



DELHI METRO RAIL CORPORATION LTD.

(A Joint Venture of Govt. of India & Govt. of NCT, Delhi)

“Supply, installation, testing, commissioning of Air Cooled Scroll Chiller HVAC system including the interconnection with the existing FCUs and existing chilled water piping at Four Underground Metro Station of Metro Corridor of Delhi Metro Rail Corporation Limited”

TENDER DOCUMENT

- * **NOTICE INVITING TENDER**
- * **INSTRUCTION TO TENDERER**
- * **SPECIAL CONDITIONS OF CONTRACT**
- * **OTHER TERMS AND CONDITIONS**
- * **BILL OF QUANTITY**

SECTION 1 NOTICE INVITING TENDER

1.1 GENERAL

Delhi Metro Rail Corporation (DMRC) Ltd. Invites sealed Open tenders from the eligible working contractors/Joint Ventures/Consortium, in Govt./Semi Govt. organization (refer clause 1.2.2 of NIT) for **"Supply, installation, testing, commissioning of Air Cooled Scroll Chiller HVAC system including the interconnection with the existing FCUs and existing chilled water piping at Four Underground Metro Station of Metro Corridor of Delhi Metro Rail Corporation Limited"**

1.1.1 The details of the Tender are as per following:

Estimated cost of work : ₹ 2,75,24,540 /-(inclusive of all taxes)

Tender Security amount : ₹ 2,75,245/-

Cost of Tender form (Non- : ₹ 21000/- (Rs.20000 plus 5% VAT)

Refundable)

Completion period of the Work : **Six months** (from 10th day of issue of letter of acceptance)

Tender documents on sale : **04/04/2011 to 15/04/2011 (on working days between 10:00 Hrs to 16:00 Hrs)**

Date & time of Submission of Tender : **22/04/2011 up to 1600 hrs**

Date & time of opening of Tender : **22/04/2011 at 16.30 hrs.**

The tender documents (non-transferable) **can only be obtained from the office of Deputy General Manager/Traction**, 2nd Floor, Metro Bhawan, Fire Brigade Lane, Barakhambha Road New Delhi-110001. **Downloaded tender document will not be entertained.**

Payment shall be made by demand draft drawn in favour of DMRC Ltd. payable at New Delhi.

1.2 POINTS TO BE NOTED

1.2.1 Works envisaged under this contract are required to be executed in all respects up to the period of completion mentioned above.

1.2.2 **Only those agencies, who have experienced in this field for not less than 3 years & completed** one single work of similar nature of at least 80% value of contract or two similar work each of at least 50% value of contract and 3 works each of at least 40% each value of contract in Govt./Semi Govt. organization etc..

Similar nature of work means **Supply, installation, testing, commissioning of Air Cooled Scroll Chiller or OEM of Air cooled chillers.**

The tender will be issued only to those tenderers who will submit the relevant experience, completion certificates of desired values or more.

Self attested copy of VAT/Service tax registration certificate, PAN no. along with the Demand draft against the cost of tender.

- i. Financial Standing (Annual turnover) : Application should have average Annual Turnover of last three audited financial years not less 80% of total estimated cost of work.
- ii. Applicant must not have been blacklisted or deregistered by any Govt. or Public sector undertaking during the last 5 years.

Net worth of applicants should be positive.

- 1.2.3 The mere fact that the tenderer is Pre-qualified as shall not imply that his bid shall automatically be accepted. The same should contain all Financial & other details as required for the consideration of tender.
- 1.2.4 Tender document consists of the following:
 - a. Notice Inviting Tender - consisting of
 - i. Notice Inviting Tender
 - ii. Scope of Work
 - iii. Tender prices
 - b. Instructions to Tenderers
 - c. General Conditions of Contract
 - d. Special Conditions of Contract
 - e. Bill of Quantities.
- 1.2.5 The tenderers may obtain further information in respect of these tender documents from the office of Deputy General Manager /Traction office, 2nd Metro Bhawan Fire Brigade lane, Barakhamba Road New Delhi-110001
- 1.2.6 Tenderer is cautioned that the tender containing any material deviation from the tender document which consists of NIT, Instructions to tenderes, General conditions of contract, Special conditions of contract, Bill of quantities is liable to be summarily rejected as non-responsive.
- 1.2.8 DMRC reserves the right to accept or reject any or all proposals without assigning any reasons. No tenderer shall have any cause of action or claim against the DMRC for rejection of his proposal.

(SUBODH PANDEY)
DGM / Traction

Delhi Metro Rail Corporation Ltd
2nd floor, Metro Bhawan,
Fire Brigade lane,
Barakhambha Road
New Delhi-110001

SECTION 2

SCOPE OF WORK

The contractor will execute the work i.e. **“Supply, installation, testing, commissioning of Air Cooled Scroll Chiller HVAC system including the interconnection with the existing FCUs and existing chilled water piping at Four Underground Metro Station of Metro Corridor of Delhi Metro Rail Corporation Limited”**

2.0 Name of the stations where the Air Cooled scroll chiller is to be installed as per the BOQ.

2.1 New Delhi

2.2 Central secretariate

2.3 Chandni Chowk

2.4 Rajeev Chowk

The contractor shall enclose technical details of equipments indicating make & model of air-cooled chiller. The selected model & its accessories shall conform the following:

2.0.1 The specification, rating & suggested make of all the major parts of Air cooled Scroll chiller HVAC system is detailed in BOQ, the same shall be referred from there.

2.0.2 All the new installation provided shall be interconnected with the existing HVAC system as per the direction of engineer in-charge so that the overall efficiency of the system will not affected.

2.0.3 Capacity Of Air Cooled Scroll chiller shall be minimum 34TR X 03 UNITS (2 Main + 1 standby) per station. ‘

2.0.4 The contractor shall submit the technical specification, dimensions for the civil foundation, digging, and cutting etc. work required for the installation of the equipments.

2.0.5 The FCU shall be connected a per the Room & station wise tonnage requirement and as per the direction of engineer in-charge.

2.0.6 Existing FCUs shall be re-use in consultation with engineer in-charge.

2.0.7 All the material removed from the system shall be handed over to DMRC.

3 Make of equipments to be installed.

3.0 Refrigerant to be used R 134a, R-407c or 410a.

3.1 Air cooled scroll Chiller: York/Trane/BlueStar/ETA

3.2 Fan Coil Unit: Blue Star, ETA, York

3.3 Water Pump: Kirloskar /ITT Bell & Gossett/ star rating (minimum three star and above)

3.4 Motor- ABB / Siemens/ Alstom / Crompton Greaves/Teco/KBL (minimum three star and above)

3.5 Soft starter : Siemens/ Schneider

3.6 Panels: ELSTEEL-KIK/Siemens/Schneider

3.7 Switch Gear: Siemens/ Schneider

3.8 **G.I. Sheet:** SAIL/Jindal/TATA/Ispat

3.9 GI ‘B’ class pipe JINDAL /TATA

- 3.10 Pipe fittings including valves MAKE – Leader / Neta / Fouress for entire connection
- 3.11 Y Strainer: Emerald/ Sant
- 3.12 2 way valve & flow switch: Landis & Saefa/Honeywell/Johnson/Sauter/Anergy
- 3.13 Thermostat: Landis & Saefa/Honeywell/Johnson/Sauter/Anergy
- 3.14 Expanded Polystyrene : Beardsell/ Owen Corning
- 3.15 Insulation Material (Glass wool): UP Twiga/ KIMMCO
- 3.16 Insulation Material (Rockwool): Lloyds
- 3.17 Automatic Expansion Tanks: CIMM/Taco/Elbi/Anergy
- 3.18 Automatic air vents: Anergy, Flamco/Taco
- 3.19 Thermometers /Pressure Gauges: Fiebig/WAREE
- 3.20 Ball Valves/ Gate Valves: Audco/ Kirloskar/Zoloto/ Kitz
- 3.21 Butterfly vale: Audco/ Honeywell/ Kitz
- 3.22 Balancing Valve: Advance
- 3.23 Non Return Valve: Intervale/ Advance
- 3.24 Check Valve: Kirloskar
- 3.25 Prefabricated ducts: Rolastar or equivalent facility
- 3.26 Precoated sheets: Shree/ISPAT
- 3.27 Cables used shall be of: polycab, Ducab, KEI, Finolex, cords.
- 3.28 Wires used shall be of: polycab, KEI, Finolex, Havells,cords.

For BMS Equipment

- 3.29 Two way & Three Way Motorized Valves with actuators: Honeywell
- 3.30 Butterfly valves: Honeywell
- 3.31 The make wherever not specified shall be of repute & ISI marked....

The firm should quote after seeing the physical location at site.

6.0 Manpower deployment

- 6.0.1 The contractor shall deploy the manpower in consultation with Engineer in-charge and carry out the activities in hygienic manner.
- 6.0.2 The manpower can also be deployed during OFF days/holidays/night hours as per site requirements for which nothing shall be paid extra.
- 6.0.3 All the work associated with finishing complete in all respect shall be carried out by contractor for which nothing shall be paid extra.
- 7.0 the contractor shall submit the following along with their offer:
 - 7.0.1 List of important spares to be kept by DMRC after DLP for 1 year requirement.
 - 7.0.2 List of consumables to be kept by DMRC after DLP for 1 year requirement.
 - 7.0.3 Make, address of supplier & tentative cost of above listed items.
- 8.0 DMRC is an ISO-14001 & OHSAS 18001 certified Organization for Environment, Health & safety. The work is to be carried out as per International Norms/Standards and in such a manner that all premises always look Neat & Clean. Similarly, the waste disposal is also carried out in totally sealed manner without affecting the Environment.

Specifications for Air Cooled Chillers

1.0 General

This section specifies the requirements for furnishing, installing and testing of Air Cooled Water chilling units with scroll compressors and appurtenances as specified herein, including but not limited to:

- Chiller package
- Charge of refrigerant and oil
- Controls and control connections
- Chilled water connections
- Condenser water connections

Air cooled chiller packages shall be factory assembled and tested for rated efficiency. Unit shall be delivered to site fully assembled, and charged with refrigerant and oil by the manufacturer.

2.0 Quality Control

- 2.1 Materials and workmanship shall be in accordance with the latest edition of the following standards and codes to the extent specified herein. The publications listed below form a part of these specifications to the extent referenced. The publications are referred to in the text by basic designation only.
- 2.2 Chiller shall be pressure-tested, evacuated and fully charged with refrigerant and Oil and shall be factory operational run tested with water flowing through the vessel.
- 2.3 Within 14 days after successful completion of all factory tests the Contractor shall submit the following:
 - i. Certified results for all factory tests conducted. All test data shall be bound in one report. The test report shall be indexed and cross-referenced in an easily understood manner.
 - ii. Field test procedures.

2.4 Relevant Codes and Standards

- 2.5.1 Deleted.
- 2.5.2 BS 5422: Method for Specifying Thermal Insulating Materials on Pipes, Ductwork and Equipment (In Temperature Range 40 Degrees Celsius to +700 Degrees Celsius).
- 2.5.3 BS 5970: Thermal Insulation of Pipework and Equipment (In the Temperature Range – 100 Degrees Celsius to +870 Degrees Celsius).
- 2.5.4 NFPA Code 90A: Installation of Air Conditioning
- 2.5.5 NFPA Code 90B: Installation of Air-Conditioning Systems
- 2.5.7 All insulating materials shall comply with the requirement of BS 5422 & BS 5970.
- 2.5.7 All insulating materials shall be tested to comply with the following: BS 476: Part-4: Non Combustibility, Combustion rating when tested in accordance with NFPA Standard Nos. 90A and 90B, shall not exceed 25 for flame spread and 50 for smoke developed, Part 5: Product shall not ignite when tested by source A for 10s by face ignition, Part 6: Fire propagation I less than 12, i less than 6, Part 7 Class 1: surface spread of flame

- 2.5.08 ANSI/ASHRAE 15-1992, Safety code for mechanical refrigeration.
- 2.5.09 Material and workmanship shall be in accordance with the latest edition of the following standards and codes, and the materials shall be certified by the standard organization.
- 2.5.10 ASTM A167: Standard Specification for Stainless and Heat-Resisting Chromium – Nickel Steel Plate, Sheet and Strip
- 2.5.11 BS 21: Pipe Threads for Tubes and Fittings where Pressure-Tight Joints are made on the Threads (Metric Dimensions)
- 2.5.12 BS 759: Valves, Gauges and other Safety Fittings for Application to Boilers and to Piping Installations for and in Connection with Boilers
- 2.5.13 BS 1010: Draw off Taps and Stopvalves for Water Services (Screwdown Pattern)
- 2.5.14 BS 1212: Float Operated Valves (Excluding Floats)
- 2.5.15 BS 1400: Copper Alloy Ingots and Copper alloy and High Conductivity Copper Castings.
- 2.5.16 BS 1452: Flake Graphite Cast Iron
- 2.5.17 BS 2456: Floats (Plastics) for Floated Operated Valves for Cold Water Services
- 2.5.18 BS 2879: Draining Traps (Screw – Down Pattern)
- 2.5.19 BS 3456: Safety of Household and Similar Electrical Appliances
- 2.5.20 BS 4346: Joints and Fittings for Use with Unplasticized PVC Pressure Pipes
- 2.5.21 BS 4504: Circular Flanges for Pipes, Valves and Fittings (PN Designated)
- 2.5.22 BS 4514: Unplasticized PVC Soil and Ventilating Pipes, Fittings and Accessories
- 2.5.23 BS 4994: Design and Construction of Vessels and Tanks in Reinforced Plastics
- 2.5.24 BS 5150: Cast Iron Gate Valves
- 2.5.25 BS 5152: Cast Iron Globe and Globe Stop and Check Valves for General Purposes
- 2.5.26 BS 5154: Copper Alloy Globe, Globe Stop and Check, Check and Gate Valves
- 2.5.27 BS 5155: Butterfly Valves
- 2.5.28 BS 5163: Predominantly Key–Operated Cast Iron Gate Valves for Waterworks Purposes
- 2.5.29 BS 7350: Double Regulating Globe Valves and Flow Measurement Devices for Heating and Chilled Water Systems

3.0 Manufacturer’s qualifications and experience

The Air cooled chilling units manufacturer shall show at least five years of continuous and current experience in the design, assembly and testing of such units.

4.0 Technical and Installation requirements

4.1. Chiller

- 4.1.1 The water chilling machine shall be self contained type consisting of multiple scroll compressors, squirrel cage induction motor, air cooled condensers, chiller, refrigerant piping, wiring and automatic controls all mounted on a steel base frame forming a compact assembly. The water chilling machine shall be complete with full charge of Zero ODP Environmental friendly refrigerant R134a/ R410A/ R407C and

oil, vibration isolation pads and accessories, factory assembled and tested for rated capacity.

- 4.1.2 The IKW/TR for part load conditions of 25% and 50% under operating conditions shall be indicated.
- 4.1.3 Structure shall be factory assembled and constructed out of formed & powder coated galvanized steel panels.
- 4.1.4 Any special requirements for the installation of the equipment will be advised to the Engineer. All components shall be sized to fit through all plant room access doorways.
- 4.1.5 The air cooled chiller package housing compressor, chiller and condensers shall be mounted on structural foundation. The Contractor shall supply all necessary foundation bolts, nuts, washers, leveling screws, mounting frame or base plate, vibration isolation pads etc. After erection, the unit shall be properly leveled before grouting the foundation bolts and the levels should be shown to the Engineer's representative. All the equipment shall be thoroughly tested and checked for leaks.
- 4.1.6 Chillers shall be shell and tube and multi-pass type. The shell shall be of welded steel construction fitted with machined steel tube sheets on either ends. End water boxes shall be designed to provide adequate space for water movement such that there is no erosion of the tube ends. End box covers shall be removable, and allow easy access for cleaning the tubes.
- 4.1.7 The chillers shall either have internally finned copper tubes or tubes with other means for increasing heat transfer surface. The tube shall be supported in the shell by adequate, stiff supports to eliminate vibration and noise. The tube ends shall be mechanically bonded to the tube sheets to prevent leakage of refrigerant gas.
- 4.1.8 Tubes shall be of minimum 12mm O.D. The chiller shall be tested against leaks with a pressure of not less than 15.75 Kg/cm² both on the shell and the waterside.
- 4.1.9 Chillers shall be complete with the following accessories:
 - a. Thermostatic expansion valves, pilot solenoid valves and filter drier.
 - b. Necessary drain valves and vent.
 - c. Anti freeze thermostat.
 - d. Other standard accessories, necessary for the equipment supplied.
 - e. The chiller shall be insulated with factory-installed insulation.

4.2. Condenser

- 4.2.1 Condensers shall be air cooled type of copper tube and copper fin construction. Copper tube dia shall be minimum 9.5mm. Condenser shall be manufactured to ASME codes for unfired pressure vessels and designed for refrigerant working pressure of 450 psig. Condenser shall be complete with provisions for refrigerant piping connections, shut off valves and any other standard accessory necessary with the equipment supplied. In case of twin compressor system two independent sets of condenser coils shall be incorporated. The condenser coils shall be arranged in staggered rows and shall be expanded into super slit aluminum fins to achieve superior efficiency. The fins shall have hydrophilic coating.
- 4.2.2 The condenser fans shall be propeller type, directly driven by a motor and positioned for vertical air discharge. The draw-through design provides uniform airflow over the entire condenser coil shall be, thus ensuring proper condensation throughout the coil. The condenser fan motors shall be of totally enclosed squirrel

case type with IP-55 type protection and shall be designed for outdoor operation in high ambient temperatures. They shall operate on 415 Volts, 3 Phase, 50 Hz supply.

4.3. Compressor

- 4.3.1 Chiller packages shall be provided with Hermetic Scroll compressors. The compressor shall be hermetically sealed having an integral cast iron frame & cast iron scrolls with a sight glass & an oil adjustment port. The compressor shall be internally lubricated with a highly refined, low foaming, mineral oil and should be provided with a crankcase heater.

4.4. Compressor Motor

- 4.4.1 The compressor motor should be hermetic, refrigerant gas cooled with inherent all phase protection and shall be suitable for 415 V (+/-10%), 3 phase, 50 cycles AC supply.
- 4.4.2 Motor shall be screen protected drip proof squirrel cage induction type, designed and guaranteed for continuous operation at name plate rating and motor to be suitable for the refrigerant being used. Temperature sensor shall be provided in motor winding to protect the motor for high temperature rise.

4.5. Starter for compressor motor

- 4.5.1 The starter for the motor shall be automatic Soft type with tapplings to limit starting current, within 2 times the full load current.
- 4.5.2 Unit mounted pre-wired & pretested with factory settings Starters shall include all necessary safety devices i.e. Overload relays, under voltage release and single phase preventing device.
- 4.5.3 The motor starter shall be factory mounted and fully wired and factory tested during the run test of the unit
- 4.5.4 The starter shall have a metal nameplate showing Manufacturer's identifying, serial number, maximum full load amps, and maximum overload trip setting. Starter shall have affixed to the inside of the door complete, as built, wiring scheme showing all accessory items.

4.6. Capacity Controls

The compressors shall have an automatic regulating capacity from 100% to 25%. In case of multiple compressors, sequencing of compressors shall be provided to allow the compressors to start at a time lag of 3-4 minutes.

4.7. Fans

- 4.7.1 The fans shall be dynamically and statically balanced, direct drive, corrosion resistant glass fiber reinforce composite blades molded into low noise, providing vertical air discharge from extended orifices for efficiency and low sound. Guards shall be made from heavy gauge, steel wire epoxy oven baked painting.
- 4.7.2 The Fan Motors shall be of High efficiency, direct driven, 6 Pole 3 phase, insulation class "F". Totally Enclosed Fan Cooled (TEFC), rigid mounted, with double sealed, permanently lubricated, ball bearings.

4.8 FCU

- 4.8.1 This shall consist of aluminium impeller of forward curved type, both statically and dynamically balanced, along with properly designed GI sheet casing.
- 4.8.2 Maximum noise level acceptable shall be 65dB at a distance of 3m from fan.

- 4.8.3 The two impeller shall be directly mounted on to a double shaft, single phase, multiple winding motor, capable of running at three speeds.
- 4.8.4 Motor shall be capable of providing at least 3 fan speeds ('LOW-MEDIUM- HIGH') and shall be of adequate capacity to prevent over-loading at any speed and duty of the fans. Each fan coil unit shall be equipped with a three-speed fan switch ('LOW-MEDIUM-HIGH') and ON/OFF switch for the fan control.
- 4.8.5 Motor shall be of the permanent split-capacitor type for direct-on-line starting, and factory wired to a terminal block inside a factory installed junction box. Motor shall be provided with UL listed thermal overload protection. Motor windings and electrical components shall be impregnated or protected to avoid trouble from condensation.
- 4.8.6 Connection unit or socket outlet shall be provided near each fan coil unit. Location of these electrical power points shall be coordinated so that the connection unit or socket outlet shall be positioned within 1 m from the fan coil unit
- 4.8.7 Electrical wiring connection including cables and wiring accessories between the connection unit or socket outlet and the fan coil unit shall be provided.
- 4.8.8 Electrical cables or wiring installed outside the casing and inside the air stream shall be protected by metallic flexible conduit.

4.9 Control Panels

- 4.9.1 The chiller shall be provided with a factory installed and wired micro processor based rain tight control panel. The control panel shall be provided with necessary TPN isolator for termination of incoming power cable. A contactor shall be included in the control centre for each compressor and a pair of fan motors.
- 4.9.2 The control system shall automatically control the operation of the unit from the time the unit is started, through the operating period, until the unit is stopped. The internal components shall be arranged for easy access. The panel shall incorporate necessary interlocking between equipment as required. The motor control centre should include safety devices to protect the unit from mal functions. These controls should shut down the unit and signal the operator with their respective lights. The protective controls shall be as listed hereunder:
 - i. High condenser pressure cutout.
 - ii. Low oil pressure cutout.
 - iii. High oil temperature cutout.
 - iv. High discharge temperature cutout.
 - v. Solid state motor over current cutout.
 - vi. Solid state low evaporator temperature control.
- 4.9.3 The chiller shall be BMS compatible. The control panel shall incorporate hardware cards/control units for complete integration of chillers to building automation system.
- 4.9.4 The Software shall be stored in non-volatile memory, with programmed set-points retained in lithium battery backed real time clock (RTC) memory for minimum 5 years.
- 4.9.5 Liquid crystal display, descriptions in English, numeric data in English (or Metric) units. Sealed keypad with sections for Set points, Display/Print, Entry, Unit Options and clock, and On/Off Switch.

- 4.9.6 **Programmable Set-points:** Display language; chilled liquid temperature set point and range, remote reset temperature range, manual override for servicing, low and high ambient cutouts, number of compressors, low liquid temperature cutout, low suction pressure cutout, high discharge pressure cutout, anti-recycle timer (compressor start cycle time), and anti-coincident timer (delay compressor starts).
- 4.9.7 **Display Data:** Return and leaving liquid temperatures, low leaving liquid temperature cutout setting, low ambient temperature cutout setting, outdoor air temperature, English or metric data, suction pressure cutout setting, each system suction pressure discharge pressure (optional), liquid temperature reset via a Building Automation System (by others) via PWM input as standard or at a 4-20 milliamp or 0-10VDC input or contact closure with optional BAS interface, anti-coincident system start timer condition, compressor run status, no cooling load condition, day, date and time, daily start/stop times, holiday status, automatic or manual system lead/lag control, lead system definition, compressor starts/operating hours (each), status of hot gas valves, evaporator heater and fan operation, run permissive status, number of compressors running, liquid solenoid valve status, load and unload timer status, water pump status (optional).
- 4.9.8 **System Safety:** Shall cause individual compressor systems to perform auto shut down; for high discharge pressure, low suction pressure, high pressure switch, and motor protector. Compressor motor protector shall protect against damage due to high input current or thermal overload of windings.
- 4.9.9 **Unit Safety:** Shall be automatic reset and cause compressors to shut down if low ambient, low leaving chilled liquid temperature, under voltage, and flow switch operation. Contractor shall provide flow switch and wiring per chiller manufacturer requirements.
- 4.9.10 **Alarm Contacts:** Low ambient, low leaving chilled liquid temperature, low voltage, low battery, and (per compressor circuit): high discharge pressure, and low suction pressure.
- 4.9.11 Manufacturer shall provide any controls not listed above, necessary for automatic chiller operation. Mechanical Contractor shall provide field control wiring necessary to interface sensors to the chiller control system.

4.10 Power Panels

- 4.10.1 Rain tight, powder painted steel cabinets with hinged, latched, and gasket sealed outer doors. Provide main power connection (s), control power connections, compressor and fan motor start contactors, current overloads, and factory wiring. Power supply shall enter unit at a single location, be 3-phase of scheduled voltage, and connect to unit terminal blocks. Exposed compressor, control and fan motor power wiring shall be routed through liquid tight conduit.
- 4.10.2 Service life: All equipment, cables and wiring shall be designed, manufactured and installed so as to secure a service life as shown below:

Main switchboards	30 Years
Sub – main switchboards	30 Years
Cables	30 Years
Luminaries	20 Years
Tray, trunking and supports	30 Years
All other equipments	minimum 20 Years

- 4.10.3 Switchboards, equipment, and components shall be rated for operation in ambient temperatures of 50°C and humidity upto 75%.

4.11 Insulation

- 4.11.1 Semi-rigid fibre glass / wool or rockwool duct wrapped with a factory applied vapour barrier jacketing secured in position with adhesive and fixing pin/retaining washers. Vapour barrier shall be double sided aluminium foil reinforced by cross grid fibre glass filament. Areas of flat insulation with any dimension greater than 1200mm shall have galvanised fixings equal to the thickness of the insulation secured to the surface with self-sealing aluminium 'pop' rivets to provide firm fixing for finishes.
- Minimum density: 48kg/m³ for glass wool and 64 kg/m³ for Rockwool
 - Maximum K-factor: 0.035W/mK at 25°C mean temperature
 - Temperature range: 0 to 120°C
- 4.11.2 Deleted
- 4.11.3 Flexible elastomeric pipe insulation shall be of fire-retardant, flexible, close-cell, CFC free, in continuous lengths, with factory applied talc coating on inner surface. Flexible elastomeric insulation shall have a flame spread rating of 25 or less and a smoke developed rating of not over 150 for 12mm thickness, in accordance with ASTM E84 test method.
- Maximum K-factor : 0.04W/mK at 20°C mean temperature
 - Density: 64kg/m³ for pipes, 80kg/m³ at supports
 - Closed cell content: at least 90%
 - Water vapour permeance: not exceeding 0.28 mgm/Nh
 - Resistance to heat: at least 800 C.
- 4.11.4 Insulation inside false ceiling and service ducts shall not require any finish.
- 4.11.5 0.8mm thick aluminium hammerclad cladding firmly secured with 'pop' rivets evenly spaced at 100mm centres shall be applied to indoor insulation which is visually exposed to view inside station areas and within plant rooms. Cladding shall be provided with means of removal for repair and maintenance. The same cladding is to be provided on the chilled water pipes.
- 4.11.6 15mm cement plaster finish on chicken-wire mesh with additional finish of 0.8mm polyisobutylene sheeting with solvent weld joints shall be applied to outdoor type insulation which is exposed to ambient. The whole shall be then provided with a completely weatherproof external enclosure to the insulation. Corrosion proof bands and clips shall hold the sheeting tight against the insulation such that ballooning will not occur.

4.12 Globe Valves

- 4.12.1 The bodies shall be of an even thickness throughout, clean and free from scale and flaws. Valves up to and including 50 mm nominal bore shall have bronze bodies and valves of 65 mm bore and larger shall have cast iron bodies. No material used shall be susceptible to dezincification.
- 4.12.2 Globe valves are used for circuit regulation and shall have characterised plug discs. The discs shall be free to rotate, readily removable from the valve stem and renewable. Discs may be manufactured proprietary composition type materials if approved by the Engineer.
- 4.12.3 Valves may have packed stuffing boxes or be fitted with 'O' rings.
- 4.12.4 Valves up to and including 50 mm nominal bore shall have taper screwed ends, valves of 65 mm nominal bore and larger shall have flanged connections.
- 4.12.5 Regulating valves shall be fitted with a lockable spindle to limit the proportion open once regulation is complete.

4.12.6 Bronze globe valves shall be rising stem pattern. Cast iron globe valves shall be outside screw rising stem type.

4.13 Gate Valves

4.13.1 Generally, gate valves shall be used on service pipelines where isolation of plant, equipment and system circuits is required and shall be fitted in the locations indicated on the Definitive Design Drawings.

4.13.2 The bodies shall be of an even thickness throughout, clean and free from scale and flaws. Valves up to and including 50 mm bore shall be bronze, 65 mm bore and larger shall be cast iron. No material used shall be susceptible to dezincification.

4.13.3 Valve wedges may be of cast iron, bronze, nickel alloy or stainless steel. Cast iron wedges shall have bronze trims and seating. Wedges shall be renewable and free to rotate on the valve spindle.

4.13.4 Valves may have packed stuffing boxes or alternatively may be fitted with 'O' rings.

4.13.5 Bronze gate valves shall have non-rising spindles. Cast iron body gate valves shall be outside screw rising stem type.

4.14 Balancing Valves

4.14.1 The balancing valves shall be capable of measuring, regulating and isolating the flow.

4.14.2 The balancing valves up to 40 mm dia shall be of gunmetal screwed type and 50 mm dia. And above shall be C.I double-flanged type confirming to B.S. 1452 or equivalent specifications.

4.14.3 The balancing valves shall be made of stainless steel AISI 410. All other internals shall be non-corrosive material preferably of forged brass.

4.14.4 The port opening shall permit precise regulation of flow rate, by accurately measuring the pressure drop across the port.

4.14.5 The valve shall be complete with two ports for connections to a mercury manometer, to measure the pressure drop, as well as drain port.

4.14.6 The spindle shall have a shielded/concealed locking screw to avoid the tempering of the setting after balancing.

4.14.7 The valves must have easily accessible pressure drop measuring facility.

4.14.8 The balancing valve shall have indication of number of turns on hand wheel preferably digital type.

4.14.9 The balancing valve shall be used in lieu of butterfly / gate / globe / regulating / flow measurement valves and shall be suitable at 16 kg/sqm working pressure.

4.15 Flow Measurement Valves

4.15.1 Flow measurement valve sets shall comprise a screwed or flanged gate valve close-coupled to a flow measurement device.

4.15.2 Sets up to DN50 size shall be screwed end valves and threaded nipple type carrier with integral orifice ring. Sets DN65 size and above shall be flanged and include an

orifice plate and carrier with mating flange. Sets shall be used for measurement and isolation in conjunction with a double regulating valve.

4.16 Flow Measurement Variable Orifice Double Regulating Valve

4.16.1 Double regulating valves as described shall additionally be provided with 2 No. double seated pressure test valves for flow measurement in conjunction with a double regulating valve used in a balancing application.

4.17 Flow Measurement Fixed Orifice Double Regulating Valves (FODR Valves)

4.17.1 FODR valves up to DN50 shall be as for double regulating valves to BS 7350 or other equivalent standard directly coupled to a flow measurement device comprising male/female threaded nipple type carrier with integral orifice ring and 2 No. double seal pressure test valves.

4.17.2 FODR valves DN65 and above shall be cast-iron double regulating valves to BS 7350, or other equivalent standard with flanged connections.

4.17.3 The flow measurement device shall comprise a single piece stainless steel square edged orifice plate carrier with 2 No. double seal pressure test valves, integral orifice to fit between the valve outlet flange and mating flange.

4.17.4 Low flow rate commissioning sets shall comprise bronze double regulating globe valve with bronze stem, slotted parabolic disc and screwed ends, close-coupled to a bronze carrier with integral fixed orifice and 2 No. double seal pressure test points.

4.17.5 Butterfly valve commissioning sets DN65 to DN300 shall comprise cast-iron wafer semi-lugged valves with stainless steel shaft, aluminium bronze disc, nitrile liner and gear operated double regulating properties close-coupled to fixed orifice nickel-plated cast-iron measuring station, with 2 No. double seal pressure test points.

4.18 Check Valves

4.18.1 Check valves shall be supplied and fitted in the locations indicated on the Definitive Design Drawings. Care shall be taken to ensure that the valves supplied are suitable for installation in the plane required as per data sheets. Check valves shall not be installed in vertical pipes with a downward fluid flow.

4.18.2 Check valves up to DN50 shall be bronze with renewable nitrile rubber faced disc and screwed-in cap with ends screwed taper thread.

4.18.3 Check valves DN65 to DN150 shall be cast iron with bronze seat and trim and nitrile rubber faced disc with flanged connection.

4.18.4 Check valves DN200 and above shall be with metal faced disc, bronze trim with flanged to connection to PN16.

4.19 Butterfly Valves

4.19.1 Valves of DN40 and larger shall be of cast iron body and arranged to be fixed between pairs of mating flanges (wafer body) with interconnecting long bolts except for 'end of line' service or equipment isolation. Valves for the latter applications shall be fully lugged type.

4.19.2 Valve stems shall be of stainless steel with either 'O' ring type seals or non-asbestos material packed glands.

- 4.19.3 All isolation valves shown on pipe schematic for all major branches and risers shall be lugged butterfly valves.
- 4.19.4 Valve discs shall be either stainless steel or aluminium bronze and shall be machined to give tight shut off against the valve seat. Valves may contain proprietary latex based materials to ensure that a good seat is obtained. Where such materials are utilised they shall be well proven in use and fully bonded.
- 4.19.5 Valves shall be supplied with graduated indicator plates to show disc position.
- 4.19.6 Generally valves up to and including DN150 shall be lever operated and valves in excess of DN150 shall be provided with gear operation.

4.20 Ball Float Valves

- 4.20.1 Level controllers size 15mm shall be brass bodied float operated valves of the diaphragm type with discharge component to effectively prevent back-siphoning of water, all in accordance with BS 1212 Part 2. Copper floats shall be to BS 1968, and plastic floats to BS 2456 or equivalent.
- 4.20.2 Valves DN20 to DN30 shall be gunmetal bodies double seat balanced equilibrium type of full bore pattern with inlet screwed end.
- 4.20.3 A stopcock shall be fitted on the inlet to all ball float valves.
- 4.20.4 Ball float valves of the delayed action type shall incorporate an equilibrium type ball valve with the float operating in an auxiliary chamber within the storage tank, cooling tower, etc. A second float below the base of the chamber shall operate a quick-operating valve, which shall provide open/shut control. Such ball valves shall be fitted where indicated on the Definitive Design Drawings.
- 4.20.5 Ball float valve installations shall be complete with water stilling pipes to minimize the effect of the water inflow on the operation of the floats and the level controllers.

4.21 Ball Valves

- 4.21.1 Ball valves up to DN50 shall be copper alloy bodies of DZR to BS 2872.CZ 132 or equivalent, have an inhibited brass body with chrome coated ball plug and valve stem, and PTFE seat and seals.
- 4.21.2 Valves shall be 1/4 turn lever handle operated.
- 4.21.3 Valves DN65 and above shall be cast iron.

4.22 Foot Valves

- 4.22.1 Foot valves with inlet bolted strainer shall be fitted on all pump suction dip pipes.
- 4.22.2 Valves shall be fitted with a leather flap and shall be screwed up to DN50 and flanged DN65 and above.

4.23 Three-way Escape Valves

- 4.23.1 Three-way escape (diverting) valves as per datasheet shall be provided.
- 4.23.2 Seat arrangement shall be that closure of one outlet port occurs when the alternate outlet port is opened. Clockwise hand wheel operation shall open the vent port.

4.24 Strainers

- 4.24.1 Strainers shall be 'Y' pattern, unless otherwise indicated, suitable for the working pressures and service of the piping system and of the same nominal bore as the pipeline in which they are to be installed.
- 4.24.2 Strainers shall be screw or flanged connected to suit the isolating valves adjacent to, and on the 'dead' side of which they shall be installed.
- 4.24.3 Strainers 15-300mm for use up to 120oC shall have upstream and downstream self-sealing test points incorporated and two blank tapped points.
- 4.24.4 Baskets/screens shall be readily accessible for removal with adequate clearances for inspection and clearing.
- 4.24.5 Baskets/screens shall be of specified sheet material with perforations recommended by the manufacturer for the service application.
- 4.24.6 Baskets/screens shall be cleaned with solvent after pipeline pre-operational cleaning and shall be again thoroughly cleaned before issue of a Completion Certificate.
- 4.24.7 Strainers for cold service up to 17 bar and size DN15 to DN40 shall be gunmetal body, screwed ends, with stainless steel screen, non-ferrous cap and non-asbestos cap gasket.
- 4.24.8 Strainers DN50 to DN200 shall be cast iron flanged body, with stainless steel strainer screen, cast iron cap, asbestos-free reinforced non-stick cap gasket. The cap shall be complete with 20mm drain valve fitted with hose union.
- 4.24.9 Strainers DN250 and above shall be cast steel flanged pot-type with scantlings as for DN200.

4.25 Thermoplastic Valves

- 4.25.1 Thermoplastic valves only shall be installed in ABS and uPVC pipework systems.
- 4.25.2 Solvent weld end valves shall be provided for sizes up to DN50. DN80 size valves shall be flanged.
- 4.25.3 Pipelines requiring regulation shall be fitted with 'B' grade diaphragm valves.
- 4.25.4 Pipelines requiring shut-off provision only shall be provided with ball valves with plain ends for solvent weld jointing in sizes DN15 to DN80 inclusive.
- 4.25.5 Foot valves and strainers in thermoplastic pipework systems shall be PVC ball foot valves and strainers for solvent welding.

4.26 Stopcocks

- 4.26.1 Stopcocks for fresh water systems shall conform to BS1010 Part 2 or equivalent standard and the materials for constructing the stopcock shall be non-dezincifiable type. They shall generally be able to withstand a working pressure of 16 bar.

4.27 Drain Valves

- 4.27.1 Drain valves shall be provided at the bottom of every riser and at all low points within the water systems to enable full draining down of the entire system.
- 4.27.2 Drain valves shall comply with BS 2879, be screwed end, solid wedge disc, inside screw, non-rising stem, screwed in bonnet lock shield type bronze gate valves with hose union connection.

4.27.3 Extended drain lines shall be of the same size as the drain valves.

4.27.4 Drain valves shall be of sizes indicated below:

4.27.5 Main Pipe Size (DN)	4.27.6 Drain Valve Size (DN)
4.27.7 Up to 25	4.27.11 15
4.27.8 32-100	4.27.12 20
4.27.9 100-300	4.27.13 32
4.27.10 300-600	4.27.14 50

4.28 Insulation and Protection at Pipe and Duct Supports

4.28.1 Insulated pipes shall be provided with high-density rockwool insulation of minimum 160kg/m³ density.

4.28.2 The collar shall not be less than 75mm width for pipe sizes up to 80mm diameter, 150mm width for pipe sizes up to 200mm diameter and 200mm for pipe sizes above 200mm diameter.

4.28.3 Brackets shall be of same width as the collar.

4.28.4 Insulation at pipe support shall be protected by galvanized sheet steel sleeve of 1.2mm in thickness and not less than 250 mm in length.

4.28.5 For insulated pipes above 300mm diameter, steel bridging pieces will be allowed to penetrate the insulation to support the pipe. All annular space between support saddle and pipe shall be filled with insulation and the supports shall be adequately insulated to prevent condensation (for chilled water pipes).

4.28.6 High density PUF supports shall be added between pipes and hangers.

4.29 Pipeline fittings

4.29.1 Brass, bronze or cast iron valves shall generally be of 16 bar pressure rating (working pressure) type and UPVC valves of 10 bar. In addition, all valves at discharge side of transfer water pumps shall be of minimum 16 bar pressure rating.

4.29.2 Where valves are provided at the discharge side of 2 or more pumps, each valve shall be so selected to withstand effectively the anticipated system pressure under the worst case scenario.

4.29.3 Screwed valves shall have taper threads to BS 21. Flanged valves shall have dimensions and bolting in accordance with BS 4504.

4.30 Refrigerant Circuit

The unit shall consist of copper refrigerant piping, independent refrigerant circuits for multi compressor unit. Each refrigerant circuit shall include: liquid line shutoff valve with

charging port, filter-drier, solenoid valve, sight glass with moisture indicator, thermostatic expansion valves, and flexible, closed-cell foam insulated suction line.

5.0 Installation, Testing and commissioning

5.1 General

- 5.1.1 An approved Commissioning Specialist shall undertake the entire commissioning and performance testing of ECS installation. The Contractor shall at all times be responsible for the supervision of the Commissioning Specialist's work and shall ensure satisfactory completion of commissioning and recording results.
- 5.1.2 The Employer will be given the opportunity to witness all tests.
- 5.1.3 Any defects of Workmanship, materials, performance, maladjustment, non-compliance with this specification or other irregularities which become apparent during the tests or commissioning shall be rectified by the Contractor, at its own expense, until the whole Works is free from defects and in full working order to the complete satisfaction of the Engineer.
- 5.1.4 The Contractor shall provide all instruments, and sufficient evidence of the accuracy of the test instruments shall be provided. Test methods shall be demonstrated to the Engineer where required.
- 5.1.5 The Contractor shall submit to the Engineer a schedule detailing the equipment, which he proposes to use in the testing and commissioning of the services and the test methods to be employed.
- 5.1.6 Testing and commissioning of major items of proprietary plant or specialist equipment will be carried out by the suppliers personnel and witnessed by the Commissioning Specialist. The Engineer will be advised of such activities.
- 5.1.7 Test results will be recorded on approved Commissioning certificates
- 5.1.8 All test and commissioning instruments will be provided by the Contractor or its Commissioning Specialist, and certified evidence of the accuracy of the test instruments will be provided. The Contractor will submit to the Engineer a schedule detailing the equipment which he or its Commissioning proposes to use in the testing and commissioning of the services and the test methods to be employed.
- 5.1.9 Instruments for testing will include as a minimum the following:
- Anemometer (range 1.5m/s to 13 m/s)
 - Inclined tube anemometer
 - Pitot tubes of various lengths to suit duct sizes
 - Mercury in glass thermometers
 - Weekly recording thermometers
 - Weekly recording R.H. meters
 - Specially mounted anemometers fixed in a conical sheet metal sheet box hood for measuring accurately air low from diffusers
 - Ammeter, Tachometer
 - Vibration and Noise testing instruments
 - Surface contact dial indicating pyrometer

5.2 Chiller

- 5.2.1 The refrigeration filling shall be as per manufacture's recommendation. The system shall be vacuumed to within 7.6mm Hg Absolute and maintained for four hours. At the end of this period the pumps shall be stopped and vacuum

maintained for twenty four hours without exceeding a vacuum drop of 2.5mm Hg Absolute. The Contractor shall certify that the vacuum was maintained as specified above. All safety controls, low and high refrigerant pressure controls, starter, overload trips shall be suitably set and record of all the setting shall be furnished to the employer.

- 5.2.2 The plant will be continuously operated for a minimum period of 24 hours before tests are witnessed. The Contractor will confirm to the Employer, giving a minimum period of 24 hours notice, that the installation is ready for witness of performance testing.
- 5.2.3 The Contractor will be responsible for the supply, fixing, connection and safe operation of sufficient temporary artificial heat load equipment and any instrumentation necessary to demonstrate system performance and for subsequent disconnection and removal from site when the Employer is satisfied that tests are complete.
- 5.2.4 The Contractor will subject the entire plant to a total continuous run of the duration agreed with the Engineer to ensure that all apparatus, materials and systems are working properly. During the run tests will be carried out to ensure, that all controls, safety devices, operating services and all units are properly adjusted and operating correctly, that design temperatures in the piping system and throughout the air system are established and that the system provide the required internal conditions. The Contractor will assure himself that the design intent is achieved before demonstration to the Engineer. The performance will be evaluated during environmental conditions prevailing at that time.
- 5.2.5 The Contractor will provide a temporary installation of portable recorders where indicated and simultaneously record temperatures and humidifies for summer and winter design conditions. The location of test instruments shall be approved by the Engineer. The corresponding external conditions will also be recorded whilst tests are in progress. The capacity of refrigeration plant, (including components thereof such as condensers, evaporators will also be demonstrated and recorded.
- 5.2.6 Individual room temperatures shall be measured by mercury-in-glass thermometers located 1.5m above floor level at points unaffected by the influence or draughts or direct radiation from hot or cold surfaces.
- 5.2.7 Measurements and records of performance test results will be entered on the Commissioning formats and handed to the Employer within a reasonable time after the tests are completed. Copies of the results will be retained on site by the Contractor and be available to other official representative as required.

5.3 FCU Installation

- 5.3.1 The FCU shall be installed as per good engineering practice and as per the standard referred.
- 5.3.2 Each FCU shall be provided with a thermostat positioned in an approved location. The thermostat shall have switches provide Low-Medium-High fan speeds and a rotating temperature set point selector.
- 5.3.3 The thermostat shall have an aesthetically made housing/cover.
- 5.3.4 The end of the flexible conduit shall be properly terminated in the junction box of the FCU and the pipe conduit/switch box at the other end.

5.4 The control panel shall have the following extended capabilities:

5.4.1 Remote indication of:

- Chiller operating status
- Shutdown codes
- Key operating parameters including but not limited to:
 - Entering and leaving chilled water temperatures
 - Entering and leaving condenser water temperatures
 - Oil feed and sump temperatures
 - Oil pump discharge and oil differential pressure
 - Motors amps and amps as a percent of rated load amps
 - Hours of operation and number of starts, time of last start and stop
- Fault history for last 8 failures
 - Self-diagnostics

5.4.2 Programming capabilities of:

- Leaving chilled water temperature

5.4.3 Reset of chilled water temperature from:

- Return chilled water temperature (to maintain constant return chilled water temperature)
- Reset of supply water temperature between +8°C to +12°C
- Load on chiller
- Power demand limit
- Lead-lag operation and control

5.4.4 The control panel should include but not to be limited to the items listed below:

- Start/Stop switch (for both local/remote operation) and micro-processor module for capacity control system with overload limit control point adjustment, oil pump and purge unit controls, etc
- Indicating lights
- Suction, oil and discharge pressure indications
- Necessary motor protection devices
- Other time delays, relays, etc as required

5.4.5 As a minimum the following safeties shall be incorporated in the control panel:

- High and low discharge pressure
- High discharge temperature
- Chilled or condenser water pumps failure
- High or low oil feed temperature
- Low oil differential pressure
- High motor temperature, low motor current
- Starter fault

5.4.6 The display shall have a minimum of 160-characters liquid crystal having multi colour display and be backlit with a light emitting diode. Messages shall be in plain English. Coded two or three characters displays are not acceptable.

- 5.4.7 A time clock shall be incorporated to allow daily time starts and stops
- 5.4.8 The control system shall have automatic restart after a power failure and not require a battery backup for memory continuity.
- 5.4.9 The microprocessor shall be capable of communicating to other units or a PC using a twisted pair communication interface RS-232 or RS422/485 or with a 9600-baud modem. The protocol should be BAC-NET/MOD BUS compatible. In case of any translator being required for communication between the chiller panel & BMS the same would be provided by the contractor.

5.5 Pump

- 5.5.1 The pump shall be installed on a concrete foundation .
- 5.5.2 Each pump shall be provided with certified performance curves showing power absorbed and corresponding flow rates by varying the speed. The tests shall be done at factory. Testing report shall be submitted to DMRC.
- 5.5.3 Split casing pumps, prior to testing shall be aligned with a dial indicator within 0.05mm.
- 5.5.4 Pump performance curves and power consumption with operating points clearly indicated shall be submitted and verified at the time of testing and commissioning of the installation.
- 5.5.5 Pump performance shall be computed from the pump curves provided by manufacturer. All pumps shall be tested at factory as per relevant codes.

5.6 Deleted

5.7 SENSOR / TRANSMITTERS

Provide field mounted differential pressure sensor transmitter(s) as indicated on the plans. Unit shall transmit an isolated 4-20mA dc signal indicative of process variable to the pump logic controller via standard two wire 24 DC system. Unit shall have stainless steel wetted parts with two 0.25" male NPT process connections. It shall be protected against radio frequency interference and shall have a watertight, NEMA 4 electrical enclosure capable of withstanding 2000 PSI static pressure with a 0.5" NPT conduit connection. Accuracy shall be within 0.25% of full span.

5.8 Insulation

- 5.8.1 Insulation shall not be applied before the relevant plant or service has been satisfactorily inspected and tested.
- 5.8.2 All insulation shall be applied by skilled workmen.
- 5.8.3 Apply insulation on clean and dry surface with no foreign materials, such as oil, grease, rust, scale or any other dirt.
- 5.8.4 Apply clean and dry insulation only.
- 5.8.5 Install insulation in accordance with the manufacturer's recommendation as a minimum requirement.
- 5.8.6 Provide a complete moisture and vapour seal wherever insulation terminates against metal hangers, anchors, or other projections through insulation on cold surfaces.
- 5.8.7 Stagger all joints with respect to the adjacent butt joint. Seal with 50mm wide aluminium foil type for fibre glass insulation.
- 5.8.8 Apply insulation in a manner to give an acceptable look, smooth and lineable surface of uniform thickness. Steps and undulations in the surfaces will be rejected by the Engineer.

5.9 Insulation on Sheet Metal Ducts

- 5.9.1 Cut insulation slightly longer than perimeter of duct to insure full thickness at corners.
- 5.9.2 All insulation shall be applied with edges tightly banded.
- 5.9.3 Adhesive shall be applied so that insulation conforms to duct surfaces uniformly and firmly.
- 5.9.4 Provide metal fixing pins and retaining clips in addition to adhesive for securing of insulation.
- 5.9.5 The protruding ends of the pins shall be cut off flush and the vapour barrier facing shall be thoroughly sealed with a vapour barrier mastic or tape where the pins have pierced through. Pin spacing shall not exceed 300mm on centres.

5.10 Insulation of Pumps

- 5.10.1 Fit insulation snugly against equipment without voids.
- 5.10.2 Bevel curved surface edges to provide a tight joint.
- 5.10.3 Provide metal insulated cover with metal fasteners, supports, frames and membranes.

5.11 Piping

- 5.11.1 Install same thickness insulation as the adjoining pipe insulation on flanges, valves and other fittings to obtain the maximum strength and security. Seal joints, protruding metal parts and valve stems thoroughly.
- 5.11.2 All valves, traps, flanges and strainers shall be insulated in conformity with the pipework in which they are incorporated except that 1.2mm thick galvanised steel or aluminium split boxes shall be provided to ensure easy removal of insulation.
- 5.11.3 Insulate strainers in such a manner to permit removal of gasket without disturbing the insulation of the strainer body. Insulate valves up to and including bonnets.

5.12 Pipeline fittings

- 5.12.1 This Section specifies the manufacture and installation of globe valves, gate valves, check valves, butterfly valves, motorized valves, gauge cocks, automatic air valves, strainers, dirt pockets, stopcocks, pressure reducing valves, double regulation valves, safety and relief valves, thermostatic mixing valves, UPVC valves for flushing water, drain cocks, ball float valves, safety and pressure relief valves, escutcheons, thermometer, pressure gauges, flow measuring elements, vortex inhibitors, pipe sleeves, expansion loops, expansion joints, pipe anchors, pipe guides, gaskets for pipe separation, access pipes, traps, water – closet connectors and fresh air inlets.
- 5.12.2 All valves, taps and cocks shall be of the types and working pressures suitable for the systems to which they are connected. Valves shall be rated to withstand the system hydraulic test pressure.
- 5.12.3 All valves shall comply with British Standards in respect of tests and working pressures, dimensions and materials of construction.

- 5.12.4 Wheel head valves shall be arranged for clockwise operation of the handle to close the valve.
- 5.12.5 Connections shall be made between each valve and the adjoining pipe work or equipment with flanges for 65mm size pipe work and above. Flanges shall be selected to suit working pressure and temperature.
- 5.12.6 Screwed connections shall be made between each valve and the adjoining pipe work or equipment for 50 mm size pipe work and below. A union shall be fitted on each side of all screwed valves.
- 5.12.7 All valves shall be suitably located in accessible positions for operation and maintenance purposes.
- 5.12.8 All drain outlets and manual air vents shall have connection pipes leading to the nearest drain.
- 5.12.9 Valve packing shall be suitable for the service intended. Valve packing consists of asbestos or asbestos based materials shall not be used.
- 5.12.10 Valves of identical make, size, type and duty shall be fully interchangeable.
- 5.12.11 Inverted mounting of valves shall not be permitted without prior Approval.
- 5.12.12 All valves provided for manual operation shall have a hand wheel or other suitable device which shall be fixed to the valve. Hand wheels shall be rotated clock-wise to close the valves and shall be clearly marked with the words "OPEN" and "CLOSE" and arrows pointing in the appropriate directions. The rims of hand wheels shall be machined to a smooth finish. All hand wheels which may be dangerously hot to touch when the system is in use shall be provided with Approved heat insulation on the rim and spokes.
- 5.12.13 Chain-operated hand wheels shall be provided including rustproof chain and chain guide for valves installed two meters or more above finished floor.

5.13 PAINTING

- 5.13.1 All pumping system, pumps, motors and bases shall be supplied with approved finish. Shop coat of paint that have become marred during shipment or erection shall be cleaned off with mineral spirits, wire brushed and spot primed over the affected areas, then coated with enamel paint to match the adjoining areas.

5.14 Sound level measurements

- 5.14.1 Reading will be taken to ensure that the required noise ratings are not exceed. Representative areas will be selected by agreement with the Engineer.
- 5.14.2 Wherever necessary, when measuring room sound levels, normal continuous background noise from sources other than the installation will be taken into account. Measurements relating to plant and equipment will generally be taken 1.5 m from the item.
- 5.14.3 Results of octave band analysis will be submitted on noise rating curve charts for each individual space.

5.15 Interlock and Padlocking Facilities

- 5.15.1 Mechanical key interlocks shall be provided and shall be so designed as to avoid mal-operation at the point of manual application. The scheme shall be such that

attempts to remove a captive key shall not result in tripping or opening of the device.

- 5.15.2 Electrical interlocks on withdrawable equipment shall be so arranged that if the equipments are withdrawn, the complete operation of the withdrawn equipment shall be independent of the remote interlocking contacts. In addition, interlocks shall not be defeated leading to damages or unsafe operations of LVSBs due to the withdrawing of equipment.
- 5.15.3 Locking facilities shall be provided where appropriate for switches and isolators in order that they may be locked in the open position. Switchgear cubicle access doors shall be equipped with integral type locks, preferably incorporated in the handles of the equipment.
- 5.15.4 Where locking facilities are of the integral barrel type, the key for each lock shall be unique to the associated lock unless otherwise specified.
- 5.15.5 Two keys shall be provided for every lock supplied. The keys shall be fitted with rings with identification labels, and wooden cabinets with glazed front- opening doors shall be provided. The cabinets shall be adequate in size and equipped with hooks to house all keys when not in use, and shall be mounted in positions to be decided.

5.16 Site preparation

- 5.16.1 All site preparatory work shall have been carried out prior to the commencement of the installation.
- 5.16.2 Such work shall include the following:
 - 5.16.3 The preparation of all fixings and drilling of any holes required
 - 5.16.4 Cutting and forming of holes for services through walls, floors, ceilings, partitions, roof, etc
 - 5.16.5 Cutting and forming of chases, recesses, in floors, walls for the services
 - 5.16.6 Formation of concrete bases, plinths, for plant and equipment
 - 5.16.7 Tenderers are advised to visit the site before quoting the rates.

SECTION 3

TENDER PRICES AND SCHEDULE OF PAYMENT

3.1 Tender Prices

- 3.1.1 a. unless explicitly stated otherwise in the Tender Documents, the contractor shall be responsible for the whole works, based on the Bill of Quantities and payment shall be as per accepted rates based on the activities carried out as in the Schedule of work.
- b. The rate quoted by the tenderer shall be inclusive of all duties, taxes, fees, octroi and other levies, materials, labour to & for transportation of material and labour charges etc.

3.1.2 Schedule of Payment

Payment shall be made against two running bills 70% after delivery of material at DMRC's respective sites & rest of the 30% shall be released after successful completion of 100% work as per accepted rates on actual basis.

The payment shall be made subjected to submission of jointly signed report of DMRC Engineer in charge & your representative.

Payment shall be subjected to deduction of all T.D.S as per applicable law.

“Supply, installation, testing, commissioning of Air Cooled Scroll Chiller HVAC system including the interconnection with the existing FCUs and existing chilled water piping at Four Underground Metro Station of Metro Corridor of Delhi Metro Rail Corporation Limited””.

INSTRUCTIONS TO TENDERERS

GENERAL

1.1 INTRODUCTION

Sealed Open tenders are invited for DMRC hereinafter called the 'Employer', for Works in accordance with this Tender Package. The tender papers consist of the following documents, along with their annexure, appendices, addenda and errata if any.

- Notice Inviting Tender (NIT)
- Instructions to Tenderers (ITT)
- Special Conditions of Contract (SCC)
- General Conditions of Contract (GCC)
- Bill of Quantities

Tender shall be prepared and submitted in accordance with the instructions given herein.

- 1.2 Relevant address for correspondence relating to this tender is given below:

Deputy General Manager/Traction, 2nd Floor, Metro Bhawan, Fire Brigade Lane, Barakhamba Road New Delhi-11001

- 1.3 Some essential data/requirements pertaining to this Tender along with reference to Clause number of this volume where full details have been given are detailed below.

- a. Tender Security” to be furnished by the Tenderer: Amount as per NIT.
- b. Tenders will be accepted in the office of Dy. General Manager/Traction only. **Late or delayed tenders will not be accepted under any circumstances.**
- c. Date of opening of the Tender Package: **As per NIT.**
- d. Period for which the tender is to be kept valid: As per clause-11.0

2.0 POST QUALIFICATION REQUIREMENTS

- 2.1 This invitation to open eligible renderers who has completed the similar nature of work refer clause 1.2.2 of NIT.
- 2.2 The Tenderer shall submit only one tender either himself or as a lead partner/ Lead Constituent in a joint venture/consortium for the work. The tenderer who submits more than one tender for the same work will be disqualified.
- 2.3 The tender, and, in the case of a successful tender, the Form of Agreement, shall be individually signed so as to be legally binding on all partners/constituents as the case may be.
- 2.4 Each page of tender shall be signed by the authorized signatory of the tenderer. Power of Attorney in favour of the signatory will be required to be furnished as detailed in Clause 13.0.

3.0 COST OF TENDERING

- 3.1 The Tenderer shall bear all costs associated with the preparation and submission of his tender and the Employer will in no case be responsible or liable for these costs.

4.0 SITE VISIT

- 4.1.1 The Tenderer is advised to visit and examine the Site of Works and its surroundings at his/their cost and obtain for himself on his own responsibility, all information that may be necessary for preparing the tender and entering into a Contract.
- 4.1.2 The agency shall be deemed to have inspected the Site and its surroundings before hand and taken into account all relevant factors pertaining to the Site in the preparation and submission of the Tender

TENDER DOCUMENTS

5.0 CONTENTS OF TENDER DOCUMENTS

- 5.1 The tenderer is expected to examine carefully all the contents of the tender documents as mentioned in Sub-clause 1.1 including instructions, conditions, forms, terms, and take them fully into account before submitting his offer. Failure to comply with the requirements as detailed in these documents shall be at the tenderer's own risk. Tenders which are not responsive to the requirements of the tender documents will be rejected.

6.0 AMENDMENT TO TENDER DOCUMENTS

- 6.1 At any time prior to the deadline for the submission of tenders, the Employer may, for any reason, whether at his own initiative or in response to a clarification or query raised by a prospective tenderer, modify the tender documents by an amendment.
- 6.2 The said amendment in the form of an addendum will be sent to all prospective tenderers who have received the tender documents, on or prior of opening of Tender. This communication will be in writing or by telefax and the same shall be binding upon them. Prospective tenderers should promptly acknowledge receipt thereof by telefax to the Engineer.

PREPARATION OF TENDERS

7.0 LANGUAGE OF TENDER

- 7.1 The tender prepared by the tenderer and all correspondence and documents relating to the tender exchanged between the tenderer and the Employer/Engineer shall be in the English language.

8.0 DOCUMENTS COMPRISING THE TENDER

8.1 TENDER PACKAGE

- 8.1.0 The Tender package shall be sealed and addressed to Dy. General Manager / Traction, DMRC duly superscripted with name of work, time and date for submission and time and date for opening. The envelope should also bear the name and address of the tenderer.
- 8.1.1 The Tender package will comprise of Two envelopes namely Envelope-A & Envelope -B.

Envelope-A

Envelope -A shall contain Tender security in original superscripted with Name of work & "Tender Security" At lower portion Name and address of tenderer shall be mentioned.

Envelope-B

Envelope B shall be superscripted with Name of work and the words "Commercial Bid" & shall contain all documents including price bid given in original tender documents comprising of following Forms & documents duly filled in. At lower portion Name and address of tenderer shall be mentioned.

- a) Total value of similar works executed for the last three financial years along may be given in the format prescribed (Form T-V).
- b) Attested copies of the PAN. No. under income Tax Act. Sale tax registration certificate and /or service tax registration certificate whichever applicable, ESI registration certificate & PF Account certificate.
- c) Tender documents as listed below:
 - i. Notice Inviting Tender
 - i. Instructions to Tenderers
 - ii. Special Conditions of Contract
 - iii. DMRC's General Conditions of Contract
- d) Statement of deviations from tender documents (Form C).
- e) Bill of Quantities (BOQ)
- f) Experience record of similar works during the last Five years and in progress on date may be furnished in the format prescribed (Form T-II).

8.2 **The prices shall be entered in the Form of Tender and the BOQ enclosed in words as well figures. These prices should include all costs associated with the contract and taxes etc.**

8.3 Documents to be submitted by the tenderer under technical and financial packages have been described under the respective Clauses 8.1 of ITT. This list of documents has been prepared mainly for the convenience of the tenderer and any omission on the part of the Employer shall not absolve the tenderer of his responsibility of going through the various clauses in the Tender Documents including the specifications and to submit all the details specifically called for (or implied) in those clauses.

8.4 All documents issued for the purposes of tendering, and any amendments issued in accordance with Clause 6.0 shall be deemed as incorporated in the Tender.

9.0 **TENDER PRICES**

9.1 The tenderer is required to quote for all the items as per tender documents.

9.2 The Tenderer shall keep the contents of his tender and rates quoted by him confidential.

10.0 **CURRENCIES OF THE TENDER**

10.1 Tender prices shall be quoted in Indian Rupees only.

11.0 **TENDER VALIDITY**

11.1 The tender for the first year shall remain valid and open for acceptance for a period of 90days from the Last date of submission of tender.

11.2 In exceptional circumstances, prior to expiry of the original tender validity period, the Employer/the Engineer may request the tenderers for a specified extension in the period of validity. The request and the response thereto shall be made in writing or by telefax. A tenderer may refuse the request without forfeiting his tender security. A tenderer agreeing to the request, shall not be required or permitted to modify his tender but will be required to extend the validity of his tender security correspondingly.

12.0 **TENDER SECURITY**

12.1 The tenderer shall furnish, as tender security, an amount as mentioned in NIT.

12.2 The tender security will be in the form of a Bank Guarantee from a schedules bank in the performa at Annexure-B.

- 12.3 **Any tender not accompanied by an acceptable tender security will be summarily rejected by the Employer/Engineer as non-responsive.**
- 12.4 The bank guarantee shall be irrevocable and operative for a period not less than 30 days beyond the validity of the tender.
- 12.5 The tender securities of unsuccessful tenderers shall be discharged/returned by the Employer as promptly as possible as but not later than 30 days after the expiration of the period of tender validity.
- 12.6 The tender security of the successful tenderer shall be returned upon the tenderer executing the Contract Agreement after furnishing the required performance guarantee for performance, as mentioned in this Tender Document.
- 12.7 **The tender security shall be forfeited:**
If a Tenderer withdraws his tender during the period of tender validity, or
2. If the Tenderer does not accept the correction of his tendered price in terms of Clause
 3. In the case of a successful tenderer, if he fails to:
 - a. Furnish the necessary performance guarantee for performance.
 - b. Enter into the Contract within the time limit specified in Clause 26.0
 - c. Commence the work as per Terms and Conditions of Tender after issuance of LOA.
- 12.8 **No interest will be payable by the Employer on the tender security amount cited above.**

13.0 FORMAT AND SIGNING OF TENDERS

- 13.1.1 If the tender is submitted by a proprietary firm it shall be signed by the proprietor above his full name and the full name of his firm with its current address.
- 13.1.2 If the tender is submitted by a limited company or a limited corporation, it shall be signed by a duly authorized person holding the power of attorney for the firm. A certified copy of the power of attorney shall accompany the tender.
- 13.2 The documents required to be submitted by the Tenderer will be as described under Clause 8.0 herein.
- 13.3 Entries to be filled in by the Tenderer shall be typed or written in indelible ink. Each page of such document should be signed in full at the bottom by the person submitting the Tender along with the date of signing. Each page of printed documents should be initialed at the bottom by the person submitting the tender along with the date of initialing.
- 13.4 The complete tender shall be without alterations, overwriting, interlineations or erasures except those to accord with instructions issued by the Employer, or as necessary to correct errors made by the tenderer. All amendments/corrections shall be initialed by the person signing the tender.
- 13.5 All witnesses and sureties shall be persons of status and probity and their full names, occupations and addresses shall be written below their signatures.

SUBMISSION OF TENDERS

14.0 SEALING AND MARKING OF TENDERS

- 14.1 The Tenderer shall follow the procedure as indicated below:
- 14.1.1 Each tender will be submitted in one set which shall contain documents as detailed in Appendix - I.

- 14.1.2 The contents of Tender Package shall be as detailed under Clauses 8.0 hereon.
- 14.2 No responsibility will be accepted by the Employer/Engineer for the misplacement or premature opening of a tender, not sealed or marked as per aforesaid instructions.
- 15.0 **SUBMISSION OF TENDERS**
- 15.1 Tenders should be submitted in the tender box kept at the following address:
- Deputy General Manager/Traction, 2nd Floor, Metro Bhawan, Fire Brigade Lane, Barakhamba Road New Delhi-110001 on date and time as mentioned in NIT.
- 15.2 Tenders shall be submitted in person to the Office of DMRC. The Engineer/Employer cannot take any cognizance and shall not be responsible for delay in transit.
- 15.3 Tenders sent telegraphically or through other means of transmission (telefax etc.) which cannot be delivered in a sealed envelope shall be treated as defective, invalid and shall stand rejected.
- 16.0 **LATE TENDERS**
- 16.1 Any tender received in the office of DMRC after the deadline prescribed for submission of tenders will be returned unopened to the tenderer.

TENDER OPENING AND EVALUATION

17.0 TENDER OPENING

- 17.1 The Employer or his authorized representative will open the Tender package in the presence of tenderers or their Authorized representatives on date and time as mentioned in of NIT in the office of **Dy. General Manager/Traction, 2nd Floor, Metro Bhawan, Fire brigade Lane, Barakhamba Road, New Delhi 110001**. If such nominated date for opening of Tender is subsequently declared as a Public Holiday by the Employer, the next official working day shall be deemed as the date of opening of Tender at the same time. The Tender of any Tenderer who has not complied with one or more of the foregoing instructions may not be considered.
- 17.2 The tenderers name, the presence or absence of the requisite tender security and such other details as the Employer or his authorised representative, at his discretion, may consider appropriate will be announced at the time of tender opening.

18.0 PROCESS TO BE CONFIDENTIAL

- 18.1 Except the public opening of tender, information relating to the examination, clarification, evaluation and comparison of tenders and recommendations concerning the award of Contract shall not be disclosed to tenderers or other persons not officially concerned with such process.
- 18.2 Any effort by a tenderer to influence the Employer/Engineer in the process of examination, clarification, evaluation and comparison of tenders and in decisions concerning award of contract, may result in the rejection of the tenderers tender.

19.0 CLARIFICATION OF TENDERS

- 19.1 To assist in the examination, evaluation and comparison of Tenders, the Engineer / Employer may ask tenderers individually for clarification of their tenders, including breakup of prices. The request for clarification and the response shall be in writing or by telefax but no change in the price or substance of the tender shall be sought, offered or permitted except as required to confirm correction of arithmetical errors discovered by the Engineer during the evaluation of tenders in accordance with Clause 22.0 herein.

20.0 DETERMINATION OF RESPONSIVENESS

- 20.1 Prior to the detailed evaluation of tenders, the Engineer will determine whether each tender is responsive to the requirements of the tender documents.
- 20.2 For the purpose of this Clause, a responsive tender is one, which conforms to all the terms, conditions and specifications of the tender documents without material deviation or reservation. "Deviation" may include exceptions, exclusions & qualifications. A material deviation or reservation is one which affects in any substantial way the scope, quality, performance or administration of the works to be undertaken by the tenderer under the Contract, or which limits in any substantial way, the Employer's rights or the tenderers obligations under the Contract as provided for in the Tender documents and / or is of an essential condition, the rectification of which would affect unfairly the competitive position of other tenderers presenting substantially responsive tenders at reasonable price.
- 20.2 If a tender is not substantially responsive to the requirements of the tender documents, it will be rejected by the Employer, and will not subsequently be permitted to be made responsive by the tenderer by correction or withdrawal of the non-conformity or infirmity. However minor clarifications if required may be asked from the Tenderer.
- 20.3 The decision of the Engineer/Employer as to which of the tenders are not substantially responsive or have impractical / methods or Programme for execution shall be final.

21.0 EVALUATION OF TENDER

- 21.1 ***The Employer will carry out technical evaluation of submitted technical proposals to determine that the tenderer has a full comprehension of the work of the contract. Where a tenderer's technical submittal has a major inadequacy his tender will be considered to be non-compliant and will be rejected.***
- 21.2 *Technically acceptable tenders will be eligible for consideration of their financial proposals.*
- 21.3 The evaluation of Financial proposals by the Employer / Engineer will take into account, in addition to the tender amounts, the following factors:
- a). *Arithmetical errors corrected by the Employer/Engineer in accordance with Clause 22.0*
 - b). *Such other factors of administrative nature as the Employer/Engineer may consider to have a potentially significant impact on contract execution, price and payments, including the effect of items or unit rates that are unbalanced or unrealistically priced.*
- 21.4 Offers, deviations and other factors, which are in excess of the requirements of the tender documents or otherwise will result in the accrual of unsolicited benefits to the Employer, shall not be taken into account in tender evaluation.
- 21.5 Price adjustment provisions applicable during the period of execution of the contract shall not be taken into account in tender evaluation.

22.0 CORRECTION OF ERRORS

- 22.1 Tenders determined to be technically acceptable after technical evaluation will be checked by the Engineer/ Employer for any arithmetical errors in computation and summation during financial evaluation. Errors will be corrected by the Employer / Engineer as follows:
- a). *Where there is a discrepancy between amounts in figures and in words, the amount in words will govern; and*

- b. *Where there is a discrepancy between the unit price and the total amount derived from the multiplication of the unit price and the quantity, the unit price as quoted will normally govern unless in the opinion of the Employer / Engineer there is an obviously gross misplacement of the decimal point in the unit price, in which event, the total amount as quoted will govern.*

- 22.2 If a Tenderer does not accept the correction of errors as outlined above, his tender will be rejected and the tender security forfeited.

AWARD OF CONTRACT

23.0 AWARD CRITERIA

- 23.1 The Employer will award, the Contract to the tenderer, whose tender has been determined to be substantially responsive, technically & financially suitable, complete and in accordance with the tender documents.

24.0 EMPLOYER'S RIGHT TO ACCEPT ANY TENDER AND TO REJECT ANY OR ALL TENDERS

- 24.1 The Employer reserves the right to accept or reject any tender, and to annul the tender process and reject all tenders, at any time prior to award of Contract.

25.0 NOTIFICATION OF AWARD

- 25.1 Prior to the expiry of the period of tender validity prescribed by the Engineer/Employer, the Engineer/Employer will notify the successful tenderer by telegram or telefax, to be confirmed in writing by registered letter, that his tender has been accepted. This letter (hereinafter and in the Conditions of Contract called 'the Letter of Acceptance') shall name the sum which the Employer will pay to the Contractor in consideration of the execution, completion of the works by the Contractor as prescribed by the Contract (hereinafter and in the conditions of Contract called 'the Contract Price'). The "Letter of acceptance" will be sent in duplicate to the successful tenderer, who will return one copy to the Employer duly acknowledged and signed by the authorised signatory, within three days of receipt of the same by him. No correspondence will be entertained by the Employer from the unsuccessful Tenderers.

- 25.2 The Letter of Acceptance will constitute a part of the contract.

- 25.3 Upon "Letter of acceptance" being signed and returned by the successful tenderer, the employer will promptly notify the unsuccessful tenderers and discharge / return their tender securities.

26.0 SIGNING OF AGREEMENT

- 26.1 The Employer shall prepare the Agreement in the **Proforma (Form E)** included in this Document, duly incorporating all the terms of agreement between the two parties. Within **45 Days** from the date of issue of the letter of acceptance, the successful tenderer will be required to execute the Contract Agreement.

27.0 PERFORMANCE SECURITY

27.1 **Within 30 days of receipt of the letter of Acceptance the successful Tenderer shall furnish performance security in the form of a bank guarantee from branch in India of a scheduled foreign bank or from a scheduled commercial bank in India acceptable to the employer for an amount of 10% of contract value in types & proportions of currencies in which the contract Price is payable.** The approved form provided in the "Instructions to Tenderers" documents, or any other form approved by the Employer shall be used for Bank Guarantee. The Bank Guarantee shall be valid up to Defect Liability Period(24 month+6 month completion).

28.0 Cancellation of Letter of Acceptance (LOA) and Form of Tender.

28.1 In case Successful tenderer fails to commence the work (for whatsoever reasons) as per Terms and Conditions of Tender after issuance of LOA then the LOA shall be cancelled and the tender security shall be forfeited.

29.0 Defect Liability Period

29.1 Defect Liability Period shall be 02 years from the date of issue of Completion Certificate, for all the items supplied, works carried out & the defects left by contractor in execution of work.

29.2 During the DLP, contractor shall be responsible to carry out all the comprehensive preventive, corrective & breakdown maintenance of the installed system including spare parts & consumables.

APPENDIX I**CHECK LIST OF DOCUMENTS TO BE SUBMITTED WITH THE TENDER**

COMPILED FROM THE PROVISIONS IN THIS VOLUME

Sl. No.	Document	Reference to Clause No. of "Instructions to Tenderers"
	TENDER PACKAGE COMPRISING OF:	
1.	Tender Security	12.0
2.	Tender documents	8.1.1
3.	Power of attorney for individuals signing on behalf of Company/Firm Or Power of attorney in favour of the leading member of Joint Venture / Consortium.	2.4 &13.0 2.4 &13.0
4.	Financial Data (Form T-V)	8.1.1 (a)
5.	i. Pan No. as per Income Tax Act. ii. Service/Sales Tax Registration Certificate (STCC) iii. ESI registration certificate iv. PF Account certificate	8.1.1 (b)
6.	Statement of deviations from Tender Documents (Form C)	8.1.1(d)
7.	Experience record (Form T-II).	8.1.1(f)
8.	Bill of Quantities	8.1.1(e)

INDEX ON

PROFORMA OF FORMS

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- | | |
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2. **PROFORMA OF FORMS – POST QUALIFICATION PARTICULARS**
- | | |
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| | FORM |
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FORM OF TENDER

- Note:
- i. The Appendix forms part of the Tender
 - ii. Tenderers are required to fill up all the blank spaces in this Form of Tender and Appendix.

Name of Work: As in the NIT clause No. 1.1.1

To,
**Dy. GM/ Traction,
DMRC,
2nd, Floor, Fire Brigade Lane,
Barakhamba Road New Delhi-110001**

1. Having visited the site and examined the General Conditions of Contract as well as Special Conditions of Contract, Specifications, Instructions to Tenderers, for the execution of above named works, we the undersigned, offer to execute and complete such works and remedy defects therein in conformity with the said Conditions of Contract, Specifications, and Addenda for the amount indicated in BOQ.
2. We acknowledge that the Appendix forms an integral part of the Tender.
3. We undertake, if our Tender is accepted, to commence the works within 10days of issue of the LOA to commence and to complete the whole of the Works comprised in the Contract within six months calculated from the 10th day of Issue of LOA, as indicated in the Appendix.
4. If our Tender is accepted, we will furnish at our option a Bank Guarantee for Performance as security for the due performance of the Contract. The amount and form of such guarantee or bond will be in accordance with Clause 15.0 of the General Conditions of the Contract and as indicated in the Appendix.
5. We have independently considered the amount shown Clause 57.5 of the General Conditions of Contract as liquidated damages and agree that they represent a fair estimate of the damages likely to be suffered by you in the event of the work not being completed in time.
6. We agree to abide by this Tender for a minimum period of 90 days from the date fixed for receiving the same and it shall remain binding upon us and may be accepted at any time before the expiry of that period or any extended period mutually agreed to.
7. Unless and until a formal Agreement is prepared and executed, this Tender, together with your written acceptance thereof, shall constitute a binding contract between us.
8. We declare that the submission of this Tender confirms that no agent, middleman or any intermediary has been, or will be engaged to provide any services, or any other item of work related to the award and performance of this Contract. We further confirm and declare that no agency commission or any payment, which may be construed as an agency commission has been, or will be, paid and that the tender price does not include any such amount.
9. We acknowledge the right of the Employer, if he finds to the contrary, to declare our Tender to be non-compliant and if the Contract has been awarded to declare the Contract null and void.
10. We understand that you are not bound to accept the lowest or any tender you may receive.
11. If our Tender is accepted we understand that we are to be held solely responsible for the due performance of the Contract.

Dated this.....day of..... 2011

Signature

Name..... in the capacity of

duly authorised to sign Tenders for and on behalf of.....

Address

Witness - Signature

Name

Address

Occupation

APPENDIX TO THE FORM OF TENDER

		Condition of Contract Clause No.
i.	Amount of Bank Guarantee as Performance Security	27.0 of ITT
ii.	Contract Period from the date of issue of LOA	1.1.1 of NIT

Signature of
authorised
signatory on behalf
of Tenderer

Date

Name

Place

Address

PROFORMA FOR STATEMENT OF DEVIATIONS

1. The following are particulars of deviations from the requirements of the tender specifications

Sr. No.	Clause	Deviations	Remark (Including justification)	Price adjustment for withdrawal of each deviation/s.

2. The following are particulars of deviations from the requirements of the "Instructions to Tenderers," "General Conditions of Contract" and "Special Conditions of Contract".

Sr. No.	Clause	Deviations	Remark (Including justification)	Price adjustment for withdrawal of each deviation/s.

Signature of Tenderer

Note

- Where there is no deviation, the statement should be returned duly signed with an endorsement indicating 'No Deviations'.**
- The tenderer shall indicate price adjustment against each deviation, which he shall like to add to the tender price for withdrawing unconditionally his deviations if the same are unacceptable to the Employer.**

FORM OF PERFORMANCE SECURITY (GUARANTEE) BY BANK

1. This deed of Guarantee made this day of _____ 2011 between Bank of _____ (hereinafter called the "Bank") of the one part, and Delhi Metro Rail Corporation Limited (hereinafter called "the Employer") of the other part.
2. Whereas Delhi Metro Rail Corporation Limited has awarded the Contract for -----
----- of Delhi MRTS Project (hereinafter called "the contract") to M/s ___ (Name of the Contractor) ___ (hereinafter called "the Contractor").
3. AND WHEREAS the Contractor is bound by the said Contract to submit to the Employer a Performance Security for a total amount of Rs. _____ (Amount in figures and words).
4. Now we the Undersigned _____ (Name of the Bank) being fully authorised to sign and to incur obligations for and on behalf of and in the name of _____ (Full name of Bank), hereby declare that the said Bank will guarantee the Employer the full amount of Rs. _____ (Amount in figures and Words) as stated above.
5. After the Contractor has signed the aforementioned Contract with the Employer, the Bank is engaged to pay the Employer, any amount up to and inclusive of the aforementioned full amount upon written order from the Employer to indemnify the Employer for any liability of damage resulting from any defects or shortcomings of the Contractor or the debts he may have incurred to any parties involved in the Works under the Contract mentioned above, whether these defects or shortcomings or debts are actual or estimated or expected. The Bank will deliver the money required by the Employer immediately on demand without delay without reference to the Contractor and without the necessity of a previous notice or of judicial or administrative procedures and without it being necessary to prove to the Bank the liability or damages resulting from any defects or shortcomings or debts of the Contractor. The Bank shall pay to the Employer any money so demanded notwithstanding any dispute/disputes raised by the Contractor in any suit or proceedings pending before any Court, Tribunal or Arbitrator/s relating thereto and the liability under this guarantee shall be absolute and unequivocal.
6. This Guarantee is valid for a period of 30 Months from the date of signing. (The initial period for which this Guarantee will be valid must be for at least 24 **months longer than** the anticipated expiry date of Contract period.
7. At any time during the period in which this Guarantee is still valid, if the Employer agrees to grant a time extension to the Contractor or if the Contractor fails to complete the Works within the time of completion as stated in the Contract, or fails to discharge himself of the liability or damages or debts as stated under Para 5, above, it is understood that the Bank will extend this Guarantee under the same conditions for the required time on demand by the Employer and at the cost of the Contractor.
8. The Guarantee hereinbefore contained shall not be affected by any change in the Constitution of the Bank or of the Contractor.

- 9. The neglect or forbearance of the Employer in enforcement of payment of any moneys, the payment whereof is intended to be hereby secured or the giving of time by the Employer for the payment hereof shall in no way relieve the bank of their liability under this deed.
- 10. The expressions "the Employer", "the Bank" and "the Contractor" hereinbefore used shall include their respective successors and assigns.

In witness whereof I/We of the bank have signed and sealed this guarantee on the _____ day of _____ (Month) 2011 being herewith duly authorised.

For and on behalf of

the _____ Bank.

Signature of authorised Bank official

Name :
 Designation :
 I.D. No. :
 Stamp/Seal of the Bank :

Signed, sealed and delivered
for and on behalf of the Bank
by the above named _____

In the presence of :

Witness 1.

Signature
 Name
 Address

Witness 2.

Signature
 Name
 Address

FORM OF AGREEMENT

This Agreement is made on the _____ day of _____ 2011 Between **Delhi Metro Rail Corporation Limited 2nd Floor, Metro Bhawan, Fire Brigade Lane, Barakhambha Road New Delhi-110001** hereinafter called "the Employer" of the one part and _____ (Name _____ and _____ Address _____ of _____ Contractor) hereinafter called "the Contractor" of the other part.

Whereas the Employer is desirous that (***) certain Goods and Services should be provided and certain _____ Works _____ should be executed, _____ Contract _____ for _____ of Metro Corridor of Delhi MRTS Project hereinafter called "the Works" and has accepted a Tender by the Contractor for the execution and completion of such works (***) as well as guarantee of such works) and the remedying of defects therein.

NOW THIS AGREEMENT WITNESSETH as follows:

1. In this Agreement words and expression shall have the same meanings as are respectively assigned to them in the Conditions of Contract hereinafter referred to.
2. The following documents shall be deemed to form and be read and construed as part of this Agreement, viz:
 - (a) Letter of acceptance
 - (b) General Conditions of Contract
 - (c) Special Conditions of Contract
 - (d) Notice Inviting Tender
 - (e) Specifications & Drawings
 - (f) Bill of Quantities
 - (g) Form of Tender with Appendix
 - (h) Addendums, if any
 - (i) Other conditions agreed to and documented as listed below:
 - (i) Statement of deviations (if applicable)
 - (ii) Any other item as applicable
3. In consideration of the payments to be made by the Employer to the Contractor as hereinafter mentioned, the Contractor hereby covenants with the Employer to execute and complete the works by **_____ and remedy any defects therein in conformity in all respects with the provisions of the Contract.
4. The Employer hereby covenants to pay the Contractor in consideration of the execution and completion of the works and the remedying of defects therein, the Contract Price of **Rs_____ being the sum stated in the letter of acceptance subject to such additions thereto or deductions there from as may be made under the provisions of the Contract at the times and in the manner prescribed by the Contract.

5. OBLIGATION OF THE CONTRACTOR

The contractor shall ensure full compliance with tax laws of India with regard to this contract and shall be solely responsible for the same. The contractor shall submit copies of acknowledgements evidencing filing of returns every year and shall keep the Employer fully indemnified against liability of tax, interest, penalty etc. of the contractor in respect thereof, which may arise.

6. JURISDICTION OF COURT

The Courts at Delhi/New Delhi shall have the exclusive jurisdiction to try all disputes arising out of this agreement between the parties.

IN WITNESS WHEREOF the parties hereto have caused their respective Common Seals to be hereunto affixed / (or have hereunto set their respective hands and seals) the day and year first above written.

For and on behalf of the Contractor

For and on behalf of the Employer

Signature of the authorised official

Signature of the authorised official

Name of the official

Name of the official

Stamp/Seal of the Contractor

Stamp/Seal of the Employer

SIGNED, SEALED AND DELIVERED

By the said _____ Name

on behalf of the Contractor in the presence of:
Witness _____
Name _____
Address _____

By the said _____ Name

on behalf of the Employer in the presence of:
Witness _____
Name _____
Address _____

Note :

- + To be made out by the Employer at the time of finalization of the Form of Agreement.
- ** Blanks to be filled by the Employer at the time of finalization of the Form of Agreement.
- *** to be deleted if not applicable

GENERAL INFORMATION

Notes :

- (i) Attach an attested photocopy of Certificate of Registration and ownership as well as of Constitution and legal status.

1. Names of participating member

(a)

2. Address, telephone, telefax, cable numbers

Registered Office

Office for correspondence

(a)

(b)

(c)

3. Contact persons address, telephone etc.

(a)

(b)

(c)

EXPERIENCERECORD

1. Details of experience of similar work".

Sl. No.	Period	Details of work handled	Total Cost of work in Rs.	Remarks
(1)	(2)	(3)	(4)	(5)

Notes :

i) Details submitted in any other Performa will not be considered.

ii) The details of work including the cost of the work should be supported by attested copy of each client's certificate.

iii) Additional pages may be attached if required.

iv) All the pages must be signed by the authorize signatory of the tenderer.

DETAILS OF PERSONNEL

S. No.	Designation	No. of Personnel Available
A	B	C
1	Engineer	
2	Supervisors	
3	Technician	

Resources for the works - Machinery & Equipment

Sl.No.	Description Of Machines/Equipments	Nos. available	Location

FINANCIAL DATA

Total value work for Similar work done During the period 2007-2008 to 2009-2010.

S.No.	Description	Year 2007-2008	Year 2008-2009	Year 2009-2010
(1)	(2)	(3)	(4)	(5)
1.	Total value of work done			

FINANCIAL DATA

(Refer Clause 8.1.1)

List of all Ongoing Contracts

Name of the applicant (constituent member in case of Group)	Total number of works in hand	Number of contracts of each type		Number for which applicant went in for		Number of contracts in which date of completion given in the original has already burst	Total value of works done in Rupee equivalent as on 31/03/2010		
				Arbitration	litigation		Year 2007- 2008	Year 2008-2009	Year 2009-2010

Applicant should provide information on their current commitments or all contracts that have been awarded or for which a letter of intent or acceptance has been received or for contracts approaching completion but for which a completion certificate is yet to be issued.

Special Conditions of Contract

1. **Advance Payment:** - No Advance of any type shall be paid.
2. **Price Variation Clause:** - The Price Variation Clause is not applicable in this contract. The rate quoted shall be inclusive of all taxes and duties.
3. **Termination of Contract:** - If the contractor fails to perform satisfactorily, the contract can be terminated at any time without assigning any reason by giving 15 days notice to the Contractor.
4. **Penalty:** A penalty will be imposed @Rs.10000/- per day, in case of non-completion of work with in stipulated time or poor work quality. However, the maximum penalty shall be limited to 10% of the total cost of the contract.
5. **Safety of Personnel:** - The Contractor will take full responsibility for the Safety of his Staff, Materials etc.
6. **Quantity Variation Clause:** The Quantity of Equipments mentioned may vary by +/- 25% of BOQ.
7. Any Damage/Breakage to the DMRC property during the execution of work will be at the risk & cost of the Contractor & in this regard The DMRC' decision will be final regarding amount of damage/breakage etc. The amount will be deducted from contractor's bill.
8. Materials identified as such by the Engineer and advised to the contractor, shall not be dispatched from the site without written authority from the Engineer.
9. The Contractor if awards either partly or fully of any work covered under contract to a Sub-contractor/OEM/Third party, he shall submit the documentary proof from the contractor concerned, that such award will not in any way affect the performance of the equipment/Plant, prior to the start of such work. Also, the sub-contractor firm name, address and availability of trained manpower shall be furnished for the approval.
10. The DMRC shall have the right to make minor alterations/additions/substitutions in the specifications in the scope of work or issue instructions that may be deemed necessary during the period of the contract and contractor shall carry out the work in accordance with the instructions which may be given to him by Authorized DMRC' representative.
11. The contractor shall on request of Engineer-in-charge forthwith remove from the works any person employed thereon by him who in the opinion of Engineer-in-charge may misconduct himself or suspicious from security point of view and such persons shall not again be employed on the work without permission of the Engineer-in-charge.
12. The DMRC' General Conditions of Contract are applicable & can be seen by the contractor at the office of Dy.GM/traction on any working day.
13. Electrical power connection, water as as required shall be provided by DMRC free of cost. However, contractor shall use its own resources to take necessary connections from point informed by Engineer in-charge.
14. In some cases where operations are affected the work shall be carried out only during night time after taking permit to work from station controller, power block from JE/OHE etc. No extra payment shall be made on this account.

Terms and Conditions

1. The Contractor during the Execution of work shall follow the Indian Electricity Rules, Indian Electricity Act & all other Statutory Rules, Regulations & Acts as available on date & during the period of contract.
2. The Contractor shall be responsible to fulfill all statutory liabilities, if any towards his staff such as payment of minimum wages, PF, ESI and any other dues etc including all amendments issued by the Govt. from time to time. Being a Principal Employer, DMRC may ask to submit documents in original.
3. The work is to be carried out under the guidance of DMRC only.
4. No T&Ps shall be issued to the contractor. All T&Ps, Instruments, Machines, etc. will be brought by the Contractor only. The cost of all these items shall be borne by the contractor.
5. Labour- No labour shall be provided by DMRC.
6. Transport: No separate charges will be paid for transport.
7. As per site conditions the contractor may have to carry out the work during night hours. No extra payment shall be made on this account.
8. **Successful Contractor shall be submit the following along with submission of invoice insurance cover under the following requirements:**
 - a) Contractor's all risk & third party.
 - b) Liability under the workmen's compensation act 1923, minimum wages act 1948 and contract labour (regulation and abolition) act, 1970.
 - c) Accident to staff, engineers, supervisors and other who are not governed by workmen's compensation Act.
 - d) Damage to material, machinery and works due to fire, theft etc.

Bill of Quantity

“Supply, installation, testing, commissioning of Air Cooled Scroll Chiller HVAC system including the interconnection with the existing FCUs and existing chilled water piping at Four Underground Metro Station of Metro Corridor of Delhi Metro Rail Corporation Limited”

Sl. No	Description of Item	Unit	Total Qty	Unit Rate in Rs. (in fig.)	Unit Rate in Rs. (in Words.)	Amount in Rs.
1	Chiller (Please refer S.No.1 of Annexure-A)	Nos.	12			
2	Chilled Water Pumps (Please refer S.No.2 of Annexure-A)	Nos.	6			
3	FCU (Please refer S.No.3 of Annexure-A)					
a	2 TR	Nos.	17			
b	2.5 TR	Nos.	12			
c	3 TR	Nos.	22			
d	3.5 TR	Nos.	34			
4	Chilled Water Piping (Please refer S.No.4 of Annexure-A)					
	Indoor Application					
a	100 mm dia MS C Class	Rmt	821.5			
b	80 mm dia MS C Class	Rmt	105.6			
c	50 mm dia MS C Class	Rmt	220			
d	40 mm dia MS C Class	Rmt	220			
e	32 mm dia MS C Class	Rmt	231			
f	25mm dia MS Pipes	Rmt	104.5			
5	Providing & fixing of following valves, strainers, gauges (Please refer S.No.5 of Annexure-A)					
a	Butterfly Valves (PN 16 rated) of cast iron body with SGI epoxy coating disc 80 mm dia	Nos.	26			
b	Balancing Valves of cast iron with flange and pressure test cocks in SS-410 Stem, SS-410 Disc and EPDM sealing disc 80 mm dia	Nos.	13			
c	NRV- Dual Plate check valves of cast iron to conforming to IS 210 Gr FG 260 Body, CA-15 (SS-410) plates, wafer type 80 mm dia	Nos.	13			
i	Y Strainer- MS/ CI Y strainer with Stainless steel Bucket having 03 perforation with flanged ends 80 mm dia	Nos.	13			
6	Chilled Water Piping (Please refer S.No.6 of Annexure-A)					
	Exposed Application					
a	100 mm dia MS C Class	Rmt	130			
b	80 mm dia MS C Class	Rmt	78			

7	Providing & fixing of following valves, strainers, gauges (Please refer S.No.7 of Annexure-A)					
a	Butterfly Valves (PN 16 rated) of cast iron body with SGI epoxy coating disc 80 mm dia	Nos.	26			
b	Balancing Valves of cast iron with flange and pressure test cocks in SS-410 Stem, SS-410 Disc and EPDM sealing disc 80 mm dia	Nos.	13			
8	Providing & fixing of following valves, strainers, gauges (Please refer S.No.8 of Annexure-A)					
a	Supply and installation of Bronze Ball Valve at inlet & outlet and MS strainer at inlet for existing FCU's 32 mm dia	R/O	18			
b	Supply and installation of Bronze Ball Valve at inlet & outlet and MS strainer at inlet for existing FCU's 25 mm dia	Nos.	16			
c	Motorized Butterfly valve with On/off Actuator. Actuator Housing shall be IP-54 with close off pressure of 1200 KPA 100 mm dia	No	8			
9	Supply Installation of 3 way valves (Please refer S.No.9 of Annexure-A)					
i	32 mm dia	R/O	18			
ii	25 mm dia	Nos.	17			
10	Providing and fixing in position pressure gauges -100 mm dia dial type with syphon and gauge cock	Nos.	78			
11	Providing and fixing in position temperature gauges -100 mm dial type	Nos.	26			
12	Providing & fixing of Auto air vent-10 mm dia	Nos.	8			
13	Rubber Expansion joints with retainer rings and control units (Single Arch) with hydro test pressure of 15 kg/sqcm of 80 mm dia	No.	26			
14	Supplying, installing, testing and commissioning of OPEN TYPE EXPANSION TANK OF HDPE material complete with makeup connection, quick fill, outlet connection, drain with valve, over flow connection, air vent, brass float wall along with necessary structural arrangement	No.	4			
15	Victaulic mechanical couplings for joining Mild Steel Pipe (Please refer S.No.15 of Annexure-A)					
a	Rigid Type: for 100 mm dia	Nos.	119			
b	Flexible Type: for 100 mm dia	Nos.	40			

16	Electrical Work					
A	Main Electrical Panel (Please refer S.No.16 of Annexure-A)					
a	IP-42 Panel Enclosure Compartmentalized Floor mounted Single Front type fabricated from 2/1.6mm thick CRCA sheet with Dimension of (1875H X 2100W X 500D) mm.	Nos.	1			
b	IP-42 Panel Enclosure Compartmentalized Floor mounted Single Front type fabricated from 2/1.6mm thick CRCA sheet with Dimension of (1675H X 2100W X 500D) mm.	Nos.	3			
c	Power & Control Cabling (Please refer S.No.16-B of Annexure-A) Supply & Installation of complete cable work using LSZH fire rated cables as per BS 6724 of following sizes for electric supply of including interconnections from starters to motors on suitable cable trays/ support as required including connections on both control wiring of panel shall also be done with wires of LSZH category)					
i	3 C x 50 Sq. mm Cu armoured cable for chiller	Rmt	760			
ii	3C x 6 Sq. mm Cu armoured cable for Pumps	Rmt	260			
c	Cable tray GI 40 mm X 150 mm X 1.6 mm	Rmt	690			
d	Providing and fixing GI wire on surface or in recess for loop earthing complete as required 8 SWG	Rmt	200			
e	Cabling Glanding & Termination	lot	4			
17	Dismantling of existing equipments and shifting to the storage area within 100 mtrs					
a	Control Valves of existing FCU's	No	21			
b	Split Air conditioners 1/1.5/2 /2.5 TR	No	104			
	Total amount					

Amount in words:

**(Signature of contractor
with stamp)**

Sl. No	Description of Item	Unit	Qty			
			RCK	NDI	CTST	CCK
1	Chiller Supply, Installation, Testing and Commissioning of Air Cooled Scroll Type Package Chilling Machine each having a minimum capacity of 34 TR at chilled Water Inlet/ Outlet Temp of 54 Deg F/ 44 Deg F & Fouling Factor of 0.0001 Deg F Sqft Hr / Btu with 95 D,water flow rate of 82usgpm with interlocking through BMS of station complete as required.	Nos.	3	3	3	3
	3 Nos. - Hermetic Scroll Compressors with Automatic Capacity Control, safety control switches, complete with Refrigerant Cooled Motor suitable to work on 415+/-10% Volts, 50 Hz, AC Supply complete with OEM supplied Star Delta Starter/Soft starter etc, as reqd.					
	1 No.- Matching Shell and Tube type chiller of MS Shell and integrally finned Copper Tubes					
	1 No.- DX type Air Cooled Condenser having 3 rows consisting of Copper tubes and Aluminium fins					
	Refrigerant piping, fittings, valves and accessories to inlet connect compressor, condenser, chiller and expansion valve complete with safety valve angle valve. Liquid Line indication & liquid line control etc.					
	Fins shall be 10-12/inch with hydrophobic coating to give 3-5 times higher corrosion resistance					
	Initial /First charge of Refrigerant Gas & Compressor Oil					
	Frame work for mounting the above condenser, chiller, Compressor & Motor with Base Plate complete with Anti-Vibration pads.with GI powder coating & RCC foundation etc. as required.					
	Each machine will be witness tested at manufacturer works at 100% loading					
	The units shall be capable to operate at higher ambient of 52 Deg C					
	Max IKW/TR at full load at rated parameters for the chiller will be 1..25					
	The unit shall have microprocessor based control panel with Modbus communication capability .					
2	Chilled Water Pumps					
i	Providing & Fixing of end suction centrifugal chilled water pump set capable of delivering 82 USGPM of water against a head of 42 Mtr. Each pump shall comprise of cast Iron casing, bronze impeller, SS-10 shaft sleeve and EN-8 Shaft and MS fabricated base plate,vibration isolators,foundations,insulation and all other necessary civil works complete as per site requirement.	Nos.	3	3	0	0

ii	Providing & Fixing of end suction centrifugal chilled water pump set capable of delivering 82 USGPM of water against a head of 25/31 Mtr. Each pump shall comprise of cast Iron casing, bronze impeller, SS-10 shaft sleeve and EN-8 Shaft and MS fabricated base plate,vibration isolators,foundations,insulation and all other necessary civil works complete as per site requirement.	Nos.	0	0	3	3
	The pump shall be duly insulated with the fire rated glass wool (minimum density 48kg / cu mtr , 50 mm thick) wrapped in vapour barrier jacketing secured in position with adhesive and fixing pins/ retaining washers & 22 G Aluminium sheet cladding					
3	<p>FCU Supply, Installation, Testing & Commissioning of horizontal fan coil units, each complete with 3 rows deep chilled water cooling coil, centrifugal blowers, cleanable filters, insulated condensate drain pan, casing, coil piping connections,</p> <p>All fan coil units shall be suitable for 220 ± 10% volts, 50 Hz, single phase power supply. Fan coil units shall be of following sizes and capacities. Quoted rate shall be including of vibration isolators as per specification.</p> <p>The unit shall be certified to International Standards for Thermal Performance (ASHRAE 33-1978), Air flow measurements (ASHRAE-51-85) and Sound level measurement (ISO 3741-1988).</p> <p>The forward curved 3 speed fan shall be designed for effective operation with the cooling coil assembly to ensure noiseless operation. This allows the unit to achieve high capacity at optimum fan revolution, thus assuring the lowest noise level with thermal O/L protection.</p>					
a	2 TR	Nos.	3	2	6	6
b	2.5 TR	Nos.	6	4	2	0
c	3 TR	Nos.	9	6	1	6
d	3.5 TR	Nos.	8	10	8	8
4	<p>Chilled Water Piping</p> <p>Indoor Application</p> <p>Supplying, Laying, Fixing of following nominal sizes of pipes pre insulated with 36 kg per cum PUF of thickness 50mm with 22G lock seam Aluminum jackets. Chilled Water Plumbing (with necessary clamps, vibration isolators and fittings but excluding valve, strainers, gauges.etc) duly insulated</p> <p>The pipes shall be preinsulated leaving 150mm on either side for the connections which will be welded in the open areas/ joined with vitaulic coupling. The scope and quantity of the coupling shall be measured and paid seperately.</p> <p>The joints will be insulated with fire rated glass wool (minimum density 48kg / cu mtrs , 50 mm thick) wrapped in vapour barrier jacketing secured in position with adhesive and fixing pins/ retaining washers & 22 G Aluminium sheet cladding</p>					
a	100 mm dia MS C Class	Rmt	220	420	82.5	99
b	80 mm dia MS C Class	Rmt	26.4	26.4	26.4	26.4
c	50 mm dia MS C Class	Rmt	55	55	55	55
d	40 mm dia MS C Class	Rmt	55	55	55	55

e	32 mm dia MS C Class	Rmt	110	55	33	33
f	25mm dia MS Pipes	Rmt	55	27.5	11	11
5	Providing & fixing of following valves, strainers, gauges duly insulated with fire rated glass wool (minimum density 48kg / cu mtrs , 50 mm thick) wrapped in vapour barrier jacketing secured in position with adhesive and fixing pins/ retaining washers & 22					
a	Butterfly Valves (PN 16 rated) of cast iron body with SGI epoxy coating disc					
i	80 mm dia	Nos.	8	6	6	6
b	Balancing Valves of cast iron with flange and pressure test cocks in SS-410 Stem, SS-410 Disc and EPDM sealing disc					
i	80 mm dia	Nos.	4	3	3	3
c	NRV- Dual Plate check valves of cast iron to conforming to IS 210 Gr FG 260 Body, CA-15 (SS-410) plates, wafer type					
i	80 mm dia	Nos.	4	3	3	3
d	Y Strainer- MS/ CI Y strainer with Stainless steel Bucket having 03 perforation with flanged ends					
i	80 mm dia	Nos.	4	3	3	3
6	Chilled Water Piping					
	Exposed Application					
	Supplying, Laying, Fixing of following nominal sizes of pipes (with necessary clamps, vibration isolators and fittings but excluding valves, strainers, gauges, etc)					
	The pipes & joints will be insulated with fire rated glass wool & glasswool (minimum density 48kg / cubic mtr , 50 mm thick, and for glass wool 64kg/cubic meter) wrapped in vapour barrier jacketing secured in position with adhesive and finished with 15 mm thick sand cement plaster					
a	100 mm dia MS C Class	Rmt	40	30	30	30
b	80 mm dia MS C Class	Rmt	24	18	18	18
7	Providing & fixing of following valves, strainers, gauges duly insulated with fire rated glass wool (minimum density 48kg / cu mtr , 50 mm thick) wrapped in vapour barrier jacketing secured in position with adhesive and finished with 15 mm thick sand cement plaster.					
a	Butterfly Valves (PN 16 rated) of cast iron body with SGI epoxy coating disc					
i	80 mm dia	Nos.	8	6	6	6
b	Balancing Valves of cast iron with flange and pressure test cocks in SS-410 Stem, SS-410 Disc and EPDM sealing disc					
i	80 mm dia	Nos.	4	3	3	3
8	Providing & fixing of following valves, strainers, gauges duly insulated with fire rated glass wool (minimum density 48kg / cu mtr , 50 mm thick) wrapped in vapour barrier jacketing secured in position with adhesive and fixing pins/ retaining washers & 22					
a	Supply and installation of Bronze Ball Valve at inlet & outlet and MS strainer at inlet for existing FCU's					
i	32 mm dia	R/O	4	6	4	4
ii	25 mm dia	Nos.	4	3	6	3
iii	20 mm dia	R/O				

b	Motorized Butterfly valve with On/off Actuator. Actuator Housing shall be IP-54 with close off pressure of 1200 KPA					
i	100 mm dia	No	2	2	2	2
9	Supply Installation of 3 way valves of following sizes along with the Cooling & Heating Thermostats for FCU					
i	32 mm dia	R/O	4	6	4	4
ii	25 mm dia	Nos.	4	4	6	3
iii	20 mm dia	R/O				
10	Providing and fixing in position pressure gauges -100 mm dia dial type with syphon and gauge cock	Nos.	24	18	18	18
11	Providing and fixing in position temperature gauges -100 mm dial type	Nos.	8	6	6	6
12	Providing & fixing of Auto air vent-10 mm dia	Nos.	2	2	2	2
13	Rubber Expansion joints with retainer rings and control units (Single Arch) with hydro test pressure of 15 kg/sqcm of 80 mm dia	No.	8	6	6	6
14	Supplying, installing, testing and commissioning of OPEN TYPE EXPANSION TANK OF HDPE material complete with makeup connection, quick fill, outlet connection, drain with valve, over flow connection, air vent, brass float wall along with necessary structural arrangement	No.	1	1	1	1
15	Victaulic mechanical couplings for joining Mild Steel Pipe					
	Pipes shall be roll grooved for the installation of valves					
	Manufactured in two segments of cast ductile iron, conforming to ASTM A-536, Grade 65-45-12. Gaskets shall be pressure-responsive synthetic rubber, grade to suit the intended service, conforming to ASTM D-2000. (Gaskets used for potable water applications					
	Gasket: Synthetic rubber, wide width, conforming to steel pipe outside diameter and coupling housing, manufactured of elastomers as designated in ASTM D-2000.					
	Victaulic Grooved End Fittings: Fittings shall be cast of ductile iron conforming to ASTM A-536, Grade 65-45-12, forged steel conforming to ASTM A-234, Grade WPB 0.375" wall (9,53 mm wall), or fabricated from Std. Wt. Carbon Steel pipe conforming to ASTM					
	1.All grooved components shall conform to local code approval and/or as listed by ANSI-B-31.1, B-31.3, B-31.9, ASME, UL/ULC, FM, IAPMO or BOCA.					
	Grooved end product manufacturer to be ISO-9001 certified					
	Victaulic Grooved End Fittings: Fittings shall be cast of ductile iron conforming to ASTM A-536, Grade 65-45-12, forged steel conforming to ASTM A-234, Grade WPB 0.375" wall (9,53 mm wall), or fabricated from Std. Wt. Carbon Steel pipe conforming to ASTM					
	All grooved components (including couplings, fittings, valves and accessories) to be supplied by one manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.					
a	Rigid Type: Coupling housings with offsetting, angle-pattern bolt pads shall be used to provide system rigidity and support and hanging in accordance with ANSI B31.1, B31.9, and NFPA 13. Victaulic Style 07 (Zero-Flex®).					

i	for 100 mm dia	Nos.	25	70	12	12
b	Flexible Type: Use in locations where vibration attenuation and stress relief are required. Flexible couplings may be used in lieu of flexible connectors at equipment connections. Three Couplings shall be placed in close proximity to the vibration source.					
i	for 100 mm dia	Nos.	15	15	5	5
16	Electrical Work					
A	Main Electrical Panel					
	IP-42 Panel Enclosure Compartmentalized Floor mounted Single Front type fabricated from 2/1.6mm thick CRCA sheet with Dimension of (1875H X 2100W X 500D) mm.	Nos.	1	0	0	0
	IP-42 Panel Enclosure Compartmentalized Floor mounted Single Front type fabricated from 2/1.6mm thick CRCA sheet with Dimension of (1675H X 2100W X 500D) mm.	Nos.	0	1	1	1
	500 A Bus Bar Cu. 1 No.					
i	Incomer					
	500 A MCCB TP 36KA Microprocessor Based O/C,S/C,E/F Release With Motorized Mechanism Release. + Shunt Release -1 No.					
	Push Buttons On/off Flush Head Non Illuminated Type For MCCB. -2 No					
	RYB Indicating Lamps,22.5 mm Dia LED Type- 1 No.					
	0-500 A Digital Ammeter (in built ASS)Acc. Class 1.0 96Sq. mm.- 1 No.					
	0-500 V Digital Voltmeter (inbuilt VSS) Acc. Class 1.0 96Sq. mm.- 1 No.					
	500/5 A Current Transformer Class-1.0,15 VA- 3 No.					
	6 A MCB SP 10KA- 4 No.					
	CT Shorting Terminal- 4 No.					
ii	Out-Going Feeders					
	125 A MCCB TP 36KA Microprocessor Based O/C,S/C,E/F Release With Motorized Mechanism Release. + Aux. Contact + Shunt Release- 4 no.					
	0-125 A Digital Ammeter (in built ASS)Acc. Class 1.0 96Sq. mm.- 4 no.					
	150/ 5A Current Transformer Class-1.0,5 VA- 12 No.					
	CT Shorting Terminal- 16 No.					
	Aux. Contactor with 2NO+2NC- 8 No.					
	ON/OFF Indicating Lamps 22.5 mm Dia LED Type- 8 no.					
	Push Buttons On/off Flush Head Non Illuminated Type For MCCB- 8 no.					
	6 A MCB SP 10KA- 4 No.					
iii	DOL Starter (5.5KW)- 4 no.					
	25 A MCCB TP 36KA Microprocessor Based O/C,S/C,E/F Release With Motorized Mechanism Release.- 4 No.					
	0-25 A Digital Ammeter (in built ASS)Acc. Class 1.0 96Sq. mm.- 4 No.					
	25 /5A Current Transformer Class-1.0,5 VA- 12 No.					
	CT Shorting Terminal- 16 No.					
	Aux. Contactor with 2NO+2NC- 8 No.					
	18 Amps Power Contactor TP AC-3 Duty with 2NO+2NC- 4 No.					
	9-15 A Over Load Relay - 4 No.					

	ON/OFF Indicating Lamps 22.5 mm Dia LED Type- 8 No.					
	Push Buttons On/off Flush Head Non Illuminated Type- 8 No.					
	6 A MCB SP 10KA- 4 no.					
b	Power & Control Cabling					
	Supply & Installation of complete cable work using LSZH fire rated cables as per BS 6724 of following sizes for electric supply of including interconnections from starters to motors on suitable cable trays/ support as required including connections on both					
i	3 C x 50 Sq. mm Cu armoured cable for chiller	Rmt	200	180	180	200
ii	3C x 6 Sq. mm Cu armoured cable for Pumps	Rmt	80	60	60	60
c	Cable tray GI					
	40 mm X 150 mm X 1.6 mm	Rmt	150	180	180	180
d	Providing and fixing GI wire on surface or in recess for loop earthing complete as required					
	8 SWG	Rmt	50	50	50	50
e	Cabling Glanding & Termination	lot	1	1	1	1
17	Dismantling of existing equipments and shifting to the storage area within 100 mtrs					
a	Control Valves of existing FCU's	No	5	5	7	4
b	Split Air conditioners 1/1.5/2 /2.5 TR	No	33	26	22	23