SECTION 15190

MECHANICAL IDENTIFICATION

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 installation of Mechanical Identification systems.

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 installation of Mechanical Identification systems as specified herein and where referred to on the Drawings.

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

1.03 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in the manufacture of Mechanical Identification systems whose products have been in satisfactory use for a similar application and not less than 10 years.

B. Installer: Firms regularly engaged and qualified in the installation of Mechanical Identification systems with at least 5 years successful installation experiences on projects of a similar nature.

1.04 APPLICABLE CODES AND STANDARDS

A. Mechanical Identification systems and all associated materials and workmanship shall comply fully with the latest relevant British Standards in all respects.

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

BS 1710 - Specification for Identification of Pipelines and Services.

BS 4800 - Specification for Paint Colors for Building Purposes.

1.05 SUBMITTALS

A. Drawings refer to 15010

B. Products: Full manufacturers color data for each product.

C. Samples - Full - size color sample of pipe work and ductwork identification.

1.06 OPERATION AND MAINTENANCE DATA

A. Comply with 15010

B. Mechanical identification system shall correspond totally to "As Built" data.

1.07 WARRANTY

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

PART 2: PRODUCTS

2.01 PLANT AND PIPEWORK IDENTIFICATION

A. All pipe work shall be color coded in accordance with BS 1710 as detailed in Table 1.

TABLE I

IDENTIFICATION OF PIPE LINES

Pipe contents	Color code indication (approx 100mm)	Basic color (approx 150mm)
Drinking Water	To BS 1710	Blue
Cold water down service	To BS 1710	Green
Hot water supply	To BS 1710	Green
Drainage	To BS 1710	Black

B. Identification to pipe work shall consist of 100mm PVC adhesive bands over the basic color and shall include flow direction arrows together with the abbreviation of the service name. All coding requirements are to be agreed with the Engineer.

C. Code indication for safety conditions shall be as follows:-

Safety Color	BS color reference BS 4800
Red	04 E 53
Yellow	08 E 51
Auxiliary Blue	18 E 53

Safety color references are as follows:-

1. Red for fighting equipment.

2. Yellow with black diagonal stripes for warning of danger.

3. Yellow with trefoil symbol for organizing radiation (as defined in BS 3510).

4. Auxiliary blue in connection with green basic colors, to denote pipes carrying fresh water, either potable or non-potable.

Safety color references shall be applied using 100mm wide sections of PVC adhesive band in all permanent locations, to be agreed with the Engineer.

Color references shall include notation as follows:-

1. FIRE

2. DANGER

3. RADIATION

4. POTABLE OR NON-POTABLE

In the case of fire service, all equipment, i.e. valves, suction tanks, etc., shall also be painted red.

D. Un insulated pipe work shall be painted with one coat of undercoat and one coat of gloss finish to the relevant BS color.

E. Valve identification shall be by means of 40mm diameter baterffuly discs of white/black/white composition. Letters and figures of 8mm minimum height, identifying the service and valve number shall be engraved into the material. A 3mm diameter hole shall be drilled through the disc for the purpose of securing the disc to the valve.

F. Plant identification shall be by means of traffalyte labels of white/black/white composition. Letters and figures of 8mm minimum height identifying the plant shall be of a size to be agreed with the Engineer. A minimum of two 3mm diameter holes shall be drilled through the label to the plant.

G. All plants shall carry the manufacturer's identification plate which shall incorporate all details of electrical and mechanical duties.

2.02 DUCTWORK IDENTIFICATION

A. Ductwork shall be color coded in accordance with HVAC Specification DW142 to the colors indicated in Table 2. For conditioned air, identification shall comprise either of two symbols (one red, one blue) or a single symbol colored, part red, part blue.

TABLE 2

DUCT IDENTIFICATION COLORS

Type	Color	BS 4800
Conditioned Air	Red and Blue	04353 / 18E53
Warm Air	Yellow	10E53
Fresh Air	Green	14E53
Exhaust / extract recirculated air	Grey	AA009
Foul Air	Brown	06C39

B. Direction of flow shall be by PVC self adhesive equilateral triangles with one apex pointing in the direction of flow. The minimum length of side of the triangle shall be 150mm.

PART 3: EXECUTION

3.01 STORAGE

A. All identification materials shall be stored within a well lit container or purpose made compartment racks or shelving. The material shall be adequately covered to prevent damage and ingress of dirt.

B. Refer to 01600

3.02 GENERAL

A. Identification shall be placed where it can be easily seen and at positions where identification will be required. To ensure that the symbols are seen, the following points shall be considered:-

1. The symbols shall be on the surface which faces the positions of normal access to the completed installation.

2. The symbols shall not be hidden from view by structural members, other ducts, plant or other services distribution systems.

3. The symbols shall be placed where there is adequate natural or artificial light.

B. Symbols shall occur frequently enough to avoid the need for ducts and pipes to be traced back. Symbols should be placed at any service and access points to the distribution system.

C. Identification shall be applied to pipe work and ductwork at every entry and exit point to a room but in no case of intervals of less than 12m.

3.03 PLANT AND PIPEWORK IDENTIFICATION

A. In addition to the color bands, all pipe work in plant rooms and service areas, whether insulated or not, shall be legibly marked with black or white letters to indicate the type of service and the direction of flow. Services shall be identified as follows:

Chilled Water:		CHW
Refrigerant:		RFG
Cold Water:	Raw	RW
	Sweet	SW
Domestic Hot Water:	Raw	RW
	Sweet	SW
Fire Main:		FM
Gas:		GAS

B. The basic identification color shall be applied using a PVC adhesive band either applied to pipe work insulation or pipe when uninsulate. Identification shall be placed at all junctions, at both sides of valves, services appliances, bulkheads, wall penetrations and at any other places where identification is necessary or advantageous.

C. Where pipes are run in pairs, the letters F and R shall be added to indicate flow and return respectively.

3.04 DUCTWORK IDENTIFICATION

A. All ductwork in plant rooms and services areas, whether insulated or not, shall be legibly marked with black or white letters to indicated the type of service and the direction of flow. Services shall be identified as follows:-

Supply Air - S

Return Air - R

Fresh Air - F

Exhaust - E

B. Ductwork identification shall be applied to ductwork whether insulated or not, at all branches, plant connections, wall penetrations and at any other place where identification is necessary or advantageous.

End of Section

SECTION 15290

HEATING, AND VENTILATION

PART 1: GENERAL

1.01 WORK INCLUDED

A. Internal environmental designs conditions and external ambient conditions.

B. System Design Criteria

1.02 REFERENCE STANDARDS

A. The air conditioning system has been designed in accordance with the following standards:

ASHRAE American Society of Heating Refrigeration and Air conditioning Engineers.

SMACNA Sheet Metal and Air Conditioning Contractor's National Association Inc.

UMC Uniform Mechanical Code.

1.03 SCOPE OF WORKS

A. The work covered under this section shall include all the supply, installation, testing, commissioning, maintenance and delivering in good operating conditions of complete heating, and ventilation systems as described in these specifications and shown on drawings and bill of quantities.

B. The Contractor shall provide all the necessary components and accessories as well as materials, manpower, equipment, tools, scaffolding, painting, testing facilities, supervision and overhead, etc., at his own expense to execute a complete operable system.

C. The Contractor shall obtain the necessary information and instruction for the execution of the works only from the Engineer and not from third parties.

D. The Contractor shall program his work such that it will not interfere with other trades and to suit site requirements.

E. Schedules and specifications including but not limited to the following:

1. To check the design and to undertake the responsibility of giving the design conditions in the occupied areas.

2. To supply, install and commission the air-conditioning plant to the satisfaction of the Engineer.

F. Electrical power supply terminating in an isolating switch located within 3 meters of the unit shall be provided.

1.04 DESCRIPTION OF THE WORKS

A. The works shall consists of ventilation, and heating system.

All as per specifications, drawings and bill of quantities.

B. All Toilets and Kitchens should be ventilated with independent extract fans, capacities and type as shown on drawings.

C. Fire dampers according to Civil defense requirements.

1.05 DESIGN CONDITIONS

A. General: The installation is based on the following design conditions, capacities and dimensions given in the specifications and drawings will be considered as the minimum to be accepted and it is the responsibility of the contractor to select all unspecified equipment to attain the required design and guarantee conditions.

B. External Conditions

1. Dry Bulb Temperature (winter) 0C°

C. Internal Environmental Conditions

No.	Description	Winter	Relative Humidity	Ventilation
1.	Restaurant & coffee Shop	22°C	50% RH	7.5 I/s/person
2.	Offices, shops, reception, staff lounge	22°C	50% RH	7.5 I/s/person

PART 2: PRODUCT

2-1 HEATING SYSTEM

A. General Description of the Works

The heating system shall consist of oil fired hot water boilers of capacities as shown on the drawings. These boilers feed heating water to the heating network and to the domestic hot water heat exchanger. (Calorifier). All radiators are fed with hot water from the Boilers. Hot water is circulated by hot water pumps.

B. Oil Fired Boiler (Cast Iron)

Boiler shall be of the cast iron sectional type tested at 6 bar and good for a working pressure of 4 bar with min. 90% efficiency. Each boiler shall be complete with the following:

1. Automatic, high pressure, gun-type burner suitable for light oil No. 2 atomization.
2. Fuel oil solenoid valve.
3. Burner plate .
4. Insulated and enameled steel jacket and fire bricks .
5. 4mm. thick steel breaching with 2" (50 mm.) insulation, connecting the boiler with the chimney .
6. Draft control damper .
7. Thermometer .
8. Pressure gauge .
9. Aqastat .
10. Pyrostat or photocell .
11. Safety relief valve .
12. electronic control panel (Microcomputer) complete with switches, pilot lights, room programmer, timer, and all electrical wiring .

C. Radiators (Cast Iron)

- The contractor shall supply and install cast iron radiators of the capacities indicated on the drawings.
- All radiators shall be of the sectional type.
- Each radiator shall be complete with the following:

  - Bronze, radiator supply valves,
  - Manual air vent,
  - Manual flow,
  - All necessary fixing supports,

PART 3: COORDINATION WITH STRUCTURE AND THE SERVICES

3.1 GENERAL

A. The Contractor shall ensure that all items of equipment, ductwork and pipe work are capable of being located in their allocated positions, after due consideration to their coordination with the building structure, ceiling levels and other services, before ordering or manufacturing any items.

B. Any modifications necessary on site to ensure full coordination of services shall not in any way defer from the performance of systems as a whole.

PART 4: EXPANSION AND CONTRACTION

4.1 GENERAL

A. Special consideration shall be given to the design and installation of pipework to ensure that expansion and contraction resulting from extremes of temperature can be accommodated freely without causing damage to the pipe system or the building.

B. Where pipes crossing expansion joints, expansion fittings should be used.

PART 5: COMMISSIONING

5.1 GENERAL

A. The Contractor shall allow for all water and air distribution services to be balanced and commissioned in accordance with the relevant commissioning codes published by the Chartered Institution of the Building Services Engineers.

B. The balancing and commissioning of all air-conditioning circuits shall be carried out by the contractor.

C. The Contractor shall supply and install on all air distribution systems all test points required in order to commission the systems completely. Testing and commissioning results shall be submitted to the Engineer for approval by the Engineer.

D. The Contractor will be particularly required to show, in distribution systems, that the correct design static pressure will be available at the most remote diffusers.

End of Section

SECTION 15430

PLUMBING SPECIALTIES

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 installation of piping specialties.

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 installation of piping specialties as specified herein and where referred to on the Drawings.

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

1.03 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in the manufacturer of piping specialties whose products have been in satisfactory use for a similar application for not less than 10 years.

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

1.04 APPLICABLE CODES AND STANDARDS

A. The piping specialties and all associated materials 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 piping specialties and associated materials. However the Contractor shall ensure that all applicable British Standards are complied with whether listed here or not.

BS. 21	:	Specification for Pipe Threads for Tubes and Fittings where Pressure Tight Joints are made on the Threads.
BS 4504 Part 1	:	Specification for Ferrous Flanges and Bolting for Pipes, Valves and Fittings.

1.05 SUBMITTALS

A. Drawings - refer to Section 15010

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

1.06 OPERATION AND 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 PIPE SLEEVES

A. Pipework sleeves shall be of the same materials as the pipework.

B. The inside diameter of sleeves shall be such as to allow an 8 mm minimum gap between the finished surface of an insulated pipe and the internal surface of the sleeve. The length of the sleeve shall be limited to prevent the sleeve protruding beyond the finished building surface. Mastic of an approved type shall be inserted between pipe and sleeve as necessary.

2.02 FLOOR, CEILING AND WALL COVER PLATES

A. Floor, ceiling and wall plates shall be plastic and selected to suit the pipework size and material with which they are to be used.

2.03 PIPE CLEANOUTS

A. Shall be the same size as the pipe except that cleanout plugs larger than 4 inches (100 mm) will not be required. Cleanouts in connection with other pipe, where indicated, shall be T-pattern, 90-degree branch drainage fittings with cast-brass screw plugs of the same size as the pipe up to and including 4 inches (100 mm). Cleanout tee branches with screw plug shall be installed at the foot of soil and waste stacks, at the foot of interior downspouts, on each connection to building storm drain where interior downspouts are indicated, and on each building drain outside the building. Cleanout tee branches may be omitted on stacks in single story buildings with slab-on-grade construction or where less than 18 inches (45 cm) of crawl space is provided under the floor. Cleanouts on pipe concealed in partitions shall be provided with chromium-plated bronze, nickel bronze, nickel brass or stainless steel flush type access cover plates. Round access covers shall be provided and secured to plugs with securing screw. Square access covers may be provided with matching frames, anchoring lugs, and cover screws. Cleanouts in finished walls shall have access covers and frames installed flush with the finished wall. Cleanouts installed in finished floors subject to foot traffic shall be provided with a chrome-plated cast brass, nickel brass, or nickel bronze cover secured to the plug or cover frame and set flush with the finished floor.

Heads of fastening screws shall not project above the cover surface. Where cleanouts are provided with adjustable heads, the heads shall be cast iron (or plastic).

2.04 FLASHINGS

A. A sheet-lead flashing shield shall be provided for drains and pipe sleeves with integral clamping devices that penetrate a membrane. Flashing shield shall be made from sheet lead not lighter than 4 pounds (20 kg/m^2), and extend not less than 8 inches (20 cm) from the drain or sleeve in all direction. Flashing shall be inserted into the clamping device and made watertight. Lean flashing shields, and roof flanges of lead or copper flashing with integral flange, shall be set over membrane in a solid coat of a bituminous cement and strip-flashed as specified by the manufacturer. Pipes passing through pitches roofs shall be flashed using lead or copper flashing with an adjustable integral flange of adequate size to extend not less than 8 inches (20 cm) from the pipe in all directions and lapped into the roofing to provide a watertight seal.

2.05 FLOOR AND SHOWER DRAINS

A. Shall generally consist of body, integral seepage pan and adjustable perforated or slotted strainer consisting of grate and threaded collar. Drains shall be of double drainage pattern suitable for embedding in the floor construction. The seepage pan shall have weep holes or channels which will provide drainage from the pan to the drainpipe. The strainer shall be adjustable to varying floor thickness. A suitable clamping device for attaching flashing or waterproofing membrane to the seepage pan without damaging the flashing of waterproofing membrane shall be provided when required. Cast-iron floor drains shall be installed in all locations except where metallic waterproofing membrane is installed. Where metallic shower pan membrane is installed, polyethylene drain with corrosion resistant screws for securing the clamping device shall be provided. Cast-iron floor drains shall have a heavy cast-iron body and seepage pan and a chromium-plated bronze, nickel bronze, or nickel brass strainer. In lieu of a caulked joint between the drain outlet and waste pipe, a neoprene rubber gasket may be installed provided that the drain is specifically designed for the rubber-gasket mechanical joint. Certified independent laboratory tests indicating that the rubber gasket compression joint will not leak when tested with not less than 5 feet (1.5 meters) head of water for not less than one hour shall be provided. The rubber gasket joint shall be installed as recommended by the drain manufacturer. Drains shall be provided with separate cast iron "P" traps unless otherwise indicated. Drains shall have circular body, seepage pan, and strainer, unless otherwise indicated. Cast-iron floor and shower drains shall be as manufactured by Frost Ltd. Wade International or equal & approved.

2.06 ROOF AND BALCONY DRAINS

Roof and balcony drains shall be suitable for the type of roof finish they are to be installed into. They shall have a cast iron body with membrane flange and gravel stop and be fitted with a domical or flat grating as detailed on the drawings.

End of Section

SECTION 15440

PLUMBING FIXTURES

PART 1: GENERAL

1.01 SCOPE OF SECTION

A. This technical specification establishes the quality of workmanship of plumbing fixtures.

1.02 WORK INCLUDED

A. Provision of all labour, materials and the performance of all operations in connection with the 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. 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

BS 5572	Sanitary pipe work
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

1.05 OPERATION MAINTENANCE DATA

A. Comply with Section 15010.

1.06 WARRANTY

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

PART 2: PRODUCTS

2:1 PLUMPING FIXTURES

A. All plumping fixtures shall be local standard type

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 colors 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.

B. 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

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 labor, 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 Drawings.

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

1.03 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in the manufacture of thermal insulation materials whose products have been in satisfactory use for a similar application for not less than 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 Faber Mattresses.
BS 3958 Part 4	:	Bonded Preformed Man-made Mineral Faber Pipe Sections.
BS 3958 Part 5	:	Specification for Bonded Man-made Mineral Faber Slab.
BS 5422	:	Specification for the use of Thermal Insulation Materials.
BS 5970	:	Code of Practice for Thermal Insulation of Pipe work 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 waterproof, 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, sealant, 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:

* Rock wool mineral fiber (density 110-160 Kg/m^3).
* Pre-formed glass fiber sections (density 80-110 Kg/m^3).

The insulation shall be manufactured from long stranded mineral fibers, 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. Pipe work insulation shall be high density rigid resin bonded preformed rock wool mineral fiber sections of the thickness specified. The insulation shall comprise of two half sections with a factory applied reinforced aluminum foil covering hinging the two half mating sections for ease of installation. The covering shall have a 50mm side overlap of reinforced aluminum 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 fibers (free from shot and coarse fibers) bonded with a temperature resistant resin. The density shall be a minimum of 48 Kg/m^3 and the surface shall have a factory applied reinforced aluminum 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^oC)		
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

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, sealant, 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

A. Thermal insulation to pipe work shall be carried out by specialists and strictly in accordance with this Specification. No thermal insulation shall be applied to pipe work prior to witnessing of the pipe work 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 pipe work carrying hot fluids in circulation including flanges and bodies of valves on all sizes of pipe work.
(ii) External distributing mains and fittings above ground and in ducts, chases and trenches including all valve bodies and flanges.
(iii) Cold water cisterns, feed and expansion cisterns and vent pipe work in roof spaces and elsewhere, as indicated, to prevent the shedding of condensation.
(iv) Cold water pipe work (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.
(v) Buried pipe work shall have special forms of insulation as indicated.

Insulation shall fit closely on pipe work and other surfaces without gaps between.

C. The following lines shall not be insulated:

1. Pipe used solely for fire protection.
2. Chromium-plated pipe to plumbing fixtures.

D. All 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 pipe work 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 pipe work. The valve bodies and flanges in plant rooms and those components within the entire pipe work system 65mm dia. and above shall be insulated with the same insulation as the accompanying pipe work 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. Load bearing inserts of hardwood or phenolic foam complete with a factory applied vapour seal shall be used at support positions on chilled water pipe work. The insert shall be of the same thickness as the insulating material and cut such that 50 mm protrudes either side of the support. The pre-formed insulation section shall be butt jointed to the insert and the joint fully sealed with 75 mm wide aluminum tape to maintain the vapour seal.

At flanges, expansion joints and anchor points, particular attention shall be paid to sealing the insulation against water vapour ingress.

F. Each pre-formed rigid insulation section shall be butt jointed to the next, the point being fully sealed with 75 mm wide aluminum 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 aluminum side overlap shall be sealed with a suitable adhesive or 75 mm wide aluminum tape. Outer coverings shall not come into contact with pipe work and attachments.

G. 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 fiber or adhesive sheet.

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

H. The insulation on pipe work concealed from view within buildings will not require further protective cladding.

I. Insulation on pipe work exposed to view and within plant rooms 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.

J. Insulation on pipe work 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.

K. Thermal insulation on pipe work in concrete trenches shall be as that for insulation on pipe work exposed to the outside atmosphere.

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

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.

1.02 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 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 1566	Copper indirect cylinders for domestic purposes. In conjunction with BS 476, 864, 2779, 2871, 3456 and 5546.
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.

1.04 SUBMITTALS

A. Drawings - refer to Section 15010

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

1.05 OPERATION MAINTENANCE DATA

A. Comply with Section 15010.

1.06 WARRANTY

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

PART 2: PRODUCTS

2.01 WATER HEATERS

A. The electrical water storage heaters shall be water heaters of capacities as shown on the drawings. Electric water heater shall be as manufactured by " ARI STON" .

1- Electric water heaters shall be of the storage type, cylindrical shape, white enamel, insulated and complete with the following:

Capacity liters	Capacity watts
50	750
75	1000
100	1500

2- One chrome plated recessed type gate valve, at the inlet.
3- Thermometer.
4- Thermostat.
5- Electrical connection.
6- Relief valve.
7- Metallic supports and accessories required for its installation, connection, support, fixing and its satisfactory operation.

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 STERILIZATION

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 whichever is the greater, 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) 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

SECTION 15452

PUMPS

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:

i) Hot water pumps

1.02 WORK INCLUDED

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

B. The work includes testing of pumps.

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

1.03 REFERENCES

A. ASME Section 8D - Pressure Vessel.

B. U.L 1453 - Electric Boosters

C. U.L 174 - Household electric storage tank water heaters.

1.04 SUBMITTALS

A. Drawings - Refer to Section 15010.

B. Submittals - Refer to Section 01340 - procedures for submittals.

C. Product Data

1. Indicate pump type, capacity, power requirements.

2. Provide certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include N.P.S.H curve when applicable.

3. Provide electrical characteristics and connection requirements.

1.05 QUALITY ASSURANCE

A. Manufacturers qualifications: Company specializing in manufacturing the products specified in this Section with minimum ten years experience.

B. Provide pumps with manufacturers name plate, model number and rating/ capacity identified.

C. Ensure products and installation of specified products are in conformance with recommendation and requirements of the following organizations:

1. American Society of Mechanical Engineers (A.S.M.E).

2. National Sanitation Foundation (N.S.F)

PART 2: PRODUCTS

2.01 INSTALLATION

A. Pumps:

1. Hot Water Pumps

Supply and install as shown on the drawings two identical water pumps , having capacities as shown on the drawings, (One pump shall act as stand– by) .

Each of the aforementioned pumps shall be of the single suction horizontally centric–fugal single stage type, complete with direct coupled electric motor. The pump and motor assembly shall be mounted on a steel base with an approved type vibration pad (I.e. cork or similar).

End of Section

SECTION 15530

FIRE FIGHTING SYSTEM

PART 1: GENERAL

1.1 SCOPE OF WORK

A. The work shall be designed, erected and commissioned by specialist Fire Protection Engineers and Contractors, conversant with modern conception of First Aid fire protection effective and dependable in an emergency; the requirements of the local authorities on fire prevention shall be incorporated. The tender shall obtain the necessary approval to the system design and working drawings and the required acceptance certificates, if so required, under local rules, from such authorities.

B. The system proposed is purely an auxiliary protection system with a static fire reserve, fire pumps, and hose reels facilities at strategic locations in the building as indicated.

C. The Contractor shall furnish all labor, materials equipment, appurtenances, and tools, services all temporary work to provide and install the system comprising:

a. Hose reel with cabinets.
b. Fire fighting pump set.
c. Test line with flow meter to test the pumps.
d. Piping and valves for wet risers network.
e. Automatic air release valves.
f Portable fire extinguishers
g. All builders' works as required.
h. All electrical work associated with fire protection system.
i. Floor alarm control assembly.
j. Painting.
k. Installing, testing and commissioning.

1.2 GENERAL REQUIREMENTS

A. Piping shall be pitched to permit complete draining of the system.

B. Fire reserve shall not be used in any way to provide water for other purposes and shall be sufficient for minimum of 1 1/2 hour continuous operation of fire pump at full load.

C. All valves shall be readily accessible and risers shall be securely supported at each floor and shall not pass through extra hazard occupancy.

D. All valves shall be located where readily accessible secured from use of unauthorized personnel.

E. No item shall be installed delaying any of the existing Local Fire Department regulations. In all cases, however, installation shall comply with NFPA.

1.3 BUILDER'S WORK

A. All Builder's work in connection with supports, brackets, Clamps, walkways, closing of shafts, pump foundations, anchors, concrete bedding isolation of anti-vibration pads as necessary, all mechanical and electrical supports, electrical control panel, pressure switches, storage batteries shall be carried out to the entire satisfaction of the Engineer.

B. Cutting openings, constructing fire hose and extinguisher cabinets with frames of appropriate materials and size, chases and making good shall be carried out to the entire satisfaction of the Engineer.

1.4 PAINTING

A. All steelworks in connection with supports for pipes and equipment exposed to the elements shall be painted with two coats of an approved rust preventative paint.

B. All exposed surfaces or equipment, machinery, motors, pipe work, hangers, brackets, valves, etc., shall be painted with two undercoats and two finishing coats of enamel paint to approved color.

1.5 TESTS

A. Fire line piping shall be tested at 200-psi (1380 CPA) hydrostatic pressure. Pressure test shall be maintained for two hours without any perceptible drop in pressure.

B. Test shall be performed in the presence of, and to the satisfaction of the Engineer.

C. The Engineer or his appointed Agent would require witnessing the work tests of the pumping station when completed as packaged unit. The testing shall be carried out prior to leaving the manufacturer's works and shall include as minimum hydrostatic, mechanical, electrical and functional tests to determine compliance with the Specification requirements.

PART 2: SYSTEM COMPONENTS

2.1 PIPING SYSTEM

Refer to Section 15060 pipe, pipe fittings.

2.2 HANGERS SUPPORTS, ANCHORS & GUIDES

Refer to Section 15090 supports, anchors and seals.

Since coupling must be 65mm male instantaneous, horizontal mounting, 2-way breaching constructed to meet the requirements of BS 5041 Part 3 and boxes with BS 5041 parts. These units shall have spring-loaded non-return valves at the inlet ports and shall be fitted with 25mm-drain valve and drain cock. Blank caps are supplied as standard.

2.3 FIRE FIGHTING CABINETS

2.3.1 Fire Hose Cabinet (FHC-1)

A. Cabinet shall consist of two compartments, one compartment for hose reel and the other compartment for dry powder fire extinguisher type and capacity as shown on drawings.

B. Cabinet shall be made of hang gauge steel sheet (1.5mm) painted from inside and outside with Electro static powder paint with full recessed door handle. The color of the cabinet subject to the engineer's approval.

C. Each hose reel must be supplied by a pressure-reducing valve for an inlet pressure more than 5 bar.

D. Swing type for wet riser 25mm Dai, braided red rubber hoses according to BS 3169 of 30 meter length with necessary lock shield valve diameter 25mm at inlet, fog and spray nozzle of 5mm outlet and with integrated cut off valve shall be provided. The varying pattern and shut off feature of the nozzle shall be such as to prevent possibility of heavy water damage. The flow of water shall be quickly changed from straight stream to fog to shut off with a flick of a wrist.

E. The nozzle shall be cast in gun metal or brass, machined inside and outside and chromium plated, with nylon lever operated jet/spray and nozzle should at all times be left in the open position.

F. The manual reels feature flexible water inlets shall have separate wall-mounting brackets for easy installation.

G. The hose reels shall be of the automatic recess swinging type, swinging through 270 degrees. The Contractor shall order with hinges left or right, depending on locations.

2.4 AIR RELEASE VALVES

A. It shall be fitted at the top of riser to release air when the riser is charged with water or admit air when draining off.

B. When fitted the automatic air release valve ensures complete charging and draining of the riser column.

C. It shall be screwed 25mm BSP male.

2.5 PORTABLE FIRE EXTINGUISHERS

A. It shall be UL listed and FM approved.

B. Supply and install wherever shown on the drawings portable fire extinguishers of the capacities and ratings indicated on the drawings.

C. Each unit shall be complete with a frame for hanging, hose, discharge valve and pressure gauge.

D. Extinguisher types:

1. Carbon dioxide self-expelling type capacity as shown on drawings. Capacity for use in all flammable liquid services and electrical hazard spaces. Body shall be of red enamel galvanized steel body, flexible hose and horn discharge, squeeze lever, carrying handle, pressure gauge and mounting brackets. Extinguisher of this type is suitable for indoor use. Extinguishers serving guestrooms corridors shall be inside cabinet made of 1.5mm steel electrostatic powder painted to the approval of the architect.

2. Automatic dry powder extinguishers (ceiling mounted) should be at a maximum distance 1.8m above burner portable fire extinguishers suitable for use in boiler room and fuel tanks room. Body shall be of red enamel galvanized steel body, and mounting brackets, boiler room and fuel tanks must be protected by sprinkler system.

E. Extinguishers shall be of the approved type by Civil Defense.

PART 3: EXECUTION

3.1 OPERATING AND MAINTENANCE INSTRUCTIONS

A. Three sets of operating and maintenance instructions, on cloth, covering completely the operation and maintenance of fire fighting system, and automatic control shall be furnished to the Employer. In addition, one set of operating and maintenance instructions for each article shall be neatly framed behind glass and hung where directed.

B. The Contractor shall upon completion of the Contract, furnish a list of names of local manufacturers representatives, with telephone numbers in order to expedite the future ordering of replacement parts.

3.2 OPERATING SERVICES, MAINTENANCE AND GUARANTEE

A. After completion of all installation and required tests, the Contractor shall be responsible for and shall effectively maintain and uphold in good working condition to the satisfaction of the Engineer every part of the works for the period of twenty four (24) Calendar months from the date of issue of the Substantial Completion Certificate for the whole period.

B. The Contractor shall at his own cost make good all defects due to faulty design bad workmanship or the use of defective or improper material which shall occur during the said period, and shall replace at his own expense such parts or materials which in the opinion of the Engineer found unsatisfactory. During the said period the Contractor is required to carry on all maintenance work including cleaning, oiling, greasing, adjusting controls, checking oil levels, replacing defect parts and pressure etc., and painting at the end of the Maintenance Period.

End of Section

SECTION 15891

HEATING THERMAL 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 for heating items.

1.02 WORK INCLUDED

A. The work includes the provision of all labor, 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 Drawings.

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

1.03 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in the manufacture of thermal insulation materials whose products have been in satisfactory use for a similar application for not less than 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.

C. No thermal insulation shall be applied to pipe work and ductwork services until the installations have been inspected by the Engineer and tested in accordance with the relevant sections of this specification.

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 is 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 Faber Mattresses.
BS 3958 Part 4	:	Bonded Preformed Man-made Mineral Faber Pipe Sections.
BS 3958 Part 5	:	Specification for Bonded Man-made Mineral Faber Slab.
BS 5422	:	Specification for the use of Thermal Insulation Materials.
BS 5970	:	Code of Practice for Thermal Insulation of Pipe work and Equipment.

1.05 SUBMITTALS

A. Drawings refer to 15010

B. Products: Full manufacturer data confirming type and composition of all products including thermal characteristics.

C. Samples - Section of insulated pipe

Showing detail of resilient spacer at bracket location.

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 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, odorless, 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, sealant, tapes, adhesives, securing bands and protective cladding shall be as specified or equal and approved.

2.2 INSULATION AND LAGGING

A. Supply and install all insulation as specified in accordance with the following requirements and as manufactured by M/s. "Johns Manville" of USA or equivalent.

1. General requirements:

Insulation material shall be fiberglass having a thermal conductivity not greater than 0.23 Btu/sq.ft. Hr. or per inch thickness, with density of 65 kg / m3 for pipe insulation.

Pipe insulation shall be performed rigid sections. Equipment insulation shall be rigid slabs or mats. Insulation shall be applied after hydrostatic tests have been done. Insulation shall be applied in such away to prevent dew points & moisture droplets forming against metal under humid conditions.

2 Method of Insulation:

Before applying the insulation, surfaces shall be thoroughly clean & dry. All dirt, scale, rust, oil, grease or water shall be adequately removed.

Valves, strainers, fittings and flanges shall be insulated with insulating cement applied over galvanized wire mesh reinforcement, fixed onto the fittings.

Insulation shall not be applied on valves above the bonnet on strainer basket plugs or on nameplate. Any part of equipment that is normally removable for service shall be individually insulated.

3 Insulation Finish:

Insulation shall be protected against humidity by an aluminum foil vapor BA-rier. This protection shall be adequately fixed and held in place by an adequate number of non-corrodible bands and lap joints shall be made of good quality special adhesive.

The finished insulated surface shall present a neat, uniform and parallel appearance, whether concealed or exposed to view.

Hot water pipes on canopies in trenches and in pump room shall be covered, in addition, with an aluminum sheet metal jacket of not less than 18-gauge thickness. The Hot water pipes in shaft under tiles and inside the building shall be covered with canvas and foster 36/30. Also all ducts must be covered by canvas foster 36/30 after insulation.

Insulation shall be suitably taped and wired up to prevent due point and moisture droplets forming against the cold metal under humid conditions and shall receive two coats of finishing point in accordance with a color code as per ASHRAE recommendations.

4 the insulation thickness for the various items shall be as follows:

1.	Condensate piping 0.5"	1"	(inch)
2.	Hot water piping upto 2"	1.5"	(inch)
3.	Hot water piping 2.5" and larger	2"	(inch)

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, sealant, 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 manufacturer recommendations.

3.03 REFRIGERATION PIPEWORK INSULATION

A. The suction line from the evaporator to the compressor shall be insulated with foamed plastic as specified previously and shall be protected by a vapor barrier which shall not be broken between joints of sectional material or at discontinuities of valves or brackets.

B. Where possible the insulation shall be sleeved on the pipes before they are fitted. At all junctions, elbows, valves, and the like, it shall be carefully cut and fitted to the method recommended by the manufacturer.

C. All open edges, joints and the like, shall be sealed with an adhesive as recommended by the insulation manufacturer.

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 vapor 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