SECTION 15410

PLUMBING PIPING

PART 1 GENERAL

1.01 SCOPE OF SECTION

A. This technical Specification establishes the minimum requirements for the equipment to be incorporated into the above ground Soil, Waste and rainwater and hot and cold water services plumbing pipework.

It also establishes the quality of materials and workmanship to be used in the supply and installation of the systems.

1.02 WORK INCLUDED

A. Provision of all labour, materials and the performance of all operations necessary for the supply and installation of pipework and fittings of the soil and waste systems as specified herein and as detailed on the Drawings.

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

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

No works shall commence on the site until the design has received the approval of the Engineer.

1.03 QUALITY ASSURANCE

A. Manufacturers: The contractor shall only propose the use of materials produced by firms who have been regularly engaged in the manufacture of plumbing pipework systems and whose products have proved satisfactory in similar service for not less than 10 years.

B. Installer: Firms proposed for the installation of the plumbing pipework systems shall have been regularly engaged for at least 5 years in the installation of plants of a similar type, quality and scope as is required for this project.

1.04 APPLICABLE CODES AND STANDARDS

A. The plumbing pipework shall comply fully with the latest relevant British and Saudi Arabian Standards in all respects.

B. The following are the most commonly used and relevant British and Jordanian Standards associated with Soil and Waste Systems. However the Contractor shall ensure that all applicable British and Jordanian Standards are complied with, whether listed here or not.

BS: 3380 - Wastes (excluding skeleton sink wastes) and bath overflows. In conjunction with BS 2779, 3643 and 5572.

BS: 3505 - Specification for uPVC pressure pipes.

BS: 3943 - Plastic waste traps. In conjunction with BS 2779 and 3380.

BS: 3974 - (Part 1 & 2) Pipe supports.

BS: 4118 - Glossary of sanitation terms.

BS: 4514 - Unplasticized PVC soil and ventilating pipes, fittings and accessories.

BS: 4576 - Unplasticized PVC rain water goods. In conjunction with BS 2494 Part 2, 4514.

BS: 4660 - Unplasticized PVC underground drain pipe and fittings. In conjunction with BS 2494, 5955 and CP312.

BS: 5255 - Plastic waste pipe and fittings. In conjunction with BS 21, 2494, 2779 and 4515.

BS 5911 - Plain and reinforced concrete pipes and fittings.

BS 843 - Thermal-storage electric water heaters. In conjunction with BS 3456, Sections 2.21, 2.7 an 3.9 and 3999 Part 2.

BS 1010 - Specification for drains off taps and stop valves for water services.

BS 2494 - Elastomeric joint rings for pipework and pipelines. In conjunction with BS 1179, 3502, 3574, 4250, and 4947.

BS 2779 - Pipe threads. for tubes and fittings where pressure-tight joints are not made on the threads

BS 3284 - Polythene pipe (type 50) for cold water services. In conjunction with BS 21 and 5556.

BS 3505 - uPVC pressure pipes for cold potable water. In conjunction with BS 21 and CP 312.

BS 3605 - Seamless and welded austenitic stainless steel pipes and tubes for pressure purposes. In conjunction with BS 3600.

BS 3955 - Electrical controls for household and similar general purposes

BS 3974 - Pipe supports.
Part 1 & 2

BS 4346 - Joints and fittings for use with uPVC pressure pipes. In conjunction with BS 3505, 3506, 4576, 4660, 5481 and 6209.

BS 4368 - Compression coupling for tubes. In conjunction with BS 1706, 2051, 2779, 2871, 3601, 3602, 3605, 3643, 4368 and Din 2353.

BS 5114 - Performance requirements for joints and compression fittings for use with polyethylene pipes. In conjunction with BS 1972, 1973,2494 and 3284.

BS 5433 - Underground stop valves for water services. In conjunction with BS 21,61,864, 1972, 3284, 3885 and 5728 Part 1 and 2.

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 1387 - Galvanised steel medium and heavy duty.

BS 6675 - Servicing valves (copper alloy) for water services. In conjunction with BS 864, 1400, 2871, 2872 and 2874.

BS 6700 - Design, installation, testing and maintenance of services supplying water for domestic use within buildings and their curtilages.

BS: 5481 - Unplasticized PVC pipes and fittings for gravity sewers. In conjunction with BS 2494, 4660 and CP 312.

BS: 5572 - Sanitary pipework. In conjunction BS 416, 437, 1188, 1387, 1710, 1973, 2871, 3506, 3868, 4118, 4514, 5254, 5255, CP3.

BS: 6283 - Safety devices for use in hot water systems. In conjunction with BS 864, 2056, 2779, 2872, 2874, 3075, 3457, 4504, 5412 and 5413.

BS: 8000 - Part B Section 3 - Above ground drainage

BS: 6367 - Drainage of roofs and paved areas

In addition to the above standards the works shall be in accordance with all local bye-laws, local municipality requirements and the manufacturers recommendations.

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 SOIL WASTE AND RAINWATER PIPEWORK

A. Pipework and fittings

1. All main soil, waste and rainwater stack pipes shall be installed in UPVC.

B. Vent / antisiphon pipework

1. All vent and antisiphon pipework pipes shall be installed in UPVC pipework .

2. The jointing of the pipework and fittings shall be by the use of solvent weld sockets and shall be carried out in full compliance with the manufacturer's recommendations.

3. Expansion joints and pipe support brackets shall be installed in accordance with the manufacturer's recommendations and BSCP312.

4. Sleeves shall be provided where pipes pass through walls or floors to allow free axial movement of the pipes. Sleeves shall be of a material compatible with the pipes they protect, non combustible and two pipe sizes larger than the pipe being protected and packed with mineral .

5. Where such pipes pass through fire compartment walls, floors or ceiling cavity barriers the pipes shall be installed with fire sleeves.

C. PVC branch soil waste and vent pipework

1. The soil, waste and vent pipework shall be UPVC TO BS4514.

2. The soil waste and vent pipework shall have solvent joints in general, with expansion joints where specified.

3. All pipework shall be adequately supported at the centers indicated in Table 13 of BS5572. All PVC pipework shall be supportering with extensioexpanding ragbolt fixings in the brickwork. Where the brackets are to be used as anchor points they will be made to grip the pipe by means of a rubber sleeve, and must support the pipe with additional studding and back plates to the duct wall. All horizontal waste pipework shall be supported on the manufacturer's screw-to-wall brackets.

4. All waste pipes shall fall from fittings to their respective main soil pipe so as to be self draining. Branch vent pipes shall rise towards their respective main vent pipe so as to be self venting.

5. All branch waste pipes to a range of fittings shall have an access provided on the pipe in an accessible position at the end of the run. All traps shall be adequately ventilated in order that the seal may be maintained.

6. Water closets shall be connected by flexible self sealing w.c. "Multikwik" connector, and shall be discharged into adjacent soil pipe.

D. PVC traps

1. All basins shall be provided with an appropriately sized PVC bottle trap to BS3934.

2. All sinks, etc, and other mechanical and specialist items of equipment, shall be provided with an appropriately sized white PVC "P" or "S" trap to BS3943 (unless such specialist item of equipment is supplied with its own integral trap).

3. Traps to be chrome plated where exposed to view, and in these situations a chrome plated cover plate shall be provided to mask the penetration of the waste pipe through the duct wall or structure. Approval shall be obtained from the local Public Health Authority of all types of traps that are intended for installation. All traps shall have a 75 mm water seal.

2.02. POTABLE COLD WATER SERVICES

A. PIPEWORK AND FITTINGS

1. Pipes:

a. XLPE Pipes to JS 1021, 1022, 1023 / 1995 and matching fitting for Domestic cold water from water manifolds to Sanitary Fixtures.

b. Galvanized Steel seam welded Pipes to BS 1387 medium weight and fitting to BS 21 for main Pipes and Booster Pumps installation.

B. SYSTEM DESCRIPTION

1. This section relates to the installation of potable cold water systems at all facilities.

2. Incoming pipeline from the municipality water mains shall be provided with a water meter located in an area free of wheeled access, but positioned to enable the meter to be read without entering the building served by the metered connection. The loction shall be as shown on drawings.

3. Internal Potable Water Installation:

i. All cold water supply piping inside the building shall be made of XLPE unless other wise indicated on relevant drawings. The piping layouts are as indicated on the drawings.

ii. Potable water supply is provided for all uses.

C. PIPEWORK SUPPORTS

Pipework supports and hangers will comply with Section 15511.

D. Thermal insulation shall comply with Section 15450.

PART 3 EXECUTION

3.01 SOIL WASTE AND RAINWATER PIPEWORK

A. Workmanship

1. Materials and workmanship to be of best quality and executed in accordance with the Specification, drawings and manufacturers recommendations.

2. Where any pipe is required to be shortened it shall be cut off square and cleanly with an approved pipe-cutting machine.

3. Where special joints or jointing materials are shown for pipes of any materials, they shall be of an approved type and manufacture, and the

joint shall be made in accordance with the manufacturer's instructions, or as directed.

4. Responsibility shall be assumed to identify and install all necessary expansion couplings and fire sleeves throughout the installations.

5. All plant, pipes and fittings etc shall be thoroughly cleaned of all foreign matter before installation. Each section of the installation shall be clean and free from any obstructions whatsoever before proceeding with the next section of the installation.

6. All vertical soil, waste and vent pipes are to have access doors provided on each floor, above flood level of fittings served. Access to be provided in ducts to sanitary services. All vent pipes are to terminate 300 mm above roof level, with suitable weathering slate apron and vent cowl or copper wire balloon.

7. Flexible joints are to be provided wherever pipes cross expansion joints.

8. All soil, waste, vent and rainwater pipes shall be the size and positions indicated on the drawings to take the discharge from the branch waste and vent pipes, sanitary fittings and equipment adjacent thereto.

9. On completion the whole of the work is to be handed over in a sound and clean condition. In the event of any pipe being fractured from any cause whatsoever after having been (to all appearances) properly installed, responsibility shall be assumed in every instance and any such defective pipes shall be replaced for approval.

10. All pipework shall be erected to present a neat and orderly appearance, arranged parallel to or at right-angles to the structural members of the buildings, giving maximum headroom and shall not obstruct windows or doorways. Pipes shall bend round piers, projections and into recesses forming part of the structural works whether so indicated on the drawings or not. Pipework shall be erected such that there is a minimum clearance of 75 mm to finished floor level and a minimum clearance of 25 mm to finished wall faces.

11. Slopes of drainage system (gravity) shall be a minimum of:
    Foulwater - 1%
    Drain and rainwater pipes - 1%

B. The discharge pipework shall be so installed as to minimize the risk of blockage. Access covers and/or rodding eyes are to be positioned such as to enable maintenance equipment to be inserted into the system(s) to permit cleaning or clearing of all sections of the system(s).

The pipework system and fittings are to be installed so that broken or defective parts can be easily removed and replaced.

The discharge pipework shall ensure that there is no leakage of contaminated water or foul air into any building.

C. The work shall be set out and responsibility assumed for the accuracy of the same, and the position of all fittings shall be approved by the Employer's representative. When first setting to any work, consideration must be given to the work of other trades.

D. Responsibility shall be assumed for leaving all unfinished works in a safe conditions during the progress of the works.

All materials & plant are to be installed and protected in such manner as to be adequately covered against damage and deterioration, and during the execution of the work the open ends of all pipework shall be temporarily plugged off by means of blank ends and compression caps respectively.

E. Vent pipe roof termination

1. Discharge stacks complete with domicil cages shall terminate not less than 300 mm above the roof, 900 mm above and not less than 3000 mm, measured horizontally from any window or air conditioner.

2. Where the stack passes through floors, ceilings and roofs, the openings are to be perfectly sealed-off by proprietary fittings. They shall terminate with neoprene aluminium weathering slate, weathering collar; and a balloon grating on 180° bend.

F. Connection to sanitary fittings

All outlets shall be trapped and provided with accessible and adequate means of removal and cleaning. The traps shall be designed to be self-cleaning all surfaces and joints are to be smooth.

1. All traps with outlets for pipes up to and including 50 mm shall have a minimum water seal of 75 mm.

2. Traps with outlets for pipes of over 50 mm shall have a minimum water seal of 50 mm.

The waste pipes to the various sanitary fittings shall be of the following sizes:

Wash basins	32 mm diameter
W.C's	100 mm diameter
Shower bath tray	50 mm diameter
Floor gullies	75 mm diameter
Sink	40 mm diameter
unit tubular tray	50 mm diameter

G. Self siphonage tests

The contractor shall undertake tests for self-siphonage and induced siphonage in branch discharge pipes by fitting each appliance to over flowing and then discharging by removing the plugs and discharging the W.C(s) at the upstream end of the discharge pipe. All seals are to remain in the traps.

The numbers of sanitary appliances to be discharged for this performance test are enumerated below:

Type of Use	Number of appliances of each kind on the stack	Number of appliances to be discharged simultaneously		
		9 litres WC	Wash basin	Kitchen sink
Domestic	1 to 9 24 to 24	1 1	1 1	1 2
Congested	1 to 24 5 to 9 10 to 13 14 to 26 27 to 39 40 to 50	1 1 2 2 3 3	1 2 2 3 4 5	

H. Testing and commissioning

1. All tests requested by Local Municipality or engineer on the entire installation shall be carried out, and all necessary appliance and equipment for this purpose shall be supplied.

2. Provision shall be made to carry out any test requested at any time during the progress of the works or after their completion.

3. Whilst phased testing may be carried out (which may or may not have been witnessed) it will be required to demonstrate the watertightness, alignment, and level and cleanliness of the whole installation seven days prior to the installation.

4. This requirement will be discharged by the applying a full running water test to the whole installation as described below and by the drawing through of a drain profile which will be provided to the required detail.

5. All tests shall be carried out in the presence of the Employer's representative, and seven days notice shall be given readiness to test any section of the installation. Test Certificates shall be submitted to

the person witnessing the test, for their signature of approval, to the effect that the system satisfies the requirements of this Specification.

6. All sections of works must be pretested to satisfy that the system will pass the required test, prior to carrying out the main test.

7. The Test Certificate shall be required to be completed for all sections of the installation.

8. After erection and immediately prior to sealing in, all rainwater, main soil, waste, vent and branch soil, waste pipes, shall be checked throughout for obstructions and finally tested for soundness.

9. The above ground sanitation and rainwater pipe installation shall be subjected to two air tests, one of 75 mm water gauge for a minimum period of 15 minutes prior to connection of sanitary fittings and building in of pipework, and a second air test on completion of the system with all traps and WC's connected when the test pressure shall be 45 mm water gauge for a minimum period of 15 minutes. Water test according to Jordanian codes may be used as an alternative.

10. At start of testing sanitation and Rainwater Pipework shall be checked for alignment and stability; mechanical joints shall be re-torqued where necessary.

11. Access doors shall be removed, felt washers greased and doors replaced.

12. The whole system shall be rodded through with an appropriately sized disc type plus the allowance shall also be made for testing to the Local Authority requirements and for carrying out separate and independent tests if required.

13. The provision shall also be made for obtaining an acceptance test certificate form the Local Authority on completion of the works. The test for the Local Authority shall be allowed for as an addition to the tests required under this specification.

3.02. POTABLE COLD WATER SERVICES PIPEWORK

A. Product handling

1. All products shall be delivered in manufacturer's original protective packaging. All products shall be inspected at time of delivery for damage and for compliance with Specifications. Any products that are found to be damaged or not in accordance with the Specifications shall immediately be repaired or removed from the site and replaced. Repairs shall not be undertaken before the Engineer's review of Contractor's proposed action.

2. All products shall be handled and stored as recommended by the manufacturer to prevent damage and deterioration. The Contractor shall supply handling equipment such as lifting beams, reinforced canvas slings, protective padding, struts, cradles, etc., required to handle the products without damaging hardware or linings and coatings.

3. Products shall be protected against damage and the ambient conditions both during transport, site storage and immediately up to the time products are installed. Precautions shall be taken to protect the product from mechanical damage and the effect of sunlight heat, until the backfilling operations have been completed. All site storage areas shall be shaded.

B. Installation of pipework

1. Pipework from the water meter to the inside of the buildings where running below ground level shall be galvanized steel pipes (class B) and the distribution within Toilet, shall be XLPE pipes.

   Joints in buried pipework shall be kept to the absolute minimum. Marker tapes shall be laid 150 mm above the pipework. If valves are required, they are to be in a valve chamber with the surface box lettered to indicated what service is below them.

2. The underground pipework shall be laid in 200 mm of sand or stone free bedding material and wherever possible in straight lines to uniform gradients. The clearance between the pipework and footings of the buildings is not to be less than 200 mm. If less, the pipes shall be installed in a flexible sleeve.

3. All pipework shall run vertically or at an inclination of 1° to the horizontal to enable the whole system to be drained off either through the system or through a valve discharging externally with an air gap to prevent contamination by backflow. When the pipework is drained down, air is to be allowed into the system to prevent failure or damage to the hot water cylinder. A manual air inlet value shall be fitted to the high point in the system to achieve this.

4. Where pipes are run in walls, floors, etc., all pipework shall be insulated.

5. All pipework shall be erected to present a neat and orderly appearance, arranged parallel to or at right-angles to the structural members of the buildings, giving maximum headroom and shall not obstruct windows or doorways. Pipes shall bend round piers, projections and into recesses forming part of the structural works whether so indicated on the drawings or not. Pipework shall be erected such that there is a minimum clearance of 75 mm to the finished floor level and at least 25 mm to the finished wall faces.

6. All fittings shall, as far as practicable, be the same size as the tubes and pipes connected to them. Bushed outlets will only be accepted if the required outlet size of a fitting is not of standard manufacturer. Eccentric bushings and square tees shall be used where concentric bushing and pitcher tees might cause air to be trapped in the system. Elsewhere square tees shall be confined to dead-leg branches of domestic hot water supply systems and on cold-water branches to fitting or ranges of fittings.

7. Elbows shall be used, where practicable, in preference to bends Square elbows will not be permitted.

8. Pipework shall follow the contours of walls and shall be graded to ensure venting and draining. The clearance between pipework (or the insulation) and the wall and any other fixtures shall be not less than 20 mm.

9. Purpose-made sets or springs may be used where it is necessary to deviate from a straight run.

10. Sets or springs in tubes of 50 mm size and above shall be fire-made and tubes shall remain circular after setting.

11. Eccentric reducing sockets shall be used where changes of bore are made in runs of nominally horizontal pipework to facilitate air venting and draining.

12. Tubes shall be reamed after cutting and shall be free from burrs, rust scale and other defects and shall be thoroughly cleaned before erection. Open ends left during the progress of work shall be temporally closed with purpose-made metal or plastic plugs or caps, or blank metal flanges.

13. Where pipe passes through walls, ceilings, shall be provided. Pipe passing through flooring shall be provided with approved type floor and ceiling plates fastened securely to the pipe. The sleeves to be of the same metal as the pipe.

14. All entry and exit holes to or from a building for pipework services shall be sealed and plugged. For service conditions below 60°C the sealant shall be mastic compound, Above this temperature it shall be silicon rubber. Where the pipework enters the building through a large hole or duct, a mild steel blanking plate not less than 6 mm thick shall be built into the walls of the hole or duct. The service pipes shall pass through clearance sockets welded to the plate and the space between pipe exterior and socket interior shall be sealed and plugged.

15. All pipes shall be secured by copper or copper alloy clips or brackets to allow for thermal movement and support at spacings not exceeding

300 mm for copper pipes up to 38 mm diameter and 40 cms for those up to 75 mm diameter.

16. Pipework of 75 mm size and larger subject to expansion and contraction and hung from supports shall be suspended on swivel hangers unless otherwise agreed.

17. Hangers for horizontal pipework shall be supported in accordance with the requirements of Section 15412 support, Hangers and Brackets.

18. Piping that is insulated shall be secured by clips that allow sufficient space behind the back of the pipe for the pipe insulation to be properly installed.

19. All pipework shall be installed so that the vertical distance between the discharge point and overflow level of the receiving appliance shall not be less than 25 mm for taps and/or fittings up to and including 20 mm and 70 mm for those over 20 mm to prevent contamination as result of backflow of water.

20. A 15 mm diameter washout pipe, discharging outside the building will be provided at ground floor level to drain the system. The top of the outlet is to be in excess of 70 mm from the ground or receiver.

B. Storage

1. 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.

2. Pipework fittings shall be stored within a well-lit container made compartmented racks or shelves. The fittings shall be separated by means of their type and size and laid out in an orderly manner for ease of identification.

C. System testing

1. The Contractor shall ensure that all pipework is watertight to the satisfaction of the Engineer and shall supply all pressure gauges, meters, hoses, pumps and other temporary supports, equipment and manpower necessary for carrying out pressure tests.

2. The Contractor shall, during testing, check the satisfactory operation of each valve installed under the Contract.

3. Before filling or pressure testing is started the Contractor shall re-check pipes and valves for cleanliness and shall re-check the operation of valves. The open ends of the pipes shall normally be stopped off by

blank flanges or capped ends additionally secured where necessary by temporary struts and wedges.

4. Potable water system shall be tested with water to 1.5 times the normal system working pressure or 6 bar whichever is greater while uncovered but adequately anchored. The testing shall be carried out in sections if necessary. If a section should fail the test, the Contractor shall trace and repair all leaks and defects and retest the section before any further pipes or section of adjacent pipework are laid.

5. The system shall be filled with potable water and all air expelled. After the system has been completely filled, the pressure shall be steadily and gradually increased until the testpressure hasbeen reached. if any loss is recorded, repairs shall be made and the test re-run.

6. Written records of every test clearly identifying the tested system together with time of test and name of testing Engineer in tabulated format shall be submitted for review by the Engineer upon completion of the test.

D. Flushing and disinfection

1. Potable water pipelines shall be flushed with potable water after completion of pressure testing and before introducing disinfection.

2. Liquid chlorine, calcium hypochlorite shall be used for disinfection. Where chlorine is used, it shall be introduced only in conjunction with proper equipment and under the supervision of qualified personnel familiar with the physiological, chemical and physical properties of liquid chlorine and who are suitably trained and equipped for dealing with any emergency which may arise from it's use.

3. Potable water from a suitable source shall be injected with flow control at a constant and measured rate. The water shall receive a dosage of chlorine fed at a measured rate to ensure chlorine concentration in the water entering the pipe is maintained at a minimum of 50 mg/1. The chlorine residual shall be measured at regular intervals to ensure that the required chlorine concentration is maintained.

4. During the application of chlorine, valves shall be manipulated to prevent the treatment dosage from flowing back into the line supplying the water. Chlorine application shall continue until the entire pipeline is filled with chlorine solution.

5. After 24 hours retention, the chlorinated water shall be flushed out with potable water, until the chlorine concentration in the water leaving the pipeline does not exceed 21 mg/1. Chlorine residual determination shall be made to ascertain that the heavily chlorinated water has been removed from the pipeline.

6. Flushing water shall be discharged only to sites or into conduits. Discharges which cause damage, create nuisance or health hazard, or interfere with the work of others will not be permitted.

END OF SECTION 15410

SECTION 15411

PLUMBING VALVES

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 valves.

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 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.

1.03 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.

1.04 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 (Part 2)	-	Specification for Copper Alloy and Composite Flanges.

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.
BS: 5156	-	Diaphragm Valves.
BS: 6683	-	Guide to Install and Use of Valve.

1.05 SUB

A. Draw- 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 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 screwed 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 a sound joint and heavy shoulders to prevent over entry of pipes, fittings or adapters.

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.

2.02 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.

2.03 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.

2.04 DRAIN VALVES

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

2.05 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.

2.06 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.

2.07 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.

2.08 PRESSURE RATINGS

A. Unless otherwise indicated, use valves suitable for 862 kPa and 232 degrees C. and 1379 kPa minimum and 121 degrees C.

PART 3 EXECUTION

3.01 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.

3.02 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.

3.03 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.

3.04 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.

3.05 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.

END OF SECTION 15411

SECTION 15412

PLUMBING SUPPORTS, HANGERS AND BRACKETS

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 Supports, Hangers and Brackets.

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 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.

1.03 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in the manufacture of Supports, Hangers and Brackets 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 pipework systems with at least 5 years successful installation experience on projects of a similar nature.

1.04 APPLICABLE CODES AND STANDARDS

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

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

BS 5572 : Sanitary pipework.

BS 1387	:	Specification for screwed and socketed steel tubes and tubulars and for plain end steel tubes suitable for welding or for screwing to BS 21 Pipe Threads. 8mm - 150 mm dia.
BS 3505	:	uPVC pressure pipes for cold potable water. In conjunction with BS 21 and CP 312.
BS 3974 (Part 1 & 2)	:	Pipe supports.
ASTM F 437	:	Threaded CPVC Plastic Pipe Fittings Schedule 80
ASTM F 439	:	Socket type CPVC Plastic Pipe Fittings Schedule 80
ASTM D 1784	:	Rigid PVC Compounds and CPVC Compounds.

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 months warranty in accordance with the contract conditions.

1.08 EXTRA MATERIALS

A. Comply with Section 15010.

PART 2 PRODUCT

2.01 GENERAL

A. All supports, hangers and brackets shall be of an approved manufacture as herein and indicated on the drawings.

B. All steel products used for support systems if not manufactured from malleable cast iron or stainless steel shall be either galvanised or painted with one coat of red oxide paint.

C. All drop rods shall be galvanised 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 shall be supported by cast iron and steel clips, copper pipework by copper or brass clips and UPVC pipework by brass or PVC clips. Where galvanised steel pipework is used all pipework clips shall be galvanised.

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 manufacturers recommendations and suitable for the imposed loads. Where fixings are to be made close to the outside edge of concrete or masonry structures resin banded fixings shall be used to reduce the risk of fracture.

G. Brackets for fixing to woodwork or light weight partitioned walls shall be of the screw on pattern.

H. Purpose made girder clamps shall be used where any system is supported from steelwork and only with the approval of the Engineer.

PART 3 EXECUTION

3.01 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 for ease of identification.

3.02 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.

C. Hangers for horizontal systems at high level shall be supported from angle or channel irons 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 brackets. All pipe brackets over 50 mm diameter shall be submitted to the Engineer and approved by the Engineer prior to manufacture.

Where rollers and chairs are required, these shall be preformed 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 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 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.

Maximum spacing of fixings finternal piping

Type of piping	Nominal size of pipe mm	Spacing on horizontal run m	Spacing on vertical run m
Steel complying with BS 1387	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	4.500
	80	3.600	4.500
	100	3.900	4.500
	150	4.500	5.400

Copper complying	15	1.800	2.400
with BS 2871	20	2.400	3.000
	25	2.400	3.000
	32	2.700	3.600
	40	3.000	3.600
	50	3.000	4.500
	80	3.600	4.500
	100	3.900	4.500
	150	4.500	5.400
Unplasticized	12	0.530	1.060
PVC complying	15	0.610	10220
with BS 3505	20	0.685	0.370

Figures are for normal ambient temperatures below 20°C. For temperatures above 20°C the pipe manufacturer should be consulted. Based on average temperature of 80°C.

END OF SECTION 15412

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

1.05 SUBMITTALS

A. Drawings - refer to Section 15010

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

Shall be the same size as the pipe except that cleanout plugs larger than 100 mm will not be reduced. 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 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 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 20 kg/m^2, and extend not less than 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 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. 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 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.

Water hammer arrestors shall be fitted as required and indicated on the drawings.

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 pvc body as detailed on the drawings.

END OF SECTION 15430