sirs,

This is to notify you that your Bid dated_____for execution of the _____ (name of the contract and identification number, as given in the Instructions to Bidders) for the Contract Price of Rupees _____(_____) (amount in words and figures), as corrected and modified in accordance with the Instructions to Bidders[1] is hereby accepted by our agency.

We accept/ do not accept that_____be appointed as the Adjudicator[2]. Your are hereby requested to furnish Performance Security, in the form detailed in Para 34.1 of ITB for an amount equivalent to Rs. _ _____ within 21 days of the receipt of this letter of acceptance valid up to 28 days from the date of expiry of defects Liability Period i.e. up to_____ and sign the contract, failing which action as stated tender clause.

Yours faithfully,

Authorized Signature Name and title of Signatory

Name of Agency

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[1] *Delete "corrected and" or "and modified" if only one of these actions applies. Delete as corrected and modified in accordance with the Instructions to Bidders, if corrections or modifications have not been affected.*

[2] *To be used only if the Contractor disagrees in his Bid with the Adjudicator proposed by the Employer in the "Instructions to Bidders".*

Issue of Notice to proceed with the work

(Letterhead of the Employer)

_____(Date)

To

_____(Name and address of the Contractor)
_____
_____

Dear Sirs,

Pursuant to your furnishing the requisite security as stipulated in ITB Clause 34.1 and signing of the Contract for the construction of
_____
_____at a Bid Price of Rs._____.

You are hereby instructed to proceed with the execution of the said works in accordance with the contract documents.

Yours faithfully,

(Signature, name and title of signatory authorized to sign on behalf of Employer)

UNDERTAKING

I, the undersigned do hereby undertake that our firm M/s _____agree to abide by this bid for a period

_____days for the date fixed for receiving the same and it shall be binding on us and may be accepted at any time before the expiration of that period.

_____

(Signed by an Authorised Officer of the Firm)

_____

_____

Title of Officer

_____

Name of Firm

***