SECTION 15440

PLUMBING FIXTURES

PART 1 GENERAL

1.01 SCOPE OF SECTION

A. This technical specification establishes the quality of materials and workmanship to be used in the supply and installation of plumbing fixtures.

1.02 WORK INCLUDED

A. Provision of all labour, materials and the performance of all operations in connection with the supply and installation of plumbing fixtures as specified herein and shown on the drawings.

B. Coordination: The Contractor shall be responsible for proper coordination of the work of all trades.

C. Note for actual specification of type of appliances in toilet areas refer to Section 10800 toilet and bath accessories.

1.03 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in the manufacture of plumbing equipment and fittings whose products have been in satisfactory use in similar service for not less than 10 years.

B. Installer: Firms regularly engaged in the installation of plumbing works of a similar quality and scope as this project for at least 5 years.

1.04 APPLICABLE CODES AND STANDARDS

A. The plumbing fixtures shall comply fully with the latest relevant British Standards in all respects.

B. The following are the most commonly used British Standards associated with plumbing fixtures. However the contractor shall ensure that all applicable British Standards are complied with, whether listed here or not.

BS 1010 part 2	Draw-off taps and stop valves for water services. In conjunction with BS 21, 61, 864, 1224, 1806, 2779, 2879, 3457, 3885 and 4518
BS 1125	W.C. flushing cisterns In conjunction with BS 1212, 2456, 3402, 4781, 5503, 5504 and 6700

BS 1188	Ceramic wash basins pedestals
BS 1189	Baths made from porcelain enamelled cast iron
BS 1206	Fireclay sinks
BS 1224	Electroplated chromium coatings
BS 1254	W.C. seats (plastics) In conjunction with BS 771 and 1322
BS 1329	Metal hand rinse basins In conjunction with BS 1010, 1344, 3380, 3831 and 6731
BS 3380	Water (excluding skeleton sink wastes) and bath Overflows In conjunction with BS 864, 2779, 3643 and 5572
BS 3402	Quality of vitreous China sanitary appliances
BS 3456 Section 2.9	Household and similar electrical appliances 2.21, 2.22, 2.34, 2.35, 3.6, 3.8, 3.9, 102.5, 102.7, 102.11, 102.24, 102.31
BS 3457	Water tap and stop valve seat washers
BS 5388	Spray taps In conjunction with BS 1010, 5412 and 5413
BS 5412	Draw-off taps with metal and plastic bodies In conjunction with BS 864, 2779, 2871 and 3506
BS 5503	W.C. pans with horizontal outlets
BS 5504 parts 2 & 3	Wall hung W.C. pan
BS 5505	Bidets In conjunction with BS 3402 and 5505
BS 5506 pts.1,2 & 3	Wash basins
BS 5572	Sanitary pipework
BS 5627	Plastic connection for use with horizontal vitreous China W.C. pans In conjunction with BS 65, 416, 437, 1387, 2598, 2871, 3868, 4514, 4660, 5503 and 5504

BS 5779	Spray mixing taps In conjunction with BS 1010, 1415, 5412, 5413 and CP 342

1.05 SUBMITTALS

A. Drawings - refer to Section 15010

B. Products - submit full manufacturer data for every item.

1.06 OPERATION MAINTENANCE DATA

A. Comply with Section 15010.

1.07 WARRANTY

A. Provide 12 month warranty in accordance with contract conditions.

PART 2 PRODUCTS

2.01 GENERAL

A. All units and assemblies of sanitary ware shall be as shown on drawings and listed in schedules.

2.02 FITTINGS

A. Each plumbing fixture shall be installed complete with all necessary fittings for operational and maintenance requirements. All fitexposed to view (i.e. not concealed in chase, void, duct or buried in building structure) shall be heavily chrome plated unless otherwise indicated in the specification or on the drawings.

B. Each water connection to each plumbing fixture shall have a stop valve. The stop valves shall be the same size as the connection and shall be of the wall fixing angle pattern, complete with a chromium plated copper pipe tail for connection to the fixture.

The fittings to be supplied for each of the plumbing fixtures shall be as follows:

Water Closets
Stop valve to cold water supply for cistern .
Stop Valve to Spray hose.

Wash Hand Basins
a) Stop valves to cold and hot water supply

Sinks
a) Stop Valves to cold and hot water supply

PART 3 EXECUTION

3.01 STORAGE

A. All plumbing fixtures shall be stored in their original containers in a secure enclosed store. Vitreous china ware shall be stored out of direct sunlight. Fittings (Taps, Showers etc.) shall stored in boxes or wrappings to prevent the ingress of dust to machined surfaces. All storage areas shall have adequate artificial lighting to allow for inspection of the equipment by the engineer.

3.02 FIXINGS

A. All fixings (Screens, Bolts etc.) shall be as supplied and/or recommended by the fitting/fixture manufacturer. The fixings shall be entirely suitable for the medium they are fixing into and shall be chosen to prevent any electrolytic action between any of the installation elements. All fixings exposed to view shall be stainless steel or where only the heads are exposed shall have caps of the same colours as the item they are fixing.

3.03 INSTALLATION OF FIXTURES

A. All preparation work (provision of holes, pipes etc.) shall be carried out in strict accordance with the fixture manufacturers requirements and shall be arranged such that pipe fittings, offsets & connections are kept to a minimum. All plumbing fixtures shall be securely fixed to the structure or their support system and shall be plumb & level. The fixtures & their plumbing connections shall be arranged to ensure the connections are not subject to any strain or load from the fixtures.

3.04 INSTALLATION OF FITTINGS

A. All fittings shall be installed true & straight or where curved, shall follow the manufacturers recommendations to produce a smooth, fair & continuous radius. Any fittings exhibiting `tool working' or surface finish damage shall be replaced. When positioning fixtures & fittings the contractor shall ensure that all items are central, or where in a range, consistent and symmetrical about architectural finishes as indicated on the drawings.

B. Where fittings are concealed the contractor shall ensure that they are accessible for maintenance without affecting the structure or finishes.

3.05 PROTECTION

A. The Contractor shall take all measures necessary to protect fixtures and fittings during construction. Any damaged fixtures and fittings shall be replaced by new equivalent units. Repairing of damaged units shall not be accepted.

All fixtures and fittings shall be finally cleaned and put into working order upon completion of construction. The Contractor shall be fully responsible for maintaining these items until the facility is finally handed over.

3.06 TOOLS

A. The contractor shall supply any special wrenches or other devices necessary for servicing and maintaining the fixtures & fittings. The contractor shall supply 1 No. device for each 10 No. units installed.

END OF SECTION 15440

SECTION 15450

PLUMBING PIPING INSULATION

PART 1 GENERAL

1.01 SCOPE OF SECTION

A. This technical specification establishes the type and quality of materials and the standard of workmanship to be used in the supply and application of thermal insulation to plumbing piping.

1.02 WORK INCLUDED

A. The work includes the provision of all labour, materials and the performance of all operations in connection with the supply and application of thermal insulation as specified herein and where referred to on the Drawin.

B. Coordination: The Contractor shall be responsible for the full coordination of the work of all trades.

1.03 QUALITY ASSURANCE

A. Manufacturer: Firms regularly engaged in the manufacturing of thermal insulation materials whose products have been in satisfactory use for a similar application for not lthan 10 years.

B. Installer: Firms regularly engaged and qualified in the application of thermal insulation materials with at least 5 years successful installation experience on projects of a similar nature.

1.04 APPLICABLE CODES AND STANDARDS

A. The thermal insulation products and all associated materials shall comply with the latest relevant British Standards in all respects.

B. The following are the most commonly used and relevant British Standards associated with thermal insulation products and associated material. However, the Contractor shall ensure that all applicable British Standards are complied with whether listed here or not.

BS 476 Part 4	:	Non-combustibility Test for Materials.
BS 476 Part 7	:	Method for Classification of the Surface Spread of Flame of Products
BS 476 Part 20	:	Method for Determination of the Fire Resistance of Elements of Construction.

BS 1485	:	Specification for Zinc Coated Hexagonal Steel Wire Netting.
BS 3958 Part 3	:	Metal Mesh Faced Man-made Mineral Fibre Mattresses.
BS 3958 Part 4	:	Bonded Preformed Man-made Mineral Fibre Pipe Sections.
BS 3958 Part 5	:	Specification for Bonded Man-made Mineral Fibre Slabs.
BS 5422	:	Specification for the use of Thermal Insulation Materials.
BS 5970	:	Code of Practice for Thermal Insulation of Pipework and Equipment

PART 2 PRODUCTS

2.01 GENERAL

A. For general applications the thermal insulation materials shall be made from materials which will not burn, but materials which are not entirely non-combustible may be accepted if they have self-extinguishing characteristics, the total mass of combustible materials is small and combustion does not produce dense smoke or toxic fumes. All material finishes shall conform to spread of flame classification class O. Such materials shall only be used with the prior permission of the Engineer.

B. Insulation shall be rotproof, odourless, non-hyroscopic, shall not sustain vermin and shall not contribute to metal corrosion. Any finishes (or coverings) used shall not deteriorate with age or the effects of solar heat.

C. Thermal insulation materials and their finishes shall be asbestos free and be suitable for continuous use throughout the range of operating temperatures and within the environment indicated.

D. All insulating materials and associated products, sealants, tapes, adhesives, securing bands and protective cladding shall be as specified or equal and approved.

2.02 PLANT AND PIPEWORK INSULATION

A. Thermal insulation shall be pre-formed rigid sections or slabs, the basic material consisting of one of the following:

* Rockwool mineral fibre (density 110-160 Kg/m^3).

* Pre-formed glass fibre sections (density 80-110 Kg/m^3).

The insulation shall be manufactured from long stranded mineral fibres, resin bonded to form sections having uniform density and high compressibility. The preformed rigid insulation outside surface shall be smooth, unbroken, uniform, concentric and firm.

B. Pipework insulation shall be high density rigid resin bonded preformed rockwool mineral fibre sections of the thickness specified. The insulation shall comprise of two half sections with a factory applied reinforced aluminium foil covering hinging the two half mating sections for ease of installation. The covering shall have a 50mm side overlap of reinforced aluminium foil to enable the outside surface to be completely sealed.

C. Where thermal insulation of plant is required the insulation shall be preformed rigid sections or slab. The material shall consist of long fine fibres (free from shot and coarse fibres) bonded with a temperature resistant resin. The density shabe a minimum of 48 Kg/m^3 and the surfshall have a factory applied reinforced aluminium foil finish.

D. Thickness of insulation shall be determined in accordance with the following tables for the appropriate medium and the declared value of thermal conductivity of the insulation material at the relevant temperature.

When selecting the insulation thermal conductivity, the space available for the installation shall be thoroughly examined to ensure that the resultant thickness can be accommodated.

TABLE 1

THICKNESS OF INSULATION FOR HOT WATER SERVICES

DECLARED THERMAL CONDUCTIVITY (W/m°C)			
Size of Tube	Up to 0.040	0.041-0.055	0.056-0.070
mm	Minimum thickness of insulation(mm)		
15 to 32	25	25	25
40 to 50	25	32	32
65 to 80	32	32	32
100	32	32	38
125	32	38	44
150	38	44	44
Flat Surface	44	44	44

TABLE 2

THICKNESS OF INSULATION FOR COLD WATER SERVICES

DECLARED THERMAL CONDUCTIVITY (W/m°C)						
Pipework within Building				External Pipework		
Size of tube	Up to 0.040	0.041 to 0.055	0.056 to 0.070	Up to 0.040	0.041 to 0.050	0.056 to 0.070
(mm)	Minimum thickness of insulation (mm)					
15 to 40	32	50	75	38	63	100
50 to 80	25	32	50	25	44	63
100 to 150	19	25	38	25	32	50
Flat Surfaces	19	25	38	25	32	50

PART 3 EXECUTION

3.01 STORAGE

A. All thermal insulation materials shall be stored in their original packaging in such a manner as to prevent the ingress of dust or moisture. The height of the packages shall be restricted to prevent any deformation of preformed rigid sections.

B. Flat sheet and rolled metal materials used for protective claddings shall be stored away from the ground surface, adequately covered and protected in a manner to prevent damage to the materials.

C. All storage areas shall have adequate lighting to allow for the inspection of all materials.

3.02 FIXINGS

A. All mechanical fixings (rivets, screws) shall be as recommended by the manufacturer of the material being fixed. All mechanical fixings, sealants, tapes and adhesives shall be entirely suitable for the medium that they are being applied to and the application shall be fully in accordance with the manufacturers recommendations.

3.03 PLANT AND PIPEWORK INSULATION

Thermal insulation to pipework shall be carried out by specialists and strictly in accordance with this Specification. No thermal insulation shall be applied to pipework prior to witnessing of the pipework pressure test and only then after a full inspection and approval by the Engineer.

B. Thermal insulation shall be applied to the following:-

(i) All pipework carrying hot fluids in circulation including flanges and bodies of valves on all sizes of pipework.

(ii) External distributing mains and fittings above ground and in ducts, chases and trenches including all valve bodies and flanges.

(iii) Cold water pipework (including valve bodies and flanges) run above ground external to buildings and run in ducts, chases, roof spaces and elsewhere as indicated, to prevent shedding of condensation.

Insulation shall fit closely on pand other surfaces without gaps be.

C. The following lines not be insulated:

1. Chromium-plated pipe to plumbing fixtures.

D. Al sections of the insulation shall be of the correct size and made for the type and grade of piping to which it is fitted and shall form a tight fit on the pipework after application of adhesive and lapping. Bends shall be formed by cutting a series of gussets in the pre-formed sections to form a continuous finish with the pipework. The valve bodies and flanges in plantrooms and those components within the entire pipework system 65mm dia and above shall be insulated with the same insulation as the accompanying pipework but contained within a removable aluminum box. Where a vapour seal is incorporated into the insulation, all joints shall be effectively sealed with approved sealing material and securely fixed.

E. Each pre-formed rigid insulation section shall be butt jointed to the next, the point being fully sealed with 75 mm wide aluminium tape. The preformed sections on domestic hot and cold water services shall be secured hard to the bracket where inserts are not used. The reinforced aluminium side overlap shall be sealed with a suitable adhesive or 75 mm wide aluminium tape. Outer coverings shall not come into contact with pipework and attachments.

F. Each section of pre-formed insulation shall be screwed to the pipe by one of the following means:

* Circumferential tie wires each formed from three turns of wire not less than 1 mm thick, spaced not more than 450 mm apart.

* Circumferential bands of non-ferrous metal, plastic fibre or adhesive sheet.

* Rigid insulation applied to cylinders and flat surfaces shall be secured with non-ferrous metal or plastic fixings.

G. The insulation on pipework concealed from view within buildings will not require further protective cladding.

H. Insulation on pipework exposed to view and within plantrooms shall be clad fully in a pre-formed aluminum stucco finish cladding 0.8 mm thick held in place by means of rivets or self tapping screws. All joints shall be sealed with a non-setting sealing compound.

I. Insulation on pipework exposed to the outside atmosphere shall be clad with a covering of polyisobutylene sheet fixed with adhesive, lapped and solvent welded to form an impervious seal. At entries into buildings, the weatherproof insulation shall extended not less than 100 mm beyond the inner face of the wall and be sealed to the satisfaction of the Engineer.

3.04 PROTECTION

A. The Contractor shall take all necessary measures to protect the works during construction. Any damaged sections of insulation shall be completely cut out and replaced with a new section. The vapour seal shall be repaired to ensure continuity.

All damaged sections shall be replaced at the Contractor's expense until the system is accepted and finally handed over.

END OF SECTION 15450

SECTION 15451

WATER HEATERS

PART 1 GENERAL

1.01 SCOPE OF SECTION

A. This technical specification establishes the quality of materials and workmanship to be used in the supply and installation of water heaters.

1. WORK INCLUDED

A. The work includes the provision of all labour, materials and the performance of all operations in connection with the installation of the water heaters as specified herein and shown on the drawings.

B. The work includes testing of the water heaters.

C. Coordination: The Contractor shall be responsible for full coordination of the work of all trades.

1.03 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in the manufacture of water heaters and ancillary equipment and fittings whose products have been in satisfactory use in similar service for not less than 10 years.

B. Installer: Firms regularly engaged in the installation of plumbing works of a similar quality and scope as this project for at least 5 years.

1.04 APPLICABLE CODES AND STANDARDS

A. The water heaters, and associated fittings and accessories shall comply fully with the latest relevant British Standards in all respects.

B. The following are the most commonly used and relevant British Standards associated with water heaters. However the contractor shall ensure that all applicable British Standards are complied with, whether listed here or not.

BS 699	Copper direct cylinders for domestic purposes. In conjunction with BS 476, 864, 2779, 3456 and 5546.
BS 759	Valves, gauges and other safety fittings for application to boilers and to piping installations for and in connection with boilers. In conjunction with BS 779 and 855.
BS 853	Calorifiers and storage vessels.

BS 1566	Copper indirect cylinders for domestic purposes. In conjunction with BS 476, 864, 2779, 2871, 3456 and 5546.
BS 2870	Rolled copper sheet.
BS 3198	Copper hot water storage combination units for domestic purposes. In conjunction with BS 864, 1212, 1968, 2456, 2779, 2870 and 2871.
BS 5970	Code of practice for thermal insulation of equipment.
BS 6280	Vacuum (back siphonage) test for water-using appliances.
BS 6281	Devices without moving parts for the prevention of contamination of water by backflow. In conjunction with BS 864, 2779, 2872, 4504, 5412 and 5413.
BS 6282	Devices with moving parts for the prevention of contamination of water by backflow. In conjunction with BS 864, 2779, 2872, 4504, 5412 and 5413.
BS 6283	Safety devices for use in hot water systems. In conjunction with BS 864, 970, 2056, 2779, 2870, 2871, 2872, 2874, 3074, 3075, 3457, 4504, 5412 and 5413.
BS 6759	Safety valves.

1.05 SUBMITTALS

A. Drawings - refer to Section 15010

B. Products - submit full manufacturers data for every item.

1.06 OPERATION MAINTENANCE DATA

A. Comply with Section 15010.

1.07 WARRANTY

A. Provide 12 month warranty in accordance with contract conditions.

PART 2 PRODUCTS

2.01 WATER HEATERS

The electrical water storage heaters shall be capable of withstanding the static head imposed from the water tank as indicated on the Drawings and the cylinders shall be capable of withstanding a test pressure of 3 BAR. Water heaters shall be provided with temperature gauges, pressure/temperature relief valves, anti-vacuum valves, reverse flow prevention, stop cocks and test stop tap.

B. The water heaters shall be manufactured of heavy gauge copper or steel with copper lining and high density magnesium anode protection rod, all as indicated on the drawings and all suitable for the above working and test pressures.

C. All wall mounted units are to have factory fitted 3 cm thick polyurethane foam, or equivalent thermal insulation with a thermal conductivity value not greater than 0.035W/m deg.C, protected by an outer stove enameled casing. In the case of floor mounted units, the insulation shall not be less than 4 cm thick.

D. The water heaters shall be suitable for use with an electrical power supply of 220V, 1 phase 50Hz as indicated the drawings.

Water heaters upto including 300 litre capacity shall be provided with one or more immersion heater banks coby thermostats in steps to a of 9 kw per thermostat. A manual reset hilimit thermostat shall also be incorporated. Immersion heaters shall be highest quality mineral filled titaniheaters with connection box for conduit/wiring entry.

E. All water heaters shall have a thermometer calibrated in deg C mounted on the outer casing of the heater.

F. All wall mounted units less than 200 litres capacity will require 2 No. safety valves.

PART 3 EXECUTION

3.01 PIPEWORK CONNECTIONS

A. All pipework connections to each water heater shall have a union disconnection point between the heater and it's stop valve.

B. All drain points, vent and safety valve discharge pipes shall be extended to discharge over a tundish which shall be piped to the nearest floor drain. Tundish pipework shall be concealed.

C. The Contractor shall ensure that all the pipe and electrical connections to each water heater are easily accessible for maintenance and that the heater can be removed and replaced with the minimum of disturbance to the system.

3.02 INSPECTION, TESTING AND STERILISATION

A. All pipework shall be visibly examined and tested before being concealed or built into the structure.

1) All pipework and water heaters are to be pressure tested to twice the working head, without loss of pressure for 2 hours.

On satisfactory completion of A(1) all pipes shall be washed out and shall only then be built into the structures prior to final testing.

2) The final tests will be as A(1) above but shall also include that each draw-off tap and shower fitting meets the approved suppliers specification.

3) On, satisfactory completion A(2), the system shall be flushed out and refilled with chlorinated water at a chlorine concentration of 50 mg/l free chlorine for 24 hours. The system is to be washed-out prior to acceptance until the free chlorine at the outlets is no greater than that present in the water mains.

4) The above tests are to be witnessed by representatives of the Engineer and Contractor who will sign that the tests have been fully complied with.

END OF SECTION 15451

SECTION 15452

TANKS

PART 1 GENERAL

1.01 SCOPE OF SECTION

A. The work described in this section covers the support, installation and quality of materials and workmanship for the potable water storage tank installation.

1.02 QUALITY AS

A. Material and equshall be standard products of a manufacturer regularly engaged in the manufacture of products that have been in satisfactory use for a period of ten years.

B. Installer firms proposed for the installation of the storage tanks and equipment shall have been engaged for at least 5 years in the installation of tanks of a similar type, quality and scope as is required for this project.

1.03 WORK INCLUDED

A. Provision of all labour, materials, and the performance of all operations necessary for the supply and installation of potable water storage tank and equipment of the as specified herein and as detailed on the Drawings.

B. Coordination: The Contractor shall ensure that the storage tanks are fully compatible with all trades, particularly those of the Civil, Mechanical and Electrical services, for successful installation and operation.

C. Submittals: The Contractor shall submit to the Engineer for review and approval, all calculations and drawings for the equipment proposed and associated builders works to show that the plant as installed will meet all the specified criteria.

No works shall commence on the production of the package or associated site works until the design has received the approval of the Engineer.

1.04 APPLICABLE CODES AND STANDARDS

BS 8007: Design of Concrete Tanks for Aqueous Liquids.

BS 3792: Installation of Liquid Level and Temperature – Measuring Instruments.

PART 2 PRODUCTS

2.01 GENERAL

A. All concrete tanks are to be concrete formed as detailed in Division 3 Concrete 03300 Cast in Place Concrete.

B. For number site and location of tanks refer to drawings.

C. In accordance with the sites shown on the drawings each tank shall be provided with connections for the following:

Water inlet	Vent pipe (with insect screen)
Water outlet	Water level alarm system
Drain	Access manholes with bolted covers
Over flow	

PART 3 EXECUTION

3.01 INSTALLATION OF TANKS

A. Concrete storage tanks to be installed in strict accordance with Division 3 recommendations.

3.02 INSPECTION OF TANKS AND TESTING

A. Concrete storage tanks: slowly fill with water to top water level and visually inspect for leaks.

END OF SECTION 15452

SECTION 15500

HEATING, VENTILATION AND AIR CONDITIONING

PART 1 GENERAL

1.01 SCOPE OF SECTION

A. HVAC scope

B. Basis of design

C. Systems descriptions

1.02 HVAC SCOPE

A. The Heating, Ventilation and Air Conditioning shall include the following systems and all systems and components shown of the drawings.

a) HVAC to Restaurant, Conference hall and Exhibition.

b) Conference foyer, corridor, offices and other similar areas.

c) Local ventilation systems.

d) Kitchen mechanical ventilation.

e) Toilet mechanical ventilation.

1.03 BASIS OF DESIGN

A. DESIGN CRITERIA USED FOR HVAC CALCULATIONS

1. External ambient

Summer	:	40°C dry bulb, 21°C wet bulb (for coil selections)
Winter	:	10°C dry bulb
Site location	:	Ma'in
Altitude	:	107 m above sea level
Latitude	:	31.78° N

The above summer design temperature does not apply to equipment operating ambients which are given separately in this specification.

2. Internal Conditions

Summer: 23 °C
Winter : 21 °C

3. Noise Criteria

Offices, & Common Areas	NC 35
Toilets/Janitor and Kitchenette:	NC 40
Conference hall :	NC 35

PART 2 PRODUCTS

Not used

PART 3 EXECUTION

Not used

END OF SECTION 15500

SECTION 15670

CONDENSING UNITS

PART 1 GENERAL

1.01 SCOPE OF SECTION

A. This Technical Specification establishes the quality of materials and workmanship to be used in the supply and installation of Condensing Units.

1.02 WORK INCLUDED

A. Provision of all labour, materials and the performance of all operations in connection with the supply and installation of Condensing Units as specified herein and shown on the Drawings.

B. Coordination: The Contractor shall be responsible for proper coordination of the work of all trades.

1.03 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in the manufacture of Condensing equipment and fittings whose products have been in satisfactory use in similar service for not less than 10 years.

B. Installer: Firms regularly engaged in the installation of Condensing equipment of a similar quality and scope as this project for at least years.

1.04 APPLICABLE CODES AND STANDARDS

A. The Condensers shall comply fully with the latest relevant American, International and British Standards in all respects.

B. The following are the most commonly used standards associated with Air Cooled Condensers. However, the Contractors shall ensure that all applicable standards are complied with whether listed here or not.

NFPA 90A	-	Installation of Air Conditioning and Ventilating Systems.
NFPA 70	-	National Electrical Code.
ASHRAE 15-78	-	Safety Code for Mechanical Refrigeration.
NEC Article 44	-	Air Conditioning and Refrigerating Equipment.

IEC 328-ANSI	-	Safety Requirements for the Electrical Equipment Room Air Conditioners.
ISO R859	-	Testing and Rating Room Air Conditioners.
ARI 210	-	Unitary Air Conditioning Equipment.
ARI 270	-	Sound Rating of Outdoor Unitary Equipment.
ARI 360	-	Commercial Industrial Air Conditioning Equipment.

1.05 SUBMITTALS

A. Drawings refer to 15010

B. Noise data as certified by manufacturer.

C. Products - full manufacturers data for every item.

1.06 OPERATION AND MAINTENANCE DATA

A. Comply with 15010

1.07 WARRANTY

A. Provide 12 months warranty in accordance with contract conditions.

PART 2 PRODUCTS

2.01 AIR COOLED CONDENSING UNITS

A. The package air cooled condensing units shall be completely factory assembled, wired, charged and tested ready for installation. Each unit shall comprise of compressor section, air cooled condenser section,and automatic controls; the whole enclosed in a weatherproof composite frame and casing constructed from galvanised sheet metal with stove enamel finish. A local disconnect switch shall be provided at each unit to isolate the whole electrical supply.

B. Each condensing unit shall comprise multiple compressors, dependent on load and capacity, as indicated on the Drawings and schedules.

C. Each compressor shall be rotary or reciprocating, hermetic or semi-hermetic type and shall have an automatically reversible oil pump and operating oil charge. Each compressor shall be equipped with suction anddischarge shuoff valves and be mounted on spring vibration isolators. Each motor shall be cooled by suction gas, shall have high temperature protection and be equipped with an insert type crank case heater to minimise oil dilution during shut down period, all parts of the motor to be proofed against long term contact with

halocarbon refrigerants and compressor lubricating oil. A contactor and calibrated manual reset ambient insensitive overload protector shall be factory installed for each compressor motor. The safety device shall be designed to open all three phases in the event of overload in any one phase. The oil pump of three phase units shall either operate equally well under each direction of rotation or special arrangements shall be made to prevent reverse rotation.

D. The condenser coil shall be non-ferrous construction and shall have aluminium plate fins mechanically bonded in seamless copper tubin with additional anti corrosion coating suitable for salty spray atmosphere.

E. The coil shall be circuited for sub-cooling. The condenser fans shall be direct drive propeller type arranged for vertical or horizontal discharge as required. Each fan unit shall be provided with a safety guard.

F. The casing shall be fully weatherproof for outside installation and be arranged to allow for ease of maintenance. An internal control panel shall be provided with a lockable hinge access door. The control panel shall be factory pre-wired and tested and shall incorporate all necessary prdetectors and overload devices to facilitate fully automatic operation.

G. Each unit shall have pressure control and be capable of operating continuously at 46oC ambient air temperature. Capacity controls shall be provided at the factory with an electrically operated device for loading and unloading compressor cylinders together with control for cycling the compressor. Also restricted load starting control shall be provided to prevent excessive suction pressure during high ambient starting.

H. All refrigerant suction pipework shall be insulated.

J. All controls shall be factory wired and enclosed in a weatherproof cabinet, with lockable door. Control panel provisions to include the following, but not necessarilbe limited to:-

(a) Positive acting timer to prevent short cycling of compressors and delay restart of compressors after shutdown.

(b) High and low pressure thermostats.

(c) Capacity control via room thermostat.

(d) power and control terminal blocks.

(e) Circuit breakers.

(f) Motor contactors.

(g) Control relays.

(h) Isolators.

(i) Plant control shall be via room or air handling unit mounted thermostat as indicated on the Drawings.

K. Manual restart of the packaged air cooled condensing unit shall be required after motor stoppage due to thermal overload or low oil pressure.

L. Systems using a thermostatic expansion valve shall have the following items preceding it in the refrigerant liquid pipe.

1. A solenoid valve

2. A sight glass

3. refrigerant drier (replaceable)

4. A refrigerant strainer

5. A capped refrigerant charging valve

M. A cooler pressure regulating valve where fitted shall be protected by a strainer, and a cooler pressure gauge shall be provided, up-stre of the valve, fitted with means of isolation.

N. Units having a direct expansion evaporator at a higher level than the compressor shall operate on a pump down cycle.

O. Refrigerant stop valves which incorporate a spindle gland shall be serviceable with the valve "in-situ".

PART 3 EXECUTION

3.01 PRODUCT STORAGE AND HANDLING

A. All products shall be delivered in manufacturer's original protective packaging.

B. All products shall be inspected at time of delivery for damage and for compliance with Specifications.

C. All products thatare found to be damaged or not in accordance with the Specifications shall immediately be repaired or removed from the site and replaced. Repairs shall not be undertaken before the Engineer's review of the Contractor's proposed action.

D. All products shall be handled and stored as recommended by the manufacturer to prevent damage and deterioration.

E. The Contractor shall supply handling equipment such as lifting beams, reinforced canvas slings, protective paddings, struts, cradles, etc., required to handle products without damaging hardware or linings and coatings.

F. Comply with Section 01600

3.02 INSTALLATION

A. All units mounted externally shall have a raised concrete base with a minimum height of 100mm above surrounding surfaces. The base shall be sloped to provide natural drainage and ensure that ponding does not occur under the unit.

B. Each Air Cooled Condensing Unit shall be complete with a local electrical disconnect switch.

C. The units shall be of the sizes, capacities, duties and types indicated on the Drawings and schedules and shall be installed in strict accordance with the manufacturer's requirements.

END OF SECTION 15670