PARTICULAR TECHNICAL SPECIFICATIONS MECHANICAL

GENERAL STATEMENT OF COMPLIANCE

The Sub-Contractor shall be responsible to submit a statement of compliance of every single paragraph, sub-paragraph of the referenced systems, for air-conditioning services, hot and cold water services and sewage.
Following are the technical descriptions for each of the mechanical installations services.

1.0 SERVICES FOR COLD AND HOT WATER

Cold water shall be supplied from the existing distribution network of the Monastery.
The water distribution piping shall be constructed of multilayer polypropylene pipes and fittings with a minimum coefficient of elongation a = 0,030.
Domestic hot water shall be produced by solar panels and stored in the Hot Water Cylinder located on the roof of the Residence as shown on the drawings.

1.1 COLD WATER SERVICES PRESSURIZING UNIT

The Sub-Contractor shall supply, install, test and commission, a single-pump pressuring unit for domestic water supply as shown on the drawings and described below.

The pumpset shall draw water from the storage tanks and provide pressurized supplies to both hot and cold water systems.
The pumpset shall be entirely suitable for fresh, potable water.

The pressurizing unit shall have 1-No. Pump of vertical multi-stage, centrifugal type.
Pump shall have top and bottom body of cast iron, intermediate stages, impeller and shaft of stainless steel, and self-adjusting mechanicals seals of tungsten carbide.

Motor shall be TEFV, with IP54 enclosures with anti-condensation heaters and Class ‘F’ insulation and be suitable for use with 240 volts, 1-phase, 50 Hz, electric supply.
The pump motor shall incorporate a frequency inverter for variable speed drive.

The pumpset and control unit shall be programmed to provide a constant discharge pressure on the set point, throughout the entire flow range of the units.

The pump shall operate at a maximum speed of 2900 rpm at 50Hz.

The pressurizing unit shall have the following features:

- Pump, as detailed above.
- Pipework shall be of multilayer polypropylene pipes.
- Isolating valves on suction and delivery connections and non-return valves on delivery connection.
- Flexible pipe connections on supply and delivery of the pressuring unit.
- One pressure vessel of fabricated steel construction, housing a removable butyl rubber bag, of minimum capacity to suit manufacturers specific recommendations, to contain the water content of the vessel. Maximum working temperature 40 degree C and

pressure of 10 Bar.

- A fully automatic, programmable microprocessor control centre.
- The pressurizing unit shall be entirely suitable for continuous operation in ambient temperatures of up to 45 degree C and relative humidity of up to 95%.
- Pressure gauge, relief valve, and pressure switches as required.
- Pump shall have self adjusting mechanical seals.
- Bedplate fabricated in galvanized steel with supports.
- The entire unit, including bedplate, shall be protected against corrosion by means of special epoxy paint, or other equal and approved, all pipework and bedplate having been suitably primed, prior to application of finish paint coats.
- The unit shall have facilities for prevention of 'dry running'. Suitable level control float switches shall be supplied with the unit, to be installed in the respective storage tanks, in order to prevent the pumps from operating at 'low water level conditions'.
- The unit shall be supplied complete with adjustable anti-vibration mountings for fitting below its bedplate / frame.

The pressurizing unit shall be controlled by a fully automatic, programmable microprocessor control panel, incorporating a control and programming unit, mounted on the front door of the control cabinet. This unit shall have the following main features and function:

- The microprocessor control and programming unit shall be operated by means of push buttons and shall incorporate a digital display to indicate the operating status of the pumps and to control and monitor the various functions.
- The system pressure shall be kept constant at the programmed set point throughout its entire operating range.
- Low water cut out.

The Pressurizing set and its associated control unit shall be manufactured as a complete, comprehensive and coordinated package, and wet run tested at the factory.

1.2 DOMESTIC HOT WATER (DHW) CYLINDER

The cylinder (of specified capacity) and base shall be constructed of mild steel, with copper internal lining. The coil shall be of copper and be attached to the tank with flange complete with gasket and bolts. Immersion thermostat shall be installed to operate the circulator. The cylinders shall be pressure tested. The cylinder shall be insulated with 50mm rigid polyurethane and covered externally with painted steel cladding, suitable for near sea water installation.

<u>The Cylinder shall have the following features</u>:

- Working pressure of at least 4Bar. Test pressure 1.5 x Working pressure.
- Drain valve DN20, complete with hose union connection.
- 3KW electric heating element in titanium for maximum corrosion resistance.

The temperature control thermostat shall be initially set at 60°C.

1.3 SOLAR COLLECTOR PANELS

The Sub-Contractor shall supply and install a solar hot water heating system as shown on the drawings, including solar panels and pipes, and accessories etc.

The Solar collectors shall be of 'vertical pattern', each with a surface area of approximately 2.0m^2 each (2.0 x 1.0 metre) and shall be rigidly supported on a galvanized steel box-section welded frame and facing due south.

Collector panels shall be constructed of copper pipes with a copper absorber plate, of aluminium fins, or alternatively, a double-skin, multi-channel construction. The top surface of the absorber plate shall be coated with a blackmat paint, having a minimum of 90% absorption. The bottom surface and sides shall be thermally insulated with 50mm rigid fiberglass insulation of 65 Kg/m^3 density. The whole assembly shall be tightly encased in an anodized aluminium frame, with 4mm thickness top glazing with low iron content glass, completely sealed with a rubber gasket. The collector efficiency shall be 79% or higher, when $\Delta t/G=0\ ^oCm^2/W$ and 55% when $\Delta t/G=0.04\ ^oCm^2/W$.

The Sub-Contractor shall submit with his Tender, performance curves for the solar panels offered. The curve parameters shall be efficiency 'η' vs Δt/G.

1.4 HOT WATER SECONDARY CIRCULATION PUMP

The Sub-Contractor shall provide, install, test and commission a H.W. Secondary Circulation Pump as shown on the drawings.

The pump shall be of the Glandless Circular type of Bronze construction, entirely suitable for H.W. Services Secondary Circulation.
The pump shall be complete with 3-speed manual selector switch on the terminal block.

The pump shall be suitable for a max. working pressure of 10 bar.

1.5 COLD WATER STORAGE TANKS (CAPACITIES AS SHOWN ON DRAWINGS)

Of polyethylene material incorporating a ball valve, drain cock, overflow metal base, with an opening access door on top, or otherwise as shown on drawings & schedules of equipment.

1.6 VALVES AND ACCESSORIES

All valves and cocks shall be supplied and installed by the Contractor as described and shown on the drawings and in such a way that they shall be easily accessible for maintenance and operation. Valves and cocks shall comply with the appropriate latest British standards.

Cold / Hot Water Valves

Up to 50mm isolating valves shall be wedge type, bronze construction,screwed bonnet, non-resisting stem, screwed ends and enamelled aluminum handwheel similar to Crane D159 of Hattersley Figure No.32 or equal and approved.
Test and gauge cocks shall be bronze polish finish Hattersley 2805 or equal and approved.

Check valves up to 50mm shall be bronze construction swing type screwed ends Crane D139 of Hattersley Figure No.48 or equal and approved.

1.7 SUPPORTS OF PIPING AND HANGERS

All piping shall be supported from the building structure by means of approved hangers and supports. Piping shall be supported to maintain required grading and pitching of line to prevent vibration and to secure piping in place and shall be so arranged as to provide for expansion and construction. Pipes valves shall be used where is required to allow free movement of the pipes.
All hangers shall be secured to approved inserts wherever possible and practicable. Where necessary hanger inserts will be put in place before the concrete is poured.

1.8 UNIONS FLANGES AND VALVES

(a) No union or flange shall be placed in a location which will not be accessible after completion of the building unless otherwise specified.

Unions and/or flanges shall be installed on each side of all special valves, regulators etc. on the side of each check valve, and at all pieces of equipment such as pumps, compressors, tanks, coils, etc. in order that such equipment may be readily disconnected. (b) Where unions are required in lines 65mm and under, they shall be made with brass seated heavy pattern unions having ground joints and both sides hexagonal. All union connections 75mm and up shall be made with flagged unions.
On all piping connections, supply and return, on all pieces of equipment and coils, valves of the type as necessary by the service provided shall be installed.

1.9 EXPANSIONS JOINTS

Expansion joints will be used where indicated in the drawings or specified subject to the approval by the Engineer.

1.10 ACCESS PANELS

Access Panels shall be provided for access to concealed valves, P-traps, cleanouts, unions expansion joints dampers etc. where no other means of access is provided.

1.11 THERMAL INSULATION

Thermal insulation works on pipework may commence only when the pipework has been cleaned and tested. The insulation on pipework shall be applied as recommended by the manufacturer and by skilled labor. No pipes shall be insulated together, and insulation shall be carried through sleeves and walls at full thickness.

The Contractor shall replace and repair any damaged insulation materials to the satisfaction of the Engineer and without any cost to the Employer before hand over of the works.

Where practicable the insulation and outer covering shall be continuous and at all pipe hangers and ductwork (if applicable) support location a wood block or cork stopper shall be inserted between the hanger and or saddle and the pipe or duct so that insulation is not compressed. All applied insulation shall be of uniform thickness and shall not vary from the specified thickness by more than 10%.

Preferably and where possible pipe insulation shall be fitted by slipping complete sections over the open ends of piping or by slitting tubular sections and applying them around the piping. Same manufacturer as pipe insulation adhesive or equal shall be used for closing joints and seams.
Insulation must have the following characteristics:

a) Density 80-90kg/m3

b) Mean thermal conductivity of 0.375 w/mk at a mean temperature of 21°C.

c) Water vapor transmission of less than 0.167 metric terms (CMS) and average water absorption.

d) Suitable for application on pipework with range of -40°C to 105°C.

e) Self extinguishing.

Unless otherwise indicated by the Architect for decorative reasons insulation inside the building require no finishing. If requested that shall be done by the main Contractor.
All outside the building and exposed to weather pipework shall be made waterproof with special attention to be paid at joints and seams.

1.12 WATER SYSTEM DISINFECTION

Upon completion of all tests and necessary repairs or replacements, all water piping systems shall be subjected to a disinfection as will be indicated by the Engineer. After disinfection all systems must be flushed with fresh water and returned to service.

1.13 COMMISSIONING

Prior to the completion of all the works described herein or shown on the drawings the Contractor shall prepare and submit to the Engineer a program for the commissioning of the installation.

The Contractor shall take measurements of:

a. The power absorbed by all equipment

b. The water flow

c. Temperature and humidity

d. Any other measurements which shall be required to indicate the performance of the system.

1.14 AS FITTED DRAWINGS AND OPERATING / MAINTENANCE INSTRUCTIONS

The Contractor shall furnish for approval by the Engineer, before the works are taken over.

1. Two sets of operating and maintenance instructions manuals and equipment installed, and as fitted drawings Manual shall be in the English language.

2. Two CDs with the 'as fitted' drawings of the whole installation.

2.0 SERVICES FOR SEWAGE

The sewage and waste water shall be driven by gravity through the main line to a pit containing two submersible sewage pumps (one stand-by) , driving sewage to the existing septic tank.
The slope of the horizontal piping shall be 2 % minimum. Piping network shall be of plastic UPVC pipes and fittings.

2.1 PIPES AND FITTINGS

Above ground: Soil, waste and vent pipes and fittings 75mm and over shall be UPVC pipes to BS 4514/69.

Waste and vent pipes and fittings 50mm and below shall be UPVC pipes according to BS 4660/76.

Underground: Gravity soil and waste pipes and fittings shall be UPVC pipes according to BS 4660/71.

2.2 AIR VENTS

Air vents shall be used at all high points in the pipework and where air blockage may, at the opinion of the Engineer be formed. The air vent shall be of the automatic type unless otherwise agreed with or directed by the Engineer. Air Vents type and material must be approved by the Engineer.

2.3 INSTALLATION OF SANITARY FITTINGS

The Employer will supply the Sanitary Fittings and deliver them to the site.

The Sub-Contractor shall be responsible for the installation of all sanitary fittings and their associated waste traps and mixers, together with all services connections, (i.e., water and drain).

The Sub-Contractor shall also be responsible for the final water and drainage connections associated with all kitchen equipment.

WC's shall be connected to the piping system by means of proprietary "quick-connector" couplings of appropriate angle to suit each application. These quick-connectors shall be supplied and installed by the Sub-Contractor. The tender shall note that in general, all WC's are 'wall hung' type, with back pipe outlet.

2.4 COMMISSIONING

Prior to the completion of all the works described herein or shown on the drawings the Contractor shall prepare and submit to the Engineer a program for the commissioning of the installation.

2.5 AS FITTED DRAWINGS AND OPERATING / MAINTENANCE INSTRUCTIONS

The Contractor shall furnish for approval by the Engineer, before the works are taken over.

1. Two sets of operating and maintenance instructions manuals and equipment installed, and as fitted drawings Manual shall be in the English language.

2. Two CDs with the 'as fitted' drawings of the whole installation.

3.0 SERVICES FOR AIR-CONDITIONING (ONLY PIPING AND INFRASTRUCTURE)

3.1 V.R.V. INDOOR AND OUTDOOR UNITS

General

The V.R.V. system will control flow of refrigerant through the indoor units, by means of an electronic expansion valve fitted in each indoor unit. It will have the following features:

1) The V.R.V. system will have inverter controlled fan motors to allow the system to accurately respond to head pressure control requirements.

2) The system must be able to vary evaporating and condensing temperatures based on ambient temperatures and/or load to ensure optimum seasonal efficiency and comfort. Or alternatively fix the evaporating temperature for continual very high off coil temperatures.

3) Part load conditions must be met by a combination of change of compressor speed and change in refrigerant temperature at a suitable reaction speed which is set at the condenser on commissioning.

4) The V.R.V. systems will have a minimum of 50 step inverter fan control to allow the system to accurately respond to head pressure control requirements.

5) The compressor shall respond to control frequencies from 60 to 402Hz to provide stepless capacity control.

6) All condenser fans must be capable of at least 78 Pascal's of external static pressure.

7) The refrigerant must be distributed by the use of a refrigerant networking system to ensure low pipe pressure losses as well as keeping the require pipe work installation space and material used to a minimum compared to other parallel pipe work systems.

8) The system must be able to adjust capacity depending on the load requirements and outside temperature to ensure that the efficiency is optimised and responsiveness maintained.

9) The system must be able to operate a continuous heating during defrost system on single as well as multi-unit installations resulting in no cold air dumping.

10) The system has to smoothly operate at ambient temperatures ranging at least from –5°CDB to +38°CDB in cooling and down to -5°CWB and up to +15,5°CWB in heating. The system operation must be possible outside above mentioned limits, unless safety devices are activated.

11) The system will operate with Refrigerant R410A, being a zeotropic blend constituted of a maximum of two different refrigerants providing a maximum temperature glide of less than 0.17K to avoid fractionation problems.

12) In the event of compressor failure, the system will allow emergency operation of its other compressors in order to maintain 8 hours of interim capacity whist spares are sourced.

13) The outdoor unit shall display, detailed error codes, stage of the start-up procedure as well as function and operating data of the system. For the commissioning of a system and in order to properly set all necessary data and values for the optimum operation of it, it is recommended for the starting-up the use of special software provided by the manufacturer of the system.

14) The system shall have the capability to monitor and log data in a critical memory which will store and provide 5 minutes of real time operational data prior to any system failure. This information provides the system with "Black Box" data recording capability which can be used by a qualified service technician to perform efficient and precise interrogation.

3.2 EQUIPMENT MANUFACTURER

The equipment manufacturer must be fully certified and registered to comply in the areas of CE, Eurovent, ISO9001 and ISO14001. The equipment manufacturer shall be responsible for the manufacture of the compressor, refrigerant oil and refrigerant used within the system to maintain integrity of design and optimise efficiency and reliability of equipment.

3.3 TESTING AND CERTIFICATION

All equipment shall be run tested in accordance with the following procedures prior to leaving place of manufacture:

1) A choke test carried out on the refrigerant piping to detect obstacles.
2) The pipework shall be tested to 38bar.
3) Electronic leak testing shall be carried out to ensure maximum system refrigerant containment.
4) System vacuum test to 2 Torr
5) Refrigerant test to within 0.3%
6) Electrical tests shall include flash testing at 1440V AC to ensure that current leaks above 5mA are detected, megger test at 500V DC to ensure resistance levels are above 10 mega Ohm and earth continuity tests.

3.4 OUTDOOR UNIT(S) FEATURES

Outdoor unit physical appearance

The outdoor unit must be suitable for outdoor installation. The shell/casing of the unit will have to be made of enamelled stainless steel sheet, with polyester thermal powder coating (minimum 70μ) for high protection in environment near the seaside. The units shall be air-cooled type incorporating heat exchanger coils manufactured from copper tubes and aluminium fins. The air-cooled heat exchanger of the outdoor unit will have to have undergone appropriate treatment for protection and long life efficient operation against atmospheric corrosion. Specifically, the aluminium fins will be coated with a layer of acrylic resin and on top covered with a hydrophilic film or any other material which will provide minimum 5 to 6 times greater resistance to acid rain and salt corrosion. The bottom of the unit will have a sheet of stainless steel for protection against oxidation.

Outdoor unit mechanical features and components

The outdoor units will be able to deliver cooling capacities ranging in a single shell/housing. Aforementioned cooling capacities will have to be clearly mentioned in the manufacturer's official technical documentation and literature and will have to be calculated, based on the following conditions:

- Indoor room air temperature: 27^{o}CDB / 19^{o}CWB.
- Ambient air temperature: 35^{o}CDB.
- Equivalent piping length: 5,0m.
- Height difference: 0m.

Compressors

In the outdoor unit there will be either one or two compressors in separate shells, so in case one fails it will not be necessary to replace both. The outdoor units will have axial fan(s) DC inverter driven, air-cooled heat exchanger, piping, wiring and automation, factory-installed electronic expansion valves, oil separator, accumulator at the suction side of the compressor, high & low pressure sensors, protection thermostats, fuses, protection against overcurrent, protection for overloading of the inverter, liquid and gas stop valves and solenoid valves, timers and all the necessary sensors and protection equipment to ensure continuous, safe and smooth operation.

The outdoor unit - and consequently the whole system - will keep on operating even if one compressor is turned off (emergency operation). In case of a multi-outdoor unit system it will be possible to isolate one module, while the rest of the system will continue to operate even if delivering reduced capacity. This ensures continuous air conditioning of the premises, until the cause of the issue seizes to exist.

Outdoor units should have a specific function and appropriate devices to prevent refrigerant in liquid phase to return to the compressor. This ensures the specified density of the oil and therefore the adequate lubrication of the compressor. This function increases the efficiency of the system and extends the lifespan of the compressor.

Compressors will have to be hermetically closed scroll type with integrated motor and sound absorbing jacket. They will have a DC inverter driven motor and be able to continuously change the frequency, resulting in a change to the volumetric refrigerant flow from the compressor, in order to accurately and fast respond to the required load. The change in frequency should be done incrementally, but in enough steps so the change of delivered capacity can be approximated as linear. The minimum number of capacity steps will have to be no less than 100.
The motor windings will have to be specially constructed, in order to achieve the safe and smooth operation to avoid hazards due to the continuously changing of frequency and voltage. The compressors will be protected by an electrical crankcase heater to prevent oil condensation at low ambient temperatures.
The oil supply in the compressor will have to be on the high pressure side, ensuring optimum lubrication of all moving parts. There for a separate lubrication system will not be required for the moving parts of the compressor, since the oil in the centre of the crankshaft will be transported across the surface of the rotating parts from the centre to the perimeter. This optimizes the performance of the compressor and minimizes stress and wear, extending its lifetime. The compressors' motors will have a cooling system using compressed gas, to avoid sudden changes in temperature resulting in significant stresses on winding and bearings.

Compressors will alter the rotation speed linearly and consume energy in accordance with cooling and heating loads, ensuring operational autonomy and independent temperature control in each room. The two DC inverter compressors will vary their speed separately controlling the volumetric flow more accurately, with lower power consumption, resulting in higher efficiencies at all loads and connection ratios.

For protecting the compressor from frequent start-stops, there will be an appropriate timer.

Oil recovery system

The oil recovery from the piping network and the indoor units has to be achieved by the use of a microprocessor. The oil will be recovered at least once every eight hours, via a special oil recovery function, ensuring smooth operation of compressors.

Fans

The fan motor(s) of the outdoor unit will have to be DC inverter to further increase energy savings, to more accurately adjust the fan speed and reduce noise. The setting of the fan speed will result in precise control of system's performance in accordance with the requirements of indoor and ambient conditions. The DC inverter fan motors will automatically adjust the rotation speed - thus the air flow - and have at least 120 different steps. Each fan will be separately controlled in order to further increase the accuracy of system control.

The impeller will be made of plastic and with a special configuration to achieve greater air flow with low noise level. Outdoor units will have a protective cover over the fan to guard against accidents and to avoid foreign objects entering the units. It will be special design and construction to minimize the external static pressure drop of the fan.

Fans will have a high external static pressure setting in order to reach at least 78 Pa. This will allow the installation / connection of duct(s) for greater flexibility during installation. In case of an outdoor unit with two fans, then each fan will have the ability to be separately ducted.

System control and functions

All indoor units to be connected to a system must be independently controlled depending on the requirements of each room. The indoor units will be connected to the outdoor unit via the wiring and refrigeration piping network. The wiring cables are not required to be shielded, but the installer will have to ensure that it will not be closer than 5cm to power cables.

The system's operation has to be based on pressure sensors and thermostats, which via a specially designed integrated circuit will control the frequency of the compressor motor (inverter) by varying the compressor's speed resulting in changes to the refrigerant's volume and temperature. The result, combined with ambient temperature and building's load requirements, will always deliver the necessary capacity while maintaining optimum efficiency.

The system will have the ability to perform capacity control from down to 9% and up to 100% of the nominal capacity. The capacity delivered by the system should match the building's load. This way the system will consume the minimum required energy, at the highest possible efficiency.

The room temperature for each room must be controlled by a microprocessor, where processing of the various parameters and the corrective settings are proportional and according to the integral - differential method of regulation.

- Parameters; set temperature and return air temperature for the differential control, gas and liquid refrigerant temperatures for controlling the superheat
- Corrective settings; opening of the expansion valve, fan speed

Variable Refrigerant Temperature

The system has to automatically adjust the evaporating and the condensing temperature in order to always deliver the exact capacity for the building's load, with the highest possible efficiency. In parallel, it must be possible to also set a target refrigerant temperature. This way the delivered capacity will be ambient temperature dependant thus having very high seasonal efficiency. In addition, it has to be possible to operate the system with at least three different set refrigerant temperatures. Higher evaporating temperatures will result in less dehumidification indoors, while the system will deliver mostly or even only sensible capacity. The adjustment of the evaporating and the condensing temperature will have to be easily field set, without any optional accessories prior or after the commissioning of the system.

Ambient temperature dependant variation of the refrigerant temperature – evaporating and/or condensing is required, and results in even greater energy savings and optimal seasonal efficiencies, as per latest directives of the European Union.

It should also be possible to fix the evaporating temperature at different values in order to have the system operate with different Sensible Heat Factors. This way and depending on the indoor relative humidity the supply air temperature can vary (e.g. higher), thus increasing comfort levels through less cold air supplied in the rooms. At the same time relative humidity levels can be maintained within the comfort zone according to international standards and guidelines.

3.5 INDOOR UNIT(S) FEATURES

Function and Type

The indoor units shall be wall mounted type, as there is no false ceiling space available and the ceiling height is not large.

Description and Mechanical Features

The unit casing shall be manufactured from heat resistant plastic. The casing colour shall be Ivory White. The front panel will be flat with return air from the top of the unit. The back plate and the support frames shall be manufactured from galvanised steel plate. The heat exchanger coils will be manufactured from copper tubes and aluminium fins. It shall have electronic expansion valve to control refrigerant flow rate in response to the load variation in the conditioned space. The expansion valve shall be controlled by an integral computerised PID control system to maintain correct room temperature. The fan shall be multi blade cross flow type, statically and dynamically balanced to ensure low noise and vibration free operation. The fan motor must be brushless DC inverter type to reduce the energy consumption. The condensate shall be drained from the unit using suitable tube and run directly to a main drainage point.

Key Characteristics

All maintenance functions must be able to be performed from the front of the unit. Piping connections will be possible from either side or the back of the unit.

Functions

The units must have the ability to control the louvers by remote controller and fix them at different angles. The number of positions must be at least 5.
The units must be able to be operated by wired or wireless remote controllers (by designer choice), available wired controllers must be available in 2 types at least (simplified and fully functional) to allow the design flexibility. The units must have the automatic restart function and multi-tenant ability.

Additional Options

Adapters for remote control and monitoring must be available as options to allow integration with other types on engineering equipment. Remote temperature sensor must be also available as an option to allow the correct temperature control if installation situation does not allow using the built-in sensor or remote controller sensor. The suitable drain pump must be offered as an additional accessory by manufacturer.

3.6 LOCAL CONTROLLER

Each indoor unit will be controlled by wall mounted wireless remote controller.

The controller will have a high resolution LCD, which will indicate the various operating parameters of the controlled indoor unit(s).

From the remote controller it will be possible to independently control the louvers of the indoor unit(s). Any energy saving function and / or sensor related to indoors for increasing either efficiency and / or comfort, must also be possible to control by the remote controller.

3.7 REFRIGERANT PIPING

Refrigeration piping is to be oxidized phosphorous seamless copper tube specifically manufactured for refrigeration industry use and selected for the rated pressure and flow.
All pipe to be new and ends plugged.
Joints are to be hard soldered capillary joints utilizing either a compatible phosphorcopper solder or silver solder with suitable flux.

Whenever pipework is opened for jointing, nitrogen gas must be passed through the piping to prevent the possibility of oxidation. Pipework must be capped immediately after any jointing work is left incomplete.

Pipework must be labelled during the installation process to avoid cross-linking pipework. An accurate record must be kept of installed pipework lengths and routes.

Pipework must be annealed prior to flaring.

Once all jointing is complete pipework must be flushed with nitrogen to remove oxidation, dirt and moisture and to check connections.

Pipework must be pressure tested with nitrogen in stages:
1. 3.0 bar for 3 minutes or longer
2. 15.0 bar for 3 minutes or longer
3. 28.0 bar for 24 hours

Pipework will only be accepted if stage 3 is accomplished i.e. no pressure drop (other than that accountable by change of ambient temperature) with 28.0 bar in 24 hours.

After pressure testing has been passed the pipework system is to be vacuum dried. The vacuum drying procedure is to be done in accordance with the manufacturers' installation specifications. If there is any suspicion of moisture having contaminated the pipework then the two stage vacuum drying procedure is to be utilized.

After vacuum drying has been completed the system must be charged with additional refrigerant as calculated in accordance with the length and size of refrigerant piping installed. Charging must be done to the liquid line using apparatus that will precisely determine the mass of refrigerant charged. The volume of additional charge must be recorded on the outdoor unit name plate.

Refrigeration pipework must be insulated with closed cell foam insulation which has a fire rating of class 1 when tested in accordance with BS 476 Part 7. All joints to be glued and sealed.

Insulated thickness to be:
Gas pipe inside the building - 19 mm; outside - 25 mm
Liquid pipe inside the building - no insulation; outside - 13 mm

Insulation to be 19mm ARMAFLEX AF or equal.

Note:
The installation and testing procedures given above are guidelines and minimum requirements only, and the manufacturer's instructions must be followed where more stringent.
Pipework inside the building will be run in ceiling voids, or wall cavities. Where piping is run in shafts, ceilings or voids, the pipes are to be adequately supported at regular intervals not exceeding 1m, to prevent them from sagging or coming loose. Proposed pipe routes are indicated on the drawings.

All pipework insulation exposed to the elements (ie. at the condensing units) shall be protected from UV-deterioration, by being wrapped in either 'Denso' or canvass tape.

All horizontal piping on the external roof slab shall be run in galvanised sheet metal trunking with removable top cover, and supported off the roof slab on Uni-strut steel sections.

All pipework must be done in accordance with the installation instructions and as required by the installer quality assurance programme.

DRAWINGS

M-00	NOTES N.T.S.
M-01	DRAINAGE SERVICES 1:100
M-02	AIR CONDITIONING SERVICES 1:100
M-03	HOT AND COLD WATER SERVICES 1:100
M-04	DRAINAGE DETAILS SCHEMATIC DIAGRAM 1:100

SCHEDULES

1. V.R.V./F. SYSTEMS – INDOOR UNITS SCHEDULE
2. V.R.V./F. SYSTEMS – OUTDOOR UNITS SCHEDULE