Details for Air Chilling Plant in underground
At Adriyala Longwall Project

Section - A
Tentative Specification

CONTENTS

<table>
<thead>
<tr>
<th>Contents</th>
<th>Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Special Terms &amp; Conditions for Submission of Tender</td>
<td>01</td>
</tr>
<tr>
<td>2. System Design</td>
<td>02</td>
</tr>
<tr>
<td>3. Special Technical Requirement of the tender</td>
<td>03</td>
</tr>
<tr>
<td>4. Standard Specifications of Water-cooled Screw Water Chilling M/c</td>
<td>04</td>
</tr>
<tr>
<td>5. Standard Specifications of Pump Sets</td>
<td>05</td>
</tr>
<tr>
<td>6. Standard Specification of Double Skinned Air Handling Units</td>
<td>06</td>
</tr>
<tr>
<td>7. Standard Specification for Flame Proof power panels for air-handlers &amp; Pumps</td>
<td>07</td>
</tr>
<tr>
<td>8. Standard Specification of Piping Work</td>
<td>08</td>
</tr>
<tr>
<td>9. Technical Data (To be furnished by the bidder)</td>
<td>09</td>
</tr>
<tr>
<td>10. Deleted</td>
<td>10</td>
</tr>
<tr>
<td>11. List of Approved Makes (Preferable)</td>
<td>11</td>
</tr>
<tr>
<td>12. Reference Standards</td>
<td>12</td>
</tr>
</tbody>
</table>
SPECIAL TERMS & CONDITIONS FOR SUBMISSION OF TENDER

Subject: Proposed Underground Air-cooling System for Adriyala Project, Singareni Collieries Company Ltd., Andhra Pradesh

It is proposed to supply, install, test and commission Air-cooling system of Suitable capacity at the above premises.

1.0 THE AIR-COOLING SYSTEM SHALL COMPRIZE OF:

Water-cooled Screw Water Chilling Machines, Condenser Water Pump Sets, Chilled Water Primary & Secondary Pump Sets, Plate Type Heat Exchangers, Double Skinned Air Handling Units, Piping & Valves, G.I Ducting, Insulation, Electrical Works, etc.

2.0 SHOP DRAWINGS.

2.1 On the award of the work, the Tenderer shall immediately proceed with the preparation of detailed working drawings showing the detail of the equipment that are to be installed and the ancillary works that are to be carried out.

2.2 Three sets of all such working drawings dully signed by the head of the planning & design department shall be submitted to the SCCL for approval to ensure that the works will be carried out in accordance with the specifications and drawings, including such changes as may have been mutually agreed upon. All the drawings shall be received by the SCCL for approval within 04 (Four) weeks of the award of Purchase order. The approval of the drawings by the SCCL shall in no way relieve the Tenderer from his obligations to provide a complete and satisfactory plant installation, testing and commissioning as per intent and purpose as laid down in the specifications.

2.3 Any omissions and / or errors shall be made good or rectified whether or not the drawings are approved. Tenderer shall obtain written approval for samples (like grills / diffusers) and other materials before placing the order. Tenderer shall guarantee the specified inside conditions at specified outside conditions. Prior to the completion of the work, the Tenderer shall furnish to the employer (4) four sets of a comprehensive manual, describing all components furnishing a list of spare parts and setting forth in details the instructions for the operation and maintenance of the plant.

2.4 The Tenderer shall also fix in the plant room, neatly typed and framed, instructions in details, for the starting and running of the plant.

The following shop drawings shall be prepared by the Tenderer for approval-

a) AC Plant room layout plans with sectional drawings.

b) Schematic chilled & condenser water piping drawings with insulation and support details.

c) AC layout plans for Air Handling Units.

d) Electrical panel, sub panels, power & control wiring drawings.
f) Foundation details of all equipments.

g) Any other shop drawings necessary for the project.

3.0 AS BUILT DRAWINGS

At the completion of work and before issuance of certificate of virtual completion the Tenderer shall submit three (03) sets to the SCCL, layout drawing drawn at appropriate scale indicating the complete HVAC system “as installed”.

4.0 INSTRUCTION / MAINTENANCE MANUAL

The Tenderer shall prepare and produce instruction, operation and maintenance manuals in English for use, operation and the maintenance of the supplied equipment and installations, and submit to the SCCL in (03) three copies at the time of handing over. The manual shall generally consist of the following:

a) Description of the Project.

b) Operating instructions.

c) Maintenance instructions including procedures for preventive maintenance.

d) Manufacturers catalogues.

e) Spare parts list.

f) Trouble shooting charts.

g) Drawings.

h) Type and routine test certificates of major items.

i) One (1) set of reproducible ‘as built’ drawings.

5.0 Bidders

5.1 Only manufacturers quoting with self manufactured main equipment like chilling machine and air handling units (AHUs) are eligible in the tendering process. These manufacturers should have also testing facilities of these equipments at their plant site.

5.2 Prior experience of installing a similar air cooling system for an underground mine shall be preferred.
6.0. PRICES, UNIT RATES & DUTIES ETC.

6.1 The prices and unit rates quoted by the bidder in the bid shall be firm and deem to be adequate to cover the entire responsibility involved in the execution and completion of work. The rates shall be complete in all respects including cost of materials, erection, fabrication, labour, supervision, tools and plant, transport, contingencies, breakage, wastage, sundries, scaffoldings, insurance etc. on the basis of works contract.

6.2 The contract value shall be inclusive of custom duty, CVD etc on Imported Equipments & also inclusive of excise duty & inclusive of local sales tax on indigenous Equipments / Materials and inclusive of octroi duty or any other duties or fees levied by government or any public or local bodies. Quoted price shall also include Service Tax on the labour / installation & commissioning portion.

6.3 The contract value shall remain firm during the currency of the contract and shall be subject to statutory variation in taxes and duties only like sales tax on works contract or on rate of custom duty / excise duty and service tax only.

6.4 The total contract price quoted by the bidders shall be inclusive of works contract / turnover tax if applicable & shall be deducted by the SCCL at source & certificate shall be issued for the same. The works contract price quoted shall remain firm till completion of job and handing over the same in working condition to the SCCL.

6.5 The price should not be subject to exchange rate variations. No foreign exchange and license shall be arranged by the SCCL and it shall be Tenderers responsibility to do so, if required.

6.6 The rates quoted shall be deemed to allow for all minor extras and constructional details, which are not specifically shown on drawings or given in the specifications but are essential in the opinion of the SCCL for the execution of works to conform to good workmanship and sound engineering practice.

6.7 The SCCL decision to clarify any item under minor changes, minor extras and constructional details shall be final, conclusive and binding on the Tenderer.

6.8 The rates quoted by the Tenderer shall be net so as to include all the requirements described in the contract agreement and no claim whatsoever due to fluctuations in the price of materials and labour will be entertained.

6.9 In case the rates of identical items under different sub-heads / parts are different, the lowest of these will be taken for the purpose of making the payments.

6.10 The Tenderer shall provide all equipments, instruments, labour and such other assistance required by the SCCL for measurement of the works, materials etc.
7.0 VARIATION IN QUANTITIES & TENDER DRAWINGS:

The quantities for ancillary works given in the schedule (BOQ) and / or in drawings are for the guidance of the Tenderer. The Tenderer shall be paid on the basis of actual quantities of works carried out. However the Tenderer shall check these quantities after detailed engineering is over and will bring to the notice of SCCL for any major variation. The contract shall be on works contract basis and the SCCL reserves the right to add / delete any items of work during the currency of contract.

8.0 PERFORMANCE BOUND CONTRACT

The Tenderer shall guarantee that the capacity of various components as well as the whole system shall be within ± 3% of the specified capacity.

9.0 GUARANTEE

The Tenderer shall guarantee the complete AC system for a period of 12 months from the date of handing over the plant after successful commissioning. They shall also guarantee that the performance of the various equipments individually or jointly shall be within ± 3% of the specified ratings when working under operating conditions for the complete installation.

During guarantee period loss of refrigerant and oil, if any shall be borne by the air-conditioning Tenderer. De-scaling, if required during the guarantee period, shall be done by air-conditioning Tenderer on a chargeable basis.

10.0 REPAIRS / REPLACEMENT OF PARTS DURING GUARANTEE

Any defects or other faults which may appear within defect liability / guarantee period of twelve months from the date of handing over the plant in a satisfactory working conditions to the SCCL (except for normal wear and tear) arising in the plant from material or workmanship not in accordance with the contract specification will be rectified by the Tenderers free of cost & nothing shall be paid extra on any account.

11.0 TESTING

11.1 All testing instruments, velocity meter, digital thermometer, pyschrometer, measuring steel tapes, tools, scaffolding and ladders etc. that may be required for taking measurements shall be arranged by air-conditioning Tenderer at his own cost.

11.2 All types of routine and other tests shall be carried out at the works of the Tenderer or the manufacturers of the components. The SCCL shall be free to witness any or all tests, if they so desired. The Tenderer has to inform to the SCCL before dispatch of any material / equipment.
11.3 On the completion of the installation the Tenderer shall arrange to carry out various initial tests as detailed below, in the presence of and to the complete satisfaction of the or his representative / SCCL, any defect or shortcoming found during the tests shall be speedily rectified or made good by the Tenderer at his own expenses. The initial tests shall include, but, not be limited to the following:

a) To operate and check proper functioning of all electrically operated components viz. Compressor motor, pumps, fan of air handling units etc. as well as other electrical motors.
b) To test and check the proper functioning of electrical gears, safety and other controls to ensure their proper functioning.
c) To check the air distribution system and to provide designed air flow at AHU outlet.
d) To check & balance / adjust the water in the water circuit for smooth and noiseless flow.
e) To check the systems against leaks in different circuits, alignment of motor, ‘V’ belt adjustments, control setting and all such other tests which are essential for smooth functioning of the plant.
f) Tenderer shall have to submit the capacity test of all equipment at site.
g) On the satisfactory completion of all ‘Initial’ tests the plant shall be considered ‘Virtually Complete’ for the purpose of taking over by the SCCL.

12.0 LIQUIDATED DAMAGES CLAUSE

For all delays attributed to the Tenderer in completion of job which do not merit extension of time the Tenderer shall have to pay 0.5 % per week of delay subject to a maximum of 5% of the total contract value & part thereof delay in completion of work. The liquidated damages shall be recoverable from the payments due to air-conditioning Tenderer. It may be noted that the deduction of liquidated damages shall not, however, absolve the Tenderer of his responsibility and obligation under the contract to complete the work in totally as required under the contract.

13.0 OPERATION OF PLANT

If required, the successful Tenderer shall arrange to operate the plant for a period of 4 years from the date of commissioning of plant and successful completion of initial test as per BOQ.
14.0 TRAINING OF PERSONNEL

The Tenderer shall impart training to the minimum three technical staffs appointed by the Department free of cost during erection and commissioning of the plant.

15.0 WEEKLY PROGRESS REPORT

A weekly progress report of site shall be submitted in writing to the Department.

16.0 INSPECTION & TESTING

All major equipments such as water chilling units, cooling coils of air-handlers, air-handlers, electrical panels etc. may be got inspected & tested before dispatch if desired by the SCCL at the manufacturers work.

The Tenderer shall intimate the Department in minimum 10 days advance about the date of readiness of equipment for inspection & testing at a date to be mutually agreed upon by the SCCL & the Tenderer.

The manufacturer of these equipments must have a facility of testing the equipments at the test bed on full load at their works. All the test readings mutually taken shall be recorded & evaluated with the technical data furnished by the Tenderer.

17.0 STORAGE OF MATERIALS / EQUIPMENTS

Plant room / Air handling unit room or areas, if ready can be used for storage of materials / equipment brought to site. Watch and ward of the same shall be the responsibility of the SCCL. In case the plant room space is not readily available, it shall be responsibility of the SCCL to provide that storage space to the Tenderer.

18.0 POWER & WATER SUPPLY

Water and power required for erection, testing and commissioning purpose shall be provided by SCCL free of cost to the Tenderer as required in the work area.

19.0 INSURANCE

The SCCL shall be responsible for the storage and safe custody of all equipment / materials brought to site from time to time till the plant is taken over by the department. The Tenderer may provide adequate and comprehensive insurance coverage for storage and execution.

The Tenderer shall be responsible for all the injury or damage to persons, buildings, structures, property etc., which may arise from any act of omission on part of the Tenderer or his servants or sub Tenderers or his employee etc. The Tenderer shall indemnify and keep indemnified the owner and hold him harmless in all respects of and any expenditure liability, loss, claims or proceeding arising from any such injury or damage to persons or property as aforesaid.

The Tenderer may undertake all risk policy including earthquake risk with an insurance company approved by the owner in the joint names of owner and Tenderer at his own expense.
20.0 COMPLETION PERIOD

All supplies are required to be completed within 6 months from the date of order along with advance period. Erection shall be completed within 8 months from the date of order along with advance payment.

21.0 TERMS OF PAYMENT

The Tenderer shall be paid as per the following terms of payment:

Part A (Completion of project work)

Supply of Materials:

- 10% of Supply value shall be paid as interest free advance against submission of a Bank Guarantee of equivalent amount valid till end of Supply period.
- 80% of supply value shall be paid on pro rata basis against delivery of materials to site.
- 5% of total supply value shall be paid on commissioning of the system and the final 5% of the total supply value shall be paid on handing over of the system (Virtual Completion) and submission of O&M manual and against submission of a Performance Bank Guarantee of equivalent amount valid till end of 12 months warranty period.

Installation and Commissioning Work:

- 10% of Installation and Commissioning (I&C) value shall be paid as interest free advance against submission of a Bank Guarantee of equivalent amount valid till end of installation and commissioning.
- 80% of I&C value shall be paid on pro rata basis against installation of materials at site.
- 5% of total I&C value shall be paid on commissioning of the system and the final 5% of the total I&C value shall be paid on handing over of the system (Virtual Completion) and submission of O&M manual and against submission of a Performance Bank Guarantee of equivalent amount valid till end of 12 months warranty period.

Part B (AMC & OPERATION)

Annual Maintenance Contract: Quarterly (3 months) advance at the beginning of each period.

Operation: Quarterly (3 months) advance at the beginning of each period.
AIR COOLING SYSTEM FOR UNDERGROUND MINE WORKING AREA:
ADRIYALA PROJECT, SINGARENI COLLIERIES COMPANY LTD.

It is proposed to cool ventilation air of three major working areas in 1 Seam working by installing this air cooling plant. Each working area is expected to be ventilated by 3000 m³/min of air and therefore, total amount of air to be cooled for three working areas is 9000 m³/min, 540000 cmh. It is proposed that 50% of each of the stream (i.e. 90000 cmh) shall be passed through two Air Handling units which would cool the air from 32 Deg. C (89.6 Deg. F) dry bulb & 31 Deg. C (87.8 Deg. F) wet bulb to 18 Deg. C (64.4 Deg. F). Approximate cooling capacity required for each stream of air is 462TR.

Considering some safety factor of about 5%, 500 TR of refrigeration capacity per stream shall be required. Hence for three working areas taken together, the total capacity requirement shall be 1500TR.

Considering the high efficiency and reliability of water cooled screw chillers – Sufficient water cooled Screw chillers are to be recommended for this application.

18 Deg. C cold air (from the Air Handling Units) will mix up with 32 Deg C air (in equal proportion) and produce a mixed air temperature of 25 Deg. C, which will get carried forward (under the overall ventilation system of the mine) to the working area.

Location of Air Handling Units (AHU) required for cooling the air shall be placed as per the following locations:

1. For cooling longwall panel LWP1:
   • AHU1 -45000 cmh capacity 850m in bye from the junction of PE and 73L
   • AHU2 -45000 cmh capacity 850m in bye from the junction of PE and 74L

2. For cooling development drivage for LWP2/ operation of LWP2:
   • AHU3 -45000 cmh capacity 850m in bye from the junction of PE and 79L
   • AHU4 -45000 cmh capacity 850m in bye from the junction of PE and 80L

3. For cooling development drivage for LWP3/ operation of LWP3:
   • AHU5 -45000 cmh capacity 850m in bye from the junction of PE and 85L
   • AHU6 -45000 cmh capacity 850m in bye from the junction of PE and 86L

Since the distance between location of the chilling plant and Air Handling Units are quite substantial, the entire chilled water circulation are to be distributed into suitable separate circuits.

a) This separation of circuits will ensure that the chilled water circuits are operated within manageable pressure levels.

Above arrangement of having 3 segregated chilled water circuits shall also facilitate relocation of AHUs along 73L, 74L, 79L, 80L, 85L and 86L without disturbing the primary and secondary side piping, and chilled water pumps.
When cooling demand is less, less number of refrigerant circuits shall be operated avoiding over cooling of air and thereby saving energy.

Since mine water is available in sufficient quantity at reasonable temperature (less than 33 Deg. C) within the mine, and the same is being continuously pumped out to the surface, the same water may be used for condenser cooling purpose. Tenderer shall provide primary filtration and treating of this water before it is being used for the chilling machine’s condenser. This water shall be provided to chilling machines free of all slurry and suspended particles. Maximum permissible hardness in terms of CaCO3 shall be 50ppm, Iron content less than 0.3 ppm and pH factor 7.

The water cooled screw chilling machine along with primary chilled water pumps, condenser water pumps and electrical panels for the same shall be located in the A.C. Plant room. Approximate area required for this room shall be spelt out. Clear height required shall be minimum 3.5 m. This A.C. Plant room shall be located at a suitable location in 58L or between 57L sump and 58L. The location of AC plant area should be chosen in such a way that horizontal length of 100m and vertical distance of 25m of pipe (one way) between AC Plant and the sump are not exceeded for the discharge of condenser water to sump. This parameter has been considered for the design of condenser cooling water circuit. Sump should be at a higher level than the A.C. Plant area.

The piping distance shall be suitably considered between A.C. Plant room to AHUs The distance shall around 1500 to 1800 Mtrs. All the above are one way pipe distances.

Location of the A.C. Plant is at the highest point in the chilled water circuit, and hence expansion tank for the primary chilled water circuit shall be located in the AC Plant room. Expansion tank for the secondary circuits shall be provided and located suitably

For supporting of pipes and ducts through the roadways, AHU area and AC Plant area, suitable arrangement of rock bolts / inserts shall be provided by SCCL at regular intervals (max. 8 ft interval) from which the Tenderer shall extend their supporting structures.

**Electrical Power Distribution:**

SCCL shall terminate 3 phase, 11 kV , 50 Hz main incoming power supply with double earthing leads. Suitable Electrical Switchgear, Transwitches, Load centres and starters shall be provided by the Tenderer.

All electrical motors and fittings shall be of flame proof construction for the AHUs, Secondary Pumps and any tertiary pumps. Electrical items in A.C. Plant room area can be of non-flame proof type.

No aluminum / aluminum based alloy can be used for the project.

No welding can be done at underground site.

**Other associated works to be provided by the SCCL:**

a) Housing of equipments and civil foundations for all in A.C. Plant room and location of AHUs, Plate Type heat exchangers. However, GA Drgs should be provided by the Tenderer.
b) Makeup water connections with fittings and valves to each chilled water expansion tanks (5 nos).

c) Drain points in each AHU and AC plant room.

d) Power and water for erection, testing and commissioning of the plant.

e) Any kind of supporting arrangement for laying pipes / cables / ducts etc.

f) Fire signal from potential free contact from fire panel to be wired to each AHU starter panel and A.C. Plant M.C.C.

g) Transport and rigging facility for shifting equipment from surface / ground level to A.C. Plant room, Plate type heat exchanger and AHU locations.

h) Proper lighting and illumination arrangement at the work area during construction as well as normal operation.
SPECIAL TECHNICAL REQUIREMENT OF THE TENDER

Subject: Proposed Centralized Air-cooling System for Adriyala Project, Singareni Collieries Company Ltd.

It is proposed to supply, install, test and commission Air-cooling system of suitable capacity at the above premises.

1. The Air-cooling System shall comprise of:

Water-cooled Screw Water Chilling Machines, Condenser Water Pump Sets, Chilled Water Primary & Secondary Pump Sets, Plate Type Heat Exchangers, Double Skinned Air Handling Units, Piping & Valves, G.I. Ducting, Insulation, Electrical Works, etc.

2. Special conditions:

2.1 The Air-cooling system shall be supplied in complete packaged condition, modular design or CKD conditions so as to be taken inside the underground mine in the trolley used for transport in punch entries (trolley dimensions : 8’L x 3’W x 1’H).

2.2 The Air-cooling system components shall have robust construction & have provision of manual lifting, shifting & handling as there is no provision of crane, forklifts & other material handling equipments in the underground mines.

2.3 The Air-cooling system components shall be shifted from one location to installation location on the trolley of dimensions 8’ L X 3’W X 1’ H with caster wheels & which can run on rails.

2.4 The Air-cooling system components shall be shifted from one location to installation location in the road way dimensions of 10’ W X 5’ 8” H.

2.5 The Air-cooling system components shall required to be shifted from one location to other location from time to time based on progress on mines getting deeper & deeper. So the above components should have capability to dismantle, relocation at new place, commissioning & performance without problems.

2.6 The Air-cooling system shall be suitable for installation and satisfactory operation in hazardous underground coal mine and the system will run in hot, humid and corrosive atmosphere as prevalent in coal mines. The ambient temperature for operation of Air-cooling system can be as high as 45 deg C with 95 % RH.

2.7 The Air-cooling system components shall have provision of flange, quick couplers or other suitable joints mechanism for joining the components without below stated operations:

- 2.7.1 Welding
- 2.7.2 Brazing
- 2.7.3 Any other operation which can create spark & restricted by DGMS
2.8 The Air-cooling system shall be robust & sturdy & shall able to perform satisfactorily even in the intensity of vibrations caused due to blast during coal breaking operations in underground.

2.9 The air-cooling system should be easy installation, commissioning, accessibility & serviceability for the components like filters, strainers etc. Adequate covering shall be provided for the moving components.
STANDARD SPECIFICATION OF WATER COOLED SCREW TYPE CHILLING MACHINES

1.0 SCOPE

The specifications under this section cover the supply, installation, testing and commissioning of water-cooled Screw chilling machines confirming to these specifications and in accordance with the requirements of Schedule of Equipments, Bill of Quantities & drawings.

2.0 CODES & STANDARDS

The chiller shall be manufactured as per the standard manufacturing practice of approved vendor – however matching the requirement of these technical specifications and the description of Bill Of Quantities.

3.0 TYPE OF CHILLING MACHINE

The screw water chilling machines shall comprise of Single stage, Semi Hermetic screw compressor, complete with squirrel cage induction motor with suitable Star Delta starter and microprocessor based control Panel, working on 415 Volts ±10%, 50Hz ± 5%, AC supply, Shell and Tube type water cooled condenser, Shell and Tube type chiller, refrigerant piping, wiring and automatic controls, factory mounted microprocessor based control panel etc. all mounted on a suitable steel frame. Each chilling machine shall have 2 compressors and 2 independent refrigerant circuits. Each compressor should be able to unload up to 25% of its full load capacity.

3.1 Capacity of Chilling Machine

The actual refrigeration capacity of chilling machine shall be as given in schedule of equipment & Bill of Quantities.

3.2 Refrigerant

The Centrifugal Water Chilling Machine shall be selected for HFC refrigerant only. The water chilling unit should be fully factory charged with refrigerant & oil. Spare refrigerant & oil must be sent along with the machine for topping up of gas & oil as may be required during start-up and commissioning.

4.0 SELECTION OF WATER CHILLING UNIT

The water chilling unit should be selected of suitable duty
5.0 INSTALLATION:

The chilling machine shall be installed over a RCC platform in the basement floor in the AC Plant Room and shall be adequately isolated as per manufacturer’s recommendations against transmission of vibration to the building structure.

6.0 TESTING AT SITE

a) Unit capacity in tons of refrigeration, shall be computed from the temperature reading and water flow measurements. Flow measurements shall be taken through performance curves of pumps duly cross checked with the pressure drop curves of the chiller heat exchangers (cooler and condenser). Computed results shall be tallied with the specified capacities as furnished with tender.

b) All instruments, services needed for the tests required for the computation of capacities and power consumption shall be provided by the Tenderers themselves. All instruments shall be calibrated and Tenderers shall produce calibration certificate in support.

c) Tenderer shall furnish detailed certificates of routine tests carried out on test bed in the factory.

7.0 PAINTING:

Screw water chilling machine shall be finished with durable enamel paint / or as per manufacturer standard. Shop coats of paint that have become marred during shipment or erection, shall be cleared of with mineral spirit, wire bushed and spot primed over the effected areas, then coated with enamel paint.
1.0 STANDARD SPECIFICATIONS OF PUMP SETS

This section deals with supply, erection, testing and commissioning of water pump sets conforming to general specification and suitable for the duty selected. The Pumps selected should have high efficiency which should be supported by selection charts and curves.

1.10 Horizontal Split Casing Pumpsets

The horizontal split casing pumps design shall be selected for condenser water / chilled water re-circulation duty. The pump casing shall have heavily ribbed construction, suction and discharge branches, drilled to BS 4504 PN-16 or equivalent. The impeller made of SS shall be double shrouded, single entry, radial flow type. It shall be hydraulically balanced to minimise axial thrust. The stuffing box shall be factory fitted with mechanical seal.

A minimum of the following accessories shall be provided with each pump:-

a) Air vent Cocks.

b) Lubrication fittings and seals.

1.20 The construction of Horizontal Split Casing Pumps shall be as follows and as per IS 1520.

<table>
<thead>
<tr>
<th>Description</th>
<th>Specification</th>
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<tbody>
<tr>
<td>Duty</td>
<td>Condenser water / chilled water</td>
</tr>
<tr>
<td>Casing</td>
<td>Cast Iron / Steel</td>
</tr>
<tr>
<td>Impeller</td>
<td>SS</td>
</tr>
<tr>
<td>Shaft</td>
<td>Stainless Steel</td>
</tr>
<tr>
<td>Bearings</td>
<td>Ball Bearing</td>
</tr>
<tr>
<td>Base Plate</td>
<td>MS</td>
</tr>
<tr>
<td>Speed (Synchronous)</td>
<td>1500 RPM</td>
</tr>
<tr>
<td>Motor</td>
<td>TEFC</td>
</tr>
<tr>
<td>Mechanical seal</td>
<td>Factory fitted</td>
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The impellers of pumps shall be statically and dynamically balanced.

1.30 The capacity of motor shall be at least 15% in excess of BHP requirement of pump & shall be as per Flame Proof design approved by DGMS. Detailed calculation for selection of pumps shall be provided by the tenderer.
The installation of pumps shall be carried out by the Tenderer as per manufacturer recommendations. The pumps shall be mounted on concrete foundations with vibration isolators sandwiched between foundation and floor. As far as possible, the pump sets shall be factory aligned and if necessary site alignments shall be done by experienced and trained person. The pumps shall be installed in a manner that would allow maintenance without causing damage to the insulation.
**SECTION - 6**

**TECHNICAL SPECIFICATION FOR AIR HANDLING UNIT**

**NOTE:**
- No material with Aluminium base shall be used in the AHU.
- All electrical items should be DGMS approved.
- All rotating items should be spark resistant

<table>
<thead>
<tr>
<th>Sr No.</th>
<th>Component Name</th>
<th>Product Specification</th>
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<tbody>
<tr>
<td>1</td>
<td>Frame construction</td>
<td>Material – GI Skin pass Minimum 180 GSM</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Material thick -- 1.6 mm.</td>
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<tr>
<td></td>
<td></td>
<td>Finish - Powder Coating with 60 micron (appr)</td>
</tr>
<tr>
<td>2</td>
<td>Fan &amp; Motor Mounting</td>
<td>Material – GI Skin pass Minimum 180 GSM</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Material thick -- 2 mm.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Finish - Powder Coating with 60 Micron</td>
</tr>
<tr>
<td>3</td>
<td>Inner and outer Skin material and thickness</td>
<td>Material – Pre Coated (both inner and outer)</td>
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<tr>
<td></td>
<td></td>
<td>Material thick -- 0.8 mm.</td>
</tr>
<tr>
<td>4</td>
<td>Corner and PTT joints</td>
<td>Nylon 6 with 0% Glassfill</td>
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<tr>
<td>5</td>
<td>Insulation material (minaral wool)</td>
<td>23 mm Thick + 48 kg/m³ Density + K = 0.03 W/m K</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Moisture absorption less than 3%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>As per IS 8183.</td>
</tr>
<tr>
<td>6</td>
<td>Coil</td>
<td>Dia ½” with 0.41 mm thick.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>99.9% copper.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ASTM B356</td>
</tr>
<tr>
<td></td>
<td>Fin</td>
<td>Copper Fin,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Thickness 0.12 mm.</td>
</tr>
<tr>
<td></td>
<td>Coil Casing</td>
<td>Material SS 304.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Matl Thickness -- 1.2 mm</td>
</tr>
<tr>
<td></td>
<td>Header</td>
<td>Out let connection with Removable MS Flange type.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Header Material -- Copper</td>
</tr>
<tr>
<td>10</td>
<td>Drain Tray</td>
<td>SS 304,</td>
</tr>
<tr>
<td>11</td>
<td>Fan</td>
<td>AMCA Certified Spark resistance construction.</td>
</tr>
<tr>
<td></td>
<td>Type</td>
<td>Plug Fan</td>
</tr>
<tr>
<td>12</td>
<td>Motor</td>
<td>Type Flameproof.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>550 Volts 50 Hz. 3 Phase</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DGMS approved.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Body with non-aluminium</td>
</tr>
<tr>
<td>14</td>
<td>Hard ware</td>
<td>Zinc coated and tafflon coated</td>
</tr>
<tr>
<td>16</td>
<td>Canvass connection</td>
<td>Fire retardent cloth with GI frame</td>
</tr>
<tr>
<td>17</td>
<td>Unit condition in Transportation</td>
<td>CKD</td>
</tr>
<tr>
<td>18</td>
<td>Air filter</td>
<td>Frame should be in GI powder coated and GI mesh on both sides of filter media.</td>
</tr>
<tr>
<td>19</td>
<td>Door accessory</td>
<td>Door knob with Stud.</td>
</tr>
<tr>
<td>20</td>
<td>Limit switch</td>
<td>Flameproof Cast iron body</td>
</tr>
<tr>
<td>21</td>
<td>Spring Isolator for Fan Mounting</td>
<td>Spring isolator</td>
</tr>
</tbody>
</table>
SPECIFICATION FOR FLAME PROOF POWER PANELS FOR AIR-HANDLERS, SECONDARY & TERTIARY CHILLED WATER PUMPS

1.0 SCOPE

The intent of this specification is to define the requirement for the design, manufacture, testing, packing and supply of flameproof panels of Air handlers, MCC panel for Secondary and tertiary chilled water pumps etc.

2.0 CODES AND STANDARDS

2.1 The equipment shall comply with requirements of latest edition following standards issued by BIS (Bureau of Indian Standards) unless otherwise specified.

   IS : 5571 Guide for selection of electrical equipment for hazardous areas.
   IS : 5780 Intrinsically safe electrical apparatus & circuits.
   IS : 13346 General requirements for electrical apparatus for explosive gas atmospheres.
   IS : 13947 L.V. Switchgear and control gear.
   IEC : 60079:2007 Electrical apparatus for explosive gas atmosphere (Applicable Parts)

   The equipment shall also conform to the provisions of Indian electricity and other statutory regulations as applicable.

2.2 Wherever the requirements in this specification is in conflict with any of the above standards, the requirements under this specification shall be binding.

3.0 SITE CONDITIONS

The flameproof lighting and power panels shall be suitable for installation and satisfactory operation in classified hazardous location in tropical, humid and corrosive atmosphere as prevalent in coal mines or as specified in the material requisition.

4.0 CERTIFICATION

All flameproof power panels shall be of a type already approved by CCE/DGMS/DGFASLI (as required) for use in specified gas group locations. BIS marking on the equipment is mandatory. Type test and approval certificates for each type of power panels shall be furnished along with the offer.

5.0 GENERAL REQUIREMENTS

5.1 Unless otherwise specified in the material requisition, all power panels used in AHUs and secondary & tertiary pumps shall be flameproof (FLP) type, suitable for gas group I, as per IS:2148 and surface temperature class T3 as per IS:13346.
5.2 The FLP power panels shall have house the bus bars and other components in a MS fabrication or cast iron, which shall be free from frictional sparking hazard.

5.3 Unless otherwise specified in the material requisition, all FLP power panels shall suitable for 550V, 50 HZ, three phase incoming supply with 550V +/-10% phase to phase supply.

5.4 FLP power panels shall be supplied with suitably sized cable entries, with gland for incoming and outgoing cables. Panels shall be complete with double conical type Brass glands. Size of cable glands for the FLP power panels shall be as required depending upon the incoming and outgoing cables.

5.5 Cable entry for all FLP power panels shall be decided by the vendor based on the cable sizes to be furnished post-order, by Tenderer.

5.6 All internal wiring in FLP power panels shall employ adequately sized, PVC insulated copper conductor wires, colour coded for phase, neutral and earth.

5.7 All metal surfaces shall be thoroughly cleaned, degreased and made free from rust, before the primer coat is applied. The under surface shall be made free from all imperfections before undertaking the finishing coat. The final paint for the panel exterior shall consist of two coats of epoxy based paint. Interior of the panels shall be given synthetic enamel finish.

5.8 A warning inscription "Isolate elsewhere before opening" shall be provided on each enclosure. The warning inscription shall be embossed on the enclosure or a separate warning plate with above inscription shall be fixed to the enclosure with screws.

5.9 A Nameplate indicating TAG NO. shall be provided on each FLP power panel. Separate nameplate shall also be provided to indicate the details of testing agency.

5.10 Requisite sets of special tools and tackles, such as Allen keys etc. recommended for the maintenance of the panels, shall form a part of the vendor's scope of supply.

5.11 The terminal arrangement shall be adequately sized to facilitate termination of the cables by taking into account the required bending radii of cable cores.

6.0 COMPONENT SPECIFICATION

6.1 Incoming, outgoing cables shall be terminated in respective cable termination compartments, which shall be distinct from incoming and outgoing feeder compartments. Various compartments, if interconnected, shall employ certified flameproof bushings for such interconnection. Flame proof sealing bushings shall be filled with epoxy or other permissible sealing compound, after interconnecting wires are installed, so that no flame propagation is possible between the two adjacent compartments.

6.2 Busbars in the FLP power shall be made of high conductivity copper, and shall be supported by non-hygroscopic insulators. Busbars shall be colour coded for
identification of phases. Individual compartments shall have separate inspection covers secured by bolts which shall be openable only with special tools.

6.3 Stud / clamp type terminals shall be provided in an independent cable terminal termination compartment for connection of cables. Terminals shall be anti-loosening, anti-vibration type.

6.5 The offered panels shall be exactly in conformity with the configuration and approved by CCE/DGMS/DGFASLI.

7.0 TESTING AND ACCEPTANCE

7.1 Routine and acceptance tests shall be conducted on the FLP power panels, accordingly to the relevant Indian Standards, at the manufacturer's works under his care and expense. An advance four weeks notice shall be given to the owner to enable him or his authorized representative to witness the tests. During the course of manufacture, the owner or his authorized representative shall be free to visit the works and assess the progress of work. The manufacturer shall render all assistance to the purchase or his representative for doing the same.

7.2 Main acceptance tests shall be as follows:

a) General visual inspection.
b) Dimensional inspection.
c) Verification of mechanical and electrical operations.
d) Insulation resistance test before and after high voltage test.

Owner's representative may verify or check the test reports / drawings as well as test reports of sub-vendors, where applicable.

8.0 PACKING AND DESPATCH

8.1 Cable entries shall suitably plugged before packing.

8.2 The FLP power panels shall be shipped to site packed in wooden crates. Lighting and power panels shall be wrapped in polyethylene sheets before packing in crates to prevent damage the finish. The crates shall be provided with skid bottom for ease of handling, special notations such as, 'Fragile'.
STANDARD SPECIFICATION ON PIPING WORK

This section deals with supply, installation, testing & commissioning of chilled water / condenser water / drain water pipes, pipe fittings and valves etc. as detailed below in specifications. All pipes, fittings and valves etc. shall conform to relevant Indian standards.

1.0 WATER PIPING

1.1 The pipes, fittings and valves shall be of approved make given in the NIT & shall be designed for 16 kg/cm² test pressure.

1.2 Chilled water / Condenser water pipes shall be "C" Class M.S. E.R.W Black pipes & shall conform to IS:1239 (Part 1) - 1991 & IS:3589 - 1991 with latest amendments. The wall thickness of "C" Class M.S. E.R.W. Black pipes as per IS:1239 (Part 1) and for other pipes it should be as per BOQ given in Section 10.

1.3 Drain water / make up water pipes shall be "B" Class GI Pipe & shall Conform to IS: 4736.

1.4 The pipes shall be sized for individual liquid flow & shall ensure smooth noiseless balanced circulation of fluid.

1.5 All piping and their steel supports shall be thoroughly cleaned and primer coated before installation.

2.0 PIPE FITTINGS

2.1 The pipe fittings for screwed piping shall be malleable iron and for piping with welded joints shall of weldable quality. Also the fittings shall be suitable for same pressure ratings as for the piping system.

2.2 All bends up to sizes 150 mm dia shall be ready made of heavy duty wrought steel of appropriate class.

2.3 All bends in sizes 200 mm and above shall be fabricated from the same dia and thickness of pipe in at least four sections and having a center in radius of at least 1.5 times diameter of pipes. Fittings such as tees, reducers etc. shall be fabricated from the same pipe and its length shall be at least twice the diameter of the pipe.

2.4 The dead ends shall be formed with flanged joints & shall have 6 mm thick blank between flange pair for 150 mm and over wherever future expansion is to be done otherwise 8 mm thick blank end to be welded to pipes up to 350 mm dia. & above 350 mm dia. pipes dished ends shall be used.
3.0 FLANGES

3.1 All flanges shall be of mild steel as per IS: 6392 / 71 (with latest amendments) & shall be slip on type welded to the pipes. Flanged thickness shall be to suit Class II pressure. 3 mm thick gasket shall be used in between the flanges.

3.2 Flanged pair shall be used on all such equipments which are required to be isolated or removed for service for example condenser / chilled water pumps, chilling m/c, AHU etc.

4.0 VALVES (BUTTERFLY VALVES)

4.1 Butterfly valves shall be of PN 1.6 rating as per IS 13095 preferably with fixed linear design to suit duty and flanges as per IS 6392 Table "E". Valves of sizes 32 mm and above diameter shall be made of cast iron close end body, cast iron epoxy coated disc, Nitrile Seat and SS 410 Stem with tefflon bush. Valves up to 150mm NB shall be with detachable hand lever operation whereas valves above 150 mm NB shall have warm gear operation.

4.2 These valves shall be installed in condenser / chilled water lines, make up / drain water piping lines. All valves shall be supplied with factory test reports and the manufacturer must have test facilities at their works.

5.0 NON-RETURN VALVE (DUAL PLATE CHECK VALVES)

5.1 The dual plate check valves shall be used for horizontal / vertical run of pipes & shall conform to PN 1.6 rating .The valve design shall confirm to API 594 and tested as per ANSI SERIES.

5.2 The valves shall have cast iron body, and SS 410 plates, SS 410 Shaft & Nitrile Seat. All valves shall be supplied with factory test reports and the manufacturer must have test facilities at their works.

6.0 Y-STRAINER & POT STRAINER

6.1 The Y-strainer shall be fabricated out of MS `C` class pipe two size higher than that of strainer pipe size. Flanges as per BS 10 shall be provided at inlet & outlet of connections. The body shall be pressure tested at 16 kg/cm² and shall be hot dip galvanized. Permanent magnet shall be provided in the body of the strainer to arrest MS particles. Filter element shall be of nonmagnetic 20 gauge SS sheet with 3 mm perforation. Strainer shall be provided at inlet of each AHU & chilled water pumps.

6.2 Pot Strainer body shall be fabricated out of MS plate IS 226. Thickness of sheet shall be as per size of the strainer chamfered pipes with flanges shall be provided at inlet / outlet connections of the strainer. The tangential entry of water shall create a centrifugal action and due to velocity shall separate sediments and deposit on the inner surface of filter element and at bottom of the Strainer. The strainer body shall have two separate chambers properly sealed to avoid mixing of filtered and unfiltered water. A powerful magnet shall be provided in the body to arrest MS particles. Filter element of Pot Strainer shall be of non-magnetic 18 gauge SS sheet properly reinforced to avoid damage of the element. A cone with sufficiently large drain pipe with butterfly valve shall be provided at the bottom chamber to flush-out
foreign particles. This arrangement shall avoid frequent opening of Pot Strainer for cleaning of filter element. Gauge connection shall be provided at inlet and outlet connection.

6.3 A set of MS flanges with tongue and groove arrangement and neoprene rubber gasket shall be provided on the top cover and Pot Strainer flange with sufficient bolts and nuts to make the joint water tight. Bearing loaded lope cover lifting and swinging arrangement shall be provided. The pot strainer body shall be properly de-rusted and epoxy coated from inside and outside. Manufacturers Test Certificate shall be provided with each Pot Strainer.

6.4 Size of various Pot Strainer, Filter Element and Thickness of MS sheet shall be as under.

<table>
<thead>
<tr>
<th>Pipe Size (mm)</th>
<th>Pot Dia (mm)</th>
<th>Pot HT (mm)</th>
<th>Element Dia. (mm)</th>
<th>Element HT (mm)</th>
<th>MS Plate Thickness (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>300</td>
<td>400</td>
<td>200</td>
<td>240</td>
<td>6</td>
</tr>
<tr>
<td>80</td>
<td>350</td>
<td>450</td>
<td>250</td>
<td>250</td>
<td>6</td>
</tr>
<tr>
<td>100</td>
<td>450</td>
<td>500</td>
<td>300</td>
<td>280</td>
<td>6</td>
</tr>
<tr>
<td>125</td>
<td>500</td>
<td>600</td>
<td>330</td>
<td>340</td>
<td>8</td>
</tr>
<tr>
<td>150</td>
<td>540</td>
<td>700</td>
<td>360</td>
<td>390</td>
<td>8</td>
</tr>
<tr>
<td>200</td>
<td>610</td>
<td>815</td>
<td>400</td>
<td>470</td>
<td>8</td>
</tr>
<tr>
<td>250</td>
<td>800</td>
<td>955</td>
<td>550</td>
<td>510</td>
<td>8</td>
</tr>
<tr>
<td>300</td>
<td>1000</td>
<td>1105</td>
<td>750</td>
<td>580</td>
<td>8</td>
</tr>
<tr>
<td>350</td>
<td>1300</td>
<td>1190</td>
<td>895</td>
<td>678</td>
<td>12</td>
</tr>
<tr>
<td>400</td>
<td>1350</td>
<td>1500</td>
<td>1020</td>
<td>785</td>
<td>12</td>
</tr>
<tr>
<td>450</td>
<td>1518</td>
<td>1700</td>
<td>1060</td>
<td>890</td>
<td>12</td>
</tr>
<tr>
<td>500</td>
<td>1690</td>
<td>1800</td>
<td>1100</td>
<td>900</td>
<td>12</td>
</tr>
<tr>
<td>600</td>
<td>2000</td>
<td>2200</td>
<td>1500</td>
<td>1160</td>
<td>12</td>
</tr>
<tr>
<td>900</td>
<td>2400</td>
<td>2600</td>
<td>1680</td>
<td>1440</td>
<td>12</td>
</tr>
</tbody>
</table>

The Y-Strainer & Pot Strainer should be tested at works for 16 kg/cm² pressure. The screen shall be made out of 3 mm perforated stainless steel sheet. It should be easily removable when required to be cleaned. Isolating butterfly valves at either end of the pot strainer shall be provided.

7.0 JOINING OF THE PIPE LINES UNDERGROUND

No welding shall be allowed within the mines. Prefabricated lengths of pipes shall be joined with the help of flanges, nuts bolts and gaskets inside the mine.

8.0 LAYOUT AND SIZING OF PIPE LINES

The sizes and layout given in the drawings / bill of quantities are for guidance purpose only. The A/C Tenderer shall prepare and submit detailed drawings after the award of contract to the Engineer in Charge and consultant for his approval. No work at site shall be started before final approval of drawings is given. The drawings shall indicate sizes of pipes, quantity of water flow in each length of pipe. All details of fittings, location of all valves, air vents, pipe supports etc. shall be clearly indicated in the drawings.
9.0 INSTALLATION OF CHILLED / CONDENSER / DRAIN / MAKE UP WATER PIPING

9.1 All pipes shall be securely supported or suspended on stands, hangers, clamps etc. as required. The Air-conditioning Tenderer shall design all brackets, saddles, anchors, clamps etc. & shall be responsible for structural adequacy.

9.2 All pipe supports shall be of steel, coated with two coats of anti-corrosive paint and finally finished with paint.

9.3 The pipe spacing shall be as follows:

<table>
<thead>
<tr>
<th>Dia of Pipe</th>
<th>Maximum Spacing between supports</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 25mm</td>
<td>1.5 mt</td>
</tr>
<tr>
<td>30 mm to 50 mm</td>
<td>2.0 mt</td>
</tr>
<tr>
<td>65 mm to 75 mm</td>
<td>2.5 mt</td>
</tr>
<tr>
<td>100 mm &amp; above</td>
<td>3.0 mt</td>
</tr>
</tbody>
</table>

9.4 The vertical rises shall run parallel to walls and should be straight to wall duly checked with plumb line.

9.5 In case pipes with/ without insulation while passing through the wall / slab, shall be provided with sleeve 50mm higher in size than the pipe with / without insulation.

9.6 Wherever insulated pipes are running, it should be supported in such a way that no undue pressure is exerted on the insulated pipe.

9.7 The expansion-joints or expansion-loops shall be provided to take care of the expansion and contraction in pipes due to temperature rises.

10.0 TESTING OF PIPE SYSTEM

10.1 All tools, tackles, labours etc. shall be arranged by A/C Tenderer.

10.2 All pipes shall be tested hydraulically at 1.5 times the maximum operating pressure for a period of 24 hours. The test pressure should not be less than 10 kg/sq.cm at any times. All leaks occurring during testing shall be rectified to the satisfaction of the Engineer in Charge. After repairs of leak it shall be tested again at the same pressure.

10.3 In case piping is tested in parts, these sections shall be securely sealed and capped during testing.

10.4 The A/C Tenderer should ensure that there should be minimum vibration / noise in the chilled water / condenser water circuit due to water turbulence.
11.0 AIR-VENTS

Air vents for purging of air trapped in piping system shall be provided at the highest point. Globe valves of the size as indicated below shall be provided & no additional price shall be paid.

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>Valve Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upto 100mm</td>
<td>25mm dia</td>
</tr>
<tr>
<td>Above 100mm to 300mm</td>
<td>40mm dia</td>
</tr>
</tbody>
</table>
TECHNICAL DATA
(TO BE FURNISHED BY THE BIDDER)

1.0 SCREW TYPE WATER COOLED CHILLING MACHINE

1.1 COMPRESSOR

   a) Manufacture Name : 
   b) Model : 
   c) Type of Compressor : 
   d) No. of Compressor per Machine : 
   e) Nominal Capacity of Each Compressor in TR : 
   f) Nominal Capacity of Chilling Machine : 

Operating Conditions

   g) Saturated Suction Temperature Deg. C. : 
   h) Saturated Discharge Temperature Deg. C. : 
   i) Max. RPM : 
   j) Mode of Start : 
   k) Refrigerant used : 
   l) Qty. of Refrigerant used : 
   m) Power Consumption lkW/TR :
       At Full Load 100 % : 
       90 % : 
       80 % : 
       70 % : 
       60 % : 
50 % : 

40 % : 

30 % : 

n) Range of Capacity Variation : 

1.2 MOTOR (COMPRESSOR)

a) Make of Motor : 

b) Type of Motor : 

c) Motor kW : 

d) Class of Insulation : 

e) R.P.M. : 

f) Type of Starter : 

g) Electrical characteristics
Voltage / Frequency : 
Fluctuations permissible : 

j) Full load current (Amp) : 

k) Starting current (Amp) : 

1.3 CONDENSER

a) Manufacture Name : 

b) Model : 

c) Number of Condensers : 

d) Fouling Factor MKS. : 

e) Heat rejection capacity kCal / hr. : 

f) Pressure Drop in Meter : 

g) Water flow rate (LPM) : 

h) No. of passes :
i) Water temperature in °C : 

j) Water temperature out °C :

1.4 CHILLER

a) Manufacturer Name :

b) Model :

c) Type of Chiller :

d) Water Flow LPM :

e) No. of Passes :

f) Water Temperature Out °C :

g) Water Temperature In °C :

h) Pressure Drop in Mt. of water:

i) Cooling Capacity kCal / hr. :

j) Fouling factor MKS :

1.5 OVERALL SIZE OF WATER CHILLING MACHINE

a) Overall Dimension mm :

b) Operating Wt. kg. :

c) Service Clearance Required :

2.0 CONDENSOR WATER / CHILLED WATER PUMP SETS.

2.1 CONDENSOR WATER PUMP SETS

a) Make :

b) Type :

c) Model :

d) Discharge (LPM) :

e) Head (m) :

f) Efficiency :

g) Brake Horse Power :
2.2 PRIMARY CHILLED WATER PUMP SETS

a) Make :

b) Type :

c) Model :

d) Discharge (LPM) :

e) Head (m) :

f) Efficiency :

g) Brake Horse Power :

h) Horse Power of Motor :

i) Make / Type of Motor :

j) Type of Starter :

k) Impeller Diameter (mm) & Material :

l) Material of Bearing & Seal :

m) Type of Bearing / Seal :

n) Speed (RPM) :

o) Material of Shaft :
2.3 SECONDARY CHILLED WATER PUMP SETS

a) Make : 

b) Type : 

c) Model : 

d) Discharge (LPM) : 

e) Head (m) : 

f) Efficiency : 

g) Brake Horse Power : 

h) Horse Power of Motor : 

i) Make / Type of Motor : 

j) Type of Starter : 

k) Impeller Diameter (mm) & Material : 

l) Material of Bearing / Seal : 

m) Type of Bearing / Seal : 

n) Speed (RPM) : 

o) Material of Shaft : 
3.0 AIRHANDLING UNITS

3.1 AHU Details

a) Make of AHU

b) Capacity CMH

c) Material/Gauge (Casing Drain Pan.)

d) Over all size LxBxH mt

e) Type of AHU, vertical / horizontal / Ceiling Suspended

f) Over all Weight in kg.

g) Type of AHU, SSAHU/DSAHU

3.2 COOLING COIL

a) Make

b) Material of tube/fins

c) No. of fins/cm

d) No. of rows deep

e) Dia of tubes (MM)

f) Face area(SMT)

g) Cooling capacity (kCal/hr)

h) chilled water flow rate LPM

i) Face velocity MPS

j) Test pressure kg/cm²
3.3 FILTER SECTION

a) Make
b) Type of filters
c) No. of filters
d) Size of filters
e) Air velocity through filter FPM
f) Efficiency of filter %

3.4 FAN AND FAN MOTOR

a) Make of Fan & Motor
b) Type of fan
c) No. of fans
d) Width and dia of fans (mm)
e) Type of blade
f) Air quantity CMH
g) Static pressure in wg
h) Type of balancing
i) Brake horse power in HP
j) Horse power of motor in HP
k) Motor RPM
l) Fan speed
m) Type of Drive (Belt Driven / Direct Driven)
LIST OF APPROVED MAKES OF EQUIPMENTS / MATERIALS

1. Motors - Flame Proof Design – Kirloskar, BBL, CGL. ABB, Siemens
2. Horizontal Split Casing Pump Sets - Kirloskar / Beacon / KSB
3. Air Handlers Unit - Self Manufactured by bidder having prior experience of installation in underground mines
4. AHU Fans - Comferi / Nikotra / Kruger
5. Water Piping - Jindal / ITC / Tata / SAIL / HSL
6. Y-strainer / Pot - strainer - Emerald / Rapid Cool
7. Butterfly Valve - Advance / Audco / C&R
8. Non Return / Check Valve - Advance / Larsen Toubro / C&R
10. Globe valve - Leader / Sant
11. Auto Air Vent Valve - Anergy / Rapid Cool
12. Pressure Gauges - Feibig / Emerald
13. Water Cooled Screw Chilling Machine - Self manufactured having AHRI service facility in Southern India and having prior experience of installation in underground mines
14. Thermostat - Honeywell / Johnson / Siemens / Danfoss
15. GSS Sheet - SAIL / Tata
16. Plate Type Heat Exchanger - ALFA LAVAL
17. Cable & Accessories - ICC / CCI / Gloster / Universal / Asian / Radiant / Polycab / Havells
REFERENCE STANDARDS

1.0 SCOPE OF WORK

The complete scope of work shall cover supply, erection, testing and commissioning of the entire AC system as detailed under specification.

2.0 BASIS OF DESIGN

The entire system has been based and designed on climatological data available and as preexisting ventilation system of the mine.

3.0 TERMS AND DEFINATIONS

The followings terms have been used in the tender specifications, drawings etc.

- **ISI** Bureau of Indian Standards.
- **ASHRAE** American Society of Heating Refrigeration & Air-conditioning Engineers, USA.
- **ASME** American Society of Mechanical Engineers.
- **ASA** American Standard Association.
- **B.S.** British Standards.
- **CMH** Cubic Meter per Hour.
- **US GPM** US Gallons per minute.
- **IGPM** Imperial Gallons per Minute.
- **RPM** Revolutions per Minute.
- **BTU/Hr.** British Thermal Unit per Hour.
- **kCal/Hr.** Kilo Calories per Hour.
- **HZ** Hertz.
- **H.P.** Horse Power
- **kg/cm2** Kilogram per Square Centimeter.
4.0 The codes, regulation as detailed below shall be followed in this contract:

1. Safety code for air-conditioning (revised) amendment 1
   IS 659 : 1964 (reaffirmed 1991)

2. Safety code for mechanical Refrigeration
   IS 660 : 1963 (reaffirmed 1991)

3. Piping Work
   IS 1239 Part I & II 1990 / 1992
   IS & BS : 3601

4. Refrigeration
   As per ASHRAE / ISI
   Air conditioning & Refrigeration
   Air-conditioning institute Standards.

5. Butterfly Valve
   IS 13095 : 1991

6. Steel Pipe flanges
   IS : 6392

7. Gaskets
   IS 638 : 1979 (reaffirmed 1993)

8. Mild steel tubes & fittings
   IS 1239 Part I & II
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<thead>
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<th>Code for practice for electrical wiring installations. IS 732 : 1989</th>
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<tr>
<td>9</td>
<td>Code for practice for earthing IS 3043 : 1966</td>
</tr>
<tr>
<td>10</td>
<td>Bourden tube pressure and vacuum gauges IS : 3624</td>
</tr>
<tr>
<td>11</td>
<td>Glossary of terms used in refrigeration and air-conditioning IS : 3615</td>
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<tr>
<td>12</td>
<td>Three phase induction motors IS : 325</td>
</tr>
<tr>
<td>13</td>
<td>Specifications for flameproof motors IS : 2148</td>
</tr>
<tr>
<td>14</td>
<td>Circuit breaker A.C IS 2516 : 1980 Part I &amp; II</td>
</tr>
<tr>
<td>15</td>
<td>Contactors for A.C for voltage upto 1100 V IS 2959 : 1975</td>
</tr>
<tr>
<td>16</td>
<td>Low voltage switch gear and control gear assemblies IS 8623 : 1993 Part I &amp; II</td>
</tr>
<tr>
<td>17</td>
<td>Code of practice for selection of starters for AC induction motors IS 3914</td>
</tr>
<tr>
<td>18</td>
<td>Specification for cables glands IS 4821</td>
</tr>
<tr>
<td>19</td>
<td>Code for selection, installation &amp; maintenance of switch gear and control gear IS 10118 : 1982 Part I to IV</td>
</tr>
<tr>
<td>20</td>
<td>Conduits for electrical installations IS 9537 : 1981 Part I to IV</td>
</tr>
<tr>
<td>21</td>
<td>Permissible limits of noise level for rotating electrical machines IS 12065 : 1987</td>
</tr>
<tr>
<td>22</td>
<td>Code of practice for installation and maintenance of motors IS 3106 : 1966</td>
</tr>
<tr>
<td>23</td>
<td>Bourden tube pressure and vacuum gauges IS : 3624</td>
</tr>
<tr>
<td>24</td>
<td>Expanded polystyrene for thermal insulation purposes. (1st. revision) IS 4671 ; 1984 (reaffirmed)</td>
</tr>
</tbody>
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5.0 **SAFTEY CODES**

The following IS codes shall be followed:

- Safety code for mechanical refrigeration \( \text{IS 660} \)
- Safety code for air conditioning \( \text{IS 659} \)
- Safety code for scaffolds & ladders \( \text{IS 3696} \)
- Code of practice for fire precaution in Welding & cutting operations \( \text{IS 3016} \)
- Code for safety procedures and practices in electrical works \( \text{IS 5216} \)

*Code of practice for safety and health (IS 3696)*

Requirements in electrical & gas welding and cutting operations.
Section B

2.0 ANNUAL MAINTENANCE CONTRACT, AFTER WARRANTY PERIOD OF ONE YEAR.

2.1 SCOPE OF WORK: Annual Maintenance contract for Preventive and Breakdown maintenance of plant beyond Warranty / Guarantee period for all mechanical and electrical equipment of Air –conditioning System. It comprises of the following

1. Water-cooled Screw Type Water Chilling Machines.
2. Condenser Water Pump Sets.
3. Chilled Water Primary, Secondary & Tertiary Pump Sets.
4. Double Skinned Air Handling Unit

All spares and consumables required to be provided by the firm in A.C Plant system.

Water-cooled Screw Type Water Chilling Machines.

A. De scaling of chillers once in every four months or as and when required for efficient operation of the Chiller.
B. Refilling of Refrigerant gas in case of leakage/ Shortage.
C. Maintaining the Temperature of chilled water leaving the chiller at 6.11°C:and water receiving at the chiller not more than 12.77°C
D. Cleaning of suction filters/oil filters and replace if damaged
E. Leakage arresting by tightening the bolts /replacement of gasket
F. Replacement of compressor internal parts with original spares

Condensate /Condenser Water Pump Sets:
A. Clean the foot valve strainer and Filter, if any.
B. Clean the impeller and remove the clogged particles
C. Replace the lantern ring if damaged in stuffing box
D. Check the condition of packing rope & replace if damaged tight the gland to arrest leakage
E. Replace the shaft sleeve
F. Replace the worn out bearings
G. Check the correctness of alignment.
Chilled Water Primary, Secondary & Tertiary Pump Sets
A. Clean the impeller and remove the clogged particles
B. Replace the lantern ring if damaged in stuffing box
C. Check the condition of packing rope & replace if damaged tight the gland to arrest leakage
D. Replace the shaft sleeve
E. Replace the worn out bearings
F. Check the correctness of alignment

Double Skinned Air Handling Unit
A. Clean the filters and replace if damaged.
B. Clean the cooling coil and free from clogging
C. Adjust the V-belts and replace if damaged
D. Adjust the flow rate by volume control damper or change pulley if required.
E. Adjust the air quantity to the design capacity

Note: The above AMC charges shall be valid for 3 years after 12 months guarantee period.

1. The firm shall deploy required Service Engineers/Technicians to attend the defects if any promptly.

2. The firm shall keep the spares with the service engineers/technicians deployed to replace the defective spares within 24-hours of receipt of breakdown intimation.

3. Consumable items like Refrigerant gas, V-Belts, filters and other spares shall be provided by the firm.

4. The firm should accept responsibility for personnel injury and damages to property if caused by the firm's neglect of the Service Engineers.

5. Any compensation to be paid to Firm's personnel shall be to Firm's account and the SCCL remains absolved of the responsibility of payment of any such compensation

2.2 PENALTY CLAUSE:
During the AMC period, if the breakdown is not rectified with in 24-48hours, 1% of AMC value will be deducted from the Quarterly bill towards penalty for delay of every 24 hours (i.e. after 48 hours)
2.3 PAYMENT TERMS:

Once in three months for the service carried out on certification by the Colliery Manager / ALP mine.

The traveling and other charges of Engineers, Technicians are to be borne by the firm.

2.4 PLANT OPERATION AND ROUTINE MAINTENANCE (During Warranty period):

During the warranty period firm shall operate the A.C. Plant for 3-months from the date of commissioning and train the SCCL personal during these 3-months at firm’s cost. After 3-months, SCCL persons will operate the plant. However, preventive and breakdown maintenance are to be carried out till the end of the warranty period.

2.5 Performance Bound Contract:

The Tenderers shall guarantee that the capacity of various components as well as whole system shall be with in ± 5%.