

**Inviting Bids from eligible Firms/Agencies/Individuals for Design,  
Supply, Installation, Testing and commissioning of Cold Store &  
Incubation room**

**INVITATION FOR BID (IFB)**



**January 2025**





# The West Assam Milk Producers' Co-operative Union Ltd.

## PURABI DAIRY

### INVITATION FOR BID

WAMUL/LMP/Cold Store & Incubation room/2024-2025/02

Dated: 22-01-2025

Sub: Inviting Bids from eligible Firms/Agencies/Individuals for Design, Supply, Installation, Testing and commissioning of Cold Store & Incubation room.

West Assam Milk Producers' Cooperative Limited (WAMUL) is pleased to invite eligible Firms/Agencies/Individuals for the purpose as detailed below:

Sl No.	Brief Description of works	BOQ	Technical Specification	Location	Delivery/ Completion Time
1.	Design, Supply, Installation, Testing and commissioning of Cold Store & Incubation room	Attached as Annexure- I	Attached as Annexure- II	WAMUL (Purabi Dairy) Panjabari, Guwahati- 781037	30 days from the date of issue of Purchase Order

#### **Schedule of bidding:**

The bidding shall be done on the basis of the following timelines:

Sl. No.	Particulars	Date	Time
1.	Commencement of publishing of Tender	22.01.2025	12.00 HRS
2.	Last date of submission of bid	05.02.2025	12.00 HRS
3.	Date of bid opening	05.02.2025	12.30 HRS

#### **Terms and Conditions**

##### **1. Eligibility criteria of the bidder**

The Purchaser shall assess each Bid against the following Qualification Criteria.

- The bidder should be in the business in same name & style from past 3 (three) years.
- The bidder should be a manufacturer (Relevant document which proves that the bidder is a manufacturer e.g Incorporation certificate, MSME or any other relevant documents proves that the party is a manufacturer) and in case of Dealer, the dealer should submit authorization certificate of manufacturer.
- The bidder's average Financial Turnover should be minimum of Rs.1.50 Crore in the last three financial years ending 31st March (FY 2021-22, 22-23, 23-24 or 22-23, 23-24, 24-25 & years should be consecutive). Relevant document required (Audited balance sheet or Chartered Accountant certified copy having valid UDIN no).



R.K. Jyoti Prasad Agarwala Road, Panjabari, Guwahati- 781 037

E-mail: purabimilk@gmail.com • Website: www.purabi.org, GST No. 18AAAJW0070G1Z6

- iv. The bidder should have completed minimum of 3 contracts for same works in the last 3 financial years mentioned herein FY 2021-22,22-23,23-24 or 22-23, 23-24, 24-25 having value equal or more than 30 Lakhs (Relevant documents required: relevant P.O copies along with satisfactory work completion certificates or equivalent)
- v. The bidder should have valid GST registration certificate (Certificate required).
- vi. MSME documents if applicable.

**2. Earnest Money Deposit:** The Bidders shall submit EMD amounting to **Rs. 30,000/-** in the form of Bank Draft in favor of "West Assam Milk Producers Cooperative Union Limited" payable at Guwahati. If the bidder is not earnest about the bid, then the bid security is liable to be forfeited.

**3. Performance Security:** The successful bidder shall furnish to the WAMUL a performance security of **10%** of the contract value in the form of Bank Guarantee or a Bank Draft from any Nationalized/Scheduled Bank in favor of "West Assam Milk Producers Cooperative Union Limited", payable at Guwahati within 30 days after the issue of Work and shall be valid for one year from the date of completion of work. The Performance Security furnished by the successful bidder will be retained by the office up to 60 days after expiry of Performance Obligation Period/PBG. The PBG held by the office till it is returned to the successful bidder will not earn any interest.

**4. Delivery and installation period:** within 30 days from the issue of purchase order.

**5. Payment terms:** 100% payment will be made within 30 days from the date of completion of the Design, Supply, Installation, Testing and commissioning of Cold Store & Incubation room and subject to the certification of the bills by the competent authority.

**6. Validity of the Bids:** Bids must be valid for 120 days from the due date of submission. The rates quoted by the bidder shall be fixed for the duration of the contract and shall not be subject to adjustment on any account.

**7. Liquidated Damages:** If the bidder fails to deliver any or all the goods or perform the services within the time period(s) specified in the purchase order/contract, the WAMUL shall, without prejudice to its other remedies under the purchase order/contract, deduct from the purchase order/contract price, as liquidated damages, a sum equivalent to the following clauses which is applicable as per Order.

- b) 0.5% of the full contract value for each completed week of delay.

The total amount so deducted shall not exceed 10% of the purchase order/contract value. Once the maximum is reached, the WAMUL may consider cancellation/termination of purchase order/contract, and forfeiture of performance/ deposit bond.





## **8. Price Bid**

8.1. The Prices shall be quoted in Indian Rupees only.

8.2. Each bidder shall submit only one Bid. Bidder shall not contact other Bidders in matters relating to this Bids

### **8.3. Documents:**

#### **i) The Technical Part of Bids shall comprise the following:**

a) Letter of Bids – Technical Part Comprises of all relevant documents as mentioned at point 1 of eligibility criteria of the bidder.

b) Complete address and contact details of the Bidder having the following information:

- Name of Firm:
- Address for communication:
- Telephone No(s) Office:
- Mobile No:
- Electronic Mail Identification (E-mail ID):

#### **ii. The Financial Part of Bids shall comprise the following:**

(a) Price Schedule as per specified format (BOQ) Attached as Annexure-II.

## **9. Evaluation and Award of Contract:**

9.1. The Purchaser will evaluate on overall basis and compare the Bids of the responsive bidders only to be responsive i.e. which are properly signed; and Conform to the terms and conditions, and specifications

9.2. **The Bids would be evaluated for complete set/works to be executed under this IFB.**

9.3. GST, charges in connection with the services shall be taken into account in evaluation.

9.4. The Purchaser will award the contract to the bidder whose Bid has been determined to be responsive and who has offered the lowest evaluated Bids price.

9.5. Notwithstanding the above, the Purchaser reserves the right to accept or reject any Bids and to cancel the bidding process and reject all Bids at any time prior to the award of contract.

9.7. The bidder whose bid is accepted will be notified of the award of contract by the Purchaser prior to expiration of the Bids validity period. The terms of the accepted offer shall be incorporated in the supply order.

**10. Warranty:** 12 months from the date of commissioning.





**11. Freight charges or any other charges:** Freight charges or any other incidental charges should be included in the BOQ.

**12. Cancellation of Contract:** WAMUL shall be free to cancel the order either in full or in part, in the case of non-delivery/ non-completion of execution within the stipulated completion period.

**13. Rejection:** WAMUL reserves the right to reject the goods either in part or full if at the time of delivery, it is noticed that the services provided do not conform to the specifications/description given in the purchase order

**14.** For any dispute/legal issues, the jurisdiction is at Guwahati Only.

Bids can be submitted in person on or before the due date and time specified above. Such Bids should be dropped in the tender box only kept at the Office of the "West Assam Milk Producers Cooperative Union Limited," Juripar Panjabari-Guwahati-781037.

Alternatively, the bidder can submit the Bids by registered post so as to reach the above address on or before the due date and time specified above. Bids received after due date and time will not be considered and WAMUL shall not be liable or responsible for any postal delays.

The completed IFB document duly signed on all the scanned signed pages by WAMUL should be submitted by the bidder along with the offer letter.

The bidder should submit the bids (technical bid along with all the required supporting documents and the financial bid in the designated format mentioned in Annexure-I) in two (02) separately sealed envelopes and then insert them in a single large envelope duly sealed and shall address to on or before last date of submission of bid.

Sd-

**Managing Director**

**West Assam Milk Producers'  
Cooperative Union Limited  
(Purabi Dairy),**



## Annexure-1

## BOQ for Incubation Room &amp; Curd cold store

Sl. No.	Item	Capacity/Specification	Approx Quantity	Basic Rate (In Rs)	P&F, Freight or other incidentals (if applicable) (In Rs)	GST	Unit Rate Incl GST (In Rs)	Total Amount (Incl GST & All) In Rs
1	Forced Draft Cooler (DX Type)(2 w & 1 sb)	15,000 kcal/hr, Evaporating Temp: -5°C, Room Temp: 0°C, Freon Refrigerant DX System	3 Sets					
2	Incubator Heater	5KW	3 nos					
3	Floor Insulation	PUF Slabs, 80 mm (2 Layers, 40 mm each)	100 Sqm					
4	Ceiling/Wall Insulation	Prefabricated PUF Panels, 80 mm Thickness	300 Sqm					
5	Sliding Doors (Cold Store)	SS 304, 80 mm PUF, Clear Opening: 1.5 m x 2.1 m	2 Nos					
6	Sliding Doors (Incubation Room)	SS 304, 80 mm PUF, Clear Opening: 1.2 m x 2.1 m	1 No					
7	Air Curtain with Limit Switch	For Doors (1.5 m x 2.1 m & 1.2 m x 2.1 m)	2 Nos					
8	Air Shield Curtain (PVC Strips)	For Sliding Doors	1 Lot					
9	Pipes, Valves, Fittings (Freon)	For Refrigerant & Oil Lines, with Future Expansion Provisions	1 Lot					
10	Water/Drain Pipes, Valves, Fittings	As per Requirement	1 Lot					
11	Power, Control & Signal Cables	Includes Cable Tray, Accessories, etc.	1 Lot					
12	Refrigeration Plant Controls	Freon System Instruments, Control Panel	1 Lot					
13	Internal Electrification	10 Moisture-Proof Lights, IP-65 MCB Controls	1 Lot					
14	Service Cover	For 1 Year	1 job					
<b>Grand Total</b>								





## Annexure-II

### Introduction

This tender document outlines the technical specifications and scope of work for the Freon-based refrigeration system for cold stores, including PUF insulation works, cold stores, and the incubation room at Purabi Dairy, Guwahati. The document provides guidance to bidders and defines the responsibilities and deliverables required for the successful completion of the project.

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#### 1. Introduction

This section details the requirements for the refrigeration plant and associated works. Specific site details and layout plans are attached for reference. The successful bidder shall ensure adherence to high standards of engineering and workmanship, maintaining compliance with statutory requirements.

#### 2. Scope of Work

The scope of work includes but is not limited to:

1. **Design and Supply:**
  - o Design and supply new Freon-based refrigeration systems, including cold store and incubation items as per the schedule.
2. **Installation and Commissioning:**
  - o Labour charges for installation, testing, and commissioning of respective items.
3. **Service Cover:**
  - o Maintenance and service cover for the refrigeration plant for one year from the date of successful commissioning.

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### 3. Technical Specifications

#### Refrigeration System

- The plant shall operate on Freon-based refrigerants, ensuring energy efficiency and minimal environmental impact.
- The design must facilitate round-the-clock operation for 365 days, adhering to relevant IS/ASHRAE standards.

#### PUF Insulation

- High-quality PUF panels with a density of 38-40 kg/m<sup>3</sup>, ensuring thermal conductivity below 0.023 W/mK.
- Panels must be CFC-free and manufactured using high-pressure foam injection equipment.

#### 4. Design Basis

1. Compliance with relevant IS, ASME, and international standards.
2. Energy-efficient, cost-effective design with a minimum life span of 15 years.
3. Highest safety standards and minimal maintenance requirements.

#### 5. Construction Requirements

1. **Accessibility:**
  - Easy access for maintenance and servicing.

#### 6. Equipment Specifications

##### Evaporators (Forced Draft Coolers)

1. **Design:**
  - Copper tubes with aluminum fins and dynamically balanced axial fans.
2. **Defrosting:**
  - Electric defrost for deep freeze applications and water defrost for above 0°C cold rooms.
3. **Drainage:**
  - Self-draining design with insulated drain trays.

#### 7. Piping and Insulation

1. **Materials:**
  - Copper tubes for refrigerants and galvanized steel for water lines.
2. **Insulation:**
  - Closed-cell elastomeric foam for all piping, ensuring no condensation and minimal thermal loss.
3. **Installation:**
  - Adherence to standards for pipe supports, anchors, and thermal expansion accommodations.

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## 8. Electrical Works

1. **Control Panels:**
  - Design, supply, and installation control instruments, and safety interlocks.
2. **Power Supply:**
  - All motors shall be IP55 protected with premium efficiency.
3. **Cabling:**
  - Use of armored copper cables for all power and control systems.

## 9. Safety Systems

1. **Freon Leakage Detection:**
  - Installation of sensors and alarms for early detection and alert systems.
2. **Personnel Safety:**
  - Emergency lighting, exit signs, and distress alarms integrated with the UPS system.

## 10. Documentation and Training

1. **Manuals:**
  - Submission of operation and maintenance manuals.
2. **Training:**
  - Onsite training for operators and maintenance staff.
3. **As-Built Drawings:**
  - Detailed engineering drawings post-completion.

## 11. Bidder Responsibilities

1. Provide all tools and consumables for commissioning and maintenance.
2. Conduct performance trials and ensure compliance with tender specifications.

## 12. Completion Timeline

The entire project, including installation and commissioning, must be completed within two months from the issuance of the purchase order.

## 13. Utilities for Installation

1. **Water:** Provided free of charge at one site point.
2. **Electricity:** Provided free of charge at one site point.

## 14. Annexures

1. **Appendix-1:** Site Layout and Equipment Placement.
2. **Appendix-2:** Design Basis and Detailed Specifications, PUF Panel and Insulation Requirements.
3. **Appendix-3:** Battery Limits, Schedule of major items

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## 1. Scope of Work: -

The scope of this contract shall include, but not limited to design, manufacture, supply, install, test and commission the complete cold store & incubation system as per requirement indicated in the basis of design and the Schedule of major items required for the proposed plant as listed at the proposed location, within the battery limits. The scope of work also includes following;

- Design, supply, install, test and commissioning of ACU/FDCs with copper tubing installation, condenser water piping as per requirement and schedule.
- Design, supply, fabricate, install, test and commission all the copper tubing's, pipelines, valves, fittings and ancillaries pertaining to refrigeration system, make-up/drain water lines, , oil drain piping, insulation of piping/vessels etc. as per the schedule of requirements and specification.
- Design, supply, installation, testing and commissioning of the Motor Control Centers, RCP's, control instruments, safety systems, interlocking, automatic power factor correction panel, active harmonic filter panel, etc. as per requirement and specification.
- Design, supply, install, test and commission the Automation system hardware & software, data logging, power/ control/instrumentation/communication cabling, safety systems, interlocking, etc. as per requirement and specification.
- Design, supply, fabricate and install all the pipe supports, maintenance platform, access ladders, railing, etc. wherever required for the entire work.
- Providing required top-up of refrigerant, lubricating oil (including first change, as required by compressor manufacturer after 100 hrs of operation or as per schedule recommended by OEM) and all consumables as required for initial testing, commissioning and subsequent trial runs. Minimum refrigerant charge considered as well as supporting calculation is to be mentioned in the offer.
- Providing special tools and tackles necessary to carry out regular maintenance of various system components.
- Conduct performance trial of the plant as per requirement after commissioning and establish the rated performance of the plant.
- Providing as-build drawings, detailed operation and maintenance manuals.

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- Impart training to the operating personnel in systematic operation and maintenance of the complete plant and its components in efficient and safe manner.

## **2. Design basis:**

The basis for design of the plant is provided in Appendix-2. The refrigeration plant /incubation room shall be designed for reliable and continuous, round the clock operation for all 365 days of the year, in accordance with following requirements;

- Comply with relevant codes and standards indicated in the tender.
- Energy efficient, cost economical and simple to operate and maintain
- Comply with highest level of safety standards.
- Comply with statutory requirements.
- Useful working life of over 15 years.

## **3. Construction:**

### **3.1 Accessories**

- Easier access to be provided to provide easy access to the unit interior for servicing.
- Evaporative condenser shall be provided with extended lubrication lines with standard grease fittings for lubricating the fan shaft bearings from the outside base of the condenser.
- Evaporative condenser shall be provided with a field-installed external platform with an access ladder and handrails to provide access to the top of the evaporative
- Electronic Water Level Control system mounted in the basin with a float valve in the make-up water line.
- Air Inlet Screens over the inlet louvers and the spray distribution system to prevent debris from entering the unit.

**3.2** Refrigeration system bidder shall provide necessary layout drawings with static/dynamic load of the condensers to design the roof slab suitably.

### **3.3 Fittings and Mountings:**

To provide:

- Liquid inlet with weldable valve.
- Dip pipe for liquid outlet with valve.
- Drain pocket with bottom-plugged socket, with valve oil drain connection.
- Dual Safety valve branch with 2-position change-over valve and 2 Nos. safety valves. Simultaneous closing of both branches must not be possible. The safety valve selection/ set pressure to be between the operating pressure and design pressure of the vessel.
- Gauge glass having branches incorporating glass failure shut-off and isolating valves. Provide secure and substantial protection to the gauge glass.
- System charging valve which may be of type combined with item 7.6
- Pressure transmitter tapping with valve and pressure transmitter.
- Pressure gauge tapping with valve and pressure gauge.

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- Purge connections, valve, 2 Nos.
- Valve and plugged pump-out connection.
- Saddle supports.
- Equalization connection tapings with valve for both liquid & vapor phases.

#### **4.0 EVAPORATORS (FORCED DRAFT COOLERS)**

##### **4.1 Function:**

Evaporators or Forced draft cooler is of direct dry expansion type evaporator. The evaporators shall be used to maintain the desired temperature of rooms with the help of high velocity fans which shall ensure proper and complete circulation of air within the cold stores & pre-cooling room etc. The unit shall work in conjunction with respective rack system or water-cooled packaged type condensing unit to which it shall be connected with. The evaporator and respective rack system or water-cooled packaged type condensing unit shall work automatically based on room temperature with the help of thermostat of appropriate range and type.

The refrigerant piping/tubing to be insulated as per Clause 17.2.1.

##### **4.2 Duty:**

The duties of respective units are scheduled in Appendix-2.

##### **4.3 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 copper tubes with Aluminum fins.**

Fin spacing shall be:

Cold store - Not less than 8 mm (3 FPI)

Parallel coils shall be supplied with refrigerant liquid through fixed metering orifices from the liquid supply header to ensure even distribution.

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The casing shall be of made of PCGI sheet. Refrigerant coils and defrost piping shall be fixed to substantial bearers. The manufacturer is responsible, through the Bidder, to ensure that no rattles /vibrations occur when the unit is operating.

Induced draft (draw through) fans shall be axial, directly coupled to motors. Belt drives are not acceptable. Fans and motors shall be dynamically balanced. Fans made of Polyamide glass fibre reinforced material are acceptable. Fan and motor assemblies shall be resiliently mounted and effectively guarded. The fan design/RPM shall be in such a way that the operating noise level is bare minimum. Motors and bearings shall be suitable for operation at an ambient temperature of -5 Deg.C and motors shall have degree of protection IP55 or better and of **premium efficiency (IE3)**.

The drain tray shall be of heavy gauge galvanized sheet, cross broken to provide falls, and arranged to intercept condensation from the casing and designed to avoid splashing of water inside cold room defrosting, as well as with adequate slope towards drain water outlet. The tray shall be insulated to intercept condensation from the casing. The outlet shall be vertical.

The evaporators required shall be of ceiling suspended specifically intended to operate with suitable refrigerant in conjunction with the respective condensing unit located outside (preferably over the terrace). Fixing of the unit shall be by adequate number of suspension rods attached to substantial lugs on the casing.

Water defrosts spurge pipes and header shall be provided, arranged to be self-draining. This provision is required for cold room units (above 0 Deg. C). **For cold rooms & ante-room, unit shall be provided with off-cycle type defrosting arrangement.**

For units meant for **pre-cooling rooms and deep Freeze application** shall be provided with high efficiency fast automatic timer-based **electric defrost arrangement**. The heater shall slide into deep slopes provided in the finned surface of the coil and easily removable when servicing is required.

Also, the Deep freeze FDC units shall be provided with heater elements for drain tray. Heater elements for the coils & tray shall be easily accessible. The system includes solenoid valves, pressure regulation valves, pressure gauge, timers and other necessary items required.

#### **4.4 Defrost Water Drain Piping:**

Post defrosting (Off cycle or Electric) defrost water shall be drained. For a particular cold store, pre-cooling room a drain points of all the FDCs is to be made common and that common drain header shall be connected to one of the 'Amul trap' inside the room.

For deep freeze room drain header shall be taken out of the room and connected to nearest drain / Amul trap.

All water drains pipeline(s) inside low temperature zone (deep freeze) shall be electrically heat traced, with thermostatic controls and insulated. The defrost water assembly shall be generally as detailed and subject to approval.

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## **Connections:**

- To the drain, with a funnel and water "U" seal of approved construction, outside low temperature area. "U" seal also to have provision for drain at its lowest point with suitable valve.
- All pipe work shall be self-draining.

## **4.5 Installation:**

Suspension members for the units shall incorporate a thermal break within the thickness of the insulation. The detailed arrangement and supply of this is the responsibility of the Bidder, subject to approval, who shall co-operate with the insulation fixer in installing these items. Suspend the evaporators, level and lock suspension nuts.

## **Pipe Connections:**

To each evaporator supply and install a liquid feed assembly with service valves as per the functional requirement and shall ensure proper oil return.

**Wall penetrations:** Piping and electrical services penetrating the wall shall be designed and installed:

- To avoid forming a thermal bridge from outside to inside that could cause sweating on the outside.
- To prevent infiltration of air.
- To preserve the integrity of the insulation vapour barrier.
- The arrangements for this shall be subject to approval, and the work shall be executed in co-operation with the insulation fixer.

## **5.0 MATERIAL OF CONSTRUCTION FOR PIPING AND EQUIPMENT VESSEL:**

### **5.1 Requirement:**

All connections of Refrigerant piping shall be in high grade Copper of Refrigeration quality with Eddy Current Testing and material test Certificates.

All connections, tees, reducers etc. shall be standard make fittings.

Insulation of cold lines shall be carried out with closed-cell elastomeric foam insulation sheets (as per preferred list of makes) and tubes of appropriate thickness so that condensation does not occur.

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For individual Piping 50 / 100 mm wide Aluminum Tape shall be used at joints of Piping with Bands for identification.

For outdoor piping, the finish shall be Glass clothe with coloured Epoxy/ UV resistant paints to withstand outside ambient conditions and UV Radiation.

For Copper pipe sizing of supply and wet return for the packaged type units will be subject to approval and will be as per relevant IS / ASHRAE codes.

**Design:**

The detailed design and material of construction of the piping for various applications shall be the responsibility of the Bidder. The alternate material as proposed by the Refrigeration Bidder shall be approved by the Purchaser during the detailed engineering stage subject to Bidder provides certificate from the Bidder/Manufacturer that all material selected are satisfactory for the duty requirement/relevant codes.

**5.2 Materials:**

Piping for the respective services as required by the Purchaser shall be:

Service	Material	Specification
PIPING:		
Refrigerant piping (for minus 20 Deg C and below)	Copper Tube	TYPE-K* & TYPE-L* OR As per ASME B280
Evaporative condenser tube	Steel pipe (seamless)	ASME B31.5 compliant
Water circulating pipelines / chilled water lines (up to 150 NB )	Galvanized steel (ERW) medium duty class B	IS 1239 ( ERW – GI class "B")
Water circulating pipe-lines / chilled water lines (up to 200 NB and higher)	Galvanized steel (ERW) medium duty class B	IS 3589 – ERW GI class B
Make up water supply, bleeds, drains, defrosting water, etc.	Galvanized steel (ERW) medium duty class B	IS 1239 / 3589, Medium duty /GI class B

**NOTE: ALL REFRIGERANT, OIL PIPING, THE BIDDER MUST USE "SEAMLESS COPPER TUBE FOR AIR CONDITIONING AND REFRIGERATION FIELD SERVICE" AS PER INTERNATIONAL STANDARD DEPENDING ON SIZE OF PIPE.**





### 5.3 Valves:

Manually operated isolating valves and check valves shall be of types:

Service	Material	Specification
Refrigerant	Ferrous, globe, lift check.	IS:11132 or relevant ASME/DIN/IIAR standards
Cooling water: Over 75 mm, 50mm & Below	CI, butterfly, CS ball valve	IS :778, 1703
Water supply, bleeds, and drain	Cast steel ball valve	IS:778
Chilled water –supply and return lines	Butterfly Valve Swing check	IS :778
Defrost water –supply and return	Cast steel ball valve	IS :778

ALL water line VALVES ABOVE 50 MM SHALL BE OF FLANGED CONSTRUCTION.

ALL WATER VALVES OF 50 MM. AND BELOW MUST BE BALL VALVES WITH CAST STEEL BODY, SS WORKING PARTS, 3 SECTION TYPE, WELDABLE END TYPE.

### 5.4 Equipment Vessel:

Service	Material	Specification
HP receiver, oil separator, economizer, priority vessel, LP accumulator (NH3), Oil rectifiers, Oil collection vessels & tanks, (up to minus 10 Deg C application)	Steel plates	IS:2002/SA516, Gr 70 and IS:2825 Class-I
LP accumulator, oil vessels, etc. for below Minus 20 Deg C application	Steel Plates	SA 516, Gr 70, and IS:2825 class-I

### 5.5 Installation:

Special Conditions of Contract Part IIIA clause 3.0 shall apply.

Pipe supports supplied and installed within the plant room shall be adequate to accommodate other services piping, if any, entering the room. Installation drawings shall be approved, clause 21. All outdoor supports shall be MS duly galvanized.

In lines subject to thermal expansion, anchors shall be provided at approved locations and hangers and supports adjusted to be fair when the line is in working condition.



## 5.6 Particular Requirements:

### 1. Refrigerant suction

The wet return line shall be laid to fall to the respective "liquid accumulators" (pump separator) wherever a rise in the direction of flow is necessary, it shall be achieved with a "lifting trap" at the low point. Any rise of over 3m shall "include a lifting trap/leg at each 2m interval" branches entering the suction main shall do so only at the top.

The size of the main headers such as suction, wet return and discharge line of high stage and suction and discharge line of low stage shall be selected for operation of all the compressors mentioned in the specification including standby compressor as well as one more compressor of similar capacity proposed to be installed in future in the high/low stage.

### 2. Refrigerant hot gas

Hot-gas lines should be designed to have-

- Avoid trapping oil at part-load operation
- Prevent condensed refrigerant and oil in the line from draining back to the head of the compressor
- Have carefully selected connections from a common line to multiple compressors
- Avoid developing excessive noise or vibration from hot-gas pulsations, compressor vibration, or both

### 3. Liquid drain

The refrigerant liquid drain system from the condensers to the liquid receiver shall grade down to the liquid receiver. Relative height at which the condenser installation to achieve gravity flow is to be determined by the Bidder.

### 4. Refrigerant valves

UNLESS OTHERWISE DIRECTED OR APPROVED, ALL VALVES SHALL BE INSTALLED WITH SPINDLES HORIZONTAL. **Oil drain / purging valves shall be spring loaded, self-closing type.**

### 5. Water supply

Mains water will be supplied by Purchaser at one point near process hall inside the dairy as described in the Battery Limit: Appendix-4. Distribution from this point is the responsibility of the Bidder.

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**6. Cooling water and chilled water drains**

Drain lines will be installed from the locations to the nearest drain. Connections shall be made to this to receive:

Overflow, Drains including pump wells. Bleed as appropriate, from the cooling and chilled water systems.

**7. Flow switches**

In each of the condenser cooling water supply pipelines, provide and install a "flow switch". The make and type of these switches shall be subject to approval.

**8. Pressure Transmitter**

On the Low Pressure Accumulator Vessel provide and install a modulating pressure transmitter of the type specified and rated for the operating pressure.

**9. Compressor head water-cooling**

Not applicable.

10. Outdoor piping: Piping comprising: Refrigerant lines to condensers/Priority vessel/receiver, cooling/make-up water piping.

ALL OUTDOOR PIPING SHALL BE MOUNTED AND SUPPORTED ON STRUCTURAL STEEL MEMBERS, HOT DIP GALVANISED AFTER FABRICATION. DRAWINGS SHALL BE APPROVED.

11. Insulation

Pipelines operating below ambient temperature shall be insulated and aluminum cladded.

12. Vents

All refrigerant safety valve vents shall be piped outdoors to a place of safe discharge, and the vent outlet shall be of vermin proof (protected from obstruction).

13. Galvanization of MS Surfaces

In case of hot dip galvanization wherever specified in the tender specification, the minimum zinc coating required is 75 to 80 microns uniform thickness all around the surfaces.

In case of spray galvanization wherever specified in the tender specification, the minimum zinc coating required is 120 to 125 microns' uniform thickness all around in surfaces.

14. Soldering of Copper refrigerant lines

Soldering Copper and Copper Alloy Tube and Fittings Using a Manual Air-fuel Torch and ASTM B 828 Procedure is to be carried out as under-

First a test solder joint to be made with the same material as to be used for actual piping. The tube and fitting for the test solder joint shall be fabricated in the horizontal position.





- Filler Metal: Filler metals shall meet the requirements of Table 5 of the latest revision of ASTM B 32, Standard Specification for Solder Metals. Filler metals shall contain less than 0.2% lead (Pb). Filler metals shall be stored in accordance with manufacturer's recommendations.
- Soldering Flux: Soldering fluxes shall be in accordance with the requirements of ASTM B 813, Standard Specification for Liquid and Paste Fluxes for Soldering Applications of Copper and Copper Alloy Tube and Fittings.
- Joint Design and Tolerances: Joint type shall be socket/lap. The minimum and maximum joint clearance/capillary space shall be 0.002" to 0.010". Lap (overlap) shall meet the dimensional requirements of the latest revisions of ASME/ANSI B16.22 Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
- Cutting: Cut tube ends square. Cutting process shall be performed in a manner that prevents tube ends from being deformed. If a tube cutter is used, it shall be free of oil, dirt, lint and other debris. The cutter wheel(s) shall be sharp and the rollers free-rolling.
- Reaming: Ream all tube ends to the original I.D. of the tube to remove the small burr created by the cutting operation. Care shall be exercised to insure that no shavings are left in the tube.
- Cleaning: Surface oxidation on the I.D. of the fitting shall be removed with an appropriately sized fitting brush or abrasive cloth. Surface oxidation on the O.D. of the tube ends shall be removed with a wire brush or abrasive cloth for a distance slightly more than the depth of the fitting cup. **Steel wool shall not be used.**
- Fluxing: Apply a thin even coating of flux with a brush to both tube and fitting as soon as possible after cleaning.
- Assembly and Support: Insert tube ends into the fitting cup, making sure that the tube end is seated against the base of the fitting cup. Support the tube and fitting assembly to insure an adequate capillary space around the entire circumference of the joint.
- Post-solder cleaning: When the joint is cool to the touch, the outside shall be cleaned using a damp cloth to remove any remaining soldering flux and allow a clear visual inspection of the joint.
- Visual examination: The finished joint shall be visually examined. The following conditions shall be considered unacceptable according to this specification:
  - Drips of excess solder on the outside of the tube and/or fitting
  - Cracks in the tube or fitting
  - Cracks in the solder filler metal

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## **Welding:-**

- All the refrigeration vessel in the system such as oil separator, thermos-siphon vessel, receiver, pump separator (LP accumulator) must be considered as class I vessel according to IS 2825 or equivalent British or American code and all weld joints must be tested for 100% radiography.
- Oil drain /purge valve:
  - All oil drain valves, vent/purge valves open to atmosphere shall be of spring loaded self-closing valves
- Access platforms
  - Access platforms with ladder shall be provided for easy access of instruments, valves and actuators, where the same were not located at convenient locations.

## **6.0 INSULATION**

Insulation for pipelines and equipment shall be carried out as per special conditions of contract with suitable thickness.

### **6.1 Refrigerant Suction, wet return and Cold Liquid Lines:**

Thermal insulation material for Pipe insulation shall be closed cell Elastomeric non Polar-Anti Microbial-UV resistant – UL94 – Class O and Nitrosamine free EPDM covered by UV resistant Armachek silver 350 or equivalent durable multi-layer material suitable outdoor installation. Insulation thickness shall be in such way that thermal losses minimized and no sweating during monsoon climatic conditions.

EPDM of Thermal conductivity as per **BS 874 part 2 – 86 (DIN 52613 52612)** of the insulation material shall not exceed 0.038 W/m<sup>2</sup>K at an average temperature of 30°C.

Density of the nitrile rubber shall be 40-60 Kg/m<sup>3</sup>.

The product shall have temperature range of – 40 °C to 105 °C.

The insulation material shall be fire rated for Class 0 as per BS 476 Part 6: 1989 for fire propagation test, smoke density shall be 25/50 as per ASTM E 84 and for Class 1 as per BS 476 Part 7, 1987 for surface spread of flame test.

Water vapor permeability shall be not less than 0.024 per inch (2.48 x 10<sup>-14</sup> Kg/m.s.Pa i.e. μ<sub>v</sub>≥7000: Water vapor diffusion resistance) **as per DIN 53122 part 2, DIN 52615.**

Product shall be FM Global approved. **Each lot of insulation material delivered at site shall be accompanied with manufacturer's test certificate for thermal conductivity values,**





**density, water vapour permeability and fire properties.** Samples of insulation material from each lot delivered at site may be selected by Owner's site representative and gotten tested for thermal conductivity and density at Contractor's cost.

**MINIMUM THICKNESS OF CLOSED CELL ELASTOMERIC EPDM RUBBER for COPPER PIPE INSULATION**

<b>Pipe nominal bore</b>	<b>Thk. for non-coastal places</b>	<b>Thk. for coastal places</b>
15 mm – 25 mm	19 mm	25 mm
32 mm – 80 mm	25 mm	32 mm
100 mm – 400 mm	32 mm	38 mm
Above 400 mm	45 mm	45 mm

Above data is based on Average condition and shall be modified to suit the individual technical requirement.

The insulated pipelines shall be supported using polymeric rigid foam hanger with rubber foam tape inner-lining, which absorbs vibration of operating pipelines. The outer cover consists of flame retarding rubber tape, which seals the hanger completely after installation in order to prevent moisture penetration and condensation problems.

**6.2 Application Process:**

The procedure for application described below:

- All Pipe surfaces shall be free from dirt, dust, mortar, grease, oil, etc.
- Insulating material in tube form shall be sleeved on the pipes.
- Adhesive must be allowed to tack dry and then press surface firmly together starting from butt ends and working towards center.
- Wherever flat sheets shall be used it shall be cut out in correct dimension. All longitudinal and transverse joints shall be sealed as per manufacturer recommendations.
- The insulation shall be continuous over the entire run of piping, fittings and valves.
- All valves, fittings, joints, strainers, etc. in the piping shall be insulated to the same thickness as specified for the main run of piping and application shall be same as above. Valves bonnet, yokes and spindles shall be insulated in such a manner as not to cause damage to insulation when the valve is used or serviced.
- Outer covering of the insulation with Armachek silver 350 or equivalent durable multi-layer material. The same should be properly applied and secured as per the instruction of insulation manufacturer.





- Adhesive used for sealing the insulation shall be non-flammable, vapour proof adhesive strictly as per manufacturer's recommendations
- All ancillary accessories required for the insulation and the adhesive to be used and the detailed Application specifications shall be as per the manufacturer's recommendation.
- Never insulate plants and systems that are in operation! Only start insulated plants after 36 hours. Only after elapsing of this timeline the adhesive is fully cured.
- The insulation manufacturer's trained installer shall only be used for installation.
- ***The detailed specification of the insulation proposed by the Bidder shall be provided in the bidding document.***

## 7.0 ELECTRICALS

### 7.1 GENERAL

The electrical installation works is listed below but not necessary limited to the items specified. Everything essential to have safe operation is deemed to be covered within the scope of this contract even though same is not described in detail.

### 7.2 Bidder's Scope:

The following works broadly describe the scope of electrical installation pertaining to Bidder(s) of Refrigeration contract:

- Preparation of all necessary drawings, submission of the same to Union and obtaining approval of the drawings.
- Design, supply, erection, testing and commissioning of all control panels as per requirement and which are essential for safe operation of the plant.
- Design, supply, erection, testing and commissioning of remote control panels in adequate numbers for smooth operation.
- Sealing of cable-entries through wall/trenches by mastic compound or equivalent including supply of compound and other building materials, duly finished.
- The complete electrical installation and distribution system of curd cold room section including associated earthing system shall be as per prevailing Indian electricity rules, state inspectorate regulations.
- All earthing mains shall be galvanized. The earthing to the equipment will be with the help of PVC coated/ insulated aluminum wire/cable.
- Supply and placement of elastomeric electrical grade mats in front of all electrical panels including MCC's.
- Arranging of inspection by Electrical Inspector and obtaining approval for the

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installation and permission for charging as electrical installation of refrigeration plant i.e. obtaining the safety certificate from CEIG.

- Electronic equipment, automation and control equipment shall be fully protected against electrical voltage fluctuations, voltage surges and transitory spikes, by the inclusion of adequate protective equipment/system.
- Pre-commissioning of all protective relays/devices i.e. testing and calibration of all protective relays to be done through separate testing agency and the same shall have to be arranged by Bidder.
- Checking of connections (power and controls), testing and commissioning of all equipment erected and or connected under this contract and complete distribution system as a whole as per testing procedure and instructions of Engineer In-charge.

THE BIDDER SHALL CONSIDER THIS JOB AS A TOTAL JOB. HENCE, ALL ITEMS INCLUDING ELECTRICAL CONTROL EQUIPMENT, INSTRUMENTATION AND INTERLOCKING REQUIRED FOR SAFE OPERATION OF THE PLANT IS INCLUDED IN THE SCOPE OF THE WORK EVEN THOUGH SAME IS NOT DETAILED IN THE DESCRIPTION/SPECIFICATION.

### 7.3 Motors:

Supply is at 415 V,  $\pm 10\%$ , 50 Hz, 3 phase. ALL MOTORS SHALL BE SQUIRREL CAGE, TEFC, IP-55 PROTECTION of ratings to suit continuous operation of the driven equipment at the specified ambient conditions, but not less than scheduled. COMPRESSOR-DRIVING MOTORS SHALL BE EQUIPPED WITH WINDING THERMISTORS.

All motors shall have large terminal boxes suitable to receive armored copper cables. All poly phase motors shall have a minimum acceptable nominal full load motor efficiency confirming to premium energy efficient motors IE 3 type.

The provisions of clause 4.4 of Special Conditions of Contract –Electrical installation (IV-IV) apply.

### 7.4 Starters:

1. AC variable speed drive for the main screw compressor:

To provide the VFD as per requirement specified in clause No

2. Other motors: Starters for all other motors will be included in the related switchboards.

Motors below 10 HP shall have DOL starter type whereas that of 10 HP & above rating shall be provided with soft starter.

### 7.5 Power Factor Improvement Panel.

One set of automatic power factor improvement panel complete with ultra-heavy duty APP capacitors (box type Aluminum Poly-Propylene capacitor), programmable APFC Relay, instruments and outgoing feeders with suitable switchgear, capacitor duty contactors, **detuned**





**harmonic filter (7% reactor for entire non-linear electrical load), etc.**, duly prewired, shall be provided for Refrigeration MCC for monitoring and controlling power factor of 0.98 to 0.99.

The capacitors and APFCR to be incorporated in MCC itself.

The rating and number of capacitors to be provided in the bank shall be designed suitable for the entire refrigeration plant electrical load as well as future provisions.

#### 7.6 Earthing system:

The bidder can tap into the existing earthing connections

#### 7.7 Ancillary Items:

1. Isolating switches: Provide and install a local isolating switch at each motor or other item of connected equipment where :
  - The motor or equipment is not in the plant room.
  - The distance from the switchboard is more than 25 meters.
  - Required by the Indian Electricity Act and Rules.

ISOLATORS SHALL BE in cast aluminium housing (alternatively heavy duty polycarbonate enclosure), AND IF OUTDOORS OR IN COLD ROOMS, WEATHER-PROOF -IP65 refer Special Conditions of Contract –Electrical installation (IV-IV) clause 3.10

#### 2. Junction boxes:

On motors, final connection shall be from an adjacent metal clad (cast aluminum) junction box (alternatively heavy duty polycarbonate enclosure) weather-proof, IP65, from which final connection shall be made with flexible multi-core copper conductors in heavy duty flexible conduits with water tight adopter/cable gland.

Refer Special Conditions of Contract –Electrical installation (IV-IV) clause 3.11.

#### 7.8 Cabling:

1. **General:** Provide and install all cabling and accessories including but not limited to conduit, cable trays, glands and lugs for termination at ends, circuit markers and insulating materials.

#### 2. POWER CABLE (LT)

**Power cable from PCC (located in substation building) to New Refrigeration system MCC to be of Aluminum conductor, XLPE insulated, armored and overall PVC sheathed, strictly as per IS: 7098 (Part I) – 1988 amended up to date, the size, number of runs etc. will be as per the connected load and subject to approval.**





All outgoing power cables from MCC to all other consumption points shall be of armoured Copper conductor cable.

Connection from plug & socket/isolator junction boxes to motor junction boxes shall be with braided flexible Copper conductor with water tight cable gland. Further, external sheath of all copper braided cables (power/control/ communication) shall be of rodent proof.

Power cables for use on 415 V system shall be of 1100-volt grade, steel braided PVC insulated and PVC sheathed copper conductor upto 70 sq. mm conductor size and above 70 sq. mm HR PVC / XLPE insulated, PVC sheathed, armoured and overall PVC sheathed copper conductor.

Unarmoured cable to be used for vibrating equipment & only if specifically mentioned in schedule of quantities.

The size of these cables shall be as specified in single line diagram. The minimum size shall be as per the table given above.

The following selection table shall be followed for cables of motors unless otherwise specified:

3 Phase 415 V Motor H.P.	Copper conductor Cable Size in mm <sup>2</sup>	
	For Soft Starter /VFD	
	Supply side	Motor side
Up to 7.5	2.5	2.5
10	4	4
15	6	6
20	10	10
25	16	16
30	16	16
40	25	25
50	35	35
60	50	50
75	70	70
100	95	95
125	150	150
150	185	185
180	240	2 X 120

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3 Phase 415 V Motor H.P.	Copper conductor Cable Size in mm <sup>2</sup>	
	For Soft Starter /VFD	
	Supply side	Motor side
200	2 X 120	2 X 120
250	2 X 150	2 X 150
275	2 X 185	2 X 185
300	2 X 185	2 X 185
425	2 X 240	2 X 240

3. Plant room: Motors and other connected items in the plant room shall be cabled in floor trenches, which will be constructed by the building Bidder to an approved drawing. Refer Special Conditions of Contract –Electrical installation (IV-IV)

Refrigerant liquid control solenoids and controls shall be surface cabled (insulated & sheathed) in G.I. screwed conduit (as the case may be).

4. Outdoor equipment: Cables to compressors, cooling water pumps, cooling towers, etc. shall be in cable trays (the trays outside building to be covered using cable tray covers as per Section-IV-IV), generally following pipe routes, and then in underground conduits/trenches, as suitable for site conditions.
5. Cold room/Deep freeze evaporators connection: Cabling shall be by:
- In the plant room - overhead trays, following pipe routes.
  - On the pipe gantry connecting the buildings trays
  - Within the production block - in GI trays, GI screwed conduit as appropriate.
6. Cool rooms: Within the rooms cable shall be insulated and sheathed. These cables shall not be enclosed in conduit. Entry to cold room shall be through sleeves, thermal bridging and air infiltration shall be prevented.
7. Earthing: The main system earth will be installed by the Bidder. An earth conductor from this will be provided to the plant room control panel location. Each item of equipment required to be earthed shall have two separate earth connections.

The following selection table shall be followed for earthing of electrical loads:

- Control switches/glands and Motor up to 10 HP : PVC insulated Copper conductor wire 4 mm<sup>2</sup>
- Motor above 10 HP up to 125 HP : GI strip 25 x 3 mm
- Motor above 125 HP : GI strip 25 x 6 mm
- Switch board /MCC/Earthing main in trenches : GI Strip 40 x 6 mm
- Cable trays - GI strip 25 x 3 mm

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8. Signal cables: Control and metering cabling to as per the requirement is included in the contract. These cables shall be segregated from the power cables and routed in GI conduits. End terminations shall be with suitable water tight cable glands.
9. Fan coil unit/Air-conditioning unit: Cabling shall be by:
  - In the plant room - overhead trays, following pipe routes.
  - On the pipe gantry connecting the buildings - trays.
  - Within the production block - trays or GI screwed conduit as appropriate.

### **7.9 Testing and Commissioning:**

Test the electrical installation, as provided in Special Conditions of Contract –Electrical installation (IV-IV) and to the requirements of the Electricity Authority.

This work shall be carried out in advance of mechanical testing and commissioning, sections 22 and 23, and in co-operation with other Bidders.

Adjust the settings of motor overload protection devices, including those in switchboards.

### **7.10 SCOPE OF WORK**

The scope of work shall cover design, project engineering, control philosophy, software development, manufacture, assembly, shop testing, packing, transportation to site, unloading at site, storage, erection, site testing & pre-commissioning, commissioning, initial & successful operation and performance testing of the entire control and instrumentation package of the plant including all necessary field instruments, transmitters, sensors, indicators, VFD, UPS, cabling, earthing, cabinet etc. for safe, reliable, consistent, optimum and efficient operations.

The bidder shall provide necessary manuals and documents, including submission of I/O List, loop diagram, logic diagram, specification / data sheets and other necessary drawings in printed and electronic medium for approval of purchaser in multiple sets.

The bidder to ensure that all the basic control functions such as analog, discrete element controls shall be performed by the system. This includes logic, sequences, interlocks, PID and ON/OFF control and also the acquisition and monitoring.

The bidder shall provide necessary training for Operators, systems engineers and maintenance engineers.

#### **7.10.1 Manufacturer Support:**

- The HMI system shall be from a reputed manufacturer with a proven track record in industrial automation solutions.
- Technical support must be available, including remote troubleshooting options and local service representatives.





#### 7.10.2 Training and Documentation:

- Training: Vendor must provide onsite training for operators and maintenance staff.
- Documentation: Detailed user manuals, wiring diagrams, and maintenance guides must be provided, both in hard copy and digital formats.

#### 7.11 Switchboard items:

The switchboards provided by the bidder will incorporate equipment necessary for the functioning of the control system.

The Refrigeration bidder shall furnish details of requirements for activation of control circuits as part of the particulars of switchboards and control panels.

#### 7.12 Control Functions:

##### 7.12.1 Indicating, controlling and **General requirement:**

recording instruments necessary for operation of the plant shall be provided and installed to requirements detailed. This is in addition to the digital instrument as specified in the respective equipment.

Field Instruments shall be suitable for area in which these are located. In general, field instruments shall be weatherproof, dust tight and corrosion resistant with Protection Class IP-65.

The minimum accuracy of instruments shall be as under:

Electronic transmitters	: ± 0.2 % of FSD
Pressure & temperature gauge	: ± 1.0 % of FSD
Conductivity transmitter	: ± 0.5 % of FSD
Level gauges	: ± 5.mm of the reading

Measuring ranges of transmitters shall be selected in such a way that best accuracy of measured value (in the measurement range) is achieved.

Field instruments shall be suitably mounted, supported and terminated in local junction boxes. Die cast aluminum or stainless steel casing shall be used as case material in general.

Temperature stub to be welded on process pipe / vessel and shall match with thermo-well process connection and size. Thermo-well shall be drilled out of bar stock and the length & construction shall comply with process requirement / relevant standards. Material of construction of thermo-well shall be suitable for the application.

**All field instruments / equipment shall be provided with stainless steel (SS) tag plates (in-line with approved P&ID) with engraved tag no. and service description. The tag plate shall be secured to the instrument / equipment with SS chain.**



All gauges on the refrigerant system, whether in contact with refrigerant or oil, shall have steel elements and shall withstand without effect pressure of 1.5 MPa. Gauges elsewhere shall have bronze elements.

Control & Instrument (C&I) equipment furnished shall incorporate necessary techniques for protection against electrostatic discharge and radio frequency interface, as per international codes and standards.

Safety earthing and C&I System earthing shall be separate. Safety earth bus shall be connected to main plant earth pit. Separate earth pit/s shall be provided for system earth bus (electronic earth). Electronic earth shall be cabled directly to the corresponding earth bar.

All instruments shall have clear access for maintenance, removal, lay-down, calibration etc.

All readable instruments shall be clearly visible unassisted.

Control & Instrument (C&I) equipment furnished shall incorporate necessary techniques for protection against electrostatic discharge and radio frequency interface, as per international codes and standards.

#### **7.12.2 Temperature & Pressure Transmitter:**

The transmitters shall be provided as per requirement for process & utility having best accuracy/reliability and the hard wired signals (4- 20 mA) shall be connected with automation system. The transmitters shall have field diagnostic/configuration facility. The transmitters shall have separate local digital indicators as per requirement. All Critical parameters shall be provided with Local Remote Display (to be installed at operating height).

Accuracy of the process transmitters should be at least  $\pm 0.2$  % of FSD or better.

The sensing elements and internal parts shall be constructed with AISI 316. In case of stock and corrosive fluid application, diaphragm seal type transmitter with capillary is foreseen. The bidder to quantify the number of such transmitters required, based on the tender as well as functional requirement & offer accordingly.

#### **7.12.3 Conductivity Transmitter:**

The conductivity transmitters of required turn down capacity shall be used for conductivity measurement of evaporative condenser basin water having best accuracy & reliability suitable for application (with required IP class). The conductivity transmitters shall have separate field display (digital) unit with hard wired (4-20 mA) signals & field diagnostic/configuration facility having connectivity with automation system.

The bidder to quantify the number of CTs required, based on the tender as well as functional requirement & offer accordingly.

**7.12.4 Pressure gauges:** Pressure gauges shall be of Bourdon tube type, conforming to the requirements of IS:3624.





7.12.5 Calibration of gauges shall be in SI metric units: refer IS: 10005. The scale range shall be approximately 1.5 times the normal working pressure. Gauges reading refrigerant pressure shall be calibrated additionally with saturated refrigerant temperature.

7.12.6 Connection of gauges to the related equipment shall be through an isolating valve or cock of appropriate type. When on low temperature items, the connection shall be of sufficient length to ensure that the gauge does not incur condensation.

Types of gauges to be fitted in the situations noted are:

Condensers, liquid receivers purger, oil rectifier,	100mm dial, weather-proof casing oil filled.
liquid pump discharge, Liquid accumulators:	100mm dial. Oil filled in weather proof casing

#### 7.12.7 Temperature measurement

**Digital temperature indicators** of approved make, of ranges suitable for indicating temperatures incubation rooms, cold stores, deep freezers, pre-cooling rooms, ante-room etc. **(large display, clearly visible in day light at reasonable distance) shall be provided in addition to monitoring at central PLC panel.** The Bidder shall have to provide necessary technical details of the system offered, such as number of digits, colour, digit size, accuracy, housing details, etc.

Digital type humidity indicators shall be provided in the comfort air-conditioning rooms to display the RH locally as well as transfer the same to central PLC panel.

Analogue thermometers shall be of dial type with vapour or gas pressure actuation.

In vessels or pipelines, wells shall be provided, filled with oil of appropriate grade.

Types of thermometers in situations noted are:

Cooling water flow lines: at condensers, chilled water pump discharges	100mm dial, weather-proof casing
Condenser sump	100mm dial, capillary bulb, weatherproof casing.
Each cool rooms, deep freezers, air lock, and each air conditioned rooms	Digital temperature indicators (large display)

#### 7.12.8 Cold Store

a) Forced draft coolers: Fans operate in unison from On-Off selector switches in the related control panel. A pilot light for each fan indicates that the starter is on.

Refrigerant liquid feed solenoids operation:

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Interlocking: Opening of the solenoid is possible only if the fan starters are closed.

Activation: A 4-position switch on the control panel provides functions:

Manual - solenoid opens

Off - solenoid closes

Auto - Room thermostat controls & also in conjunction with Auto defrost system

Remote - Control from central PLC system.

A 2-position selector switch, Off-Auto, in the plant room main MCC, for each liquid feed assembly, provides remote operation, and a pilot light for each assembly indicates activation of the solenoid.

For automatic operation, supply for each liquid feed assembly of each FDC shall be controlled by DX type valves with probes properly fixed on return lines.

In AUTO mode, the FDCs are cut-in and cut-out depending on the cold room temperature. When cut-in temperature for any FDC is reached, PLC will first start the FDC fan. After receiving running feed-back of the fan, it will give command to liquid line solenoid valve (LLSV) of that FDC. PLC will not energize the LLSV unless one of the fans of that FDC is running. As PLC gives command to LLSV to energize, SCADA will indicate this on the screen by changing the colour of LLSV.

If FDC is running and the temperature changed to its cut-out temperature, PLC will de-energize the LLSV, which will be indicated on SCADA. But PLC will not stop the fan. Now PLC will energize the LLSV at cut-in temperature. If LLSV remains de-energized for more than 15 minutes, PLC will give STOP command to FDC fan. Next time fan will start only at cut-in temperature.

In manual mode, all FDC fans can be started and stopped manually by clicking Start Push Button. SCADA waits for the running feedback of the started fan. If received in specific time, SCADA will indicate the same by changing the colour as well as showing the animation, else SCADA will pop-up message indicating started fan failed. Hence, problem is to be attended, rectified and click Failure reset push button on screen to enable the failed fan. The liquid line solenoid valves can be energized or de-energized from the MCC. The interlock is provided in such a way that liquid line solenoid valve will not energize unless the FDC fan has started.

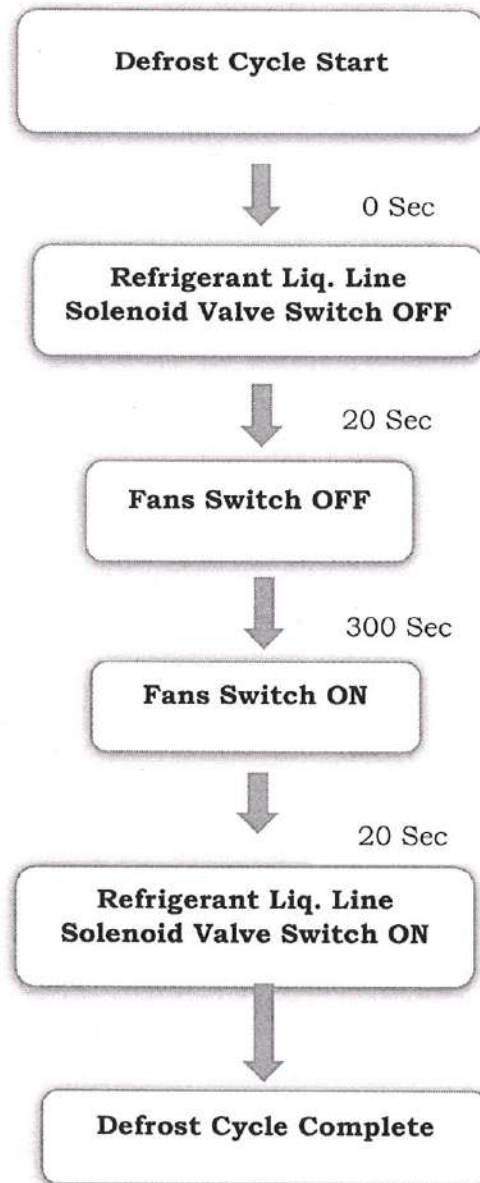


7.12.9 **Automatic Defrosting system:**  
7.12.9.1 **For cold stores:**

The defrost cycle shall be as per the below indicated algorithm-1.  
Defrosting cycle shall be operated in Auto-Manual-Mode.

**Algorithm-1**

**Defrost Cycle of Cold stores**



NOTE: All indicated time delays shall be settable type and the values can be modified by operator only through plant manager login as per actual defrost cycle requirements of respective cold stores.

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## **INSTRUMENTS:**

### **8. General:**

Indicating, controlling and recording instruments necessary for operation of the plant shall be provided and installed to requirements detailed. This is in addition to the digital instrument as specified in the respective equipment. The make and types of instruments shall be subject to approval.

Field Instruments shall be suitable for area in which these are located. In general, field instruments shall be weatherproof, dust tight and corrosion resistant with Protection Class IP-65.

The minimum accuracy of instruments shall be as under:

Electronic transmitters	: ± 0.2 % of FSD
Pressure & temperature gauge	: ± 1.0 % of FSD
Conductivity transmitter	: ± 0.5 % of FSD
Level gauges	: ± 5.mm of the reading

The repeatability of pressure, temperature, level and flow switches shall be ± 2.0 % of FSD (minimum).

Measuring ranges of transmitters shall be selected in such a way that best accuracy of measured value (in the measurement range) is achieved.

Field instruments shall be suitably mounted, supported and terminated in local junction boxes. Die cast aluminum or stainless steel (**SS**) or thermoplastic casing of reputed makes shall be used as case material in general.

Temperature stub to be welded on process pipe / vessel and shall match with thermo well process connection and size. Thermo well shall be drilled out of bar stock and the length & construction shall comply with process requirement/ relevant standards. Material of construction of thermo well shall be suitable for the application.

All field instruments / equipments shall be provided with SS tag plates with engraved tag no. and service description. The tag plate shall be secured to the instrument / equipment with SS chain.

All gauges on the refrigerant system, whether in contact with refrigerant or oil, shall have steel elements and shall withstand pressure of 1.5 MPa without any adverse effect. Gauges elsewhere shall have bronze elements.

Control & Instrument (**C&I**) equipment furnished shall incorporate necessary techniques for protection against electrostatic discharge and radio frequency interface, as per international codes and standards.

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Safety earthing and C&I System earthing shall be separate. Safety earth bus shall be connected to main plant earth pit. For C&I system, separate earth pit/s and earth bus (electronic earth) as per standards shall be provided. Electronic earth shall be cabled directly to the corresponding earth bar.

All instruments shall have clear access for maintenance, removal, lay-down, calibration etc.

All readable instruments shall be clearly visible unassisted.

### 8.1 Pressure gauges:

Pressure gauges shall be of Bourdon tube type, conforming to the requirements of IS:3624.

All gauges on the refrigerant system, whether in contact with refrigerant or oil, shall have steel elements and shall withstand without effect pressure of 1.5 MPa. Gauges elsewhere shall have bronze elements.

Calibration of gauges shall be in SI metric units: refer IS:10005. The scale range shall be approximately 1.5 times the normal working pressure. Gauges reading refrigerant pressure shall be calibrated additionally with saturated refrigerant temperature.

Connection of gauges to the related equipment shall be through an isolating valve or cock of appropriate type. When on low temperature items, the connection shall be of sufficient length to ensure that the gauge does not incur condensation.

Types of gauges to be fitted in the situations noted are:

Refrigerant compressors For LP, OP, HP etc.	100mm dial, oil-filled.
Condensers, liquid receivers Purger, oil rectifier, liquid pump discharge	100mm dial, weather-proof casing oil filled.
Liquid Accumulators	150mm dial. Oil filled in weather proof casing
Chilled water and cooling water pump discharges	100mm dial, weather-proof casing, Oil filled

### 8.2 Temperature measurement

**Thermometers:** shall be of dial type with vapour or gas pressure actuation.

In vessels or pipelines, wells shall be provided, filled with oil of appropriate grade. Types of thermometers in situations noted are:

Refrigerant compressors- Suction, Discharge, liquid condensing etc.	100mm dial, weather-proof casing oil filled.
Cooling water flow lines- at condensers, chilled water pump discharges	100mm dial, weather-proof casing.
Condenser sump-	100mm dial, capillary bulb, weather-proof casing.
Cool rooms	100mm dial capillary bulb

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**Digital temperature indicators** (large display min. 4-inch font size) of approved make, of ranges suitable for indicating temperatures in each cool rooms, air lock, and each air conditioned rooms

## **9.0 COLD ROOM/ PUF PANEL INSULATION AND ASSOCIATED ACCESSORIES**

Functional Requirement:

The cold room should be of pre-fabricated type made of sandwiched PUF panels designed suitable for hygienic storage of food products at desired temperature.

Design Requirements and Scope of Work:

The scope of work includes Design, supply and installation of required insulated sandwich panels, insulation materials and all accessories as required for the proposed cold rooms, which comprises of ;

- The ceiling and wall should be with pre-fabricated sandwiched PUF panels of required thickness as per specification detailed below (clause 20.1.2).
- The floor insulation should be with required thickness of rigid polyurethane foam slabs as per specification detailed below (clause 20.1.3)
- Light fittings as per Clause-20.4 for adequate illumination inside the cold store and airlock, safety alarm system, digital temperature indicator & sensor, control switch gears, electrical wiring, conduiting, power/control cabling, earthing, etc.
- Providing suitable pressure relief valves for the deep freezes and hardening room as required.
- Manual sliding type doors with padlocking facility and airstrip curtains with all accessories.
- Manual hinge type doors with padlocking facility and airstrip curtains with all accessories.
- Providing suitable supporting /suspension system for ceiling panel and wall panels.
- Providing suitable provisions/cutouts for installation of refrigeration units, refrigerant piping, defrost piping, light fittings, power/control wiring, sliding type cold store doors, air curtains, etc., to be supplied and installed by other agency. The scope of this work involves making good the cutouts / opening and arrange to seal the completely to make it air/water/vapour proof, by in-situ injection of PUF/silicone sealants, without any extra cost, after installation of the units/piping/fittings.

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The scope is to design, supply, install, test and commission the Pre-fabricated cold room, complete in all respect including all system components and accessories as required, even if the same are not described in the specification, except for the exclusions specifically mentioned below;

The design of the cold room should take care of following aspects:

- Wall panels should be self-supporting type and bear the load of ceiling panels, fittings, etc. Wall panels should not buckle under the operating weight.
- In either case, ceiling panels should not sag due to self-weight, as well as the weight of refrigeration units, light fittings, etc, which are to be suspended from the ceiling panels.
- Wall panels should be designed with suitable impact protection arrangement.
- Should withstand earthquake intensity, as well as high velocity wind applicable to the zone, where the cold room to be constructed.
- Design should facilitate convenient installation and future expansion of the cold room by assembly of standard size sectional insulated panels.
- The cold room, accessories and finish should be designed for suitable for hygienic storage perishable food products, considering a minimum life span 20 years.

Detailed engineering/ execution drawings shall be approved prior to commencement of the work.

**The schedule of quantity & thickness of ceiling/wall/floor insulation to be carried out has been furnished in Appendix-3. The quantities of wall/ceiling panels and floor insulation indicated in the schedule are only tentative. The payment however should be made for the actual area of work executed based on the unit rate applicable.**

**10. SANDWICHED PANELS FOR CEILING AND WALL /COLUMN**

The wall and ceiling of the insulated cold rooms are to be constructed using pre-fabricated (continuous panels only), self-supported, sandwich panels insulated with rigid polyurethane foam of required thickness. Sandwiched Panel should be CFC free, manufactured using high-pressure foam injection equipment in a precise ratio and proportion.

The properties of the polyurethane insulation should be as under:

Injected density	:	38-40 kg/m <sup>3</sup>
Thermal conductivity	:	0.023 W/mt/Deg. K (tested @ 10 Deg. C)
Thermal conductivity	:	0.030 W/mt/Deg. K (tested @ 50 Deg. C)
Compressive strength	:	115 kPa
Closed cell contents	:	min. 85 %
Operation temperature range	:	minus 60°C to 80°C





Test certificates should be produced to support above properties. The skin material for the wall and ceiling panels should be of galvanized steel sheet (PCGI / PPGL) of **minimum 0.5 mm thick** on one side while SS of **minimum 0.5 mm thick** on the other side with grooved profile to enhance strength and aesthetics. The external surface of sheet for PCGI/PPGI should be pre-painted with minimum 25-micron thick silicon modified polyester coating. For areas where PUF wall is also acting as partition between two cold store / deep freeze there the skin for PUF panel shall be of **SS skin on both sides of minimum 0.5 mm thick**. In case bidder proposes any alternatives for the type of pre-coating indicated above, the same should be clearly brought-out in the bid with details & advantages, etc. Such alternatives may be considered in appraisal of the bid, provided the same is equivalent or better than the one indicated.

**The insulated panel of continuous type having tongue and groove type joining system.**

The joining system of the panels shall be designed to ensure a quick and secure assembly at site, with the help of tongue and groove joints with eccentric cam locks. The joints shall be made hermetic and perfectly vapour tight by use of silicone sealants. The wall panels should be in single lengths to match the room height, and width of ceiling/wall panels should be min. 1 mt. while higher width shall be preferred, in order to minimize the number of joints. The configuration should incorporate factory made standard L shape panels for corners and TEE shape panels for partitions.

The system should be complete with all ancillary items like, ceiling panels suspension system complete with insulated beam, suspension chain/ hardware, suitable corner pieces, pre-painted steel/aluminum profiles for inner/outer junctions and joint corners, pressure relief valves, silicone sealants, foam chemicals and all other components & accessories as required. The costs of these ancillary items are to be included in the respective rates for installation of ceiling/wall panels and no separate payment should be made for these items.

**a. FLOOR INSULATION:**

The floor insulation should be made of rigid polyurethane foam slabs in two layers of required thickness. The properties of polyurethane foam insulation should be as mentioned above. The insulation should be carried out in the following manner:

- Coat of bituminous primer should be applied over the finished PCC floor, after thorough cleaning and drying.
- Tarfelt of min. 2 mm thick or cross-linked laminated polythene sheet of 200 micron thick shall be applied on the concrete surface below the insulation layer as vapour barrier with bitumen as adhesive. The joints should be staggered having minimum 150 mm overlap thoroughly sealed to make it perfect vapour barrier. The ends should be turned up the outer wall above the height of protective curb and completely sealed with silicone sealant.
- A coat of bitumen should be applied on the outer surface of tarfelt and fix the first layer of rigid polyurethane foam insulation slabs (of required thickness) with the joints staggered. All joints sealed completely using hot bitumen.



- A coat of bitumen should be applied on the surface of first layer of insulation and fix the second layer of rigid polyurethane foam insulation slabs with cross-wise joints staggered. Seal all joints completely using hot bitumen.
- Provide tarpelt of min. 2 mm thick or cross linked laminated polythene sheet of 200 micron thick provided above the insulation layer using bitumen as adhesive. The joints should be staggered and should have minimum 150mm overlap thoroughly sealed to make it waterproof barrier. The ends should be turned up the inner wall above the height of protective curb (approx. height 500 mm above finished floor level) and completely sealed with silicone sealant.

The purchaser would arrange to provide only the concrete flooring and RCC protective curbing.

**b. COLD STORE AIR LOCK DOORS**

**i. Sliding / Hinge Type (Manual):**

The doors shall be of PUF insulated with both side covered with stainless steel sheet of **minimum 0.6 mm thick** complete with all accessories properly engineered and made by specialist manufacturer broadly meeting following requirements.

The insulated doors shall be manually operated, horizontally sliding/hinge type, easy to mount, mechanically reinforced for heavy duty usage complete with all required fittings, sliding rails/hinges, 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/wheel shall be provided.

Brief specifications of door shall be as given below:

PUF insulation by injection under pressure of polyurethane with density of minimum 40 kg/cum. Gasket to ensure air tightness and for prevention of refrigeration losses.

The door slide rail arrangement shall be made of high quality aluminum extrusion and with indentations for a 3D movement of the door, so that the door drops a little down and towards the frame uniformly while closing to achieve a hermetic seal. Top rollers shall be heavy duty made of self-lubricating nylon which ensures smooth and noise free movement of the door, without friction.

The door shall be surrounded by a four side rubber sealing gasket that ensures hermetic sealing, which reduces the risk of loss of cooling and controls the temperature. The gasket material shall be durable and shall not harden at low temperature.

The doors shall have padlocking arrangement from outside. Safety release provision shall be made for opening door from inside, even with padlock in place.

**Kick plate made of SS chequered plate of 0.6 m thickness** shall be provided up to a height of about 900 mm from bottom for mechanical impact protection on both sides.

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Sil portion of main insulated door openings and hatch door openings shall be finished with pre-coated sheet as per the requirement. Sil insulation shall be provided for the three sides of opening for main door openings and all the four sides in case of hatch door openings. The refrigeration bidder shall be responsible to finish the SIL portion of the Hinge/sliding door area with PUF insulation of appropriate thickness and cladded with pre coated sheet, flashing, angles at the corner, etc.

The detailed design and performance of sliding doors for cold store is under Refrigeration Bidder's responsibility. The drawing shall have to be got approved from the Purchaser.

GI Pipe Protecting Guard:

IN FRONT OF EACH SLIDING DOOR (ON CLOSING AND OPENING CONDITION) A SET OF METALLIC GUARD MADE OUT OF MS HEAVY DUTY 'C' CLASS PIPE OF 100 MM DIA (STAND TYPE) AND 50 MM DIA 'C' CLASS PIPE FOR BRAZING TO PROTECT THE SLIDING DOORS FROM THE EXTERNAL DAMAGES. THE PURCHASER SHALL APPROVE THE DRAWINGS. GUARD SHALL BE PAINTE IN "YELLOW-BLACK STRIPS".

**ii. Hatch Doors:**

The emergency hatch doors provided in each cold room is of hinge type doors. The dimensions of the hinge doors mentioned in the Appendix- 3 are indicating the clear opening required by the Purchaser.

The construction shall be generally as per 20.2.1

The hatch door shall be complete with heavy-duty hinges, handles and locking arrangement, emergency exit lock release knob/wheel, etc. Necessary gasket to ensure air tightness for prevention of refrigeration losses.

The detailed design and performance of hinge hatch doors for the cold store is under Refrigeration Bidder's responsibility. The drawing shall have to be got approved from the Purchaser.

**iii. Trap Door:**

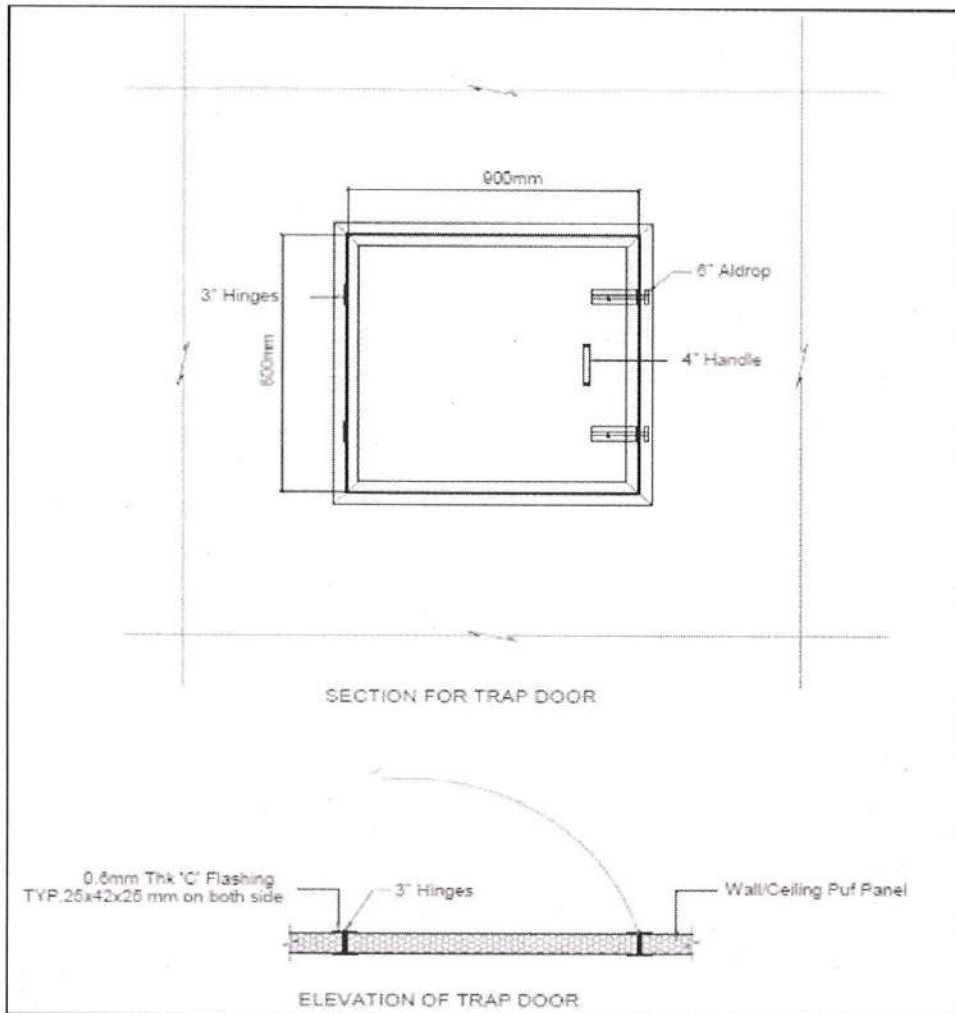
Trap doors shall be provided for having access to area between PUF ceiling and slab, for maintenance purposes and shall be made of PUF ceiling itself.

The hatch door shall be complete with heavy-duty hinges, handles and locking arrangement. Necessary gasket to ensure air tightness for prevention of refrigeration losses. Quantity and location of same shall be finalized during detail engineering and will be subject to approval.





**Typical drawing of trap door is attached below-**



**c. Air Curtains:**

Application: Dust, thermal and insect barrier.

The air curtain shall be heavy duty, extra high velocity type, installed on each cold store / hatch doors consists of a case for air canalizing, conveniently shaped permitting a rational arrangement of the outgoing air. It shall consist of a set of deflectors for good distribution of the jet of air of adequate velocity on the whole door span surface to avoid loss of refrigeration.

The capacity of the blowers is to be designed by the Bidder to achieve best performance. The fan shall be and dynamically balanced and free from vibration and low noise level. The fan motor shall be suitable for 3 phase, 50 HZ AC supply. The bearing should be pre-lubricated & sealed for life and maintenance free, suitable for low temperature application.



There shall be a proximity sensor/limit switch with required accessories, contactors, etc. in weatherproof enclosure for automatic operation of Air curtain blowers whenever the door is opened. Electrical power & control cabling to be done from MCC (clause 18).

The power/control panel board should be wall mounted weather proof, dust proof complete with pre-wired.

**d. Air Shield curtains:**

With each air curtain; provide a transparent PVC air shield curtain having flaps (rounded edge) of minimum thickness 3 mm with 50% overlap between adjacent flaps. The strip curtain should be complete with all accessories made of material suitable for low temperature application and the PVC strips should remain soft up-to operating temperature of minus -38 Deg. C.

**e. Internal lighting:**

Cold stores and pre-cooling room etc. are to be provided with suitable moisture proof fittings as per the enclosed layout. Necessary wiring from the DB to the fittings as per requirement.

- The light fittings suitable for the cold stores shall be 4 ft LED upto 40W with minimum 3500 lumen output weather proof and should maintain min. 70% of lumen output at 50000 burning hrs (minimum IP65 protected) fixture.
- The lux level to be maintained in a particular cold room is minimum 200 Lux.
- The luminaire should have neutral white light colour. Housing & optical cover of the luminaire should be made of virgin polycarbonate body with double gasket, UV stabilized polycarbonate diffuser with transparent prismatic interior and smooth exterior, polycarbonate cable gland, with built-in switch gears and all accessories including lamps with necessary mounting arrangement.
- Following to be ensured -
  - THD < 15%, PF > 0.90.
  - Surge protection of min.-2KV.
  - Operating voltage range 140-270V AC.
  - Fixture catalogue
  - LM80 & LM79 report
  - Technical test certificate of the fixture in accordance with IS & IEC standards and detailed driver report to be submitted



- Conduits inside the cold stores shall be made of heavy-duty PVC conduit with ISI mark. Wiring shall be using 3 core 2.5 sq.mm flexible copper cables. The conduits shall be suitably concealed using Pre-coated flashing of matching shade with panel.
- All end terminations shall be vapour tight with proper cable gland to prevent ingress of moisture inside light fitting.
- All conduit entries, cutouts made in insulation panel shall be thoroughly sealed to make it vapour proof, by in-situ injection of PUF/silicone sealants.
- Power supply for the lighting shall be taken from new MCC for colds store equipment placed in process area. The bidder shall carry out the complete internal wiring including providing necessary MCB control panel/Distribution Board as required for the light points. Distribution board shall be IP65 ingress protection if installation of same is inside the cold store rooms as required for the light points.
- Suitable nos. of light fixtures shall also be provided above PUF ceiling whose switch shall be near to the trap doors such that to switch on these fixtures trap needs to be opened.
- **In case of power failure suitable nos. of light fittings in each CS & DF to have 240 V AC, 50 Hz uninterrupted power supply, made available from UPS complete with voltage and frequency regulators. Suitable KVA (capacity / rating subject to approval or as per Clause-15.6.8.1.c) –online- UPS power supply shall be considered On total failure of the incoming A.C. supply to the plant, sufficient battery back-up has been envisaged to allow light points and safety system to operate for at least 15 minutes to allow safe evacuation from the cold store / deep freeze.**

**NOTE- Bidder to indicate his selection and suggest the number of points in the bid.**

**f. Cold store Safety System:**

Provision for safety of personnel shall be made by the Bidder in accordance with the relevant factory act and Indian/International standards.

Each cool room shall have a safety pilot light outside indicating the presence of people in distress in the room and electric bells shall be provided for distress signaling. **The sirens shall be installed at approved locations-one in Refrigeration Plant room and other in outside cold store corridor.** The siren push switch shall be of self-illuminated type. **Moisture proof 'EXIT' light** suitable for the application in IP 65 enclosure (made by specialist manufacturer) provided inside each cold store/deep freeze shall be mounted above to the exit hatch door/main door.

The circuits for sirens, safety pilot lights, and safety illumination shall be independent of the mains power supply and shall work on 240 V AC through the uninterrupted power supply, made available from UPS complete with voltage and frequency regulators/ shall have in-built power source (in form of replaceable batteries).

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**i. Safety System Function:**

Lights to indicate presence of people in distress inside the cold store are to be provided both inside and outside the cold store and shall be red in colour. These lights shall be switched ON by heavy duty toggle switch in suitable boxes adjacent to siren push bottom. The lights provided inside the cold store shall be inside an acrylic box (material suitable low temperature application) indicating 'EXIT'.

Industrial electric sirens (audible upto 100m) are to be provided both in the refrigeration plant room and outside cold store corridor.

Self-illuminated push buttons of "press to stay" and "rotate to release" are to be provided inside each cold store connected with the electrical sirens.

Any person entrapped inside the cold rooms shall be able to locate the 'EXIT' since the 'EXIT' lights inside shall always 'ON'. In case of distress, the person entrapped can approach the 'EXIT' point and press the self-illuminated push button. This shall put 'ON' the siren in both the refrigeration plant room and the process hall indicating that personnel are trapped inside the cold room. The self-illuminated push button shall also be continuously 'ON' and the siren will be 'ON' the moment the person presses the button. Only after the personnel are rescued the self-illuminated push button can be released by rotating the push button.

The emergency illumination system shall incorporate extra-long-life lamps, preferably LED type of approved make.

**g. UN-INTERRUPTED POWER SUPPLY (UPS)**

For applications requiring AC power, 240 V AC, 50 Hz uninterrupted power supply shall be made available by Bidder from UPS complete with voltage and frequency regulators. True Online UPS (with static bypass) shall be provided for CCPUs,

The UPS shall also take care of the power requirement of the Refrigerant leak detection panel.

UPS power supply shall be considered On total failure of the incoming A.C. supply to the plant, battery back-up has been envisaged to allow all control and instrumentation equipment to operate for at least 30 minutes to allow safe shutdown of the plant.

For the instruments located far in the new proposed LMP plant the UPS power required for instruments are to be supplied from UPS and in this case the above rating (minimum) can be split in capacity requirements to be provided from UPS to respective area and UPS with battery banks to be supplied and installed in respective areas. Splitting of UPS must be in accordance with the minimum back-up time sought in the respective section.

A metallic rack dully painted shall be provided for placing the batteries with each UPS & battery bank. All Batteries shall be SMF type.

**UPS Scheme, UPS load details, GA drawing, datasheet, battery sizing calculation, heat loss calculation shall be submitted during detail engineering for approval.**



**APPENDIX-3  
BATTERY LIMITS:**

<b>Item</b>	<b>Purchaser's Scope</b>	<b>Bidder's Scope</b>
<b>Civil works</b>	Room will be arranged as per the requirement.	Supply of necessary foundation bolts along with the template, sub base and all other associated erection materials.  Civil work pertaining to the cable laying, earthing pits, grouting of various foundation bolts, cut-openings in the wall, ceiling etc.  Cut-openings in the wall, ceiling etc. for piping/cabbling and finishing/sealing the cut-outs.  Rectification of defective work resulting from the incorrect / delayed / in sufficient information provided by the bidder.
<b>Water lines</b>	Nearest/suitable location of soft/RO water main header.	Tapping of soft/ RO water from the main header of dairy and distribution to all the equipment considered under refrigeration work as per the requirement.
<b>Drain lines</b>	Drain points in the building.	The drains from all the new FDCs to be taken out of the building at the nearest drain point available. (The drawing and route of the same will be subject to approval).
<b>Power</b>	Main power supply will be available at the sub mcc refrigeration panel	Main power cables from sub MCC to isolator boxes. Termination of incomer cables (at both ends)  Distribution of power and controls for cold rooms in respective sections to Air Curtains, heater, etc. with supply of all items.  Electrical wiring for the lighting inside all cold stores etc. Installation and commissioning of Fixtures/Lamps.  Distribution of UPS power to various instruments, cold store safety systems etc., as per requirement.
<b>Refrigeration tubing &amp; Refrigerant</b>	Nil.	Entire refrigeration tubing for the new equipment with complete initial charge of refrigerant as per the requirement included in the scope of this tender.
<b>Cold Store, Deep Freeze, Air-locks/ Ante-rooms</b>	Civil works pertaining to the cold stores.	Supply, installation, testing & commissioning of Cold stores/ insulation works with internal lighting, sliding doors, air/ strip curtains deep freeze safety system.  Supply, installation, testing & commissioning of Cold store insulation works with internal lighting, sliding doors, air/ strip curtains.  Forced draft coolers for all Cold store and refrigerant leakage detection system with temperature indication outside respective cold store and on the central system.  Electrical wiring for the lighting inside all cold stores installation and commissioning of Fixtures/Lamps.

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## APPLICABLE STANDARDS

### MECHANICAL

IS:	660	Safety code for mechanical refrigeration
IS:	661	Safety code for mechanical refrigeration
IS:	662	Anhydrous refrigerant
IS:	702	Industrial bitumen
IS:	778	Gunmetal gate, globe and check valves for general purposes
IS:	1703	Ball valves including floats for water supply purposes
IS:	1239	Mild steel tubes, tubular and other wrought steel pipe fittings
IS:	2041	Steel plates for pressure vessels used at moderate and low temperatures
IS:	2379	Colour code for the identification of pipelines
IS:	2494	V-belts for industrial purposes
IS:	2629	Hot-dip galvanizing of iron and steel
IS:	2825	Code for unfired pressure vessels
IS:	3233	Glossary of terms for safety and relief valves
IS:	3503	Steel for pressure vessels and welded structures
IS:	3601	Steel tubes for mechanical and general engineering purposes
IS:	3615	Glossary of terms used in refrigeration and air-conditioning
IS:	3624	Pressure and vacuum gauges
IS:	3696	Safety code for scaffolds and ladders
IS:	4049	Formed ends for tanks and pressure vessels
IS:	4503	Shell and tube type heat exchangers
IS:	11714	Steel Tubes For Heat Exchangers (Part 1)
IS:	11714	Steel Tubes For Heat Exchangers (Part 2)
IS:	11714	Steel Tubes For Heat Exchangers (Part 3)
IS:	11714	Steel Tubes For Heat Exchangers (Part 4)
IS:	11714	Steel Tubes For Heat Exchangers (Part 5)
IS:	4544	Code of safety for refrigerant
IS:	4671	Expanded polystyrene for thermal insulation purposes
IS:	12436	Preformed rigid Polyurethane (PUR) and Polyisocyanurate (PIR) foams for thermal insulation

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IS:	4736	Hot-dip zinc coating on steel tubes
IS:	4831	Units and symbols for refrigeration
IS:	4984	HDPE pipes for potable water supplies, sewage and industrial effluents
IS:	5428	Gauge glasses (All parts / Applicable parts of Code)
IS:	5905	Specification for sprayed Aluminum and zinc coating on iron and steel surfaces
IS:	6392	Steel pipe flanges
IS:	8910	General technical delivery requirements for steel and steel products
IS:	8008	Injection moulded HDPE fittings for potable water supplies
IS:	8172	Vertical steel ladders
IS:	8188	Treatment of water for industrial cooling systems
IS:	9520	Nominal sizes for valves
IS:	9623	Selection, use and maintenance of respiratory protective devices
IS:	9762	Polythene floats for ball valves
IS:	9890	General-purpose ball valves
IS:	10005	SI Units
IS:	10234	Recommendations for general pipeline welding
IS:	11132	Refrigerant Valves
IS:	11329	Finned type heat exchanger for room air conditioner
IS:	11330	Refrigeration oil separators
IS:	16678	Refrigerating Systems and Heat Pumps — Safety and Environmental Requirements Part 1 Definitions, Classification and Selection Criteria
IS:	16678	Refrigerating Systems and Heat Pumps — Safety and Environmental Requirements Part 2 Design, Construction, Testing, Marking and Documentation
IS:	16678	Refrigerating Systems and Heat Pumps — Safety and Environmental Requirements Part 3 Installation Site
IS:	16678	Refrigerating Systems and Heat Pumps — Safety and Environmental Requirements Part 4 Operation, Maintenance, Repair and Recovery
IS:	3646.1	Interior Illumination
BS:	3059	MS tubes for vertical condenser
BS:	874	EPDM of Thermal conductivity (Part 2)
BS:	476	Fire propagation test (Part 6)

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BS:	476	Surface spread of flame test (Part 7)
ASTM E:	84	Smoke density Test
ASTM B:	280	Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service
ASTM B:	32	Specification for Solder Metal
ASTM B:	813	Standard Specification for Liquid and Paste Fluxes for Soldering Applications of Copper and Copper Alloy Tube and Fittings
ASTM B:	16.22	Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
ASTM B:	31	Refrigeration Piping And Heat Transfer Components
ISO:	4126	Safety devices for protection against excessive pressure – Part -1: Safety valves

**ELECTRICAL**

IS:	325	Three-phase induction motors
IS:	1248	Electrical measuring instruments and their accessories
IS:	2705	Current transformers
IS:	2968	Dimensions of slide rails of electric motors
IS:	3480	Flexible steel conduits for electrical wiring
IS:	4064	Air-break switches
IS:	8544	Motor starters for voltages not exceeding 1000 V
IS:	9537	Conduits for electrical installation
IS:	10028	Selection, installation & maintenance of transformers
IS:	10118	Selection, installation & maintenance of switchgear & control
SP:	30	National Electrical Codes

Other standards to be followed for electrical work are listed in **Special Conditions of Contract** for Electrical installation.

***Latest revisions shall be followed in all cases.***

**DUCTING, DUCT INSULATION FOR AIR-CONDITIONING SYSTEM**

IS:	655	Specification for metal air duct.
IS:	227	Specification for galvanized steel sheet
SMACNA		Sheet metal and air-conditioning SUPPLIERS, National Association Standard for low velocity and high duct construction

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**Note: Relevant standards/ codes of ASHRAE / IIR or other equivalent International standards/ codes are also acceptable, subject to approval.**

**PROJECT INFORMATION AND BASIS OF DESIGN**

**1.0 Project Information**

Plant name : Purabi Dairy

Address : R.K Jyoti Prasad Agarwalla Road Panjabari

**2.0 Electricity Supply Voltage** : 415 V,  $\pm$  10%, 3 phase & Neutral, 50 HZ + 2.5%, AC Supply

**3.0 Proposed refrigeration system:**

**3.1** The system will consist of Multi Compressor Screw Rack system, evaporative condensers, ACU/FDCs and shall use **Freon: R-134A / 404A / 410A** as refrigerant. The refrigeration system shall cater to the direct expansion loads of Curd pre-cooling rooms, curd cold stores, paneer cold store ante-room and butter deep freeze room.

**3.2** The schedule of major items required for the proposed expansion of refrigeration plant listed in Appendix-3. The operation of the plant shall be suitably automated to optimize the capacity utilization and improve overall plant efficiency. Necessary facility shall also be provided to operate the system manually (with basic interlock for safety in place), in the event of any maintenance/breakdown in the automation system.

**3.3** The installation of proposed equipment as per Appendix-3 to be done at the designated refrigeration system space at second floor of new proposed plant. The execution of new works and interconnections need to be planned meticulously.

**3.4** As the dairy plant operates 24X7 and 365 days, this work needs to be executed with meticulous planning and utmost care, so as to ensure no hindrances/ disruption caused to the regular processing operations. The scope of the work includes necessary detailed engineering, installing new rack system, providing cooper tubing with necessary valves required on supply and return lines of refrigerant, insulation of refrigerant pipes, water piping from and to cooling tower, supports, etc.

**3.5** For the new equipment, new MCC shall be provided with provisions for adding future equipment (one each) and spare feeders as specified in Clause-13.4. Incoming power cables supply, laying including end terminations from existing electric sub-station (new feeders shall be provided) upto the new MCC is included in the scope of this tender. Termination of the cables at both ends to be carried out by bidder.

**3.6** The operation of the all the rack units, condensers, water pumps, FDCs shall be automated to optimize the capacity utilization and to improve overall plant efficiency.

**Note: To assess the exact quantum of work involved in for the complete project, bidder must visit the site.**





#### 4.0 Refrigeration/ incubation details:

The below table outlines the details of the product loading pattern etc. for capacity calculation of various rooms. The bidders are requested to study the basis of design

#### Specifications

##### 1. Pre-Fabricated Panels (Cold Room)

Parameter	Details
Cold Room Size	9 m x 6.7 m x 4 m (Height)
Wall & Ceiling Panel Thickness	80 mm
Floor Panel Thickness	60 mm
Floor Panel/Slab Skin Material	PUF Slab
Product Type	Curd (Cups/Pouches), Lassi
Storage Capacity	16,680 LPD
Packing Type	Cups/Pouches in Crates
Temperature	Room: +2°C to +4°C; Incoming: +10°C to +12°C; Final: +4°C
Pull Down Time	6-7 hours
Insulation	PUF, Density 40 ± 2 Kg/m <sup>3</sup>
Construction	Prefabricated Sandwich PUF Panels with Cam Lock Joints & PVC Gasket
Floor Panel Construction	PUF Slab with one side Tarfelt for P.C.C or Kota Flooring (Kota Flooring by Buyer)
Lighting	Vapor-proof Bulkhead for uniform lighting
Pressure Relief Port	To balance air pressure and reduce panel vacuum damage
Clear Opening Size	1200 mm x 2100 mm (W x H)
Door Leaf Thickness	80 mm
Condenser Type	Air-Cooled Aluminum Fin & Copper Tube Type
Cooling Capacity	59,744 BTU/Hr (17.51 kW/unit)
Refrigerant	R404a
Connected Load	8.75 kW/unit
Power Supply	440 V / 50 Hz / 3 Phase
Compressor Model Type	Hermetic Scroll

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## 2. Pre-Fabricated Panels (Incubation Room)

Parameter	Details
Cold Room Size	3 m x 6.7 m x 4 m (Height)
Wall & Ceiling Panel Thickness	80 mm
Floor Panel Thickness	60 mm
Floor Panel/Slab Skin Material	PUF Slab
Product Type	Curd (Cups/Pouches)
Storage Capacity	5,560 LPD
Packing Type	Cups/Pouches in Crates
Temperature	Room: +40°C to +45°C; Incoming: +40°C to +45°C
Pull Down Time	5-7 hours
Insulation	PUF, Density $40 \pm 2 \text{ Kg/m}^3$
Construction	Prefabricated Sandwich PUF Panels with Cam Lock Joints Gasket
Floor Panel Construction	PUF Slab with one side Tarfelt
Lighting	Vapor-proof Bulkhead for uniform lighting
Pressure Relief Port	To balance air pressure and reduce panel vacuum damage

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### Schedule of Major Items Proposed

Sl. No.	Item	Capacity/Specification	Quantity
1	Forced Draft Cooler (DX Type)(2 w & 1 sb)	15,000 kcal/hr, Evaporating Temp: -5°C, Room Temp: 0°C, Freon Refrigerant DX System	3 Sets
2	Incubator Heater	5 kW/hr	2 Nos
3	Floor Insulation	PUF Slabs, 80 mm (2 Layers, 40 mm each)	100 Sqm
4	Ceiling/Wall Insulation	Prefabricated PUF Panels, 80 mm Thickness	300 Sqm
5	Sliding Doors (Cold Store)	SS 304, 80 mm PUF, Clear Opening: 1.5 m x 2.1 m	2 Nos
6	Sliding Doors (Incubation Room)	SS 304, 80 mm PUF, Clear Opening: 1.2 m x 2.1 m	1 No
7	Air Curtain with Limit Switch	For Doors (1.5 m x 2.1 m & 1.2 m x 2.1 m)	2 Nos
8	Air Shield Curtain (PVC Strips)	For Sliding Doors	1 Lot
9	Pipes, Valves, Fittings (Freon)	For Refrigerant & Oil Lines, with Future Expansion Provisions	1 Lot
10	Water/Drain Pipes, Valves, Fittings	As per Requirement	1 Lot
11	Power, Control & Signal Cables	Includes Cable Tray, Accessories, etc.	1 Lot
12	Refrigeration Plant Controls	Freon System Instruments, Control Panel	1 Lot
13	Internal Electrification	10 Moisture-Proof Lights, IP-65 MCB Controls	1 Lot
14	Service Cover	For 1 Year	4 Jobs

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**LIST OF PREFERRED MAKES FOR MAJOR COMPONENTS**

<b>Description</b>	<b>Make</b>
Screw compressor package	GRASSO / MYCOM / HOWDEN/ JOHNSON CONTROLS
Reciprocating compressor package	VILTER / MYCOM / KIRLOSKAR
Skid mounted Package Screw Chiller	BITZER/HITACHI/VOLTAS/CARRIER/YORK
Compressor for multi-compressor rack	BITZER / COPELAND / GEA BOCK (GRASSO) / FRASCOLD / YORK / CARRIER
Motor	SIEMEN / ABB / KIRLOSKAR / BHARAT BIJLEE/ CROMPTON GREAVES / SEW
Electronic soft starter /VFD	SIEMENS / ALLEN BRADLEY /LK (FORMERLY L&T) / DANFOSS / SCHNEIDER / ABB / AMTECH
Evaporative Type condensers	FRICK / STAR COOLERS / THERMAX / OMEGA ICEHILL
Plate heat exchanger for pre-chiller, condenser	ALFA LAVAL / KELVION / DANFOSS (SONDEX)
Falling Film Chiller	OMEGA ICEHILL / BUCO / PAUL MUELLER
Liquid refrigerant- Canned motor pump	HERMETIC / HYDRODYNE
Liquid refrigerant pumps- Centrifugal	WITT / FRICK
Chilled water pump	GRUNDFOS / WILO / XYLEM / KSB / EBARA
Automatic air Purger	ARMSTRONG / HANSEN /GRASSO / YORK / DANFOSS
Water Pipes	TATA / JINDAL / ZENITH / MST / KALYANI
Cassette Type Air Conditioners	DAIKIN/ TOSHIBA/ HITACHI/ VOLTAS/ LG/ BLUE STAR/ MITSUBISHI
Forced draft coolers	GUENTNER / HELPMAN / GOEDHART/ KUBA / STAR COOLERS / FRICK
Decorative Fan coil unit	CARRIER / VOLTAS / BLUE STAR
Industrial Heavy-Duty Fan coil unit	STAR COOLERS / FRICK / ETHOS
Air curtains	RUSSEL /RADEN /ALMONARD / SIMURG/ MITZVAH
Cold store & deep freeze door	METAFLEX / SALCO / MTH / GANDHI AUTOMATION

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Description	Make
(sliding)	
Cold store door (hinged)/ Hatch door	METAFLEX / SALCO / MTH / GANDHI AUTOMATION
Pre-fabricated insulating panels	LLOYDS / RINAC / BEARDSSELL / FRICK / KINGSPAN JINDAL / METECNO / SUCHIFOAMS
Elastomeric Foam	AEROFLEX / ARMAFLEX / K FLEX
Saddles for cold insulation	SUPERTHERM (LLOYDS) / BEARDSSELL
Refrigerant / Oil pipes	TATA / JINDAL / KALYANI / MSL / ISMT
Copper Tubes	MANDEV / RAJCO / TOTALINE
SS Pipes and Tubes	RATNAMANI / BHANDARI FOILS & TUBES / APEX / JINDAL QUALITY TUBULAR / SHUBLAXMI / RENSA
Refrigerant line mechanical valves (Hand expansion, straight/angle shut-off, single & double head pr. relief, self-closing oil drain valves)	PARKER /HERL-KIRLOSOKAR / HANSEN / REVALCO / DANFOSS / SUPER FREEZE / MANIK
Refrigerant line system solenoid or motor operated valves, control valves (like expansion, shut-off valves, wet return line pilot operated valve, probe type DX valves), liquid level floats/ controllers, LP-HP-OP Cut-outs etc.	PARKER /HERL-KIRLOSOKAR / HANSEN / REVALCO / DANFOSS / MANIK / ALCO / AMERICAN SPECIALITIES, USA / E&H
Water valves	SAUNDERS / LK (FORMERLY L&T) (AUDCO) /BDK / INTERVALVE / CRESCENT / LEADER/ GEMU
SS & MS Structural channels & angles	SAIL / TATA STEEL / RINL / ESSAR
SS Coils & Plates	SAIL / TATA STEEL / RINL / JINDAL/ ESSAR
Flow Switch	DANFOSS/ SWITZER / IFM / E&H / IFB / ANDERSON NEGELE / BAUMER / HONEYWELL
Vortex / Magnetic Flowmeter	E&H / EMERSON / ANDERSON NEGELE
Automation system	SIEMENS / ROCKWELL / SCHNEIDER
Human Machine Interface (HMI)	ALLEN BRADLEY (ROCKWELL) / SIEMENS / SCHNEIDER

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<b>Description</b>	<b>Make</b>
Reflux type refrigerant liquid level gauge	REVATHI / RK DUTTA
Dial type Pressure/ Temperature gauges	H.GURU / PRICOL / FIEBIG/ WARREE
Digital temperature sensors/ indicator / controller	E&H / EMERSON / ANDERSON NEGELE / IFM/ RADIX
Digital temperature indicating controller with defrost control for packaged refrigeration units	DANFOSS / JONHSON CONTROLS/ DIXELL-EMERSON/ HONEYWELL
Reflux type refrigerant liquid level gauge	REVATHI / RK DUTTA
Refrigerant Leak Sensors	DANFOSS / EVIKON /
Harmonic Filter	LK (FORMERLY L&T) / SIEMENS / SCHNEIDER / ABB / EMERSON / SCHAFNER / AMTECH
MCCB	LK (FORMERLY L&T) / SIEMENS / ABB/ SCHNEIDER / MDS LEGRAND
Switch fuse units	SIEMENS/LK (FORMERLY L&T)/SCHNEIDER / ABB
MPCB	LK (FORMERLY L&T) / SIEMENS / SCHNEIDER / ABB
MCB	HAGER/SIEMENS/MDS-LEGRAND/SCHNEIDER/ABB
Contactors	LK (FORMERLY L&T) / SIEMENS / SCHNEIDER / ABB
LT armoured Power Cables	KEC (RPG) / FINOLEX / RR KABEL / APAR / POLYCAB/ SBEE / GLOSTER / LAPP / KEI / THERMOCABLE
LT armoured Copper Control Cables	KEC (RPG) / FINOLEX / RR KABEL / APAR / POLYCAB/ SBEE / GLOSTER / LAPP / KEI / THERMOCABLE
LT steel braided copper power & control cables	LAPP KABEL / SBEE / RR KABEL
Signal & Instrument cable	LAPP KABEL / FINOLEX / POLYCAB / RR KABEL / THERMOPAD/SBEE
Protective relays / Over-load relays / Timer / MPCB	L & T/SIEMENS/ SCHNEIDER/ABB / ELMEX
Push button	LK (FORMERLY L&T)/SIEMENS/SCHNEIDER/ABB/TEKNIC/ VAISHNAV / GE





Description	Make
LED type indication lamp	LK (FORMERLY L&T) / SIEMENS / SCHNEIDER / ABB / BINAY/ TEKNIC
Terminal block	WAGO / LAPP INDIA /CONNECTWELL
HRC fuse	L & T/SIEMENS /EE/GE POWER / C&S
Measuring instruments	LK (FORMERLY L&T) / SIEMENS / IMP/ MECO / AE / RISHAB
Resin Cast / Poly Carbonate Current transformer, Potential Transformer	KAPPA / BHARTI / LK (FORMERLY L&T) / NEWTEK / PRECISE / AE / ELMEX / RISHABH
Rotary selector switches	LK (FORMERLY L&T) / SIEMENS/ SALZER /TEKNIC / KAYCEE
Power Capacitors	EPCOS / SCHNEIDER / NEPTUNE DUCATI / LK (FORMERLY L&T) / KHATAU JANKAR / UNISTAR
APFC Relay	BELUKE / EPCOS / LK (FORMERLY L&T) / SIEMENS
Cable Lugs	DOWELLS/ COMET / LAPP KABEL
Cable Gland	DOWELLS/ COMMET / LAPP KABEL / BRAVO
LT Energy meter/ Digital Voltmeter & Ammeter	SIEMENS / LK (FORMERLY L&T) / SCHNEIDER / RISHABH / ENERCON/ INDIAMETER /CADEL
Analog Ammeter & Voltmeter	RISHABH / IMP / MECO / AE
Digital Energy Meter	SIEMENS / LK (FORMERLY L&T) / SCHNEIDER /HPL SOCOMEC
Digital Power Factor Meter	SIEMENS / LK (FORMERLY L&T) / SCHNEIDER / RISHABH /EPCOS
Programmable Protection Relay	MINILEC / LK (FORMERLY L&T) / SCHNEIDER
Isolating Switches	SIEMENS / LK (FORMERLY L&T) / SCHNEIDER / ABB
Motor isolator/junction box	HENSEL / RITTAL / R STAHL/HANSU
PVC Conduit & accessories	PRECISION / CLIPSAL / POLYCAB/ P - PLAST
Cable Tray	INDIANA / MEK / PILCO / ELCON / METALICA PRESSINGS / OM ENGINEERING / OBO/ SWASTIK
Vapour proof Light fittings for cold store /deep freezes	PHILIPS / WIPRO / BAJAJ / CROMPTON GREAVES
Personal Computer	HEWLETT-PACKARD / DELL / LENOVO / IBM

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Description	Make
UPS	EMERSON / HI-REL / DB ELECTRONICS/ SOCOMEC / REILO
SMF Battery	AMCO / EXIDE / AMARA RAJA / AMCO YUASA
Plug & Socket	LEGRAND / CLIPSAL / BCH / HENSEL
Servo Voltage Stabilizer	LOGICSTAT / SUVIK / VOLTAMP / CRYCARD / NEEL
Cooling Tower	PAHARPUR / MIHIR / ADVANCE / TEKNI

### Electricals

#### 1. Moulded Case Circuit Breakers (MCCB) :

MCCBs shall always be provided with separate operating handle mechanism with door interlocking. The MCCBs shall be of tripple/four pole construction (as required in the feeder details) arranged for simultaneous three/four pole manual closing or opening and automatic instantaneous tripping on short circuits. MCCBs shall be provided with adjustable type tripping device with inverse time characteristics for over load protection. All MCCBs are to be provided with operating handles interlocked with cubicle doors.

Closing mechanism shall be quick make, quick break and trip free type. Operating handle shall give a clear 'ON', 'OFF' & 'TRIP' indication. Control voltage for MCCB shall be 240 volts. The MCCBs shall be rated for continuous maximum duty as specified. The rating of the MCCBs shall be as per the feeder details.

#### **Minimum rated breaking capacities shall be as under:**

MCCBs upto 100 Amps    35 KA  
Above 100 Amps        50 KA

**Note : All feeders having 3 pole MCCB shall be provided with neutral link complete with isolating link. However, the MCCBs for incoming and non-motor feeders shall be of 4 pole construction, unless stated otherwise.**

#### 2. Switches & fuse switches :

Switches or fuse switches shall be load break, heavy duty, air break having continuous maximum rating type with manual quick make / break mechanism. 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 should be possible to defeat this arrangement for testing purpose.

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**3. 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. Wherever required fuse pullers shall be provided. 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 of fuse pullers also shall be provided.

**4. Contactors:**

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 240 volts, 50 Hz. 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 16 Amp and all contactors of Star Delta Starter to be of same rating. Rating of contactor shall be based on feeder rating.

**All contactors of motor starters shall be suitable for AC 3 duty unless specified otherwise.**

**5. Protective Devices :**

**Bimetal overload relays with inbuilt single phase protection shall be provided for all motor feeders. The relays shall be adjustable and self reset type.**

Heavy duty starters shall be provided with saturable type current transformer operated overload relays only, which shall be suitable for motor starting time of 15-60 seconds.

Any other relays, if required for incoming & outgoing feeders shall be specified in the feeder details.

**6. Timers :**

The timers shall be continuously adjustable and electronic type, suitable for 240 V, 50 Hz. supply. The timers for Star Delta automatic starters shall have time delay of 0 to 60 seconds between change over of contacts.

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**7. 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 should have minimum 1 NO + 1 NC contacts. Push buttons shall conform to IP-65 protection against dust and water ingress.

**8. 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
TRIPPED	:	Yellow

**Indication lamps shall be in the form of cluster of high intensity light emitting diodes (LED) to give bright indication. These lamps shall be of 22.5 mm dia and having operating voltage of 240 V, AC.**

**9. 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 less than "5.0".

Separate CT's to be provided for protection and metering purpose.



## 10. Measuring Instruments :

These shall be of square pattern having approximate dimensions 96 mm x 96 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 not have provision for simultaneous display of three phase readings.

Voltmeter shall be suitable for direct line connection. Voltmeters shall be connected through fuses 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, power factor, active energy, reactive energy, etc.

All motor feeders of 15 HP and above shall be provided with ammeter. Ammeter shall also be provided for all incoming & outgoing switches / MCCB / ACB of rating 100 A & above. Ammeters shall always be CT operated.

### 1.2 Special Requirements :

1. All motor feeders above 10 HP rating shall have soft starter upto 10 HP shall have DOL starters unless specified otherwise.
2. All motor feeders up to 20 HP shall be provided with switch fuse unit or MPCB as specified in the feeder details and motor feeders above 20 HP shall be provided with MCCB having a minimum breaking capacity of 50 KA.
3. All the power contactors of Star-Delta starters shall have same current rating.



4. The following selection table shall be followed for switches & contactors of motor feeders unless otherwise specified :

Sr. No	415 V. Motor HP	Contactors Rating Amps.	Fuse Switch/MCCB Amps.
1	0 to 10 HP	16	63
2	12.5 to 15 HP	25	63
3	20 to 25 HP	32	63
4	30 HP	32	100
5	40 to 45 HP	40	100
6	50 to 60 HP	70	100
7	65 to 70 HP	70	200
8	75 to 90 HP	110	200
9	100to 125 HP	110	250
10	150 to 180 HP	160	400

For motors of smaller ratings, MPCB with suitable thermal release may also be provided as per the requirement given in the feeder details. The following selection table shall be followed for MPCB of motor feeders unless otherwise specified:

Sl.no	415 V Motor HP	Contactor ratings (Amps)	MPCB Rating
1	0.5 to 1	16	16
2	1.5	16	3.2
3	2	16	5
4	3	16	6
5	5	16	8
6	7.5	16	13
7	10	16	16
8	12.5	16	20
9	15	16	20
10	17.5	16	25

**For capacitors, rating of contactors/switch shall be double of rated current of capacitor.**

5. For incoming feeder of rating higher than 600 A, ACB shall be provided unless otherwise stated in the feeder details.
6. If the outgoing feeder rating is higher than 63 Amps., MCCB shall be provided unless stated otherwise and preferably these shall be located at the lower portion of the panel. These feeders shall also have isolating link for neutral in case 3 pole MCCBs are to be supplied as per the requirement given in feeder details.

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7. Electrical interlocking shall be provided between various feeders as required by the process and specified in feeder details.
8. **If the total operating load on MCC is more than 600 kW, MCC shall be provided with two incoming feeders with a bus coupler unless specified otherwise.** Each incoming feeder shall have independent instrumentation and protection.
9. Induction motors (above 15 H.P) having 3000 RPM shall require higher rating for fuses, contactors and electronic timers due to very high starting current. MCC Bidder has to specially check this requirement from purchaser.
10. Bidder has to submit GA & power circuit drawing for approval to purchaser before starting manufacturing of MCC.
11. All the major components of an MCC shall be of same "Make".

**Technical bid to be submitted by the bidder**

	<b><u>FORCED DRAFT COOLER</u></b>	<b><u>UOM</u></b>	<b><u>CURD COLD STORE</u></b>
1.	Make		
2.	Model		
3.	Dimensions (L x B x H)	Mm	
4.	Weight of Each Unit	Kg	
5.	Heat Transfer Capacity (Minimum)	TR	
6.	Total Surface Area	m <sup>2</sup>	
7.	LMTD	Deg. K	
8.	Coil Diameter	Mm	
9.	M.O.C. (Coil)		
10.	M.O.C. (Fins)		
11.	No. of Rows & Deep		
12.	Fin Spacing	Mm	
13.	Defrosting Arrangement		
14.	No. of Axial Fans in Each Unit		
15.	Motor Rating for Each Fans	kW	
16.	Fan Air Flow Rate and Static Head		
17.	Air throw	M	
18.	Fan impeller material		
19.	Fan RPM		
20.	No. of FDC's		
21.	Design Pressure of Coils (Pneumatic)	kg/cm <sup>2</sup>	
22.	Working Pressure of Coils (Pneumatic)	kg/cm <sup>2</sup>	
23.	Test Pressure of Coils (Pneumatic)	kg/cm <sup>2</sup>	

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**For Incubation Room**

	<b><u>INCUBATION ROOM</u></b>	<b><u>UOM</u></b>	
1.	Make		
2.	Model		
3.	Dimensions (L x B x H)	Mm	
4.	Weight of Each Unit	Kg	
6.	Total Surface Area	m <sup>2</sup>	
14.	No. of Fans in Each Unit		
15.	Motor Rating for Each Fans	kW	
16.	Fan Air Flow Rate and Static Head		
17.	Air throw	M	
18.	Fan impeller material		
19.	Fan RPM		



*R. M. S.*