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مشروع :إعادة تأهيل
نظام التبريد الخاص بثلاجات مجمّع صوامع الجويدة

المواصفات الفنية للمشروع

P.O. Box: 11732
info@hreo-c.com
00962 42 00204
Jordan, Amman, Al-Hurriyah street, Noman Al-Hamshari complex, Bldg#333, 1st floor

(General Specifications)

A- General

- The Refrigerant Cooling & Freezing system employed in the project shall be, Rehabilitation of constructed system, utilizing refrigerant R22 .

- The system will provide Cooling & Freezing operation to all constructed Coolers (evaporators) units. An electronic expansion valve controlled by the Micro-processor system controller provides an optimum level of fill for each cooler (evaporator).

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- Contractor / Supplier: Firms in Jordan regularly engaged in servicing and installing Refrigerant Systems equipment of a similar quality and scope as this project for at least 5 years.

- Contractor / Supplier has to present a warranty based on system's brands (parts & assembly) as follows:
- 3 years from date of commissioning Full Warranty for all spare parts.
- 2 years from date of commissioning Full Guaranty.

B- Submittals

- The Contractor /Supplier must have official certificated experience in installing & servicing at least one type project with large capacities of the same selected brand name in Jordan or International.
- The selected brand shall be of the most known & famous top-quality types which meet or exceed specified requirements as the following brands:
- Valves: Oventrop , Hertasely and equal approval
- Seamless Sch.80 Pipes: China or Ukrainian or equal approval
- Aluminum Cladding: Arabian Gulf
- Rock Wall: Arabian Gulf
- The submittal shall show all technical data such as not limited to – total capacities, air flow rate, evaporative temperatures and any other values subject to engineer request.
- The Contractor / supplier shall specify the manufacturer name and all the technical data for the main components such as - not limited to -compressor, condenser fans, motors, microprocessor controller, and any other parts subject to request.
- Before starting the mechanical works the contractor must submit the coordination and shop drawings for the engineer approval, and not allowed to start the work before having copy of approved.
- After finishing the mechanical works, the contractor must submit the as - built drawings for the engineer approval.

C- Gas R22 Pumps:

- Pumps shall be Semi-hermetic and at least with IP-67 for all types. (Note: DC inverter Pumps are preferred).
- R22 pumps shall be vibration free with high-capacity (the lighter units are preferred) & the Pumps shall has Vibration eliminators.
- The pumps for R22 refrigerant.
- High Pressure /Low Pressure Adjustable Switches are required.
- Crank Case Heater are required
- Suction filters are required
- Multiple Suction Stubs fitted with ball valves
- Flexible pipes for each pump (Suction & Discharge)
- Pump Stand by for each set system.

D- Mechanical Oil Management System:

1- Oil level regulator & sight glass fitted on compressors suction are required.

2- Oil Sight Glasses & Filter in oil management System.

3- Oil Pressure Switch are required for safety.

E- Liquid Line Requirements:

1- Sight Glass
2- Ball Valves
3- Liquid Line Filter drier.

F- Liquid Receiver Requirements:

1- Inlet &Outlet valves for isolation
2- Sight Glass
3- Pressure Relief Valve

G- Refrigerant Piping

1- GENERAL

A. Pipework and fittings shall be as specified or approved equivalent and shall be manufactured fully in accordance with the relevant American Standards.
B. Pipework and fittings which have been subject to corrosion or damage shall not be acceptable.
C. This technical Specification establishes the type and quality of material and the standard of workmanship to be used in the supply and installation of Hydronic refrigerant piping.

2- WORK INCLUDED:

A. The work includes the provision of all labor, materials and the performance of all operations in connection with the supply and installation of Pipe and Pipe Fittings 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

3- APPLICABLE CODES AND STANDARDS:

A. The Pipes and Fittings and all associated materials and workmanship shall the most commonly used and relevant American Standards associated with pipework products and associated materials. However, the Contractor shall ensure that all applicable American Standards are complied with, whether listed here or not.
ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings.
ASTM A53/ASTM53M - Standard Specification for Pipe, Steel, Black and Hot Dipped, Zinc-Coated, Welded and Seamless.
ASTM A234/ASTM234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Services. OR BS standards.

- **SUBMITTALS**

A. Drawings - refer to relevant section.
B. Calculations - refer to relevant section .R22 pump head calculations shall be submitted for Engineer's approval based on Contractor's working Drawings.
C. Products - Submit full manufacturers data for every item.

4- OPERATION AND MAINTENANCE DATA

A. Comply with 15010

5- WARRANTY

A. Provide warranty in accordance with contract conditions.

6- COOLING R22 PIPE WORKS:

A. Pipework Materials
Nominal Diameter mm Material Standard
0-400 Diameter Black Seamless, Schedule 80 BS
B. All fittings for steel tube shall be heavyweight to BS.
C. All flanges to pipework shall be manufactured from mild steel in accordance the appropriate thickness required for the pressure specified.
Flanges shall be machine faced, trimmed at the edges and spot-faced for nuts. Bolt holes shall be drilled and not punched. Flanges for welded pipework shall be of the weld-neck type. The use of slip-on flanges will not be permitted. Nuts, bolts and washers shall be of bright mild steel and the bolts shall be of the correct length and show a minimum of two threads after tightening.
D. Pipework for screwing and welding shall be black seamless steel tube to BS, supplied with screwed and socketed ends for those screwed, and plain end for welded ones.
E. All fittings for screwed and welded pipework shall be wrought carbon steel pipe fittings to BS.
F. Bends and swept tees shall be used throughout. The use of elbows will not be permitted and square tees will be allowed only where vent connections are taken off.
G. All unions shall be formed in malleable iron as "Navy" pattern with conical ground bronze seats and taper threads. Unions haflat seats shall not be used.

7- EXECUTION

7.1 STORAGE

A. All pipework shall be stored on purpose made pipe racks of welded construction and of sufficient strength to support the entire weight of the materials without any noticeable deformation. The racks shall be such that all pipework is clear of the ground. All pipe work shall be free from rust.

- Furnish complete Pipe network with all accessories and specialties between Coolers (Evaporators) & Headers.
- The Contractor /Supplier shall be responsible for all Piping Limitations & sizing.
- Seamless pipes & fittings pipes specifications: Sch80 nitrogenized arc/med. All joints shall be accessible for future inspection & leak detection.
- Furnish thermal insulation for refrigerant piping of minimum 50 mm closed cell Rock Wall (50mm to 100mm) according to the size and (**Black Elastomeric Rubber or Polyolefin with optimum thermal conductivity)** insulation (the insulation must be covered with

aluminum layer to avoid humidity) with density about 50-80 kg/m³ and thermal conductivity not more than 0.033 W/m.k. All pipes shall be cladded with Aluzinc or aluminum cladding according to thickness in BOQ.

- Pipes shall be hanged on ceiling & walls by rubber lined split pipe clamps (Tightening scope, MS rods & anchors M12 or more (Stainless Steel Rods) min. Pipes shall be supported on roof by rubber lined split pipe clamps (Tightening scope), MS rods & anchors M12 min. mounted on concrete block bases or Galvanized Steel Hangers, or Cable Tray.

GENERAL INSTALLATION

A. The runs of pipework indicated on the Drawings are as accurate as possible. They shall be taken as diagrammatic only and all pipework shall be installed in the neatest possible manner in the space available. Where this involves special fittings or settings of pipe they shall be provided by the Contractor, even though they are not indicated on the Drawings. Where possible pipework shall be run parallel to, or at right angles to the building walls.

B. Where changes in direction are required and because of either lack of space or for neatness, fittings are not suitable, `offsets shall be installed as follows:

* A `Formed Bend', for a change in direction of less than 90 degrees.
* A `Single Offset', made up of two form bends, returning the pipe to the same direction.
* A `Double Offset', made up of four formed bends, returning the pipe to the same direction and the same axis.

In all instances offsets shall be `Cold Drawn' and on no account shall heat be applied.

All sets, double sets and springs shall be formed on long lengths of tube with as large a radius as possible and all shall be free from distortion.

C. All pipework shall be installed in such a manner as to ensure the automatic release of air and ease of drainage.

Any pipework fitted in an unsightly manner and not to the satisfaction of the Engineer shall be removed and re-fitted at the Contractor's own expense.

The Engineer shall have the right to inspect any pipe, pipe joint or pipe fitting in order to check quality of materials and workmanship or system operation. Any defects shall be made good by the Contractor at his own expense and to the satisfaction of the Engineer.

D. All pipes shall be at least 150mm from lighting and power cables or conduit unless otherwise specifically indicated on the Contract Drawings.

Pipes shall not be located above electrical equipment or in any other position where pipe leaks could cause liquids to come into contact with electrical equipment.

E. Pipework shall be installed such that there is a minimum clear distance of 75mm to the finished floor level and a minimum clear distance of 25mm to the finished wall face from adjacent pipework services.

All pipework which is to be insulated shall allow space for each pipe to be insulated around its whole circumference. Adequate clearance shall be provided between insulated pipework running together and adjacent to walls and floors. Clearances between insulation and floor and insulation and wall

shall be as for bare pipework.
All pipework fittings, valves and other components forming the piping installation shall be installed such that they can be dismantled and are accessible for repair removal of valves and equipment.
F. No joints shall be formed in the thickness of walls, floor slabs or roof slabs. No pipework shall be chased into floor slabs, roof slabs or walls. During the installation period open ends of pipework shall be capped off using purpose made plugs or blank counter flanges. Pipework shall be kept free of dirt and other foreign debris at all times.
All pipework buried in concrete, underground or in accessible trenching shall be wrapped in `Denso Tape' after painted with two layers of zinc rich antirust coating and thermal insulation. The tape shall be fixed strictly in accordance with the manufacturer's instructions.
G. All pipework shall be arranged so that thermal expansion or contraction may be readily taken up by bends or changes in direction.
H. All pipework shall be plumbed in the vertical and levelled to the turn of a bubble in the horizontal, except where wall of floor finishes deviate from the vertical or horizontal, in which case the pipework shall be parallel to the surface to present a neat appearance.
J. All high points shall be provided with automatic air vents with weep lines piped to drain. Automatic air vents shall be connected to full bore "air bottle" connections from service pipe to ensure good air collection.
All low points shall be provided with valved drain connections. Where these occur in areas not having free access, the Contractor shall pipe the drain position to the nearest drain point, to be agreed with the Engineer. Flanged, full bore dirt traps shall be provided at the bottom of each riser pipe.
K. Due allowance shall be made for all necessary reducers, matching flanges, etc. to equipment, whether detailed or not.
L. Where pipework crosses expansion joints in buildings, flexible couplings or axial compensators shall be employed in the pipework system to take account of both contraction and expansion of the pipework and the building structure. Axial compensators shall not be used on suspended pipework.
M. Where unions are used these shall have bronze spherical seats suitably ground in; flat seated unions shall not be permitted.
N. Eccentric reducers shall be used on horizontal pipework to assist with purging of air. Concentric reducers shall be used on vertical pipework.

WELDED and GROOVED PIPEWORK
A. Joints on all pipework in locations concealed from view shall be welded. At dismantling points or where the pipework is connected to an appliance, groundin spherical seated unions shall be used for pipework up to 50mm size and flanges shall be used for pipework 65mm size and above. All flange joints shall be flush and truly aligned and shall employ corrugated brass rings coated on both sides with an approved jointing compound. Chilled water risers shall be provided with flanged joints every 12 meters (approx.).

B. Pipework below 100mm, bore may be oxyacetylene or electric arc welded. However, the Contractor shall allow only for electric arc welding for pipework

above 100mm bore. If the tenderer does not wish to conform to this clause, he must so state at the time of submitting his Tender.

The Contractor shall allow for the Engineer to inspect the filler rods or electrodes before commencement of work. These rods and electrodes must be stored carefully to avoid deterioration.

C. All welded joints shall be executed by first-class certified welders working under skilled supervision. All craftsmen shall be experienced in this particular class of work for a period of not less than 12 months immediately preceding the commencement of the welding work called for in this Specification.
Each weld forming part of the installation shall be stamped by the welder responsible for the work with his own identifying die.
D. During the welding process proper attention shall be given to correct alignment of pipe and fittings. The correct degree and duration of preheat shall be applied and the weld made with proper welding rod or electrode between properly prepared ends. Upon completion of the weld, the correct degree and duration of post-weld treatment shall be applied to ensure normalization of the weld. All welds shall be of good clean metal, free from slag, of even thickness and contour, well fused with the parent metal, annealed and hammered upon completion and finished smooth prior to painting.
E. No rusty pipework or fittings shall be used for welding prior to being thoroughly wire brushed.
"Flame cut" entries into pipework may be used, but cut edges shall be filed smooth and all swarf and cuttings removed from the bore of the pipe prior to the fitting being welded to the pipe. Square tee welds shall not be permitted. Long radius branch bend fittings shall be used for all sweep connections from mains in lieu of welding tees.
F. The Engineer reserves the right to have up to 2% of all welds cut for his examination. The cutting of selected welds and remaking shall be carried out at no extra cost. Should a test weld prove to be unsound and not in accordance with the Specification, the Engineer shall be entitled to cut further test pieces of work by the welder responsible for the fault. A maximum of 20%of this faulty welder's work may be cut out and remade at no extra cost. Should further welds prove to be unsound the Engineer reserves the right to instruct all welds made by the faulty welded be cut out and remade at no extra cost. Should the Engineer's opinion be that the unsound/imperfectly made welds are due to faulty workmanship the Engineer shall have the right to insist on the suspension of the welder responsible.
G. In addition, the Engineer reserves right to demand 'x-ray' analysis of any welds up to an initial number of 10. Should any weld fail then a further 15welds shall be examined by 'x-ray'. Should any of the second batch of welds fail then the Engineer shall have the right to instruct the court and replacement of all welds and the replacement of all welders previously employed on site.
In the event that all failed welds prove to be the work of a single other the foregoing stipulation will be relaxed such that all the welds of the designated welder shall be cut out and replaced.
Radiographic examination of welds shall be carried out in accordance with BS

2910 and the Contractor shall employ a specialist firm approved by the Engineer to carry out this work.
H. All pipe work above 50 mm in diameter shall be connected by Victaulic Grooved Couplings with EPDM gaskets. Carbon steel grooved fittings to ASTM A53 40 shall be used for pipe sizes larger than 50 mm in diameter.

All pipework 50mm and below shall be wielded and where it is concealed from view where it shall be welded.
I. All pipework joints shall be cleaned thoroughly to remove traces of paste and hemp prior to painting with a final coat of red oxide.

PAINTING AFTER INSTALLATION
A. All ferrous surface shall wire bushed and painted with one coat oxide paint after installation.

HYDRONIC PIPING SUPPORTS, HANGERS AND BRACKETS

PART 1 GENERAL
1.1 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 Hydronic Supports, Hangers and Brackets.
1.2 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 Hydronic Supports, Hangers and Brackets 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.

1.3 APPLICABLE CODES AND STANDARD
A. The Supports, Hangers and Brackets and all associated materials and workmanship shall comply with the latest relevant British Standards in all respects.

1.4 SUBMITTALS
A. Drawings - refer to relevant specification section.
B. Calculations:
Contractor shall submit calculations for all supports, guides and anchors.

B. Products - submit full fabrication details for each bracket hanger and support.

1.5 OPERATION AND MAINTENANCE DATA
A. Comply with Relevant specification section.

1.6 WARRANTY
A. Provide warranty in accordance with contract conditions.

PART 2 PRODUCTS

2.1 GENERAL
A. All supports, hangers and brackets shall be of an approved manufacture as described herein and detailed on the drawings.
B. All steel products used for support systems if not manufactured from malleable cast iron or stainless steel shall be painted with one coat of red oxide paint except external ferrous brackets and supports which shall be galvanized and epoxy coated.
C. All drop rods shall be galvanized and sized to suit the bracket type and system weight but in no case shall be less than 6 mm diameter.
D. All materials used for support systems shall be compatible with the material they are supporting. Generally steel pipework and duct work systems shall be supported by cast steel clips, copper pipework by copper or brass clips and UPVC pipework by brass or PVC clips. Where galvanized steel pipework is used all pipework clips shall be galvanized.
E. Where brackets are exposed to view, they shall be of a chrome plated finish.
F. Fixings to concrete and masonry shall be of the expanding bolt or wedge anchor type selected in accordance with the manufacturer's recommendations and suitable for the imposed loads. Where fixings are to be made close to the RD&I Building Construction IFB # 202101789 / GS 15511-2 outside edge of concrete or masonry structures resin bonded fixings shall be
used to reduce the risk of fracture. All fixing methods shall be subject to the approval by the Engineer.
G. Brackets for fixing to woodwork light weight partitioned walls shall be of the screw on pattern.
H. Details of brackets, guides and anchors for chilled water pipework shall be submitted to the Engineer for approval, together with a schedule of applied loads.
I. All supports, hangers and brackets shall be of the seismic type. Calculation of loading along with support and hanger selection, and shop drawing shall be submitted to Engineer for approval.

PART 3 EXECUTION

3.1 STORAGE
A. All continuous lengths of channel angle and screwed rod shall be stored on purpose made pipe racks of welded construction and of sufficient strength to support the entire weight of the material without any noticeable deformation. The racks shall be such that all material is clear of the ground.
B. All raw metal shall be wire brushed and painted with one coat of red oxide paint prior to storage.
C. All general support materials shall be stored within a well-lit container on purpose made compartmented racks or shelving. The materials shall be separated by means of their type and size and laid out in an orderly manner ease of identification.

The configuration of anchors, guides and supports for all piping systems shall conform to the requirement of the specialist manufacturer of expansion devices bellows, guides.

3.2 GENERAL

A. All systems shall be adequately supported in such a manner as to permit free movement due to expansion, contraction, vibration or other changes in the system. Supports shall be arranged as near as possible to joints and changes in direction.
B. Vertical rising pipes and ducts particularly in shafts shall be adequately supported at the base to withstand the total weight of the riser. Under no circumstances shall branches from vertical rising pipes be the means of support for the vertical pipework. Intermediate chilled water brackets shall have droprods and loadsprings to permit longitudinal movement of the supported pipework.
C. Hangers for horizontal systems at high level shall be supported from angle or channel rolled steel sections suitable for securing to the structure.
D. Pipework shall be independently supported. Double stacking of pipes from the same support will not be permitted.
E. Adjustable mild steel hangers on steel pipework systems shall be used with swivel joints at the pipe rings and spherical washers at the top of the hanger rods. Pipe rings shall be malleable cast iron or fabricated steel made in halves and secured by bolts or screws. Malleable iron hinged pipe rings may also be used but caliper hooks shall not be permitted. Pipework 65 mm diameter and over shall not be supported using malleable iron.
F. Where rollers and chairs are required, these shall be performed and where used singularly they shall have restraining "U" straps or bolts formed over the diameter of the pipe and bolted to the base support of the chair. The "U" straps RD&I Building Construction IFB # 202101789 / GS 15511-3 or bolts shall be fitted to allow movement of the pipe without binding. Continuously threaded "U" bolts will not be permitted.
G. The spacing of basic supports shall be determined in accordance with the following table. Where one support carries more than one pipe of different diameters the spacing shall be determined by the requirement of the smallest diameter. Guides and anchors shall be provided in addition to basic supports to control expansion and contraction.

to solar expansion and contraction.

Maximum spacing of fixings for internal piping

Type of piping	Nominal size of pipe mm	Spacing horizontal run m	on vertical run m	Spacing on
Steel complying with ASTM BS	15	1.800	2.400	
	20	2.400	3.000	
	25	2.400	3.000	
	32	2.700	3.600	
	40	3.000	3.600	
	50	3.000	3.600	
	65	3.400	3.900	
	80	3.600	4.500	
	100	3.900	4.500	
	125	4.000	4.500	
	150	4.500	5.400	
	200	5.000	5.500	
	250	5.500	5.700	
	300	5.800	6.000	

H. Heating water pipework shall be provided with insulator blocks between the pipe and bracket. The thickness of the insulator blocks shall be the same as the insulation. The vapour seal shall be continuous over the insulator block.
I. All horizontal pipework in plant rooms and external plant areas shall be support using spring hangers for a distance of 100 pipe diameters from the point of connection to plant.
J. Pipework passing through floors and walls shall be provided with sleeves which shall be built-in to the construction or fire barrier.
The sleeve shall be of the same material as the pipe and of sufficient diameter to allow the insulated pipe to pass through it without deforming the insulation.
Where the insulation has insufficient fire rating it shall be replaced for the sleeve length, plus 100mm at each side, with a material of adequate fire rating with the same outside diameter as the thermal insulation butting up to it.
Pipes passing through sleeves shall be located centrally in the sleeve.
All sleeves shall be retained in position by lugs or plates prior to final positioning and making good.
Sleeves shall not protrude beyond the finished surface.

METERS AND GAUGES

1.1 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 Meters and Gauges.

1.2 WORK INCLUDED

A. The work includes the provision of all labor, materials and the performance of all operations in connection with the supply and installation of Meters and Gauges 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.

1.3 APPLICABLE CODES AND STANDARDS

A. The Meters and Gauges 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 meters and gauges. However, the Contractor shall ensure that all applicable British Standards are complied with, whether listed here or not.

BS 1365 - Specification for short range short stem thermometers.

BS 1780 - Specification for bourdon tube pressure and vacuum gauges.

BS 2765 - Specification for dimensions of temperature detecting elements and corresponding pockets.

BS 3792 - Recommendations for the installation of automatic liquid level and temperature measuring instruments on storage tanks.

1.4 SUBMITTALS

A. Drawings refer to relevant specification section.

B. Products - full manufacturers data for each item.

1.5 OPERATION AND MAINTENANCE DATA

A. Comply with 15010

1.6 WARRANTY

A. Provide warranty in accordance with contract conditions.

1.7 EXTRA MATERIALS

A. Comply with specifications.

2.1 THERMOMETERS

A. Thermometers shall be fitted on the pipework systems and ductwork systems as indicated on the Drawings and as described in this Specification. Thermometers shall be of the bimetal pattern having dials of 150mm. diameter with stove enamel cases and plated bezels. Thermometers on ductwork systems shall be provided with sliding flanges for ease of mounting, and for pipelines, separate brass pockets screwed 15mm. BSP shall be fitted. All exposed thermometers shall be weatherproofed.

PRESSURE AND ALTITUDE GAUGES

A. Pressure and altitude gauges shall be fitted in the positions shown on the Drawings and as described in this Specification. All gauges shall be of the bourdon pattern having dials not less than 150mm. diameter with cases of chromium plate milk steel. All Outdoor gauges shall be made of stainless steel.

B. Each gauge shall be provided with a polished brass cock having an ebonized lever handle and where required a suitable syphon pipe connector. Gauges shall each be provided with an adjustable red pointer, set to indicate the working pressure on head of the systems. Gauges shall be of the glycerin

filled type.
Pressure Gauges: - Dials shall be calibrated in bars and meters R22 from zero to a maximum of twice the operating pressure.

2.3 MANOMETERS

A. Manometers shall either be of the inclined scale type for all pressure differentials of up to 250 Pa, or "U' tube for all pressure differentials in excess of 250 Pa.
B. The manometer shall contain colored fluid (red) and the scale shall be protected by a metal (non-ferrous) or sturdy plastic casing.

2.4 TEST PLUGS AND INSTRUMENTS

A. Test plugs shall be fitted on the pipework systems as indicated on the Drawings to provide a convenient means of checking the temperatures and pressures across heat exchangers, pumps automatic control valves chillers and cooler coils.

3.1 STORAGE

A. Meters and gauges shall be stored on compartmented racks or shelving in a well-lit container separated and clearly marked for ease of identification.
B. Meters and gauges shall be stored in protective coverings to protect them from the ingress of dirt and moisture.
C. Comply Section 01600

3.2 DIAL THERMOMETERS

A. Thermometers shall be installed in brass thermometer pockets filled with a recommended conducting fluid where shown on the drawings, at each branch circuit and at the inlet and outlet of each item of major plant including boilers, chillers and coils.
B. Dial thermometers shall be provided on the supply air discharge of each air handling unit.
C. One stem thermometer suitable for insertion into self sealing test points shall be provided for every 50 number test points installed on the system.

3.3 PRESSURE GAUGES

A. Pressure gauges shall be installed at the inland outlet of each pump and chiller, adjacent to each major item of plant and where indicated on the drawings.
B. Differential pressure gauges shall be connected via syphons and gauge cocks across each pump. Where duplicate pumps are installed, one gauge shall be so connected with isolating cocks so that the head of each pump can be read.
C. One pressure gauge suitable for insertion into self-sealing test points shall be provided for every 50 number test points on the system.

3.4 MANOMETERS

A. Manometers shall be installed across each individual filter in a position where it can be easily inspected.
B. Each manometer shall be clearly marked with the clean filter pressure drop and the pressure drops at which the filter shall be cleaned or changed.
C. One bottle of replacement fluid shall be supplied for every two manometers fitted to the system.

R22-VALVES

PART 1 GENERAL

1.1 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 valves.

1.2 WORK INCLUDED

A. The work includes the provision of all labor, materials and the performance of all operations in connection with the supply and installation of valves 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.

1.3 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in the manufacture of valves whose products have been in satisfactory use in similar applications for not less than 10 years.

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

1.4 APPLICABLE CODES AND STANDARDS

A. The valves and all associated materials 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 valves 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 - Specification for Ferrous Flanges and Bolting for Pipes, (Part 1 (Valves and Fittings.

BS: 4504 - Specification for Copper Alloy and Composite Flanges.
)Part 2(

BS: 5150 - Cast Iron Wedge and Double Disk Gate Valves.

BS: 5151 - Cast Iron Gate (Parallel Slide) Valves.

BS: 5152 - Cast Iron Globe and Globe Stop and Check Valves.

BS: 5153 - Cast Iron Check Valves.

BS: 5154 - Copper Alloy Globe, Globe Stop and Check, Check and Gate Valves.

15411-1

BS: 5156 - Diaphragm Valves.

BS: 6683 - Guide to Install and Use of Valve.

1.5 SUB

A. Draw- refer to Section 15010

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

1.6 OPERATION AND MAINTENANCE DATA

A. Comply with Section 15010.

1.7 WARRANTY

A. Provide warranty in accordance with contract conditions.

PART 2 PRODUCTS

2.1 GENERAL

A. Bodies of valves and cocks on mild steel pipework up to and including 50mm size shall be of cast gunmetal or bronze. Approved valves having hot-pressed bodies may be offered as an alternative. Bodies of valves 65mm size and larger shall be of cast iron.

Castings and pressings shall be of good quality, clean and smooth and free from scale or flaws.

B. Holes in covers or in gates for screwed portions of spindles shall have full threads of a length not less than the diameter of the spindle over the thread. Glands shall be machined to provide a running fit between the spindle and the stuffing box. Stuffing boxes shall be properly packed or fitted with "O" rings, which may be located in plastic bushes.

C. Valves and cocks on mild steel pipework up to and including 50mm size shall have taper flanged ends, and of 65mm size and above shall have flanged ends to BS 4504 Tables 6/2 or 6/5 for welded type and Table 6/4 for screwed type.

D. All screwed valves shall have heavy hexagonal reinforcements at openings, threads of

ample length to ensure sound joint and heavy shoulders to prevent over entry of pipes, fittings or adapters.

a. Flanged valves shall have flat-faced flanges conforming to BS 4504.

E. All valves and valve components (e.g. seatings, packings, etc.) shall be suitable for the working pressures, operating temperatures and conditions of the fluid handled in the systems in which they will be installed. All valves shall be hydraulically tested to at least twice the working pressure of the systems in which they will be installed. Where necessary valves shall have extended spindles to facilitate insulation. The declared pressure rating of the valve shall be equal to or greater than the maximum test pressure of the system.

F. The working pressure for valves is to be based on the total static pressure in the pipework in addition to the operating pressure exerted by the pumps on the system.

G. Each valve shall have the manufacturer's name or trade mark, the BS number, the nominal diameters, the nominal pressure rating and body material all identified in the form of stamped or cast body markings.

2.2 ISOLATING VALVES

A. Isolating valves up to and including 50mm nominal bore shall be bronze or gunmetal

gate valves to BS 5154 with solid wedge discs, non-rising stems, screwed in bonnets, metal hand wheels and screwed ends to BS 21 (ISOR/7).

B. Isolating valves for 65mm nominal bore and above shall be cast iron gate valves to BS 5150 with solid wedge discs with bronze trim and seatings, bolted on cast iron bonnets, high grade graphited asbestos packings, rising stems with outside screws and yokes, cast iron handwheels and flanged ends to BS 4504.

C. Where shown on the drawings or specified herein, lock shield valves shall have easy clean shields or enclosures to match the inlet valves. As a minimum requirement, one loose key shall be provided for every 25 No valves of the same spindle size.

2.3 NON-RETURN VALVES

A. Non-return valves up to and including 50mm nominal bore shall be of the bronze swing

pattern with screwed ends and conforming to the requirements of BS 1400.

B. Non-return valves 65mm nominal bore and above shall be of the cast iron swing pattern
with bolted access covers, solid discs with bronze trim and seatings all to BS 5153 and
flanged ends to BS 4504. An air cock shall be fitted to the bolted cover for air release purposes.

2.4 DRAIN VALVES

A. Drain valves shall be of the bronze straight type glanced pattern complete with brass
hose union and malleable iron lever conforming to the requirements of BS 1400.

2.5 AIR COCKS

A. Air cocks shall be nickel or chrome plated, of the spoutless pattern anwith screwed thread. Two loose keys shall be provided for each installation having up to 10 air cocks
and one loose key shall be provided for every additional ten air cocks.

2.6 AUTOMATIC AIR VENTS

A. Automatic air vents shall be of bronze or gunmetal construction and be suitable for hot
water. Vents shall be designed to eliminate air from the system automatically without passage of water. The unit shall be of the float operated type screwed connection on the outlet to enable the unit to be piped to a remote drain position.

2.7 HOSE BIBS

A. Hose bibs shall be bronze ASTM B62 or red brass ASTM B124, with coupling union
elbow replaceable hexagonal disc, hose thread spout, vacuum breaker, chrome plated where exposed.

2.8 PRESSURE RATINGS

A. Unless otherwise indicated, use valves suitable for 1616 kPa and 121 degrees C.

2.8 PRESSURE REDUCING VALVES

A. Valve shall be provided with by pass arrangement complete with all valves and pressure gauges as detailed on drawings. Valve shall be selected a way from cavitation
range.

PART 3 EXECUTION

3.1 STORAGE

A. All valves shall be stored within a well-lit container on purpose made compartmented
racks or shelves, constructed in a similar manner to support the entire weight of materials without noticeable deformation.

B. The valves shall be separated by means of their type and size and laid out in an orderly
manner for ease of identification.

C. Valves shall be supplied and stored with purpose made or manufactured plugs to prevent ingress of dirt.

3.2 GENERAL INSTALLATION

A. Valves with screwed ends shall have a union installed adjacent to the valve for ease of
dismantling.

B. Where possible, valves shall be installed with the stem in the vertically upright position.

However, all valves shall be installed in a manner such that they are readily accessible for ease of operation.

C. Sufficient clearance shall be allowed for the application of thermal insulation, valve boxes, etc. and to ensure that full travel of the valve stem can be achieved.

3.3 ISOLATING VALVES

A. Separate isolating valves shall be provided at all pipe work service of each plant equipment and on pipe main and submain, except where flow measuring or regulating valves are required and these valves can be used for isolating purposes without affecting their measuring or regulating functions.

3.4 DRAIN VALVES

A. Drain valves shall be installed at all system low points on the dead side of isolating valves and on all items of plant to facilitate emptying down and removal.

B. Line sized drain valves shall be installed at the end of each pipework run and at the base of each pipework riser to enable the system to be adequately flushed.

3.5 AIR VENTING DEVICES

A. Air venting devices shall be installed at all system high points.

B. Automatic air eliminators shall be complete with galvanised mild steel relief pipework,
taken to within 1.5 m of the floor level with a gunmetal isolating valve and extended to
a position where any discharge will not damage building fabrics, decorations or the like.