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UCLH Eastman Dental Hospital

Building Services Performance Specification for a new Air Conditioning System to the Oral Surgery & Dental Medicine Clinic. RAG 2915.

LE4451-SP-ME-001

May 2014

JOB: UCLH Eastman Dental Hospital

JOB NO: LE4451

REPORT: LE4451-SP-ME-001

Building Services Performance Specification for a new Air Conditioning System to the Oral Surgery & Dental Medicine Clinic. RAG 2915.

STATUS: Tender

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This report has been authorised by:

…….

Adrian Wordsworth

Partner

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Contents

T70 LOCAL COOLING UNITS

PART 1 SYSTEM OBJECTIVES

100.010 PERFORMANCE OBJECTIVES

To survey, design, supply and install a new VRF (Variable Refrigerant Flow) air conditioning system to serve the treatment and consulting rooms within the Oral Surgery & Dental Medicine Clinic at the Eastman Dental Hospital. The system is to provide cooling to the areas as indicated on the drawing contained within the appendices. Complete with all necessary condensate drainage, controls wiring, electrical works and builderswork for a complete installation.

100.020 DESIGN PARAMETERS

External Design Temperature	
Summer	28degC db / 20 degC wb
Winter	-4degC 100%RH
Summer Internal Design Temperature	
Consulting/treatment rooms	23 degC (+2)
Winter Internal Design Temperature	
Consulting/treatment rooms	22 degC (+2)
Design Criteria	
Maximum noise	NR30

All new services installations will be subject to detailed survey, investigation, validation and design development, and will require careful coordination with the final layout of the respective areas.

The contractor shall survey, design and install all materials and works in accordance with the appropriate British Standard or Code of Practice and where no BS or CP is applicable the Agreement Certificate for the particular item.
Comply with all statutory instruments and regulations, relating to the area of the site
Comply with the requirements of the Local Authority Building Inspector.
Comply with all Statutory Obligations arising from current legislation and regulations, together with other requirements, including, but not limited to, the following:-
Statutory Obligations
Health and Safety at Work etc Act 1974
Management of Health & Safety at Work Regulations 1999
The Working Time Regulations 1998
Gas Safety (Management) Regulations 1996
Gas Safety (Installation and Use) Regulations 1998
Dangerous Substances and Explosives Atmosphere Regulations 2002
Building Regulations 2010 and current amendments
London Building Act and/or Building (Inner London) Regulations
Public Health Acts
Electricity Acts
Electricity at Work Regulations 1989
Factories Act 1961
Clean Air Act 1993

The Clean Air (Arrestment Plant) (Exemption) Regulations 1969
The Control of Pollution Act 1974 and Amendment Acts
The Workplace (Health, Safety and Welfare) Regulations 1992
The Construction (Design and Management) Regulations 2007
The Health and Safety (Display Screen Equipment) Regulations 1992
The Control of Substances Hazardous to Health (COSHH) Regulations 2002
The Control of Substances Hazardous to Health (Amendment) Regulations 2003
Control of Asbestos at Work Regulations 2002
The Provision and Use of Work Equipment Regulations 1998
Personal Protective Equipment at Work Regulations 1992
The Construction (General Provisions) Regulations 1961
The Lifting Operations and Lifting Equipment Regulations 1998
Other relevant Safety Regulations
Public Utility Company and/or Statutory Authority regulations, specifications, and requirements.
British Standards and Codes of Practice.
BS 7671 - Requirements for Electrical Installations (IEE Wiring Regulations).
BS EN 50110.
Insurance Company Requirements.
LDSA Fire Safety Guides.
IEC Standards.
Notify all authorities in accordance with their regulations and obtain any required approvals for the installation.
Where no specific design, performance or installation standards are quoted the following shall apply.
CIBSE Guide Books
Guide A Environmental design
Guide B Heating, Ventilating, Air Conditioning and Refrigeration
Guide C Reference data
CIBSE D, E, F, G, H, J, K,L
CIBSE Knowledge Series
CIBSE Code for Lighting.
CIBSE Technical Memoranda.
Institute of Plumbing - Plumbing Engineering Services Design Guide.
Ensure all equipment and systems are designed and installed in accordance with the relevant standards and that operational compatibility exists between the systems and any other system installed at the same location.
Supply plant and equipment to achieve the specified design conditions and to provide stable control.

Contractors responsibility:

The contractor shall undertake the full design, planning and installation of all the refrigeration, associated mechanical, electrical and building management system installations. The mechanical installations shall include cooling and condensate drainage.

Carry out the full design, planning, supply, installation, testing, commissioning and setting to work the building services installations defined in this specification

100.030 SYSTEM DESCRIPTION

The mechanical drawing (LE4451-SK-M01A) contained within the appendices highlights two shaded areas of priority. The clinic areas is the first priority and the support spaces the second priority. The contractor shall provide costs for providing cooling to the clinic rooms and an option for providing cooling to all areas (clinic rooms and the support spaces).

The electrical drawing (LE4451-SK-E01A) contained within the appendices describes a potential electrical connection point for the external condensing unit associated with the new air conditioning installation.

The following is a description of the works:

Mechanical Services (including condensate drainage)
The contractor shall survey, design, supply and install a new VRF (Variable Refrigerant Flow) air conditioning system to serve the treatment and consulting rooms within the Oral Surgery & Dental Medicine Clinic at the Eastman Dental Hospital.
A proposed location for the condenser unit has been suggested on the drawing. Please see the Ground floor Sketch enclosed in the Appendix section.
The contractor is to agree the final location or find alternatives for the condensing equipment. Proposals shall be submitted for review.

The indoor units shall be wall mounted.

The contractor shall coordinate and route refrigerant pipework from condensing units to indoor units.

The manufacturer of the system shall be selected from either Daikin or Mitsibishi or equal and approved. The location of the fan coil unit(s) shall be such to allow for adequate access for routine maintenance. It is the responsibility of the contractor to liase with the building users to coordinate and position the equipment.

Condensate drainage pipework shall be installed to all indoor units to local drainage stack locations.
The contractor shall survey the hosiptal for a suitable drainage connection point for the gravity condensate from the fan coil unit(s).

A local controller/sensor shall be provided in a suitable representative location so local adjustment can be made within a pre-determined range. This range of control and location is to be agreed with management.

The contractor shall submit drawings to the PM for review/sanction of the proposed installation prior to commencing works. Technical submittals shall be provided for each element of the mechanical installation to the PM for review/sanction prior to commencing the works.

The contractor shall include for all mechanical testing and commissioning associated with the new installation and provide certification in compliance with clause 100.020. The contractor shall offer the PM the opportunity to witness the testing and commissioning.

The contractor shall provide record drawings of the installation indicating pipe routes and sizes, points of connection, and equipment locations. The drawings shall be submitted in AutoCAD format to the PM for comment/review prior to acceptance.

The contractor shall provide operating and maintenance manuals for the mechanical (including drainage) installation. The manuals shall be submitted electronically to the PM for comment/review prior to acceptance.

The contractor shall include for out of hours working as set out in the main contract preliminaries for any works in a live trading environment.

Electrical Services

The contractor shall provide all necessary power supplies for the new cooling equipment. The contractor shall establish the electrical loads of the proposed cooling equipment and design suitable power supplies to the equipment derived from the local electrical infrastructure in the hospital.

The contractor shall survey the local electrical services distribution boards to establish suitable spare ways to use to provide power to the cooling equipment. The contractor shall establish by survey that the additional load imposed by the cooling equipment will not overload the distribution board proposed for use as the source of supply. The contractor shall demonstrate to the PM that this has been carried out and provide a technical submittal setting out the loads, and spare capacity remaining on the distribution board with the cooling equipment included. Connection to the existing electrical infrastructure shall be by prior consent of the PM.

The contractor shall be responsible for the selection of appropriate final circuit protective devices for the circuits serving the new cooling equipment and shall be responsible for selecting cable types (LSF type insulation) and cable sizing design for compliance with BS 7671. Acceptable cable types are XLPE/LSF armoured cables, or LSF singles in metal cable containment. The contractor shall also demonstrate that the protective devices selected discriminate with other downstream devices.

The contractor shall survey a route for the power cables from the distribution board to the cooling equipment, and shall include for new cable containment throughout the length of the cables. Unsupported cables or cables clipped to other services/other containment will not be permitted. The cable route shall be accessible throughout and the contractor shall include for all necessary builders work associated with the new cable route, and shall include for any fire stopping as may be necessary along the route.

The contractor shall provide suitably sized isolators adjacent to the indoor cooling unit and the external condenser. The contractor shall provide all necessary interconnecting cables between the indoor and external units, including power and controls. The contractor shall include for all necessary controls wiring to sensors and control panels. All cabling shall be in metallic containment.

The contractor shall submit drawings to the PM for review/sanction of the proposed installation prior to commencing works. Technical submittals shall be provided for each element of the electrical installation to the PM for review/sanction prior to commencing the works.

The contractor shall include for all electrical testing and commissioning associated with the new installation and provide certification in compliance with BS7671. The contractor shall offer the PM the opportunity to witness the testing and commissioning.

The contractor shall provide record drawings of the installation indicating cable routes and sizes, point of connection, and equipment locations. The drawings shall be submitted in AutoCAD format to the PM for comment/review prior to acceptance.

The contractor shall provide operating and maintenance manuals for the electrical installation. The manuals shall be submitted electronically to the PM for comment/review prior to acceptance.

The contractor shall include for out of hours working as set out in the main contract preliminaries for any works in a live trading environment or where connection to existing services is required.

PART 2 SELECTION SCHEDULES FOR REFERENCE SPECIFICATIONS

251.000 TESTING AND COMMISSIONING OF MECHANICAL SERVICES

251.010 GENERAL:
Comply with work section general clauses reference Y51.1000 and those detailed below.
- Carry out testing and commissioning as specified in section

251.030 STATIC TESTING:
- Pressure testing
  - General - reference Y51.2010
  - Refrigerant pipework
    - Strength pressure test - reference Y51.2055A
    - Leak test - reference Y51.2055B
- Deep vacuum test - reference Y51.2055C

251.040 COMMISSIONING:
- Commissioning codes - reference Y51.3020
  - Commissioning
  - Refrigerating systems - reference Y51.3060
  - Automatic control systems - reference Y51.3070
- Instruments and gauges
- Reference Y51.3090A
- Control system specification details required for commissioning - reference Y51.3110
- Pre-commissioning - reference Y51.3120
- Plant ready for control system commissioning
  - Reference Y51.3130A
- Control system requirements for plant commissioning - reference Y51.3140
- Commissioning - reference Y51.3150

251.050 PERFORMANCE TESTING:
- System performance testing - reference Y51.4010
- Environmental tests
  - Artificial loads - reference Y51.4020A

252.000 VIBRATION ISOLATION MOUNTINGS

252.010 GENERAL:
- Comply with work section general clauses reference Y52.1000 and those detailed below.

254.000 IDENTIFICATION - MECHANICAL

254.010 GENERAL:
- Comply with work section general clauses reference Y54.1000 and those detailed below.

254.020 PIPEWORK IDENTIFICATION:
Reference Y54.2010

254.040 PLANT AND EQUIPMENT IDENTIFICATION:
- Lettering
- Laminated plates, multi-coloured with outer layer removed for lettering - reference Y54.2030B

254.045 GRAPHICAL SYMBOLS FOR USE ON EQUIPMENT IN ACCORDANCE WITH BS EN 80416:
Reference Y54.2035

290.000 FIXING TO BUILDING FABRIC

290.010 GENERAL:
Comply with work section general clauses reference Y90.1000 and those detailed below.
- Carry out fixing to building fabric as specified in work section

290.020 FIXINGS:
- Standards - reference Y90.2010
- Plugs - reference Y90.2020
- Screws - reference Y90.2030
  - Non-penetrative support systems - reference Y90.2080

290.030 WORKMANSHIP:
- Drilling - reference Y90.3010
- Fixing to timber rails - reference Y90.3050
- Fixing to hollow stud/tile/block wall
  - Reference Y90.3060A
- Fixing to concrete, brickwork or blockwork
  - Reference Y90.3070A
- Fixing to metalwork
  - Reference Y90.3080A
- Fixing to structural steelwork and concrete structures
  - Reference Y90.3090A
- Non-penetrative support systems for roof mounted equipment - reference Y90.3100#

291.000 OFF-SITE PAINTING AND ANTI-CORROSION TREATMENT

291.010 GENERAL
Comply with work section general clauses reference Y91.1000 and those detailed below.
- Carry-out off-site painting and anti-corrosion treatment as work section

PART 3 SPECIFICATION CLAUSES SPECIFIC TO T70

300.000 PRODUCTS/MATERIALS

300.001 PRESSURE EQUIPMENT DIRECTIVE/PRESSURE EQUIPMENT REGULATIONS:
All equipment and assemblies which fall within the scope of the Pressure Equipment Directive (PED) 97/23/EC, implemented in the UK through the Pressure Equipment Regulations 1999,

must be tested by the manufacturers, and be certified as compliant with the Directive. Such compliance shall be evidenced by displaying the appropriate CE Mark on the equipment and assemblies.
Only relevant equipment and assemblies certified as compliant will be permitted under this specification, and any substitution put forward must also be compliant with the Directive.

300.015 REFRIGERANTS:
CFC and HCFC refrigerants are prohibited and must not be used.
- Leak detection system
  - Provide an electronic gas detection system on the refrigerant circuit.

300.060 REFRIGERANT PIPEWORK:
Material
- Refrigerant quality copper, fully annealed and internally degreased and cleaned.
- Jointing
  Do not use screwed joints in pipelines except for connection to equipment.
- Insulation
  On internal pipelines insulate suction pipe from evaporator to compressor.
  On external pipelines insulate both suction and discharge pipes and protect from solar radiation where necessary.

310.000 WORKMANSHIP

310.010 INSTALLATION:
Install equipment in accordance with manufacturer's recommendations.

BS APPENDIX

BS 1710:1984
Specification for identification of pipelines and services

BS 3928:1969
Method for sodium flame test for air filters (other than for air supply to I.C. engines and compressors)

BS 41:1973
Specification for cast iron spigot and socket flue or smoke pipes and fittings

BS 476-7:1997
Fire tests on building materials and structures. Part 7 Method of test to determine the classification of the surface spread of flame of products

BS 715:2005
Specification for metal flue boxes for gas-fired appliances not exceeding 20kW

BS 7697:1993
Nominal voltages for low voltage public electricity supply systems

BS 835:1973

Specification for asbestos-cement flue pipes and fittings, heavy quality

BS EN 12327:2000
Gas supply systems. Pressure testing, commissioning and decommissioning procedures. Functional requirements

BS EN 1254-1:1998
Copper and copper alloys. Plumbing fittings. Part 1 Fittings with ends for capillary soldering or capillary brazing to copper tubes.

BS EN 1254-2:1998
Copper and copper alloys. Plumbing fittings. Part 2 Fittings with compression ends for use with copper tubes

BS EN 1254-3:1998
Copper and copper alloys. Plumbing fittings. Part 3 Fittings with compression ends for use with plastics pipes

BS EN 12693:2008
Refrigerating systems and heat pumps. Safety and environmental requirements. Positive displacement refrigerant compressors

BS EN 13792:2002
Colour coding of taps and valves for use in laboratories

BS EN 15287-1:2007
Chimneys. Design, installation and commissioning of chimneys. Part 1 Chimneys for non-roomsealed heating appliances

BS EN 1822-1:1998
High efficiency air filters (HEPA and ULPA). Part 1 Classification, performance testing, marking

BS EN 1822-2:1998
High efficiency air filters (HEPA and ULPA). Part 2 Aerosol production, measuring equipment, particle counting statistics

BS EN 1822-4:2000
High efficiency air filters (HEPA and ULPA). Part 4 Determining leakage of filter element (scan method)

BS EN 1822-5:2000
High efficiency air filters (HEPA and ULPA). Part 5 Determining the efficiency of filter element

BS EN 1856-1:2009
Chimneys. Requirements for metal chimneys. Part 1 System chimney products

BS EN 1859:2000
Chimneys. Metal chimneys. Test methods

BS EN 378-1:2008+A1:2010
Refrigerating systems and heat pumps. Safety and environmental requirements. Part 1 Basic requirements, definitions, classification and selection criteria

BS EN 378-2:2008+A1:2009
Refrigerating systems and heat pumps. Safety and environmental requirements. Part 2 Design,

construction, testing, marking and documentation

BS EN 378-3:2008
Refrigerating systems and heat pumps. Safety and environmental requirements. Part 3 Installation site and personal protection

BS EN 378-4:2008
Refrigerating systems and heat pumps. Safety and environmental requirements. Part 4 Operation, maintenance, repair and recovery

BS EN 779:2002
Particulate air filters for general ventilation. Determination of the filtration performance

BS EN 80416-1:2009
Basic principles for graphical symbols for use on equipment. Part 1 Creation of symbol originals

BS EN 80416-2:2001
Basic principles for graphical symbols for use on equipment. Part 2 Form and use of arrows

BS EN 80416-3:2003
Basic principles for graphical symbols for use on equipment. Part 3 Guidelines for the application of graphical symbols

BS EN ISO 354:2003
Acoustics. Measurement of sound absorption in a reverberation room

BS EN ISO 717-1:1997
Acoustics. Rating of sound insulation in buildings and of building elements. Part 1 Airborne sound insulation

BS EN ISO 9001:2008
Quality management systems. Requirements

PAS 57:2003
Cellar cooling equipment. Procedure for determining performance and calculating energy efficiency

Y10 PIPELINES

Y10.1000 GENERAL
- Supply pipes and fittings as specified in work section
- Supply pipes and fittings as schedule reference N13-Sanitary appliances and fittings
- Location
- As schedule reference

1010 PRE-FABRICATED PIPEWORK:
Supply pre-fabricated pipework in accordance with relevant materials and workmanship clauses.

1020 FITTINGS:
For changes in direction use centreline radius/nominal bore of not less than 1.5 unless otherwise directed. For reductions and enlargements use easy transition type with inclined angle not exceeding 30 degrees.
1030 FABRICATED FITTINGS:
Use only with approval, if manufacturer's standard fittings are not available.
1040 PIPE JOINTS:
Obtain approval for Local Water Authority or Water Research Centre for materials used in water supplies.

Y10.2270A COPPER HALF HARD:
Kitemarked.
Material - Copper.
Standard - BS EN 1057, R250, (Class X).
Dimensions - BS EN 1057 table 3.
Ends - Plain, grooved for mechanical joints.
Finish - Uncoated.

Y10.2270B CHROMIUM PLATED COPPER, HALF HARD:
Kitemarked.
Material - Copper.
Standard - BS EN 1057, R250, (Class X).
Dimensions - BS EN 1057 table 3.
Ends - Plain
Finish - Chromium plated.

Y10.2310A CAPILLARY FITTINGS FOR COPPER TUBING, GENERAL POTABLE RANGE:
Material - Copper or dezincifiable resistant copper alloy.
Standard - BS EN 1254-1.
Size range - 6mm to 67mm.
Dimensions - BS EN 1254-1 table 2.
Ends - Integral (lead-free) solder ring.
Finish - Natural.

Y10.2310B CAPILLARY FITTINGS FOR CHROME PLATED COPPER TUBING, POTABLE RANGE:
Material - Copper or dezincifiable resistant copper alloy.
Standard - BS EN 1254-1.
Size range - 6mm to 67mm.
Dimensions - BS EN 1254-1 table 2.
Ends - Integral (lead-free) solder ring.
Finish - Chrome plated.

Y10.2320A TYPE A COMPRESSION FITTINGS FOR COPPER TUBING:
Kitemarked.

Material - Dezincifiable resistant copper alloy
Standard - BS EN 1254-2, type A, non-manipulative.
Size range - 6mm to 54mm.
Dimensions - BS EN 1254-2, table 2 and 3.
Ends - Socket.
Finish - Natural.

Y10.2320B TYPE A COMPRESSION FITTINGS FOR CHROME PLATED COPPER TUBING:
Kitemarked.
Material - Dezincifiable resistant copper alloy and brass.
Standard - BS EN 1254-2, type A, non - manipulative.
Size range - 6mm to 54mm.
Dimensions - BS EN 1254-2, table 2 and 3.
Ends - Socket.
Finish - Chrome plated.

Y10.2322 CAPILLARY FITTINGS, SHORT, FOR BRAZING TO COPPER TUBING:
Material - Dezincifiable resistant copper alloy.
Standard - BS EN 1254-5
Size range - BS EN 1254-5 - 67mm to 159mm.
Dimensions - BS EN 1254-5, table 2.
Ends - Plain.
Finish -Natural.

Y10.2580A PVC-U PIPING SYSTEMS - PIPES:
Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure.
Material - Unplasticised polyvinyl chloride (PVC-U).
Standard - PVC-U to BS EN 1329-1.
Dimensions - Length - manufacturer's standard range. BS EN 1329-1 tables 1, 2, 3 and 4.
Ends - Plain; elastomeric ring seal socket and spigot; or socket and spigot for solvent cement.
Finish - Grey, black, or white.

Y10.3060# BRAZED JOINTS:
- Use filler metal alloys to BS EN 1044.
- Use nickel bearing zinc free grades of filler metals to BS EN 1044.

Y10.3070A CAPILLARY JOINTS FOR COPPER:
Use materials as follows
Solder - BS EN ISO 9453.
Flux - Copper pipe - BS EN 29454-1.

Y10.3070B CAPILLARY JOINTS FOR POTABLE WATER:
Use materials as follows
Solder - Use lead-free fittings in accordance with BS EN 1254-1, on potable water systems.
Flux - Copper pipe - BS EN 29454-1.

Y10.3190A WALL, FLOOR AND CEILING CHROMIUM PLATED MASKING PLATES:
Material - Copper alloy, chromium plated.
Type - Heavy, split on the diameter, close fitting to outside of pipe.
Fixing - Chrome raised head fixing screws.

Y10.3190B WALL, FLOOR AND CEILING PLASTIC MASKING PLATES:
Material - Plastic.
Fixing - Clipped with plastic lug.

Y10.4010 APPEARANCE:
Arrange all exposed pipe runs to present neat appearance, parallel with other pipe or service runs and building structure, subject to gradients for draining or venting.
Ensure all vertical pipes are plumb or follow building line.

Y10.4020 SPACING:
Space pipe runs in relation to one another, other services runs and building structure, allow for specified thickness of thermal insulation and ensure adequate space for access to pipe joints, etc.
The following are recommended as minimum clearances in spacing of pipe runs:-

Between	and	Clearance (mm)
Pipeline insulated or uninsulated	Wall Finish	25
	Ceiling Finish	50
	Soffit Floor Finish	150
Insulated Pipeline	Adjacent service runs	25
Uninsulated pipeline	Adjacent service runs	50
Adjacent pipelines	Both uninsulated	150
	One uninsulated	75
	Both insulated	25

Y10.4030 GRADIENTS:
Install pipework with gradients to allow drainage and/or air release, and to the slopes where indicated.

Y10.4040A AIR BOTTLES:
Provide a means of venting the pipe system at all high points.
Provide a vertical extension from the pipe approximately 100mm long, at the bore of the pipe, with a copper extension pipe with a manual vent cock located in an easily accessible position.

Y10.4040B AUTOMATIC AIR VENTS:
Provide a means of venting the pipe system at all high points.
Provide an automatic air vent valve with a copper outlet pipe from the valve to a tundish in an adjacent drain line or to another suitable location.

Y10.4050 DRAIN REQUIREMENTS:
Grade pipework to allow system to be drained. Provide a means of draining the system at all low points.

Y10.4060 EXPANSION AND CONTRACTION:
Arrange supports and fixings to accommodate pipe movement caused by the thermal changes, generally allow the flexure at changes in direction. Allow for movement at branch connections.

Y10.4070A PIPE FITTINGS, BENDS/SWEPT TEES:
Use eccentric type reductions and enlargements on horizontal pipe runs to allow draining and venting, concentric on vertical pipes,with easy transition and an included angle not exceeding 30 degree. Do not use bushes, except at radiators and at fittings where required size is not of standard manufacture. Where required, use eccentric bushes to allow draining or venting; maximum aspect ratio not to exceed two pipe sizes; above this ratio use reducing fittings. Use square tees at venting and draining points. Square elbows are not acceptable. Use bends and swept tees where practical.

Y10.4070B PIPE FITTINGS, ELBOWS/SQUARE TEES:
Use eccentric type reductions and enlargements on horizontal pipe runs to allow draining and venting, concentric on vertical pipes, with easy transition and an included angle not exceeding 30 degree. Do not use bushes, except at radiators and at fittings where required size is not of standard manufacture. Where required, use eccentric bushes to allow draining or venting; maximum aspect ratio not to exceed two pipe sizes; above this ratio use reducing fittings. Use square tees at venting and draining points. Square elbows are not acceptable. Use elbows and square tees.

Y10.4110 PIPES THROUGH WALLS AND FLOORS:
Enclose pipes passing through building elements, (walls, floors, partitions,etc.) concentrically within purpose made sleeves. Fit masking plates where visible pipes pass through building elements, including false ceilings of occupied rooms.

Y10.4120A PIPE SLEEVES:
Where pipe insulation is not carried through pipe sleeve, cut sleeves from material same as pipe one or two sizes larger than pipe to allow clearance. Do not use sleeves as pipe supports.
Install sleeves flush with building finish. In areas where floors are washed down install with a 100mm protrusion above floor finish.

Y10.4120B PIPE SLEEVES WITH INSULATION CARRIED THROUGH:
Where pipe insulation is carried through pipe sleeve, cut sleeves from material same as pipe one or two sizes larger than pipe and insulation to allow clearance. Do not use sleeves as pipe supports.
Install sleeves flush with building finish. In areas where floors are washed down install with a 100mm protrusion above floor finish.

Y10.4125 PIPE SLEEVES THROUGH FIRE BARRIERS:
Pack annular space between pipe and sleeve or insulation and sleeve with non-flammable and fire resistant material to form a fire/smoke stop of required rating. Apply 12mm deep cold mastic seal at both ends within sleeve.

Y10.4150A TEMPORARY PLUGS, CAPS AND FLANGES:
Seal all open ends as installation proceeds by plugs, caps or blank flanges, to prevent ingress of foreign matter.
Use plugs of metal, plastic or wood to suit pipework material.
In the event of such precautions not being taken, strip out pipework adjacent to open ends to demonstrate that fouling of bores has not occurred.

Y10.4160 FLANGED JOINTS GENERAL:
Use number and diameters of bolts to standard. Fit bolts of length to give not less than one thread, or more than 3mm protrusion beyond nut when joint is pulled up.
Fit washers under each nut.

Y10.4170 DISSIMILAR METALS:

Take appropriate means to prevent galvanic action where dissimilar metals are connected together.

Y10.4180 PIPE RINGS AND CLIPS:
Select type according to the application and material compatibility, give particular attention where pipes are subject to axial movement due to expansion or contraction.

Y10.4190 ANCHORS:
Location
- As drawing numbers

Construct to resist axial stress transmitted by flexure of horizontal and vertical pipe runs or loading on vertical pipes assuming that unbalanced forces exist at all anchor points, even when these are situated in intermediate positions between two expansion loops or bellows. Use similar or compatible materials to the attached pipe.
Provide and fix all associated backing plates, nuts, washers and bolts for attachment to or building into building structure; ensure structure is suitable for transmitted stress. Set out and line up anchors accurately in position. Inspect final grouting into building structure.

Y10.4200 SLIDE GUIDES:
Location
- As drawing numbers

Direct movement of expansion and contraction from pipe anchor points towards loops, bellows or flexible inserts. Ensure that thrust is linear relative to the axis of pipe.
Apply a friction reducing material between metal faces subjected to movement.

Y10.4205 PIPE SUPPORTS:
Arrange supports and accessories for equipment, appliances or ancillary fitments in pipe runs, so that no undue strain is imposed upon pipes.
Ensure that materials used for supports are compatible with pipeline materials.

Y10.4210 SUPPORT SYSTEM - WIRE ROPE:
- 4215# WIRE ROPE SUSPENSION SYSTEM:
  - Type
  - Application
  - Manufacturer and reference
    - Or approved equivalent
  - Standards
    - BS EN 12385-1.
    - BS EN 13411-3.
    - BS EN 13411-4.
    - DIN 3093.
    - BSRIA COP 22/2002.
  - Dimensions
    - Safe working load (kg)
    - Length
  - Components
    - Wire rope
      - Safe working load (kg)
      - Length (mm)
      - Material
        - Stainless steel grade 316
        - Galvanised
    - Fastener
      - Components

        - Springs - stainless steel grade 302
        - Adjustment
            - Tamperproof
    - Fixing
        - Loop
            - Safe working load (kg)
            - Length (mm)
        - Stud (permanently fixed to wire rope length)
        - Single toggle
        - Double toggle
        - Double karabiner
        - Hook
- Accessories
    - Setting keys
    - Span/bearer supports
    - Ceiling clip fixings
    - Threaded adaptors
    - Anchor bolts
    - Anchor for stud fixings
    - Ceiling fixing kit
    - Corner saddle
    - Fastener décor cover

Provide wire rope support system. Confirm wire rope is suitable for supporting pipelines.

Y10.4220 SUPPORT SPACING:
Space supports as tables.

Pipe Bore (mm)	Maximum Support Spacing (M)					
Nominal	Steel Pipe		Copper Pipe		Iron Pipe	
	horizontal	vertical	horizontal	vertical	horizontal	vertical
Up to 15	1.8	2.4	1.2	1.8	-	-
20	2.4	3.0	1.4	2.1	-	-
25	2.4	3.0	1.8	2.4	-	-
32	2.7	3.0	2.4	3.0	-	-
40	3.0	3.6	2.4	3.0	-	-
50	3.0	3.6	2.7	3.0	1.8	1.8
65	3.7	4.6	3.0	3.6	-	-
80	3.7	4.6	3.0	3.6	2.7	2.7
100	3.7	4.6	3.0	3.6	2.7	2.7
125	3.7	5.4	3.0	3.6	-	-
150	4.5	5.4	3.6	4.2	3.7	3.7
200	5.6	6.0	-	-	3.7	3.7
250	5.0	6.0	-	-	4.5	5.4
300	6.1	10.0	-	-	8.0	10.0
350	10.0	12.0	-	-	-	-
400	10.5	12.6	-	-	-	-
450	11.0	13.2	-	-	-	-
500	12.0	14.4	-	-	-	-

600	14.0	16.8	-	-	-	-

For grooved steel and copper pipe, no individual pipe length should be left unsupported.
Vertical support spacing

Check total self-weight and pressure loading against manufacturer's recommendations when using mechanical joints or end load capable flexible couplings. Ensure adequate pipe support when using non-end load capable flexible couplings.

Space vertical support intervals for plastics pipe at not greater than twice horizontal intervals tabulated.

Where multiple pipe runs of differing bores are supported from a common point, use support spacing of pipe requiring closest spacing.
Spacings give for PVC-U pipe to BS EN 1452.

Y10.4230A ISOLATION AND REGULATION:
Provide valves, cocks and stop taps for isolation and/or regulation where indicated, and on:-

mains to isolate major sections of distribution;

the base of all risers and drops except in cases where one item of apparatus only is served which has its own local valve or stop tap;

points of pipe connection of all items of apparatus and equipment except where the item could conveniently be isolated or regulated by valves provided for other adjacent items;

draw-off fittings except where ranges of fittings are served by a common float, the isolator then being fitted with the float.

Y10.4240 MAINTENANCE AND RENEWAL:
Arrange pipework, valves, drains, air vents, demountable joints, supports, etc., for convenient routine maintenance and renewals. Provide all runs with a regularly spaced pattern of demountable joints in the form of unions, flanges, etc., and also at items of equipment to facilitate disconnection.
Locate valves, drains, flanges etc. in groups.

Y10.5010A WELDING GENERAL, CLASS 1:
Use skilled craftsman in possession of a current Certificate of Competence appropriate to type and class of work, issued by an approved authority. Mark each weld to identify operative. Submit specimen welds, representative of joints and conditions of site welding, for each craftsman, test non-destructively, approximately 10% of butt weld joints and 5% of all other joints.
Weld pipeline joints to BS 2633 as appropriate. Carry out non-destructive testing on 10% or as indicated.

Y10.5010B WELDING GENERAL, CLASS 2:
Use skilled craftsman in possession of a current Certificate of Competence appropriate to type and class of work, issued by an approved authority. Mark each weld to identify operative. Submit specimen welds, representative of joints and conditions of site welding, for each craftsman, test non-destructively, approximately 10% of butt weld joints and 5% of all other joints.
Weld pipeline joints to BS 2971 and to HVCA Code of Practice TR/5, Welding of Carbon Steel Pipework, as appropriate.

Y10.5020 WELDED JOINTS, STEEL PIPES:
Preparation, Making and Sealing.

Arc welding, conforming to BS 2971 appropriate to system temperature and pressure. Use arc welding process on piping greater than 100mm.

Y10.5030 PAINTING WELDED JOINTS, STEEL PIPES:
Unless pipework is being prepared for galvanizing after manufacture, wire brush and paint all welds with red oxide paint when welds are complete.

Y10.5040 FLANGED JOINTS, STEEL PIPES:
Welded Flanges
Weld neck and bore of 'slip on' flange.
Butt weld neck of welding neck flange.
Screwed Flanges
Apply jointing materials. Screw on flange and expand tube into flange with roller expander where necessary.
Preparation
Ensure that flange mating faces are parallel; flange peripheries are flush with each other; and bolt holes are correctly aligned.
Making and Sealing
Insert jointing between flange mating faces. Pull up joint equally all round.

Y10.5050 SCREWED JOINTS, STEEL PIPES:
Preparation
Ensure that plain ends are cut square. Reamer out bore at plain ends.
Screw plain ends, taper thread.
Making and Sealing
Coat male pipe threads with jointing compound and hemp, or PTFE tape on small sizes. Immediately after applying coating, connect with female end of socket or fitting, and tighten ensuring that coating does not intrude into pipe. Leave joint clean.

Y10.5070A ANCHORS, STEEL PIPES, U-BOLTS:
Provide anchors constructed using mild steel over-straps or heavy U-bolts. Secure to channel section, adequately attached to or grouted into building structure; weld longitudinal edges of strap to pipe.

Y10.5070B ANCHORS, STEEL PIPES, SLIP-ON FLANGES:
Provide anchors constructed by passing two slip-on flanges over pipe to anchor point. Bolt together through an interposed mild steel channel section attached to or grouted into building structure, and finally weld flanges to pipe.

Y10.5090 STEEL PIPEWORK PAINTING:
Remove scale, rust or temporary protective coating by chipping, wire brushing or use of approved solvents and paint with one coat of red oxide primer, as work proceeds.

Y10.5100 COMPRESSION JOINTS, STAINLESS STEEL PIPES:
Use BS EN 1254-2 Type 'A' fittings.
Preparation - Ensure that plain ends are cut square. Reamer out bore at plain ends to full bore size. Clean plain ends with fine steel wool.
Making and Sealing - In accordance with fitting manufacturer's instructions.

Y10.5120 BRAZED JOINTS, STAINLESS STEEL JOINTS:
Preparation - Prepare for brazing in accordance with BS EN 14324.
Making and Sealing - Use flame heat and make in accordance with BS EN 14324. Use nickel bearing zinc free filler metals.

Y10.6030 COMPRESSION JOINTS, COPPER PIPES, LIGHT GAUGE:

Preparation for fittings to BS EN 1254-2.

Type `A' fitting

Ensure that plain ends are cut square. Reamer out bore at plain ends to full bore size. Clean plain ends with fine steel wool or fine sandpaper.

Type `B' fitting

Ensure that plain ends are cut square. Reamer out bore at plain ends to full bore size. Clean plain ends with fine steel wool or fine sandpaper. Then comply with manufacturer's instructions.

Making and Sealing - As manufacturer's instructions.

Y10.6040 CAPILLARY JOINTS, COPPER PIPES, LIGHT GAUGE:
Preparation - Ensure that plain ends are cut square. Reamer out bore at plain ends to full bore size. Clean plain ends with fine steel wool.
Making and sealing - Use specified flux ensuring no excess material used. Make joint in accordance with manufacturer's instructions. Clean off traces of flux when joint is completed.

Y10.6060A ANCHORS, COPPER PIPES, SADDLE CLAMPS:
Provide anchors constructed by fitting two flanges to copper female adapters in pipe run at anchor point. Bolt together through an interposed mild steel channel section attached to or grouted into building structure.

Y10.6060B ANCHORS, COPPER PIPES, SADDLE CLAMPS:
Anchor pipework using saddle clamps to mild steel channel section attached to or built into building structure.

Y10.8010 SOLVENT WELDED JOINTS, PVC PIPES:
Use solvent welded joints generally, ring seal joints at expansion joints and elsewhere as necessary.
Preparation - Ensure that plain ends are cut square. Reamer out bore at plain ends. Clean plain ends with solvent cleaner.
Making and Sealing - In accordance with fitting manufacturer's instructions.

Y10.8020 FUSION JOINTS, POLYETHYLENE PIPES:
Preparation - Square cut plain ends. Form pipe ends for socket type joints.
Making and Sealing - In accordance with fitting manufacturer's instructions.
Carry out butt fusion jointing of pipes and fittings in accordance with the procedures given in BS ISO 21307.

Y10.8030 MECHANICAL FITTINGS FOR POLYETHYLENE PIPE:
Preparation - Ensure that cut ends are square. Check wall thickness/pressure rating of fitting.
Making and sealing - Ensure correct gasket type is used for service (e.g. water or gas). Assemble fitting in accordance with manufacturer's instructions.

Y10.8040 ANCHORS - PVC PIPES:
Clamp pipework to mild steel channel section attached to or grouted into building structure, using PVC coated over-straps, or clamps and with a polypropylene strip between pipe and mild steel section.

Y10.8050 JOINTING POLYBUTYLENE PIPES AND FITTINGS:
Carry out installation of polybutylene pipes and fittings in accordance with manufacturer's instructions.

Y10.8060 COMPRESSION FITTINGS ON MULTI-LAYER PIPES:
Carry out installation of compression fittings on multi-layer pipe in accordance with manufacturer's recommendations.

Y10.9010 FLEXIBLE COUPLINGS AND FLANGE ADAPTERS, SLEEVE TYPE:
Preparation - Ensure that cut ends are square and free of bumps, dents and score marks and are within manufacturer's tolerances.
Making and sealing - Ensure gasket is suitable for service. Thoroughly lubricate gasket using manufacturer's recommended lubricant. Assemble coupling in accordance with manufacturer's instructions.
For non-end load capable couplings, ensure that adequate pipe anchorage is provided to prevent pipe disengagement.

Y10.9120A STEELWORK GALVANIZED AFTER MANUFACTURE:
Prepare supports, bearers and other uncovered steelwork as steel pipework.
Where not exposed, paint with one coat zinc chromate or red oxide primer.

Y11 PIPELINE ANCILLARIES

Y11.1000 GENERAL
1010 SAFETY AND RELIEF VALVES, SELF OPERATED, APPLICATION:
Safety - To discharge with rapid opening action to prevent pre-determined safe pressure being exceeded.
Relief - To discharge with opening action proportional to increase in pressure above set pressure.
1020 EXPOSED VALVES:
Fit easy-clean covers over glands and bonnets to small copper alloy valves exposed in areas other than plant rooms. Fit thermoplastic valve wheels. Fit dust caps to lockshield valves.
1030 TESTING:
Ensure that valves and cocks are pressure tested at manufacturer's works, in accordance with appropriate British Standards specification. Test valves in accordance with BS EN 12266-1 and BS EN 12266-2.

Y11.2440A DRAIN COCKS, THROUGHWAY GLAND COCK:
Bronze body threaded male to BS 21 and BS EN 10226-1.
Tapered plug with square shank for loose lever; bolted gland; strap and blank cap screwed on hand tight.
Outlet to accept hose union.

Y11.2480 VENT COCKS - BALL TYPE:
Bronze or DZR copper alloy body; chrome-plated DZR ball; PTFE seats and stem seals; blow-out proof stem.
Permanently identified ports in T-configuration.
Lever operated.

Y11.2670A TEST PLUGS, SELF SEALING:
Provide DZR copper alloy self sealing test plugs for measurement of temperature and pressure, complete with captive cap for sealing when not in use. Ensure test plugs are suitable for system operating temperature and pressure.
Provide one thermometer and pressure gauge for each range of conditions, for use with test plugs.

Y11.2670B TEST PLUGS, VALVE CONTROLLED:
Provide DZR copper alloy self valve controlled test plugs for measurement of temperature and pressure, complete with captive cap for sealing when not in use. Ensure test plugs are suitable for system operating temperature and pressure.
Provide one thermometer and pressure gauge for each range of conditions, for use with test plugs.

Y11.2680A THREADED PIPELINE STRAINERS, BRONZE:
Material - Bronze to BS EN 1982.
Ends - Threaded to BS 21 and BS EN 10226-1.
Pattern - Y pattern body.
Screen free area - Not less than 250% of pipe bore.
Screen perforations
15 to 50mm nominal size, within range 0.7 - 0.9 mm diameter.
65mm and over nominal size, within range 1.5 - 1.8mm diameter.
Internal to external flow through screen. Provide plugged connections for drain, air vent and differential pressure monitoring, threaded to BS 21 and BS EN 10226-1.

Y11.2690A TUNDISHES, COPPER:
Provide tundishes located adjacent to equipment, as indicated.

Use 3mm minimum thickness copper sheet. Form sheet into a tapered reducing cone with a minor diameter to suit drain line.
Major diameter nominally 50 mm larger than minor diameter, tapering at approximately 30 degrees.

Y11.4010 INSTALLATION:
Install pipeline ancillaries in accordance with manufacturer's recommendations and BS 6683.

Y11.4020 LOCATION:
- Positions

Install valves, cocks, traps, strainers, test plugs, tundishes and other ancillary equipment in positions indicated.

Y11.4025 LOCATION OF THERMOSTATIC RADIATOR VALVES:
Install thermostatic radiator valves in an area which reflects the space temperature. Ensure that they are not behind curtains or enclosed in heating or radiator panels.

Y11.4030 POSITIONING OF COMPONENTS:
Locate flow and pressure measurement valves to ensure manufacturer's recommended straight length of pipe upstream and downstream of valve is provided.

Y11.4040 POSITIONING OF DOUBLE REGULATING VARIABLE ORIFICE VALVE:
Install double regulating variable orifice valve to ensure equivalent of 10 diameters of straight pipe upstream and 5 diameters downstream of double regulating valve.

Y11.4050A POSITIONING OF CONTROL COMPONENTS:
Install pipeline control components in accordance with manufacturer's instructions and in positions indicated.
Insulation - Where control components are incorporated in insulated pipelines provide details of insulation method proposed, for approval.
Supports - Arrange supports for control components to ensure no strain is imposed on components.
Access - Arrange control components to ensure adequate access for operation and maintenance.

Y11.4070 VALVE STUFFING BOXES:
Adjust glands of all stuffing boxes at normal plant operating temperature and pressure in accordance with manufacturer's instructions. Ensure that valve action is not impaired by over tightening.

Y11.4080A DISCHARGE CONNECTIONS, SAFETY VALVES:
Fit pipework connections, where indicated, to provide discharge connection to Safety and Relief valves terminating at a safe discharge point.

Y11.4080B DISCHARGE CONNECTIONS, VENT COCKS:
Fit pipework connections, where indicated, to provide discharge connection to vent cocks terminating 150mm above floor level.

Y11.4080D DISCHARGE CONNECTIONS, AUTOMATIC AIR VENTS:
Fit pipework connections, where indicated, to provide discharge pipe to automatic air vents terminating over a suitable gully or drain line in a visible location.

Y11.4090 EXPANSION DEVICES:
Where expansion and contraction cannot be accommodated by selected route, provide pipework loops, as indicated. Limit total stress set up in material of pipe wall, taking into account

components due to internal pressure, tension and bending to less than 69 MPa for steel pipelines and less than 51.5 MPa for copper pipe lines.
Where location does not permit sufficient flexibility, provide proprietary devices, as indicated.

Y11.4100 EXPANSION COMPENSATORS INSTALLATION:
Provide anchors and guides to contain all movement and resist maximum loads imposed. Install expansion compensators strictly in accordance with manufacturer's instructions.

Y11.4110 FLEXIBLE CONNECTIONS INSTALLATION:
Fit rubber bellows as close to source of vibration as practicable. Ensure the pipe at other end of bellows is a fixed point. Install flexible connections strictly in accordance with manufacturer's instructions.
Ensure flexible connections are tied when the plant is on vibration isolation mountings.

Y25 CLEANING AND CHEMICAL TREATMENT

Y25.1000 GENERAL
1010 CONDITIONS FOR CLEANING AND CHEMICAL TREATMENT:
Ensure treatment complies with statutory authority and health and safety regulations.
Notify manufacturer's and suppliers of equipment of proposed system cleaning and chemical treatment processes. Establish if any manufacturer or supplier of equipment requires any particular cleaning and chemical treatment process due to size of waterways or materials used.
All chemicals used are to be compatible with the metallurgy of the systems.
1015 METHOD STATEMENT:
Provide a method statement covering the sequence of events, chemicals to be used etc. Statement to be provided at least two months prior to the start of any flushing and/or chemical cleaning works.

Y25.2030A PRELIMINARY CHECKS:

- Prior to carrying out cleaning or chemical treatment process, ensure that
  - All foreign matter is removed.
  - Certified pressure tests have been carried out in the parts of the system to be cleaned. Carry out further pressure tests on the isolated sections of the system independently.
  - All water used for pressure testing is inhibited. Leave remaining pipework sections full after testing.
  - Where there is a risk of freezing inhibited mono-ethyleneglycol is used.
  - Circulation has been demonstrated and approval obtained on all parts of the system. Manipulate and leave fully open all valves other than those used to isolate sections. Carry out balancing and certification after the flushing, cleaning and passivation operations.
  - No damage can occur to any item of plant or equipment due to cleaning and chemical processes.
  - Chemicals used are compatible with system materials.
  - All items of plant and equipment subject to damage or blockage due to cleaning and chemical treatment processes are isolated or removed.
  - Permanent or temporary by-passes are provided as indicated on drawings.
  - Dirt pockets are installed at low points to facilitate solids removal. Supply dirt pockets with drain valves sized to pipework size.
  - All drains provided have been tested and approved and that any pumping equipment associated with the drainage system is fully commissioned.
  - Dead legs, that are more than 3 pipe diameters in length are looped to allow effective cleaning.
  - Strainer baskets and filter media, incorporated within systems, are removed; and where necessary spool or stool pieces are installed.
  - Temporary strainers and filters are installed as required for removal of solids during cleaning and chemical treatment processes.
  - Strainers are clean prior to the start of the cleaning process, throughout the cleaning and on completion.
  - Suitable supply and drainage points are provided with 50mm minimum connections, properly sited and installed, either valved or plugged.
  - All automatic/manual air vents are fully commissioned.
  - All requirements of COSHH regulations are complied with during the chemical cleaning and chemical treatment of the system.
  - Where required by local water authority, provide effluent tanks for storage of all waste products of cleaning and chemical treatment processes.
  - Following local water authority approval, either neutralize and dispose to drain of all waste products; or ensure authorised disposal at registered sites.

- Comply with Waste Management Duty of Care: A Code of Practice and The Hazardous Waste (England & Wales) Regulations 2005 where appropriate.

Y25.2040A PROCEDURAL PRECAUTIONS FOR CLEANING AND CHEMICAL TREATMENT:
- Carry out tests to ensure that cleaning and chemical treatment processes are operating as required.
- Carry out tests to ensure that cleaning and chemical treatment processes are operating as required. and detailed in the Method Statement.
- Submit all test and sample results for certification and approval.

Y25.2040B PROCEDURAL PRECAUTIONS FOR CLEANING AND CHEMICAL TREATMENT INCLUDING TAKING SAMPLES:
- Take samples during and following chemical treatment and/or cleaning.
- Submit samples to an independent analyst.
- Use sterile containers to take samples.
- Carry out tests to ensure that cleaning and chemical treatment processes are operating as required.
- Submit all test and sample results for certification and approval.
- Ensure all samples are witnessed.

Y25.3010A FLUSHING:
- System filling
  - Temporary connection from mains in compliance with the Water Supply (Water Fittings) Regulations 1999, and the Water Supply (Water Fittings) (Amendment) Regulations 1999.
  - Temporary connection from fire hydrant pipework.
  - By installation of temporary tank and pump arrangement.

Carry out flushing of water systems in accordance with BSRIA Application Guide 1/01
Pre-commission cleaning of pipework systems.
Section 2 Installation considerations
2.1 Management
2.2 Pipework installation
2.3 Preparation for flushing and cleaning
2.4 Procedure for filling, pressure testing and static flushing.
Section 3 System dynamic flushing.
C1 Flushing objectives
C2 Dynamic flushing procedure.
Inspection and witnessing, as section 1.4.

Y25.3010B FLUSHING:
All water used for pressure testing, flushing and system filling is of good quality. Leave remaining pipework sections full and treated after pressure testing.
Install all necessary pipework ancillaries to enable a specialist to carry out flushing, inspection and witnessing of water systems in accordance with BSRIA Application Guide AG 1/01.
Pre-commission cleaning of pipework systems.
Temporary connection from the mains must be in compliance with the Water Supply (Water Fittings) Regulations 1999 and amendment, or by installation of a temporary tank and pump arrangement.
Domestic water systems are to be flushed and disinfected in accordance with the requirements of BS 6700, and to the satisfaction of the local water supply authority. Flush systems using mains water until the water is clear.

Y25.3090 DOCUMENTATION:
Provide number of copies as indicated of hard cover binders containing details of

Programme outlines.
Purpose of chemical treatment.
Chemicals used and quantity.
On site testing procedures.
Control limits of tests.
Equipment data and drawings.
Product notes and material safety data sheets for all chemicals used.

Provide a complete training programme for site operatives covering
Methods of basic water testing.
Explanation of results obtained.
Actions to be taken on test results.

Y50 THERMAL INSULATION

Y50.1000 GENERAL
1010 TEMPERATURE RANGE:
Surface temperature within range -40ºC to 230ºC.
1020 STANDARDS:
Comply in general with BS EN ISO 12241. Use the description of terms as BS 3533.
1030 MATERIALS:
Employ materials that comply with BS 476-7.
Ensure metals and materials that cause galvanic corrosion are not installed in contact.
Do not use galvanized or zinc coated steel jacketing and accessories on austenitic stainless steel and austenitic nickel steel/alloy equipment and piping.
1032 PRE-INSULATED EQUIPMENT:
Where fire and surface spread of flame certificates relate to factory made products, ensure that certificates are still valid where products are incorporated in pre-insulated equipment.
1034 PROTECTION APPLIED IN SITU:
Where fire and surface spread of flame certificates relate to factory made products, ensure that the certificate remains valid when the finish is site applied.

Y50.1035A CLASS A1 EUROPEAN CLASSIFICATION FOR REACTION TO FIRE PERFORMANCE:
Supply insulating materials that comply with Euroclass A1.

Y50.1050A SPREAD OF FLAME:
When completed, ensure surface-finish complies with BS 476-7 Class 1 spread of flame.

Y50.1055A SMOKE EMISSION CHARACTERISTICS:
Supply materials classified as less than 5% smoke obscuration rating when tested in accordance with BS EN ISO 5659-2.

Y50.1080 ELECTRICAL BONDING TERMINAL:
Ensure an electrical bonding terminal suitable for connection of 6mm^2 maximum conductor is provided where indicated.

Y50.1090 INSPECTION AND TESTING:
Arrange performance test of thermal conductivity on materials selected, carried out at manufacturer's works or at an approved laboratory and in accordance with appropriate British Standard.

Y50.2010 THERMAL CONDUCTIVITY:
Ensure values are in accordance with BS EN 12664, BS EN 12667, BS EN 12939 or BS EN ISO 8990.

Y50.2015A THERMAL PERFORMANCE LIFE EXPECTANCY FOR PLANT DESIGN LIFE:
Ensure the insulation will maintain it's thermal performance for a minimum of the plant design life.

Y50.2015B THERMAL PERFORMANCE LIFE EXPECTANCY DETAILS:
Provide manufacturer's details which define the life expectancy of the insulation material.

Y50.2020 RESTRICTIONS ON USE OF MATERIALS:
Protect insulated stainless steel surfaces from the risk of stress corrosion in accordance with the recommendations in BS 5970.

Y50.2030A FOIL FACED ROCK MINERAL FIBRE PIPE INSULATION:

Standard - BS 3958-4.
Nominal density - 80 kg/m^3 to 120 kg/m^3.
Thickness - 20mm to 100mm.
Thermal conductivity - Rock Mineral Fibre
Not exceeding 0.038 W/mK at a mean temperature of 50^{o}C.
Finish - Reinforced aluminium foil with at least 25mm overlap.

Y50.2040A FOIL FACED ROCK MINERAL FIBRE RIGID DUCT INSULATION:
Standard - BS 3958-5.
Nominal density - 45 - 48 kg/m^3.
Thickness - 25mm to 100mm.
Thermal conductivity - Not exceeding 0.04 W/mK at a mean temperature of 50^{o}C.
Finish - Reinforced aluminium foil.

Y50.2050A FOIL FACED ROCK MINERAL FIBRE FLEXIBLE DUCT INSULATION:
Nominal density - 28 kg/m^3 to 45 kg/m^3.
Thickness - 25mm to 60mm.
Thermal conductivity - Not exceeding 0.04 W/mK at a mean temperature of 50^{o}C.
Finish - Reinforced aluminium foil.

Y50.2110A FOIL FACED CLOSED CELL RIGID PHENOLIC FOAM (PF) PREFORMED SECTIONS - CFC AND HCFC FREE:
Standard - BS EN 13166.
Nominal density - 35 - 40 kg/m^3.
Temperature range: -180 to +120^{o}C.
Thickness - 15mm to 50mm.
Thermal conductivity - Not exceeding 0.021 W/mK at a mean temperature of 10^{o}C.
Finish - Reinforced aluminium foil.

Y50.2110B CLOSED CELL RIGID PHENOLIC FOAM (PF) PREFORMED SECTIONS - CFC AND HCFC FREE:
Standard - BS EN 13166.
Nominal density - 35 - 40 kg/m^3.
Temperature range: -180 to +120^{o}C.
Thickness - 15mm to 50mm.
Thermal conductivity - Not exceeding 0.021 W/mK at a mean temperature of 10^{o}C.

Y50.2120A FOIL FACED CLOSED CELL RIGID LAMINATED PHENOLIC FOAM (PF), DUCT INSULATION SLAB - CFC AND HCFC FREE:
Standard - BS EN 13166.
Nominal density - 40 kg/m^3.
Thickness - 20mm to 50mm.
Thermal conductivity - Not exceeding 0.021 W/mK at a mean temperature of 10^{o}C.
Finish - Reinforced aluminium foil.

Y50.2120B CLOSED CELL RIGID LAMINATED PHENOLIC FOAM (PF), DUCT INSULATION SLAB - CFC AND HCFC FREE:
Standard - BS EN 13166.
Nominal density - 40 kg/m^3.
Thickness - 20mm to 50mm.
Thermal conductivity - Not exceeding 0.021 W/mK at a mean temperature of 10^{o}C.

Y50.2130A HIGH DENSITY PHENOLIC PIPE AND DUCT SUPPORT FOAM:

- Obtain written confirmation from the manufacturer that the material is CFC and HCFC free.

Standard - BS EN 13166.

Nominal density - 60 kg/m^3 to 120 kg/m^3.

Temperature range: -180 to +120^{o}C.

Thermal conductivity - Not exceeding 0.040 W/mK at a mean temperature of 50^{o}C.
CFC and HCFC free.

Y50.2140A CLOSED CELL NITRILE RUBBER ELASTOMERIC SHEET AND PREFORMED FLEXIBLE SECTIONS:

Nominal density - 90 - 100 kg/m^3.

Temperature range: -40 to +105^{o}C.

Thickness

Sections - 13mm to 25mm for pipe sizes 15mm to 100mm.
Sheets - 6mm to 25mm.

Thermal conductivity - Not exceeding 0.04 W/mK at a mean temperature of 20^{o}C.

Y50.2180A BITUMEN VAPOUR BARRIER COATINGS:
Cut-back bitumens with cotton canvas or open mesh glass cloth to reinforce coatings.

Y50.2180B VINYL VAPOUR BARRIER COATINGS:
Vinyl emulsions with cotton canvas or open mesh glass cloth to reinforce coatings.

Y50.2180C SOLVENT POLYMER VAPOUR BARRIER COATINGS:
Solvent-based polymers with cotton canvas or open mesh glass cloth to reinforce coatings.

Y50.2180D BITUMEN EMULSION VAPOUR BARRIER COATINGS:
Bitumen emulsions (with or without elastomer latex) with cotton canvas or open mesh glass cloth to reinforce coatings.

Y50.2190 ADHESIVES:
Comply with the recommendations of clause 8.2 of BS 5970, section 2 for insulation bonding adhesives, lagging adhesives; and facing and film attachment adhesives.

Y50.2210A ALUMINIUM BANDS REINFORCEMENT:
Aluminium bands at 300mm centres.

Y50.2210B ALUMINIUM BANDS REINFORCEMENT:
Aluminium bands at 450mm centres.

Y50.2220A VALVE AND FLANGE INSULATION - ALUMINIUM CASING:
Install insulation on flanges and valves.
Use a protected metal split casing fabricated from 0.91mm aluminium sheet fitted with spring clip fasteners, filled with insulating material with same thermal performance as insulation on adjoining pipe.

Y50.2220B VALVE AND FLANGE INSULATION - ALUMINIUM-ZINC COATED STEEL CASING:
Install insulation on flanges and valves.
Use a protected metal split casing fabricated from 0.7mm aluminium-zinc coated steel sheet fitted with spring clip fasteners, filled with insulating material with same thermal performance as insulation on adjoining pipe.

Y50.2285 CALCULATION OF INSULATION THICKNESS:

Provide insulation of thickness conforming with the values given in the tables below. These figures are derived from the tables given in BS EN ISO 12241.

Y50.2286 CALCULATION OF INSULATION THICKNESS - BUILDING REGULATIONS (ENGLAND AND WALES):
Provide insulation of thickness conforming with the requirements of the Building Regulations (England and Wales) Part L Approved Documents, and the calculation methods given in BS EN ISO 12241.

Y50.2286 CALCULATION OF INSULATION THICKNESS - BUILDING REGULATIONS (ENGLAND AND WALES):
Provide insulation of thickness conforming with the requirements of the Building Regulations (England and Wales) Part L Approved Documents, and the calculation methods given in BS EN ISO 12241.

Y50.2286 CALCULATION OF INSULATION THICKNESS - BUILDING REGULATIONS (ENGLAND AND WALES):
Provide insulation of thickness conforming with the requirements of the Building Regulations (England and Wales) Part L Approved Documents, and the calculation methods given in BS EN ISO 12241.

Y50.2286 CALCULATION OF INSULATION THICKNESS - BUILDING REGULATIONS (ENGLAND AND WALES):
Provide insulation of thickness conforming with the requirements of the Building Regulations (England and Wales) Part L Approved Documents, and the calculation methods given in BS EN ISO 12241.

Y50.2286 CALCULATION OF INSULATION THICKNESS - BUILDING REGULATIONS (ENGLAND AND WALES):
Provide insulation of thickness conforming with the requirements of the Building Regulations (England and Wales) Part L Approved Documents, and the calculation methods given in BS EN ISO 12241.

Y50.2310 NON-DOMESTIC HEATING INSTALLATIONS - ROCK MINERAL WOOL:
Environmental insulation thickness for non-domestic heating installations to control heat loss.

Outside diameter of steel pipe (mm)	Temperature of contents ^{0}C		
	75	100	150
	Thickness of mineral wool insulation (mm)		
17	30	35	60
21	30	40	60
27	35	40	60
34	35	45	70
42	35	45	70
48	40	50	70
60	40	50	70
76	40	50	80
89	40	60	80
114	45	60	80
140	45	60	80

168	45	60	90
219	50	60	90
273	50	60	90
Flat surfaces	50	70	90

- Use this table for insulation thickness of copper pipework of the nearest equivalent outside diameter.

Y50.2320 NON-DOMESTIC HEATING INSTALLATIONS - PHENOLIC FOAM:
Environmental insulation thickness for non-domestic heating installations to control heat loss, aged K-value.

Outside diameter of steel pipe (mm)	Temperature of contents ^{0}C	
	75	100
	Thickness of phenolic foam insulation (mm)	
17	15	20
21	15	20
27	20	20
34	20	25
42	20	25
48	20	25
60	25	30
76	25	30
89	25	30
114	25	35
140	30	35
168	30	35
219	30	40
273	30	40
Flat surfaces	35	45

- Use this table for insulation thickness of copper pipework of the nearest equivalent outside diameter.

Y50.2420 PROTECTION AGAINST FREEZING - MINERAL WOOL:

Outside diameter of pipe (mm)	Indoor condition where freezing might occur	Outdoor condition where freezing might occur
	Thickness of mineral wool insulation (mm)	
Copper pipe		

15	-	-
22	20	50
28	20	25
35	20	20
42	20	20
54	20	20
76	25	25
108	25	25
Steel pipe		
21	40	-
27	20	45
34	20	25
42	20	20
48	20	20
60	20	20
76	25	25
89	25	25

- Indoor condition is for ambient air temperature of -6^{o}C, permitted ice formation of 50%.
- Outdoor condition is for ambient air temperature of -10^{o}C, permitted ice formation of 50%.

Y50.2430 PROTECTION AGAINST FREEZING - PHENOLIC FOAM:
Within the scope of BS 5422 Table 23.

Outside diameter of steel pipe (mm)	Indoor condition where freezing might occur	Outdoor condition where freezing might occur
	Thickness of closed cell phenolic foam (mm)	
15	30	70
20	20	50
25	20	20
32	20	20
40	20	20
50	20	20
65	20	20
80	20	20
Flat surfaces	25	25

- Indoor condition is for ambient air temperature of -6^{o}C, permitted ice formation of 50%.
- Outdoor condition is for ambient air temperature of -10^{o}C, permitted ice formation of 50%.
- Use this table for insulation thickness of copper pipework of the nearest equivalent outside diameter.

Y50.2440 PROTECTION AGAINST FREEZING - CLOSED CELL NITRILE RUBBER:

Outside diameter of steel pipe (mm)	Indoor condition where freezing might occur	Outdoor condition where freezing might occur
	Thickness of closed cell nitrile rubber (mm)	
15	57	-
20	25	51
25	13	32
32	13	19
40	13	13
50	13	13
65	13	13
80	13	13
Flat surfaces	13	13

- Indoor condition is for ambient air temperature of -6^{o}C, permitted ice formation of 50%.
- Outdoor condition is for ambient air temperature of -10^{o}C, permitted ice formation of 50%.
- Use this table for insulation thickness of copper pipework of the nearest equivalent outside diameter.

Y50.2470 CONDENSATION CONTROL ON CHILLED AIR DUCTWORK - PHENOLIC FOAM:
Minimum insulation thickness for condensation control on ductwork carrying chilled air in ambient conditions: indoor still air temperature 25^{0}C, relative humidity 80%, dew point temperature 21.3^{0}C.

Minimum air temperature inside duct ^{0}C	Thermal conductivity of 0.021 W/mK at a mean temperature of 10 ^{0}C Surface coefficients		
	Low (0.05)	Medium (0.44)	High (0.90)
	Thickness of phenolic foam insulation (mm)		
15	25	25	25
10	30	25	25

5	40	25	25
0	50	25	25

Y50.2475 CONDENSATION CONTROL ON CHILLED AIR DUCTWORK - CLOSED CELL PVC NITRILE FOAM:
Minimum insulation thickness for condensation control on ductwork carrying chilled air in ambient conditions: indoor still air temperature 25^{0}C, relative humidity 80%, dew point temperature 21.3^{0}C.

Minimum air temperature inside duct. ^{0}C	Thermal conductivity of 0.036 W/mK at a mean temperature of 10 ^{0}C. Surface coefficients	
	(0.7)	(0.9)
	Thickness of PVC Nitrile foam insulation (mm)	
	10	8
10	16	12
5	19	16
0	25	25

Y50.3010 GENERAL:
Carry out thermal insulation work using one of the scheduled firms employing skilled craftsmen conversant with class of work.
Do not apply thermal insulation until installation has been fully tested and all joints proved sound.
Ensure all materials are kept dry.
Ensure all pipework surfaces are dry before the installation of thermal insulation.
Insulate each unit separately. Do not enclose adjacent units together.
Ensure there is clearance between insulated pipes.
Application
Apply insulants, facings, coatings and protection strictly in accordance with manufacturer's instructions.
Finish
Neatly finish joints, corners, edges and overlaps and, where possible, arrange overlaps to fall on blind side. Ensure overlaps are neat and even and parallel to circumferential and longitudinal joints.

Y50.3020 INSTALLATION OF FOIL FACED MINERAL WOOL INSULATION ON PIPEWORK:
Ensure joints are close butted together. Secure overlaps with adhesive or matching class 'O' tape, a minimum of 50mm wide, on both longitudinal and circumferential butt joints. Insulate fittings to same standard as adjacent pipework and use mitred segments where necessary, taped as above.
Where a vapour seal or fibre containment is required tape exposed insulation membrane and return to pipe surface.
Where insulation abuts pipe support inserts that have integral vapour barriers seal using class 'O' foil tape to continue vapour barrier or containment.

Y50.3030 INSTALLATION OF FOIL FACED PHENOLIC FOAM INSULATION ON PIPEWORK:
Ensure joints are close butted together. Secure overlaps with adhesive or matching class 'O' tape, a minimum of 50mm wide, on both longitudinal and circumferential butt joints. Insulate fittings to same standard as adjacent pipework and use mitred segments where necessary, taped as above.

Y50.3040 INSTALLATION OF INSULATION WITH CANVAS FINISH ON PIPEWORK:
Ensure joints are close butted together and secure overlaps with adhesive and smooth out. Insulate fittings to same standard as adjacent pipework and use mitred segments where necessary, secure with adhesive using a minimum of 50mm wide canvas to cut mitred joints. Apply two coats of class 'O' polymer solution.

Y50.3050 INSTALLATION OF CLOSED CELL NITRILE RUBBER INSULATION ON PIPEWORK:
Install closed cell nitrile rubber in accordance with manufacturer's recommendations.
Check installation procedure when closed cell nitrile rubber is to be installed on stainless steel pipework.

Y50.3060 INSTALLATION OF FOIL FACED SEMI-RIGID SLAB INSULATION ON DUCTWORK:
Secure the insulation with adhesive in accordance with manufacturer's recommendations. Use insulation hangers spaced at maximum 300mm centres on the underside of ducts.
Cut slabs so that the top and bottom pieces overlap the sides. Seal joints and pin penetrations using 100mm wide class 'O' aluminium foil tape.
Where cut outs for test holes, etc occur tape over insulation membrane and return to the duct surface.
Where insulation abuts duct support inserts that have integral vapour barriers seal using class 'O' foil tape to continue vapour barrier.

Y50.3070 INSTALLATION OF FOIL FACED FLEXIBLE DUCTWORK INSULATION:
Secure the insulation with adhesive in accordance with manufacturer's recommendations. Use insulation hangers spaced at maximum 300mm centres on the underside of rectangular and flat oval ducts.
Seal joints and pin penetrations using 100mm wide class 'O' aluminium foil tape. Where cut outs for test holes, etc occur tape over insulation membrane and return to the duct surface.
Where insulation abuts duct support inserts that have integral vapour barriers seal using class 'O' foil tape to continue vapour barrier.

Y50.3080 INSTALLATION OF FOIL FACED LAMELLA ON DUCTWORK:
Secure the insulation in accordance with manufacturer's recommendations. Use insulation hangers spaced at maximum 300mm centres on the underside of rectangular and flat oval ducts.
Seal joints and pin penetrations using 100mm wide class 'O' aluminium foil tape. Where cut outs for test holes, etc occur tape over insulation membrane and return to the duct surface.
Where insulation abuts duct support inserts that have integral vapour barriers seal using class 'O' foil tape to continue vapour barrier.

Y50.3120 INSTALLATION OF POLYISOBUTYLENE (PIB) PROTECTION:
Wrap pipework and fittings, ductwork or tanks and vessels with PIB sheeting lapped at every joint by at least 50mm. Solvent weld joints and support with banding in accordance with manufacturer's
Arrange joints to shed water and prevent the ingress of water.

Y50.3140A INSTALLATION OF SHEET METAL FINISH ON DUCTWORK, TANKS AND VESSELS:

Form sheet metal to fit tightly over the insulation with a longitudinal overlap of at least 40mm. Secure the outer part of overlap with self tapping screws or rivets at centres of not more than 150mm. Not on vapour sealed ducts; or metal bands of same material.
Ensure circumferential overlaps are at least 50mm, secured with self tapping screws or rivets. Make provision to accommodate expansion and contraction at intervals. Ensure all joints are lapped to shed liquids and seal all joints exposed to weather or spillage. Cover all bends and fittings with matching sheet metal, tailored to fit and sealed as appropriate.

Y50.3150 INSTALLATION OF CANVAS PROTECTION:
Cover the whole with 4.5oz (minimum) canvas with at least 50mm overlaps.Seal joints.
Give two coats of class 'O' polymer solution. Fit aluminium bands where indicated.

Y50.3160 INSTALLATION OF ROOFING FELT PROTECTION:
Apply directly to insulating material with an overlap of at least 50mm on all joints, made to shed water. Secure in position with galvanized wire netting, of 1mm x 25mm mesh. Finish with two coats of black bituminous paint.

Y50.3170 INSTALLATION OF ALUMINIUM SHEETING PROTECTION:
Secure lapped joints (at least 40mm) by means of pop rivets at a maximum spacing of 150mm. For cold piping use matching aluminium straps at maximum spacing of 225mm. On piping operating below ambient temperature seal all joints against moisture. For external use make joints shed water and use sheets with treated surface.
Where `lockform' seams are used submit proposals for dealing with surfaces curved in three dimensions.

Y50.3180 INSTALLATION OF ALUMINIUM-ZINC COATED STEEL PROTECTION:
Install aluminium-zinc coated steel protection, in accordance with manufacturer's instructions.

Y50.3190 INSTALLATION OF RIGID PVC PROTECTION:
Apply rigid PVC sheet and pre-formed fittings directly to insulation with an overlap of at least 40mm on longitudinal and circumferential joints. Secure longitudinal laps with plastic rivets at 150mm centres.
Ensure rigid PVC is not installed in contact with heat sources.

Y50.3195 INSTALLATION OF LAMINATED FOIL/FILM PROTECTION:
Install laminated foil/film protection, in accordance with manufacturer's instructions.
Ensure all surfaces are dry and clean, free from dust, oil and grease/silicone.
Arrange joints to give a water shed with the lap facing down.

Y50.3210 FLANGES AND VALVES:
Cut back to allow removal of bolts and nuts, finish with neat bevel or use end caps.
Where boxes are used fit over insulation on adjacent piping. Ensure operation of valve remains unimpaired with box in place.

Y50.3230A INSTALLATION WHERE INSULATION IS CARRIED THROUGH PIPELINE SUPPORT:
For load bearing insulation, carry through insulation and finish.
For non-load bearing insulation on hot pipework close butt to a section of load bearing finished material 100mm long.
For non-load bearing insulation on cold pipework, close butt to high density phenolic foam pipe supports. Ensure the vapour barrier is maintained.

Y50.3230B INSTALLATION WHERE CLOSED CELL INSULATION IS CARRIED THROUGH PIPELINE SUPPORT:
For load bearing insulation, carry through insulation and finish.

For non-load bearing insulation on hot pipework up to 120oC, close butt to a high density phenolic or polyisocyanurate pipe support.
For non-load bearing insulation on cold pipework, close butt to high density phenolic foam pipe supports.
Ensure the vapour barrier is maintained.

Y50.3250 INSTALLATION WHERE INSULATION IS CARRIED THROUGH DUCTWORK SUPPORT:
Provide insulation between duct and support using high density phenolic foam strips. Butt insulation to spacer and carry over finish by 40mm and tape joint. Provide a sheet metal protecting sleeve.

Y50.3260 LIQUID VAPOUR BARRIERS:
Apply vapour seal solution evenly by brush in accordance with manufacturer's instructions; use solution which dries to a colour distinctive from insulating material.

Y50.3270 INTEGRITY OF VAPOUR BARRIERS:
Where a vapour barrier is indicated ensure its integrity throughout. Repair immediately any damage to vapour barriers and where such barriers have been applied off site, repair to manufacturer's instructions. Where aluminium sheeting is used for protection, submit proposals for securing sheeting without impairing the integrity of the vapour seal for approval.

Y50.Rock mineral fibre.

Y51 TESTING AND COMMISSIONING

Y51.1000 GENERAL

Y51.2010 PRESSURE TESTING - GENERAL:
Comply with procedures given in HVCA TR/6 Guide to Good Practice for Site Pressure Testing of Pipework. Ensure safety precautions detailed in HSE Guidance Note GS4 Safety in Pressure Testing are adopted.
Provide a blanked connection to accommodate a check gauge in addition to the accurate gauge fitted to section under test.
Test concealed or buried pipework before any permanent covering is applied.
Advise appropriate personnel, in advance, of the time pressure tests may be witnessed.

Y51.2055A PRESSURE TESTING - REFRIGERANT PIPEWORK, STRENGTH PRESSURE TEST:
Test refrigerant pipework using the strength test procedure as detailed in Clause R6.4 of the CIBSE Commissioning Code R: 2002.

Y51.2055B PRESSURE TESTING - REFRIGERANT PIPEWORK, LEAK TEST:
Test refrigerant pipework using the leak test procedure as detailed in Clause R6.5 of the CIBSE Commissioning Code R: 2002.

Y51.2055C PRESSURE TESTING - REFRIGERANT PIPEWORK, DEEP VACUUM TEST:
Test refrigerant pipework using the deep vacuum test method as detailed in Clause R6.6 of the CIBSE Commissioning Code R: 2002.

Y51.2080 PRESSURE TESTING - SOIL, WASTE, VENTILATION, ANTI-SYPHON AND RAINWATER PIPEWORK:
Test section by section as the work proceeds and subsequently on completion with all sanitary fittings fixed and working. Submit systems to two separate tests, Air test and Hydraulic Performance test in accordance with BS EN 12056-2.

Y51.3020 COMMISSIONING CODES:
Carry out commissioning of installations in accordance with the procedures, checks and tolerances given in the BSRIA Application Guides for water systems and air systems to achieve the standards set in the CIBSE Commissioning Codes.

Y51.3030A COMMISSIONING WATER DISTRIBUTION SYSTEMS INCLUDING BSRIA PRE-COMMISSIONING CHECKLIST:
Preliminary checks
Carry out checks and procedures as detailed in CIBSE Commissioning Code W, Section W1. Ensure system is statically complete as defined in section B4 of BSRIA Application Guide 2/89 Commissioning of water systems in buildings.
Use pre-commissioning checklist from BSRIA Application guide 2/89.
Setting to work and regulation
Set to work and regulate water distribution systems in accordance with CIBSE Commissioning Code W, Sections W2 and W3, and sections C3 and C4 in BSRIA Application Guide 2/89.
Measurement
Use instruments for measurement detailed in BSRIA Application Guide 2/89.

Y51.3040A COMMISSIONING AIR DISTRIBUTION SYSTEMS INCLUDING BSRIA PRE-COMMISSIONING CHECKLIST:
Preliminary checks
Carry out checks and procedures as detailed in BSRIA Application Guide 3/89 Commissioning of air systems in buildings.

Use pre-commissioning checklist in BSRIA Application guide 3/89.
Setting to work and regulation
Set to work and regulate air distribution systems in accordance with CIBSE Commissioning Code A, Section A2, and sections C3, C4 and C5 in BSRIA Application Guide 3/89.
Measurement of air flow
Use instruments for measurement and methods of measurement detailed in BSRIA Application Guide 3/89 and CIBSE commissioning guide, section A3.

Y51.3040B COMMISSIONING VAV AIR DISTRIBUTION SYSTEMS INCLUDING BSRIA PRE-COMMISSIONING CHECKLIST:
Preliminary checks
Carry out checks and procedures as detailed in CIBSE Commissioning Code A, Section A1. Ensure system is statically complete as defined in section B4 of BSRIA Application Guide 3/89 Commissioning of air systems in buildings.
Use pre-commissioning checklist in BSRIA Application guide 3/89.
Setting to work and regulation
Set to work and regulate air distribution systems in accordance with CIBSE Commissioning Code A, Section A2, and sections C3, C4 and C5 in BSRIA Application Guide 3/89.
For regulation of Variable Air Volume Systems follow routine in BSRIA Application Guide 1/91 The Commissioning of VAV Systems.
Measurement of air flow
Use instruments for measurement and methods of measurement detailed in BSRIA Application Guide 3/89 and CIBSE commissioning guide, section A3.

Y51.3060 COMMISSIONING REFRIGERATING SYSTEMS:
Follow the procedures given for use and handling of refrigerants, pressure and leak testing, evacuation and dehydration, charging and lubrication of refrigerating systems in CIBSE Commissioning Code R and manufacturer's instructions.
Pre-commissioning:
Carry out the procedures for pre-commissioning detailed in CIBSE Commissioning Code R, Section R5.
Combined pressure and leak testing:
Carry out the procedures for combined pressure and leak testing, including refrigerant charging, detailed in CIBSE Commissioning Code R, Section R6.
Setting to work and adjusting
Carry out the procedures for setting to work and adjusting detailed in CIBSE Commissioning Code R7.
Absorption Systems.
Carry out the procedures for Preliminary Checks, Testing and Charging, and Setting to Work and adjusting detailed in CIBSE Commissioning Code R, Section R10.
Apparatus and Instruments
Use Apparatus and Instruments detailed in CIBSE Commissioning Code R, Section R8. Apply tolerances defined in Section R8.6.

Y51.3070 COMMISSIONING AUTOMATIC CONTROL SYSTEMS:
Carry out commissioning of Automatic Control Systems in accordance with Manual prepared by the controls equipment manufacturer. Carry out the Checking and Setting-Up procedure detailed in the CIBSE Commissioning Code C, Section C1.
Measurement
Carry out measurements in accordance with CIBSE Commissioning Code C, Appendix C2.1.

Y51.3090A INSTRUMENTS AND GAUGES:
Ensure instruments are correctly calibrated. Record details of instruments on record sheets. Submit evidence of correct calibration of instruments to be used in connection with commissioning and testing.

Y51.3100B WATER SYSTEMS COMMISSIONING RECORDS TO BSRIA AG 2/89.3:
Keep a systematic record of commissioning results and distribute as indicated.
For water systems

Use record sheets as detailed in BSRIA Application Guide 2/89.3 Commissioning water systems in buildings.

Y51.3110 BMS COMMISSIONING - CONTROL SYSTEM SPECIFICATION DETAILS REQUIRED FOR COMMISSIONING:
Ensure that the following information is supplied to the commissioning engineer:
A network schematic providing a record of the overall control system architecture.
Schematics of the systems to be controlled indicating the location of sensors and actuators.
A written description of the configured control strategies.
Control strategy logic diagrams in the form of logic flow charts.
Set-points and other control settings such as initial default parameters for control loops relating to the control strategies.
Criteria relating to control accuracy and stability.
A points list including digital inputs/outputs and analogue inputs/outputs.
Control panel drawings.
BMS operator workstation graphics and associated point data displaying monitored conditions.
Trend logging archiving requirements and alarm routing.
The scope of operational and specified functionality of management software, e.g. utility monitoring and targeting software.
Functional requirements of any occupant interfaces.
Details of any hard-wired interfaces from, or to, other control devices.
Functionality and scope of data to be transferred over any gateway for use as part of an integrated system.
Functional profiles for any direct interoperability integration.
Ensure that the following is included in the BMS commissioning specification:-
A clear description of the division of responsibility between the various parties.
Off-site and on-site pre-commissioning procedures.
On-site commissioning procedures.
Requirements for assistance to air and water balancing testing (eg opening and closing control valves) and other plant tests where the controls need to be overridden.
A requirement for any point-by-point verification of correct operation.
Requirements for evaluation of control loop performance/loop tuning.
Requirements for the BMS operator workstation for assistance in the commissioning of plant.
Arrangement for the management of delays.
Phased completion requirements.
Requirements for demonstration/witness testing on the basis of a percentage of points or on a point-by-point basis. Ensure that the witnessing requirement includes the identification of those responsible.
Requirement for software/configuration data back-up.
Requirement for, and involvement in, any complete system and sub-system performance testing.
Requirement for system documentation.
Requirement for operator training requirements.
Requirement for post occupancy checks.

Y51.3120 BMS COMMISSIONING - PRE-COMMISSIONING:
Ensure that as much pre-commissioning work as possible is performed off-site:
Ensure that the following is followed:
Table 15 Pre-commissioning requirements

Pre-commissioning	Pre-commissioning off-site

action	
Control application software	Yes (final commissioning on-site)
User interface software	Yes (final commissioning on-site)
Control panels	Yes (final commissioning on-site)
Terminal units (fan coil units, etc)	Yes (final commissioning on-site)
Wiring	No
Communications network	No
Sensors	No
Actuators	No
Integration gateways	Partial

Ensure that a record of all settings, set-points and offsets are maintained throughout the pre-commissioning period.
Ensure that all final physical adjustments to the field devices are indelibly marked.
Ensure that all packaged plant interfaced with the BMS is fully tested and commissioned by the manufacturer or installer.
Ensure that the BMS is pre-commissioned in accordance with the following requirements of CIBSE Code C (Commissioning of automatic control systems).
Table 16 CIBSE Code C automatic control systems pre-commissioning requirements

Pre-commissioning action	CIBSE Code C section reference
Control applications software	C5.2
Control panels	C5.3
Wiring	C5.4
Communications networks	C5.5
Sensors	C5.6
Actuators and valves	C5.7
Digital inputs/outputs	C5.8
Pneumatic actuation with microprocessor control	C5.9
Field control devices	C5.10

Y51.3130A BMS COMMISSIONING - PLANT READY FOR CONTROL SYSTEM COMMISSIONING:

Confirm that the following plant commissioning has been performed before commencing the final BMS commissioning:
Water systems
The system is cleaned and flushed to remove any debris.
All regulating, isolating and control valves in place and operating correctly.
That all flow measuring devices are in place and in the correct location for accurate measurement (including pressure tappings).
The system is vented.
That the proportional balancing is completed to obtain the branch flow rates in the correct ratio to each other (or through the use of and setting of self-balancing valves).
That the pump flow rate has been adjusted to provide the specified flow rate.
Air systems
Debris has been removed from the air distribution system.
That dampers are in the correct location and fully functional.
That fire/smoke dampers open.
Test holes have been drilled and sealed with removable plugs.
That in-situ flow measuring devices have been installed.
Ductwork air leakage testing has been performed (if specified).
Completion of proportional balancing of regulating dampers so that terminals share the air flow in the correct proportions.
Regulation of the fan(s) to provide the specified flow rate.
Packaged equipment
Ensure that plant and controls have been fully commissioned and are functional, ready for integration with other plant/systems.
That control equipment inputs/outputs are in the specified format for connection to the main control system.
Confirm that the plant is commissioned in accordance with:
Air distribution systems, CIBSE Code A
Boiler plant, CIBSE Code B
Refrigeration systems, CIBSE Code R
Water distribution systems, CIBSE Code W
Commissioning water systems. Application principles, AG 89.3/2, BSRIA
Commissioning air systems. Application systems for buildings, AG 89.3/3, BSRIA.

Y51.3140 BMS COMMISSIONING - CONTROL SYSTEM REQUIREMENTS FOR PLANT COMMISSIONING:
Ensure that the BMS is pre-commissioned to allow the building services plant to operate under "manual" running conditions.
Ensure that the control valves can be manually set in their fully open position to allow the balancing of pipework flows.
Ensure that dampers can be manually opened to allow the commissioning of air systems.

Y51.3150 BMS COMMISSIONING:
Ensure that the BMS is commissioned in accordance with the following requirements of CIBSE Code C (Commissioning of automatic control systems).
Control strategy checking - C6.2
Checking procedures for basic control functions - C6.3
Lighting controls - C6.4
Operator workstations - C6.5
Occupant interfaces - C6.6
Communication networks - C6.7
Integrated systems - gateways - C6.8
Integrated systems - direct interoperability - C6.9
Integration with fire detection systems - C6.10
Security systems - C6.11

Interruption of electrical power supplies - C6.12
Valves - C7.1
Dampers - C7.2
Fans - single speed - C7.3
Fans - variable speed - C7.4
Pumps - C7.5

Y51.4010 SYSTEM PERFORMANCE TESTING:
Demonstrate the performance of installations including single, standby, multi-duty plants and systems, and of plants specified for future use.

Y51.4020A ENVIRONMENTAL TESTS, ARTIFICIAL LOADS:
Carry out environmental testing to prove the performance of the systems.
Apply artificial loads or provide test arrangements to simulate the full range of operating conditions and duties.

Y52 VIBRATION ISOLATION MOUNTINGS

Y52.1000 GENERAL
1010 DESIGN INTENT:
Supply equipment indicated to ensure that vibration from equipment is not transmitted to building, other supporting structure, pipework or ductwork.
1020 SPRING ANTI VIBRATION MOUNTINGS:
Select spring mounts with an overload capacity of 50%, for metal springs the outside diameter should be at least 75% of operating height. Permanently identify individual mounts with their load capacity.
1030 SPRING HANGERS:
Provide spring hangers that allow the lower hanger rod to move laterally at least 15^{o}.

1040
Where indicated, provide lockable levelling device.

Y52.3040 HORIZONTALLY RESTRAINED SPRING MOUNTINGS:
Ensure snubbers for limiting excessive movement are installed out of contact during normal operation.

Y54 IDENTIFICATION - MECHANICAL

Y54.1000 GENERAL
1010 REQUIREMENTS:
Identify all pipework, ductwork, equipment, appliances and ancillaries comprising the various systems.
1020 NEW SYSTEMS:
Comprehensively label and colour code throughout works as indicated.
1030 EXISTING SYSTEMS:
Where identification details are incompatible with those required for new systems, obtain approval to mode of cross referencing.
1040 COLOURS:
As indicated to colour ranges given in BS 381C and BS 4800.

1045 PEFORMANCE AND DURABILITY:
Ensure durability of identification for safety purposes is to BS ISO 17398.

Y54.2010 PIPEWORK IDENTIFICATION:
Standards - Colour code and label to BS 1710.
Primary Identification
Apply colour bands, 300mm wide, to each pipe at least
Once in every room or enclosed area.
At intervals not exceeding fifteen metres.
At every junction.
At every valve.
At every inspection and access position into service shafts, false ceilings, bulkheads etc.
Secondary Identification
Apply colour bands, 50mm wide, and superimpose a legend identifying circuit, direction of fluid or gas flow, nominal pipe bore and, where appropriate, fluid or gas pressure.
Legends
Apply to colour bands by transfers of an approved type.

Y54.2020 DUCTWORK IDENTIFICATION:
Standards
Generally colour code and label to HVCA Specification DW 144 (Appendix B).
Primary Identification
Apply colour bands, 300mm wide, to each duct at least
Once in every room or enclosed area.
At intervals not exceeding fifteen metres.
At every junction.
At every damper.
At every inspection and access position into service shafts, false ceilings, bulkheads etc.
Secondary Identification
For ducts with longest side or diameter up to and including 225mm. Paint colour bands 50mm wide and superimpose legends.
For ducts with longest side or diameter over 225mm. Paint or apply transfers to identification triangles, or triangular plates. Superimpose or incorporate legends.
Triangular Plates
Attach to buckle bands or stool pieces and fix to ducting, with apex indicating direction of airflow. Submit details of plates and fixings for approval before painting and marking. Use equilateral triangle of side 150mm minimum.
Legends
Apply transfers of an approved type to colour bands or triangles or triangular plates. Identify floor and space served, associated equipment reference and direction of airflow.

Y54.2030B PLANT AND EQUIPMENT IDENTIFICATION, LAMINATED PLATES:
Standards
Identify each item of equipment by name and, where appropriate, by agreed reference characters. Provide colour identification as called for in work sections and, in all cases, colour fire fighting equipment red.
Identification Colours
Use primary and secondary identification colours of associated system.
Plates
Use rectangular metal or laminated plastic, securely fixed to each item of equipment.
Lettering
Laminated plates, multi-coloured with outer layer removed for lettering.
Legends
Engrave plates with an approved text. Incorporate operating duty of equipment where this is not incorporated in other labelling.

Y54.2035 GRAPHICAL SYMBOLS FOR USE ON EQUIPMENT IN ACCORDANCE WITH BS EN 80416:
Graphical symbols for use on equipment to be created and applied in accordance with BS EN 80416-1, BS EN 80416-2, BS EN 80416-3.

Y54.2040 VALVE AND COCK IDENTIFICATION:
Standards
Identify each valve, cock, stop valve, air vent, drain cock etc. with disc engraved with numerical reference. Except where exposed in occupied areas.
Identification Colours
Use primary and secondary identification colours of associated system for painted or self colour discs.
Discs
Securely attach metal or laminated plastic discs, minimum diameter 35mm, to each item.
Legends
Engrave discs with permanent characters, minimum height 6mm.
Incorporate in operating instructions relating to regulating valves and flow measuring equipment, details of flow rate, pressure differential and setting, as appropriate.

Y54.2070 AIR VOLUME REGULATING AND CONTROL DAMPER IDENTIFICATION:
Standards
Identify each regulating and control damper. Except where exposed in occupied areas. On ductwork dampers, clearly indicate commissioning set point.
Identification colours
Use primary and secondary identification colours of associated system for painted or self colour discs.
Discs
Securely attach metal or laminated plastic discs, minimum diameter 35mm, to each item.
Legends
Engrave discs with permanent characters, minimum height 6mm.

Y54.2090 DANGER AND WARNING NOTICES:
Hazardous Systems
Colour code and label hazardous systems and equipment to requirements of Health and Safety Executive Guidance Notes.

Y90 FIXING TO BUILDING FABRIC

Y90.1000 GENERAL
1010 PREPARATION:
Mark-out, set-out and firmly fix all equipment, components and necessary brackets and supports.
1020 MANUFACTURER'S DRAWINGS:
Use manufacturer's drawings and templates for purposes of marking and setting out.
1030 FIXINGS:
Ensure structure and fixings are suitable for items to be fixed.
1040 LOADING DETAILS:
Provide loading details for all fixing types.
1050 BUILDING-IN BY OTHERS:
Provide all necessary assistance to enable any item of building-in type to be built in by others.
1060 SIZE OF FIXING:
Use largest size of bolt, screw or other fixing permitted by diameter of hole in item to be fixed.
1070 GREASING OF FIXINGS:
Ensure all bolts, screws or other fixings used are greased or lubricated in accordance with manufacturer's instructions.

Y90.2010 STANDARDS:
Ensure that fixings such as expanding anchors are tested for tensile loading in accordance with BS 5080-1.

Y90.2020 PLUGS:
Use plugs of suitable size and length for fixings. Use plastic, fibrous or soft metal non-deteriorating plugs to suit application. Do not use wood plugs.
Ensure that when screw is in place, threaded length is in plug. Ensure plugs used for screw fixing are set-in to correct depth prior to final tightening.

Y90.2030 SCREWS:
Use screws to BS 1210. Generally use sherardized steel wood screws for fixing to concrete, brickwork or blockwork.
In damp or exposed situations use greased brass wood screws.

Y90.2080 NON-PENETRATIVE SUPPORT SYSTEMS FOR ROOF MOUNTED EQUIPMENT:
- Manufacturer and reference
  - Or approved equivalent

Obtain approval prior to using non-penetrative support systems for roof mounted equipment.

Y90.3010 DRILLING:
Drill holes squarely. Use drills of requisite size and depth, and appropriate to fabric. Do not flame-cut holes in metal work.

Y90.3050 FIXING TO TIMBER RAILS:
Fix equipment, brackets and supports by drilling hole through timber rail and fixing with bolt, back plate, washer and loose nut.

Y90.3060A FIXING TO HOLLOW STUD/TILE/BLOCK WALLS:
Fix equipment, brackets and supports where there is access at rear of wall, by drilling hole through wall and fixing with bolt, back-plate, washer and loose nut.
Fix equipment, brackets and supports where there is no access at rear of wall, drill hole and use screw anchor type fixing or gravity type toggle fixing.

Y90.3070A FIXING TO CONCRETE, BRICKWORK OR BLOCKWORK:

Fix equipment, brackets and supports using wood screws in plugs or, as appropriate, drill holes and fix using steel bolts of grouted bolt type or expanding bolt type fixing.

Y90.3080A FIXING TO METALWORK:
Fix equipment, brackets and supports by drilling holes and fixing using set screws or bolts complete with washers, shakeproof washers and loose nuts.

Y90.3090A FIXING TO STRUCTURAL STEELWORK AND CONCRETE STRUCTURES:
Provide manufacturer's information on recommended fixing. Obtain approval for any fixing to structure steel work and concrete structures.
Generally use proprietary fixings to structural steelwork and concrete structures.
Obtain approval to cut holes in structural steelwork or concrete structures or weld to structural steelwork.

Y90.3100# NON-PENETRATIVE SUPPORT SYSTEMS FOR ROOF MOUNTED EQUIPMENT:
Provide manufacturer's information on recommended support systems.

- Obtain the necessary approvals to use non-penetrative support systems as follows:
  - Ensure that the roof surface is compatible with non-penetrative supports
  - Ensure that necessary approval is given by
    - The Structural Engineer
    - The Architect
- Mounting positions
- Roof loading parameters
  - Wind Loadings
  - Point Loads
  - Pressures
- Components
  - Support leg type
  - Support frame type
- Maintenance
  - Ensure that future maintenance access to roof finish is provided under support system.

Y91 PAINTING AND ANTI-CORROSION TREATMENTS

Y91.1000 GENERAL:

Y91.2010A PAINT MATERIALS:
Use the following materials as appropriate
Solvent borne priming paint to BS 7956 for bare woodwork.
Red Oxide priming paint for bare iron and steelwork.
Zinc Chromate priming paint for bare ferrous and non-ferrous metals.
Calcium Plumbate priming paint to BS 3698 for galvanized steel or composite wood/metal components.
Undercoating paint for previously primed or painted surfaces before the application of finishing coats.
Gloss finishing paint for previously primed or painted/undercoated surfaces.
Epoxy resin paint for specialist coatings requiring resistance to acids, alkalis, oils, solvents, abrasion or high humidity.
Aluminium paint to BS 388 for structural steelwork, storage vessels, heated metallic surfaces and similar applications where moisture and heat resistant properties are required.
Cold galvanizing paint for making good damage to previously galvanized surfaces and protection to galvanized materials modified during installation.
Zinc-rich metallic to BS 4652 for bare iron and steelwork where electrical conductivity has to be assured.
Black tar-based paint to BS 1070 for moisture resistant protection to metal surfaces where decorating appearance is not important.
Bitumen based coatings for cold application to BS 3416 protection to iron and steel, particularly pipelines and fittings for use in contact with potable water.
Bitumen based coatings for cold application to BS 6949 not to be used in contact with potable water.

Y91.2020 PAINT QUALITY:
Ensure paints used are of quality and type to suit application and that:-
primers have good adhesion, covering power, rust-inhibiting and grain filling properties.
gloss finishing paints are of machine finish grade having high adhesion and high resistance to solvents, mineral oils, cutting oils, detergents, chipping and impact damage.

Y91.3020 WEATHER AND OTHER CONDITIONS:
Do not apply paints where weather, temperature, humidity or other conditions may have a damaging effect upon finish or paint.

Y91.3030A CLEANING AND PREPARING STEEL SURFACES FOR PAINTING:
Ensure metal surfaces are thoroughly cleaned, all mill and weld scale removed and finally degreased. Clean steel surfaces in accordance with BS EN ISO 8503 and prepare surfaces for painting in accordance with BS EN ISO 4618.

Y91.3030B CLEANING AND PREPARING SURFACES FOR PAINTING:
Ensure metal surfaces are thoroughly cleaned, all mill and weld scale removed and finally degreased.
Prepare surfaces for painting in accordance with BS EN ISO 4618.

Y91.3040 APPLICATION OFF-SITE:
Wherever possible ensure paint finishes applied by component manufacturers are spray applied.

Y91.3050 APPLICATION:
Apply paint evenly and ensure finish shows no excessive brush marks, grinning, runs, sagging, ropiness or other application defects.

Y91.3060 COLD GALVANIZING:
Repair damage to galvanized components due to installation process, i.e. following cutting, drilling or welding, by applying 2 no. substantial coats of cold galvanizing paint.

Y91.3070 PROTECTION OF BRIGHT MACHINE PARTS:
Apply a protective coating to all bright machined parts before despatch from works.
Do not remove protective coatings unless required for installation, testing or commissioning purposes and in such cases reinstate upon completion.
Repair any damaged protective coating or bright machined part, or where necessary replace damaged component.
Use and apply metal coatings in accordance with manufacturer's instructions.
Complete where possible all welding, drilling, bending and other work before metal coating.