2nd Floor Britannic Building
3 Upperhead Row
Huddersfield HD1 2JL

Telephone: (01484)513973
Web: www.bmellorasc.co.uk
Email: general@bmellorasc.co.uk

STANDARD TECHNICAL SPECIFICATION

FOR

MECHANICAL ENGINEERING SERVICES

Document Ref: STSMS03 **Date: April 2015 Rev B**

BMA

SECTION 3

STANDARD TECHNICAL SPECIFICATION

FOR

MECHANICAL ENGINEERING SERVICES

BMA

CONTENTS

MECHANICAL SERVICES

Y10 PIPELINES

1000 GENERAL

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 from Local Water Authority or Water Research Centre for materials used in water supplies.

2000 PRODUCT/MATERIALS

2010A HEAVY BLACK STEEL PIPES TO BS 1387:
Material - Carbon steel
Standard - BS 1387
Dimensions - Heavy. Random single lengths, 4m to 7m.
Ends - Screwed to BS 21, taper thread or plain.
Finish - Varnished.

2010B MEDIUM BLACK STEEL PIPES TO BS 1387:
Material - Carbon steel
Standard - BS 1387
Dimensions - Medium. Random single lengths, 4m to 7m.
Ends - Screwed to BS 21, taper thread or Plain.
Finish - Varnished.

2020A CARBON STEEL FITTINGS, SCREWED BENDS AND SPRINGS TO BS 1387:
Material - Carbon steel, grade - seamless.
Standard - BS 1387.
Size range - 6mm to 150mm.
Dimensions - BS 1387, medium weight.
Ends - Screwed to BS 21.
Finish - Galvanized.

2030A CARBON STEEL TO BS 3601, GRADE 320:
Material - Carbon steel, grade 320
Standard - BS 3601 ERW
Dimensions - ERW or S to BS 3600 table 1.

Ends - Plain
Finish - Standard mill protective coating.

2060A HEAVY WEIGHT CARBON STEEL FITTINGS, BUTT WELDED TO BS 1965 PART 1:
Material
Carbon steel, grade 430, electric resistance welded.
Standard - BS 1965 Part 1.
Size range - 25mm to 400mm.
Dimensions - BS 1965 Part 1 Heavy
Ends - Bevelled.
Finish - Varnished.

2060B MEDIUM WEIGHT CARBON STEEL FITTINGS, BUTT WELDED TO BS 1965 PART 1:
Material
Carbon steel, grade 430, electric resistance welded.
Standard - BS 1965 Part 1.
Size range - 25mm to 400mm.
Dimensions - BS 1965 Part 1 Medium.
Ends - Bevelled.
Finish - Varnished.

2070A MALLEABLE CAST IRON FITTINGS, SCREWED:
Material - Malleable cast iron to BS 6681.
Standard - BS 143/1256 or BS EN 10242.
Size range - 10mm to 164mm.
Dimensions - BS 143/1256 or BS EN 10242.
Ends - screwed to BS 21.
Finish - Black

2070B GALVANIZED MALLEABLE CAST IRON FITTINGS, SCREWED:
Material - Malleable cast iron to BS 6681.
Standard - BS 143/1256 or BS EN 10242.
Size range - 10mm to 164mm.
Dimensions - BS 143/1256 or BS EN 10242.
Ends - screwed to BS 21.
Finish - Galvanized.

2270A COPPER TO BS 2871 PART 1 CLASS X:
Kitemarked.
Material - Copper, Class X
Standard - BS 2871.
Dimensions - BS 2871, table X

Ends - Plain
Finish - Uncoated.

2310A COPPER FITTINGS, CAPILLARY TO BS 864, PART 2:
Kitemarked.
Material - Copper (non-dezincifiable)
Standard
BS 864 Part 2, drawn or BS 864 Part 2, table 17 for potable water.
Size range - 6mm to 67mm.
Dimensions - BS 864 Part 2, drawn.
Ends - Socket - pre-soldered.
Finish - Natural cast.

2320A COPPER FITTINGS, TYPE A COMPRESSION TO BS 864 PART 2:
Kitemarked.
Material - Copper (non-dezincifiable)
Standard - BS 864 Part 2, type A non-manipulative.
Size range - 6mm to 67mm.
Dimensions - BS 864 Part 2, cast and ground.
Ends - Socket.
Finish - Cast.

2320B COPPER FITTINGS, TYPE B COMPRESSION TO BS 864 PART 2:
Kitemarked.
Material - Copper (non-dezincifiable)
Standard - BS 864 Part 2, type B manipulative.
Size range - 6mm to 67mm.
Dimensions - BS 864 Part 2, cast and ground.
Ends - Socket.
Finish - Cast.

2320C COPPER FITTINGS, CHROMIUM PLATED COMPRESSION TO BS 864 PART 2:
Kitemarked.
Material - Copper (non-dezincifiable)
Standard - BS 864 Part 2, type A non-manipulative.
Size range - 6mm to 67mm.
Dimensions - BS 864 Part 2, cast and ground.
Ends - Socket.
Finish - Chrome satin.

3010A WELDING FLANGES TO BS 4504 PART 3:
Material - BS 4504 Section 3.1.
Flange type
Weld neck flange or hubbed slip-on flange for welding.
Flange facings - Raised face - type B.
Bolting - In accordance with BS 4504 Part 3.

3010B SCREWED FLANGES TO BS 4504 PART 3:
Material to BS 4504 section 3.1
Facings - Raised face type B.
Bolting - in accordance with BS 4504 Part 3.
Threaded flanges - BS 21 parallel thread.

3020A FLANGE JOINTING RINGS:

Non-metallic flat gaskets for flanges to BS 4504

Standard - BS 4865 Part 1

Gasket type - Full face for type B.

Corrugated, flat or grooved metallic and filled metallic gaskets for flanges to BS 4504

Standard - BS 4865 Part 4

Gasket design - Corrugated metal.

Gasket type - Self centering for type B.

3030A SCREWED JOINTS TO BS 21:

Use PTFE tape to BS 7786 or use hemp and jointing compound to BS 6956 Part 5 or BS 6956 Part 6.

3040B NAVY UNION CONNECTIONS:

Seating

Spherical seating bronze to bronze, navy pattern.

3050A WELDED JOINTS, WELDING RODS FOR STEEL PIPES:

Gas welding, BS 1453 type A2 or A3; electric arc welding BS 2633; or electric arc welding BS 2971.

3070A CAPILLARY JOINTS:

Solder

BS 219 Grade 96S, 97S, 98S or 99C, or use fittings in accordance with BS 864 Part 2 on potable water systems.

Flux - Copper pipe - BS 5625 Class 1

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.

3200A PIPE RINGS AND CLIPS, STEEL PIPEWORK:

Use pipe clips as BS 3974 Part 1, take into account the pipe load, material and pipe/insulation surface temperature.

3200C BRASS PIPE RINGS AND CLIPS, COPPER PIPEWORK:

Use brass pipe clips.

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.

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 or soffit	50
	floor finish	150
insulated pipeline	adjacent service runs	25
uninsulated pipeline	adjacent service runs adjacent	50

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

4040A AIR BOTTLES:
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.

4040B AUTOMATIC AIR VENTS:
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.

4050 DRAIN REQUIREMENTS:
Grade pipework to allow system to be drained.

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.

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.

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.

4080 FABRICATED JUNCTIONS:

Form by inserting a branch section of a pulled bend into the main pipe. Develop the profiles of both the branch section and the hole in the main pipe, to ensure minimum protrusion into the main pipe. Weld or braze into position.

4090 FABRICATED FITTINGS - FERROUS:

Supply pipe material and end connections to the specification of the associated straight pipe runs.

Pattern

Bends, springs, offsets and branches.

Technique

Pipe bore 50mm or less - machine cold bend.

Pipe bore greater than 50mm - machine hot bend.

Ensure that fabricated branch bends of welding saddles are to the fitting proportions in BS 1965, Part 1.

4100 FABRICATED FITTINGS - NON-FERROUS:

Provide pipe material and end connections to the specification of the associated straight pipe runs.

Pattern

Bends, springs, offsets and branches.

Technique

Machine bend and ensure that machine guides and formers are smooth and clean, free from any scores, or other damage. Deformed bends will not be accepted.

Fabricate branch from a section of pulled bend, profiled to match the contour of the main to avoid overlap and protrusion into the main. Cut and swage the main to form a raised cup to accept the spigot end of the branch. Limit angle of the branch to 60^{o}. Join by bronze welding on site. Apply reinforcement by plates, collars or shoes.

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.

4120 PIPE SLEEVES:

Cut sleeves from material same as pipe one or two sizes larger than pipe, or pipe and insulation if insulation is carried through sleeve, 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.

Pack annular space between pipe and sleeve with mineral wool or similar 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.

4130 CONNECTIONS TO EQUIPMENT:

Make final connections to equipment in accordance with manufacturer's instructions and as indicated.

4140 DISTRIBUTION HEADERS:

Terminate ends with a cap, a blank flange or as indicated.

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.

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.

4170 DISSIMILAR METALS:

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

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.

4190 ANCHORS:

Locate anchors as indicated. 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.

4200 SLIDE GUIDES:

Locate slide guides as indicated. 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.

Construct to general requirements of BS 3974 Parts 1 and 2. Apply a friction reducing material between metal faces subjected to movement.

4210 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.

4220 SUPPORT SPACING:

Space supports as tables.

PIPE BORE	MAXIMUM SUPPORT SPACING (M)			
(mm)	STEEL PIPE		COPPER PIPE	
nominal	horiz	vert	horiz	vert
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
65	3.7	4.6	3.0	3.6
80	3.7	4.6	3.0	3.6
100	3.7	4.6	3.0	3.6
125	3.7	5.4	3.0	3.6
150	4.5	5.4	3.6	4.2
200	5.0	6.0	-	-
250	5.0	6.0	-	-
300	6.1	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	-	-

PIPE BORE	MAXIMUM SUPPORT SPACING (M)			
(mm)	IRON PIPE		UPVC PIPE	
	Class O,B,C	Class D,E,6,7		
nominal	horiz	vert	horiz	horiz
up to 10	-	-	-	0.6
15	-	-	-	0.6
20	-	-	-	0.65
25	-	-	-	0.75
32	-	-	-	0.8
40	-	-	-	0.9
50	1.8	1.8	1.1	1.2
65	-	-	1.2	1.4
80	2.7	2.7	1.4	1.5
100	2.7	2.7	1.5	1.7
125	-	-	1.7	1.9
150	3.7	3.7	1.8	2.1
175	-	-	2.0	2.3

PIPE BORE	MAXIMUM SUPPORT SPACING (M)			
(mm)	IRON PIPE		UPVC PIPE	
	Class O,B,C	Class D,E,6,7		
nominal	horiz	vert	horiz	horiz
200	3.7	3.7	2.1	2.5
225	-	-	2.3	2.7
250	4.5	5.4	2.4	2.9
300	8.0	10.0	2.6	3.1
350	-	-	2.9	3.1

400	-	-	3.1	3.7
450	-	-	3.4	3.7
above 450	-	-	3.7	3.7

PIPE BORE (mm) nominal	PE PIPE Type 32 horiz	horiz	GLASS PIPE Type 50 horiz	vert
up to 10	0.3	0.45	-	-
15	0.4	0.6	-	-
20	0.4	0.6	-	-
25	0.4	0.6	-	-
32	0.45	0.7	-	-
40	0.45	0.7	0.9	1.7
50	0.55	0.85	1.2	1.7
65	0.55	0.85	-	-
80	0.6	0.9	1.2	1.7
100	0.7	1.1	1.2	1.7
150	-	1.3	1.2	1.7

Maximum horizontal support spacing for grooved steel pipe

6.5m when jointed with flexible type mechanical joints.

10m when using flexible couplings, sleeve type.

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 given for UPVC pipe to BS 3505 are for 20°C ambient or working temperature. Reduce spacing between supports for temperatures above 20°C. Support continuously for temperatures 60°C and above.

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.

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.

4250 CLEANING:
Remove cement and clean off all pipework and brackets.

4260 NON-FERROUS COMPONENTS:
Thoroughly clean and degrease.

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 buttweld joints and 5% of all other joints.
Weld pipeline joints to BS 2640 and BS 2971 and to HVCA Code of Practice TR/5, Welding of Carbon Steel Pipework, as appropriate.

5020 WELDED JOINTS, STEEL PIPES:
Preparation, Making and Sealing.
Oxy-acetylene welding, conforming to BS 1821 or BS 2640 appropriate to system temperature and pressure.
Arc welding, conforming to BS 2633 or BS 2971 appropriate to system temperature and pressure. Use arc welding process on piping greater than 100mm.

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.

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.

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.

5060 MECHANICAL JOINTS, STEEL PIPES:

Preparation

Ensure that cut ends are square, free of bumps, dents and score marks and are within manufacturer's tolerances. Form groove to manufacturer's detail. Assemble joint in accordance with manufacturer's instructions.

Making and Sealing

Ensure gasket is suitable for service. Thoroughly lubricate gasket using manufacturer's recommended lubricant. Slip gasket over pipe end and bring ends together. Slide gasket into central position over both pipe ends. Position metal half housings over gasket and insert bolts and nuts. Tighten bolts to manufacturer's instructions. Check alignment of joint and pipework.

5070A ANCHORS, STEEL PIPES, U-BOLTS:

Provide anchors constructed using mild steel overstraps or heavy U-bolts. Secure to channel section, adequately attached to or grouted into building structure; weld longitudinal edges of strap to pipe.

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.

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.

6030 COMPRESSION 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 or fine sandpaper. Then if using BS 864 type `A' fitting, no further preparation.

If using BS 864 type `B' fitting, in accordance with fitting manufacturer's instructions.

Making and Sealing

In accordance with fitting manufacturer's instructions.

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.

6060A ANCHORS, COPPER PIPES, FLANGES:

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.

6060B ANCHORS, COPPER PIPES, SADDLE CLAMPS:

Anchor pipework using saddle clamps to mild steel channel section attached to or built into building structure.

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.

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.

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.

8040 ANCHORS, PVC PIPES

Clamp pipework to mild steel channel section attached to or grouted into building structure, using PVC coated overstraps, or clamps and with a polypropylene strip between pipe and mild steel section.

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.

9030 PROTECTION OF UNDERGROUND PIPEWORK:

Protect where indicated against corrosion by the application of a compatible anti-corrosive, non-cracking, non-hardening waterproof sealing tape.

Apply, after cleaning pipework, by wrapping contrawise with two layers spirally around the pipe, ensuring a 50% minimum overlap.

9040A PROTECTION OF BURIED PIPES, UNMARKED:

Provide earth cover as follows

Water pipework

900 mm minimum; 1200 mm maximum where practicable.
Fuel oil and gas - 500 mm minimum.
Under roadways provide minimum cover of 900 mm.

9040B PROTECTION OF BURIED PIPES, MARKED:
Provide earth cover as follows
Water pipework
900 mm minimum; 1200 mm maximum where practicable.
Fuel oil and gas - 500 mm minimum.
Under roadways provide minimum cover of 900 mm.
Provide a marker tape to identify buried pipe services as indicated.

9100 CORROSION PROTECTIVE TAPE:
Apply basic cotton carrier tape saturated with petroleum hydrocarbons with inert siliceous fillers. Wind tape spirally contrawise round pipework applied and overlapped to manufacturer's recommendations.

9110 MECHANICAL PROTECTIVE TAPE:
Apply hessian based bituminous tape over the corrosion protective tape. Wind tape spirally contrawise round pipework applied and overlapped to manufacturer's recommendations.

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

BMA

Y11 PIPELINE ANCILLARIES

1000 GENERAL

1010 SAFETY AND RELIEF VALVES - SELF OPERATED - APPLICATION:

Safety

To discharge with rapid opening action to prevent predetermined 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 6755.

2000 PRODUCTS/MATERIALS

2010A STOP TAPS TO BS 1010 PART 2:

Material

Bronze or DZR copper alloy body. Washer material suitable for service fluid and operating temperature.

Ends

Threaded to BS 21 or with capillary fitting to BS 864 Part 2 to match pipework as indicated.

Pattern - Straight pattern.

2020A GATE VALVES TO BS 5154:

Series - B.

Gate valve type - Solid or split wedge.

Ends

Threaded to BS 21; flanged to BS 4504; or compression to BS 864 Part 2 to match pipework as indicated.

Stem - Inside screw non-rising stem.

Trim material - Manufacturer's standard.

Operation - Handwheel.

2030A GATE VALVES TO BS 5150:

Valve type - Solid or split wedge.

Seat - Metal.

Ends - Flanged to BS 4504.

Body and bonnet material - Grey cast iron.

Trim category - Copper alloy faced.

Operation - Handwheel.

2040A GLOBE VALVES TO BS 5154:

Series - B.
Pattern - Straight.
Ends
Threaded to BS 21 or flanged to BS 4504 to match pipework as indicated.
Stem - Inside screw rising stem.
Trim material - Manufacturer's standard.
Operation - Handwheel.
Options - Non-metallic renewable seat/disk rings.

2050A GLOBE VALVES TO BS 5152:

Pattern - Straight.
Stem - Rising stem outside screw.
Ends - Flanged to BS 4504.
Material - Manufacturer's standard.

2060A PARALLEL SLIDE VALVES TO BS 5151:

Ends - Flanged BS 4504.
Stem - Rising stem.
Valve faces - Stainless steel disc and seat.

2070A PARALLEL SLIDE VALVES TO BS 5157:

Pattern - Full bore or venturi.
Material - Cast steel body.
Ends
Flanged to BS 4504 or butt-welded body ends to suit pipework as indicated.
Operation - Handwheel.

2080A BALL TYPE VALVES, COPPER ALLOY:

Materials - Bronze or DZR copper alloy body.
Ends
Threaded to BS 21; or with compression or capillary fittings to BS 864 Part 2 to match pipework as indicated.
Chrome or nickel plated sphere with flow aperture. PTFE seats and stem seals. Anti-blowout stem.
Operation
Screw driver operated spindle; allen key operated or lockshield as indicated.

2090A BUTTERFLY VALVES TO BS 5155:

Construction
Provide controlled elastomer compression on flange faces; semi-lugged wafer type design, for installation between flanged pipework connections, body to suit BS 4504.
Provide lever operated valves with long body neck for lagging clearance.
Seat - Bonded.

Materials
Cast iron body; stainless steel shaft; aluminium bronze disc; EPDM seat.
Operation
Lever and graduated notch plate or wrench.

2210A DOUBLE REGULATING BUTTERFLY VALVES TO BS 5155:

Construction

Provide controlled elastomer compression on flange faces; semi-lugged wafer type design, for installation between flanged pipework connections, body to suit BS 4504.

Provide lever operated valves with long body neck for lagging clearance.

Seat - Bonded seat.

Materials

Cast iron body; stainless steel shaft; aluminium bronze disc; EPDM seat.

Operation

Infinitely variable setting with travel stops and indicator; and lever operation.

2220A DOUBLE REGULATING VALVES TO BS 7350, COPPER ALLOY:

BS 7350 section 3.1.

Ends

Threaded to BS 21 or flanged to match pipework as indicated.

Material

Bronze or DZR copper alloy to BS 5154.

Series B; oblique or Y pattern; inside screw rising stem; manufacturer's standard trim material.

Options

Provide drain plug facility; independent means for positive isolation on pressure tapping or adapter; and test and manufacturer's certificates as indicated.

2220B DOUBLE REGULATING VALVES TO BS 7350, CAST IRON:

BS 7350 section 3.1.

Ends - Flanged to BS 4504.

Cast iron to BS 5152.

Oblique or Y pattern; copper alloy or nickel alloy valve face; rising stem outside screw; manufacturer's standard materials.

Options

Provide drain plug facility; independent means for positive isolation on pressure tapping or adapter; and test and manufacturer's certificates as indicated.

2230A FLOW MEASUREMENT DEVICES TO BS 7350 TYPE 3, COPPER ALLOY:

BS 7350, section 3.2 - type 3

A fixed orifice either integral with or as a fixed orifice fitting close coupled to a double regulating globe valve.

Ends

Threaded to BS 21 or flanged to BS 4504 to match pipework as indicated.

Material

Double regulating globe valve, bronze or DZR copper alloy to BS 5154 series B and close coupled fixed orifice fitting to BS 7350 table 6.

Options

Independent means for positive isolation on pressure tapping or adapter.

2230B FLOW MEASUREMENT DEVICE TO BS 7350 CAST IRON, TYPE 3:

BS 7350, section 3.2 - type 3

A fixed orifice either integral with or as a fixed orifice fitting close coupled to a double regulating globe valve.

Ends - Flanged to BS 4504.

Material

Double regulating globe valve, cast iron to BS 5152 and close coupled fixed orifice fitting to BS 7350, table 6.

Options

Independent means for positive isolation on pressure tapping or adapter.

2230C FLOW MEASUREMENT DEVICES TO BS 7350 TYPE 4, COPPER ALLOY:

BS 7350, section 3.2 - type 4, variable orifice valve.

Ends

Threaded to BS 21 or flanged to BS 4504 to match pipework as indicated.

Material

Variable orifice, double regulating globe valve, bronze or DZR copper alloy to BS 5154 series B.

Options

Independent means for positive isolation on pressure tapping or adapter.

2230D FLOW MEASUREMENT DEVICES TO BS 7350 TYPE 4, CAST IRON:

BS 7350, section 3.2 - type 4, variable orifice valve.

Ends - Flanged to BS 4504.

Material

Variable orifice, double regulating globe valve, cast iron to BS 5152.

Options

Independent means for positive isolation on pressure tapping or adapter.

2260A RADIATOR VALVES TO BS 2767 (TYPE 4):

Material - Bronze or DZR copper alloy body.

Pattern - Angle or straight to suit application.

Straight

Threaded to BS 21 or compression to BS 864 Part 2 to suit pipework as indicated.

Angle

Threaded to BS 21 with one end internal and other end external with union nut and tail pipe; or compression joint to BS 864 Part 2 one end and other end externally threaded to BS 21 with union nut and tail pipe to suit pipework as indicated.

Options

Fit wheel valves on flow connections to radiators, and other heat emitters, without thermostatic radiator valves. Fit lockshield valves on return connections.

2320A SWING CHECK VALVES TO BS 5154:

Series B; horizontal pattern.

Ends

Threaded to BS 21 or flanged to BS 4505 to suit pipework as indicated.

Trim material - Manufacturer's standard.

2330A SWING CHECK VALVES TO BS 5153:
Pattern - Straight pattern, horizontal.
Valve face - Copper or nickel alloy.
Ends - Flanged to BS 4504.
Material - Manufacturer's standard.

2340A CHECK VALVES, WAFER TYPE FOR FLANGE FITTING:
Wafer pattern design suitable for installation between flanged pipework, body to suit BS 4504.
Disc - Double disc.
Type - Light spring type.
Seat - Bonded.
Materials
Cast iron body; aluminium bronze disc; EPDM seat.

2390A COMBINED CHECK AND ANTI-VACUUM TYPE ANTI BACK SYPHONAGE VALVES:
Bronze or DZR copper alloy body assembly with compression connections to BS 864 Part 2.
Pattern - In-line pattern.
Components
Stainless steel domed air inlet. Non-return valve with plastic body, rubber actuator and stainless steel to plastic seal. Water Research Centre approval.

2430B SAFETY VALVES TO BS 6759, COPPER ALLOY, DOUBLE SPRING:
Material - Bronze or DZR copper alloy body.
Ends - Threaded to BS 21.
Spring type - Double spring loaded, high lift type.

2430D SAFETY VALVES TO BS 6759, CAST IRON, DOUBLE SPRING:
Material - Cast iron body.
Ends - Flanged to BS 4504.
Spring type - Double spring loaded, high lift type.

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

2450A DRAIN COCKS, SCREWDOWN TO BS 2879 TYPE 1:
Bronze body threaded male to BS 21. Screw down plug with square shank for loose lever. Serrated outlet to accept hosepipe, fixed or union pattern.

2460A DRAIN COCKS, BALL TYPE:
Bronze or DZR copper alloy body; chrome plated ball; PTFE seats and stem seals; blowout proof stem. Strap and blank cap screwed on hand tight. Serrated outlet to accept hose pipe.

2470 TWO WAY GLAND TYPE VENT COCK:
Bronze body threaded to BS 21. Tapered plug with square shank for loose lever; plug position indicator; bolted gland.

2480 BALL TYPE VENT COCKS:

Bronze or DZR copper alloy body; chrome plated ball; PTFE seats and stem seals; blowout proof stem.
T port configuration.

2490 THREE WAY GLAND TYPE VENT COCK:

Bronze body threaded to BS 21. Tapered plug with square shank for loose lever; plug position indicator; bolted gland. Port markings to indicate inlet, vent, waste.
T port configuration.

2500A THREE WAY PLUG VALVE VENT COCKS:

Cast iron body, plug and bottom cover. PTFE thrust washer.
Ends - Flanged to BS 4504.
T port configuration. Wrench operation.

2510A AUTOMATIC AIR VENTS, FLOAT TYPE:

Construction

Bronze or DZR copper alloy body with threaded inlet to BS 21. Solid polypropylene float and air release valve. Ensure valve is self closing.

Operating Conditions

Maximum temperature 130°C.
Maximum pressure 10 bar.

Options

Provide connection for piping away released air and integral non-return valve where indicated.

2630A EXPANSION COMPENSATORS, AXIAL BELLOWS:

Ends

Threaded to BS 21; flanged to BS 4504; or bevelled for welding to suit pipework as indicated.

Bellows

Stainless steel, multi ply construction fitted with stainless steel inner sleeves.

Operation

Supply expansion joints capable of not less than 2000 reversals of full movement at given working conditions; and withstanding a pressure test of twice the design duty without deformation.

2650A FLEXIBLE CONNECTIONS UP TO 70oC:

Material

Multi-ply reinforced EPDM rubber with wire reinforced cuffs. High tensile synthetic fibre reinforced.

Marking

Mould date of manufacture on bellows. Show manufacturer, country of origin, type and batch number of membrane.

Ends

Flanges to BS 4504 that can swivel and are removable; or threaded to BS 21 with one union end to suit pipework as indicated.

Operation

Ensure flexible connections on heating circuits have a design life of 120 months at given conditions and after this time a minimum burst pressure of 30 bar. Provide tie bars with rubber top hat washers where working pressure exceeds 1.5 bar. Supply threaded tie bars with adjustable length.

2650B FLEXIBLE CONNECTIONS, 70 to 100oC:

Material

Multi-ply reinforced EPDM rubber with wire reinforced cuffs. Steel wire mesh reinforced.

Marking

Mould date of manufacture on bellows. Show manufacturer, country of origin, type and batch number of membrane.

Ends

Flanges to BS 4504 that can swivel and are removable; or threaded to BS 21 with one union end to suit pipework as indicated.

Operation

Ensure flexible connections on heating circuits have a design life of 120 months at given conditions and after this time a minimum burst pressure of 30 bar. Provide tie bars with rubber top hat washers where working pressure exceeds 1.5 bar. Supply threaded tie bars with adjustable length.

2660A TERMINAL UNIT CONNECTIONS:

Material

EPDM inner liner with stainless steel wire braid. Nickel plated brass fittings with stainless steel ferrules.

Operation

Minimum length 300 mm. Ensure hose is capable of resisting kinking when bent through 180^{o}. Working pressure 15 - 20 bar and temperature 110^{o}C.

2660B TERMINAL UNIT CONNECTIONS, INSULATED:

Material

EPDM inner liner with stainless steel wire braid. Nickel plated brass fittings with stainless steel ferrules. Fully insulated with end caps for chilled water.

Operation

Minimum length 300 mm. Ensure hose is capable of resisting kinking when bent through 180^{o}. Working pressure 15 - 20 bar and temperature 110^{o}C.

2670A TEST PLUGS, SELF SEALING:

Provide 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.

2670B TEST PLUGS, VALVE CONTROLLED:

Provide 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.

2680A PIPELINE STRAINERS, BRONZE:

Material - Bronze to BS 1400, LG2.

Ends

Threaded to BS 21; flanged to BS 4504; or compression fittings to BS 864 part 2 to match pipework as indicated.

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.

2680B PIPELINE STRAINERS, CAST IRON:
Material - Cast iron.
Ends - Flanged to BS 4504
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 iameter.
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.

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.

2700A GAUGES, GENERAL:
Use dial type gauges of robust construction, enclosed in dust tight metal cases. Retain dial glass with bezels screwed to case. Finish with chromium plating.
Use white dial scales indelibly and clearly marked with black lettering to indicate measured values. Select scale ranges which indicate `Normal' when pointer is vertical or central on scale.

2700B GAUGES, 150MM DIAMETER, FLUSH PANEL:
Dial case - 150mm diameter, heavy pattern, finished in black stove enamel for flush mounting.
Mount gauges with dial face in vertical plane flush to panel and conceal casing within a steel metal cubicle.

2700C GAUGES, 150MM DIAMETER, DIRECT MOUNTING:
Dial case - 150mm diameter, heavy pattern finished in black stove enamel, for direct connection to instrument.
Mount gauges with dial face in vertical plane and support casing by connection to instrument.

2700D GAUGES, 150MM DIAMETER, FLANGED:
Dial case - 150mm diameter, heavy pattern finished in black stove enamel, with annular mounting flange.
Mount gauges with dial face in vertical plane and surface mount casing to equipment or building element, as required.

2710A TEMPERATURE GAUGES, GENERAL:
Mercury in steel type, mounted direct in pocket.

Use temperature gauges with pocket and provided with gland attachment on thermometer stem.
Use separable type pockets, threaded 15/19mm BSP and manufactured from stainless steel.

Screw pockets into tapped bosses or stools set in pipelines or vessels. Fill pockets with oil to BS 7207 to ensure contact with thermometer bulb.
Provide gauges with dial graduation in degrees celsius marked on a logarithmic scale. Ensure pointer movement is clockwise for increase in temperature.
Provide sensing elements for air and gas systems, where indicated, and fix to provide airtight joints. Provide with metal shielding around sensing element to prevent effects of local radiation from equipment.

2710B TEMPERATURE GAUGES, MERCURY IN STEEL:
Provide mercury in steel temperature gauge, mounted direct in pocket.

2710C TEMPERATURE GAUGES, VAPOUR PRESSURE TO BS 5235 FOR DIRECT MOUNTING:
Vapour pressure type to BS 5235, mounted direct in pocket, with horizontal or vertical stem as appropriate .

2710D TEMPERATURE GAUGES, VAPOUR PRESSURE TO BS 5235 FOR REMOTE MOUNTING:
Vapour pressure type to BS 5235, for remote mounting with capillary tube of sufficient length to allow slack run to immersion bulb. Protect capillary along full length by a flexible sheath jointed to dial case and bulb.

2720 PRESSURE AND ALTITUDE GAUGES:
Use vapour pressure type gauges to BS 1780. Connect to pipeline systems via matched gauge cocks and cock connectors.
Ensure dial graduation is from zero to between 1.5 and 3.0 times normal working pressure. Graduate in bar (gauge) on gauges reading head or working pressure, or in Pascals where pressure differences across plant items are to be established. Where fitted on boilers and pressure vessels, clearly mark with operating and maximum permissible working heads in accordance BS 759. Elsewhere provide gauges with normal working pressure. Ensure dial movement is clockwise for an increasing head.
Fit syphons on steam systems.
Provide flexible piping where gauge is subject to noticeable vibration.
Fit gauge cocks preceding all connections to altitude and pressure gauges; copper alloy, tapered ground plug, with ebonite lever. Unless flanged joints are required, screw inlet ends female and fit outlet ends with union connections allowing removal of gauges.

2730 VACUUM GAUGES:
Use vacuum gauges complying with BS 1780. Calibrate in mm of mercury.

2740A GAUGE MOUNTING BOARDS, HARDWOOD:
Manufacture from 12mm thick, polished hardwood.
Mount on walls or purpose made steel frames at a height approximately 1.3m above floor level.

3010A LOOSE ITEMS, KEYS FOR SPINDLE SHANK VALVES:
Provide tee handled short shank keys suitable for each size of valve spindle shank.

3010B LOOSE ITEMS, FOR DRAIN COCKS:
Provide lever pattern keys suitable for each drain cock and loose hose unions for drain cocks.

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

4020 LOCATION:
Install valves, cocks, traps, strainers, test plugs, tundishes and other ancillary equipment in positions indicated.

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.

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.

4050 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 for approval of method proposed to insulate component, if required.
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.

4060 VENT COCKS:
Provide outlets of vent cocks with discharge pipes.

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.

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.

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

4080C DISCHARGE CONNECTIONS, AIR BOTTLES:
Fit pipework connections, where indicated, to provide bleed connection from air bottles terminating with air cock or needle valve in a convenient position.

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.

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 pipelines.

Where location does not permit sufficient flexibility, provide proprietary devices, as indicated.

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.

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.

4120 TERMINAL UNIT CONNECTIONS INSTALLATION:

Install hose connections strictly in accordance with manufacturer's instructions.

BMA

Y20 PUMPS

1000 GENERAL

1010 PUMPS:
Provide pumps manufactured and tested in accordance with appropriate British Standard, in particular BS 3456 section 202.41 (EN 60335-2-41) and BS EN 60335-2- 51 where applicable.

1020 PUMP SELECTION:
Select pump at or near most efficient part of performance curve for duty required.

1030 SAFETY GUARDS:
Fit safety guards around revolving parts on close coupled and belt drive pumps.

1040 PUMP TESTING:
Ensure pumps comply with BS 599 and BS 5316 Parts 1, 2 and 3 as appropriate.

2000 PRODUCTS/MATERIALS

4010 GENERAL:
Comply with manufacturer's recommendations for installation of pumps. For in-line pumps ensure that motor is positioned in accordance with manufacturer's requirements.

4020 PIPELINE CONNECTIONS:
Support pumps independently from connecting pipework to ensure no load is transmitted from pipework to pump casing on pump suction and discharge.

4030 MOUNTINGS:
Mount motors and pumps for belt drive pumps resiliently.

4040 ALIGNMENT:
Align pump to prevent undue restraint and thrust on interconnecting pipework.
Align drives to prevent undue wear and restraint on pump shaft.
For belt drives, align pulleys and tension belts to prevent undue wear and out of balance forces.

4050 ACCESS:
Locate pump within the system with adequate space around it for service and maintenance.

4060 MAINTENANCE REQUIREMENTS FOR SEWAGE PUMPS:
For ease of service and maintenance, install submersible sewage pumps on guide rails or with lifting cables. Fit pumps with automatic discharge connections, which locate on to permanent pipework at low level in chamber.

Y25 CLEANING AND CHEMICAL TREATMENT

1000 GENERAL

1010 CONDITIONS FOR CLEANING AND CHEMICAL TREATMENT:

Provide cleaning and chemical treatment, as indicated. Ensure treatment complies with statutory authority and health and safety regulations.

Notify manufacturers 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.

2000 PRODUCTS/MATERIALS

2010 CLEANING AND CHEMICAL TREATMENT SPECIALIST:

Use a specialist for analysis and for design, supply, installation and operation of any system cleaning and chemical treatment process.

2020A MAINS WATER ANALYSIS:

Obtain an analysis of mains water taken from site supply point. Check with local water authority to ensure analysis results are typical for site area and report variances for instruction; or submit a sample of water to water treatment specialist as appropriate.

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- ethylene glycol 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.

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 Control of Pollution (Special Waste) Regulations 1980 where appropriate.

2040A PROCEDURAL PRECAUTIONS FOR CLEANING AND CHEMICAL TREATMENT:

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.

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.

2050A WATER TREATMENT METHODS FOR HOT WATER HEATING CLOSED RECIRCULATING WATER SYSTEMS:

Scale control

Pretreatment - base exchange softening plant.

Corrosion control

Chemicals as BSRIA Application Guide AG 2/93, Appendix A Table A1.

2050B WATER TREATMENT METHODS FOR CHILLED AND CONDENSER WATER CLOSED RECIRCULATING WATER SYSTEMS:

Corrosion control

Chemicals as BSRIA Application Guide AG 2/93, Appendix A Table A2.

2050C WATER TREATMENT METHODS FOR COOLING TOWER OPEN RECIRCULATING WATER SYSTEMS:

Scale control

Pretreatment - base exchange softening plant.

Corrosion control

Chemicals as BSRIA Application Guide AG 2/93, Appendix A Table A3.

Control of microbiological fouling

Chemical

Biocides and biodispersants. Chemicals as BSRIA Application Guide AG 2/93, Appendix A Table A3.

Physical - Ultraviolet disinfection units.

2060A CHEMICAL INJECTION AND DOSING METHODS FOR CLOSED SYSTEMS:

Method of introducing chemicals

Dosing pots; manually initiated timer controlled dosing; or proportional dosing as appropriate.

2060B CHEMICAL INJECTION AND DOSING METHODS FOR OPEN RECIRCULATING SYSTEMS:

Method of introducing chemicals

Chemical dosing for scale and corrosion inhibitors

Continuous; timer controller; or proportional dosing as appropriate.

Bleed-off control.

Biocide dosing - automatic dosing control.

2060C PACKAGED CHEMICAL INJECTION AND DOSING PLANT:

Provide packaged monitoring and treatment plants.

2070A MONITORING:

Provide monitoring system to enable on-line analyses, system alarms and chemical stock levels to be monitored by water treatment specialist.

Where indicated, provide facility for system to be monitored by water treatment specialist at remote location.

2070B SAMPLING:

Provide testing equipment to carry out tests for all inhibitors used in treatment programme indicated.

2070C SAMPLING KITS:

Provide the following test kits as appropriate.

Boiler water test kit for steam boilers; conductivity test kit; pH test kit; inhibitor test kit; hardness test kit where a softener is installed; chloride level test kit.

Install a corrosion test rig to enable corrosion rates to be monitored using corrosion coupons.

Bacteriological monitoring with use of dipslides.

Log sheets for recording of test results, bacteriological analysis and any actions required or taken.

2080A CHEMICAL PROVISION, STANDARD ARRANGEMENT:

Provide consumables for a period of 12 months.

Where indicated, provide for supply of chemicals from containers refilled by drumless delivery system.

Include for supply of chemicals for all systems using the basis of:

Open circuit systems operating at 100 % load for 2080 hours per annum.

Closed circuit systems make-up 1% system volume/month.

3010A FLUSHING, BSRIA APPLICATION GUIDE 8/91:

Carry out flushing of water systems in accordance with BSRIA Application Guide 8/91 Pre-commission cleaning of water systems.

Part B Installation considerations

B1 Management; B2 Pipework installation; B3 Preparation for flushing and cleaning; B4 Procedure for filling, pressure testing and static flushing;

Part C System dynamic flushing.

C1 Flushing objectives; C2 Dynamic flushing procedure.

Inspection and witnessing, as section A4.

3020 PURGING:

Arrange purging connections to ensure all sections of system are purged. Purge system using steam, nitrogen or compressed air medium as indicated.

Ensure minimum pressure and velocity indicated, is maintained during purging. Provide temporary connections to system terminal points. Purge continuously for minimum time indicated.

Following purging, clean and flush out dirt pockets, remove any temporary filters and strainers, clean and re-install. Re-purge continuously for minimum time indicated.

Clean and flush out dirt pockets, remove any temporary filters and strainers. Reinstate system for handover.

3030A CHEMICAL CLEANING AND SOLIDS REMOVAL AS BSRIA APPLICATION GUIDE 8/91:

Carry out chemical cleaning procedure in accordance with BSRIA Application Guide 8/91 Pre-commission cleaning of water systems.

D1 Introduction.

D2 Cleaning options.

D2.1 Degreasing; D2.2 Removal of surface oxides (Inhibited acid cleaning or formulated products as indicated); D2.3 Effluent disposal/final flushing; D2.4 Neutralisation; D2.5 Passivation; Corrosion inhibitor/biocide dosing.

D3 On-going water treatment.

D4 Reinstatement of terminal units and main plant items.

Inspection and witnessing, as section A4.

3040 STERILIZATION - GENERAL:

After flushing process, carry out sterilization in accordance with BS 6700.

Prior to sterilization ensure each system is flushed, cleaned and drained.

Provide temporary connections to system terminal points suitable for introduction of sterilization chemicals and fluids and 22mm minimum valved drain connection on incoming main immediately downstream of mains isolating valve.

Fill system with clean, fresh water.

3050 STERILIZATION - MAINS WATER SYSTEM:

Carry out the following operations in accordance with BS 6700.

Flush system and introduce sterilisation chemical.

Take samples to ensure correct chlorine concentration.

Leave system to stand for period of time indicated.

Repeatedly flush system with clean water until all traces of chlorine have been removed - leave system filled.

Submit samples to registered laboratory for microbiological analysis and report.

Certificate of conformity

Immediately prior to handover, retake samples and submit for analysis and report.

Where necessary repeat sterilisation of potable water system immediately prior to handover.

3060 STERILIZATION - WATER STORAGE SYSTEMS:

Carry out the following operations in accordance with BS 6700 and Health and Safety Executive Guidance Notes HS(G) 70.

Carry out operations on all water storage tanks and cisterns, cold and hot.
Carry out procedures as for mains water systems.

3070 WATER TREATMENT FOR BOILERS:

Provide water treatment for boiler plant in accordance with BS 2486.
Ensure water treatment plant changes the area raw water characteristics to those recommended within BS 2486 for boiler plant installed.

3080 SERVICE VISITS:

Provide monthly service visits for one full year by a fully qualified chemist, to carry out the following:-
Review water analysis records, correspondence and reports since previous visit. Test water samples on site for hardness; all inhibitors; dissolved solids; pH; total alkalinity. Check performance of feeding equipment, softeners, and testing equipment on site. Submit a written report. Carry out micro- biological analysis using dipslides.
Special requirements as indicated.

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.

Y30 AIR DUCTLINES AND ANCILLARIES

1000 GENERAL

Where reference is made to DW142 this shall also mean DW144. In the event of conflict between these documents the requirements of DW144 shall take precedence.

1010 DUCTWORK FABRICATION:

Prepare fabrication drawings and carry out fabrication of ductwork in accordance with DW 142, DW 151 and DW 191 as appropriate. Ensure ductwork complies with the requirements of BS 476 Part 24.

1020 DUCTWORK DIMENSIONS:

Sizes of ductwork are internal dimensions. Where applicable make allowance for any internal lining.

1030 ELECTRICAL BONDING TERMINAL:

Ensure an electrical bonding terminal suitable for connection of 6 mm^2 maximum conductor is provided where indicated.

2000 DUCTWORK FABRICATION/MATERIALS

2010A DESIGN INFORMATION, LOW PRESSURE, CLASS A:

Fabricate ductwork to meet pressure classification in accordance with DW 142 Part 2 Section 5.1 Table 1, low pressure - positive or negative as appropriate.
Fabricate ductwork to meet leakage classification in accordance with DW 142 Part 2 Section 6.3 Table 2, low pressure; Class A.
Where indicated ensure ductwork is suitable for a variable air volume system.
For special installations where contaminants are indicated, ensure materials and construction of ductwork are suitable for contaminants in the airstream.

2010B DESIGN INFORMATION, MEDIUM PRESSURE, CLASS B:

Fabricate ductwork to meet pressure classification in accordance with DW 142 Part 2 Section 5.1 Table 1, medium pressure - positive or negative as appropriate.
Fabricate ductwork to meet leakage classification in accordance with DW 142 Part 2 Section 6.3 Table 2, medium pressure; Class B. Where indicated ensure ductwork is suitable for a variable air volume system.
For special installations where contaminants are indicated, ensure materials and construction of ductwork are suitable for contaminants in the airstream.

2020C DUCTWORK AIR LEAKAGE TESTING, DW 142/143, LOW & MEDIUM PRESSURE:

Carry out ductwork air leakage testing in accordance with DW 142. Test low and medium pressure ductwork in accordance with DW 142 and DW 143.
Test ductwork components with the ductwork, where indicated.

2030A RECTANGULAR GALVANISED MILD STEEL DUCTWORK TO DW 142:

Duct

Comply with DW 142 Part 3 Sections 8 & 9 for construction of rectangular ductwork.

Fittings

Comply with DW 142 Part 3 Section 11 for manufacture of all fittings for rectangular ducts.

Cross joints

Use cross joints in accordance with DW 142 and tested in accordance with DW/TM1 where indicated.

Finish

Electroplated or hot dip galvanised zinc coated steel.

2040A CIRCULAR GALVANISED MILD STEEL DUCTWORK TO DW 142 - SPIRAL WOUND:

Duct

Comply with DW 142 Part 4 Sections 12 & 13 for construction of circular ductwork. Use spirally wound ducts.

Fittings

Comply with DW 142 Part 4 Section 14 for manufacture of fittings for circular ductwork.

Cross joints

Use cross joints in accordance with DW 142 and tested in accordance with DW/TM1 where indicated.

Finish

Electroplated or hot dip galvanised zinc coated steel.

2050A FLAT OVAL GALVANISED MILD STEEL DUCTWORK TO DW 142 - SPIRAL WOUND:

Duct

Comply with DW 142 Part 5 Sections 15 & 16 for construction of flat oval ducts, spirally-wound.

Cross Joint

Submit for approval details of any cross joints not in accordance with DW 142 Section 16 Figs. 75, 76, 77, 78 or 79.

Fittings

Comply with DW 142 Part 5 Section 18 for manufacture of fittings for flat oval ductwork.

Finish

Electroplated or hot dip galvanised zinc coated steel.

2070 FLEXIBLE DUCTS - METAL:

Supply bendable and flexible ducts in accordance with DW 142 Part 7 Section 24. Comply with relevant fire authority regulations.

2080 FLEXIBLE DUCTS - FABRIC:

Supply fabric flexible connections in accordance with DW 142 Part 7 Section 25. Comply with relevant fire authority regulations.

2140 FLANGED CONNECTIONS:

Provide bolted flanged joints for connecting ductwork to flanged items of plant, builder's work frames and where removable sections of ductwork are required.

3010 CONSTRUCTION AND FINISHES:

Ensure that materials of accessories are compatible with ductwork and that finishes of accessories comply with any special requirements for ductwork.

3020A FLEXIBLE JOINTS, FANS:

Supply and install flexible joints as detailed in DW 142 Part 7 Section 26 or DW 151 Section 11, as appropriate. Comply with BS 476 Parts 6, 7, 20, 21, 22, 23 and 24.

Position

Use flexible joints to make connections to inlet and outlet of all fans or fan and attenuator assemblies.

Properties

Fit flexible joints for expansion and vibration transmission inhibition.

3020B FLEXIBLE JOINTS, TERMINALS AND FANS:

Supply and install flexible joints as detailed in DW 142 Part 7 Section 26 or DW 151 Section 11, as appropriate. Comply with BS 476 Parts 6, 7, 20, 21, 22, 23 and 24.

Location

Use flexible joints to make connections to air diffusers, grilles and air registers and on inlet and outlet connections to all fans or fan and attenuator assemblies.

Properties

Fit flexible joints for expansion, vibration inhibition and to permit final adjustment to terminal position.

3030 SEALANT GASKETS AND TAPES:

For sealing materials and method of use comply with DW 142 Part 7 Section 27 or DW 151 Section 12 as appropriate.

3040 SPLITTERS:

Construct splitters in same gauge and material as enclosing ductwork and attach to duct as described in DW 142 Part 3 Section 11.4.

3050A TURNING VANES-LOW AND MEDIUM PRESSURE, SINGLE SKIN:

Provide single skin pattern turning vanes in low and medium pressure ductwork.

Construct vanes from material similar to enclosing ductwork. Fasten turning vanes as described in DW 142 Part 3 Section 11.5.

3070 ACCESS OPENINGS:

Provide access openings in accordance with DW 142 Part 7 Section 21, DW 151 Section 10 or DW 191 Section 8 as appropriate and **as a minimum at distances of 3.0 linear metres on straight duct runs**

3080 ACCESS AND INSPECTION COVERS:

Provide purpose made access and inspection covers in positions indicated in accordance with DW 142 Part 7 Section 21.2. Fit access covers with quick release catches. Provide restraining straps where indicated.

3090A ACCESS DOORS, DW 142 PART 7:

Provide purpose made hinged access doors where indicated in accordance with DW 142 Section 21.3. Fit access doors with latch style fastenings. Size access doors in accordance with DW 142 Part 7 Section 21.2.1

3100 ACCESS DOORS HANDLES:

Provide handles on all access doors.

3110A PRE-INSULATED ACCESS DOORS:

Provide standard access door with 25 mm thickness of insulation.

3110B ACCESS DOOR INSULATION:
Insulate access doors as ductwork.

3120 HANGERS AND SUPPORTS:
Provide hangers and supports throughout in accordance with DW 142 Part 6, DW 151 Section 7 or DW 191 Section 7 as appropriate.

3160A OPPOSED BLADE CONTROL DAMPERS WITH LOCKING DEVICE:
Provide single skin section, plain opposed blade control dampers in accordance with DW 142 Part 7 Section 22 or DW 151 Section 8 as appropriate.
Provide locking device.

3160C OPPOSED BLADE, AEROFOIL SECTION, CONTROL DAMPERS WITH LOCKING DEVICE AND POSITION INDICATOR:
Provide extruded aerofoil section, plain opposed blade control dampers in accordance with DW 142 Part 7 Section 22 or DW 151 Section 8 as appropriate.
Provide locking device and position indicator,

3170A MOTORISED CONTROL DAMPERS:
Provide control dampers complete with motor, motor linkage and motor support.

3190A FIRE DAMPER ACCESSORIES:
Provide installation frames to suit fire dampers.

3270A BIRD WIRE GUARDS:
Fit bird screens of 13mm square mesh wire on all intake and extract louvres to atmosphere. Wire gauge to be not less than 1mm.
Finish, plastic coated wire.

3280 INSECT GUARDS:
Provide insect guards where indicated.

4010 GENERAL WORKMANSHIP:
Install ductwork in accordance with DW 142, DW 151 and DW 191 as appropriate.
Ensure that there are no sharp edges or corners on cut edges on ductwork, flanges and supports.

4030 DUCTWORK SUPPORTS:
Support ductwork in accordance with DW 142 Part 6 Section 19, DW 151 Section 7 or DW 191 Section 7 as appropriate. Install supports to ensure insulation can be applied unless otherwise indicated.

4040A DUCT SUPPORT FOR VAPOUR SEAL CONTINUITY, METHOD 1:
Where a vapour seal is indicated, ensure continuity over ductwork support using method 1 of DW 142 Part 6 Section 19.6.1.

4050A DUCTWORK VIBRATION ISOLATION, RUBBER:
Ensure that ductwork does not come in direct contact with building fabric except in cases of fire dampers, silencers and builders frames. Isolate all supporting members from ductwork, secure lining of 6mm thick rubber to support by means of adhesive.

4060A ACCESSORY SUPPORT:
In accordance with DW 142 Part 6 Section 19.5 for supporting ductwork ancillaries provide supports as indicated on drawings.
Provide additional supports adjacent to dampers, diffusers and other items of equipment to prevent distortion.

4060B ACCESSORY SUPPORT, FOR APPROVAL:
In accordance with DW 142 Part 6 Section 19.5 for supporting ductwork ancillaries submit details of supports for approval.
Provide additional supports adjacent to dampers, diffusers and other items of equipment to prevent distortion.

4070 EXTERNAL DUCTWORK SUPPORT:
Support ductwork external to building as indicated.

4080 DUCTWORK FLOOR SUPPORT:
Support ductwork from floor as indicated.

4090 APPEARANCE OF DUCTWORK SUPPORTS:
Cut off protruding ends of hanger rods and bolts close to nuts. Ensure that supports and drop rods are clear of ducts and not enclosed in thermal insulation, as DW 142 Section 19.6.

4100 DRAINAGE OF DUCTWORK:
Arrange ductwork to drain any entrained moisture and ensure the lapping of joints prevents moisture leakage.

4110 CONNECTIONS:
Plant connections
Make connection between air handling assembly and ductwork system in accordance with DW 142 Part 3 Section 10.
Connections to builders work
Comply with DW 142 Part 7 Section 29.

4120A FLEXIBLE DUCTWORK, WIRE LOOP TIES:
Ensure that flexible ductwork does not become kinked or flattened. Support flexible ductwork using wire loop tie supports to prevent sagging.

4140B INTERNAL CLEANLINESS, INTERMEDIATE:
Provide the level of cleanliness and protection as defined in HVCA document DW/TM2 as intermediate.

4150A WEATHERPROOFING, FLASHING AND COWL:
Fit ductwork with trimming angle and weather cravat, skirt, flashing plate and cowl where ductwork passes through or terminates in roof, to ensure a weatherproof seal to building structure, as indicated.

4180A TEST HOLES, EACH SIDE ALL EQUIPMENT:
Provide test holes in ductwork system to allow complete testing and balancing of system in accordance with CIBSE Commissioning Code Series A. Drill test holes on site in accordance with DW 142 Part 7

Section 21.4 or DW 151 Section 10.5 as appropriate. Provide test holes on each side of all equipment in system.
At least 1.5 duct diameters upstream of all dampers.
Provide, at each location, the number of test holes shown below
Circular ducts

Duct diameter	No. of test holes
Up to 150mm	1
151 to 450mm	2
Over 450mm	4

Rectangular ducts

Longest side	No. of test holes
Up to 200mm	1
201 to 400mm	2
401 to 600mm	3
601 to 800mm	4
801 to 1000mm	5
1001 to 1200mm	6
1201 to 1500mm	7
Over 1500mm	One per 250mm

4190 HOLES FOR CONTROL EQUIPMENT:
Provide holes in ductwork to accommodate thermostats, humidistats and other control sensors as indicated. Where holes are provided on insulated ductwork, extend to finish flush with insulation.

4200 INSTALLATION OF CONTROL EQUIPMENT:
Fit sensors, damper motors and other control equipment as indicated.

4210 INSTRUMENT CONNECTIONS:
Provide instrument connections where indicated.

4240 FIRE DAMPER ACCESS:
Ensure access is provided to fire damper mechanism through access doors, false ceilings etc. Demonstrate that fire damper blades close completely and that fire links can be replaced. Where more than one fire damper is installed in a frame ensure access is provided to all fire dampers.

4250 POSITIONING:
Position components as indicated and in accordance with manufacturer's instructions.

Y40 AIR HANDLING UNITS

1000 GENERAL

1010A AIR LEAKAGE:

Ensure air handling unit is sealed to prevent air leakage at design pressure. Determine air leakage in accordance with HEVAC Guide to Air Handling Unit Leakage Testing, Figure 3 at 400 Pa negative pressure.

2000 PRODUCTS/MATERIALS

2020B MANUFACTURER'S STANDARD DOUBLE SKIN CASING AIR HANDLING UNITS:

Outer skin material - Manufacturer's standard.
Inner skin material - Manufacturer's standard.
External casing finish - Manufacturer's standard.
Internal casing finish - Manufacturer's standard.

2030A AIR HANDLING UNIT CONSTRUCTION:

General construction

Construct unit to withstand maximum fan static pressure without plastic deformation.

Ensure panels do not deflect by more than 1/120 of maximum panel dimension when unit is in operation.

Use corrosion resistant fastenings throughout.

Do not use self tapping screws.

Provide panel gaskets to give a durable seal between panels and frames to prevent excessive air leakage.

Provide stacking units where indicated.

Casing Insulation

Ensure insulation complies with BS 476 Parts 6 & 7. Ensure insulation is fixed securely to panel, and protected to prevent migration of fibre into air flow.

Insulation to provide thermal, structural or acoustic treatment as indicated.

Ensure insulation is vapour sealed throughout and incorporate thermal breaks.

Insulation material

Provide insulation that is inorganic, vermin proof and non-hygroscopic.

Use mineral fibre, minimum of 50mm thick or rigid polyurethane foam, minimum of 25 mm thick.

Framework

Ensure framework is rigid enough to prevent distortion during transportation and after final assembly on site.

Seat panels into folded, rolled or extruded frame with purpose made corner joints; or pentapost type frame with purpose made corner joints.

Ensure framework is self supporting.

For vertical units strengthen framework to support additional weight.

Base

Provide feet under each section; formed base; or RSC base.

2040A AIR HANDLING UNIT ACCESS:
Provide access openings and covers complete with opening devices, and sealed to prevent air leakage. Ensure seals are designed for normal maintenance operations for a minimum of 10 years.
Provide hinged access doors, 400mm minimum width.
Operating device - key operated door locks.
Provide access to fans, dampers, filters, spray coils, humidifiers and within air handling unit for inspection of nozzles and tanks.

4010A COMPONENT ASSEMBLY:
Assemble air handling units using gaskets to prevent air leakage from casing.

4020 ACCESS:
Ensure air handling units are positioned to allow adequate space for maintenance and access.

4040 DUCT CONNECTIONS:
Ensure air stream is straightened as it leaves unit discharge. Ensure ductwork connection is long enough to preserve (ensure) the aerodynamic performance of the fan. (is not affected.)

4050 SERVICES CONNECTIONS:
Ensure panels are sealed around electrical cable and pipework service entry points to prevent air leakage.
Provide flexible cables between fan motor and local isolator.

4060 ISOLATION OF UNITS:
Provide means of isolating air handling units electrically to allow maintenance and repairs to be carried out.
Provide means of isolating pipework to air handling units to allow maintenance and repairs to be carried out.
Provide means of isolating steam to humidifier when access door is opened.

4070 DRAINAGE OF FREE WATER:
Make provision for free water to be caught, collected and drained away. Provide U-traps on all drains suitable for the negative/positive pressure created by the fan.

4080A SUPPORT AIR HANDLING UNIT on builders work base.

Y41 FANS

1000 GENERAL

1010 DESIGN DUTIES:

Air Volume

Ensure scheduled volume is provided when operating against resistance of system corrected for changes between specified and selected component resistances.

System Resistance

Adjust scheduled resistance to compensate for actual resistance of selected components.

Operating Point

Select operating point on pressure/volume curve to provide stable and efficient operation.

Guaranteed Performance

Provide fan performance figures. These must either be measured or scaled in accordance with BS 848 Part 1.

1020 PROTECTION:

Protect casings, impellers and shafts against corrosion. Protect bearings against dirt and moisture.

2000 PRODUCTS/MATERIALS

2010A OPERATING CONDITIONS, CIBSE NOISE REQUIREMENTS:

Installation arrangement as shown on drawings.

Configuration

Parallel or series operation as shown on drawings.

Sound Power Level

Select fan, motor, drive and speed control system not to exceed typical fan noise level spectra as given in CIBSE Guide.

Provide sound power data in accordance with BS 848 Part 2.

Air Density

Relate fan performance to air density 1.20kg/m^3.

Temperature Range

Minimum to maximum operating temperatures -5^{o}C to 30^{o}C.

2020A CONSTRUCTION AND HANDLING:

Casings

Construct rigid casing free from drumming under operating conditions.

Supply in sections as required for access or handling.

Rotating assemblies

Balance in accordance with BS 4675 Part 1; BS 7508; or BS 6861 Part 1 as appropriate.

Shafts and hubs

Machine impeller bosses and shafts to BS 4500 and key in accordance with BS 4235 Part 1. Hold impeller to shaft with set screw or taper lock fitting.

Shaft bearings - Sealed for life.

Drives and guards

Provide guards over shaft, couplings and rope in accordance with BS 5304 and Factory Inspectorate requirements.

Material - galvanized or sheet steel.

Lifting

Provide lifting eyebolts or similar facilities on fans or sections heavier than 20kg.

2030 TESTING:

Provide results of aerodynamic performance tests in accordance with BS 848 Part 1; noise tests in accordance with BS 848 Part 2; and fan vibration measurements in accordance with BS 848 Part 6.

4010 LOCATION:

Install fans in positions indicated, in accordance with manufacturer's instructions and recommendations in the HEVAC Fan Application Guide.

4030 ALIGNMENT:

Ensure fan is installed aligned to allow optimum air flow path.

4040 TESTING:

Ensure fan is isolated from installation during air leakage testing of ductwork.

Y43 HEATING/COOLING COILS

1000 GENERAL

2000 PRODUCTS/MATERIALS

2010A HOT WATER HEATING COILS, COPPER WITH ALUMINIUM FINS:

Materials

Tubes - copper to BS 2871.
Fins - aluminium.
Headers - Manufacturer's standard.
Casing - Manufacturer's standard.

Casing

Make provision for coil expansion. Enclose body of coil, headers and bends within casing.

Draining and venting

Provide plugged connections in headers to allow fitting of drain cocks/air vents and provide coil complete with venting and draining devices.

Coil Testing

Pressure test coils to a minimum of 1.5 times design working pressure to ensure leak tight manufacture, and provide signed test certificates. Base coil design and sizing on performance test figures in line with BS 5141, Part 2 for heating coils.

Packaging

Fit protection for fins prior to despatch.
Protect coils from dirt after manufacture by fitting blank flanges/caps to pipe connections.

3060 MATCHING FLANGES - DUCTWORK:

Provide matching flanges for ductwork connections, to suit coil.

4010 POSITION/LOCATION:

Install coils in air distribution system as indicated. Locate coils in positions where air velocity is substantially equal over face of approach duct.
Arrange steam coils for horizontal air flow.
Ensure equipment, controls and instruments positioned adjacent to heating coils are not adversely affected by thermal radiation.

4020B HEATING COIL CONNECTIONS:

Arrange pipe connections to take up thermal expansion movement without imposing stress on coil.

4030 COIL SUPPORT:

Ensure that coils are fully supported independently of adjacent ductwork.

4040 PROTECTION:

Protect coils from damage and ingress of dirt during the course of contract. Restore fins and other parts of coils to original condition if any damage has occurred. Ensure all connected ductwork is thoroughly clean before removing protection and passing air through system.

4050 EQUIPMENT INSTALLATION:

Install equipment in accordance with manufacturer's recommendations. Ensure maintenance requirements are incorporated.

BMA

Y45 SILENCERS/ACOUSTIC TREATMENT

1000 GENERAL

1010 PERFORMANCE:
Ensure that specified performance is met where protection is applied to infill to protect from moisture and grease.

1020 TESTING:
Provide certified insertion loss data in accordance with BS 4718. Provide generated sound power levels with insertion loss data.
Where equipment is manufactured in modules ensure performance ratings apply to complete unit.

1030 PROTECTION:
Protect silencers where they are installed in positions exposed to external weather conditions.
Block ends of silencers prior to delivery to site to prevent damage.

1040 DIRECTION OF FLOW:
Clearly mark direction of air flow on silencers.

2000 PRODUCT/MATERIALS

2010B FIRE PROPERTIES, BUILDING REGULATIONS, CLASS O:
Use non-flammable adhesives. Ensure that all insulating materials and coverings are to Class O surface rating of Building Regulations.

2040B RECTANGULAR SILENCERS - CASING TO DW142 WITH EXTERNAL FLANGES:
Provide rectangular silencers compatible with ductwork installation. Provide infill that is inert, fire proof, inorganic, vermin proof, non-hygroscopic.
Construct splitters with manufacturer's standard ends.
Construct casing to DW142 with external flanges drilled for bolting to counterflanges on adjacent plant or ductwork.

2040C RECTANGULAR SILENCERS - CASING TO DW142 WITH INTERNAL FLANGES:
Provide rectangular silencers compatible with ductwork installation. Provide infill that is inert, fire proof, inorganic, vermin proof, non-hygroscopic.
Construct splitters with manufacturer's standard ends.
Construct casing to DW142 with internal flanges drilled and threaded for bolting to counterflanges on adjacent plant or ductwork.

2060A ACOUSTIC SPLITTERS TO MANUFACTURER'S STANDARD:
Mount splitters vertically or horizontally and fix splitters as shown on drawings.
Construct splitters to ensure that infill is retained and individual acoustic integrity is maintained.
Construct splitters with manufacturer's standard ends.

Provide additional stiffening on horizontally mounted splitters.
Provide infill that is inert, fire proof, inorganic, vermin proof, non-hygroscopic.
Material
Non-combustible mineral wool or glass fibre with minimum density 48 kg/m^3.
Retain infill by perforated galvanized mild steel sheet.

2070C AIR TRANSFER/CROSS TALK ATTENUATORS WITH SPIGOT ENDS:
Provide attenuators for air transfer and cross talk applications. Provide lining that is inert, fire proof, inorganic, vermin proof, non-hygroscopic.
Construct casing with lock-formed longitudinal joints, mastic sealed.
Provide plain spigot ends for connection to adjacent ductwork.
Fixing
Interface with building components as indicated.

3010 GENERAL:
Install acoustic treatment equipment in positions indicated, in accordance with manufacturer's instructions.

3040 SUPPORTS:
Supply steel section supporting frames or brackets where silencers are fixed to the walls of air chambers.

3060 SOUND PRESSURE LEVEL READINGS:
Measure sound pressure levels at the positions indicated using equipment in accordance with IEC 179.

BMA

Y46 GRILLES/DIFFUSERS/LOUVRES

1000 GENERAL

1010 PERFORMANCE:

Air Supply

Ensure air velocity at occupancy level is not greater than 0.45 m/s.

Blades

Supply grilles and diffusers with blade profile to ensure correct aerodynamic performance and minimal noise generation.

Louvres

Ensure air velocities through face area of louvres minimises `carry-over' of rain, snow or other precipitation into ducts, shafts or plant rooms.

1020 SIZE:

Sizes indicated are `Nominal'.

Provide site dimensions of linear diffusers and grilles before manufacture.

1030 NOISE LEVELS:

Ensure sound power levels indicated are not exceeded. Ensure accessories for grilles and diffusers have low noise generation characteristics, and cause minimum disturbance to airflow.

1040 ELECTRICAL BONDING TERMINAL:

Ensure an electrical bonding terminal suitable for connection of 6 mm^2 maximum conductor is provided on metal grilles, diffusers and louvres where indicated.

1050 PROTECTIVE WRAPPING:

Apply protective wrapping to exposed architectural finishes prior to despatch to site.

1060 TESTING:

Provide air terminal devices tested in accordance with BS EN 25135 (BS 4773).

2000 PRODUCTS/MATERIALS

2010A GRILLES - FIXED BLADE TYPE:

Secure blades within flanged mounting frame or core collar. Provide support mullions to ensure blade stability.

Style, blade rows and air pattern control as indicated on schedule.

2020A GRILLES - ADJUSTABLE BLADE TYPE:

Pivot blades within flanged mounting frame and retain blades in set position by tensioners external to the airstream.

Provide blade rows and blade angle adjustment as indicated on schedule.

2040A GRILLES - EGG-CRATE TYPE:

Core material - Aluminium or plastic as indicated.

Style

Flanged or channel frame; or core only as indicated.

2070A GRILLES - SIGHTPROOF NON-VISION TYPE:

Supply sightproof non-vision grilles with one set of blades at centres indicated.

Fix within a flanged mounting frame or a core box as indicated.

2070B GRILLES - LIGHTPROOF NON-VISION TYPE:

Supply lightproof non-vision grilles with two sets of blades at centres indicated.

Fix within a flanged mounting frame or a core box as indicated.

2140B DRUM PUNKAH LOUVRE DIFFUSERS:

Supply diffusers manufactured with adjustable core.

Supply core in the form of a rotatable cylinder with a rectangular outlet nozzle, the whole retained by a flanged frame allowing manual change of discharge air pattern to give an adjustable high velocity jet or full diffusion, by adjustable integral vertical blades.

Incorporate tapped ring for duct mounting, complete with felt, foam rubber or plastic sealing ring and fixing bolts or screws. When connecting to ends of flexible ducting, fit rigid flanged extension collar.

2160 LAMINAR FLOW PANELS:

Supply laminar flow panels each with a large perforated face plate complete with rear plenum box or spigot entry.

2180 DIFFUSERS - EXTRACT/EXHAUST VALVE TYPE:

Supply diffusers incorporating intake ring and adjustable valve disc assembly. Provide bayonet type fixing for purpose made mounting ring with plastic foam sealing gasket. Provide setting template.

Adjust valve to required setting and lock valve in required position.

2190A LOUVRES - EXTERNAL AIR SUPPLY/EXTRACT TYPE:

Performance

Ensure louvre withstands specified wind loads and prevent ingress of rain.

Construction

Construct louvre frame and aerodynamically profiled louvre blades from galvanized mild steel or aluminium as indicated.

Provide integral drainage channels.

Retain infill on louvre blades by perforated sheet of galvanized mild steel or aluminium as indicated.

Screen

Fit a bird-screen using mesh no coarser than 12mm, across inside face of louvres.

Fit an insect-screen using mesh no coarser than 3mm, across inside face of louvres.

Quality assurance

Ensure manufacturers are a firm of Assessed Capability to BS EN ISO 9001 and produce louvre to relevant Quality Assessment schedule.

2210B ALUMINIUM:
Use aluminium sheet/extruded aluminium produced to BS EN 485, BS EN 515 and BS EN 573, or BS 1474.

2220A GRILLE AND DIFFUSER CONSTRUCTION:
Ensure grilles and diffusers are robust and mounting frame flanges on square and rectangular terminals have mitred corners. Fit a rubber or plastic foam sealing strip or gasket to rear face of flange.
Diffusers
Ensure face of diffuser outer cone or frame is completely smooth.

2230A LOUVRE CONSTRUCTION:
Ensure louvres are robust. Incorporate in purpose made sub-frame.
Provide drip cills as indicated.

3010A OPPOSED BLADE VOLUME CONTROL DAMPERS - LOCAL CONTROL:
Balance and tension operating mechanisms to give positive setting for blade positions from fully open to fully closed.
Local blade operation
Supply device for operating damper blades through face or side of grille/diffuser as indicated.

3070 BLANKING PLATES:
Supply blanking plates to restrict projection of air flow from a particular section of grille or diffuser. Ensure that indicated dimensions or angles in degrees are maintained.

3100 CEILING OR WALL MOUNTED PLENUM BOXES:
Supply single plenum box or series of plenum boxes butted together to form continuous length, as indicated. Ensure sturdy and rigid construction with circular inlet spigots 65mm minimum length.
Incorporate at least four drilled angle brackets, or flat bar lugs, for securing to, or suspension by rods or wires from building or other construction.

3130 SPARES:
Supply indicated number of loose keys, suitable for adjusting each size and type of grille, or operating accessories.

4010 GRILLE/DIFFUSER LOCATION:
Fit at terminal air supply, extract and transfer points indicated, in accordance with the HEVAC Air Diffusion Guide.

4020 LOUVRE LOCATION:
Fit at system main air intake and discharge points, as indicated.

4030 ACCESSORIES:
Fit accessories to each grille and diffuser in accordance with manufacturer's instructions and as indicated.

4040 CONNECTION TO DUCTWORK:

When connecting directly to duct spigot, secure grille mounting frame or flange with screws, or bolts and nuts, to returned flange, with filled in corners, at end of duct spigot.

4050A INSTALLATION IN BUILDERSWORK:

Ensure outer edge of grille mounting frame or flange extends on all sides beyond the joint between any builders work frame and surrounding building construction.

Ensure grilles are sealed to building fabric - including ceilings, to prevent air leakage from pressurised rooms to voids above.

Fix louvres to building fabric using method indicated on drawings.

4060A TRANSFER GRILLES:

Where transfer points are located in partitions or walls, prevent through vision by fitting a fixed blade grille on both faces of partition or wall. Connect cavity wall or partition transfer grille assemblies with ducting sleeve or collar extending between grilles.

4060B TRANSFER GRILLES WITH FIRE DAMPER:

Where transfer points are located in partitions or walls, prevent through vision by fitting a fixed blade grille on both faces of partition or wall. Connect cavity wall or partition transfer grille assemblies with ducting sleeve or collar extending between grilles.

Incorporate fire damper in fire compartment wall transfer grille assembly.

4070 FIXING:

Provide details of fixing method for approval.

BMA

Y50 THERMAL INSULATION

1
000 GENERAL

1010 TEMPERATURE RANGE:
Surface temperature within range -40°C to 650°C.

1020 STANDARDS:
Comply in general with BS 5422 and the British Standards publications referred to therein. Also comply with BS 5970. Description of terms as BS 3533.

1030 MATERIALS:
Employ materials that comply with BS 476 Part 4, non- combustibility test, or obtain a Class `O' fire rating to Building Regulations.

1040 CFC'S:
Ensure all insulation materials and insulated pipe supports are free of CFC's.

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

1060 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.

1070 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.

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

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.

2000 PRODUCTS/MATERIALS

2010 THERMAL CONDUCTIVITY:
Ensure values are in accordance with BS 874 and BS 2972.

2020C FOIL FACED MINERAL WOOL PIPE INSULATION, HIGH DENSITY:

Standard - BS 3958 Part 4.
Nominal density - 130 to 150 kg/m^3.
Thickness - 19mm to 100mm.
Thermal conductivity

Mean temperature °C	Thermal Conductivity W/mK
10	0.031 or 0.033
50	0.035 or 0.037
100	0.042 or 0.043
150	0.050

Finish
Reinforced aluminium foil with at least 25mm overlap.

2030B FOIL FACED MINERAL WOOL DUCT INSULATION - RIGID DUCT INSULATION:

Standard - BS 3958 Part 5.
Nominal density - 48 kg/m^3.
Thermal conductivity

Mean temperature °C	Thermal Conductivity W/mK
10	0.030
25	0.032
50	0.035
75	0.039
100	0.044
125	0.049

Finish - Reinforced aluminium foil.

2040B FOIL FACED MINERAL WOOL DUCT INSULATION - DUCTWRAP:

Nominal density - 28 kg/m^3.
Thermal conductivity

Mean temperature °C	Thermal Conductivity W/mK
10	0.033
25	0.035
50	0.039
75	0.046
100	0.052
125	0.059

Finish - Reinforced aluminium foil.

2050B FOIL FACED MINERAL WOOL DUCT INSULATION - FLEXIBLE DUCT INSULATION:

Nominal density - 16 - 20 kg/m^3.

Thermal conductivity

Mean temperature °C	Thermal Conductivity W/mK
10	0.037
25	0.040
50	0.047
75	0.056
100	0.065
125	0.076

Finish - Reinforced aluminium foil.

2170A VAPOUR BARRIER PERMEANCE:

Do not exceed the following permeance values for vapour barriers.

Cold water pipework - 0.05g/sMN.

Chilled water pipework - 0.015g/sMN.

Refrigeration pipework - 0.010g/sMN.

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.

2200D ALUMINIUM SHEETING PROTECTION:

Apply flat or profiled aluminium cladding directly to insulating material, thickness, BS 5970 table 5.

2210A GALVANISED WIRE NETTING REINFORCEMENT:

Where reinforcement is required use galvanized wire netting. Comply with BS 1485, not less than 0.9mm diameter wire, 25mm mesh.

2220C VALVE AND FLANGE INSULATION, FLEXIBLE JACKET:

Install insulation on flanges and valves, where indicated. Use flexible insulation jackets.

2280 PUMPS AND OTHER IRREGULAR SHAPES:

Where access is required to pumps and other irregular shapes submit proposals for materials and methods of applying a demountable finish, for approval.

2290 HOT WATER SUPPLY SERVICES THICKNESS TABLE - MINERAL WOOL INSULATION:

Pipe size	Fuel	Water temperature 60°C Gas	Oil	Solid fuel
mm	Thickness of mineral wool insulation (mm)			
15		25	30	25
20		30	30	25
25		30	30	25
32		30	30	25
40		30	30	25
50		30	40	30
65		40	40	30
80		40	40	30
100		40	40	30
125		40	40	30
150		40	40	30
200		40	50	40
250		40	50	40
Flat Surfaces		50	50	40

2310 HEATING SYSTEMS THICKNESS TABLE - MINERAL WOOL INSULATION:

Pipe size	Fuel	Gas	Oil	Solid fuel
		Water temperature 75°C		
(mm)		Thickness of mineral wool insulation (mm)		
15		25	25	25
20		25	25	25
25		25	25	25
32		25	25	25
40		25	30	25
50		25	30	25
65		30	30	25
80		30	30	25
100		30	30	25
125		30	40	25
150		30	40	25
200		30	40	25
250		40	40	25
Flat Surfaces		40	40	30

Pipe size	Fuel	Gas	Oil	Solid fuel
		Water temperature 100°C		
mm	Thickness of mineral wool insulation (mm)			
15		25	25	25
20		25	30	25
25		30	30	25
32		30	30	25
40		30	30	25
50		30	40	25
65		40	40	30
80		40	40	30
100		40	40	30
125		40	40	30
150		40	40	30
200		40	40	30
250		40	50	40
Flat Surfaces		40	50	40

Pipe size	Fuel	Gas	Oil	Solid fuel
		Water temperature 150°C		
mm	Thickness of mineral wool insulation (mm)			
15		30	40	25
20		30	40	30
25		40	40	30
32		40	40	30
40		40	40	30
50		40	40	30
65		40	50	40
80		40	50	40
100		50	50	40
125		50	50	40
150		50	50	40
200		50	60	40
250		50	60	40
Flat Surfaces		60	60	50

2330 CHILLED AND COLD WATER SUPPLIES THICKNESS TABLE - MINERAL WOOL INSULATION:

Pipe size	Temperature of contents °C 0	5	10
mm	Thickness of mineral wool insulation (mm)		
15	25	25	25
25	30	25	25
50	40	25	25
100	40	30	25
150	50	40	25
250	50	40	30
Flat Surfaces	60	50	40

2360 PROTECTION AGAINST FREEZING THICKNESS TABLE - MINERAL WOOL INSULATION:

Pipe size	Indoor installation where freezing might occur.	Outdoor installation within scope of BS 5422
mm	Thickness of mineral wool insulation (mm)	
15	60	-
22	25	60
28	25	30
35	25	25
42	25	25

Pipe size	Indoor installation where freezing might occur.	Outdoor installation within scope of BS 5422
mm	Thickness of mineral wool insulation (mm)	
54	25	25
76	25	25
89	25	25
Flat Surfaces	25	25

2390 WARM AIR DUCTWORK THICKNESS TABLE - MINERAL WOOL INSULATION:

Temperature difference between air inside ductwork and ambient still air (K)	10	25	50
Thermal conductivity at mean temperature (W/mK)	0.04	0.04	0.055
Economic thickness of mineral wool insulation (mm)	40	50	75

2410 CONDENSATION CONTROL ON CHILLED AIR DUCTWORK - MINERAL WOOL INSULATION:

	Thermal conductivity of 0.035 W/mK at a mean temperature of 10°C		
Minimum air temperature inside duct	Surface coefficients		
	Low	Medium	High
°C	Thickness of mineral wool insulation (mm)		
15	25	15	15
10	40	25	15
5	60	30	25
0	75	40	30

2430 THICKNESS OF INSULATION:

Supply thickness of insulation as indicated.

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.

Separation

Insulate each unit separately. Do not enclose adjacent units together.

Clearance

Ensure 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.

3020 INSTALLATION OF MINERAL WOOL INSULATION ON PIPEWORK - WITH REINFORCED ALUMINIUM FACING:

Stick down longitudinal overlaps securely with adhesive or matching tape. Ensure joints are close butted together. Cover butt joints with self-adhesive tape at least 50mm wide. Insulate bends with mitred segments of insulation covered with self-adhesive tape. Insulate fittings to same standard as adjacent pipework.

3080 INSTALLATION OF INSULATION ON DUCTWORK - SQUARE OR RECTANGULAR DUCTWORK:

With reinforced aluminium facing cut insulation to fit on site so that top and bottom pieces overlap sides. Bond the insulation to the ductwork with adhesive in accordance with manufacturer's recommendations. Secure the insulation to the underside of ductwork with insulation hangers spaced at maximum 300mm centres square spacing. Butt all insulation pieces closely together and seal all joints with matching self- adhesive tape at least 100mm wide.

Vapour seal all joints and penetrations made by hangers.

3090 INSTALLATION OF MINERAL WOOL INSULATION ON DUCTWORK - ROUND OR OVAL DUCTWORK:

Flexible ductwork insulation with reinforced aluminium facing

Wrap the insulation round ductwork and bond with adhesive, applied in accordance with manufacturer's recommendations. Seal joints with matching self- adhesive tape at least 100mm wide.

Lamella with reinforced aluminium facing

Cut Lamella to length to wrap around duct with an additional 75mm to form an overlap. Remove insulation from facing of overlap together with dust, and seal overlap with adhesive in accordance with manufacturer's instructions. Butt joints closely together and seal with matching self- adhesive tape at least 100mm wide.

3100 INSTALLATION OF INSULATION ON TANKS:

Fit insulation so that two opposite pieces overlap the sides. Bond insulation to the tank with adhesive, applied in accordance with the manufacturer's recommendations. Closely butt together all slabs and seal joints with a matching self-adhesive tape 100mm wide.

3110 INSTALLATION OF MINERAL WOOL INSULATION ON VESSELS:

Cut Lamella to length to wrap around duct with an additional 75mm to form an overlap. Remove insulation from facing of overlap together with dust, and seal overlap with adhesive in accordance with manufacturer's instructions. Butt joints closely together and seal with matching self-adhesive tape at least 100mm wide.

3130A INSTALLATION OF SHEET METAL FINISH ON DUCTWORK, TANK AND VESSEL INSULATION:

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 except on pipes with vapour barrier; or metal bands.

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.

3150 INSTALLATION OF PROTECTION:

Ensure that where protection is applied to insulation, the joints fall blind side and that all joints are made to shed water and sealed with waterproof tape, adhesive or joint sealant where appropriate.

3190 INSTALLATION OF PROTECTION - ALUMINIUM SHEETING:

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.

3200 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.

3220B PIPELINE SUPPORTS WITH INSULATION CARRIED THROUGH:

For non-load bearing insulation on hot pipework close butt to a section of load bearing finished material 100mm long and provide a 2mm thick sheet metal protective sleeve (for installation by pipe erector).

For non-load bearing insulation on cold pipework, close butt to high density phenolic foam or polyisocyanurate pipe supports with metal sleeve. Ensure the vapour barrier is maintained. (For installation by pipe erector.)

3230 PIPE SLEEVES:

Carry finished insulation through pipe sleeve. Pack annular space between insulation finish and sleeve with non-flammable and fire retardant material to form fire stop.

3240 DUCTWORK SUPPORTS:

Insulation carried through between duct and support

Provide insulation between duct and support using high density phenolic foam or polyisocyanurate strips. Butt insulation to spacer and carry over finish by 40mm and tape joint. Provide a sheet metal protecting sleeve.

Insulation not carried through between duct and support

Provide end caps or bevelled seal.

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.

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 protectionsubmit proposals for securing sheeting without impairing the integrity of the vapour seal for approval.

3280 WATER TANKS:

Arrange insulation and finish to allow removal of access covers and/or tank top.

Y51 TESTING AND COMMISSIONING MECHANICAL SERVICES

1000 GENERAL

2000 STATIC TESTING

2010 PRESSURE TESTING - GENERAL:
Comply with procedures given in HVCA 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.

2020 PRESSURE TESTING - WATER CIRCULATING AND SUPPLY SYSTEMS AND STEAM AND CONDENSE LINES:
Carry out Hydraulic Pressure Testing as described in HVCA Guide to good Practice for Site Pressure Testing of Pipework. Test section by section for one hour, as the work proceeds and prior to application of thermal insulation as follows

Operating gauge pressure less than 3.5 bar, test gauge pressure 7.0 bar.
Operating gauge pressure 3.5 - 7.0 bar, test gauge pressure twice operating pressure.
Operating gauge pressure greater than 7.0 bar, test gauge pressure 14.0 bar or one and a half times operating pressure which ever is the greater.

2030A PRESSURE TESTING - UNDERGROUND PIPEWORK, 1 HOUR:
Test to a gauge pressure not less than twice the operating pressure for 1 hour.

2030B PRESSURE TESTING - UNDERGROUND PIPEWORK, 4 HOURS:
Test to a gauge pressure twice the operating pressure or 7 bar, whichever is the greater, for 4 hours.

2040 PRESSURE TESTING - WATER MAINS:
Test to Local Authority requirements. Ensure the provisions laid down in HVCA Guide to Good Practice for Site Pressure Testing of Pipework for testing underground CWS mains are carried out.

2050 PRESSURE TESTING - FIRE RISERS:
Test hydraulically to a pressure of 10 bar (gauge) measured at the top outlet to maintain pressure for not less than 15 minutes. Demonstrate to Fire Brigade when tests are satisfactory. Carry out flow tests after satisfactory pressure testing.

2060 PRESSURE TESTING - GAS PIPEWORK:
Carry out a pneumatic leak test followed by a pneumatic pressure test as described in HVCA Guide to Good Practice for Site Pressure Testing of Pipework.

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 5572.

2090 PRESSURE TESTING - UNDERSLAB DRAINAGE:

Test section by section as the work proceeds and subsequently after completion of backfilling and compaction to the satisfaction of the Engineers and the local Authority.

Individually test sections which will be permanently embedded in the structure or concealed in ducts or voids.

Submit sections to two separate tests Water test and Test for Straightness and Obstruction in accordance with BS 8301.

2110 TESTING RECORDS:

Keep a systematic record of tests. Distribute records as indicated.

3010 CLEANING DUCTWORK SYSTEMS:

Clean ductwork before plant is first run, using access openings in ductwork.

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.

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.

3040A COMMISSIONING 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.

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.

3050 COMMISSIONING BOILER PLANT:

Follow the procedures laid down for carrying out Preliminary Checks and Start Operation in accordance with CIBSE Commissioning Code B and manufacturers instructions.

Apparatus and Instruments

Use Apparatus and Instruments detailed in CIBSE Commissioning Code B, Appendix B3.1. Apply tolerances defined in Appendix B3.2.

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 manufacturers instructions.

Reciprocating Compressor

Carry out the procedures for Preliminary checks, Testing and Charging, and Setting to Work and Adjusting detailed in CIBSE Commissioning Code R, Section R2.

Centrifugal Compressor

Carry out the procedures for Preliminary Checks, Testing and Charging, and Setting to Work and adjusting detailed in CIBSE Commissioning Code R, Section R3.

AbsorptionSystems.

Carry out the procedures for Preliminary Checks, Testing and Charging, and Setting to Work and adjusting detailed in CIBSE Commissioning Code R, Section R4.

Screw Compressor

Carry out the procedures for Preliminary Checks, Testing and Charging, and Setting to Work and adjusting detailed in CIBSE Commissioning Code R, Section R5.

Apparatus and Instruments

Use Apparatus and Instruments detailed in CIBSE Commissioning Code R, Section R1.13. Apply tolerances defined in Section R1.14.

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.

3080 COMMISSIONING PLANT ITEMS:

Comply with the manufacturers' recommendations for setting to work.

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.

3100A AIR SYSTEMS COMMISSIONING RECORDS TO BSRIA GUIDE 3/89:

Keep a systematic record of commissioning results and distribute as indicated.

For air systems

Use record sheets as described in BSRIA Application Guide 3/89 Commissioning of air systems in buildings.

3100B WATER SYSTEMS COMMISSIONING RECORDS TO BSRIA GUIDE 2/89:

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, Commissioning of water systems in buildings.

4010 SYSTEM PERFORMANCE TESTING:

Demonstrate the performance of installations including single, standby, multi-duty plants and systems, and of plants specified for future use.

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.

4030 RECORDERS:

Provide and maintain on free loan portable seven day space temperature and relative humidity recorders, as indicated, together with adequate charts.

4050 PERFORMANCE TEST RECORDS:

Keep a systematic record of tests. Distribute records as indicated.

BMA

Y52 VIBRATION ISOLATION MOUNTINGS

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 LOCKING FACILITY:
Where indicated, provide lockable levelling device.

2000 PRODUCTS/MATERIALS

2010E PAD MOUNTINGS:
Provide pad mountings manufactured from composite synthetic rubber.

2050A SYNTHETIC RUBBER HANGERS, TURRET COMPRESSION:
Provide turret compression hangers fabricated from synthetic rubber incorporated with hanger box.
Construct hanger box from steel (minimum thickness 1.6mm) complete with hole for suspension rod and enlarged lower hole for drop rod to equipment.

2050B NEOPRENE HANGERS, TURRET COMPRESSION:
Provide turret compression hangers fabricated from neoprene incorporated within hanger box.
Construct hanger box from steel (minimum thickness 1.6mm) complete with hole for suspension rod and enlarged lower hole for drop rod to equipment.

2060 HANGERS, SPRING COMPRESSION:
Provide spring compression hangers comprising high strength low stress helical spring capped with steel pressure plate, on resilient base pad, mounted within hanger box. Construct hanger box from steel (minimum thickness 1.6mm) complete with hole for suspension rod and enlarged lower hole for drop rod to equipment.

2070A SYNTHETIC RUBBER HANGERS, COMBINED TURRET/SPRING COMPRESSION:
Provide turret/spring compression hangers with turret fabricated from synthetic rubber and high strength low stress helical spring capped with steel pressure plate, on resilient base pad, incorporated within hanger box.
Construct hanger box from steel (minimum thickness 1.6mm) complete with hole for suspension rod and enlarged lower hole for drop rod to equipment.

2070B NEOPRENE HANGERS, COMBINED TURRET/SPRING COMPRESSION:

Provide turret/spring compression hangers with turret fabricated from neoprene and high strength low stress helical spring capped with steel pressure plate, on resilient base pad, incorporated within hanger box.

Construct hanger box from steel (minimum thickness 1.6mm) complete with hole for suspension rod and enlarged lower hole for drop rod to equipment.

3010 GENERAL:

Install vibration isolation equipment and carry out levelling of equipment in accordance with manufacturer's instructions.

3030 FIXING:

Fix down vibration isolation mountings only where indicated.

BMA

Y54 IDENTIFICATION - MECHANICAL

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.

2000 PRODUCTS/MATERIALS

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; and 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.

2020 DUCTWORK IDENTIFICATION:
Standards
Generally colour code and label to HVCA Specification DW 142 (Appendix C).
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; and 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.

2030A PLANT AND EQUIPMENT IDENTIFICATION, ENGRAVED 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- Engraved plates filled with paint.

Legends

Engrave plates with an approved text. Incorporate operating duty of equipment where this is not incorporated in other labelling.

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.

2030C PLANT AND EQUIPMENT IDENTIFICATION, BACK FILLED PERSPEX:

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

Clear perspex back filled to reveal lettering.

Legends

Engrave plates with an approved text. Incorporate operating duty of equipment where this is not incorporated in other labelling.

2040 VALVE AND COCK IDENTIFICATION:

Standards

Identify each valve, cock, stop valve, air vent, drain cock etc. with disk 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.

2080 INSTRUMENT IDENTIFICATION:

Standards

Identify each instrument by name and, where appropriate, by agreed reference characters.

Plates

Use rectangular metal or laminated plastic, securely fixed to each instrument.

Legends

Engrave plates with an approved text.

2090 DANGER AND WARNING NOTICES:

Hazardous Systems

Colour code and label hazardous systems and equipment to requirements of Health and Safety Executive Guidance Notes.

2100C SYSTEM IDENTIFICATION INSTALLATION CHARTS, PLASTIC ENCAPSULATED:

System Schematics

Supply and fix a referenced schematic diagram (or diagrams) of all systems as installed, including equipment and ancillary schedules. Show scheduled information on diagram. Identify all items by appropriate reference characters.

Control Schematics

Supply and fix a referenced schematic diagram (or diagrams) of all control systems as installed, including equipment and ancillary schedules. Show scheduled information on diagram. Identify all items by appropriate reference characters.

Location

Fix in each boiler house, calorifier room, plant room or equipment room.

Finish -Plastic encapsulated chart.

BMA

Y72 CONTACTORS AND STARTERS

1000 GENERAL

1010A 3 PHASE ELECTRICAL SUPPLY:
Ensure all electrical equipment supplied and installed is suitable for 3 phase power supply to BS 7697.

2000 PRODUCTS/MATERIALS

2130B MOTOR STARTERS - MOTORS OF 0.37KW AND ABOVE:
Provide starters incorporating overcurrent protection for motors of 0.37kW and above.
Provide starter with manual reset, adjustable, inverse time delay, and ambient temperature compensated thermal overcurrent release to BS EN 60947-4-1. Ensure overcurrent release is compatible with starting, accelerating and running characteristics of motor, starter and driven machine combination. Use phase unbalance protection on three phase equipment.

2150 DIRECT-ON-LINE MOTOR STARTERS:
Use direct-on-line starter to BS EN 60947-4-1, with single phase motors and three phase motors.

2200 AUTOMATIC CHANGEOVER FOR RUN/STANDBY DUTY - SINGLE POWER SUPPLY:
Fit a control switch to starter enclosure arranged to select either motor for `run' or `standby' duty. Indicate selection of respective motor by illumination of indicator lights on starter enclosure.
Provide facilities for connection of remote indicator lights to indicate selection/operation of system and for connection of a system malfunction audible alarm, as indicated.
Arrange for selected `run' duty motor to operate in response to system controls, and in event of operation of duty motor starter overcurrent trip, for automatic changeover to `standby' motor.
Control power supply to starter by an air break isolating switch interlocked with starter enclosure access door.

3010 INSTALLATION:
Install control panels, motor control centres, contactors and starters in accordance with BS EN 60947 and manufacturer's recommendations.

BMA

Y90 FIXING TO BUILDING FABRIC

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.

2000 PRODUCTS/MATERIALS

2010 STANDARDS:
Comply with BS 3974 Part 1 for fixings. Ensure that fixings such as expanding anchors are tested for tensile loading in accordance with BS 5080.

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.

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.

2040 CAST-IN FIXINGS:
Where cast-in fixings are permitted, mark out and set fixings in accordance with manufacturer's instructions.

2050 SHOT FIRED FIXINGS:
Obtain approval prior to using shot fired type fixings.

2060 SELF ADHESIVE FIXINGS:
Obtain approval prior to using self adhesive type fixings.

2070 PROPRIETARY CHANNEL INSERTS:
Provide proprietary channel inserts for casting in where indicated.

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

3020 PROPRIETARY FIXINGS:
Comply with manufacturer's instructions for all fixings.

3030 FIXING TO REINFORCED CONCRETE:
Take precautions to avoid fixing through reinforcement.

3040 FIXING TO BRICKWORK:
Do not fix to unsound material or mortar between brickwork courses.

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.

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.

3070A FIXING TO CONCRETE, BRICKWORK OR BLOCKWORK:
Fix equipment, brackets and supports using wood screws in plugs.
Drill holes and fix using steel bolts of grouted bolt type or expanding bolt type fixing.

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.

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.

Y91 OFF-SITE PAINTING AND ANTI-CORROSION TREATMENTS

1000 GENERAL

1010 GENERAL REQUIREMENTS:

Where particular methods of finish and painting are not specified, ensure following requirements are met.

Protect all metal work, plant, equipment, pipelines, ductlines, ancillaries, brackets and supports against corrosion and oxidization.

Provide ferrous metals, machined or otherwise with protective coatings at manufacturer's works.

Ensure all items requiring on-site decorative finishes are provided primed to suit base material and required finish.

1020 DAMAGED FINISHES:

Following delivery to site, storage on site and installation make good any damage to finishes, by cleaning, degreasing and re-furbishing.

2000 PRODUCTS/MATERIALS

2010A PAINT MATERIALS:

Use the following materials as appropriate

Solvent borne priming paint to BS 5358 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.

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.

2030 HEAT RESISTANT PAINT:
Use heat resistant paints for applications to surfaces over 80^{o}C.

3010 GENERAL:
Ensure paints are applied in accordance with manufacturer's instructions and to BS 6150.

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.

3030 CLEANING:
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 (BS 7079).

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

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

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

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.

Y92 MOTOR DRIVES - ELECTRIC

1000 GENERAL

1010 STANDARDS:
Supply and install motors in accordance with BS 4999, BS 5000 and BS EN 60034, as appropriate and local supply authority regulations.

1020 ELECTRICAL SUPPLY:
Ensure all electrical equipment supplied and installed is suitable for power supply indicated.

1030 PERFORMANCE CHARACTERISTIC DETAILS:
Provide details of electrical input, starting and performance characteristics of all motors above 750W to an agreed format.

1060 MOUNTING:
When duplicate motors are required for automatic changeover, mount separately, ensure each is complete with drive and guard and make due allowance for power loss of idling motor.

1070 KEYS:
Ensure motors and drives are supplied complete with keys and keyways.

2000 PRODUCTS/MATERIALS

2010A STANDARD OPERATING CONDITIONS:
Ensure motors, starters and ancillary equipment are suitable for operation at full capacity at heights above sea level not exceeding 1000m, with air cooling at an average temperature over 24 hours not exceeding 35°C dry bulb with maximum conditions of 40°C dry bulb and 50 per cent RH.

2050B MOTOR RATINGS - ABOVE 0.75KW UP TO AND INCLUDING 4KW:
Three phase, squirrel cage induction type, totally enclosed, frame cooled or fan cooled. To BS 4999 Part 105 and BS EN 60034-6 IP44 - IC 01.411.