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SECTION TWO/ONE

GENERAL TECHNICAL SPECIFICATION

PIPEWORK AND ACCESSORIES

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PIPEWORK AND ACCESSORIES

2.1.1 DEFINITIONS

For the clarification of this Specification, the following definitions relating to differing types of heating systems shall apply:-

a] Low pressure hot water (LPHW) heating systems

A system open or closed to the atmosphere which operates at temperatures to a maximum of 95 degree centigrade.

2.1.2 TUBE AND PIPES

Tube and pipes conform to the following for the differing types of installations:-

a] LPHW heating and Chilled Water Systems

Shall be installed utilising black mild steel tube, heavyweight to BS 1387/1985.

Where copper pipework is called for under section three of this Specification, then light gauge copper to BS 2871, Part 1, 1971 Table X shall be used.

b] DHWS Systems

Domestic Hot Water Service Systems shall be installed utilising light gauge copper to BS2871, Part 1, Table X.

c] CWS Systems

Cold water service systems shall be installed as follows:-

1. Internal within buildings:-

   Light gauge copper to BS 2871, Part 1, 1971 Table X.

2. Buried Pipework, external to buildings:-

   Light gauge soft copper to BS 2871, Part 1, Table X

OR

Blue Polyethylene to BS 6572 1985. (For pipes up to and including 63mm)

For above 63mm WAA Information and Guidance 4-32-03 (1SSN 0267-0305) is applicable.

OR

PVC-U to BS 3505, 1986.

As called for under relevant section of this Specification and/or to comply with the requirements of the Local Water Authority.

d] Natural Gas Service

Gas pipework shall be installed as follows:-

1. Internal within buildings:-

   Black Mills steel tube, heavyweight to BS 1387/1985

   Where copper pipework is called for under relevant section of this Specification, then light gauge copper to BS 2871; *Part 1*; 1971 Table X shall be used.

2. Buried pipework, external to buildings:-

   Medium density polyethylene to BGC/PSPL; Part 1 as called for under relevant section of this Specification and/or to comply with the requirements of the Local Gas Authority.

e] Oil Fuel Lines

Oil lines, including tank filling, vent and drain pipes shall be installed utilising black mild steel tube, heavyweight to BS 1387/1985.

f] System Cold Water Feeds, Vents and Overflows

The above shall be installed utilising light gauge copper to BS 2871, Part 1, 1971, Table X throughout.

2.1.3 PIPEWORK FITTINGS

a] LPHW heating and Chilled Water Systems

Sweep black malleable iron fittings to BS 143 of the banded type as manufactured by Messrs Crane Limited, on pipework 65mm and above, black heavyweight welding fittings to BS 1965 shall be used.

For pipework 65mm and above, black heavy weight welding fittings to BS 1965 shall be used.

All pipework within plant rooms, builderswork ducts, ceiling voids, trenches and all inaccessible areas shall be welded throughout irrespective of size.

Where copper pipework is called for under relevant Section of this Specification, fittings shall be in accordance with Clause 2.1.3. b.

b] DHWS Systems

On pipework up to and including 54mm, copper capillary fittings to BS 864 shall be utilised as manufactured by Messrs IMI Yorkshire Fittings Limited.

For pipework 65 mm and above, bronze welded gunmetal fittings shall be used, as manufactured by Messrs Donald Brown (Brownall) Limited, with bronze weld flanges to B.S.T."E" utilised for disconnecting.

c] CWS Systems

Where copper pipework is specified under Section Three of this Specification, then fittings shall be in accordance with Clause 2.13.b.

If polyethylene or PVC pipework is to be installed, then compatible fittings, in accordance with the pipe manufacturers recommendations, shall be used.

d] Natural Gas Service

In accordance with Clause 2.1.3.a

e] Oil Fuel Lines

In accordance with Clause 2.1.3. a

f] System Cold Water Feeds, Vents and Overflows

In accordance with Clause 2.1.3.a

g] Bends, Elbows, Tees

Long radius elbows, twin elbows and swept tees shall be used throughout, except on drain points and venting points where they shall be square.

Reducing tees shall be used in preference to equal tees and reducers. Where reducers are used, they shall be eccentric on horizontal pipework, or concentric on vertical pipework, bushings or connectors will not be allowed.

All fittings shall be of the same material and finish as the tube to which they are fitted.

h] Unions

Unions shall be used only where necessary to facilitate erection and maintenance of equipment, or as indicated on the contract drawings. Where used, they shall be on the "navy" type consisting of two screwed halves with ground spherical faced joints between two gunmetal seats up to and including 50mm diameter. BS143.

i] Flanges

Flanges for MS pipework shall conform to BS No. 10 and be of forged steel, machined full face, and welded or screwed to the pipe. They shall conform to the appropriate BS Table for the pressure and temperature to which they will be subjected, but shall not be of lower standard than BS Table E.

Flanged joints shall be made with well graphited klingerite full face joint rings and approved jointing compound.

BSS brass or nickel corrugated rings may, where applicable, be utilised but again full faced.

Black bolts and nuts with washers shall conform to BS 916 with no more than 15mm thread protruding through the nut.

Flanges to be employed on 65mm diameter tube and above.

Bolts used to effect cold-draw on expansion fittings shall be removed after pulling up and replaced by bolts of the correct length.

j] Dezincification of Fittings used on Copper Installations

Materials used on services must be zinc free, and shall be of gunmetal construction. Suitable insulating nipples shall be used at connections of dissimilar metals on water supply services to minimise electrolytic action.

k] Offsets

All bends and offsets are to be made utilising proper bending machines, and are to be used in preference to fittings at all times.

The work shall be carried out in a neat and workmanlike manner in accordance with the opinion of the Consulting Engineer. Where this work is not considered to be of acceptable standard by the Consulting Engineer, then the work shall be removed and re-installed at no additional cost to the Contract.

2.1.4 PIPEWORK JOINTS

a] All screwed joints shall be made in accordance with the provision of BS 21: 1985 and shall be clean threaded, pulled up tightly and made with an approved jointing material or unsintered PTFE tape.

b] All welded joints shall be made in accordance with BS 2640:1982 Class II Oxy-Acetylene Welding of Steel Pipelines and Pipe Assemblies for Carrying Fluids or BS 2971:1982 Class II Metal-Arc Welding of Steel Pipelines and Pipe Assemblies for Carrying Fluids, incorporating all amendments.

Each welder, whether carrying out work on or off site shall hold a valid NJIC Certificate of Competency.

The names of welders together with copies of their Certificates of Competency shall be submitted to the Consulting Engineer for his approval before any such welder executes any welding.

Each welder on the Contract shall be provided with a steel marker die by his Employer and after he has completed a welded joint he shall mark same with his identification symbol. The symbol for each welder shall be agreed with the Consulting Engineer prior to commencement of work on site.

On completion of the first ten production welds by each welder, three of these welds may be selected by the Consulting Engineer and subjected to laboratory tests. The costs for carrying out the tests by an independent source and the re-instatement of the work shall be included within the Tender.

Should any of the three welds tests be rejected or require to be repaired then the Contractor shall provide at his own expense radiographic/ultrasonic evidence of the acceptability of all that particular welders welds.

All branch welds shall be set-on branches.

Distance between nearest points of two adjacent branch welds shall be not less than twice the diameter of the larger branch pipe.

The opening in the main shall be equal to the bore of the branch and where branches are 25mm or less in diameter the opening in the main shall be drilled. Where openings are flare cut, all loose scale, oxide etc., shall be removed before welding the branch.

Where swept branches are used the branch shall be used as a template for the opening in the main.

Where branch joints, bosses and drain pockets are made, special attention shall be given to ensure that there is no obstruction by welding metal or tube projection and to ensure full bore is maintained.

All welds shall be carefully made-up as to ensure that perfect continuity of the cross section is maintained.

All ungalvanised mild steel pipe 100mm and above shall be arc welded. Where arc welding is employed on the site it shall be used for all steel welding flanges.

The Contractor shall protect the building fabric by using suitable mats and shall take every precaution against scorching or fire damage and shall provide in the immediate vicinity of any welding work, two suitable fire extinguishers for use in an emergency.

Staging and protection from the weather shall be provided by the Contractor to enable the welding operation to be performed correctly and screened from view in the case of arc welding.

c] All brazed joints on copper pipelines shall be carried out to BS.1723. The filler rod and flux (if necessary) shall comply in all respects to BS.1845 type CP2 except that type CP1 rod shall be used where specifically called for in any subsequent clause.

d] All capillary joints on copper pipelines shall be formed as follows:-

In order to promote solder flow and bonding, surfaces to be jointed shall be cleaned free from dirt, oxide films, residual greases and oil. The socket of all fittings and tube ends for a distance of up to 10mm and beyond the end of the fitting shall be thoroughly cleaned using fine steel wool. Special wire brushes shall be used for the cleaning of sockets of 28mm and smaller sizes.

Care should be taken to prevent particles of steel wool entering the fitting or pipe.

All surfaces, once cleaned, shall not be touched with bare hands or oily gloves.

Under no circumstances shall emery cloth be used for cleaning purposes.

All flux shall be that recommended by the fitting manufacturer and where possible shall be cold water soluble.

All prepared joints shall be completed within a single working day.

Heat shall only be applied by means of an approved type torch. Oxy-acetylene torches shall not be used for heating capillary fittings. Additional solder shall not be applied and any joint found to have additional solder applied will be rejected.

Before any capillary joints are installed the Contractor shall arrange for one of his workmen to prepare and make, at the bench, a tee joint typical of the size to be employed at the site. This joint shall be prepared and sectioned in the presence of the Consulting Engineer. If accepted by the Consulting Engineer as a satisfactory joint, and being reasonably free from flux and foreign matter, the joint shall be labelled and retained by the Consulting Engineer for possible future reference.

2.1.5 PIPEWORK CLEANLINESS

a] Cleanliness of Pipes

The Contractor shall at all times observe the installation and storage procedure as recommended by the pipework manufacturer.

Pipework and similar materials shall be adequately supported and stored on properly made racks, approved by the Consulting Engineer, to prevent bending and distortion, and the ends shall be closed and threads protected by means of purpose made end caps.

The storage of pipework, or other materials, by laying them on earth will not be permitted.

Care shall be exercised during the erection of pipework to ensure that foreign matter is not allowed to enter or remain in the pipes.

When any portion of the installation is left open for any purpose whatsoever, the open end(s) shall be temporarily sealed with purpose-made plugs or blanking caps manufactured from metal or plastic material. Rags, paper or similar substances, shall not be used under any circumstances.

A valve fitted at the end of a discontinued pipe shall not be considered satisfactory to prevent the ingress of foreign matter.

Failure to comply with this instruction shall mean that the Consulting Engineer shall have the right to instruct the Contractor that pipework so left unprotected shall be dismantled for such lengths as the Consulting Engineer requests and the pipework blown through and/or cleaned at the Contractors expense.

All black mild steel pipework installed throughout the Contract whether utilising screwed or welded joints including mild steel, brackets, drop rods etc., after erection shall be suitably wiped clean and one coat of red oxide anti corrosion paint shall be applied, by the Contractor.

b] Pipe Cutting

Piping shall be cut clean and square with the axis of the pipe, except where a bevelled edge is required for welding, using a saw, pipe-cutting tool or machine.

Before installation the ends of the pipes shall be correctly prepared by filing or grinding, and any internal burrs shall be removed by filing or reaming to a distinct countersink. The Consulting Engineer may call upon the Contractor to reveal any neglect of reaming, the Contractor will be required to remove, re-fix and re-test at his own expense as much of the pipework as may be deemed necessary by the Consulting Engineer.

2.1.6 PIPEWORK SUPPORTS

a] Pipework shall be adequately supported in such a manner as to permit free movement due to expansion and contraction.

The spacing of supports shall not exceed the centres given in Tables (A), (B) and (C) based upon the smallest pipe in a group.

b] All non rigid plastic pipework shall be continuously supported.

c] Pipework supports shall be arranged as near as possible to joints, and each support must take its proportion of the pipe weight.

d] Vertical rising pipes shall, in addition, be adequately supported at the base to withstand the total filled weight of the riser. Branches from risers shall not be used as a means of support for the riser.

e] Hangers for horizontal pipework at high level shall be supported from angle or channel irons supplied by the Contractor, and suitable for building in or otherwise securing to the structure. Adjustable mild steel hangers shall be used, with swivel joints at the pipe rings, and shall be malleable fabricated steel, made in halves and secured by bolts.

f] On copper pipework all pipe clips, supports or brackets shall be of cast brass construction, and fixing shall be of non-corroding construction.

g] Insulation material shall be inserted between chilled water and incoming mains water pipework and pipework supports to obviate condensation occurring on exposed supports. This material shall be installed to the same thickness as the pipework insulation to be applied.

h] Where called for the Contractor shall support pipework within plantrooms with anti-vibration hangers.

i] Brackets in trenches shall comprise suitable steel section spanning trench walls clear of trench floor, with a pipe laid inside the section to support the pipes. Pipes shall be held in place by U-Bolt guides. Alternatively, the Contractor may employ the use of floor mounted rollers and chairs with matching roller, chair guide assemblies.

Where U-Bolts are used as guides, they shall be bent to a radius of 1.5mm greater than the outside radius of the pipe, with the two ends threaded and secured to the supporting steel.

The diameter of the rod shall be 15mm for pipes of 150mm to 80mm bore, 10mm for pipes of 65mm to 40mm bore and 5mm for pipes of 32mm bore and below.

j] A bracket on the draw off line, on hot and cold water services, is to be provided on each side of every stopcock, while they shall be elsewhere arranged at appropriate equal intervals.

k] All pressurised cold water and fire protection mains are to be supported as previously specified but with purposed-made lateral anchors on both sides of each change of direction, to oppose the tendency of the bends and sets to open under pressure.

l] Detail of all pipe brackets and anchor points along with the method of incorporation to the structure shall be produced by the Contractor to a scale not less than 1:20 for approval by the Consulting/Structural Engineer a minimum of 14 days prior to the incorporation into the works.

TABLE (A) SUPPORTS FOR STEEL PIPEWORK RECOMMENDED MAXIMUM SPACING

SIZE OF TUBE [mm]	HORIZONTAL RUNS EXPOSED [m]	INSULATED [m]	VERTICAL RUNS INSULATED OR EXPOSED [m]
15	1.8	1.8	2.4
20	2.4	2.4	3.0
25	2.4	2.4	3.0
32	2.7	2.4	3.0
40	3.0	2.4	3.7
50	3.0	2.4	3.7
65	3.7	3.0	4.6
80	3.7	3.0	4.6
100	4.0	3.0	4.6
125	4.5	3.7	5.5
150	5.5	4.5	5.5

TABLE (B) SUPPORTS FOR COPPER PIPEWORK RECOMMENDED MAXIMUM SPACING

SIZE OF TUBE [mm]	HORIZONTAL RUNS EXPOSED [m]	INSULATED [m]	VERTICAL RUNS EXPOSED OR INSULATED [m]
15	1.2	1.2	1.8
22	1.2	1.2	1.8
28	1.8	1.5	2.4
35	2.4	1.8	3.0
42	2.4	1.8	3.0
54	2.7	1.8	3.0
65	3.0	2.4	3.7
76.1	3.0	2.4	3.7
100	3.0	2.4	3.7
133	3.7	3.0	3.7
159	4.5	3.7	3.7

TABLE (C) SUPPORT FOR PLASTICS PIPEWORK RECOMMENDED MAXIMUM SPACING

NORMAL BORE OF PIPE [mm]	HORIZONTAL RUNS [m]	VERTICAL RUN [m]
1/2	0.75	1.5
3/4 to 1	1	1.8
1.1/4	1	2
1.1/2	1.2	2.4

2 to 2.1/2	1.4	2.8
3	1.8	3.5
4 and over	2	4

2.1.7 PIPEWORK CLEARANCES

Pipes shall be so fixed as to give the following minimum clearances between the pipe or Insulation (where specified) and adjacent surfaces as follows:-

Wall	25mm
Ceilings	100mm
Finished Floor	100mm
Adjacent Pipes, both insulated	25mm
Adjacent Pipes, both uninsulated	150mm
Adjacent Pipes, only one insulated	75mm
Adjacent Pipes, to conduit or trunking insulated	25mm
Adjacent Pipes, to conduit or trunking uninsulated	100mm

Under no circumstances shall pipes be spaced close together and enclosed in a common insulating covering. Notwithstanding the above minimum clearances, sufficient clearance shall be allowed to facilitate easy application of thermal insulating material of the thickness specified in the Insulation Sections of this Specification.

2.1.8 PIPEWORK EXPANSION

a] The Contractor shall make provision for movement due to expansion, either by special expansion joints, or by changes in direction of the pipework as indicated. Supports at such expansion joints shall be arranged to ensure that all expansion is taken up by the loop or changes in direction of the pipework. Where pipes are required to be re-stressed for the purpose of reducing expansion stress under working condition, the extent of the cold pull will be 50% of the total movement of the pipe expansion joint from cold to normal working temperatures, unless specifically noted to the contrary.

Where flanged joints have been utilised for cold draw, all nuts and bolts shall be renewed after pre-stressing has taken place.

Not more than 10mm of expansion vertical movement will be permitted on branches from risers unless a suitable loop or change in direction is incorporated in the branch.

b] Expansion joints must be adequately supported and the pipework provided with proper guides. All bellows shall be of stainless steel single wall multiple convolution construction, with suitable end connections and external sleeves. Mild steel flanges or female screwed connections shall be argon arc welded. Gunmetal female screwed ends shall be silver soldered. Bellows on domestic hot water circuits shall be so constructed that only stainless steel will be in contact with the pipe contents. Bellows shall be installed with 50% of the total calculated movement being taken up by cold draw. The recommendations of the manufacturer must be rigidly adhered to.

Details of the proposed methods must be submitted to the Consulting Engineer for approval, prior to installation.

2.1.9 ANCHOR POINTS

Suitable anchor points shall be installed where pipework expansion is occurring.

Anchor points for pipework in trenches shall generally consist of mild steel channel iron framework, welded to the pipework, built into trench or adequately bolted and designed to withstand the calculated thrust.

All pipework subject to movement shall be adequately guided.

Any cold pull-up expansion joints shall not be applied until the anchors are rigid and firm.

The Contractor shall submit detailed calculations for approval by the Engineer/Structural Engineer.

2.1.10 SLEEVES AND FLOOR/WALL PLATES

Pipes passing through walls, floors and ceilings shall be provided with Chrome or white PVC plates.

Chilled water pipework sleeves shall be of sufficient diameter to allow the insulation to be carried through, together with vapour barrier.

In kitchens and bathrooms the pipe sleeve shall project 100mm above floor level.

The space between the pipe and the pipe sleeve shall be lightly caulked with glass cloth or other suitable material so that a one hour minimum of fire resistance is obtained in accordance with the latest Building Regulations. Pipes, ducts, subways etc., shall be caulked between pipe and sleeve with an approved material e.g. Lead wool, to form an effective and permanent vermin proof and weatherproof seal.

2.1.11 AIR VENTING AND DRAINING

The Contractor shall make full provision for draining and venting of the complete pipework installation whether shown on the drawings or not. All costs shall be included in the Tender Price.

All pipes shall be laid to fall so that they clear themselves of air naturally through vent pipes or through air bottles where deemed necessary. The Contractor shall allow adequate facilities to drain sections of work without disrupting the entire system.

At venting points, air bottles shall be provided constructed of 25mm bore for pipes up to that size, the same bore as the pipes up to 80mm bore, and for pipes over that size they shall also be 80mm bore.

The length of air bottle to be 150mm-300mm long, according to location and duty.

10mm n.b. release pipework is to be provided and shall terminate with 10mm needle valve.

Where air bottles are fixed out of reach, extension bleed pipes shall be neatly run from the top of the air bottle to a convenient but unobtrusive position 1.2 metres from finished floor and terminated with a needle valve. Needle valves on all systems shall be suitably capped.

Automatic air vents shall have gunmetal or brass bodies, non-ferrous or stainless steel floats and guides, non-corrodible valves and seats. Each A.A.V. shall be controlled by a lockshield valve, and shall be Type 'B' or 'C' pattern depending on application as manufactured by Messrs BBS (Winns) Ltd.

Air venting devices and any air release pipes installed in exposed positions shall be insulated to prevent freezing.

Drain points shall be fitted at all low points which cannot be emptied through other parts of the system.

2.1.12 DIRT POCKETS

Dirt pockets shall be the same material as the pipe. The dirt pocket shall be 300mm long and provided with capped end up to and including 50mm bore pipe and blanked flange end on pipes 65mm and above. 25mm drain cocks shall be fitted to the side of the pocket 200mm from the end.

Dirt pockets shall be provided at the base of all vertical pipes serving more than three floors.

2.1.13 TEST POINTS

Self-sealing neoprene rubber test points as manufactured by Messrs Binder Engineering Ltd, shall be installed in the following positions, unless gauges are called for in the Specification or on the drawings.

1No On each return main immediately prior to their connection into the common return header.
1No On both suction and delivery connections of all pump sets.
1No On both inlet and outlet of items of equipment.
1No On each port of control valves immediately adjacent to the control valve.
These connections are to be used for testing and balancing purposes.

The Contractor is to supply suitable pressure gauges and thermometers for test purposes only and they will remain the property of the Contractor.

Upon completion of the Contract, one new, complete boxed set all gauges shall be handed over by the Contractor to the Client.

2.1.14 VALVES, TAPS AND COCKS

a] Safety and Relief Valves

Safety and relief valves shall be N.A.B.I.C. pattern and suitable for operating conditions of the systems and as required by BS759 & BS6283 for the boilers, calorifiers or pressure vessels to which they are connected unless otherwise stated.

They shall be totally enclosed spring loaded type with padlock. Safety valves and relief valves shall have full-bore discharge connections and where any low points occur in the discharge run it shall be fitted with a waste pipe sized in accordance with manufacturer's recommendations and relevant regulations carried clear of the insulation for drainage. The discharge and waste pipes shall be run to a visible safe position to be agreed with the Consulting Engineer and in accordance with the current Building Regulations.

b] L.P.H.W. Heating, Chilled Water, D.H.W.S. and C.W.S. - General

Valves, taps and cocks shall be supplied and fitted by the Contractor at the positions shown on the Tender drawings; at all other positions necessary for the proper working of the systems, and in compliance with the Local Water Authority requirements.

In general, however, plant and equipment shall be valved such as to provide for easy removal and maintenance. Commissioning valves should be incorporated on all items of plant, control valves and branch mains to facilitate balancing and accurate determination of flow rate in accordance with the latest Edition of the C.I.B.S.E Commissioning Codes C&W.

All valves up to and including 50mm shall be of cast gunmetal. Body castings for valves and cocks 65mm and above shall be cast iron. All castings shall be of even thickness throughout, clean and smooth, free from scale, blow-holes and flaws.

Gunmetal gate valves shall conform to BS5154 and cast iron gate valves shall conform to BS5150.

Gate valves shall have split or solid wedge gates. Disc valves shall have renewable discs free to rotate on the spindle.

All working parts shall be gunmetal. 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 threads.

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.

Valves and cocks in mild steel pipework up to and including 50mm size shall have taper screwed ends, and of 65mm size and above shall have flanged ends as specified in Clause 2.1.3 [i]. Valves and cocks on copper pipework shall have ends as for fittings (Clause 2.1.3 [b]).

c] Isolating Valves

Straight pattern for heating, chilled water, condenser water and DHWS shall be of the fullway gate type. Angle valves shall have domed discs designed to offer minimum resistance to flow.

d] Isolating Valves on Terminal Appliances

Valves for terminal heating or cooling appliances shall have union ends and either:-

1. composition hand wheels shaped to enclose the stem and gland.

OR

2. easy clean polished shields and composition hand wheels.

Lockshield valves shall have easy clean shields to match the shield or enclosure on the inlet valve, two loose keys shall be provided for each size of spindle.

e] Double Regulating Valves

All regulating valves for heating, chilled water, condenser water and DHWS shall be of "Vee-Ref" oblique type, giving proportional flow over the extra lift of the valve. Boilers shall be cast gunmental or cast iron as required.

All regulating valves shall have:-

1. integral seats and discs.
2. guaranteed valve packings.
3. lockable indicator on spindle to show proportional opening.

Double regulating valves shall be installed on the by-pass connections of 3 port control valves serving all items of central station plant.

f] Commissioning Valves

All commissioning valves for heating, chilled water and condenser water shall be either the oblique type orifice pattern complete with two mechanically self sealing test points, or alternatively an orifice device fitted with two mechanically self sealing test points and close coupled to a fullway pattern gate valve offering minimum resistance to flow.

All commissioning valves shall be positioned in good straight lengths of pipework equal to 10 diameters upstream and 5 diameters downstream of any fitting, and test points positioned for quick and easy manometer attachment.

Orifice valves and devices should be sized so as to generate a pressure differential at design flow rate of between 1 and 4Kpa, enabling them to be accurately measured on a standard fluorocarbon manometer.

g] Check Valves

The flaps of check valves shall be of light construction and shall pivot on a spindle secured by two phosphor bronze hangers.

Each valve shall be fitted with stop to prevent undue movement of the flap and shall be as silent as possible in operation.

The valve shall be constructed so that the minimum resistance is offered to flow.

D.H.W.S. check or non-return valves shall be extremely sensitive in action even under the slightest pressure difference. The net area past the valve shall not be less than 2.5 times that of the area through the branches ensuring negligible restriction to flow. A radiator type aircock should be fitted on the valve cover. Maximum working pressure in the valve body 10 bar. Construction of valve body to be gunmetal, with screwed connections up to 50mm, 65mm and over flanged. Valve plate of stainless steel or bronze construction, link bronze construction.

h] Strainers

Strainers shall be of the single strainer cage type, screwed BSPT up to 50mm and flanged for bores over 65mm. The bodies shall be of bronze up to 50mm and of cast iron on 65mm and over. Cages shall be of non-ferrous metal on stainless steel and shall have perforations of 1.5mm diameter.

The free area of the cage shall be at least 5 times the cross sectional area of the pipe.

i] Stopcocks

Stopcocks on domestic hot and cold water systems shall comply with BS1010 and meet Local Water Authority requirements. Attention is drawn to a possible demand by the Authority for pinned valve (fixed jumper) stopcocks to be fitted on services.

Stopcocks shall be fitted on cold water systems before each fitting whether indicated on the drawings or not in an accessible position.

Fullway valves complying with BS.5154:1989 shall be fitted on hot water systems and before each fitting whether indicated etc.

Draincocks shall be fitted on the isolated side of all stopcocks as per BS.5154:1989.

j] Draincocks

Emptying cocks shall be fitted at all low points. Plugs for drain cocks shall be ground in and to BS2879. A loose key of mild steel forged to shape shall be provided for each gland cock.

k] Three Way Cocks

Three way cocks shall be of the 'T' ported type, the position of the ports being clearly grooved on the square end of the plug. A loose key shall be provided for each three-way cock.

l] Air Cocks

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

m] Gas Cocks

Gas cocks of the square head 'Nited' pattern shall be supplied and installed as indicated on the drawings.

All cocks shall be fitted in accessible positions. A union cock shall be fitted to the outlet side of a primary meter and at the outlet side of a secondary meter. A valve or cock shall also be fixed on each main branch and each appliance.

Each gas appliance shall be fitted with a suitable pressure governor.

VALVE SCHEDULE

DESCRIPTION OF VALVE	DESCRIPTION OF SERVICES	HOLMES	HATTERSLEY	CRANE
G.M. GATE VALVE PN20 W/H	G, L, N	1400	33X	D151
G.M. GATE VALVE PN20 L/S	G, L, N	1401	33X L/S	D237
G.M. GATE VALVE PN20 W/H [CP]	G, L, N	N/A	2407CP	N/A
G.M. GATE VALVE PN20 L/S [CP]	G, L, N	N/A	2407CPLS	N/A
G.M. LEVER GATE VALVE	J, K	1404	28	D200
G.M. GATE VALVE PN32	G, L, N	1406	N/A	D166
G.M. GATE VALVE FLANGED PN16	G, H	1407	35 PN16	DM160
C.I. GATE VALVE FLANGED PN6	H, M, P	1410	M549 PN6	FM52
C.I. GATE VALVE FLANGED PN10	H, M, P	1411	M511 PN10	FM57
C.I. GATE VALVE FLANGED PN16	H, M, P	1412	M541 PN16	FM63
G.M. GLOBE VALVE PN32	J	1426	13	D15
G.M GLOBE VALVE FLANGED PN16	J	1432	17 PN16	DM6
G.M. CHECK VALVE PN32	K	1454	1013	D115
G.M CHECK VALVE FLANGED PN16	J	1457	O14NR PN16SL	N/A
C.I LUBRICATED PLUG VALVE PN16	K	N/A	200M/201M	VB170
G.M. CHECK VALVE PN16	G, L, N	1461	47	D138
G.M. SWING CHECK, FLANGED PN16	H, M, P	1464	M651 PN16	FM492
G.M. CHECK VALVE PN25	J	1454	1213	D115
C.I. CHECK VALVE FLANGED PN16	J	1463	3651	N/A
G.M. 'Y' STRAINER PN16	G, K, L, N	1471	807	D297
G.M. NEEDLE VALVE	K	1426/T	5N	D71
G.M. 'Y' STRAINER FLANGED PN16	H, K	1472	N/A	D298'F'/9
C.I. 'Y' STRAINER FLANGED PN16	H, K, M, P	1473	810	FM276
G. M. DRAW OFF COCK HOSE UNION	G, K, L, N	1481	81HU	D344
G.M. EMPTYING COCK L/S	G, J, L, N	1483	371	D340/1
G.M. DRV SCREWED BSP	A, G	BV201	CV1432	D[M]920
G.M. ORIFICE VALVE SCREWED BSP	A, G	B202	CV332	D[M]900
C.I. DRV FLANGED PN16	B, H, L	BV203	CVM733DR PN16	DM930
C.I. ORIFICE VALVE FLANGED PN16	B,H	BV204	CVM733 PN16	DM900
G.M. ORIFICE DEVICE SCREWED BSP	A, G	BV289/BV210		N/A N/A
S.S. ORIFICE PLATE FLANGED FORGED STEEL ORIFICE VALVE	B, H	BV211	N/A	N/A
G.M. RADIATOR VALVE L/S	L	N/A	2386/LS	D881
G.M. THERMOSTATIC RAD VALVE	L	N/A	DELFLO TRV	D859
STOPCOCKS	G	N/A	N/A	YORKSHIRE508/GM
TEE PORTED COCK TO 25mm		N/A	85T	N/A
DRY RISER OUTLET VALVE		N/A	N/A	CHARLES 21151A
DRY RISER AIR VALVE		N/A	N/A	2751

CATEGORY	DESCRIPTION
A.	Low and medium temperature hot water heating and chilled water. Isolating/double regulating and commissioning valves up to 50mm.
B.	Low and medium temperature hot water heating and chilled water. Isolating/double regulating and commissioning valves 65mm and above.
G.	Hot and cold water services isolating and regulating up to 50mm.
H.	Hot and cold water services isolating and regulating 65mm and above.
J.	Compressed air services isolating and regulating all sizes.
K.	Fuel oil and gas services isolating and regulating all sizes. [see particular specification for fuel mediums, pressures and temperatures].

L. Low and medium temperature hot water heating general isolating up to 50mm.
M. Low and medium temperature hot water heating general isolating 65mm and above.
N. Chilled water general isolating and control up to 50mm.
P. Chilled water general isolating and control 65mm and above.

2.1.15 THERMOMETERS AND ALTITUDE GAUGES

Thermometers shall be fitted in pipes and ducts in the position indicated on the drawings and as detailed in the Specification and on the inlet and outlet of all pumps. Suitable pockets shall be provided and fixed in the case of pipelines.

Where thermometers are installed in pipelines and the diameter of the pipe is too small for the length of the standard bulb, the pipe shall be increased to the requisite diameter for a minimum length of 150mm or as necessary to allow for the proper fitting and insertion of the thermometer well.

Dial thermometers for distance reading shall be provided with necessary length of capillary tube encased in a non-corrodible armoured sheath.

Dial thermometers shall, unless stated otherwise, be mounted with the dial in the vertical position and shall be mercury in steel type.

Dial thermometers shall be calibrated in degrees Celsius with black pointer and clear black lettering and scale on a white background with no more than 5^0C per division, and not less than 2^0C division. Where the effective fixed working temperature is being measured, the thermometer shall be fitted with a tamper-proof loose red pointer which can be set on site to the working temperature.

Obtuse angle thermometers shall be provided when necessary. The scales will be included for easy reading.

Right angle or obtuse angle thermometers shall be provided when fitted to vertical pipes or vertical face of calorifiers, or ducts, etc.

100mm dial thermometer, mercury in steel shall be provided with black/C.P. case and separate M.S. pocket.

Bourdon type altitude or pressure gauges shall be fitted in pipelines in the positions indicated on the drawings and where called for in later sections of the Specification.

The gauges shall be scaled in metres of waterhead or KPa.

The gauges will be 100mm diameter with white dials and black lettering and fitted with an adjustable red pointer which shall be set on site at the head of the system.

Pressure of altitude gauges shall be provided with suitable syphon connections with G.M. gauge cocks 10mm diameter.

Thermometers, altitude and pressure gauges shall be of uniform pattern/appearance, and be as manufactured by Steward Buchanan Industrial Estate, Kilsyth, Glasgow, G65 9JX, Tel: 0236 821533, Fax: 0236 824090.

They shall however all be of the same manufacture. The temperature or pressure gauge scales selected must ensure that the normal range of condition lies at the point of the full scale.

2.1.16 RADIATORS

Radiators shall be manufactured in accordance with BS 3528: 1977 and shall be factory tested, to 1035Kn/square metre air under water before being supplied to site, for buildings not more than 52 metres high or operating at a working pressure of not more than 518Kn/square metre.

Where operating conditions exceed the above the radiators shall be tested to twice the working head imposed on them by the system in which they are to be installed.

The finish of the radiators shall have one coat of good quality primer.

The Contractor is to allow for removing all radiators twice and re-fixing for decorating purposes.

The radiator heating surface provided shall not be less than that scheduled on the drawings.

Radiators shall be supported from the walls on standard concealed brackets unless otherwise stated. The positions and heights above floors of all radiators shall be confirmed on site before fixing. A minimum clearance of 100mm shall be provided beneath pipes feeding the radiators and the minimum clearance between the floor and underside of the radiators shall be 150mm. Unless otherwise stated radiators shall be kept 40mm clear of walls.

Radiator brackets shall be of the completely concealed type. Brackets which clip over the edge of the radiator will not be permitted.

The number and position of brackets shall be as recommended by the manufacturer.

Brackets shall be secured to the wall with either black japanned mild steel mushroom head wood screws or coach screws with washers where required.

Suitable expanded plugs, expanding bolts, toggle bolts or running bolts with backplates, shall be used where situated on partition walls. Timber supports will be provided by the Main Contractor within the thickness of the partition, but the Contractor shall be responsible for the accurate positioning of these timber supports.

Radiators supplied under this specification shall be manufactured by a member of the Radiator Manufacturers Association (MARC).

2.1.17 FEED/EXPANSION & STORAGE CISTERNS

As far as the Construction, and the installation of these cisterns is concerned, relevant sections of Bye-Laws 30-45, BS6700 and Local Water Authority requirements are to be observed.
For details regarding Cistern capacity etc, see relevant section of Specification and/or drawings.

2.1.18 PUMPS

Each pump connection shall be valved and the discharge connection shall be fitted with a non-return valve to facilitate ease of change-over operation when duplicate pumps are to be provided.

Each suction connection shall have drain cocks fitted at the lowest point.

The pump suction and delivery are to be properly supported to ensure that the weight of pipework and valves is not transferred to the pump casing.

2.1.19 IDENTIFICATION

All insulation and exposed pipework shall by identified by colour code/safety indicated and basic colour identification bands to BS1710.

The safety colour and code indication bands shall be 100mm wide, between two basic colour identification bands each of a length of 150mm. The identification shall be at centres of not more than six metres, and adjacent to all valves, items or plant, changes in direction and both sides where the pipework passes through walls, floors etc., and all service access points.

Pipe sizes, pipe contents, flow and return (F or R) designation and direction of flow arrows in black, shall be applied on the basic colour identification band as detailed in Appendix 'E' of BS1710.

Colours for colour code/safety indication and basic colour identification shall be as detailed in Tables 1, 2 and Appendix 'D' of BS1710. An extract from the 1975 Edition of Appendix 'D' being shown in the table at the end of this Section.

The safety colour, contents and colour indication bands shall be applied by means of self adhesive coloured or printed tape.

Flow and return (F and R) and direction of flow arrows shall be in Black with letters 25mm high on 50mm wide white self adhesive tape applied in a continuous band around the pipe insulation.

Pipe sizes shall be metric in Black printed lettering 25mm high on 50mm wide clear self adhesive labels.