



**NDDB
ANAND**

**DIRECT EXPANSION TYPE BULK MILK
COOLING SYSTEM
(capacity up to and including 2000 L)**

SPECIFICATION NO.
01.13.001.00 R1
(2009)

1. General Description

Design, supply, installation, testing and commissioning of Direct Expansion type bulk milk cooling systems including all accessories & items given in the detailed scope of supply, on turnkey basis.

2. Functional Requirement

These systems would be installed in village Dairy Co-operative Society (DCS)/ village milk collection centre, which collects milk everyday in the morning & evening from milk producers. The milk collected shall be stored in the bulk milk cooler and cooled from ambient temperature to 4⁰ centigrade. The stored milk shall be dispatched to dairy plant through insulated road milk tanker once in a day.

3. Design Requirement

3.1 Capacity

The net capacity of the bulk milk cooler shall be as mentioned above and as per the requirement given in the enquiry/tender document. However, the gross capacity in all the sizes shall be around 10% higher than the rated capacity to avoid accidental spillage of milk due to agitation or any other reason.

3.2 Applicable manufacturing/ design code

3.2.1 Bulk Milk Cooler (BMC)

The BMC tank shall meet the requirements of **ISO 5708 – 2 II (Latest version)** for milk collection cycle of two times in a day with not more than 3.0 hours cooling time from 35 to 4 Deg. C for all milking* and not more than 1.5 hours for second milking* i.e. from 10 to 4 Deg. C.

For design of condensing unit for BMC **ARI Standard 520-2004** (Air-Conditioning & Refrigeration Institute, Arlington, Virginia) for ambient temperature condition shall be applicable.

The tank shall be of an established & proven Direct Expansion type design, in regular production & use and not a prototype.

(*Note: All milking means quantity of milk received in either morning shift or evening shift. When a Tank for two milkings is either empty or contains 50% of its' rated volume of milk at 4⁰ C, and 50% of the rated volume of milk at 35⁰ C is added in one batch, all of the milk shall be cooled to 4⁰ C in not more than the specified cooling time.

If a volume of milk corresponding to the second milking is added to the tank, the total volume of the milk shall be cooled to 4⁰C in not more than specified cooling time.)



3.2.2 Refrigeration System

The refrigeration system shall be designed to meet performance ratings of positive displacement condensing units specified in **ARI Standard 520- 2004**.

3.2.3 Accessories

Accessories like diesel generator set, electric & control cables, control panel, temperature sensor, electrical switchgears, refrigeration control valves & fittings etc. shall be of approved make as detailed in the specifications and shall meet the requirement of the latest relevant **Indian electricity rules**, ISO/BIS Standards.

4. Scope of the bidder

4.1 Scope

The bidder's scope starts from SS 304 funnel with a SS mesh at inlet of the BMC tank for manual receiving of milk. Alternatively, milk is received in milk can with SS 304 funnel with SS mesh and then manually poured in to a balance tank (200 litres) and pumped to bulk milk cooler. In some cases, the reception equipment will include a can tipping bar. The balance tank of capacity 200 litres shall be made up of SS sheet conforming to AISI 304. From BMC, the milk shall be transferred to Road Milk Tanker (RMT) through food grade quality flexible hose of adequate length and milk transfer pump installed either on the RMT or through the pump supplied along with BMC.

Bidders should furnish separate prices for gravity fed system as well as for pumped system.

4.2 Supply

The bulk milk cooler shall be a complete unit with the refrigeration system, agitator(s), lockable inlet & outlet valve with strainer. Also includes supply of AISI 304 balance tank with SS 304 filter for pumped system, SS piping & milk hose of food grade quality, unions and milk transfer pump of 5000 LPH, SS 304 pipes & fittings, erection materials, pipe supports, floor plates, hinged type pipe clamps. The hose pipe shall be 10 metres long and end with SS liner and blank nut chained with the hose. A wall mounted SS hook of adequate size for hanging the milk hose pipe roll shall also be provided. The scope includes electrical & control panels and interconnecting cables, cable conduits shall also be supplied, earth pit pipes with removable cover & earthing as required by local electrical regulation.

The indicative distances between BMC outlet to milk pump inlet - 3 m, BMC to Mains power point & DG set – 20 m may be considered for calculating cable, SS piping requirement, supports etc. However, the exact distances shall be as per site conditions and complete piping & cabling necessary for installation shall be supplied.

4.3 Installation & Commissioning

The total job is on turnkey basis and includes supply, installation, testing, commissioning and training of the field personnel. Minor civil works, providing & grouting supports are included in the scope. Giving satisfactory training to the staff



of the collection centre and trial runs for the complete unit. Moreover, supplier has to demonstrate performance of the unit as per operating parameters to the Client /NDDB.

5. Constructional Features

5.1 Bulk Milk Cooling Tank

5.1.1 Material of construction

Tank inner, outer, bottom, top openable cover shall be fabricated from Stainless Steel AISI 304 material. All components, as under, shall be made out of AISI 304 grade stainless steel.

Piping & fittings, Filter, Lockable cover, adjustment, Dipstick, Outlet & Inlet
Agitator shaft & blade, adjustable Ball Valves, Blank flanges etc.
Feet with provision for 50 mm height

The filter screen shall be fine wire mesh. All the gaskets shall be of food grade nitrile or neoprene rubber material. The AISI 304/316 evaporator shall be dimpled pressed plate jacket put as bottom plate of the inner tank. The bottom evaporation surface in contact with milk as well as outer SS cladding is passivated by standard chemical treatment to impart corrosion resistance.

5.1.2 Shape & Orientation

The preferred shape of the tank shall be horizontal rectangular with an openable top cover. The shape of the BMC tank shall conform to international sanitary design.

5.1.3 Milk Cooler Tank & Evaporator

The AISI 304 tank for the bulk milk cooler should be horizontal rectangular or horizontal semicircular bottom or vertical circular shape, which imparts smooth distribution of the fat in milk when agitator is set in to operation.

The tank shall be so designed that all surfaces in contact with milk are readily accessible either in their position or after dismantling to permit thorough cleaning.

Inner Vessel:

All joints shall be TIG welded, any filler rod used being suitable for the parent metal. All welds shall be ground smooth and free from crevices, porosity and brittleness. All milk contact metallic surfaces of the inner vessel and its attachments should have finish not less than 150 grit finish.

Any permanent attachment to the inner vessel shall be welded with fillet radii not less than 6 mm.

All parts of the inner vessel shall drain directly to the outlet.



Internal corners formed round the bottom of the inner vessel and outlet well shall be of not less than 25 mm in radius. Other internal corners shall be not less than 15 mm in radius.

The evaporator shall be laser welded dimpled jacketed. In case of rectangular type bulk milk cooler, the evaporator is fixed as the bottom plate of the inner tank. Whereas in semicircular bottom tank the jacket shall be at least up to 1/3 height of the tank. In case of double compressor, total evaporator area shall be divided and separated into two sections. Each section shall have separate suction & discharge connecting to each compressor. The evaporator surface in contact with the milk should be passivated by standard treatment to impart corrosion resistance.

5.1.4 Tank Fittings & accessories

The tank shall be provided with **stainless steel inlet with special "no-foam" design**, outlet 38/51 mm butterfly valve & blank union with locking arrangement, inspection window/ manhole with locking arrangement, agitator and top cover with locking arrangement.

At the bottom of the outlet cup on the outer surface, a temperature sensor shall be permanently fixed. It shall sense the temperature of the surface at the outlet and transmit the signal to the digital indicator. The digital type temperature indicator shall be provided in the control panel with back up battery.

The tank shall be provided with SS calibrated dipstick to measure the volume of milk inside the tank. The dipstick shall be graduated from 10% or less to not less than 100% of the rated volume. Each division on dipstick shall represent a volume not greater than 0.5% of the rated volume. The calibration chart of dipstick having adequately bold letters shall be laminated/ framed and shall be supplied with BMC. The tank shall be equipped with agitator(s) capable of producing a uniform distribution of fat in the milk.

All SS fittings shall be of SMS standard.

The BMC shall be provided with 1 (one) AISI-304 filters with SS fine wire mesh suitable to filter extraneous matter such as dust particles, hay, flies, cow dung pieces / particles etc. The filter shall be designed and installed in such a way that it can frequently and easily be cleaned.

Top cover lifting handle shall be an in-built feature of the unit. The tank shall be provided with AISI 304 adjustable ball feet tamper proof type having provision of 50 mm height adjustment. Provision of a bolt for earthing connection may be provided on one of the legs. Number of ball feet shall be minimum 4 for small capacity tank and 6 for bigger tank.



5.1.5 Balance Tank, Capacity 200 Litres

The balance tank of 200 litre capacity shall be of sanitary design, fabricated from SS 304 sheet of 1.6 mm thick for shell & 2 mm bottom. Outlet S S Cup and sufficient slope shall be provided at bottom of tank for complete draining of milk.

The dimension of tank and fittings shall be suitable to meet milk collection operations at centre. 1 no SS removable cover (1.0 mm thick) with handle shall be provided. S S filter made from 1.6 mm S S plate with 2 mm dia holes (Removable type) to be provided for placement in the balance tank to remove coarse suspended impurities from milk. Four number Ball feet shall be provided for height adjustment of 50 mm. All fabricated parts shall be polished neat to 150 grit.

5.1.6 Stainless Steel Sanitary Milk Pump

5 KLPH, 10 MWC capacity milk pump shall be supplied for pumping milk from balance tank to BMC and BMC to road milk tanker. Pump impeller & casing shall be made out of SS AISI 304/316 material. All milk contact surfaces shall be finished to minimum 150 grits. The pump should be of sanitary design. Inlet & outlet of the pump shall have ends with SMS union. The pump shall be provided with approved make motor having 'E'/'F' class insulation and IP 55 protection. The flanged end motor shall have stainless steel shaft having hygienic mechanical sealing arrangement to prevent leakage from pump casing to rotor side of the motor. Pump shall have SS shroud with air ventilation grill for circulating cooling air. The pump shall have SS adjustable ball feet.

5.1.7 Insulation

The insulation of the tank shall be done by injection, in situ, of high density (minimum 40 kg/m³, Chlorofluorocarbon free and environmental friendly) polyurethane foam without having any imperfection and hygroscopicity. The efficiency of insulation should be such that at max 50°C ambient temperature the rate of rise of the mean temperature of the milk shall not exceed by 1°C in four hours, when the rated milk volume initially at about 4°C is allowed to stand undisturbed as per the requirement of ISO 5708 2 II when the refrigeration unit is not working.

5.1.8 Cleaning In Place (CIP)

For top openable configuration, facilities for manual cleaning shall be provided with suitable brush for BMC tank as well as brush for internal cleaning of SS pipes. 4 nos. of SS hooks shall be provided to keep these brushes, loose pipes etc.

5.1.9 Welding & Finishing

Inner, outer, intermediate dimpled jacket and nozzle connections shall be welded with TIG process only. The inner shell and all other product contact surface shall be polished up to minimum 150 grit finish. The outer surface to be polished with 150 grit dull finish or a circle finish.



5.2 Refrigeration System

The refrigeration system shall be designed to comply with **ARI Standard 520-2004** and to meet the requirements of milk collection system of ISO 5708, Class 2 II. The refrigeration system shall be of direct expansion type, with Freon-22 (R-22) or CFC free environmental friendly refrigerant to cool the raw milk from reception temperature to 4°C in the prescribed period mentioned. The evaporator(s) of the refrigeration system shall form a part of the milk tank body as dimpled jacket in the bottom plate in case of rectangular open tank or atleast up to 1/3rd height of the circular/semicircular tank. It would be better if the system is compatible for the refrigerant R 407 C.

The refrigeration system shall be direct expansion type to perform cooling function in an ambient temperature of 46 °C with air-cooled condenser.

5.2.1 Compressor

The refrigeration compressor shall be adequate enough to ensure that milk is cooled to 4°C in the prescribed time limit and suitable to operate at 0°C suction temperature and 60°C condensing temperature (air-cooled condenser) assuming 46° C ambient temperature.

The refrigeration compressor (s) shall be rotary/ reciprocating, hermetically sealed type essentially suitable for refrigeration application in hot & humid Indian climatic conditions. The motor of the compressor should have a thermistor temperature sensor embedded in windings for protection from excessive heating due to overloading or short-circuiting. Similarly, a protection against off cycle migration of refrigerant to the compressor is necessary in the refrigeration unit, preferably a self-regulating PTC crank case heater. The compressors selected should be energy efficient and consume least power to meet the cooling load requirements.

The bulk milk cooler up to capacity of 1000 L shall be provided with single compressor; however, for higher capacity units two compressors system shall be preferred.

In the offer bidder shall clearly mention whether the offered system shall work on single phase or three phase mains supply. However, choice of single phase or three phases will rest on the sole discretion of the buyer.

Client shall approve Make(s) of the compressor.

Bidders can also offer Energy Efficient Hermetically Sealed Scroll Compressors of as alternative to rotary / reciprocating compressors.

5.2.2 Condenser

The condenser shall be air cooled finned tube type having sufficient heat transfer area designed for extremely high ambient temperature given above. The air circulation fan of condenser shall preferably be induced draft type sucking cold air over the compressors and throwing hot air out of the premises/place of installation. The condensing temperature should not be less than 60° C considering operating ambient temperature of 46° C.



5.2.3 Receiver

For refrigeration circuit a suitable size liquid receiver mounted on the skid near compressor to assist system to store refrigerant during pump down cycle as well as in case of maintenance.

5.2.4 Thermostatic Expansion Valve

Suitable size and capacity Thermostatic expansion valve should be provided in the refrigeration circuit of the bulk milk cooler. The TX valve should be Maximum Operating Pressure type and of adequate capacity to feed optimum quantity of refrigerant to the milk cooling tank evaporator.

5.2.5 Refrigerant pipe, fittings & controls

All pipes, valves, fittings & controls shall comply with the latest relevant BIS code applicable. Isolation valves at suction & discharge sides of the compressors is provided for compressor isolation, during maintenance of the system. A suction pressure regulating valve (KVL) shall be provided to restrict suction pressure within a reasonable limit for preventing tripping of compressor. Copper/SS tubing shall be routed in such a way that if any leakage occurred during operation can easily be detected and the defective portion can be repaired/ replaced without dismantling the whole system. All the pipes shall be clamped properly with fixed support. In case of double compressor system, pipe, fitting & control should be designed in such a way that both the compressors can run independently. The tubing shall be insulated wherever necessary.

6. Electrical Control Panel

6.1 Control Panel

Four control panels shall be provided, one for the main power supply tapping, second for the refrigeration unit, the third for the milk tank and fourth for lighting, testing equipment and computers etc. Each panel shall be provided with suitable switchgear of required ratings for switching and protection as per the system requirement. The incoming and outgoing power supply terminals shall be covered and secured with a lead seal to prevent tampering. The door of the panels should be provided with lockable handles.

6.1.1 Main Control Panel with Automatic Voltage Stabiliser

This should be suitable to receive the incoming State Electricity Authority grid supply as well as supply from BMCs D G Set. Grid supply to be stabilised for voltage fluctuation by an automatic type voltage stabiliser. Output electric supply either stabilised grid supply or DG Set supply, to be selected through a change over switch. Provision to be made in this control panel to feed output supply to the refrigeration unit & BMC agitators through refrigeration control panel, to milk dispatch pump & to lighting Distribution board.

Grid supply shall be of three phase with provision in this panel to select only one healthy phase for giving output in case BMC is of single phase. If BMC is of three phase, then this phase selector switch is not required. D G set & stabiliser to be of single phase/three phase as per requirement specific to the project.

This panel to be of rating **10 KVA** single phase for 1 KL, **15 KVA** either single or three phase in case of 2 KL.



For 10 KVA Single phase Automatic stabiliser, following major components are required:

- (1) The incoming grid power (140 to 280 volts) shall be given through TPN MCB 63 A and phase Selector switch of 63 A so that power can be drawn from the desired phase. Relay system to be provided to ensure that if incoming voltage is either less than 140 volts or more than 280 volts, stabiliser stops incoming power to stabiliser for its safety.
- (2) LED type Indicator lamps (R, Y, B) on the individual phases of supply.
- (3) A bypass switch 63 A for by passing correcting transformer
- (4) Correcting transformer ,air cooled type, with 8 steps each of 20 volts (140-160-180-200-220-240-260-280 V) to be operated through a relay system or servo controlled.
- (5) A Change-Over DP switch 63 A between DG Set and corrected mains Power supply
- (6) A digital input and output (corrected) voltage /current/frequency indicator with selector Switch. The indicator shall be so provided as to be visible from a distance of at least 5 metre, and so located as to requiring no special effort to see the readings.
- (7) DP MCB 63 A for correcting transformer ON/ OFF
- (8) DP MCB 63 A for supplying power to Refrigeration Panel .
- (9) DP MCB 32 A for supplying power to lighting DB
- (10) DP MCB 16 A for supplying power to starter of milk pump Paralley 20 A metallic power plug socket to be provided.
- (11) If the corrected voltage at the output side goes beyond 200-260 volt range, a power relay shall cut off output power supply with a loud alarm.
- (12) Suitable terminal blocks, heavy duty ,4 way for incoming mains (63 A) and 3 way (63 A) for DG Set incoming and the suitable terminal blocks, heavy duty for various outputs mentioned above.
- (13) Housing enclosure of powder coated MS of appropriate size
- (14) Double compression heavy duty Brass cable glands for two incoming armoured cables & PVC cable glands for un-armoured flexible all output cables..

For 15 KVA 3 phase Automatic stabiliser, following major components shall be provided:

- (1) The incoming grid power (Phase voltage 180 to 280 volts) shall be given through TPN MCB 40 A . Relay system to be provided to ensure that if incoming voltage is either less than 180 volts or more than 280 volts in any phase, stabiliser stops incoming power to stabiliser for its safety
- (2) LED type Indicator lamps (R, Y, B) on the individual phases of supply.
- (3) A bypass switch 40 A for by passing correcting transformer
- (4) Correcting transformer, air cooled type, for each phase, with 6 steps each of 20 volts (phase 180-200-220-240-260-280 V) to be controlled through a relay system or servo controlled .
- (5) A Change-Over TPN switch 40 A between DG Set and corrected mains Power supply
- (6) A digital input and output (corrected) voltage /current/frequency indicator with selector Switch for all three phases. The indicator shall be so provided as to be visible from a distance of at least 5 metre, and so located as to requiring no special effort to see the readings.



- (7) TPN MCB 40 A for correcting transformer ON/ OFF
- (8) TPN MCB 40 A for supplying power to Refrigeration Panel.
- (9) TPN MCB 32 A for supplying power to lighting DB
- (10) TPN MCB 16 A for supplying power to starter of milk pump. Parallely 20 A metallic power plug socket to be provided.
- (11) If the corrected voltage at the output side goes beyond 180-280 volt range, a control relay/power contactor combination shall cut off output power supply with a loud alarm.
- (12) Suitable terminal blocks, heavy duty, 4 way for incoming mains (63 A) and 4 way (63 A) for DG Set incoming and the terminal blocks (4 way 63 A for refrigeration, 4 way 32 A for lighting DB, 4 way 32 A for milk pump) heavy duty for outputs.
- (13) Housing enclosure of powder coated MS of appropriate size
- (14) Double compression heavy duty Brass cable glands for two incoming armored cables & PVC cable.

For 15 KVA Single phase Automatic stabiliser major components are to be worked out similar to 10 KVA single phase & 15 KVA three phase respectively for which details are given above.

6.1.2 Refrigeration Control Panel

The refrigeration unit shall be provided with a control panel made out of Stainless Steel suitable for wall mounting near the unit. The panel shall be provided with motor starters, ON/OFF push buttons & necessary MCBs, control wiring, line voltage controller to guard the compressor against the supply voltage fluctuations. In case more than one compressor is provided in the refrigeration system, the control panel shall be provided with a sequence controller & timer to start one compressor at a time to avoid power supply surge. The panel shall also have facility to operate refrigeration unit on auto/ manual mode. In the auto mode, as soon as the milk temperature reaches to pre-set value, the compressor should be switched off to avoid freezing of milk.

6.1.3 Milk Tank Control Panel

The milk tank shall be provided with a wall mounted control panel with timer to control the intermittent operation of the agitators & a digital temperature indicator to indicate the milk temperature to one decimal place with least count of 0.1^o C on continuous basis. It shall include suitable switchgears etc as required for switching & protection. The agitator shall have interlocking arrangement with top cover opening limit switch. The limit switch shall put off the agitator as soon as the top cover opens up. Panel shall have provision for pre setting temperature of BMC Tank (not below the milk-temperature of 4 degree centigrade) for starting/stopping refrigeration compressors. Suitable battery back up to is be provided so that temperature can be indicated when there is no electric supply.

6.1.4 Domestic Power Distribution Board

This distribution board would get single phase power from grid supply directly (it is assumed that when grid power is received in this DB, Main control panel gets power



only from D G Set) as well as stabilized power from main control panel and feed power for lighting, electric geyser/solar water heating system, testing equipment/computers. The main components of this DB shall be as follow:

- 1) Wall mounted distribution board, MCB type
- 2) 32 DP Change over switch
- 3) 32 A DP MCB as incoming
- 4) 3 nos. 10 A MCB SP for lighting
- 5) 3 nos. 20 A MCB SP for geyser/Solar water heater, AMCU etc.

6.1.5 Cables & Electrical Switch gears

All electrical switchgears and controls required for the complete system shall be of suitable rating.

All permanent wiring installed on the tank or associated units shall be carried out using PVC cable in heavy gauge, screwed galvanized steel conduit or plastic conduit, or in mineral-insulated copper-sheathed cable.

Flexible electrical connections shall be made only to items normally movable in service. Such flexibles shall be PVC insulated copper conductor cable not less than 24/0.20 mm in size (see IS 694 (Part1-1964*)) and earth continuity conductors of PVC insulated copper conductor shall be provided. Cable between DG Set and main panel shall be either steel armoured or un-armoured in steel conduits. For all electrical cables, suitable water tight cable glands and lugs should be used at ends.

* Specification for PVC insulated cables (for voltage up to 1100V): Part 1 with copper conductor (revised).

6.1.6 Earthing

The earthing should be carried as per IS:3043 - 1987 (reaffirmed 2001) - "Code of practice for earthing". Pipe type earthing can be used. The chassis, framework and the fixed parts of the metal casing of the tanks, D G Set body, refrigeration plant skid, and all panels shall be provided with two separate earthing terminals. Neutral of D G Set shall be earthed by a separate independent earth pit. Neutral of Grid supply shall also be earthed by a separate independent earth pit Suitable G I Strip(minimum 25x3 mm) to be used for connecting earth pit with nearest equipment earthing point. From this point earthing to other points can be looped by suitable GI Strip or PVC insulated copper conductor cable of green colour (size minimum 1x 4 Sq mm)

In view of above, total four earth pits to be provided for each installation.

The earthing terminals shall be readily accessible and so placed that the earth connections of the equipment are maintained when the cover or any other movable part of equipment is removed.

The earthing terminal shall be identified by means of the '≡' marked in a legible and indelible manner on or adjacent to the terminals.



7. Diesel Generator Set (Air/ water- coolant cooled) and accessories:

The DG set shall be either single or three phases as per the system requirement. Proper justification with calculations should be provided for capacity of the diesel engine and alternator being considered for DG set.

The engine should be rated for continuous operation for:

The refrigeration system, milk tank agitator & milk-loading/ unloading pump, hot water geyser (approx. 2 Kw), AMCU, Lightings, ceiling fan.

Rated maximum output of the DG set should be calculated considering the load mentioned, over and above 10 % additional load shall be considered to handle any eventuality and with the ambient design dry bulb (DB) temperature (summer) _____ Deg. C, and winter _____ Deg. C.

Performance Requirement: The working KVA rating at site conditions after accounting for de-rating as per IS: 10001/10002 or equivalent shall be obtained at 0.8 power factor.

The Genset should have the engine, alternator, control panel and silencer as an integral part of the unit. The major components of the DG set shall comprise:

7.1 Diesel Engine: The diesel engine should be suitable for Power Generation application type air /water cooled and capable of developing required BHP when running at 1500 rpm under NTP conditions and not agricultural engine. The engine should be built to IS 10000/ISO 3046/BS 5514/649 and rated for continuous running of 24 hours with an overload capacity of 10 % for a period not exceeding 1 hour in any 12 hours running. Diesel engine upto 20 KW should have valid BIS license and certificate clearly mentioning use for 'General purpose ' application as per IS 10001 norms. Engine ratings should be for operation at full load condition and should be suitable to take 100% block load.

The engine instrument panel shall be supplied with:

- Ignition key
- Starting push button
- Lubricating oil pressure gauge
- Temperature gauge for cooling water
- Temperature gauge for lubricating oil
- RPM meter (Analog type)
- Battery charging ammeter

7.1.1 The diesel engine should be four stroke, naturally aspirated/ turbocharged, Multi Cylinders & complete with the following:

- a) Flywheel & flywheel housing
- b) Engine Air/water cooling system with cooling fan & radiator CAC coolant with recovery bottle
- c) Air intake, fuel and lubricating oil filters
- d) Oil bath air cleaner
- e) Standard day fuel tank having capacity suitable for minimum 8 hours continuous operation. The **tank** shall be made with steel sheet of minimum thickness 18 gauge and complete with standard accessories such as drain pipe, fuel level indicator, valves, lockable



- cover, low-level contact & alarm.
This tank to be inside the acoustic enclosure.
- f) Fuel pump with mechanical governor
 - g) Coupling
 - h) Exhaust silencer residential type.
 - i) Holding down bolts, MS combination base frame & AVM pads.
 - j) Self-starting arrangement with 12V suitable rated heavy-duty Lead Acid accumulator type battery with Solid-state battery charging arrangement and cables.
 - k) Standard set of tools.
 - l) First fill of Lubricating oil
 - m) First fill of coolant
 - n) Lubricating oil pressure & temp. gauge
 - o) Control panel for engine with **engine safety** against over speed, High water & cylinder liner temperature, V-belt failure, low lubricating oil pressure, low water level in radiator auxiliary failure, air cleaner choke indicator.
 - p) One brand new oil barrel of 200 litre capacity with manually driven gear/barrel pump for diesel transfer along with reinforced PVC hose for supply.

7.2 Alternator: The engine should be closely / flexible coupled to suitable self excited, self regulated (through an AVR) alternator developing required KVA at 0.8 power factor, 1/3 phase, 50 cycle/sec, 230/415 volts AC power supply under NTP conditions when running at 1500 RPM. The alternator should be brushless type, screen protected and fitted with end shield and ball roller bearings. The alternator shall have 'H' class of insulation. It shall conform to IS 13364 (Part 1) 1992 up to 20 KVA or IS 13364 (part II) 1992 above 20 KVA or IS 4722 of 1992.

7.3 Control Panel: The diesel generating set should be supplied with suitable floor/wall mounting type control panel duly pre-wired with the following instruments:

- One suitable scaled and rating KwHr meter with accessories
- One ammeter with selector switch
- One voltmeter with selector switch
- One no. frequency meter
- One no. hour meter (time totalizer)
- One set of epoxy resin casted CTs of suitable ratings
- One suitable capacity MCCB with overload and short circuit protection to disconnect power supply in case load of generating set increases beyond permitted limits. The rupturing capacity of the MCCB should not be less than 35 KA.
- One set of TPN Bus bars insulated with heat shrinkable PVC sleeves (maximum permissible current density shall be 0.8 amps / mm²)
- One set of indicating lamps and control fuses
- **The control panel should conform to the Indian electricity rules.**

7.4 Frame: The diesel engine and alternator should be mounted on specially designed combination base plate and MS structure of extremely rigid fabrication. The base plate should be suitable for mounting the set on AVM pads over the foundation.

7.5 Acoustic Enclosure: DG set should carry a valid approval certificate issued as per CPCB norms complying with the provision of the Environment (Protection) second Amendment Rules 2002, vide notification no G. S. R. 371 (E), dated 17th May 2002 & amended by GSR 448 (E) dt.12/07/2004. The Diesel Generator sets shall have a standard acoustic enclosure of 25 dB (A) insertion loss. The exhaust



pipe with exhaust muffler with insertion loss of minimum 25 dB (A) is connected to the exhaust manifold preferably with flexible bellows.

7.5.1 General requirement: The enclosure could be tailor made suitable for both indoor and outdoor installation as per the requirement and depending upon the capacity of D.G. Set. The enclosure should be aesthetically designed to perform for optimum noise attenuation and in no way derate the performance of the DG set in extreme summer conditions. Acoustic Enclosure should be Environment Friendly and protected against rodents etc. The enclosure should have:

- Adequate ventilation for genset cooling air requirement.
- Absorbent /insulating material used is fire radiant.
- Suitable thermal lagging to avoid localized heating of adjoining part of exhaust.
- Appropriately located control panel.
- Easy access side doors to service points on gensets.
- Doors fitted with high quality Gaskets to avoid leakage of sound.
- Provision for Engine Air Filters to suck the Fresh Inlet Air for Engine directly from atmosphere
- Sufficient space inside to fit different accessories like batteries, etc & the maintenance can be done inside with the easy movement of the working person on DG Set.
- Enough space for Control Panel and Fuel Tank inside Enclosure
- For the proper ventilation and to maintain the temperature inside the enclosure Forced ventilated Air Circulation System using Axial Flow Fan(s) to meet total engine requirements & air charges should be provided. (Air volume required for ventilation is to be based on the combustion, cooling air, & alternator cooling air as per the specifications given by the engine and alternator manufacturer.) Temperature of enclosure should not exceed beyond 5^o C of ambient temperature.

7.5.2 Constructional features of acoustic enclosure:

- The construction and design of the Acoustic enclosure shall be very rugged, durable and shall be virtually maintenance free.
- The acoustic panels shall be filled with a special grade high-density mineral wool retained on the inside by perforated GI sheets specially designed for optimum sound attenuation.
- The outer surface of the Acoustic Panels shall be fabricated of preformed 16G corrugated CRCA sheet steel of a SAIL make only. All sheet steel frames shall be of 16G CRCA sheets of SAIL make only.
- All structural members such as angles / channels used in the construction of the enclosure frame shall of TISCO / SAIL make only.
- All materials used for Acoustic Enclosure shall be fire resistant /fire retardant grade.
- The sheet steel treatment shall consist of degreasing, de-rusting and phosphating followed by two coats of zinc chromate primer, followed by two coats of Zinc - pholite surface for superior corrosion resistance and two coats of finish paint.
- For effective Acoustic sealing, necessary gasketing material shall be provided.
- All hardware and fittings used shall be passivated with zinc.



7.5.3 In case the DG Set is installed indoor, the exhaust should be taken outside the building. The exhaust pipe of engine should be extending horizontally out of the building (assumed minimum length of pipe 3 meters, then upward rise two meters and terminate with a weather protection cowl). The entire pipe length should be insulated with resin-bonded mineral wool with aluminum cladding.

All the necessary supports are to be provided for sturdy installation.

8. Water for cleaning at milk collection centre

8.1 Water storage (This tank shall be included only if water heating other than Solar Heating has been adopted. For solar heater a tank has been included in the specification as per Clause No. 8.2.3):

A 500/1000 litre capacity overhead water storage tank - ISI Mark Rotational molded Polyethylene Water Storage Tank (HDPE heavy duty), hygienic construction conforming to IS: 12701/96 closed type with manhole for maintenance. The tank to be provided with float valve, drain, & overflow and other standard accessories. The tank stand assembly shall be made of MS angle of size 35x35x5 mm duly pre-treated and hot dip galvanized after fabrication. If during erection at site the zinc coating is punctured due to welding or any other reason, the punctured portion shall be painted (at least 2 coats) with silver paint. Alternatively tubular structure with powder coating could also be provided. GI B class piping up to convenient points in the room for hot and cold water supply shall be supplied & connected in consultation with client.

The piping from the mains (water source) up to the water storage tank shall be provided by client.

8.2 Solar Water heating system:

Solar Water heating system, indirect type, rated capacity **200 LPD**, shall be used for cleaning of BMC tank and other equipment, piping etc. at milk collection centre. System to be designed considering that ambient temperature normally does not go below 3 Degree C & normally Sun heat is available for minimum 6 hours and cold water having hardness not more than 1000 ppm. Hot water to be made available at maximum 70 Degree C. Capacity to be derived considering delta T as 50 degree C in 6 hours. The system shall consist of solar flat plate collector(s), collector stand assembly, stainless steel insulated hot water storage tank with heating jacket and various other components as per detailed specification given below.

8.2.1 Solar Flat Plate Collector:

Solar flat plate collectors shall conform to IS: 12933 (part 1) with amendment upto date and IS: 12933 (Part 2)/ 2003 with amendment up to date and various components shall be as under:

(a) Cover Plate: Cover plate shall be toughened glass and thickness of minimum 4 mm conforming to IS: 12933 (Part 2)/ 2003. The solar transmittance of the cover plate shall be minimum 82% at near normal incidence.

(b) Collector Box: Collector box frame shall be made of Extruded Aluminium sections only. Type, grade, size, workmanship and finish of the material used shall be as per IS: 12933 (Part 2)/ 2003. The minimum thickness of aluminium shall be as under:

Channel section for sides : 1.6 mm



Sheet for bottom : 0.7 mm Support for glass retaining : 1.2 mm
Frame to be given PU Powder coating.

(c) Absorber: Absorber shall consist of riser, header and sheet for absorber. The thickness of header and riser tube shall be minimum 0.71 mm and 0.55 mm respectively, and made up of copper only. The diameter of header & riser tube shall be minimum 25.4 & 12.5 mm respectively. Type, grade, size, workmanship and finish of the material used shall be as per IS: 12933 (Part 2)/ 2003.

The header and riser assembly shall be designed for a working pressure of 2.5 kg/ sq. cm and shall be tested for leakages at a minimum hydraulic pressure of 5 kg/ sq. cm.

(d) Sheet for absorber: Sheet for absorber shall be made of copper only. Type, grade, size, workmanship and finish of the material used shall be as per IS: 12933 (Part 2)/ 2003.

(e) Collector box insulation: Insulation shall be provided at back and sides. Collector box insulation shall conform to IS: 12933 (Part 2)/ 2003. Glass wool & rock wool insulation, 50 mm thick for back & 25 mm thick for side can be accepted.

(f) Gaskets and Grommets: Gaskets and grommets shall conform to IS: 12933 (Part 2)/ 2003

(g) Collector stand assembly: Collector stand assembly shall be made of MS angle of minimum size 35x35x5 mm duly pre-treated and hot dip galvanized after fabrication. If during erection at site the zinc coating is punctured due to welding or any other reason, the punctured portion shall be painted (at least 2 coats) with silver paint. Alternatively tubular structure with powder coating could also be provided.

8.2.2 Insulated Hot Water Tank with jacket:

(a) Water tank with heat exchanger: The hot water tank shall be non pressure type of capacity 200 Litres and made up of SS conforming to AISI 304/304 L with minimum 1.2 mm thick sheet & TIG welding. SS jacket around inner tank shall be there for circulation of primary heating medium (thermic fluid/ distilled water) from solar collector panel in close loop for heating secondary water stored in the tank. The outer shell shall be insulated preferably with thermal grade PUF of thickness 40 mm and clad with Aluminium/ GI sheet of minimum 24 SWG. PUF density shall be minimum 32 kg/ cu m. Alternatively minimum 50 mm thick Rock Wool slab with AL/ GI cladding can be used for insulation. A SS drain with SS cock shall be provided to take out sediments periodically.

(b) Primary liquid make-up: The hot primary liquid recirculation system through the solar collector plate and jacket of hot water tank shall be by natural convection. A 5 litre capacity SS (utensil grade, 200 series) make up tank shall be given for make up of primary heating medium. This tank to be kept at top of the hot water tank.

(c) Back-up Electrical heater: An electrical heater of 2 KW rating with built in thermostat shall be provided in the tank as 'back-up heater' for heating water in cloudy days. Location of heater shall be near the bottom of the tank. The heater shall be ISI marked and shall be fitted to the tank in such a manner so that total heat dissemination takes place in to water only. All electrical safety aspects shall be addressed regarding fitment of the heater and proper earthing connection shall be provided for connecting the earthing wire with main earthing bus of the milk collection centre. The fitment of heater shall ensure easy maintenance/ replacement.



(d) Tank stand assembly: The tank stand assembly shall be made of MS angle of size 35x35x5 mm duly pre-treated and hot dip galvanized after fabrication. If during erection at site the zinc coating is punctured due to welding or any other reason, the punctured portion shall be painted (at least 2 coats) with silver paint. Alternatively tubular structure with powder coating could also be provided. This tank to be of height such that inlet of water tank is higher than solar collector.

8.2.3 Cold Water Storage Tank (This tank shall be included if the tank specified against clause number 8.1 is not included in the specification):

For storing cold water before feeding water to hot water storage tank of solar water heating system, a HDPE tank, two layer type of capacity 500 litre to be provided with a supporting stand. The tank to be provided with float valve, drain, & overflow and other standard accessories. The tank stand assembly shall be made of MS angle of size 35x35x5 mm duly pre-treated and hot dip galvanized after fabrication. If during erection at site the zinc coating is punctured due to welding or any other reason, the punctured portion shall be painted (at least 2 coats) with silver paint. Alternatively tubular structure with powder coating could also be provided.

The bottom level of this water tank shall be at a higher level than top of the hot water storage tank. Apart from pipeline to the hot water tank, a separate pipeline for cold water with a valve at the outlet up to the use point in the room with a tap shall be provided.

8.2.4 System interconnecting piping: System interconnecting piping shall be of GI medium class (Class B), ISI marked. Piping is required between cold water tank out let to inlet of hot water tank and from hot water tank outlet to one point in BMC Tank area. Hot water piping to be duly insulated with 50 mm thick rock wool of 48 kg/ cu m density and 26 SWG aluminium cladding. Suitable piping connection of GI/ SS to be provided between solar collector and hot water tank. All fittings, accessories, valves, vent, filter etc. required for smooth functioning of the system, shall be provided. Height of air vent pipe shall be more than the top of cold water supply tank.

8.2.5 Electrical Power Connection: An isolator switch shall be provided near the solar heater unit duly protected from rain water to isolate the electrical connection during maintenance and also in case of any emergency situation.

OR

8.3 Instant Gas Water Heater, Capacity: 6 or 10 litres per minute*

Instant gas water heater shall raise temperature of flowing water by 25 deg C at the specified flow rate (either 6 or 10 litres per minute) and shall be used for cleaning of equipment in milk collection centres located in the rural area. Any variation in the flow rate than the above shall cause variation in temperature, i.e., lower the flow rate higher is the temperature and vice versa. However, the temperature of hot water shall in no case exceed 85 deg C. The unit is to work on LPG. The gas heater shall have following features:

- (a) Opening of hot water valve shall automatically ignite gas flame and open cold water inflow in to the system and closing of the valve shall put off the flame.
- (b) In case due to some reasons the temperature of water reaches to 85 deg C the heater shall be automatically put off. Additional mechanical safety arrangement shall be provided in case of failure of thermostat to cut off at 85 deg C.



- (c) There shall be water flow control valve, a filter at the inlet of water, gas flow regulator, auto battery ignition arrangement and main switch for switching ON and OFF the system.
- (d) Safety devices such as Oxygen depletion sensor (inadequate oxygen shall put off the flame), no-water shut-off, flame-out protection, maximum water temperature cut-off and a proper flue exhaust arrangement.
- (e) A funnel attachment along with a bottle of de-scaling solution shall be supplied with the gas heater for de-scaling the water coil as and when the flow of water reduces due to scaling.
- (f) The unit shall have a compact casing with adequate protection from adverse weather conditions.
- (g) Operation and maintenance manual along with Dos and Don'ts shall be supplied with the unit.

* Capacity to be chosen by the buyer

OR

8.4 A storage type Electric hot water geyser (minimum 50 litres capacity, single phase, 2 KW) and SS 304 hot water storage tank 200 lit capacity elevated suitably to achieve gravity flow & with interconnecting SS 304 pipes be provided for cleaning of BMC tank and other equipment at DCS. The pipes to be insulated with resin bonded mineral wool insulation of 40 mm thickness and should be properly cladded with 24 G Aluminium sheets. Hot water tank to have insulation with the same material (75 mm thick) and cladded with SS sheet in welded construction.

8.5 Water filtration system & treated water storage tank (Optional)

An ultra filtration type water treatment system of capacity 500 litres per day suitable to treat water having initial TDS of < 5000 ppm shall be supplied so as to provide treated water having TDS in conformity with BIS 10500-1991 for cleaning of the BMC unit & other DCS accessories. Inlet water shall be taken through the overhead water storage tank so that no power is required for the system. The membrane should be suitable to work at least for three years. The balance tank shall be used for storage of the treated water for the CIP of the BMC system.

9. Installation, Commissioning & Training

9.1 Installation

Unloading of BMC and accessories shall be arranged at site by purchaser at their cost, but advance intimation of dispatch of the consignment is to be given by the supplier to the purchaser/ client.

The installation work should be carried in the best workman like manner in conformity to the relevant codes of practices of BIS standards applicable for mechanical & electrical installation.

Suitable number (1 no for 1 KL, 2 nos for 2 KL) of ABC stored Pressure type fire extinguisher of capacity 1 Kg. shall be supplied and installed by supplier.

Installation of all equipment & interconnecting piping, including minor civil works such as providing galvanised steel supports, SS base plates, clamps (hinged type) etc. required to secure the equipment & piping to walls and floors is included in the



scope. Necessary cable trays, GI pipes/conduits, cable gland sockets at both ends, isolators, junction boxes etc are included in the scope of the contract to lay & connect all electrical and control cables. Cable trays and supporting steel members such as Galvanised angles/channel/flats, supply of CI covers for the pits etc shall be used and fixed/installed at appropriate places to ensure safe installation. The laying of cables on the floor or under the floor is not permitted.

The owner will undertake major civil works. The supplier shall make available all tools & tackles required to execute the job.

9.2 Commissioning:

Supplier shall arrange commissioning & performance trial runs of the bulk milk cooling system to the satisfaction of the client. The supplier shall supply all the consumables (excepting diesel for DG set) required during commissioning of the plant.

Along with the bulk milk cooler & DG Sets etc, the bidder shall quote for supply of spares along with prices for the complete system. A set of essential spares for the total installation as required by the user shall be worked out & finalized at the time of finalization of the contract. **The cost of spares should not be included in the main bid price.**

9.3 Tool Box

A GI sheet toolbox containing one set of all necessary tools required for regular maintenance of the unit shall be supplied along with the BMC.

9.4 Manual

Two sets of operation & maintenance manual, one in English & another in local language containing complete details of starting up, putting off, critical checks and day-to-day maintenance of the complete system shall be supplied. The manual should also have the required electrical circuit diagrams.

9.5 Training

Supplier shall arrange for training of the operating team for efficient operation and maintenance of the complete system.

10. AFTER SALES SERVICE, SERVICE CENTRE AND SERVICE CONTRACT

10.1 Obligation of BMC Package supplier for providing After Sales Service/ Warranty claims for BMC package components supplied.

It would be the responsibility of the contractor, for bought-out components of critical nature such as DG Set and Voltage stabilizer, to identify dealers/ agencies located in the region where BMC package would be installed. This is to facilitate fulfilling of the warranty obligations as per the contract and availing timely services by milk collection centre in cases of emergency.

To this effect BMC package supplier should select the suppliers for such components in the region in consultation with the client / NDDDB SO. It is necessary to have this arrangement keeping need of the far off placed milk collection centres in view.



10.2 Service Centre

Each bidder is required to quote for setting up a service centre in _____ District & for providing service cover on a continuing basis. This is to be established preferably near ----- (*name of location*), with all facilities to maintain a continuous service to the village collection centres having milk cooling systems. This includes:

- a) Adequate & skilled manpower including a dedicated technician for maintenance & repairs of DG set. It shall be the responsibility of DG set supplier jointly with BMC supplier to provide necessary support to maintain smooth operation of the total package at Village.
- b) Telephone connections and communications to call the service team round the clock.
- c) Transport facilities: The centre is to have transport (owned or hired) available round the clock of adequate capacity to;
 - Provide rapid replacement of complete milk cooling unit or DG set, if necessary.
 - Ensure regular & continuous visits of the service team(s) to the collection centers.
- d) Maintenance workshop, including essential machine tools and hand tools to tackle any repair that may be required for the system and for regular dismantling and overhauling of diesel engines that would be necessary on a continuous basis.
- e) Stock of spare parts. (The list should be provided by the bidder.)

10.3 Service Contract (Optional)

The bidder is to quote for the service contract for a period of three years from the date of expiry of the warranty period. This is to include the cost of labour, materials, transport and incidentals, and be based on the unit rate per collection centre per year. This would involve the necessary teams and vehicles to provide continuous cover as follows:

- Regular service visits to each collection centre every 8 weeks to clean and adjust all of the equipment (including topping up lube-oil levels etc.) as necessary.
- To attend to emergency breakdowns, and to arrive at the milk collection centre within **three hours** of receiving intimation of breakdown.
- In case of break down of BMC, provide emergency services for shifting of BMC milk to other locations as directed by clients. This arrangement shall be there as long as normal BMC operation is not restored.

11. Inspection

Client reserves right to inspect all the components of the bulk milk cooling system during fabrication/ manufacturing stage, finished stage before dispatch of the equipments. Before starting the fabrication work supplier shall submit QAP & QIP for approval from client. The milk cooling tank shall be checked with dye penetration



test for welding defect, surface roughness check, water tightness test / hydraulic test.

12. General Requirement

12.1 Technical Details

The bidder shall provide all the technical details, as per the format enclosed as appendix over and above the general description in each section.

12.2 Makes of Items

The bidder shall refer Appendix for the list of makes of all the bought out items required to complete the package of the bulk milk cooling system. Bidder shall obtain necessary approval from client for all items included at the time of finalization of contract.

12.3 Drawing

Bidder shall submit a detailed general arrangement drawing for complete system giving complete details with bill of materials, size, capacity, quantity, material of construction, thickness etc.

12.4 Equipment Selection criteria

Bidder shall submit along with the offer detailed calculations with proper justification for selection of compressor (s), evaporator (s), condenser (s), fan (s), thickness of tank, milk pump, insulation material and thickness, DG Set etc.

13.0 Optional Items:

The bidder should also quote for the following optional items required to meet the specific need of the cluster milk collection centres.

13.1 Can Tipping Bar:

The general design of the can tipping bar should be a horizontal wooden bar supported on two legs. The legs would be grouted down to the floor with the help of grouting bolts.

Top Bar: It should be made of teak wood. The dimensions of the bar should be sufficient to take load of 40 L milk filled can and also the dynamic load due to jerk in manual handling of the filled cans.

Legs: The legs should be made of MS `C' class pipe. A provision to fix the structure on the foundation should be given - 2 nos.

Painting: All MS surfaces are to be painted with a coat of epoxy primer allowed by two coats of epoxy paint of ivory color after thorough de-rusting.

The height should match with the equipment layout/ balance tank of the milk collection centre.

Important Note: The cost of the Optional items shall not be included in calculation of the total bid price. In the event, the optional items are



selected by the purchaser for package, the quoted price for the optional item shall include all incidental costs of installing that item as part of the contract.

APPENDIX

Format for technical details:

S.NO	DESCRIPTION	TECHNICAL DETAILS
A.	Bulk Milk Cooler tank	
1.	Capacity (rated and gross)	
2.	Make and model.	
3.	Material used for construction (SS 304/316)	
4.	Shape & Orientation:	
5.	Overall dimensions and weight.	
6.	Thickness of inner and outer SS shells	
7.	Number of agitator(s) , RPM.	
8.	CIP facility: Manual or automatic with the details	
9.	Type, thickness and efficiency of insulation.	
10.	Facility to measure milk volume (dip stick etc.)	
B.	Refrigeration unit	
1.	Make, model and size of compressor(s) at operating conditions 0° C evaporating & 60° C Condensing temperature.	
2.	Make, model and size of condenser(s).	
3.	Capacity of compressor(s) (Kcal/hr) at evaporating & condensing temperatures.	
4.	Capacity of condenser & no. of fans.	
5.	Receiver size & capacity	
6.	Thermostatic expansion valve, make, size, capacity	
7.	Overall dimensions and weight of the unit.	
8.	Type of refrigerant.	
C.	Design Parameters	
1.	Ambient temperature considered for design	
2.	Maximum cooling time considered for ALL & SECOND milking.	
3.	Temperature range considered for ALL & SECOND milking.	
D.	DG set	
	As per specifications and loading proposed at 7.1	
1.	Make and Model of the alternator.	
2.	KVA, Volts, Amps. & pF rating of the alternator	
3.	Model of the engine with no of cylinders.	
4.	BHP rating of the engine.	
5.	Type of engine cooling- Air / Water – coolant cooled, efficiency of the engine considered for selection	



S.NO	DESCRIPTION	TECHNICAL DETAILS
6.	Derating factors considered in the design/selection.	
7.	Maximum current that set can withstand.	
8.	Fuel Consumption On Genset at Load – lit/ Hr. At – 25% Load At– 50% Load At – 75% Load At –100%Load	
9.	Conformity to Noise & Emission Standards.	Attach certificate
10.	Controls & safeties for Engine & Alternator	Give details
11.	Voltage stabiliser and single-phase preventor	
E.	Electricals	
1.	Connected load in Watts & Amperes for : Compressor(s) Condenser fan(s) Agitator(s). Milk pump Water heater.	
2.	Maximum / surge current drawn by the compressor(s) (during starting).	
F.	Miscellaneous	
1.	Enclose the following: a) Performance curves of the milk cooling tank i.e. time (hrs) Vs temperature (Deg.C) curves. b) The leaflet / catalogue of the alternator and engine for the DG set. c) Performance chart of the DG set showing the fuel consumption (litres/hr) at various loading conditions and at maximum output (KW), variation of the maximum output (KW) with respect to ambient temperature assumed.	
2.	The following performance curves of the compressor(s): a) Evaporating temperature Vs Cooling capacity (kcal/hr) at various condensing temperatures. b) Compressor capacity (kcal/hr) Vs Power consumption (Watts).	
3.	Specify the assumption(s), if any, made in design / selection of any item including the tank, DG set etc.	(Along with the description of the respective item)

Technical Data to be provided for solar hot water system offered as per format given below

Sno	Item	Unit	Details
A	Solar flat plate collector		
	No of Cu risers	No.	
	Dia & thickness of Cu riser	mm	
	Dia & thickness of Cu header		
	Fin Material		
	Size of Collector	mm	



	Toughened glass thickness	mm	
	Thickness of Al side for frame	mm	
	Thickness of Al bottom sheet	mm	
	Thickness of support for glass retaining	mm	
	Thickness for entire body	mm	
	Finish of frame		
	Insulation material/thickness	mm	
	Hardware	SS/MS	
	Testing Pressure	Bar	
	Solar Absorptivity		
B	Hot Water tank		
	Capacity	Litre	
	Tank Material-SS 304/SS304 L		
	Tank cylinder plate thickness	mm	
	Tank dome plate thickness	mm	
	Tank welding type-TIG/Plasma TIG		
	Heat exchanger area	Sq M	
	Insulation material/thickness	mm	
	Cladding material/thickness	mm	
	Make up tank capacity	Litre	
	Material of make up tank		
C	Stand for Hot water /cold water tank		
	Stand Material with finish type		
	Angle/pipe detail	mm	
D	Electrical back up Heater		
	Heater rating/nos	KW	
	Thermostat	Yes/no	
E	Cold water tank		
	Material		
	Capacity	Litre	
F	G I B class piping for cold/hot water		
	Dia of piping	mm	

Schedule of items

Schedule of Items for Bulk Milk Cooler (To be in conformity with Specifications & scope of supply)		
Sr. No.	Item Description	Quantity
A	Bulk Cooling Tank with Refrigeration Control Panel	
	Bulk Milk Cooler tank complete with cover, Refrigeration unit and standard accessories.	
	Tank and pipe cleaning brushes	
	Operation and Maintenance Manual	
	Tool Box	
	Spares	



B	Electricals	
	Electrical and control Panels, Servo Voltage stabilizer, Power & Control cabling, Earthing, C I Covers etc	
	DG Set with alternator and engine, acoustic enclosure, main & control panels	
	Exhaust piping , Day tank , GI trays	
	One barrel for Diesel and hand pump	
	Battery with battery box ,	
C	Miscellaneous Items	
	SS Pipe and Fittings, Inlet Funnel with SS Strainer & Milk Reception Tray/ balance tank (applicable for gravity feed system)	
	Interconnecting SS Pipes and Fittings, Food Grade Tanker Loading Hose Size 38mm complete with end connections	
D	SS Pipe and Fittings & Tank (Pumped feed system)	
	Tanker Loading Pump Cap. 5000 LPH at 10 MWC SS Centrifugal Monobloc sanitary Design pump with single mechanical seal as per Specifications.	
E	HDPE Tank of cap. 500/ 1000 Litres as per IS standards	
F	Solar water heater 200 LPD/ Any other heater as per specs	
G	SS Hot Water Piping	
H	Structural materials etc for tank mounting	

Note:

(1) The contractor is responsible for supply and execution of all the equipment/material, instruments, controls, safeties included in the BMC packages. It would be the responsibility of the supplier to ensure that any item not appearing in the above specs but felt essential for safe & efficient operation of any component of the system is included without extra cost in the contract to make the BMC package complete.

(2) The bidders can also offer alternate equipmen/ system for better efficiency and improved performance. A detailed offer to this effect with full technical details shall be given in the bid. However, the user reserves the right to reject or adopt the alternative equipment.

APPENDIX

LIST OF APPROVED MAKES OF BOUGHT OUT ITEMS		
S.N.	ITEM DESCRIPTION	APPROVED MAKES
1.0	SS PUMPS	APV/ ALFA LAVAL (LKM)/ TETRA PACK/ L&T/ IDMC
2.0	SS VALVES & FITTINGS	IDMC/ALFA LAVAL (LKM)
3.0	REFRIGERATION CONTROLS	DANFOSS/ALCO/SANSEN/PARKER/AMERICAN
		SPECIALITIES
4.0	SS PIPES	BHANDARI FOILS/RATNAMANI/ APEX TUBES



		HEAVY METALS
5.0	SS PNEUMATIC VALVES	GEA /ALFA LAVAL (LKM)/KEYSTONE/ IDMC
6.0	MOTORS	SIEMENS/ABB /KIRLOSKAR/ BHARATH BIJLEE/SHARP/LUBI
7.0	CABLES - ARMOURED	FINOLEX/UNIVERSAL/CCI/NICCO/FORT GLOSTER/R R CABLE/HI-LIGHT/GREEN ELE/POLY CAB
8.0	Starters	L & T.
9.0	Contactors	Telemechanig/Siemens/L & T/sprecher+schuh
10.0	PUSH BUTTONS	L&T/SIEMENS/ABB / SCHNEIDER
11.0	Relays	SEGC/Siemens
12.0	INDICATING LAMPS	L&T/SIEMENS/SCHNEIDER/ TECHNIC /VAISHANAV / PRECITECH
13.0	Current Transformers	Kappa
14.0	PRESSURE SWITCH	DANFOSS/ALCO / PARKER/HANSEN
15.0	DIGITAL INDICATOR	HONEYWELL/RAXIX/MASIBUS/PROTOCOL/VIBHUTI
16.0	D G SET	CUMMINS/KIRLOSKAR/MAHINDRA/EICHER/GREAVE S/ASHOK LEYLAND
17.0	Alternator	Stamford / LeroySomler
18.0	BATTERY FOR THE DG SET	EXIDE/STANDARD-FURUKOWA/ PRESTOLITE/AMCO -YUVASA/AMARON
19.0	STABILISER	SUVIK/MICROTECH/SEN&PANDIT/PACE/POWER ENGINEERS/ ASABA/GURU NANAK
20.0	SOLAR HOT WATER SYSTEM	TATA BP SOLAR/JAIN IRRIGATION/ RACOLD SALORE/SUDARSHAN SAUR/STEEL HACKS/ DGS&D- GOI APPROVED SUPPLIERS.
21.0	Hot Water Electric Geyser	SPEARHOT/RACOLD/ USHA/BATLIBOI/BAJAJ
22.0	HDPE TANK-HEAVY DUTY	SINTEX/ KAVERI/ HITANK
