



Technical Specification

DEFRA

Richard Fairclough House, Knutsford Rd, Latchford, Warrington, WA4 1HT

Volume 2 –Standard Workmanship and Materials
NES Specification (Office Fit Out)

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Prepared by: Arun Gill

Checked by: Nick Patheyjohns

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S10 COLD WATER

PART 3 SPECIFICATION CLAUSES SPECIFIC TO S10

300.000 PRODUCTS/MATERIALS

300.001 PRESSURE EQUIPMENT DIRECTIVE/PRESSURE EQUIPMENT REGULATIONS:

- All equipment and assemblies which fall within the scope of the Pressure Equipment Directive (PED) 97/23/EC, implemented in the UK through The Pressure Equipment Regulations 1999, must be tested by the manufacturers, and be certified as compliant with the Directive. Such compliance shall be evidenced by displaying the appropriate CE Mark on the equipment and assemblies.
- Only relevant equipment and assemblies certified as compliant will be permitted under this specification, and any substitution put forward must also be compliant with the Directive.

300.005 APPROVALS:

- Ensure all water fittings and materials are listed in the Products and Materials Directory published by WRAS.

310.000 WORKMANSHIP

310.005 INSTALLATION AND COMMISSIONING GENERALLY:

- Install, test and commission systems to comply with BS EN 806-4 and complimentary guidance in BS 8558, Water Supply (Water Fittings) Regulations 1999 and equipment manufacturer's recommendations.
- Construct the system to ensure it is safe and without risks to health and where applicable incorporate in the final design/installation recommendations given in HSG274 Part 2.
- Install thermoplastics pipework in accordance with BS 5955-8.

310.010 CONNECTIONS TO TAPS AND APPLIANCES:

- Make final connections to taps and appliances

BS APPENDIX

BS 5955-8:2001

Plastics pipework (thermoplastics materials). Part 8 Specification for the installation of thermoplastic pipes and associated fittings for use in domestic hot and cold services and heating systems in buildings

BS 8558:2015

Guide to the design, installation, testing and maintenance of services supplying water for domestic use within buildings and their curtilages. Complimentary guidance to BS EN 806

BS EN 806-4:2010

Specifications for installations inside buildings conveying water for human consumption. Part 4 Installation

S11 HOT WATER

PART 1 SYSTEM OBJECTIVES

100.020 DESIGN PARAMETERS:

- BS EN 806-2, BS EN 806-3 and complimentary guidance in BS 8558, CIBSE Guide G: Public Health & Plumbing Engineering, CIBSE TM13, HSE Approved Code of Practice L8 and associated guidance HSG274 Part 2 (The control of legionella bacteria in hot and cold water systems).
- Comply with appropriate WRAS guidance.

PART 2 SELECTION SCHEDULES FOR REFERENCE SPECIFICATIONS

210.000 PIPELINES AND PIPEWORK

Please see Section Y10 PIPELINES AND PIPEWORK

211.000 PIPELINE ANCILLARIES

Please see Section Y11 PIPELINE ANCILLARIES

220.000 PUMPS

Please see Section Y20 PUMPS

222.000 HEAT EXCHANGERS

Please see Section Y22 HEAT EXCHANGERS

223.000 STORAGE CYLINDERS AND CALORIFIERS

Please see Section Y23 STORAGE CYLINDERS AND CALORIFIERS

224.000 TRACE HEATING

Please see Section Y24 TRACE HEATING

225.000 CLEANING AND CHEMICAL TREATMENT

Please see Section Y25 CLEANING AND CHEMICAL TREATMENT

250.000 THERMAL INSULATION

Please see Section Y50 THERMAL INSULATION

251.000 TESTING AND COMMISSIONING OF MECHANICAL SERVICES

Please see Section Y51 TESTING AND COMMISSIONING OF MECHANICAL SERVICES

252.000 VIBRATION ISOLATION MOUNTINGS

Please see Section Y52 VIBRATION ISOLATION MOUNTINGS

254.000 IDENTIFICATION - MECHANICAL

Please see Section Y54 IDENTIFICATION - MECHANICAL

290.000 FIXING TO BUILDING FABRIC

Please see Section Y90 FIXING TO BUILDING FABRIC

291.000 OFF-SITE PAINTING AND ANTI-CORROSION TREATMENT

Please see Section Y91 OFF-SITE PAINTING AND ANTI-CORROSION TREATMENT

PART 3 SPECIFICATION CLAUSES SPECIFIC TO S11

300.000 PRODUCTS/MATERIALS

300.001 PRESSURE EQUIPMENT DIRECTIVE/PRESSURE EQUIPMENT REGULATIONS:

- All equipment and assemblies which fall within the scope of the Pressure Equipment Directive (PED) 97/23/EC, implemented in the UK through The Pressure Equipment Regulations 1999, must be tested by the manufacturers, and be certified as compliant with the Directive. Such compliance shall be evidenced by displaying the appropriate CE Mark on the equipment and assemblies.
- Only relevant equipment and assemblies certified as compliant will be permitted under this specification, and any substitution put forward must also be compliant with the Directive.

300.005 APPROVALS:

- Ensure all water fittings and materials are listed in the Products and Materials Directory published by WRAS.

310.000 WORKMANSHIP

310.005 INSTALLATION AND COMMISSIONING GENERALLY:

- Install, test and commission systems to comply with equipment manufacturer's recommendations, BS EN 806-4, complimentary guidance in BS 8558 and relevant Water Supply (Water Fittings) Regulations or Byelaws
- England and Wales - The Water Supply (Water Fittings) Regulations 1999, as amended by The Water Supply (Water Fittings)(Amendment) Regulations 1999, The Water Act 2003 (Consequential and Supplementary Provisions) Regulations 2005 and The Construction Products Regulations 2013.
- Construct the system to ensure it is safe and without risks to health and where applicable incorporate in the final design/installation recommendations given in HSG274 Part 2.
- Install thermoplastics pipework in accordance with BS 5955-8.

310.010 HEATED TOWEL RAIL INSTALLATION:

- Supports: Support in accordance with manufacturer's recommendations to give neat appearance, with supports out of view where possible.
- Isolation: Fit an isolation valve on flow and regulating valve on return.
- Site Dimensions: Check dimensions on-site prior to ordering.

310.020 CONNECTIONS TO TAPS AND APPLIANCES:

- Make final connections to taps and appliances

310.030 WATER HEATER INSTALLATION:

- Comply with manufacturer's instructions and recommendations for the installation of heater.
- Locate heater with adequate surrounding space for service and maintenance.

310.040 INSTALLATION AND COMMISSIONING OF THERMOSTATIC MIXING VALVES:

- Install and commission thermostatic mixing valves and mechanical mixing valves in accordance with manufacturer's recommendations.
- On healthcare projects comply with HTM 04-01 Part A and NHS Model Engineering Specification D08.
- For TMV2 and TMV3 approved valves comply with the scheme's installation and maintenance documentation requirements.
- For TMV3 approved valves comply with the scheme onsite testing requirements.

310.050 INSTALLATION OF WATER METERS:

- Install water meters in accordance with manufacturer's instructions and BS EN ISO 4064-5
- Comply with the requirements of BS EN 14154-4 for additional functionality devices associated with Smart Metering.

BS APPENDIX

BS 5955-8:2001

BS 8558:2015

BS EN 14154-4:2014

BS EN 806-2:2005

BS EN 806-3:2006

BS EN 806-4:2010

BS EN ISO 4064-5:2014

T62 VRF SYSTEM

PART 3 SPECIFICATION CLAUSES SPECIFIC TO T62

300.015 SAFETY AND ENVIRONMENTAL REQUIREMENTS:

Comply with the relevant parts of BS EN 378 in the design, construction, testing, marking and documentation of the equipment and the system installation

300.080 REFRIGERANT PIPING SYSTEM:

- Seamless copper tube to BS EN 12735-1
 - Material condition (or temper)
 - Soft (R220) coiled.
 - Half hard (R250) straight lengths.
 - Hard (R290) straight lengths.
 - To be selected by the equipment manufacturer or the specialist pipework installer to suit the application, maximum operating temperature and pressure and refrigerant.
- Comply with the requirements of the BS EN 14276-2 and relevant parts of BS EN 378

- Jointing
 - Brazing - comply with British Refrigeration Association (BRA): Jointing of Copper Pipework for Refrigeration Systems - Specification & Procedures for Manual Torch Brazing and Brazer Assessment.
 - Manipulative compression (flared).
 - Manipulative compression (flared) only at connection to equipment.
- Support
 - Support all pipework and controls cabling throughout their length using cable tray, firmly fixed to the building fabric.
- Fittings
- Use factory made fittings throughout of same material type, pattern, finish and thickness as tray.

300.090 DRAINAGE PIPEWORK:

- Provide condensate drainage pipework from all units to drain
 - Copper tube to BS EN 1057
 - Fittings compression.
- Provide tees rather than bends to allow cleaning.
- Provide tundish and air break at units.
- Provide trap - depth minimum 1.5 times negative pressure on inlet and 0.5 times negative pressure at discharge.

300.100 PIPEWORK INSULATION:

- Ensure the entire length of pipework is insulated for thermal insulation and to avoid contact between copper and galvanising of tray.
- Closed cell nitrile rubber preformed flexible sections
 - CFC free.
 - HCFC free.
 - Install un-split wherever possible.
 - Use manufacturer's standard glue for jointing.
 - Ensure vapour barrier is maintained on
- all pipework.

310.000 PLANT AND EQUIPMENT WORKMANSHIP

310.010 PLANT AND EQUIPMENT INSTALLATION:

- Install equipment in accordance with manufacturer's recommendations.

310.020 REFRIGERANT PIPEWORK INSTALLATION:

- Arrange all exposed pipe runs to present neat appearance, parallel with other pipe or service runs and building structure.
- Ensure all vertical pipes are plumb or follow building line. Provide lifting loops where called for by system manufacturer.
- 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.
- Take precautions to prevent the discharge of refrigerant gases to atmosphere.
- All refrigerant pipework insulation at low level or in locations where mechanical damage could occur or which could be damaged by UV radiation shall be suitably protected.

BS APPENDIX

BS EN 1057:2006+A1:2010

BS EN 12735-1:2010

BS EN 14276-2:2007+A1:2011

Y10 PIPELINES AND PIPEWORK

1000 GENERAL

1010 PRE-FABRICATED PIPEWORK:

- Supply pre-fabricated pipework in accordance with relevant materials and workmanship clauses.

2000 PRODUCTS/MATERIALS PIPELINES

2010A HEAVY BLACK STEEL PIPES TO BS EN 10255:

- Material - Steel
- Standard - BS EN 10255
- Dimensions - Heavy. Random single lengths, 4m to 7m.
- Ends - Screwed to BS 21 and BS EN 10226-1, taper thread or plain.
- Finish - Varnished.

2010B MEDIUM BLACK STEEL PIPES TO BS EN 10255:

- Material - Steel
- Standard - BS EN 10255
- Dimensions - Medium. Random single lengths, 4m to 7m.
- Ends - Screwed to BS 21 and BS EN 10226-1, taper thread or Plain.
- Finish - Varnished.

2010C MEDIUM GALVANISED STEEL PIPES TO BS EN 10255:

- Material - Steel
- Standard - BS EN 10255
- Dimensions - Medium. Random single lengths, 4m to 7m.
- Ends - Screwed to BS 21 and BS EN 10226-1, taper thread.
- Finish - Galvanised.

2010D HEAVY GALVANISED STEEL PIPES TO BS EN 10255:

- Material - Steel
- Standard - BS EN 10255
- Dimensions - Heavy. Random single lengths, 4m to 7m.
- Ends - Screwed to BS 21 and BS EN 10226-1, taper thread.
- Finish - Galvanised.

2010E HEAVY BLACK STEEL PIPES TO BS EN 10255 - GROOVED ENDS:

- Material - Steel
- Standard - BS EN 10255
- Dimensions - Heavy. Random single lengths, 4m to 7m.
- Ends - Grooved for mechanical joints.
- Finish - Unvarnished, varnished, painted.

2010F MEDIUM BLACK STEEL PIPES TO BS EN 10255 - GROOVED ENDS:

- Material - Steel
- Standard - BS EN 10255
- Dimensions - Medium. Random single lengths, 4m to 7m.
- Ends - Grooved for mechanical joints.
- Finish - Unvarnished, varnished, painted.

2010G HEAVY GALVANISED STEEL PIPES TO BS EN 10255 - GROOVED ENDS:

- Material - Steel
- Standard - BS EN 10255
- Dimensions - Heavy. Random single lengths, 4m to 7m.
- Ends - Grooved for mechanical joints.
- Finish - Galvanised.

2010H MEDIUM GALVANISED STEEL PIPES TO BS EN 10255 - GROOVED ENDS:

- Material - Steel
- Standard - BS EN 10255
- Dimensions - Medium. Random single lengths, 4m to 7m.
- Ends - Grooved for mechanical joints.
- Finish - Galvanised.

2011 LIGHT GAUGE CARBON STEEL TO BS EN 10305-2:

- For use with push and pressfit piping systems.
- Material - Carbon steel.
- Standard - BS EN 10305
- Dimensions - BS EN 10305
- Ends - Plain.
- Finish - Uncoated.

2012 LIGHT GAUGE CARBON STEEL:

- For use with push and pressfit piping systems.
- Material - Carbon steel.
- Standard - Manufacturer's standard.
- Dimensions - Manufacturer's standard.
- Ends - Plain.
- Finish - Uncoated.

2012A LIGHT GAUGE CARBON STEEL FOR PUSH-FIT AND PRESS-FIT SYSTEMS:

- Standard - Manufacturer's standard.
- Material - Carbon steel.
- Dimensions - Manufacturer's standard.
- Ends - Plain.
- Finish - Galvanised externally.

2020A STEEL FITTINGS - SCREWED BENDS AND SPRINGS TO BS EN 10255:

- Material - Steel grade, seamless.
- Standard - BS EN 10255.
- Size range - 6mm to 150mm.

- Dimensions - BS EN 10255, medium weight.
- Ends - Screwed to BS 21 and BS EN 10226-1.
- Finish - Galvanised.

2060A HEAVY WEIGHT CARBON STEEL FITTINGS, BUTT WELDED TO BS EN 10253:

- Material
- Carbon steel, grade 430, electric resistance welded.
- Standard - BS EN 10253-1 or BS EN 10253-2.
- Size range - 25mm to 400mm.
- Dimensions - BS EN 10253-1 or BS EN 10253-2 Heavy
- Ends - Bevelled.
- Finish - Varnished.

2060B MEDIUM WEIGHT CARBON STEEL FITTINGS, BUTT WELDED TO BS EN 10253:

- Material
- Carbon steel, grade 430, electric resistance welded.
- Standard - BS EN 10253-1 or BS EN 10253-2.
- Size range - 25mm to 400mm.
- Dimensions - BS EN 10253-1 or BS EN 10253-2 Medium.
- Ends - Bevelled.
- Finish - Varnished.

2070A MALLEABLE CAST IRON FITTINGS, SCREWED:

- Material - Cast iron to BS EN 1562.
- 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 and BS EN 10226-1.
- Finish - Black

2070B GALVANISED MALLEABLE CAST IRON FITTINGS, SCREWED:

- Material - Cast iron to BS EN 1562.
- 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 and BS EN 10226-1.
- Finish - Galvanized.

2080A CAST IRON FITTINGS, GROOVED FOR MECHANICAL JOINTS:

- Material- Ductile cast iron to ASTM A-536, grade 65-45-12.
- Standard - Manufacturer's.
- Size range - 20mm to 600mm.
- Ends - Grooved for mechanical joints.
- Finish - Black.

2080B BLACK STEEL FITTINGS, GROOVED FOR MECHANICAL JOINTS:

- Material - Steel fittings to ASTM A-53.
- Standard - Manufacturer's.

- Size range - 20mm to 600mm.
- Ends - Grooved for mechanical joints.
- Finish - Black.

2080C PAINTED CAST IRON FITTINGS, GROOVED FOR MECHANICAL JOINTS:

- Material- Ductile cast iron to ASTM A-536, grade 65-45-12.
- Standard - Manufacturer's.
- Size range - 20mm to 600mm.
- Ends - Grooved for mechanical joints.
- Finish - Painted.

2080D GALVANISED STEEL FITTINGS, GROOVED FOR MECHANICAL JOINTS:

- Material - Steel fittings to ASTM A-53.
- Standard - Manufacturer's.
- Size range - 20mm to 600mm.
- Ends - Grooved for mechanical joints.
- Finish - Galvanized.

2080E GALVANISED CAST IRON FITTINGS, GROOVED FOR MECHANICAL JOINTS:

- Material - Steel fittings to ASTM A-536, grade 65-45-12.
- Standard - Manufacturer's.
- Size range - 20mm to 600mm.
- Ends - Grooved or mechanical joints.
- Finish - Galvanized.

2080F PAINTED STEEL FITTINGS, GROOVED FOR MECHANICAL JOINTS:

- Material - Steel fittings to ASTM A-53.
- Standard - Manufacturer's.
- Size range - 20mm to 600mm.
- Ends - Grooved for mechanical joints.
- Finish - Painted.

2215A CARBON STEEL COMPRESSION COUPLINGS TO BS EN ISO 8434:

- Material - Steel tubes to BS EN 10305-1 and BS EN 10305-4.
- Standard - BS EN ISO 8434-1.
- Dimensions, compression fittings BS EN ISO 8434-1
- Ends - Plain.
- Finish - Manufacturer's standard.

2215B STAINLESS STEEL COMPRESSION COUPLINGS TO BS EN ISO 8434:

- Material - Stainless steel to BS EN ISO 1127.
- Standard - BS EN ISO 8434-1.
- Dimensions, compression fittings BS EN ISO 8434-1
- Ends - Plain.
- Finish - Manufacturer's standard.

2220 LIGHT GAUGE STAINLESS STEEL TO BS EN 10312:

- For use with push and pressfit piping systems.
- Material - Stainless steel, austenitic grade 316 (1.4401).
- Standard - BS EN 10312.
- Dimensions - BS EN 10312 as per tables 1 and 2.
- Ends - Plain.
- Finish - Uncoated.

2221 LIGHT GAUGE STAINLESS STEEL:

- For use with push and pressfit piping systems.
- Material - Stainless steel, Austenitic grade 316 (1.4401).
- Standard - Manufacturer's standard.
- Dimensions - Manufacturer's standard.
- Ends - Plain.
- Finish - Uncoated.

2225A LONGITUDINALLY WELDED STAINLESS STEEL PIPES AND FITTINGS TO BS EN 1124:

- Material - Austenitic stainless steel.

2225B LONGITUDINALLY WELDED STAINLESS STEEL PIPES AND FITTINGS TO BS EN 1124:

- Material - Austenitic stainless steel.
- Standard - BS EN 1124.
- Dimensions - System X - BS EN 1124-3.
- Marking - BS EN 1124-1.
- Ends - Plain.
- Finish - Uncoated.

2250A AUSTENITIC STAINLESS STEEL TO BS EN 10216-5:

- Material - Austenitic stainless steel, seamless.
- Standard - BS EN 10216-5.
- Dimensions - BS EN ISO 1127.
- Ends - Plain.
- Finish - Uncoated.

2250B AUSTENITIC STAINLESS STEEL TO BS EN 10217-1:

- Material - Austenitic stainless steel, welded.
- Standard - BS EN 10217-7.
- Dimensions - BS EN ISO 1127.
- Ends - Plain
- Finish - Uncoated.

2255A STAINLESS STEEL FITTINGS, GROOVED MECHANICAL JOINTS:

- Material - stainless steel grades 304, 316, 316L, 316T, schedules 5S, 10S, 20S, 40S.
- Standard - manufacturer's.
- Size range - 20mm to 600mm.
- Dimensions - manufacturer's standard.
- Ends - grooved for mechanical joints. Use special 'RX' type roll sets for stainless steel pipe.

- Finish - natural.

2257 STAINLESS STEEL PUSH-FIT FITTINGS

- Material - Stainless steel
- Standard - Manufacturer's standard.
- Size range - 15mm to 54mm.
- Dimensions - to suit stainless steel pipe to BS EN 10216-5 and BS EN 10217-7.
- Ends - push-fit with EPDM O ring.
- Finish - Natural.
- Jointing - Provide manufacturer's recommended tool for releasing push-fit fittings in push-fit jointing systems.

2258 CARBON STEEL PUSH-FIT FITTINGS:

- Material - Carbon steel.
- Standard - Manufacturer's standard.
- Size range - 15mm to 54mm.
- Dimensions - to suit carbon steel pipe to BS EN 10305-3.
- Ends - push-fit with EPDM O ring.
- Finish - Galvanised.
- Jointing - Provide manufacturer's recommended tool for releasing push-fit fittings in push-fit jointing systems.

2260A COPPER, ANNEALED:

- Material - Copper.
- Standard - BS EN 1057, R220, (Class W).
- Dimensions - BS EN 1057 table 3.
- Ends - Plain.
- Finish - Uncoated.

2270A COPPER HALF HARD:

- Kitemarked.
- Material - copper.
- Standard - BS EN 1057, R250, (Class X).
- Dimensions - BS EN 1057 table 3.
- Ends - plain, grooved for mechanical joints; copper-tube dimensioned.
- Finish - uncoated.

2270B CHROMIUM PLATED COPPER, HALF HARD:

- Kitemarked.
- Material - Copper.
- Standard - BS EN 1057, R250, (Class X).
- Dimensions - BS EN 1057 table 3.
- Ends - Plain
- Finish - Chromium plated.

2280A POLYETHYLENE COVERED COPPER, SOFT:

- Material - Copper.

- Standard - BS EN 1057, R220, (Class Y).
- Dimensions - BS EN 1057 table 3.
- Ends - Plain.
- Finish - Sheathed in white polyethylene.

2280B PROFILED POLYETHYLENE COVERED COPPER, SOFT:

- Material - Copper.
- Standard - BS EN 1057, R220, (Class Y).
- Dimensions - BS EN 1057 table 3.
- Ends - Plain.
- Finish - Sheathed in profiled white polyethylene.

2290A COPPER, HARD:

- Material - Copper.
- Standard - BS EN 1057, R290, (Class Z).
- Dimensions - BS EN 1057 table 3.
- Ends - Plain.
- Finish - Uncoated.

2310A CAPILLARY FITTINGS FOR COPPER TUBING, GENERAL POTABLE RANGE:

- Material - Copper or dezincifiable resistant copper alloy.
- Standard - BS EN 1254-1.
- Size range - 6mm to 67mm.
- Dimensions - BS EN 1254-1 table 2.
- Ends - Integral (lead-free) solder ring.
- Finish - Natural.

2310B CAPILLARY FITTINGS FOR CHROME PLATED COPPER TUBING, POTABLE RANGE:

- Material - Copper or dezincifiable resistant copper alloy.
- Standard - BS EN 1254-1.
- Size range - 6mm to 67mm.
- Dimensions - BS EN 1254-1 table 2.
- Ends - Integral (lead-free) solder ring.
- Finish - Chrome plated.

2310C CAPILLARY FITTINGS FOR COPPER TUBING, HIGH DUTY RANGE:

- Material - Gunmetal (LG2 and LG4) or aluminium brass.
- Standard - BS EN 1254-1.
- Size range - 6mm to 54mm.
- Dimensions - BS EN 1254-1 table 2.
- Ends - Integral (cadmium-free) silver brazing ring.
- Finish - Natural.

2310D CAPILLARY FITTINGS FOR COPPER TUBING, WEDGE FITTING RANGE:

- Material - Gunmetal and copper/DZR copper alloy.
- Standard - BS EN 1254-1.
- Size range - 76mm and 108mm.
- Dimensions - BS EN 1254-1 table 2.

- Ends - Integral (lead-free) solder ring.
- Finish - Natural.

2310E CAPILLARY FITTINGS FOR COPPER TUBING, WASTE SYSTEM RANGE:

- Material - Copper or DZR copper alloy.
- Standard - BS EN 1254-1.
- Size range - 28mm to 54mm.
- Dimensions - BS EN 1254-1 table 2.
- Ends - Integral (lead-free) solder ring.
- Finish - Natural.

2315A COPPER PRESS FITTINGS FOR COPPER TUBING:

- Material - Copper or dezincifiable resistant copper alloy.
- Standard - Manufacturer's standard.
- Size range - 15mm to 108mm.
- Dimensions - to suit copper tube to BS EN 1057.
- Ends - With EPDM O ring for use with water.
- Finish - Natural.

2315B GUNMETAL PRESS FITTINGS FOR COPPER TUBING:

- Material - Gunmetal.
- Standard - Manufacturer's standard.
- Size range - 15mm to 54mm.
- Dimensions - to suit copper tube to BS EN 1057.
- Ends - With EPDM O ring for use with water.
- Finish - Natural.

2315C STAINLESS STEEL PRESS FITTINGS FOR COPPER TUBING:

- Material - Stainless steel.
- Standard - Manufacturer's standard.
- Size range - 15mm to 108mm.
- Dimensions - to suit copper tube to BS EN 1057.
- Ends - With EPDM O ring for use with water.
- Finish - Natural.

2315D CARBON STEEL PRESS FITTINGS FOR COPPER TUBING:

- Material - Carbon steel.
- Standard - Manufacturer's standard.
- Size range - 15mm to 108mm.
- Dimensions - to suit copper tube to BS EN 1057.
- Ends - With EPDM O ring for use with water.
- Finish - Natural.

2320A TYPE A COMPRESSION FITTINGS FOR COPPER TUBING:

- Kitemarked.
- Material - Dezincifiable resistant copper alloy
- Standard - BS EN 1254-2, type A, non-manipulative.

- Size range - 6mm to 54mm.
- Dimensions - BS EN 1254-2, table 2 and 3.
- Ends - Socket.
- Finish - Natural.

2320B TYPE A COMPRESSION FITTINGS FOR CHROME PLATED COPPER TUBING:

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

2320C TYPE B COMPRESSION FITTINGS FOR COPPER TUBING:

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

2321A COPPER TABLE X FITTINGS, GROOVED MECHANICAL JOINTS:

- Material - copper to BS EN 1057 (table X).
- Standard - manufacturer's.
- Size range - 54mm to 159mm.
- Dimensions - manufacturer's standard.
- Ends - grooved for mechanical joints.
- Finish - uncoated.

2321C CAST BRONZE FITTINGS, GROOVED MECHANICAL JOINTS:

- Material - cast bronze.
- Standard - manufacturer's.
- Size range - 54mm to 159mm.
- Dimensions - manufacturer's standard.
- Ends - grooved for mechanical joints; copper-tube dimensioned.
- Finish - uncoated.

2322 CAPILLARY FITTINGS, SHORT, FOR BRAZING TO COPPER TUBING:

- Material - Dezincifiable resistant copper alloy.
- Standard - BS EN 1254-5
- Size range - BS EN 1254-5 - 67mm to 159mm.
- Dimensions - BS EN 1254-5, table 2.
- Ends - Plain.
- Finish - Natural.

2325A PUSH-FIT FITTINGS FOR COPPER TUBING:

- Material - Dezincifiable resistant copper alloy and brass.

- Standard - Manufacturer's standard.
- Size range - 15mm to 54mm.
- Dimensions - to suit copper tube to BS EN 1057.
- Ends - push-fit with EPDM O ring.
- Finish - Natural.

2330A COPPER TO BS EN 12449:

- Material - Copper.
- Standard - BS EN 12449, seamless, round tubes.
- Dimensions - BS EN 12449.
- Ends - Plain or screwed.
- Finish - Uncoated.

2332A COPPER TO BS EN 12450:

- Material - Copper.
- Standard - BS EN 12450 seamless, round copper capillary tubes.
- Dimensions - BS EN 12450
- Ends - Plain or screwed.
- Finish - Uncoated.

2350A CAST IRON PIPES AND FITTINGS TO BS 416-1:

- Material - Cast grey or ductile iron.
- Standard - BS 416-1, spun.
- Dimensions - BS 416-1.
- Ends - Socket type A or B.
- Finish - Hot dipped to BS 416-1.

2370A CAST IRON PIPES TO BS 437 FOR FLEXIBLE JOINTS:

- Material - Cast iron.
- Standard - BS 437.
- Dimensions - BS 437.
- Ends - For flexible joint to BS EN 877.
- Finish - Hot dipped to BS 437.

2380A CAST IRON FITTINGS TO BS 437 FOR FLEXIBLE JOINTS:

- Material - Cast iron.
- Standard - BS 437, sand cast.
- Size range - 50mm to 225mm.
- Dimensions - BS 437, figures 1 to 66.
- Ends - For flexible joints to BS EN 877.
- Finish - Hot dipped to BS 437.

2390A RED CAST IRON PIPES AND FITTINGS TO BS EN 877:

- Material - Cast iron.
- Standard - BS EN 877.
- Dimensions - BS EN 877, table 1.
- Ends - Plain.
- Finish - Red epoxy.

2390B GREY CAST IRON PIPES AND FITTINGS TO BS EN 877:

- Material - Cast iron.
- Standard - BS EN 877.
- Dimensions - BS EN 877, table 1.
- Ends - Plain.
- Finish - Grey epoxy.

2410A FLANGED DUCTILE IRON PIPES AND FITTINGS TO BS EN 545:

- Material - Ductile iron.
 - Standard - BS EN 545.
 - Dimensions - Flanged, class K9.
 - Ends - Flanged.
 - Finish - External, zinc rich, with polyethylene sleeving, extruded polyethylene, extruded polypropylene or polyurethane.
- Internal, polyurethane to BS EN 15189.

2410B DUCTILE IRON PIPES AND FITTINGS TO BS EN 545:

- Material - Ductile iron.
 - Standard - BS EN 545.
 - Dimensions - Spigot/socket, tables 18 and 19.
 - Ends - Spigot and socket.
 - Finish - External, zinc rich, with polyethylene sleeving, extruded polyethylene, extruded polypropylene or polyurethane.
- Internal, polyurethane to BS EN 15189.

2415A FLANGED DUCTILE IRON PIPES AND FITTINGS TO BS EN 969:

- Material - Ductile iron.
 - Standard - BS EN 969.
 - Dimensions - Flanged, class K9 or K10.
 - Ends - Flanged.
- Finish - External, zinc rich, with polyethylene sleeving, extruded polyethylene, extruded polypropylene or polyurethane.

2415B DUCTILE IRON PIPES AND FITTINGS TO BS EN 969:

- Material - Ductile iron.
 - Standard - BS EN 969.
 - Dimensions - Spigot, table 13, socket, table 12.
 - Ends - Spigot and socket.
 - Finish - External, zinc rich, with polyethylene sleeving, extruded polyethylene, extruded polypropylene or polyurethane.
- Internal, polyurethane to BS EN 15189.

2420A FLANGED DUCTILE IRON PIPES AND FITTINGS TO BS EN 598:

- Material - Ductile iron.
 - Standard - BS EN 598.
 - Dimensions - Flanged, Class K9.
 - Ends - Flanged.
- Finish - External, zinc rich, with polyethylene sleeving, extruded polyethylene, extruded polypropylene or

polyurethane to BS EN 15189.

2420B DUCTILE IRON PIPE AND FITTINGS TO BS EN 598:

- Material - Ductile iron.
 - Standard - BS EN 598.
 - Dimensions - Spigot/socket, table 11.
 - Ends - Spigot or socket.
 - Finish - External, zinc rich, with polyethylene sleeving, extruded polyethylene, extruded polypropylene or polyurethane to BS EN 15189.
- Internal, high alumina cement mortar.

2425A FLANGED DUCTILE IRON PIPES AND FITTINGS TO BS ISO 2531:

- Material - Ductile iron.
 - Standard - BS ISO 2531.
 - Dimensions - Flanged, table 16.
 - Ends - Flanged.
 - Finish - External, zinc rich, with polyethylene sleeving, extruded polyethylene, extruded polypropylene or polyurethane to BS EN 15189.
- Internal, high alumina cement mortar.

2425B DUCTILE IRON PIPE AND FITTINGS TO BS ISO 2531:

- Material - Ductile iron.
- Standard - BS ISO 2531.
- Dimensions - Spigot/socket, table 17.
 - Permissible deviation on length of fittings, table 6.
- Ends - Spigot or socket.
- Finish - External, zinc rich, with polyethylene sleeving, extruded polyethylene, extruded polypropylene or polyurethane to BS EN 15189.
- Internal, high alumina cement mortar.

2430 MULTILAYERED PIPING SYSTEM FOR HOT AND COLD WATER TO BS EN ISO 21003:

- Piping system to
 - BS EN ISO 21003-1
 - BS EN ISO 21003-2
 - BS EN ISO 21003-3
 - BS EN ISO 21003-5
- Materials - as scheduled or specified in the particular specification.
 - Appropriate standards.
 - Polypropylene (PP)
 - BS EN ISO 15874-1
 - BS EN ISO 15874-2
 - BS EN ISO 15874-3
 - BS EN ISO 15874-5
 - Crosslinked polyethylene (PE-X)
 - BS EN ISO 15875-1
 - BS EN ISO 15875-2
 - BS EN ISO 15875-3

- BS EN ISO 15875-5
- Polybutylene (PB)
 - BS EN ISO 15876-1
 - BS EN ISO 15876-2
 - BS EN ISO 15876-3
 - BS EN ISO 15876-5
- Chlorinated polyvinyl chloride (PVC-C)
 - BS EN ISO 15877-1
 - BS EN ISO 15877-2
 - BS EN ISO 15877-3
 - BS EN ISO 15877-5
- Polyethylene of raised temperature resistance (PE-RT)
 - BS EN ISO 22391-1
 - BS EN ISO 22391-2
 - BS EN ISO 22391-3
 - BS EN ISO 22391-5
- Installation standard - manufacturer's standard.
- Size range - 16mm to 50mm.
- Dimension - manufacturer's standard.
- Ends - compression.
- Finish - black.

2440 MULTILAYERED PLASTICS PIPE SYSTEMS FOR INDOOR GAS INSTALLATIONS TO BS ISO 17484-1:

- Stress bearing polymeric materials, with or without a metallic layer.
- System standard - BS ISO 17484-1.
- Materials - as scheduled or specified in the particular specification.
 - Appropriate standards
 - Polyethylene (PE)
 - BS ISO 4437-1
 - BS ISO 4437-2
 - BS ISO 4437-3
 - BS ISO 4437-5
 - Crosslinked polyethylene (PE-X)
 - BS ISO 14531-1
 - BS ISO 14531-2
 - BS ISO 14531-3
 - BS ISO 14531-5
 - ISO 10146
 - Polyethylene of raised temperature resistance (PE-RT)
 - BS ISO 4437-1
 - BS ISO 4437-2
 - BS ISO 4437-3
 - BS ISO 4437-5
 - ISO 24003
- Size range - 16mm to 63mm.
- Dimension - Manufacturer's standard.
- Fittings - Mechanical, electrofusion.
- Finish - Manufacturer's standard.

2442 PLASTIC PIPING SYSTEMS TO BS EN 15014:

- Standard - BS EN 15014.

- Application - Buried and above ground systems for water (not potable) and other fluids under pressure.
- Performance characteristics for pipes, fittings and their joints.
- Performance characteristics - reaction to fire; external pressure strength; internal pressure strength; dimensional tolerance; tightness (air and water); durability; dangerous substances.

2455A PLASTICS PIPING SYSTEMS FOR WATER SUPPLY - PIPES TO BS EN ISO 1452:

- Material - Unplasticised polyvinyl chloride (PVC-U).
- Standard - BS EN ISO 1452-2.
- Dimensions - Length - manufacturer's standard range. BS EN ISO1452-2 tables 1, 2, 3, 4 and 5.
- Ends - Plain; elastomeric ring seal socket and spigot; or socket and spigot for solvent cement.
- Finish - Grey, blue or cream.

2475A PLASTICS PIPING SYSTEMS FOR WATER SUPPLY - FITTINGS TO BS EN ISO 1452:

- Plastic piping system for water under pressure up to 45°C and drainage/sewerage under pressure.
- Material - Unplasticised polyvinyl chloride (PVC-U).
- Standard - BS EN ISO 1452-3.
- Size range - 12mm to 315mm (injection moulding fittings); 63mm to 630mm (bends made from pipe)
- Dimensions - BS EN ISO 1452-3.
- Ends - Plain; elastomeric ring seal socket and spigot; or socket and spigot for solvent cement.
- Finish - Grey or brown.

2480A UNPLASTICIZED PVC TO BS 4514:

- Material - Unplasticized PVC.
- Standard - BS 4514.
- Dimensions - BS 4514.
- Ends - Plain.
- Finish - Black, grey or white.

2490A UNPLASTICIZED PVC FITTINGS, SOLVENT WELDING TO BS 4514:

- Material - Unplasticized PVC.
- Standard - BS 4514, table 2.
- Size range - 82mm, 110mm or 160mm.
- Dimensions - BS 4514 tables 3 and 5.
- Ends - Spigot/plain.
- Finish - Black, grey or white.

2491A ORIENTED UNPLASTICISED PVC TO BS ISO 16422:

- Material - Unplasticised PVC.
- Standard - BS ISO 16422.
- Dimensions - BS ISO 16422.
- Ends - Plain, socket.
- Finish - Blue, grey or cream.

2495A PLASTICS PIPING SYSTEMS TO BS EN 1453:

- Plastics piping system with structured wall pipes for soil and waste discharge (low and high temperature) within the building structure.
- Material - Unplasticised polyvinyl chloride (PVC-U).

- Standard - BS EN 1453.
- Dimensions - Length - manufacturer's standard range. BS EN 1453 tables 1, 2 and 3.
- Ends - Plain; elastomeric ring seal socket and spigot; or socket and spigot for solvent cement.
- Finish - Grey, black, or white.

2496A PLASTICS PIPING SYSTEMS TO BS EN 1329-1 - FITTINGS:

- Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure.
- Material - Unplasticised polyvinyl chloride (PVC-U).
- Standard - BS EN 1329-1
- Size range - 32mm to 315mm.
- Dimensions - BS EN 1329-1 tables 5 - 14.
- Ends - Plain; elastomeric ring seal socket and spigot; or socket and spigot for solvent cement.
- Finish - Grey.

2500A POLYETHYLENE PIPING SYSTEMS FOR UNDERGROUND DRAINAGE AND SEWERAGE TO BS EN 12666:

- Plastics piping system for underground drainage and sewerage both buried in the ground within the building structure, and buried in the ground outside the building structure.
- Material - polyethylene (PE).
- Standard - BS EN 12666-1.
- Dimensions - Length - manufacturer's standard range.
- Ends - Plain; elastomeric ring seal; or socket and spigot; for butt fused joints, electrofusion joints or mechanical joints.
- Finish - Black, or as agreed between manufacturer and purchaser.

2510A COMPRESSION FITTINGS FOR POLYETHYLENE PIPES:

- Material - Copper/copper alloy (dezincifiable resistant).
- Standard - BS EN 1254-3
- Size range - 20mm to 63mm.
- Dimensions - To suit pipes to BS EN 12201.
- Ends - Socket.
- Finish - Cast.

2525A BURIED POLYETHYLENE PIPES FOR GASEOUS FUELS TO BS ISO 4437:

- PE Pipes, including any identification tapes.
- Material - Polyethylene (PE).
- Standard
 - BS ISO 4437-1
 - BS ISO 4437-2
 - BS ISO 4437-3
 - BS ISO 4437-5
- Dimensions
 - BS ISO 4437-1
 - BS ISO 4437-2
 - BS ISO 4437-3
 - BS ISO 4437-5
- Ends - Plain for butt fused joints.
- Finish - Black, yellow.

2525B BURIED POLYETHYLENE PIPES FOR GASEOUS FUELS TO BS ISO 4437:

- PE pipes with co-extruded layers on either or both the outside and/or inside.
- Material - Polyethylene (PE).
- Standard
 - BS ISO 4437-1
 - BS ISO 4437-2
 - BS ISO 4437-3
 - BS ISO 4437-5
- Dimensions
 - BS ISO 4437-1
 - BS ISO 4437-2
 - BS ISO 4437-3
 - BS ISO 4437-5
- Ends - Plain for butt fused joints.
- Finish - Black, yellow.

2525C BURIED POLYETHYLENE PIPES FOR GASEOUS FUELS TO BS ISO 4437:

- PE pipes with additional external thermoplastics layer.
- Material - Polyethylene (PE).
- Standard
 - BS ISO 4437-1
 - BS ISO 4437-2
 - BS ISO 4437-3
 - BS ISO 4437-5
- Dimensions
 - BS ISO 4437-1
 - BS ISO 4437-2
 - BS ISO 4437-3
 - BS ISO 4437-5
- Ends - Plain for butt fused joints.
- Finish - Black, yellow.

2528 POLYETHYLENE PIPES TO BS EN 1555:

- Material - Polyethylene.
- Standard - BS EN 1555-1, BS EN 1555-2 and BS EN 1555-5.
- Dimensions - BS EN 1555-2
 - Lengths - straight pipe 6m or 12m.
 - Lengths - coiled pipe multiples of 50m.
- Marking - BS EN 1555-2
- Ends - Plain.
- Finish
 - Black
 - Yellow
 - Black with yellow identification stripes.

2538 POLYETHYLENE FUSION FITTINGS TO BS EN 1555:

- Material - Polyethylene.
- Standard - BS EN 1555-1, BS EN 1555-3 and BS EN 1555-5.
- Dimensions - BS EN 1555-3, Section 6, to suit pipes to BS EN 1555-2.

- Marking - BS EN 1555-3, table 7.
- Ends - Sockets with heating elements for fusion jointing.
- Finish
 - Black
 - Yellow.

2540 POLYPROPYLENE TO BS EN 1451-1:

- Material - Polypropylene.
- Standard - BS EN 1451-1
- Dimensions - BS EN 1451-1.
- Ends - Plain/Socket.
- Finish - Natural self colour.

2545A PLASTICS PIPING SYSTEMS TO BS EN 1451-1 - PIPES:

- Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure.
- Material - Polypropylene (PP).
- Standard - BS EN 1451-1 and BS EN 15012.
- Dimensions - Length - manufacturer's standard range. BS EN 1451-1 tables 1, 2, 3 and 4.
- Ends - Plain; elastomeric ring seal socket and spigot; or socket and spigot for solvent cement.
- Finish - Grey, black, or white.

2550A POLYPROPYLENE FITTINGS, TO BS EN 1451-1:

- Material - Polypropylene.
- Standard - BS EN 1451-1.
- Size range - 32 to 50mm.
- Dimensions - BS EN 1451-1.
- Ends - Plain; or ring seal, multi-vane or compression sockets.
- Finish - Natural self colour.

2552A POLYPROPYLENE PIPING SYSTEMS FOR UNDERGROUND DRAINAGE AND SEWERAGE TO BS EN 14758-1:

- Plastics piping system for underground drainage and sewerage both buried in the ground within the building structure, and buried in the ground outside the building structure.
- Material - Polypropylene with mineral modifiers (PP-MD).
- Standard - BS EN 14758-1.
- Dimensions - Length - manufacturer's standard range.
- Ends - Plain (with or without chamfer); or single socket with ring seal (with or without chamfer).
- Finish - Black, orange-brown (approximately RAL 8023) or dusty grey (approximately RAL 7037). Other colours may be used.

2553A PIPES AND FITTINGS WITH SMOOTH INTERNAL AND EXTERNAL SURFACE, TYPE A, TO BS EN 13476-2:

PVC-U, PP and PE pipes, type A.

- Material - unplasticised poly (vinyl chloride) (PVC-U), polypropylene (PP) and polyethylene (PE).
- Standard - BS EN 13476-2.
- Dimensions - BS EN 13476-2, Section 7.
- Ends - Spigot, Type A1, Type A2, Type B.

- Finish - Black, orange-brown, dusty grey.

2553B PIPES AND FITTINGS WITH SMOOTH INTERNAL AND PROFILED EXTERNAL SURFACE, TYPE B, TO BS EN 13476-3:

- PVC-U, PP and PE pipes, type B.
- Material - unplasticised poly (vinyl chloride) (PVC-U), polypropylene (PP) and polyethylene (PE).
- Standard - BS EN 13476-3.
- Dimensions - BS EN 13476-3, Section 7.
- Ends - Solid plain, Type A1, Type A2, Type B.
- Finish - Black, orange-brown, dusty grey.

2555A PLASTICS PIPING SYSTEMS TO BS EN 1451-1 - FITTINGS:

- Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure.
- Material - Polypropylene (PP).
- Standard - BS EN 1451-1 and BS EN 15012.
- Size range - 32mm to 315mm.
- Dimensions - BS EN 1451-1 tables 5 - 8.
- Ends - Plain; elastomeric ring seal socket and spigot; or socket and spigot for solvent cement.
- Finish - Grey, black, or white.

2580A PVC-U PIPING SYSTEMS - PIPES:

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

2580B ABS PIPING SYSTEMS - PIPES:

- Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure.
- Material - Acrylonitrile-butadiene-styrene (ABS).
- Standard - ABS to BS EN 1455-1.
- Dimensions - Length - manufacturer's standard range. BS EN 1455-1 tables 1, 2, 3 and 4.
- Ends - Plain; elastomeric ring seal socket and spigot; or socket and spigot for solvent cement.
- Finish - Grey, black, or white.

2580C PE PIPING SYSTEMS - PIPES:

- Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure.
- Material - Polyethylene (PE).
- Standard - PE to BS EN 1519-1.
- Dimensions - Length - manufacturer's standard range. BS EN 1519-1 tables 1, 2, 3 and 4.
- Ends - Plain; elastomeric ring seal socket and spigot; or socket and spigot for solvent cement.
- Finish - Grey, black, or white.

2580D SAN AND PVC PIPING SYSTEMS - PIPES:

- Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure.
- Material - Styrene copolymer blends (SAN + PVC).
- Standard - SAN + PVC to BS EN 1565-1.
- Dimensions - Length - manufacturer's standard range. BS EN 1565-1 tables 1, 2, 3 and 4.
- Ends - Plain; elastomeric ring seal socket and spigot; or socket and spigot for solvent cement.
- Finish - Grey, black, or white.

2580E PVC-C PIPING SYSTEMS TO BS EN 1566-1 - PIPES:

- Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure.
- Material - Chlorinated polyvinyl chloride (PVC-C).
- Standard - PVC-C to BS EN 1566-1.
- Dimensions - Length - manufacturer's standard range. BS EN 1566-1 tables 1, 2, 3 and 4.
- Ends - Plain; elastomeric ring seal socket and spigot; or socket and spigot for solvent cement.
- Finish - Grey, black, or white.

2585A PVC-U PIPING SYSTEMS TO BS EN 1329-1 - FITTINGS:

- Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure.
- Material - Unplasticised polyvinyl chloride (PVC-U).
- Standard - PVC-U to BS EN 1329-1
- Size range - 32mm to 315mm.
- Dimensions - BS EN 1329-1 tables 5-14.
- Ends - Plain; elastomeric ring seal socket and spigot; or socket and spigot for solvent cement.
- Finish - Grey, black, or white.

2585B ABS PIPING SYSTEMS TO BS EN 1455-1 - FITTINGS:

- Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure.
- Material - Acrylonitrile-butadiene-styrene (ABS).
- Standard - ABS to BS EN 1455-1.
- Size range - 32mm to 315mm.
- Dimensions - BS EN 1455-1 tables 5-12.
- Ends - Plain; elastomeric ring seal socket and spigot; or socket and spigot for solvent cement.
- Finish - Grey, black, or white.

2585C PE PIPING SYSTEMS TO BS EN 1519-1 - FITTINGS:

- Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure.
- Material - Polyethylene (PE).
- Standard - PE to BS EN 1519-1.
- Size range - 32mm to 315mm.
- Dimensions - BS EN 1519-1 tables 5-9.
- Ends - Plain; elastomeric ring seal socket and spigot; or socket and spigot for solvent cement.
- Finish - Grey, black, or white.

2585D SAN AND PVC PIPING SYSTEMS TO BS EN 1565-1 - FITTINGS:

- Plastics piping systems for soil and waste discharge (low and high temperature) within the building

structure.

- Material - Styrene copolymer blends (SAN + PVC).
- Standard - SAN + PVC to BS EN 1565-1.
- Size range - 32mm to 315mm.
- Dimensions - BS EN 1565-1 tables 5-11.
- Ends - Plain; elastomeric ring seal socket and spigot; or socket and spigot for solvent cement.
- Finish - Grey, black, or white.

2585E PVC-C PIPING SYSTEMS TO BS EN 1566-1 - FITTINGS:

- Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure.
- Material - Chlorinated polyvinyl chloride (PVC-C).
- Standard - PVC-C to BS EN 1566-1.
- Size range - 32mm to 315mm.
- Dimensions - BS EN 1566-1 tables 5-12.
- Ends - Plain; elastomeric ring seal socket and spigot; or socket and spigot for solvent cement.
- Finish - Grey, black, or white.

2595A PLASTICS PIPING SYSTEMS TO BS EN ISO 15874 - PIPES:

- Plastics piping systems for hot and cold water installations, including heating, within buildings.
- Material - Polypropylene (PP).
- Standard - BS EN ISO 15874-5.
- Dimensions - Length - manufacturer's standard range. BS EN ISO 15874-2, tables 4 to 8.
- Ends - Plain, socket for fusion fittings, socket for electrofusion fittings, for mechanical fittings or fittings with incorporated inserts.
- Finish - Grey, black or white.

2596A PLASTICS PIPING SYSTEMS TO BS EN ISO 15874 - FITTINGS:

- Plastics piping systems for hot and cold water systems, including heating, within buildings.
- Standard - BS EN ISO 15874-5.
- Size range - 16mm to 160mm.
- Dimensions - BS EN ISO 15874-3 - tables 3 to 5.
- Ends - Plain, socket fusion fittings, electrofusion fittings, mechanical fittings, or fittings with incorporated fittings.

2597A PLASTICS PIPING SYSTEMS TO BS EN ISO 15875 - PIPES:

- Plastics piping systems for hot and cold water installations, including heating, within buildings.
- Material - Crosslinked polyethylene (PE-X).
- Standard - BS EN ISO 15875-5.
- Dimensions - Length - manufacturer's standard range. BS EN ISO 15875-2 - tables 2 to 6.
- Ends - Plain, suitable for electrofusion fittings, mechanical fittings, or fittings with incorporated inserts.
- Finish - Natural, black or coloured.

2598A PLASTICS PIPING SYSTEMS TO BS EN ISO 15875 - FITTINGS:

- Plastics piping systems for hot and cold water systems, including heating, within buildings.
- Material - Crosslinked polyethylene (PE-X).
- Standard - BS EN ISO 15875-5.
- Size range - 16mm to 160mm.
- Dimensions - BS EN ISO 15875-3 - table 3 and clause 6.3.
- Ends - Plain, suitable for electrofusion fittings, mechanical fittings, or fittings with incorporated inserts.

- Finish - Natural, black or coloured.

2599A PLASTICS PIPING SYSTEMS TO BS EN ISO 15876 - PIPES:

- Plastics piping systems for hot and cold water systems, including heating, within buildings.
- Material - polybutylene (PB).
- Standard - BS EN ISO 15876-5.
- Dimensions - Length - manufacturer's standard range. BS EN ISO 15876-2 - tables 2 to 6.
- Ends - Plain, sockets for fusion fittings, suitable for electrofusion fittings, mechanical fittings, or fittings with incorporated inserts.
- Finish - Natural or coloured.

2600A PLASTICS PIPING SYSTEMS TO BS EN ISO 15876 - FITTINGS:

- Plastics piping systems for hot and cold water systems, including heating, within buildings.
- Material - polybutylene (PB).
- Standard - BS EN ISO 15876-5.
- Size range - 16mm to 160mm.
- Dimensions - BS EN ISO 15876-3 - tables 3 to 5, and clause 6.3.
- Ends - Plain, sockets for fusion fittings, suitable for electrofusion fittings, mechanical fittings, or fittings with incorporated inserts.
- Finish - Natural or coloured.

2601A PLASTICS PIPING SYSTEMS TO BS EN ISO 15877 - PIPES:

- Plastics piping systems for hot and cold water installations within buildings.
- Material - chlorinated poly(vinyl chloride) (PVC-C).
- Standard - BS EN ISO 15877-5.
- Dimensions - Length and wall thickness - manufacturer's standard range. BS EN ISO 15877-2 - tables 3 and 4, and sections 6.2 and 6.3.
- Ends - Plain, single socket.
- Finish - Natural, black, grey, white or coloured.

2602A PLASTICS PIPING SYSTEMS TO BS EN ISO 15877 - FITTINGS:

- Plastics piping systems for hot and cold water installations within buildings.
- Material - chlorinated poly(vinyl chloride) (PVC-C).
- Standard - BS EN ISO 15877-5.
- Size range - 12mm to 160mm.
- Dimensions - BS EN ISO 15877-3 - tables 3 to 13.
- Ends - Plain, cylindrical sockets, conical sockets.
- Finish - Natural, black, grey, white or coloured.

2603A PLASTICS PIPING SYSTEMS TO BS EN ISO 22391 - PIPES:

- Plastics piping systems for hot and cold water installations within buildings.
- Material - Polyethylene of raised temperature resistance (PE-RT).
- Standard - BS EN ISO 22391-5.
- Dimensions - Length and wall thickness - manufacturer's standard range. BS EN ISO 15877-2 - tables 3, 4, 5 and 6 and section 6.2.
- Ends - Plain, single socket.
- Finish - Natural, black, grey, white or coloured.

2604A PLASTICS PIPING SYSTEMS TO BS EN ISO 22391 - FITTINGS:

- Plastics piping systems for hot and cold water installations within buildings.
- Material - Polyethylene of raised temperature resistance (PE-RT).
- Standard - BS EN ISO 22391-5.
- Size range - 16mm to 110mm.
- Dimensions - BS EN ISO 22391-3 - tables 4 to 6.
- Ends - Plain, cylindrical sockets, conical sockets.
- Finish - Natural, black, grey, white or coloured.

2665A POLYETHYLENE TO WIS 4-32-17:

- Material - Polyethylene.
- Standard - WIS 4-32-17.
- Dimensions - WIS 4-32-17 table 6.
- Lengths - straight pipe 6m, 12m or 18m; coils, 25m, 50m, 100m or 150m.
- Ends - Plain.
- Finish - Blue, black, black with brown stripes or black with green stripes.

2668A POLYETHYLENE TO BS EN 12201:

- Plastic piping system for water under pressure up to 20°C and 25bar.
- Material - Polyethylene.
- Standard - BS EN 12201-1, BS EN 12201-2, BS EN 12201-5.
- Dimensions - BS EN 12201-2, table 2.
- Marking - BS EN 12201-2, table 4.
- Lengths - No requirements, to be agreed between purchaser and manufacturer.
- Ends - Plain or sockets.
- Finish - Blue or black with blue stripes.

2668B POLYETHYLENE TO BS EN 12201:

- Plastic piping system for drainage/sewerage under pressure.
- Material - Polyethylene.
- Standard - BS EN 12201-1, BS EN 12201-2 and BS EN 12201-5.
- Dimensions - BS EN 12201-2, table 2.
- Marking - BS EN 12201-2, table 6.
- Lengths - No requirements, to be agreed between purchaser and manufacturer.
- Ends - Plain or sockets.
- Finish - Black or black with brown stripes.

2705A PLASTICS PIPES TO BS 7291-2 AND BS 7291-3:

- Material - Polybutylene (PB) BS 7291-2; or crosslinked polyethylene (PE-X) BS 7291-3.
- Standard - BS 7291. Classification H unless otherwise indicated.
- Dimensions - BS 7291-2 (PB) or BS 7291-3 (PE-X); BS ISO 11922-1, BS ISO 4065 or to BS ISO 11414.
- Ends - Plain.
- Finish - Natural.

2706A PLASTICS FITTINGS TO BS 7291-2 AND BS 7291-3:

- Material - Polybutylene (PB) BS 7291-2 or crosslinked polyethylene (PE-X) BS 7291-3.
- Standard - BS 7291. Classification H unless otherwise indicated.
- Size range - BS 7291-2 and BS 7291-3; 10mm - 35mm (Cu); BS ISO 11922-1, BS ISO 4065 or BS ISO 11414.
- Dimensions - BS 7291-2 (PB) or BS 7291-3 (PE-X)
- Ends - Plain; flanged or screwed to suit method of jointing.

- Finish - Natural.

2707A PUSH-FIT FITTINGS FOR PE-X AND PB TUBING:

- Material - Dezincifiable resistant copper, copper alloy and brass.
- Standard - Manufacturer's standard.
- Size range - 10mm to 28mm.
- Dimensions - to suit PE-x and PB tube.
- Ends - push-fit with EPDM O Ring..
- Finish - Natural.

2708A POLYBUTYLENE (PB) PIPE AND FITTINGS:

- Material - Polybutylene (PB).
- Dimensions - 16mm to 25mm o.d. as flexible pipe-in-sleeve coils; and 16mm to 110mm o.d. in straight lengths.
- Ends - Plain.
- Finish - Natural.

2740A GLASS PIPELINES:

- Material - Borosilicate glass 3.3.
- Standard - BS EN 1595.
- Dimensions - BS EN 12585.
- Ends - Spherical buttress or flat buttress.
- Finish - Natural self finish.

2750A GLASS PIPELINE FITTINGS:

- Material - Borosilicate glass 3.3.
- Standard - BS EN 1595.
- Size range - 80mm to 1400mm.
- Dimensions - BS EN 12585.
- Ends - Spherical buttress or flat buttress.
- Finish - Natural self finish.

2780 CLAYWARE TO BS 1196:

- Material - Clayware. Standard - BS 1196.
- Dimensions - BS 1196, table 1.
- Ends - Plain.
- Finish - Uncoated.

2880 PRE-INSULATED BONDED PIPE SYSTEMS FOR DISTRICT HEATING - STEEL

- Supply pre-insulated bonded pipe systems for underground networks, designed, installed and tested in accordance with BS EN 13941
- For twin pipe systems comply with BS EN 15698-1
- To comprise, straight lengths of prefabricated thermally insulated pipe-in-pipe assemblies comprising mild steel service pipes, polyurethane thermal insulation and high density polyethylene outer casing to BS EN 253.
- Provide fitting and valve assemblies in accordance with BS EN 448, BS EN 488 and BS EN 15698-2. Joint assemblies to be in accordance with BS EN 489
- Installation to be in accordance with the manufacturer's instructions.

2882 PRE-INSULATED FLEXIBLE PIPE SYSTEMS FOR DISTRICT HEATING - METAL AND PLASTIC SERVICE PIPES:

- Supply pre-insulated flexible pipe systems for underground networks, installed and tested in accordance with relevant parts of BS EN 15632.
- Assembly to comprise prefabricated thermally insulated pipe-in-pipe assemblies comprising service pipes, thermal insulation and high density polyethylene outer casing.
- The detail design and installation of the system shall be in accordance with the manufacturer's recommendations.
- This shall include all trenching details, wall entry details and all provisions for thermal expansion.
- Manufacturer's proprietary fittings shall be used for tee pieces, elbows, branches, wall entry kits etc. Whenever possible these should be pre-fabricated/pre-insulated fittings to minimize on-site work.
- Installations to be in accordance with the manufacturer's instructions.

2890A PLASTIC PIPES WITH SECONDARY CONTAINMENT AND FITTINGS FOR UNDERGROUND FUEL OIL SYSTEMS:

- Material dimensions, fittings and finish all as manufacturer's standard.
- Ensure pipes are covered by OFCERT license for the application.

3000 PRODUCTS/MATERIALS - JOINTING AND ACCESSORIES

3010A CIRCULAR FLANGES FOR PIPES, PN DESIGNATED - WELDED FLANGE:

- Material - BS EN 1092-1.
- Flange type - Weld neck flange or hubbed slip-on flange for welding.
- Flange facings - Raised face - type B.
- Bolting - In accordance with BS EN 1092-1.

3010B CIRCULAR FLANGES FOR PIPES, PN DESIGNATED - THREADED FLANGE:

- Material to BS EN 1092-1.
- Facings - Raised face type B.
- Bolting - in accordance with BS EN 1092-1.
- Threaded flanges - BS 21 and BS EN 10226-1 parallel thread.

3010C CIRCULAR FLANGES FOR PIPES, PN DESIGNATED - CAST IRON FLANGE:

- Material - BS EN 1092-2 - Ductile cast iron.
- Bolting - In accordance with BS EN 1092-2.

3020A JOINTING RINGS - NON-METALLIC FLAT GASKETS:

- Non-metallic flat gaskets for flanges to BS EN 1092-4.
- Standard - BS EN 1514-1
- Gasket type - Full face for type B.

3020B JOINTING RINGS - METALLIC GASKETS:

- Corrugated, flat or grooved metallic and filled metallic gaskets for flanges to BS EN 1092-4.
- Standard - BS EN 1514-4
- Gasket type - Corrugated metal.
- Gasket design - Self centring for type B.

3020C JOINTING RINGS FOR CAST IRON:

- Non-metallic flat gaskets for flanges to BS EN 1092-2
- Standard - BS EN 1514-1.
- Gasket type - Suitable for flanges to BS EN 545, BS EN 598 and BS EN 969.

3030# SCREWED JOINTS TO BS 21 AND BS EN 10226-1:

- Use hemp and jointing compound to BS 6956-5 or BS EN 751-2.
- Use PTFE tape to BS 7786.
- Use hemp and jointing compound to BS 6956-5 or BS EN 751-2, prior to chemical treatment and use PTFE tape to BS 7786 after chemical treatment.
- Use silicone sealant.

3030A SCREWED JOINTS TO BS 21 AND BS EN 10226-1:

- Use PTFE tape to BS 7786 or use hemp and jointing compound to BS 6956-5, or BS EN 751-2.

3030B SCREWED JOINTS TO BS 21 AND BS EN 10226-1 WITH PTFE TAPE:

- Use PTFE tape to BS 7786.

3030C SCREWED JOINTS TO BS 21 AND BS EN 10226-1 WITH CHEMICAL CLEANING:

- Use hemp and jointing compound to BS 6956-5 or BS EN 751-2, prior to chemical treatment and use PTFE tape to BS 7786 after chemical treatment.

3050A WELDED JOINTS, WELDING RODS FOR STEEL PIPES:

- Gas welding, BS EN 12536; electric arc welding BS 2971.

3050B WELDED JOINTS, WELDING RODS FOR COPPER PIPES:

- Bronze welding BS EN 12536.

3070A CAPILLARY JOINTS FOR COPPER:

- Use materials as follows
- Solder - BS EN ISO 9453.
- Flux - Copper pipe - BS EN 29454-1.

3070B CAPILLARY JOINTS FOR POTABLE WATER:

- Use materials as follows
- Solder - Use lead-free fittings in accordance with BS EN 1254-1, on potable water systems.
- Flux - Copper pipe - BS EN 29454-1.

3080 JOINTING EQUIPMENT FOR MULTI-LAYER PIPE SYSTEM:

- Provide the Manufacturer's recommended compression tool for making connections in the multi-layer pipe system.

3095A JOINTING MATERIALS FOR PLASTICS PIPES TO BS 7291 - COMPRESSION:

- Plastics fittings to BS 7291.
- Method of jointing to BS 5955-8
- Mechanical joints - Compression.

3095B JOINTING MATERIALS FOR PLASTICS PIPES TO BS 7291 - PUSHFIT:

- Plastics fittings to BS 7291.
 - Method of jointing to BS 5955-8
 - Mechanical joints - Pushfit.

3095C JOINTING MATERIALS FOR PLASTICS PIPES TO BS 7291 - SOLVENT CEMENT:

- Plastics fittings to BS 7291.
 - Method of jointing to BS 5955-8 - Solvent cement joints.

3095D JOINTING MATERIALS FOR PLASTICS PIPES TO BS 7291 - THERMAL FUSION:

- Plastics fittings to BS 7291.
 - Method of jointing to BS 5955-8 - Thermal fusion joints.

3095E JOINTING MATERIALS FOR PLASTICS PIPES - COMPRESSION FITTINGS:

- Compression with fittings to BS EN 1254-3

3102 JOINTING EQUIPMENT FOR PUSH-FIT SYSTEM:

- Provide manufacturer's recommended tool for releasing push-fit fittings in push-fit jointing systems for copper and plastic pipe.

3105A STAINLESS STEEL COUPLINGS FOR CAST IRON PIPES TO BS EN 877:

- Material - Stainless steel, with zinc coated bolts and bolt holder.
- Gasket - EPDM.

3105B RED DUCTILE IRON COUPLINGS FOR CAST IRON PIPES TO BS EN 877:

- Material - Ductile iron.
- Finish - Red.
- Gasket - EPDM.

3105C GREY DUCTILE IRON COUPLINGS FOR CAST IRON PIPES TO BS EN 877:

- Material - Ductile iron.
- Finish - Grey.
- Gasket - EPDM.

3105D BLACK DUCTILE IRON COUPLINGS FOR CAST IRON PIPES TO BS EN 877:

- Material - Ductile iron.
- Finish - Black.
- Gasket - EPDM.

3110A SPIGOT/SOCKET CAULKED JOINTS:

- Use for spun cast iron pipe.
- Yarn - Tarred hemp or spun yarn; or sterile inorganic yarn.
- Lead - Virgin blue pig lead.

3125 JOINTING EQUIPMENT FOR PRESS FITTING SYSTEM:

- Provide the manufacturer's recommended press fitting tool for use with press fitting system.

3140A MECHANICAL JOINTS, GROOVED STEEL PIPES:

- Material - ductile cast iron to ASTM A536, grade 65-45-12.
- Joint type
 - For applications where vibration attenuation and stress relief is required use flexible installation - ready 2 piece housing type.
 - Use rigid installation ready 2 piece housing type where stress relief is not required.
 - For pipe sizes 350mm and above use 2 segment, wedge shaped grooved with lead-in chamfer on housing key.
- Size range - 20mm to 600mm.
- Gaskets
 - Grade 'E' EPDM for water services to +110°C (for sizes 350mm, wide width FlushSeal gasket)
 - Grade 'EHP' EPDM for water services to +120°C (for use in installation-ready couplings).
- Finish - Painted to manufacturer's standard.

3150A MECHANICAL JOINTS, PLAIN END STEEL PIPES:

- Material - Malleable cast iron to BS EN 1562; or ductile cast iron to BS EN 1564.
- Size range - 40mm to 400mm.
- Gaskets - Grade 'E' EPDM.
- Finish - Manufacturer's standard.

3151A MECHANICAL JOINTS, GROOVED COPPER PIPES:

- Material - ductile cast iron to ASTM A536, grade 65-45-12.
- Joint - standard, rigid. Size range - 54mm to 159mm.
- Gaskets
 - Grade 'E' EPDM.
 - Grade 'EW' EPDM WRAS approved for potable water systems.
- Finish - painted to manufacturer's standard.

3152A MECHANICAL JOINTS, GROOVED STAINLESS STEEL PIPES:

- Material - ductile cast iron to ASTM A536, grade 65-45-12 carbon or stainless steel type 316 conforming to ASTM A531, A743 and A744, grade CF8M
- Joint type
 - For applications where vibration attenuation and stress relief is required use flexible 2 piece housing type.
 - Use rigid 2 piece housing type where stress relief is not required .
 - For pipe sizes 350mm and above use 2 segment, wedge shaped grooved with lead-in chamfer on housing key.
- Size range
 - 20mm to 300mm, rigid: housing shall engage the bottom of the groove.
 - 350mm and larger: 2 segment, wedge shaped grooved with lead-in chamfer on housing key.
- Gaskets

- Grade 'E' EPDM.
- Grade 'EW' EPDM WRAS approved for potable water systems.
- Finish - painted to manufacturer's standard or self colour.

3170A FLEXIBLE COUPLINGS, SLEEVE TYPE:

- Joint - Bolted, sleeve type, with wedge type elastomeric gaskets.
- Type - Non-end load capable.
- Dimensions - Manufacturer's standard.
- Material - Ductile cast iron to BS EN 1564, or to BS EN 1563.
- Finish - Manufacturer's standard.
- Gaskets - In accordance with BS EN 681-1, BS EN 681-2 or BS EN 682.

3180A FLEXIBLE FLANGE ADAPTERS, SLEEVE TYPE:

- Joint - Bolted, sleeve type, with wedge type elastomeric gaskets, flanged on end.
- Type - Non-end load capable.
- Dimensions - Manufacturer's standard.
- Material - Ductile cast iron to BS EN 1564.
- Flange - To connect to BS EN 1092-2, PN10 flange.
- Finish - Manufacturer's standard.
- Gaskets - In accordance with BS EN 681-1, BS EN 681-2 or BS EN 682.

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.

3190B WALL, FLOOR AND CEILING PLASTIC MASKING PLATES:

- Material - Plastic.
- Fixing - Clipped with plastic lug.

3200A PIPE RINGS AND CLIPS, STEEL PIPEWORK:

- Use suitable pipe, hangers, slider and roller type supports, taking into account the pipe load, material and pipe/insulation surface temperature.

4000 WORKMANSHIP, GENERAL

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	50
	Soffit Floor Finish	150
Insulated Pipeline	Adjacent service runs	25
Uninsulated pipeline	Adjacent service runs	50
Adjacent pipelines	Both uninsulated	150
	One uninsulated	75
	Both insulated	25

4030 GRADIENTS:

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

4040# AIR VENT REQUIREMENTS:

- Provide a means of venting the pipe system at all high points.
- Air Vent Assembly
- An air bottle
 - 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.
- 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.

4040A AIR BOTTLES:

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

4040B AUTOMATIC AIR VENTS:

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

4050 DRAIN REQUIREMENTS:

- Grade pipework to allow system to be drained. Provide a means of draining the system at all low points.

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.
- For water systems, using a grooved pipework system, the proprietary flexible couplings may be used to accommodate thermal growth, contraction and for the elimination of expansion loops. The type, quantity required, locations and installation/support details of flexible couplings proposed shall be in accordance with

the manufacturer's written recommendations and show on the installation drawings. Where loops are required, use flexible couplings on the loop.

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 EN 10253-1 and BS EN 10253-2.

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°. Join by bronze welding on-site. Apply reinforcement by plates, collars or shoes.

4110 PIPES THROUGH NON FIRE RATED 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. Unless detailed elsewhere, carry insulation including vapour barrier where necessary

through pipesleeves.

4120A PIPE SLEEVES IN NON FIRE RATED WALLS AND FLOORS - INSULATION NOT CARRIED THROUGH:

- Where pipe insulation is not carried through pipe sleeve, cut sleeves from material same as pipe one or two sizes larger than pipe to allow clearance. Do not use sleeves as pipe supports.
- Install sleeves flush with building finish. In areas where floors are washed down install with a 100mm protrusion above floor finish and cap off end of sleeve.

4120B PIPE SLEEVES IN NON FIRE RATED WALLS AND FLOORS WITH INSULATION CARRIED THROUGH:

- Where pipe insulation is carried through pipe sleeve, cut sleeves from material same as pipe one or two sizes larger than pipe and insulation to allow clearance. Do not use sleeves as pipe supports.
- Install sleeves flush with building finish. In areas where floors are washed down to install with a 100mm protrusion above floor finish and cap off end of sleeve.

4125 PIPE SLEEVES THROUGH FIRE BARRIERS:

- Where pipes pass through a fire rated wall or floor use one of the following methods
 - Proprietary sleeves
 - Install proprietary fire sleeves, tested to BS 476-20 and the principles of BS 476-22, to meet the fire rating of the partition. In each case the thermal insulation and vapour sealing properties (where required) shall be maintained through the wall, floor or partition. The sleeves shall be
 - Mineral wool insulated fire sleeves comprising a combination of mineral wool and graphite intumescent or
 - A one piece stainless steel sleeve with an intumescent lining the full length and 3 bands of acoustic foam adhered to the bore of the sleeve. Where insulation is carried through the wall or partition and vapour seal is required, oversized mineral wool shall be fitted to the pipework with an oversized proprietary sleeve fitted over the mineral wool.
 - Ablative coated batt
 - All components and sealants / glue used must be tested to BS 476 and be provided from a single manufacturer.
 - For plastic pipes, install a proprietary ablative coated batt in combination with a proprietary fire sleeve where the pipes pass through the batt. Ablative batt minimum density to be 180 kg/m³ and have a test certificate to match the fire resistance of the wall or partition and should have LPCB third party approval.
 - For metal pipes install proprietary fire rated insulation for 500mm either side of the batt. Standard - BS 3958-4
- Proprietary systems must be installed strictly in accordance with the manufacturers' recommendations.

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:

- 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:

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

4205 PIPE SUPPORTS:

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

4207 PIPE SUPPORTS:

- Provide proprietary suspension systems comprising channel sections with return sections with return lips and compatible fixing accessories made of material to BS EN 10162, BS EN 10210 and/or slotted angles to BS 4345.
- Ensure support components for galvanised pipes have the same finishing method as the pipe carried out after manufacture.
- Ensure all steel components such as studding, bolts and steel screws, bolts, nuts and washers are either cadmium plated and passivated or zinc electroplated to BS 7371 after manufacture. Do not use metal fixing components likely to deteriorate and/or cause damage through electrolytic action.

4210 SUPPORT SYSTEM - WIRE ROPE:

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

4220 SUPPORT SPACING:

- Space supports as tables.

Pipe Size (mm)	Maximum Support Spacing (m)		
Nominal	Steel Pipe (Insulated)	Copper or Light Gauge Stainless Steel Pipe	Iron Pipe

			(Insulated)			
	horizontal	vertical	horizontal	vertical	horizontal	vertical
Up to 15	1.8	2.4	1.2	1.8	-	-
20	2.4	3.0	1.2	1.8	-	-
25	2.4	3.0	1.5	2.4	-	-
32	2.4	3.0	1.8	3.0	-	-
40	2.4	3.7	1.8	3.0	-	-
50	2.4	3.7	1.8	3.0	1.8	1.8
65	3.0	4.6	2.4	3.7	-	-
80	3.0	4.6	2.4	3.7	2.7	2.7
100	3.0	4.6	2.4	3.7	2.7	2.7
125	3.7	5.5	3.0	3.7	-	-
150	4.5	5.5	3.7	3.7	3.7	3.7
200	6.0	8.5	-	-	3.7	3.7
250	6.5	9.0	-	-	4.5	5.4
300	7.0	10.0	-	-	8.0	10.0
350	10.0	12.0	-	-	-	-
400	10.5	12.6	-	-	-	-
450	11.0	13.2	-	-	-	-
500	12.0	14.4	-	-	-	-
600	14.0	16.8	-	-	-	-

Pipe OD	Maximum Support Spacing (m)	
	PVC or ABS Pipe Contents up to 20°C	
	Horizontal	Vertical
15	0.8	1.2
20	0.8	1.2
25	0.9	1.3
32	1.0	1.5
40	1.1	1.6
50	1.3	1.9
80	1.6	2.4
100	1.9	2.8
150	2.1	3.0
200	2.4	3.6
250	2.6	3.9
300	2.8	4.2

- For grooved steel and copper pipe, no individual pipe length should be left unsupported.
- Vertical support spacing
 - Check total self-weight and pressure loading against manufacturer's recommendations when using mechanical joints or end load capable flexible couplings. Ensure adequate pipe support when using non-end load capable flexible couplings.
 - Space vertical support intervals for plastics pipe at not greater than twice horizontal intervals tabulated.
 - Space external vertical PE gas pipes in accordance with the current edition of IGEM/UP/2
- Space horizontal and vertical pliable corrugated stainless steel gas pipes in accordance with the current edition of IGEM/UP/2.
- Where multiple pipe runs of differing bores are supported from a common point, use support spacing of pipe requiring closest spacing.
- Spacings given for PVC-U pipe to BS EN ISO 1452

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.

5000 WORKMANSHIP, STEEL PIPEWORK

5010A WELDING GENERAL, CLASS 1:

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

5010B WELDING GENERAL, CLASS 2:

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

5020 WELDED JOINTS, STEEL PIPES:

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

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, GROOVED STEEL AND STAINLESS STEEL PIPES:

- Preparation
 - Ensure installers receive training from manufacturer on correct installation technique, and correct and safe use of pipe grooving tool by a factory trained manufacturer's representative. The grooving tool must be manufactured by the grooved coupling manufacturer. Ensure that cut ends are square, free of bumps, dents and score marks and that pipe outside diameter is within mechanical joint manufacturer's tolerances. Form groove in accordance with manufacturer's recommendations and to manufacturer's groove diameter tolerances. Ensure that the manufacturer supplies a grooved measuring tape to be able to check the groove is in tolerance. Manufacturer must provide certification to anyone grooving onsite or in a fabrication shop to show the correct training has been provided. Assemble joint in accordance with manufacturer's instructions.
- Making and Sealing
 - Ensure gasket material is suitable for service. For standard couplings thoroughly lubricate gasket, externally and internally, using manufacturer's recommended lubricant. Stretch gasket over one pipe end and bring pipe ends together. Slide gasket into central position over both pipe ends. Position joint half housings over gasket and insert bolts and nuts. Joints should not require any torque to show visual bolt pad to pad connection, if alternative joints are to be proposed that require torque this must be notified at the time of tender for approval. Tighten bolts to manufacturer's instructions. Check alignment of joint and pipework.
- Earth continuity
 - Full earth continuity shall be achieved by both rigid and flexible couplings. If the manufacturer's coupling selected cannot achieve this, install proprietary earth continuity clips to ensure compliance with IET regulations at each joint.
- Installation-ready couplings
 - Do not dismantle the coupling. Lubricate inner sealing lips of gasket using manufacturer's recommended lubricant. Assemble the joint by inserting the grooved pipe ends into each opening of the coupling until the ends make contact with the gasket center leg. Tighten bolts to manufacturer's instructions. Check alignment of joint and pipework.

5070A ANCHORS, STEEL PIPES, U-BOLTS:

- Provide anchors constructed using mild steel over-straps or heavy U-bolts. Secure to channel section,

adequately attached to or grouted into building structure; weld longitudinal edges of strap to pipe.

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.

5080 PRESS FITTING JOINTS:

- Make press fitting joints in accordance with manufacturer's recommendations. Ensure all fittings are electrically continuous when the jointing process is complete.

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.

5100 COMPRESSION JOINTS, STAINLESS STEEL PIPES:

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

5110 CAPILLARY JOINTS, STAINLESS STEEL PIPES:

- Preparation
 - Ensure that plain ends are cut square. Reamer out bore at plain ends to full bore size and clean plain ends.
- Making and sealing
 - Use a suitable phosphoric acid based flux to BS 5245. Make joint in accordance with manufacturer's instructions. Clean off traces of flux when joint is completed. Use end fed fittings only where indicated, using silver brazing alloy and flux to manufacturer's recommendations.

5120 BRAZED JOINTS, STAINLESS STEEL JOINTS:

- Preparation - Prepare for brazing in accordance with BS EN 14324.
- Making and Sealing - Use flame heat and make in accordance with BS EN 14324. Use nickel bearing zinc free filler metals.

6000 WORKMANSHIP, COPPER PIPEWORK

6010 WELDING GENERAL:

- Use skilled craftsman in possession of a current Certificate of Competence appropriate to type and class of work, issued by an approved authority. Mark each weld to identify operative. Submit specimen welds, representative of joints and conditions of site welding, for each craftsman, test non-destructively, approximately 10% of butt weld joints and 5% of all other joints.

6030 COMPRESSION JOINTS, COPPER PIPES, LIGHT GAUGE:

- Preparation for fittings to BS EN 1254-2.
 - Type 'A' fitting
 - Ensure that plain ends are cut square. Reamer out bore at plain ends to full bore size. Clean plain ends with fine steel wool or fine sandpaper.
 - Type 'B' fitting
 - Ensure that plain ends are cut square. Reamer out bore at plain ends to full bore size. Clean plain ends with fine steel wool or fine sandpaper. Then comply with manufacturer's instructions.
- Making and Sealing - As manufacturer's instructions.

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.

6050 BRAZED JOINTS, COPPER/COPPER ALLOY PIPES:

- Preparation - Prepare for brazing in accordance with BS EN 14324. Use manufactured fittings not subject to dezincification and suitable for application.
- Making and Sealing - Use flame heat and make in accordance with BS EN 14324. Use silver brazing filler alloy suitable for application.

6060A ANCHORS, COPPER PIPES, SADDLE CLAMPS:

- Provide anchors constructed by fitting two flanges to copper female adapters in pipe run at anchor point. Bolt together through an interposed mild steel channel section attached to or grouted into building structure.

6060B ANCHORS, COPPER PIPES, SADDLE CLAMPS:

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

6070 MECHANICAL JOINTS, GROOVED COPPER PIPES:

- Preparation
 - Ensure installers receive training from manufacturer on correct installation technique, and correct and safe use of pipe grooving tool by a factory trained manufacturer's representative. The grooving tool must be manufactured by the grooved coupling manufacturer. Ensure that cut ends are square, free of bumps, dents and score marks and that pipe outside diameter is within mechanical joint manufacturer's tolerances. Form groove in accordance with manufacturer's recommendations and to manufacturer's groove diameter tolerances. Ensure that the manufacturer supplies a grooved measuring tape to be able to check the groove is in tolerance. Manufacturer must provide certification to anyone grooving onsite or in a fabrication shop to show the correct training has been provided. Assemble joint in accordance with manufacturer's instructions.
- Making and Sealing
 - Ensure gasket material is suitable for service. For standard couplings thoroughly lubricate gasket, externally and internally, using manufacturer's recommended lubricant. Stretch gasket over one pipe end and bring pipe ends together. Slide gasket into central position over both pipe ends. Position joint half housings over gasket and insert bolts and nuts. Joints should not require any torque to show visual bolt pad to pad connection, if alternative joints are to be proposed that require torque this must be notified at the time of tender for approval. Tighten bolts to manufacturer's instructions. Check alignment of joint and pipework.

- Earth continuity
 - Full earth continuity shall be achieved by both rigid and flexible couplings. If the manufacturer's coupling selected cannot achieve this, install proprietary earth continuity clips to ensure compliance with IET regulations at each joint.

6080 PRESS FITTING SYSTEM:

- Carry out the installation of press fitting systems on copper pipe in accordance with manufacturer's recommendations. Ensure all fittings are electrically continuous when the jointing process is complete.

6090 PUSH-FITTING SYSTEM:

- Carry out the installation of push-fit fitting systems on copper pipe in accordance with manufacturer's recommendations. Ensure all fittings are electrically continuous when the jointing process is complete.

7000 WORKMANSHIP, CAST/DUCTILE IRON PIPEWORK

7010 FLANGED JOINTS, CAST IRON/DUCTILE IRON PIPES:

- Preparation - Ensure that flange mating faces are parallel, flange peripheries are flush with each other and bolt holes are correctly aligned.
- Making and Sealing - Coat both sides of joint ring with jointing compound to BS 6956-5 or BS EN 751-2. Insert joint ring between flange mating faces. Pull up joint with bolts, nuts and washers, ensuring that excess compound does not intrude into the pipe. Leave joint clean.

7020 CAULKED JOINTS, CAST IRON/SPUN CAST IRON PIPES:

- Preparation - Ensure plain ends are cut square.
- Making and sealing - Caulk socket with yarn, fill socket with molten lead, allow to cool and caulk home. Ensure bore of pipe is not obstructed.

7030 FLEXIBLE JOINTS, CAST IRON PIPES:

- Preparation - Ensure that cut ends are square. Form groove to manufacturer's detail. Assemble joint in accordance with manufacturer's instructions.
- Making and Sealing - Ensure joint ring is suitable for service. Thoroughly lubricate joint ring. Slip ring over pipe end and bring ends together. Slide ring into central position over both pipe ends. Position metal half housings over joint ring and insert bolts and nuts. Tighten bolts to manufacturer's instructions. Check alignment of joint and pipework.

8000 WORKMANSHIP, PLASTIC PIPEWORK

8005 THERMOPLASTIC PIPING SYSTEMS:

- Comply with recommendations in PD CEN/TR 13801 and general installation practice given in
 - BS EN 12056-1
 - BS EN 12056-2
 - BS EN 12056-3
 - BS EN 12056-4

- BS EN 12056-5

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.
- Carry out butt fusion jointing of pipes and fittings in accordance with the procedures given in BS ISO 21307.

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 over-straps, or clamps and with a polypropylene strip between pipe and mild steel section.

8050 JOINTING POLYBUTYLENE PIPES AND FITTINGS:

- Carry out installation of polybutylene pipes and fittings in accordance with manufacturer's instructions.

8060 COMPRESSION FITTINGS ON MULTI-LAYER PIPES:

- Carry out installation of compression fittings on multi-layer pipe in accordance with manufacturer's recommendations.

8070 WORKMANSHIP, PLASTIC PIPES WITH SECONDARY CONTAINMENT AND FITTINGS FOR UNDERGROUND FUEL OIL SYSTEMS:

- Install plastic pipes with secondary containment for underground fuel oil systems in accordance with OFTEC TI/134 and the manufacturer's recommendations.

9000 WORKMANSHIP

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.

9020B STEAM AND CONDENSATE MAINS:

- Steam mains
 - Whenever possible install with a fall not less than 1:100 in the direction of steam flow. In circumstances where this is not practical lower falls may be acceptable but no lower than 1:250.
 - Where a steam main has to rise in the direction of flow, install with a slope not less than 1:40.
- Condensate return lines
 - Install discharge lines from trap sets with a fall of 1:70.
 - Lift pumped condensate from receivers immediately after the pump and wherever possible size and install the return pipe with a gravity fall to the end of the line ensuring the fall is adequate to overcome frictional resistance of the pipe. Install a vacuum breaker at the top of the lift and install automatic air vents whenever the pipe has to drop/rise to avoid clashing with other services/building structure.
- Take steam connections to plant and equipment from the top of the steam main.
- Connect condensate discharge from trap sets into the top of the condensate main.
- Do not use trap sets to lift condensate on equipment with automatic control valves to avoid stall in the heat exchanger.
- Install strainers on their sides when they are part of a steam line to avoid water hammer.
- Use thermodynamic traps on pipelines which may be subject to freezing conditions.
- On steam mains, provide drain points comprising drain pocket and trap set trap sets discharging into condensate mains.
 - Drain pocket minimum dimensions
 - Pocket diameter - mains diameter for mains up to 100mm; 100mm diameter for main sizes 125mm - 200mm; for mains 250 diameter and above - 0.5 x mains diameter.
 - Depth - for mains up to 100mm diameter - 100mm deep; for main sizes 125mm - 200mm diameter - 150mm deep; for mains 250 diameter and above - depth to be equal to mains diameter.
 - Locate drain points at all low points on steam mains, at intervals not greater than 50m (but where possible at 30m intervals) and immediately before all automatic control valves on steam mains.

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.

9040# PROTECTION OF BURIED PIPES:

- 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.

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.

9050A PROTECTION OF PIPES IN SCREEDS, TAPE:

- Wrap pipework with two protective tapes prior to laying.

9050B PROTECTION OF PIPES IN SCREED, PVC SHEATH:

- Sheath pipework with PVC.

9060A INSTALLATION OF THERMALLY INSULATED UNDERGROUND STEEL PIPELINES:

- Install pre-insulated bonded steel pipelines to BS EN 253, BS EN 448, BS EN 488 and BS EN 489 in accordance with manufacturer's instructions and BS EN 13941 or BS EN 15698-1 for twin pipe systems.

9060C INSTALLATION OF THERMALLY INSULATED UNDERGROUND PIPELINES WITH PLASTIC SERVICE PIPES:

- Install pre-insulated bonded flexible pipe system to BS EN 15632-1 and BS EN 15632-2, with plastic service pipes, in accordance with manufacturer's instructions.
- Install pre-insulated non bonded flexible pipe system with plastic service pipes to BS EN 15632-1 and BS EN 15632-3 in accordance with manufacturer's instructions.

9060D INSTALLATION OF THERMALLY INSULATED UNDERGROUND FLEXIBLE METAL PIPE SYSTEM:

Install pre-insulated bonded flexible pipe system with metal service pipes to BS EN 15632-1 and BS EN 15632-4 in accordance with manufacturer's instructions.

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 GALVANIZED AFTER MANUFACTURE:

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

9130 STEELWORK GALVANIZED AFTER MANUFACTURE:

- Where indicated galvanize steelwork after manufacture.

BS APPENDIX

BS 1196:1989

Specification for clayware field drain pipes and junctions

BS 21:1985

Specification for pipe threads for tubes and fittings where pressure-tight joints are made on the threads (metric dimensions).

BS 2633:1987

Specification for class 1 arc welding of ferritic steel pipework for carrying fluids

BS 2971:1991

Specification for class II arc welding of carbon steel pipework for carrying fluids

BS 3958-4:1982

Thermal insulating materials. Part 4 Bonded preformed man-made mineral fibre pipe sections

BS 416-1:1990

Discharge and ventilating pipes and fittings, sand-cast or spun in cast iron. Part 1 Specification for spigot and socket systems

BS 4345:1968

Specification for slotted angles

BS 437:2008

Specification for cast iron drain pipes, fittings and their joints for socketed and socketless systems

BS 4514:2001

Unplasticized PVC soil and ventilating pipes of 82.4mm minimum mean outside diameter, and fittings and accessories of 82.4mm and of other sizes. Specification

BS 476-20:1987

Fire tests on building materials and structures. Part 20 Method for determination of the fire resistance of elements of construction (general principles)

BS 476-22:1987

Fire tests on building materials and structures. Part 22 Method for determination of the fire resistance of non loadbearing elements of construction

BS 5245:1975

Specification for phosphoric acid based flux soldered joints in stainless steel

BS 5955-8:2001

Plastics pipework (thermoplastics materials). Part 8 Specification for the installation of thermoplastic pipes and associated fittings for use in domestic hot and cold services and heating systems in buildings

BS 6956-5:1992

Joining materials and compounds. Part 5 Specification for joining compounds for use with water, low pressure saturated steam, 1st family gases (excluding coal gas) and 2nd family gases

BS 7291-2:2010

Thermoplastics pipes and associated fittings for hot and cold water for domestic purposes and heating installations in buildings. Part 2 specification for polybutylene (PB) pipes and associated fittings

BS 7291-3:2010

Thermoplastics pipes and associated fittings for hot and cold water for domestic purposes and heating installations in buildings. Part 3 specification for cross-linked polyethylene (PE-X) pipes and associated fittings

BS 7786:2006

Specification for unsintered PTFE tapes for general use.

BS EN 10162:2003

Cold rolled steel sections. Technical delivery conditions. Dimensional and cross-sectional tolerances

BS EN 10216-5:2013

Seamless steel tubes for pressure purposes. Technical delivery conditions. Part 5 Stainless steel tubes

BS EN 10217-1:2002

Welded steel tubes for pressure purposes. Technical delivery conditions. Part 1 Non-alloy steel tubes with specified room temperature properties

BS EN 10217-7:2014

Welded steel tubes for pressure purposes. Technical delivery conditions. Part 7 Stainless steel tubes

BS EN 10226-1:2004

Pipe threads where pressure tight joints are made on the threads. Taper external threads and parallel internal threads. Part 1 dimensions, tolerances and designation

BS EN 10242:1995

Threaded pipe fittings in malleable cast iron

BS EN 10253-1:1999

Butt-welding pipe fittings. Part 1 Wrought carbon steel for general use and without specific inspection requirements

BS EN 10253-2:2007

Butt-welding pipe fittings. Part 2 Non alloy and ferritic alloy steels with specific inspection requirements

BS EN 10255:2004

Non-alloy steel tubes suitable for welding or threading. Technical delivery conditions

BS EN 10305-1:2010

Steel tubes for precision applications. Technical delivery conditions. Part 1 Seamless cold drawn tubes

BS EN 10305-4:2003

Steel tubes for precision applications. Technical delivery conditions. Part 4 Seamless cold drawn tubes for hydraulic and pneumatic power systems

BS EN 10312:2002

Welded stainless steel tubes for the conveyance of aqueous liquids including water for human consumption. Technical delivery conditions

BS EN 1057:2006+A1:2010

Copper and copper alloys. Seamless, round copper tubes for water and gas in sanitary and heating applications

BS EN 1092-1:2007+A1:2013

Flanges and their joints. Circular flanges for pipes, valves, fittings and accessories, PN designated. Part 1 steel flanges

BS EN 1092-2:1997

Flanges and their joints. Circular flanges for pipes, valves, fittings and accessories, PN designated. Part 2 cast iron flanges

BS EN 1092-4:2002

Flanges and their joints. Circular flanges for pipes, valves, fittings and accessories, PN designated. Part 4 aluminium alloy flanges

BS EN 1124-1:1999

Pipes and fittings of longitudinally welded stainless steel pipes with spigot and socket for waste water systems. Part 1 Requirements, testing, quality control

BS EN 1124-3:2008

Pipes and fittings of longitudinally welded stainless steel pipes with spigot and socket for waste water

systems. Part 3 System X; dimensions

BS EN 12056-1:2000

Gravity drainage systems inside buildings. Part 1 General and performance requirements

BS EN 12056-2:2000

Gravity drainage systems inside buildings. Part 2 Sanitary pipework, layout and calculation

BS EN 12056-3:2000

Gravity drainage systems inside buildings. Part 3 Roof drainage, layout and calculation

BS EN 12056-4:2000

Gravity drainage systems inside buildings. Part 4 Wastewater lifting plants. Layout and calculation

BS EN 12056-5:2000

Gravity drainage systems inside buildings. Part 5 Installation and testing, instructions for operation, maintenance and use

BS EN 12201-1:2011

Plastic piping systems for water supply, and for drainage and sewerage under pressure. Polyethylene (PE). Part 1 General

BS EN 12201-2:2011+A1:2013

Plastic piping systems for water supply, and for drainage and sewerage under pressure. Polyethylene (PE). Part 2 Pipes

BS EN 12201-5:2011

Plastic piping systems for water supply, and for drainage and sewerage under pressure. Part 5 Polyethylene (PE). Fitness for purpose of the system

BS EN 12449:2012

Copper and copper alloys. Seamless, round tubes for general purposes

BS EN 12450:2012 :

Copper and copper alloys. Seamless, round copper capillary tubes

BS EN 12536:2000

Welding consumables. Rods for gas welding of non alloy and creep-resisting steels. Classification

BS EN 1254-1:1998

Copper and copper alloys. Plumbing fittings. Part 1 fittings with ends for capillary soldering or capillary

brazing to copper tubes.

BS EN 1254-2:1998

Copper and copper alloys. Plumbing fittings. Part 2 fittings with compression ends for use with copper tubes

BS EN 1254-3:1998

Copper and copper alloys. Plumbing fittings. Part 3 Fittings with compression ends for use with plastics pipes

BS EN 1254-5:1998

Copper and copper alloys. Plumbing fittings. Part 5 Fittings with short ends for capillary brazing to copper tubes

BS EN 12585:1999

Glass plant, pipeline and fittings. Pipeline and fittings DN 15 to 1000. Compatibility and interchangeability

BS EN 12666-1:2005+A1:2011

Plastics piping systems for non-pressure underground drainage and sewerage. Polyethylene (PE). Part 1 Specifications for pipes, fittings and the system

BS EN 1329-1:2014

Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure. Unplasticized poly(vinyl chloride) (PVC-U). Specifications for pipes, fittings and the system

BS EN 13476-3:2007+A1:2009

Plastics piping systems for non-pressure underground drainage and sewerage. Structured-wall piping systems of unplasticized poly(vinyl chloride) (PVC-U), polypropylene (PP) and polyethylene (PE). Part 3 Specifications for pipes and fittings with smooth internal and profiled external surface and the system, Type B

BS EN 13941:2009+A1:2010

Design and installation of pre-insulated bonded pipe systems for district heating

BS EN 14324:2004

Brazing. Guidance on the application of brazed joints

BS EN 1451-1:2000

Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure. Part 1 Polypropylene (PP). Specifications for pipes, fittings and the system

BS EN 1455-1:2000

Plastics piping systems for soil and waste (low and high temperature) within the building structure. Acrylonitrile-butadiene-styrene (ABS). Part 1 Specifications for pipes, fittings and the system

BS EN 14758-1:2012

Plastics piping systems for non-pressure underground drainage and sewerage. Polypropylene with mineral

modifiers (PP-MD). Part 1 Specifications for pipes, fittings and the system

BS EN 15012:2007

Plastics piping systems. Soil and waste discharge systems within the building structure. Performance characteristics for pipes, fittings and their joints

BS EN 15014:2007

Plastics piping systems. Buried and above ground systems for water and other fluids under pressure. Performance characteristics for pipes, fittings and their joints

BS EN 1514-1:1997

Flanges and their joints. Dimensions of gaskets for PN-designated flanges. Part 1 Non-metallic flat gaskets with or without inserts

BS EN 1514-4:1997

Flanges and their joints. Dimensions of gaskets for PN-designated flanges. Part 4 Corrugated, flat or grooved metallic and filled metallic gaskets for use with steel flanges

BS EN 15189:2006

Ductile iron pipes, fittings and accessories. External polyurethane coating for pipes. Requirements and test methods

BS EN 1519-1:2000

Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure. Polyethylene (PE). Part 1 Specifications for pipes, fittings and the system

BS EN 1555-1:2010

Plastics piping systems for the supply of gaseous fuels. Polyethylene (PE). Part 1 General

BS EN 1555-2:2010

Plastics piping systems for the supply of gaseous fuels. Polyethylene (PE). Part 2 Pipes.

BS EN 1555-3:2010+A1:2012

Plastics piping systems for the supply of gaseous fuels. Polyethylene (PE). Part 3 Fittings.

BS EN 1555-5:2010

Plastics piping systems for the supply of gaseous fuels. Polyethylene (PE). Part 5 Fitness for purpose of the system.

BS EN 1563:2011

Founding. Spheroidal graphite cast iron

BS EN 15632-1:2009+A1:2014

District heating pipes. Pre-insulated flexible pipe systems. Part 1 Classification, general requirements and test methods

BS EN 15632-2:2010+A1:2014

District heating pipes. Pre-insulated flexible pipe systems. Bonded plastic service pipes. Requirements and test methods

BS EN 15632-3:2010+A1:2014

District heating pipes. Pre-insulated flexible pipe systems non bonded system with plastic service pipes; requirements and test methods

BS EN 15632-4:2009

District heating pipes. Pre-insulated flexible pipe systems. Part 4 Bonded system with metal service pipes; requirements and test methods

BS EN 1564:2011

Founding. Austempered spheroidal graphite cast irons

BS EN 1565-1:2000

Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure. Styrene copolymer blends (SAN + PVC). Part 1 Specifications for pipes, fittings and the system

BS EN 1566-1:2000

Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure. Chlorinated poly(vinyl chloride) (PVC-C). Part 1 Specification for pipes, fittings and the system

BS EN 15698-1:2009

District heating pipes. Pre-insulated bonded twin pipe systems for directly buried hot water networks. Part 1 Twin pipe assembly of steel service pipe, polyurethane thermal insulation and outer casing of polyethylene

BS EN 1595:1997

Pressure equipment made from borosilicate glass 3.3. General rules for design, manufacture and testing

BS EN 253:2009+A2:2015

District heating pipes. Pre-insulated bonded pipe systems for directly buried hot water networks. Pipe assembly of steel service pipe, polyurethane thermal insulation and outer casing of polyethylene

BS EN 29454-1:1994

Soft soldering fluxes. Classification and requirements. Part 1 Classification, labelling and packaging

BS EN 448:2009

District heating pipes. Pre-insulated bonded pipe systems for directly buried hot water networks. Fitting assemblies of steel service pipes, polyurethane thermal insulation and outer casing of polyethylene

BS EN 488:2015

District heating pipes. Preinsulated bonded pipe systems for directly buried hot water networks. Steel valve assembly for steel service pipes, polyurethane thermal insulation and outer casing of polyethylene

BS EN 489:2009

District heating pipes. Pre-insulated bonded pipe systems for directly buried hot water networks. Joint assembly for steel service pipes, polyurethane thermal insulation and outer casing of polyethylene

BS EN 545:2010

Ductile iron pipes, fittings, accessories and their joints for water pipelines. Requirements and test methods

BS EN 598:2007+A1:2009

Ductile iron pipes, fittings, accessories and their joints for sewerage applications. Requirements and test methods

BS EN 681-1:1996

Elastomeric seals. Material requirements for pipe joint seals used in water and drainage applications. Part 1 Vulcanized rubber

BS EN 681-2:2000

Elastomeric seals. Material requirements for pipe joint seals used in water and drainage applications. Thermoplastic elastomers

BS EN 682:2002

Elastomeric seals. Materials requirements for seals used in pipes and fittings carrying gas and hydrocarbon fluids

BS EN 751-2:1997

Sealing materials for metallic threaded joints in contact with 1st, 2nd and 3rd family gases and hot water. Part 2 Non-hardening jointing compounds

BS EN 877:1999+A1:2006

Cast iron pipes and fittings, their joints and accessories for the evacuation of water from buildings. Requirements, test methods and quality assurance

BS EN 969:2009

Specification for ductile iron pipes, fittings, accessories and their joints for gas pipelines. Requirements and test methods

BS EN ISO 1127:1997

Stainless steel tubes. Dimensions, tolerances and conventional masses per unit length

BS EN ISO 1452-2:2009

Plastics piping systems for water supply and for buried and above-ground drainage and sewerage under pressure. Unplasticized poly(vinyl chloride) (PVC U). Part 2 Pipes

BS EN ISO 1452-3:2010

Plastics piping systems for water supply and for buried and above-ground drainage and sewerage under pressure. Unplasticized poly(vinyl chloride) (PVC U). Part 3 Fittings

BS EN ISO 15874-1:2013

Plastics piping systems for hot and cold water installations. Polypropylene (PP). Part 1 General

BS EN ISO 15874-2:2013

Plastics piping systems for hot and cold water installations. Polypropylene (PP). Part 2 Pipes

BS EN ISO 15874-3:2013

Plastics piping systems for hot and cold water installations. Polypropylene (PP). Part 3 Fittings

BS EN ISO 15874-5:2013

Plastics piping systems for hot and cold water installations. Polypropylene (PP). Part 5 Fitness for purpose of the system

BS EN ISO 15875-1:2003

Plastics piping systems for hot and cold water installations. Crosslinked polyethylene (PE-X). Part 1 General

BS EN ISO 15875-2:2003

Plastics piping systems for hot and cold water installations. Crosslinked polyethylene (PE-X). Part 2 Pipes

BS EN ISO 15875-3:2003

Plastics piping systems for hot and cold water installations. Crosslinked polyethylene (PE-X). Part 3 Fittings

BS EN ISO 15875-5:2003

Plastics piping systems for hot and cold water installations. Crosslinked polyethylene (PE-X). Part 5 Fitness for purpose of the system

BS EN ISO 15876-1:2003

Plastics piping systems for hot and cold water installations. Polybutylene (PB). Part 1 General

BS EN ISO 15876-2:2003

Plastics piping systems for hot and cold water installations. Polybutylene (PB). Part 2 Pipes

BS EN ISO 15876-3:2003

Plastics piping systems for hot and cold water installations. Polybutylene (PB). Part 3 Fittings

BS EN ISO 15876-5:2003

Plastics piping systems for hot and cold water installations. Polybutylene (PB). Part 5 Fitness for purpose of the system

BS EN ISO 15877-1:2009+A1:2010

Plastics piping systems for hot and cold water installations. Chlorinated poly(vinyl chloride) (PVC-C). Part 1 General

BS EN ISO 15877-2:2009+A1:2010

Plastics piping systems for hot and cold water installations. Chlorinated poly(vinyl chloride) (PVC-C). Part 2 Pipes

BS EN ISO 15877-3:2009+A1:2010

Plastics piping systems for hot and cold water installations. Chlorinated poly(vinyl chloride) (PVC-C). Part 3 Fittings

BS EN ISO 15877-5:2009+A1:2010

Plastics piping systems for hot and cold water installations. Chlorinated poly(vinyl chloride) (PVC-C). Part 5 Fitness for purpose of the system

BS EN ISO 21003-1:2008

Multilayer piping systems for hot and cold water installations inside buildings. Part 1 General

BS EN ISO 21003-2:2008+A1:2011

Multilayer piping systems for hot and cold water installations inside buildings. Part 2 Pipes

BS EN ISO 21003-3:2008

Multilayer piping systems for hot and cold water installations inside buildings. Part 3 Fittings

BS EN ISO 21003-5:2008

Multilayer piping systems for hot and cold water installations inside buildings. Part 5 Fitness for purpose of the system

BS EN ISO 22391-1:2009

Plastics piping systems for hot and cold water installations. Polyethylene of raised temperature resistance (PE-RT) Part 1 general

BS EN ISO 22391-2:2009

Plastics piping systems for hot and cold water installations. Polyethylene of raised temperature resistance (PE-RT). Part 2 Pipes

BS EN ISO 22391-3:2009

Plastics piping systems for hot and cold water installations. Polyethylene of raised temperature resistance (PE-RT). Part 3 Fittings

BS EN ISO 22391-5:2009

Plastics piping systems for hot and cold water installations. Polyethylene of raised temperature resistance (PE-RT). Part 5 Fitness for purpose of the system

BS EN ISO 8434-1:2007

Metallic tube connections for fluid power and general use. Part 1 24 degree cone connectors

BS EN ISO 9453:2014

Soft solder alloys. Chemical compositions and forms

BS ISO 11414:2009

Plastic pipes and fittings. Preparation of polyethylene (PE) pipe/pipe or pipe/fitting test piece assemblies by butt fusion

BS ISO 11922-1:1997

Thermoplastics pipes for the conveyance of fluids. Dimensions and tolerances. Part 1 Metric series

BS ISO 14531-1:2002

Plastics pipes and fittings. Crosslinked polyethylene (PE-X) pipe systems for the conveyance of gaseous fuels. Metric series. Specifications. Pipes

BS ISO 14531-2:2004

Plastics pipes and fittings. Crosslinked polyethylene (PE-X) pipe systems for the conveyance of gaseous fuels. Metric series. Specifications. Fittings for heat-fusion jointing

BS ISO 14531-3:2010

Plastics pipes and fittings. Crosslinked polyethylene (PE-X) pipe systems for the conveyance of gaseous fuels. Metric series. Specifications. Fittings for mechanical jointing (including PE-X/metal transitions)

BS ISO 16422:2014

Pipes and joints made of oriented unplasticized poly(vinyl chloride) (PVC-O) for the conveyance of water under pressure. Specifications

BS ISO 17484-1:2014

Plastics piping systems. Multi-layer pipe systems for indoor gas installations with a maximum operating pressure up to and including 5 bar (500 kPa). Part 1 Specifications for systems

BS ISO 21307:2011

Plastics pipes and fittings. Butt fusion jointing procedures for polyethylene (PE) pipes and fittings used in the construction of gas and water distribution systems

BS ISO 2531:2009

Ductile iron pipes, fittings, accessories and their joints for water applications

BS ISO 4065:1996

Thermoplastics pipes. Universal wall thickness table

BS ISO 4437-1:2014

Plastic piping systems for the supply of gaseous fuels. Polyethylene (PE). General

BS ISO 4437-2:2014

Plastic piping systems for the supply of gaseous fuels. Polyethylene (PE). Pipes

BS ISO 4437-3:2014

Plastic piping systems for the supply of gaseous fuels. Polyethylene (PE). Fittings

BS ISO 4437-5:2014

Plastic piping systems for the supply of gaseous fuels. Polyethylene (PE). Fitness for purpose of the system

ISO 10146:1997

Crosslinked polyethylene (PE-X) pipes - Effect of time and temperature on the expected strength

Y11 PIPELINE ANCILLARIES

1000 GENERAL

1010 SAFETY AND RELIEF VALVES, SELF OPERATED, APPLICATION:

- Safety - to discharge with rapid opening action to prevent pre-determined safe pressure being exceeded.
- Relief - to discharge with opening action proportional to increase in pressure above set pressure.

2000 PRODUCTS/MATERIALS

2015A STOP VALVES TO BS EN 1213 FOR POTABLE WATER SUPPLIES - COMPRESSION ENDS FOR COPPER:

- Pattern - Straight.
- Material - copper alloy.
- Flow rate class - VA (straight and angle pattern stopvalves).
- End connections - Compression to BS EN 1254-2.

2015B STOP VALVES TO BS EN 1213 FOR POTABLE WATER SUPPLIES - COMPRESSION ENDS FOR PLASTICS:

- Pattern - Straight.
- Material - copper alloy.
- Flow rate class - VA (straight and angle pattern stopvalves).
- End connections - Compression to BS EN 1254-3.

2015C STOP VALVES TO BS EN 1213 FOR POTABLE WATER SUPPLIES - CAPILLARY:

- Pattern - Straight.
- Material - copper alloy.
- Flow rate class VA (straight and angle pattern stopvalves).
- End connections - Capillary to BS EN 1254-1.

2015D STOP VALVES TO BS EN 1213 FOR POTABLE WATER SUPPLIES - THREADED:

- Pattern - Straight.
- Material - copper alloy.
- Flow rate class - VA (straight and angle pattern stopvalves).
- End connections - Threaded to BS 21 and BS EN 10226-1.

2020A THREADED ENDS GATE VALVES TO BS EN 12288:

- Series - B.
- Gate valve type - Solid or split wedge.
- Ends - Threaded to BS EN ISO 228-1 or ISO 7-1.
- Stem - Inside screw non-rising stem.
- Trim material - Manufacturer's standard.
- Operation - Handwheel.

2020B COMPRESSION ENDS GATE VALVES TO BS EN 12288:

- Series - B.
- Gate valve type - Solid or split wedge.

- Ends - Compression to BS EN 1254-2.
- Stem - Inside screw non-rising stem.
- Trim material - Manufacturer's standard.
- Operation - Handwheel.

2020C FLANGED ENDS GATE VALVES TO BS EN 12288:

- Series - B.
- Gate valve type - Solid or split wedge.
- Ends - Flanged to BS EN 1092-3.
- Stem - Inside screw non-rising stem.
- Trim material - Manufacturer's standard.
- Operation - Handwheel.

2020D LOOSE NUT/UNION ENDS GATE VALVES TO BS EN 12288:

- Series B.
- Gate valve type - Solid or split wedge.
- Ends - Loose nut/union end.
- Stem - Inside screw non-rising stem.
- Trim material - Manufacturer's standard.
- Operation - Handwheel.

2030A FLANGED GATE VALVES TO BS EN 1171:

- Valve type - Solid or split wedge.
- Seat - Metal.
- Ends - Flanged to BS EN 1092-2.
- Body and bonnet material - Grey cast iron.
- Trim category - Copper alloy faced.
- Operation - Handwheel.

2040A THREADED END GLOBE VALVES TO BS 5154:

- Series - B.
- Pattern - Straight.
- Ends - Threaded to BS 21 and BS EN 10226-1.
- Stem - Inside screw rising stem.
- Trim material - Manufacturer's standard.
- Operation - Handwheel.
- Options - Non-metallic renewable seat/disk rings.

2040B FLANGED GLOBE VALVES TO BS 5154:

- Series - B.
- Pattern - Straight.
- Ends - Flanged to BS EN 1092-3.
- Stem - Inside screw rising stem.
- Trim material - Manufacturer's standard.
- Operation - Handwheel.
- Options - Non-metallic renewable seat/disk rings.

2040C COMPRESSION GLOBE VALVES TO BS 5154:

- Series - B.
- Pattern - Straight.
- Ends - Compression fitting to BS EN 1254-2.
- Stem - Inside screw rising stem.
- Trim material - Manufacturer's standard.
- Operation - Handwheel.
- Options - Non-metallic renewable seat/disk rings.

2040D COMPRESSION GLOBE VALVES TO BS 5154 FOR PLASTIC PIPE:

- Series - B.
- Pattern - Straight.
- Ends - Compression fitting to BS EN 1254-3.
- Stem - Inside screw rising stem.
- Trim material - Manufacturer's standard.
- Operation - Handwheel.
- Options - Non-metallic renewable seat/disk rings.

2050A FLANGED GLOBE VALVES TO BS EN 13789:

- Pattern - Straight.
- Stem - Rising stem outside screw.
- Ends - Flanged to BS EN 1092-2.
- Material - Grey cast iron.

2060A PARALLEL SLIDE VALVES TO BS EN 1984:

- Ends - Flanged BS EN 1092-2.
- Stem - Rising stem.
- Valve faces - Stainless steel disc and seat.

2070A FLANGED STOP VALVES - GATE TYPE TO BS EN 1984:

- Pattern - Full bore or reduced bore.
- Materials - Cast steel body and materials to suit fluid and operating conditions.
- Ends - Flanged.
- Operation - Handwheel.

2070B BUTT-WELDED BODY ENDS STOP VALVES - GATE TYPE TO BS EN 1984:

- Pattern - Full bore or reduced bore.
- Materials - Cast steel body and materials to suit fluid and operating conditions.
- Ends - Butt-welded body ends.
- Operation - Handwheel.

2070C SOCKET WELDED STOP VALVES - GATE TYPE TO BS EN 1984:

- Pattern - Full bore or reduced bore.
- Materials - Cast steel body and materials to suit fluid and operating conditions.
- Ends - Socket welded ends.
- Operation - Handwheel.

2070D THREADED STOP VALVES - GATE TYPE TO BS EN 1984:

- Pattern - Full bore or reduced bore.
- Materials - Cast steel body and materials to suit fluid and operating conditions.
- Ends - Threaded to BS 21 and BS EN 10226-1.
- Operation - Handwheel.

2080A THREADED END BALL TYPE VALVES - SCREW DRIVER/KEY OPERATED:

- Materials - Bronze or DZR copper alloy body.
- Ends - Threaded to BS 21 and BS EN 10226-1.
- Chrome or nickel plated DZR sphere with full bore flow aperture. PTFE seats and stem seals. Anti-blowout stem.
- Operation - Screw driver operated or key operated.

2080B COMPRESSION END BALL TYPE VALVES - SCREW DRIVER/KEY OPERATED:

- Materials - Bronze or DZR copper alloy body.
- Ends - Compression fittings to BS EN 1254-2.
- Chrome or nickel plated DZR sphere with full bore flow aperture. PTFE seats and stem seals. Anti-blowout stem.
- Operation - Screw driver operated or key operated.

2080C THREADED END BALL TYPE VALVES - LEVER OPERATED:

- Materials - Bronze or DZR copper alloy body.
- Ends - Threaded to BS 21 and BS EN 10226-1.
- Chrome or nickel plated DZR sphere with full bore flow aperture. PTFE seats and stem seals. Anti-blowout stem.
- Operation - lever operated.

2080D COMPRESSION END BALL TYPE VALVES - LEVER OPERATED:

- Materials - Bronze or DZR copper alloy body.
- Ends - Compression fittings to BS EN 1254-2.
- Chrome or nickel plated DZR sphere with full bore flow aperture. PTFE seats and stem seals. Anti-blowout stem.
- Operation - lever operated.

2080E THREADED END BALL TYPE VALVES - LOCKSHIELD:

- Materials - Bronze or DZR copper alloy body.
- Ends - Threaded to BS 21 and BS EN 10226-1.
- Chrome or nickel plated DZR sphere with full bore flow aperture. PTFE seats and stem seals. Anti-blowout stem.
- Operation - lockshield.

2080F COMPRESSION BALL TYPE VALVES - LOCKSHIELD:

- Materials - Bronze or DZR copper alloy body.
- Ends - Compression fittings to BS EN 1254-2.
- Chrome or nickel plated DZR sphere with full bore flow aperture. PTFE seats and stem seals. Anti-blowout stem.

- Operation - lockshield.

2085A SCREWED END SERVICING VALVES - HANDWHEEL OPERATED:

- Materials - copper alloy body.
- Ends - Screwed to BS EN 1254-2.
- Operation - Handwheel operated.

2085B COMPRESSION END SERVICING VALVES - HANDWHEEL OPERATED:

- Materials - Copper alloy body.
- Ends - Compression fittings to BS EN 1254-2.
- Operation - Handwheel operated.

2085C CAPILLARY END SERVICING VALVES - HANDWHEEL OPERATED:

- Materials - Copper alloy body.
- Ends - Capillary ends to BS EN 1254-1.
- Operation - Handwheel operated.

2085D SCREWED END SERVICING VALVES - LEVER OPERATED:

- Materials - Copper alloy body.
- Ends - Screwed to BS EN 1254-2.
- Operation - Lever operated.

2085E COMPRESSION END SERVICING VALVES - LEVER OPERATED:

- Materials - Copper alloy body.
- Ends - Compression fittings to BS 864 and BS EN 1254-2.
- Operation - Lever operated.

2085F CAPILLARY END SERVICING VALVES - LEVER OPERATED:

- Materials - Copper alloy body.
- Ends - Capillary ends to BS EN 1254-1.
- Operation - Lever operated.

2085G SCREWED END SERVICING VALVES - SCREW DRIVER OPERATED:

- Materials - Copper alloy body.
- Ends - Screwed to BS 864 and BS EN 1254-2.
- Operation - Screw driver operated.

2085H COMPRESSION END SERVICING VALVES - SCREW DRIVER OPERATED:

- Materials - copper alloy body.
- Ends - Compression fittings to BS EN 1254-2.
- Operation - Screw driver operated.

2085I CAPILLARY END SERVICING VALVES - SCREW DRIVER OPERATED:

- Materials - Copper alloy body.

- Ends - Capillary ends to BS EN 1254-1.
- Operation - Screw driver operated.

2090A LEVER OPERATED BUTTERFLY VALVES TO BS EN 593 BETWEEN FLANGES:

- Construction - Provide controlled elastomer compression on flange faces; semi-lugged wafer type design, for installation between flanged pipework connections, body to suit BS EN 1092-2.
- Provide lever and gear 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.

2090B GEAR OPERATED BUTTERFLY VALVES TO BS EN 593 BETWEEN FLANGES:

- Construction - Provide controlled elastomer compression on flange faces; semi-lugged wafer type design, for installation between flanged pipework connections, body to suit BS EN 1092-2.
- Provide lever and gear operated valves with long body neck for lagging clearance.
- Seat - Bonded.
- Materials - Cast iron body; stainless steel shaft; aluminium bronze disc; EPDM seat.
- Operation - gear operated.

2090C LEVER OPERATED BUTTERFLY VALVES BETWEEN MECHANICAL JOINTS:

- Construction - one piece body with grooved ends or wafer type design, for installation between mechanical joints (up to 300mm only).
- Provide lever operated valves with long body neck for lagging clearance.
- Seat - bonded, pressure responsive elastomer..
- Materials - ductile iron body; stainless steel shaft; electroless nickel coated ductile iron offset disc; EPDM seat.
- Operation - lever and graduated notch plate.

2090D GEAR OPERATED BUTTERFLY VALVES BETWEEN MECHANICAL JOINTS:

- Construction - one piece body with grooved ends or wafer type design, for installation between mechanical joints. Grooves for 350mm and larger to be wedge shaped, for example, Victaulic advanced groove system (AGS).
- Provide gear operated valves with long body neck for lagging clearance.
- Seat - bonded, pressure responsive elastomer in sizes up to 300mm, disc mounted seal for 350mm and larger.
- Materials - ductile iron body; stainless steel shaft; electroless nickel coated ductile iron offset disc; EPDM seat.
- Operation - gear operated.

2110A STOP VALVES - KEY OPERATED SLUICE TYPE A TO BS 5163-1 AND BS 5163-2:

- Valve type - A
- Seat - Resilient or metal seated.
- Stem seal - Stuffing box and gland; injector packing foil; or toroidal sealing rings (O-rings).
- Operation - T key.
- Materials - Manufacturer's standard and WRAS approved.
- Options - Stem cap.

2110B STOP VALVES - KEY OPERATED SLUICE TYPE B TO BS 5163-1 AND BS 5163-2:

- Valve type - A

- Seat - Resilient or metal seated.
- Stem seal - Stuffing box and gland; injector packing foil; or toroidal sealing rings (O-rings).
- Operation - T key.
- Materials - Manufacturer's standard and WRAS approved.
- Options - Stem cap.

2210A LEVER OPERATED REGULATING BUTTERFLY VALVES TO BS EN 593 BETWEEN FLANGES:

- Construction - Provide controlled elastomer compression on flange faces; semi-lugged wafer type design, for installation between flanged pipework connections, body to suit BS EN 1092-2.
- Provide lever and gear 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, lever operation.

2210B GEAR OPERATED REGULATING BUTTERFLY VALVES TO BS EN 593 BETWEEN FLANGES:

- Construction - Provide controlled elastomer compression on flange faces; semi-lugged wafer type design, for installation between flanged pipework connections, body to suit BS EN 1092-2.
- Provide lever and gear 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, gear operation.

2210C LEVER OPERATED REGULATING BUTTERFLY VALVES TO BS EN 593 BETWEEN MECHANICAL JOINTS:

- Construction - installation between mechanical joints with grooved ends (up to 300mm only).
- Provide lever operated valves with long body neck for lagging clearance.
- Seat - bonded seat, pressure responsive elastomer.
- Materials - ductile iron body; stainless steel shaft; rubber coated ductile iron offset disc; EPDM seat.
- Operation - infinitely variable setting with travel stops and indicator, lever operation.

2210D GEAR OPERATED REGULATING BUTTERFLY VALVES TO BS EN 593 BETWEEN MECHANICAL JOINTS:

- Construction - installation between mechanical joints with grooved ends.
- Provide gear operated valves with long body neck for lagging clearance.
- Seat - bonded seat, pressure responsive in sizes up to 300mm, disc mounted seal for 350mm and larger.
- Materials - ductile iron body; stainless steel shaft; rubber coated ductile iron offset disc; EPDM seat.
- Operation - infinitely variable setting with travel stops and indicator, gear operation.

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

- BS 7350, section 3.1.
- Ends - Threaded to BS 21 and BS EN 10226-1.
- Material - Bronze or DZR copper alloy to BS 5154.
- Series B; oblique or Y pattern; inside screw non-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 FLANGED DOUBLE REGULATING VALVES TO BS 7350, COPPER ALLOY:

- BS 7350, section 3.1.
- Ends - Flanged to BS EN 1092-2.

- Material - Bronze or DZR copper alloy to BS 5154.
- Series B; oblique or Y pattern; inside screw non-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.

2220C FLANGED DOUBLE REGULATING VALVES TO BS 7350, CAST IRON:

- BS 7350, section 3.1.
- Ends - Flanged to BS EN 1092-2.
- Material - Cast iron to BS EN 13789.
- Oblique or Y pattern; copper alloy, nickel alloy or resilient valve face; rising stem outside screw or non-rising stem inside 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 THREADED ENDS FLOW MEASUREMENT DEVICES TO BS 7350, 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 and BS EN 10226-1.
- Material - Double regulating globe valve, bronze or DZR copper alloy to BS 7350 table 6.
- Options - Independent means for positive isolation on pressure tapping or adapter.

2230B FLANGED ENDS 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 - Flanged to BS EN 1092-3.
- Material - Double regulating globe valve, bronze or DZR copper alloy to BS 7350 table 6.
- Options - Independent means for positive isolation on pressure tapping or adapter.

2230C FLANGED 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 EN 1092-2.
- Material - Double regulating globe valve to BS EN 13789 and close coupled fixed orifice fitting to BS 7350, table 6.
- Options - Independent means for positive isolation on pressure tapping or adapter.

2230D GROOVED ENDS 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 - Grooved.
- Material - Double regulating globe valve to BS EN 13789 and close coupled fixed orifice fitting to BS 7350, table 6.
- Options - Independent means for positive isolation on pressure tapping or adapter.

2230E THREADED ENDS 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 and BS EN 10226-1.
- 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.

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

- BS 7350, section 3.2 - type 4, variable orifice valve.
- Ends - Flanged to BS EN 1092-3.
- 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.

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

- BS 7350, section 3.2 - type 4, variable orifice valve.
- Ends - Flanged to BS EN 1092-2.
- Material - Variable orifice, double regulating globe valve, cast iron to BS EN 13789.
- Options - Independent means for positive isolation on pressure tapping or adapter.

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

- Material - Bronze or brass copper alloy body.
- Pattern - Angle or straight to suit application.
- Straight - Threaded to BS 21 and BS EN 10226-1 or compression to BS EN 1254-2 to suit pipework as indicated.
- Angle - Threaded to BS 21 and BS EN 10226-1 with one end internal and other end external with union nut and tail pipe; or compression joint to BS EN 1254-2 one end and other end externally threaded to BS 21 and BS EN 10226-1 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.

2270A THERMOSTATIC RADIATOR VALVES TO BS EN 215 TABLE A.1:

- Material to A.1.
- Pattern - Straight or angle pattern to suit application.
- Dimensions - Table A.1 series D.
- Thermostatic valve type - Integral sensor unless otherwise indicated.

2270B THERMOSTATIC RADIATOR VALVES TO BS EN 215 TABLE A.2:

- Material to Annex A.
- Pattern - Straight or angle pattern to suit application.
- Dimensions - Table A.2 series F.
- Thermostatic valve type - Integral sensor unless otherwise indicated.

2270C THERMOSTATIC RADIATOR VALVES TO BS EN 215 TABLE A.3:

- Material to Annex A.
- Pattern - Straight or angle pattern to suit application.
- Dimensions - Table A.3 series S.
- Thermostatic valve type - Integral sensor unless otherwise indicated.

2270D THERMOSTATIC RADIATOR VALVES TO BS EN 215 TABLE A.4:

- Material to Annex A.
- Pattern - Straight or angle pattern to suit application.
- Dimensions - Table A.4 series GB.
- Thermostatic valve type - Integral sensor unless otherwise indicated.

2270E TAMPER PROOF THERMOSTATIC RADIATOR VALVES TO BS EN 215 TABLE A.1:

- Material to Annex A.
- Pattern - Straight or angle pattern to suit application.
- Provide tamper proof TRV's.
- Dimensions - Table A.1 series D.
- Thermostatic valve type - Integral sensor unless otherwise indicated.

2270F TAMPER PROOF THERMOSTATIC RADIATOR VALVES TO BS EN 215 TABLE A.2:

- Material to Annex A.
- Pattern - Straight or angle pattern to suit application.
- Provide tamper proof TRV's.
- Dimensions - Table A.2 series S.
- Thermostatic valve type - Integral sensor unless otherwise indicated.

2270G TAMPER PROOF THERMOSTATIC RADIATOR VALVES TO BS EN 215 TABLE A.3:

- Material - Annex A.
- Pattern - Straight or angle pattern to suit application.
- Provide tamper proof TRV's.
- Dimensions - Table A.3 series S.
- Thermostatic valve type - Integral sensor unless otherwise indicated.

2270H TAMPER PROOF THERMOSTATIC RADIATOR VALVES TO BS EN 215 TABLE A.4:

- Material - Annex A.
- Pattern - Straight or angle pattern to suit application.
- Provide tamper proof TRV's.
- Dimensions - Table A.4 series GB.
- Thermostatic valve type - Integral sensor unless otherwise indicated.

2280A FLOAT OPERATED VALVES TO BS 1212-1, COPPER FLOAT:

- Piston type float operated valve to BS 1212-1.
- Connection - Side or bottom entry to suit application.
- Float - Copper to BS 1968.

2280B FLOAT OPERATED VALVES TO BS 1212-1, PLASTIC FLOAT:

- Piston type float operated valve to BS 1212-1.
- Connection - Side or bottom entry to suit application.
- Float - Plastic to BS 2456.

2280C FLOAT OPERATED VALVES TO BS 1212-2, COPPER FLOAT:

- Diaphragm type float operated valve, brass body, to BS 1212-2.
- Connection - Side or bottom entry to suit application.
- Float - Copper to BS 1968.

2280D FLOAT OPERATED VALVES TO BS 1212-3, PLASTIC FLOAT:

- Diaphragm type float operated valve, plastic body, to BS 1212-3.
- Connection - Side or bottom entry to suit application.
- Float - Plastic to BS 2456.

2290A THREADED END FLOAT OPERATED VALVES, BALANCED EQUILIBRIUM:

- WRAS approved.
- Bronze or DZR copper alloy body.
- Inlet - Threaded to BS 21 and BS EN 10226-1.
- Spindle and head effectively guided and arranged with stops to engage with valve body and prevent over travel. Linkage fulcrum adjustable relative to vertical plane, securely locked to body tapping when set.
- Screwed plug from access cover.
- Float and lever arm.
- Spun copper float, halves brazed or welded together, with centre sleeve connecting to lever arm. For feed and expansion application use long arm type arranged to close when tank contains 150mm depth.

2290B FLANGED FLOAT OPERATED VALVES, BALANCED EQUILIBRIUM:

- Bronze or DZR copper alloy body.
- Inlet - Flanged to BS EN 1092-3.
- Spindle and head effectively guided and arranged with stops to engage with valve body and prevent over travel. Linkage fulcrum adjustable relative to vertical plane, securely locked to body tapping when set.
- Screwed plug from access cover.
- Float and lever arm.
- Spun copper float, halves brazed or welded together, with centre sleeve connecting to lever arm. For feed and expansion application use long arm type arranged to close when tank contains 150mm depth.

2315A OPEN/CLOSE CONTROL BALL VALVES:

- Valve - Open/Close valve.
- Rotary Actuator - Open/close.
- Material - Nickel-plated brass; stainless steel ball; PTFE seal; stainless steel spindle; EPDM spindle seal.
- Connections - Threaded to BS 21 and BS EN 10226-1.
- Ancillaries - Lever for manual operation.

2315B TWO WAY CONTROL BALL VALVES:

- Valve - Two way control valve.
- Rotary Actuator - Modulating.
- Material - Nickel-plated brass; stainless steel ball; PTFE seal; stainless steel spindle; EPDM spindle seal.
- Connections - Threaded to BS 21 and BS EN 10226-1.
- Ancillaries - Lever for manual operation.

2315C THREE WAY CONTROL BALL VALVES:

- Valve - Three way control valve.
- Rotary Actuator - Modulating.

- Material - Nickel-plated brass; stainless steel ball; PTFE seal; stainless steel spindle; EPDM spindle seal.
- Connections - Threaded to BS 21 and BS EN 10226-1.
- Ancillaries - Lever for manual operation.

2320A THREADED ENDS SWING CHECK VALVES TO BS 5154:

- Series B; horizontal pattern.
- Ends - Threaded to BS 21 and BS EN 10226-1.
- Trim material - Manufacturer's standard.

2320B FLANGED SWING CHECK VALVES TO BS 5154:

- Series B; horizontal pattern.
- Ends - Flanged to BS EN 1092-3.
- Trim material - Manufacturer's standard.

2330A FLANGED SWING CHECK VALVES TO BS EN 12334

- Check valve type to BS EN 736-1 - Swing.
- Body type - Flanged.
- Ends - Flanged to BS EN 1092-2.
- Body and cover materials - Grey cast iron or SG cast iron.
- Orientation of pipework - Horizontal or vertical.

2330B WAFER BODY SWING CHECK VALVES TO BS EN 12334:

- Check valve type to BS EN 736-1 - Swing.
- Body type - Wafer.
- Body and cover materials - Grey cast iron or SG cast iron.
- Orientation of pipework - Horizontal or vertical.

2330C FLANGED LIFT CHECK VALVES TO BS EN 12334:

- Check valve type to BS EN 736-1 - Lift.
- Body type - Flanged.
- Ends - Flanged to BS EN 1092-2.
- Body and cover materials - Grey cast iron or SG cast iron.
- Orientation of pipework - Horizontal or vertical.

2330D WAFER BODY LIFT CHECK VALVES TO BS EN 12334:

- Check valve type to BS EN 736-1 - Lift.
- Body type - Wafer.
- Body and cover materials - Grey cast iron or SG cast iron.
- Orientation of pipework - Horizontal or vertical.

2340A FLANGED SWING CHECK VALVES TO BS EN 12334:

- Wafer pattern design suitable for installation between flanged pipework, body to suit BS EN 1092-2.
- Disc - Double disc.
- Type - Light spring type.
- Seat - Bonded.
- Materials - Cast iron body; bronze disc; EPDM seat.

2385A COMBINED CHECK AND ANTI-VACUUM DEVICE TO PREVENT CONTAMINATION OF WATER BY BACKFLOW TO BS EN 14451:

- Standard - BS EN 14451 combined check and anti-vacuum valves.
- WRAS approval.
- Ends - Compression connections to BS EN 1254-2.

2390A COMBINED CHECK AND ANTI-VACUUM TYPE ANTI BACK SYPHONAGE VALVES:

- Bronze or DZR copper alloy body assembly with compression connections to BS EN 1254-2.
- Pattern - In-line pattern.
- Components - Stainless steel domed air inlet. Non-return valve with plastic body, rubber actuator and stainless steel to plastic seal. WRAS approval.

2391A HOSE UNION ANTI-VACUUM TYPE ANTI BACK SYPHONAGE VALVES:

- Bronze or DZR copper alloy body assembly with fittings to BS EN ISO 228-1.
- Pattern - In line pattern.
- Sizes - DN15 to DN25.
- WRAS Approval.

2395A VERIFIABLE BACKFLOW PREVENTER WITH REDUCED PRESSURE ZONE (RPZ) VALVE - GENERAL REQUIREMENTS:

- Provide an application to the local water supplier using the WRAS "RPZ Valve Assembly - Application for Installation" form.
- Obtain Water Supplier agreement that a Type BA device is a suitable means of backflow protection in the water supply system under consideration.
- Test methods and maintenance regimes shall be in accordance with the Water Suppliers requirements and any failure to comply may result in termination of supply or removal of the device. These maintenance requirements must be detailed within the project Operation & Maintenance documentation.
- The fitting must be included in the WRAS "Products and Materials Directory" and satisfy the requirements of the Regulations.
- The installer must obtain formal Water Supplier agreement that a Type BA device is a suitable means of backflow protection in the plumbing system under consideration before installation.
- Confirm that any Type BA device installed provides protection against back pressure and back siphonage at the point of use from fluids up to and including Category 4 as defined in
 - England and Wales - The Water Supply (Water Fittings) Regulations 1999, the Water Act 2014 and the Construction Products Regulations 2013.
 - Scotland - The Water Supply (Water Fittings) Byelaws 2014.
 - Northern Ireland - The Water Supply (Water Fittings) Regulations (Northern Ireland) 2009.
- Comply with the stipulations and requirements set out in WRAS Approved Installation Method Document AIM-08-01.

2395B VERIFIABLE BACKFLOW PREVENTER WITH REDUCED PRESSURE ZONE (RPZ) VALVE - INSTALLATION:

- The Type BA device shall not be installed in a place or position which is:
 - Liable to flooding
 - Above electrical equipment
 - Liable to mechanical or other damage
 - Exposed to freezing - unless measures are taken to prevent the assembly from freezing
 - Concealed

- The assembly shall be:
 - Installed horizontally with the relief valve discharging downwards
 - Installed with an inline strainer fitted immediately upstream of the device - to prevent fouling of elements of the assembly
 - Installed above ground at a height enabling effective inspection and maintenance
 - Installed not less than 300mm above ground or floor level or the base of any cabinet to the underside of the exit port of the relief valve
 - Installed no more than 1500mm above ground or floor level
 - Installed with an air break between the relief outlet port and the top of the allied tundish
- Following installation the assembly shall be flushed and disinfected in accordance with BS EN 806-4 and complimentary guidance in BS 8558
- Following flushing and prior to commissioning and site test, the assembly shall be checked by the installer to ensure that the relief valve functions correctly - in accordance with the guidelines in WRAS Approved Installation Method Document AIM-08-01.

2395C VERIFIABLE BACKFLOW PREVENTER WITH REDUCED PRESSURE ZONE (RPZ) VALVE - ON-SITE INSPECTION AND TESTING:

- Site testing must only be carried out by an accredited tester approved by the Water Supplier.
- Testing shall be carried out at intervals not exceeding 12 months.
- Test data during the commissioning of the assembly and at subsequent intervals shall be entered on the "RPZ Valve Test Report Form" produced by the WRAS.
- The inspections and testing shall be in accordance with WRAS Approved Installation Method Document AIM-08-01.
- On completion of site tests, a certificate must be completed by the tester in accordance with WRAS Guidance Note and copies submitted to the water supplier and the person responsible for the device. Copies shall be included in the Operation and Maintenance Manuals, including interval periods for subsequent testing.

2395D VERIFIABLE BACKFLOW PREVENTER WITH REDUCED PRESSURE ZONE (RPZ) VALVE - RECORD OF INSTALLATION AND TEST DATA:

- Provide records for each assembly in accordance with WRAS Approved Installation Method Document AIM-08-01.
- In general, the record shall indicate the following:
 - Purpose of the assembly
 - Precise location of the assembly
 - Data pertaining to prescribed tests
 - Details of the person who carried out the test
 - Frequency of tests
 - Defects found and measures taken to remedy these defects
- The installation, commissioning and subsequent test data shall be forwarded to the Water Supplier and copies retained by the Tester and the Water Supplier's customer for a period of at least five years.

2398A PIPE INTERRUPTER WITH VENT AND MOVING ELEMENT BS EN 1717:

- Type DB.
- Fluid category 4.
- Material - Brass body, plastic venturi nozzle, EDPM O rings.
- Finish - Chrome.
- Ends - Threaded to BS 21 and BS EN 10226-1.

2398B PIPE INTERRUPTER WITH PERMANENT ATMOSPHERIC VENT:

- Type DC.
- Fluid category 5.
- Material - Brass body, plastic internals, EDPM membrane.
- Finish - Chrome.
- Ends - Threaded to BS 21 and BS EN 10226-1.

2430A SAFETY VALVES, COPPER ALLOY, SINGLE SPRING:

- Material - bronze or DZR copper alloy body.
- Standard - BS EN ISO 4126-1, BS EN ISO 4126-7.
- Ends - threaded to BS 21 and BS EN 10226-1.
- Spring type - single spring loaded, high lift type.

2430B SAFETY VALVES, COPPER ALLOY, DOUBLE SPRING:

- Material - bronze or DZR copper alloy body.
- Standard - BS EN ISO 4126-1, BS EN ISO 4126-7.
- Ends - threaded to BS 21 and BS EN 10226-1.
- Spring type - double spring loaded, high lift type.

2430C SAFETY VALVES, CAST IRON, SINGLE SPRING:

- Material - cast iron body.
- Standard - BS EN ISO 4126-1, BS EN ISO 4126-7.
- Ends - flanged to BS EN 1092-2.
- Spring type - single spring loaded, high lift type.

2430D SAFETY VALVES, CAST IRON, DOUBLE SPRING:

- Material - cast iron body.
- Standard - BS EN ISO 4126-1, BS EN ISO 4126-7.
- Ends - flanged to BS EN 1092-2.
- Spring type - double spring loaded, high lift type.

2440A DRAIN COCKS, THROUGHWAY GLAND COCK:

- Bronze body threaded male to BS 21 and BS EN 10226-1.
- Tapered plug with square shank for loose lever; bolted gland; strap and blank cap screwed on hand tight.
- Outlet to accept hose union.

2450 DRAIN COCKS - SCREWDOWN TO BS 2879, TYPE 1:

- Bronze body threaded male to BS 21 and BS EN 10226-1.
- Screw down plug with square shank for loose lever.
- Serrated outlet to accept hosepipe, fixed or union pattern. Lockshield to accept key.

2460 DRAIN COCKS - BALL TYPE:

- Bronze or DZR copper alloy body; chrome-plated DZR ball; PTFE seats and stem seals; blow-out proof stem; strap and blank cap screwed on hand tight; serrated outlet to accept hose pipe. Lockshield key operated.

2470 VENT COCKS - TWO WAY GLAND COCK TYPE:

- Bronze body threaded to BS 21 and BS EN 10226-1; tapered plug with square shank for loose lever; plug

position indicator; bolted gland

2480 VENT COCKS - BALL TYPE:

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

2490 VENT COCKS - THREE WAY GLAND COCK TYPE:

- Bronze body threaded to BS 21 and BS EN 10226-1; tapered plug with square shank for loose lever; plug position indicator; port markings to indicate inlet, vent, waste; bolted gland.
- Port configuration, T port.

2500A THREE WAY PLUG VALVE VENT COCKS - WRENCH OPERATED:

- Cast iron body, plug and bottom cover. PTFE thrust washer.
- Ends - Flanged to BS EN 1092-2.
- T port configuration. Wrench operation.

2500B THREE WAY PLUG VALVE VENT COCKS - GEAR OPERATED:

- Cast iron body, plug and bottom cover. PTFE thrust washer.
- Ends - Flanged to BS EN 1092-2.
- T port configuration. Gear operation.

2510A AUTOMATIC AIR VENTS, FLOAT TYPE:

- Construction - Bronze or DZR copper alloy body with threaded inlet to BS 21 and BS EN 10226-1. 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.

2515A MICROBUBBLE TEMPERATURE DIFFERENTIAL DEAERATORS:

- Construction - Vertical mild steel housing incorporating internal spiral wound copper mesh system.
- Provide automatic air release mechanism.
- Ends - Line size with flanges to BS EN 1092-1, PN 16.
- Operating conditions - Maximum temperature 110°C, maximum pressure 10 bar.

2520A LTHW PRESSURE DIFFERENTIAL DEAERATORS:

- Unit - Provide a self circulating unit connected to the system by two 15mm connections at least 500mm apart.
- Isolation - Provide valves to isolate the vessel from the main system.
- Operating conditions - Maximum temperature 110°C, maximum pressure 10 bar.

2520B CHILLED WATER PRESSURE DIFFERENTIAL DEAERATORS:

- Unit - Provide a self circulating unit connected to the system by two 15mm connections at least 500mm apart. Insulate to prevent condensation.
- Isolation - Provide valves to isolate the vessel from the main system.
- Operating conditions - Maximum temperature 110°C, maximum pressure 10 bar.

2521A CENTRIFUGAL AIR SEPARATORS:

- Construction - Vertical steel housing with offset inlet and outlet ports to remove bubbles via centrifugal force. Provide automatic air release mechanism.
- Ends - Line size with flanges to BS EN 1092-1, PN 16.
- Operating conditions - Maximum temperature 110°C, maximum pressure 10 bar.

2522A GRAVITATION DIRT SEPARATORS:

- Construction - Vertical mild steel housing with internal reservoir, sludge pipe, perforation plate and automatic air release mechanism.
- Ends - Line size with flanges to BS EN 1092-1, PN 16.
- Operating conditions - Maximum temperature 110°C, maximum pressure 10 bar.

2524A MICROBUBBLE AIR AND DIRT SEPARATORS:

- Construction - Vertical steel housing with internal large surface area mechanism to remove microbubbles via coalescence effect. Fitted with dirt drain at its lowest point for removing dirt that sinks, and fitted with a dirt drain valve on the side of the housing for removing dirt that floats on the water.
- Provide automatic air release mechanism.
- Ends - Line size with flanges to BS EN 1092-1, PN 16.
- Operating conditions - Maximum temperature 110°C, maximum pressure 10 bar.

2610A STEEL EXPANSION LOOPS:

- Provide expansion loop in material and finish of associated pipeline. Size to limit stress set up in material of pipe wall to 69 MPa.
- Forge bend from a single length of pipe or join by welding fittings if expansion loops are too large to manufacture in one piece.
- Where indicated, galvanize after manufacture.
- Where scheduled or detailed in the particular specification provide expansion loops installed with grooved flexible mechanical joints and elbows. The joint manufacturer shall undertake calculations for sizing of the expansion loops. Installation to be strictly in accordance with the manufacturer's instructions.

2630A THREADED END EXPANSION COMPENSATORS, AXIAL BELLOWS:

- Ends - Threaded to BS 21 and BS EN 10226-1.
- Bellows - Stainless steel, multi ply or single-ply construction fitted with stainless steel inner sleeves.
- Operation - Supply expansion joints capable of not less than 2000 complete reversals of movement at the given working conditions; and of withstanding a pressure test of 1.5 times the design pressure without deformation.
- Design, manufacture and type test metal expansion joints incorporating corrugated bellows in accordance with BS ISO 15348.

2630B FLANGED EXPANSION COMPENSATORS, AXIAL BELLOWS:

- Ends - Flanged to BS EN 1092-1.
- Bellows - Stainless steel, multi-ply or single-ply construction fitted with stainless steel inner sleeves.
- Operation - Supply expansion joints capable of not less than 2000 complete reversals of movement at the given working conditions; and of withstanding a pressure test of 1.5 times the design pressure without

deformation

- Design, manufacture and type test metal expansion joints incorporating corrugated bellows in accordance with BS ISO 15348.

2630C BEVELLED END EXPANSION COMPENSATORS, AXIAL BELLOWS:

- Ends - Bevelled for welding.
- Bellows - Stainless steel, multi-ply or single-ply construction fitted with stainless steel inner sleeves.
- Operation - Supply expansion joints capable of not less than 2000 complete reversals of movement at the given working conditions; and of withstanding a pressure test of 1.5 times the design pressure without deformation.
- Design, manufacture and type test metal expansion joints incorporating bellows in accordance with BS ISO 15348.

2630D THREADED ENDS EXPANSION COMPENSATORS, ARTICULATED BELLOWS:

- Ends - Threaded to BS 21 and BS EN 10226-1.
- Bellows - Stainless steel, multi-ply or single-ply construction fitted with stainless steel inner sleeves.
- Operation - Supply expansion joints capable of not less than 2000 complete reversals of movement at the given working conditions; and of withstanding a pressure test of 1.5 times the design pressure without deformation.
- Design, manufacture and type test metal expansion joints incorporating corrugated bellows in accordance with BS ISO 15348.

2630E FLANGED EXPANSION COMPENSATORS, ARTICULATED BELLOWS:

- Ends - Flanged to BS EN 1092-1.
- Bellows - Stainless steel, multi-ply or single-ply construction fitted with stainless steel inner sleeves.
- Operation - Supply expansion joints capable of not less than 2000 complete reversals of movement at the given working conditions; and of withstanding a pressure test of 1.5 times the design pressure without deformation.
- Design, manufacture and type test metal expansion joints incorporating corrugated bellows in accordance with BS ISO 15348.

2630F BEVELLED ENDS EXPANSION COMPENSATORS, ARTICULATED BELLOWS:

- Ends - Bevelled for welding.
- Bellows - Stainless steel, multi-ply or single-ply construction fitted with stainless steel inner sleeves.
- Operation - Supply expansion joints capable of not less than 2000 complete reversals of movement at the given working conditions; and of withstanding a pressure test of 1.5 times the design pressure without deformation.
- Design, manufacture and type test metal expansion joints incorporating corrugated bellows in accordance with BS ISO 15348.

2630G THREADED END EXPANSION COMPENSATORS, ANGULAR BELLOWS:

- Ends - Threaded to BS 21 and BS EN 10226-1.
- Bellows - Stainless steel, multi-ply or single-ply construction fitted with stainless steel inner sleeves.
- Operation - Supply expansion joints capable of not less than 2000 complete reversals of movement at the given working conditions; and of withstanding a pressure test of 1.5 times the design pressure without

deformation.

- Design, manufacture and type test metal expansion joints incorporating corrugated bellows in accordance with BS ISO 15348.

2630H FLANGED EXPANSION COMPENSATORS, ANGULAR BELLOWS:

- Ends - Flanged to BS EN 1092-1.
- Bellows - Stainless steel, multi-ply or single-ply construction fitted with stainless steel inner sleeves.
- Operation - Supply expansion joints capable of not less than 2000 complete reversals of movement at the given working conditions; and of withstanding a pressure test of 1.5 times the design pressure without deformation.
- Design, manufacture and type test metal expansion joints incorporating corrugated bellows in accordance with BS ISO 15348.

2630I BEVELLED END EXPANSION COMPENSATORS, ANGULAR BELLOWS:

- Ends - Bevelled for welding.
- Bellows - Stainless steel, multi-ply or single-ply construction fitted with stainless steel inner sleeves.
- Operation - Supply expansion joints capable of not less than 2000 complete reversals of movement at the given working conditions; and of withstanding a pressure test of 1.5 times the design pressure without deformation.
- Design, manufacture and type test metal expansion joints incorporating corrugated bellows in accordance with BS ISO 15348.

2630J GROOVED END EXPANSION COMPENSATORS:

- Material - ductile cast iron to ASTM A536, grade 65-45-12.
- Ends - grooved for mechanical joints.
- Operation - supply expansion joints capable of not less than 2000 complete reversals of movement at the given working conditions; and of withstanding a pressure test of 1.5 times the design pressure without deformation.
- Type - slip-type expansion compensation device, gasketed, with grooved coupling ends and 'telescoping' body.
- Size - 50mm to 150mm.
- Maximum axial end movement - 76mm.
- Limiting test pressure - 24bar pressure rated.
- Gasket - grade 'E' EPDM for water services to 110°C.
- Installation to be strictly in accordance with the manufacturer's instructions.

2630K GROOVED END MULTIPLE FLEXIBLE COUPLINGS TYPE COMPENSATORS:

- Coupling material - ductile cast iron to ASTM A536, grade 65-45-12.
- Ends - grooved for mechanical joints.
- Operation - supply expansion joints capable of not less than 2000 complete reversals of movement at the given working conditions; and of withstanding a pressure test of 1.5 times the design pressure without deformation.
- Type - multiple standard flexible grooved couplings joined by grooved end nipples.
- Axial movement - dependent on number of couplings in the compensator, refer to schedule/particular specification.
- Gasket - grade 'E' EPDM for water services to 110°C.

2640A THREADED END HOSE COMPENSATORS:

- Supply convoluted stainless steel hose with stainless steel braiding. Fully welded construction.
- Ends - Threaded ends to BS 21 and BS EN 10226-1.
- Operation - Supply hose compensators capable of not less than 2000 complete reversals of movement at the given working conditions; and of withstanding a pressure test of 1.5 times the design pressure without deformation.

2640B FLANGED HOSE COMPENSATORS:

- Supply convoluted stainless steel hose with stainless steel braiding. Fully welded construction.
- Ends - Flanged to BS EN 1092-1.
- Operation - Supply hose compensators capable of not less than 2000 complete reversals of movement at the given working conditions; and of withstanding a pressure test of 1.5 times the design pressure without deformation.

2650A FLANGED EPDM RUBBER FLEXIBLE CONNECTIONS UP TO 10 BAR AND 100°C:

- Material - EPDM rubber with wire reinforced cuffs.
- Steel reinforcement within the body.
- Marking - Mould date of manufacture on bellows.
- Show manufacturer and type.
- Ends - Flanges to BS EN 1092-1 that can swivel and are removable.
- Operation - Ensure flexible connections have a design life of 120 months at 100°C. Provide tie bars with rubber top hat washers where working pressure exceeds 4 bar. Supply threaded tie bars with adjustable length. Ensure flexible connections are tied when the plant is on vibration isolation mountings.

2650B THREADED END EPDM RUBBER FLEXIBLE CONNECTIONS UP TO 10 BAR AND 100°C:

- Material - EPDM rubber with wire reinforced cuffs.
- Steel reinforcement within the body.
- Marking - Mould date of manufacture on bellows.
- Show manufacturer and type.
- Ends - Threaded to BS 21 and BS EN 10226-1 with one union end.
- Operation - Ensure flexible connections have a design life of 120 months at 100°C. Provide tie bars with rubber top hat washers where working pressure exceeds 4 bar. Supply threaded tie bars with adjustable length. Ensure flexible connections are tied when the plant is on vibration isolation mountings.

2650C FLEXIBLE CONNECTIONS ABOVE 100°C:

- Material - Convoluted stainless steel, fully welded.
- Ends - Flanged to BS EN 1092-1. Ensure flanges can swivel.
- Operation - Ensure flexible connections are tied when the plant is on vibration isolation mountings.

2650D FLANGED EPDM RUBBER FLEXIBLE CONNECTIONS UP TO 10 BAR AND 70°C:

- Material - EPDM rubber with wire reinforced cuffs.
- Synthetic fibre reinforcement within the body.
- Marking - Mould date of manufacture on bellows.
- Show manufacturer and type.
- Ends - Flanges to BS EN 1092-1 that can swivel and are removable.
- Operation - Ensure flexible connections have a design life of 120 months at 100°C. Provide tie bars with rubber top hat washers where working pressure exceeds 4 bar. Supply threaded tie bars with adjustable length. Ensure flexible connections are tied when the plant is on vibration isolation mountings.

2650E THREADED END EPDM RUBBER FLEXIBLE CONNECTIONS UP TO 10 BAR AND 70°C:

- Material - EPDM rubber with wire reinforced cuffs.
- Synthetic fibre reinforcement within the body.
- Marking - Mould date of manufacture on bellows.
- Show manufacturer and type.
- Ends - Threaded to BS 21 and BS EN 10226-1 with one union end.
- Operation - Ensure flexible connections have a design life of 120 months at 100°C. Provide tie bars with rubber top hat washers where working pressure exceeds 4 bar. Supply threaded tie bars with adjustable length. Ensure flexible connections are tied when the plant is on vibration isolation mountings.

2650F FLANGED FLEXIBLE CHLOROBUTYL RUBBER CONNECTIONS UP TO 10 BAR AND 100°C:

- Material - Multi-ply reinforced chlorobutyl rubber with wire reinforced cuffs. Synthetic fibre or steel reinforcement within the body.
- Marking - Mould date of manufacture on bellows.
- Show manufacturer and type.
- Ends - Flanges to BS EN 1092-1 that can swivel and are removable.
- Operation - Ensure flexible connections have a design life of 120 months at given conditions. Provide tie bars with rubber top hat washers where working pressure exceeds 4 bar. Supply threaded tie bars with adjustable length. Ensure flexible connections are tied when the plant is on vibration isolation mountings.

2650G THREADED END CHLOROBUTYL RUBBER FLEXIBLE CONNECTIONS UP TO 10 BAR AND 100°C:

- Material - Multi-ply reinforced chlorobutyl rubber with wire reinforced cuffs. Synthetic fibre or steel reinforcement within the body.
- Marking - Mould date of manufacture on bellows.
- Show manufacturer and type.
- Ends - Threaded to BS 21 and BS EN 10226-1 with one union end.
- Operation - Ensure flexible connections have a design life of 120 months at given conditions. Provide tie bars with rubber top hat washers where working pressure exceeds 4 bar. Supply threaded tie bars with adjustable length. Ensure flexible connections are tied when the plant is on vibration isolation mountings.

2650H FLANGED CHLOROBUTYL RUBBER FLEXIBLE CONNECTIONS UP TO 10 BAR AND 60°C:

- Material - Multi-ply reinforced chlorobutyl rubber with wire reinforced cuffs. Synthetic fibre reinforcement within the body.
- Marking - Mould date of manufacture on bellows.
- Show manufacturer and type.
- Ends - Flanges to BS EN 1092-1 that can swivel and are removable.
- Operation - Ensure flexible connections have a design life of 120 months at given conditions. Provide tie bars with rubber top hat washers where working pressure exceeds 4 bar. Supply threaded tie bars with adjustable length. Ensure flexible connections are tied when the plant is on vibration isolation mountings.

2650I THREADED END CHLOROBUTYL RUBBER FLEXIBLE CONNECTIONS UP TO 10 BAR AND 60°C:

- Material - Multi-ply reinforced chlorobutyl rubber with wire reinforced cuffs. Synthetic fibre reinforcement within the body.
- Marking - Mould date of manufacture on bellows.
- Show manufacturer and type.
- Ends - Threaded to BS 21 and BS EN 10226-1 with one union end.
- Operation - Ensure flexible connections have a design life of 120 months at given conditions. Provide tie bars with rubber top hat washers where working pressure exceeds 4 bar. Supply threaded tie bars with

adjustable length. Ensure flexible connections are tied when the plant is on vibration isolation mountings.

2660A TERMINAL UNIT CONNECTIONS FOR HEATING SERVICES - STAINLESS STEEL:

- Material - Stainless steel convoluted hose with stainless steel overbraiding. Carbon steel, stainless steel or copper tube end connections. Fully welded construction.
- Operation - Ensure hose length is sufficient to prevent the minimum hose bend radius from being exceeded during installation and commissioning.
- Working pressure 15 - 20 bar and temperature 95°C.

2660B TERMINAL UNIT CONNECTIONS WITH QUICK RELEASE COUPLINGS FOR HEATING SERVICES - STAINLESS STEEL:

- Material - Stainless steel convoluted hose with stainless steel overbraiding. Carbon steel, stainless steel or copper tube end connections. Fully welded construction.
- Operation - Ensure hose length is sufficient to prevent the minimum hose bend radius from being exceeded during installation and commissioning. Working pressure 15 - 20 bar and temperature 95°C.
- Options - Supply quick release couplings with screwed ends.
- Materials - Male and female nickel plated brass halves each with shut-off valve with rubber seat. Locking mechanism of stainless steel balls and stainless steel internal valve springs.

2660C TERMINAL UNIT CONNECTIONS FOR HEATING SERVICES - RUBBER:

- Material - EPDM inner liner with stainless steel wire braid. Nickel plated brass fittings with stainless steel ferrules.
- Operation - Ensure hose length is sufficient to prevent the minimum hose bend radius from being exceeded during installation and commissioning. Working pressure 15 - 20 bar and temperature 95°C.

2660D TERMINAL UNIT CONNECTIONS FOR CHILLED WATER SERVICES - STAINLESS STEEL:

- Material - Stainless steel convoluted hose with stainless steel overbraiding. Carbon steel, stainless steel or copper tube end connections. Fully welded construction. Nitrile rubber Class 'O' insulation with vapour seal and end protection caps.
- Operation - Ensure hose length is sufficient to prevent the minimum hose bend radius from being exceeded during installation and commissioning. Working pressure 15 - 20 bar and temperature 95°C.

2660E TERMINAL UNIT CONNECTIONS WITH QUICK RELEASE COUPLINGS FOR CHILLED WATER SERVICES - STAINLESS STEEL:

- Material - Stainless steel convoluted hose with stainless steel overbraiding. Carbon steel, stainless steel or copper tube end connections. Fully welded construction. Nitrile rubber Class 'O' insulation with vapour seal and end protection caps.
- Operation - Ensure hose length is sufficient to prevent the minimum hose bend radius from being exceeded during installation and commissioning. Working pressure 15 - 20 bar and temperature 95°C.
- Options - Supply quick release couplings with screwed ends.
- Material - Male and female nickel plated brass halves each with shut-off valve with rubber seat. Locking mechanism of stainless steel balls and stainless steel internal valve springs.

2660F TERMINAL UNIT CONNECTIONS FOR CHILLED WATER SERVICES - RUBBER:

- Material - EPDM inner liner with stainless steel wire braid. Nickel plated brass fittings with stainless steel ferrules. Nitrile rubber Class 'O' insulation with vapour seal and end protection caps.
- Operation - Ensure hose length is sufficient to prevent the minimum hose bend radius from being exceeded

during installation and commissioning. Working pressure 15 - 20 bar and temperature 95°C.

2670A TEST PLUGS, SELF SEALING:

- Provide DZR copper alloy self sealing test plugs for measurement of temperature and pressure, complete with captive cap for sealing when not in use. Ensure test plugs are suitable for system operating temperature and pressure.
- Provide one thermometer and pressure gauge for each range of conditions, for use with test plugs.

2670B TEST PLUGS, VALVE CONTROLLED:

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

2680A THREADED PIPELINE STRAINERS, BRONZE:

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

2680B FLANGED PIPELINE STRAINERS, BRONZE:

- Material - Bronze to BS EN 1982.
- Ends - Flanged to BS EN 1092-3.
- Pattern - Y pattern body.
- Screen free area - Not less than 250% of pipe bore.
- Screen perforations
 - 15 to 50mm nominal size, within range 0.7 - 0.9 mm diameter.
 - 65mm and over nominal size, within range 1.5 - 1.8mm diameter.
- Internal to external flow through screen. Provide plugged connections for drain, air vent and differential pressure monitoring, threaded to BS 21 and BS EN 10226-1.

2680C COMPRESSION PIPELINE STRAINERS, BRONZE:

- Material - Bronze to BS EN 1982.
- Ends - Compression fittings to BS EN 1254-2.
- Pattern - Y pattern body.
- Screen free area - Not less than 250% of pipe bore.
- Screen perforations
 - 15 to 50mm nominal size, within range 0.7 - 0.9 mm diameter.
 - 65mm and over nominal size, within range 1.5 - 1.8mm diameter.
- Internal to external flow through screen. Provide plugged connections for drain, air vent and differential pressure monitoring, threaded to BS 21 and BS EN 10226-1.

2680D PIPELINE STRAINERS, CAST IRON:

- Material - Cast iron.
- Ends - Flanged to BS EN 1092-2.
- Pattern - Y pattern body.
- Screen free area - Not less than 250% of pipe bore.
- Screen perforations
 - 15 to 50mm nominal size, within range 0.7 - 0.9 mm diameter.
 - 65mm and over nominal size, within range 1.5 - 1.8mm diameter.
- Internal to external flow through screen. Provide plugged connections for drain, air vent and differential pressure monitoring, threaded to BS 21 and BS EN 10226-1.

2680E GROOVED END PIPELINE STRAINERS, DUCTILE IRON:

- Material - Ductile iron.
- Ends - Grooved for mechanical joint.
- Pattern - Y pattern body.
- Screen free area - Not less than 250% of pipe bore.
- Screen perforations
 - 50 to 80mm nominal size, 1.6mm diameter.
 - 100mm and over nominal size, 3.2mm diameter.
- Internal to external flow through screen. Provide plugged connections for drain, air vent and differential pressure monitoring, threaded to BS 21 and BS EN 10226-1.

2680F GROOVED END PIPELINE SUCTION DIFFUSER STRAINERS, DUCTILE IRON:

- Body materials - ductile iron.
- Coupling gaskets - grade 'E' EPDM for water services to 110°C
- Ends - grooved for mechanical joint for jointing to pipework and flanged for jointing to pump.
- Stainless steel frame and perforated steel diffuser to provide optimum flow conditions at pump inlet.
- Unit to be complete with removable stainless steel fine mesh sleeve start-up pre-filter, bosses on either side for pressure measurement and outlet for drain connection.
- Installation to be strictly in accordance with the manufacturer's instructions.

2680G PIPELINE SUCTION GUIDE/STRAINERS:

- Body material - cast iron or ductile iron for water services to 110°C
- Ends - flanged to PN16 or PN25 to suit system maximum working pressure.
- Stainless steel strainer and fine mesh (start-up) strainer.
- Unit to be complete with flow stabilising vanes to allow connection direct to pump suction.
- Unit to be complete with removable stainless steel fine mesh sleeve start-up pre-filter.
- Provide plugged connections for drain, air vent and differential pressure monitoring.
- Installation to be strictly in accordance with the manufacturer's instructions.

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°.

2690B TUNDISHES, MILD STEEL, GALVANIZED:

- Provide tundishes located adjacent to equipment, as indicated.

- Use mild steel sheet; galvanize after manufacture.
- 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°.

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.

2700E GAUGES, 100MM DIAMETER, FLUSH MOUNTING:

- Dial case - 100mm diameter for flush mounting to steel panel.
- Mount gauges with dial face in vertical plane flush to panel and conceal casing within a steel metal cubicle.

2700F GAUGES, 100MM DIAMETER, DIRECT MOUNTING:

- Dial case - 100mm diameter for direct connection to instrument.
- Mount gauges with dial face in vertical plane and support casing by connection to instrument.

2700G GAUGES, 100MM DIAMETER, FLANGE MOUNTING:

- Dial case - 100mm diameter 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 °C marked on 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 EN 13032-3 FOR DIRECT MOUNTING:

- Vapour pressure type to BS EN 13190, mounted direct in pocket, with horizontal or vertical stem as appropriate.

2710D TEMPERATURE GAUGES, VAPOUR PRESSURE TO BS EN 13032-3 FOR REMOTE MOUNTING:

- Vapour pressure type to BS EN 13190, 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 EN 837-1. 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 in 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 EN 837-1. Calibrate in mm of mercury.

2750A 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.

2750B GAUGE MOUNTING BOARDS, MILD STEEL:

- Manufacture from 3mm mild steel plate, finished black stove enamel and trimmed with chromium plated strips approximately 10mm wide.
- Mount on walls or purpose made steel frames at a height approximately 1.3m above floor level.

3000 ACCESSORIES

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.

4000 WORKMANSHIP

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.

4025 LOCATION OF THERMOSTATIC RADIATOR VALVES:

- Install thermostatic radiator valves in an area which reflects the space temperature. Ensure that they are not behind curtains or enclosed in heating or radiator panels.

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.

4050A POSITIONING OF CONTROL COMPONENTS:

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

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 pipe lines.
- 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.
- Select and install metallic bellows expansion joints, test/inspect the systems after installation of the expansion joints and 1st full movement and provide certification in accordance with BS 6129-1.

4110 FLEXIBLE CONNECTIONS INSTALLATION:

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

BS APPENDIX

BS 1212-1:1990

Float operated valves. Part 1 Specification for piston type float valves (copper alloy body) (excluding floats)

BS 1212-2:1990

Float operated valves. Part 2 Specification for diaphragm type float operated valves (copper alloy body) (excluding floats)

BS 1212-3:1990

Float operated valves. Part 3 Specification for diaphragm type float operated valves (plastics bodied) for cold water services only (excluding floats)

BS 1968:1953

Specification for floats for ballvalves (copper)

BS 21:1985

Specification for pipe threads for tubes and fittings where pressure-tight joints are made on the threads (metric dimensions).

BS 2456:1990

Specification for floats (plastics) for float operated valves for cold water services

BS 2767:1991

Specification for manually operated copper alloy valves for radiators

BS 2879:1980

Specification for draining taps (screw-down pattern)

BS 5154:1991

Specification for copper alloy globe, globe stop and check, check and gate valves.
Partially replaced by BS EN 12288

BS 5163-1:2004

Valves for waterworks purposes. Part 1 Predominantly key-operated cast iron gate valves. Code of practice

BS 5163-2:2004

Valves for waterworks purposes. Part 2 Stem caps for use on isolating valves and associated water control apparatus. Specification

BS 6129-1:1981

Code of practice for the selection and application of bellows expansion joints for use in pressure systems.
Metallic bellows expansion joints

BS 6683:1985

Guide to installation and use of valves

BS 7207:1990

Specification for crude vegetable fats

BS 7350:1990

Specification for double regulating globe valves and flow measurement devices for heating and chilled water systems

BS 8558:2015

Guide to the design, installation, testing and maintenance of services supplying water for domestic use within buildings and their curtilages. Complimentary guidance to BS EN 806

BS EN 10226-1:2004

Pipe threads where pressure tight joints are made on the threads. Taper external threads and parallel internal threads. Part 1 dimensions, tolerances and designation

BS EN 1092-1:2007+A1:2013

Flanges and their joints. Circular flanges for pipes, valves, fittings and accessories, PN designated. Part 1 steel flanges

BS EN 1092-2:1997

Flanges and their joints. Circular flanges for pipes, valves, fittings and accessories, PN designated. Part 2 cast iron flanges

BS EN 1092-3:2003

Flanges and their joints. Circular flanges for pipes, valves, fittings and accessories, PN designated. Part 3 copper alloy flanges

BS EN 1171:2015

Industrial valves. Cast iron gate valves

BS EN 1213:2000

Building valves. Copper alloy stopvalves for potable water supply in buildings. Tests and requirements

BS EN 12288:2010

Industrial valves. Copper alloy gate valves.

BS EN 12334:2001

Industrial valves. Cast iron check valves

BS EN 1254-1:1998

Copper and copper alloys. Plumbing fittings. Part 1 fittings with ends for capillary soldering or capillary brazing to copper tubes.

BS EN 1254-2:1998

Copper and copper alloys. Plumbing fittings. Part 2 fittings with compression ends for use with copper tubes

BS EN 1254-3:1998

Copper and copper alloys. Plumbing fittings. Part 3 Fittings with compression ends for use with plastics pipes

BS EN 13032-3:2007

Measurement and presentation of photometric data of lamps and luminaires. Part 3 Presentation of data for emergency lighting of work places

BS EN 13190:2001

Thermal insulation products for buildings. Factory made products of phenolic foam (PF). Specification

BS EN 13789:2010

Industrial valves. Cast iron globe valves

BS EN 14451:2005

Devices to prevent pollution by backflow of potable water. In-line anti-vacuum valves DN 8 to DN 80. Family D, type A

BS EN 1717:2000

Protection against pollution of potable water in water installations and general requirements of devices to prevent pollution by backflow

BS EN 1982:2008

Copper and copper alloys. Ingots and castings

BS EN 1984:2010

Industrial valves. Steel gate valves

BS EN 215:2004

Thermostatic radiator valves. Requirements and test methods

BS EN 593:2009+A1:2011

Industrial valves. Metallic butterfly valves

BS EN 736-1:1995

Valves. Terminology. Part 1 Definition of types of valves

BS EN 806-4:2010

Specifications for installations inside buildings conveying water for human consumption. Part 4 Installation

BS EN 837-1:1998

Pressure gauges. Part 1 Bourdon tube pressure gauges. Dimensions, metrology, requirements and testing

BS EN ISO 228-1:2003

Pipe threads where pressure-tight joints are not made on the threads. Part 1 Dimensions, tolerances and designation

BS EN ISO 4126-1:2013

Safety devices for protection against excessive pressure. Part 1 Safety valves

BS EN ISO 4126-7:2013

Safety devices for protection against excessive pressure. Common data

BS ISO 15348:2002

Pipework. Metal bellows expansion joints. General

ISO 7-1:1994

Pipe threads where pressure-tight joints are made on the threads. Part 1 Dimensions, tolerances and designation

Y23 STORAGE CYLINDERS AND CALORIFIERS

1000 GENERAL

1010 STANDARDS:

- Comply with British Standards indicated.

1020 DEFINITIONS:

- Direct cylinder - a closed cylindrical vessel with domed ends.
- Indirect cylinder - a closed cylindrical vessel with domed ends having separate integral means of heating contents by annular or coil type element.
- Combination unit - an indirect/direct cylinder of double or single feed type with attached feed cistern.
- Calorifier - a closed cylindrical vessel having separate integral means of heating contents by 'U' tube chest type element.
- Primary heater - a heater mounted inside a cylinder or calorifier for transfer of heat to stored water from primary medium.
- Capacity - the volume of water storage excluding contents of any primary heater.
- Secondary working head - the vertical distance between bottom of cylinder or calorifier and water line of cistern supplying cylinder or calorifier.

2000 PRODUCTS/MATERIALS

2010A STEEL DIRECT CYLINDERS:

- Standard - BS 417-2; vertical arrangement.
- Connections as BS 417.
- Features - Drain cock.
- Hand hole to BS 417-2 clause 28.2.2.
- Supports - Purpose made feet or support frame.

2010B STEEL DIRECT CYLINDERS WITH IMMERSION HEATER:

- Standard - BS 417-2; vertical arrangement.
- Connections as BS 417. Provide connections for combined immersion heater and thermostat as clause 28.1.2.
- Features - Combined immersion heater and thermostat; drain cock.
- Hand hole to BS 417-2 clause 28.2.2.
- Supports - Purpose made feet or support frame.

2010C STEEL DIRECT CYLINDERS WITH GAS CIRCULATOR:

- Standard - BS 417-2; vertical arrangement.
- Connections as BS 417. Provide connections for gas circulator to BS 5546.
- Features - Gas circulator; drain cock.
- Hand hole to BS 417-2 clause 28.2.2.
- Supports - Purpose made feet or support frame.

2020A COPPER DIRECT CYLINDERS:

- Standard BS 1566-1, Type D; vertical arrangement.

- Connections as BS 1566-1.
- Provide screwed boss for drain tap, size and position as indicated.
- Features - Drain cock.
- Hand hole, size and position as drawing.
- Supports - Purpose made feet or support frame.
- Provide protective isolation material to prevent electrolytic action where mild steel is used.

2020B COPPER DIRECT CYLINDERS WITH IMMERSION HEATER:

- Standard BS 1566-1, type D; vertical arrangement.
- Connections as BS 1566-1.
- Provide connections for combined immersion heater and thermostat; and screwed boss for drain tap, size and position as indicated.
- Features - Combined immersion heater and thermostat; drain cock.
- Hand hole, size and position as drawing.
- Supports - Purpose made feet or support frame.
- Provide protective isolation material to prevent electrolytic action where mild steel is used.

2020C COPPER DIRECT CYLINDERS WITH GAS CIRCULATOR:

- Standard BS 1566-1, type D; vertical arrangement.
- Connections as BS 1566-1 type D.
- Provide connection for gas circulator to BS 5546; and screwed boss for drain tap, size and position as indicated.
- Features - Gas circulator: drain cock.
- Hand hole, size and position as drawing.
- Supports - Purpose made feet or support frame.
- Provide protective isolation material to prevent electrolytic action where mild steel is used.

2030A COPPER DOUBLE FEED INDIRECT CYLINDERS (GRAVITY FED OR PUMPED SYSTEMS):

- Standard - BS 1566-1, Type G; vertical arrangement.
- Connections as BS 1566-1.
- Provide screwed boss for drain cock.
- Features - Drain cock.
- Supports - Purpose made feet or support frame.
- Provide protective isolation material to prevent electrolytic action where mild steel is used.

2030B COPPER DOUBLE FEED INDIRECT CYLINDERS WITH IMMERSION HEATER (GRAVITY FED OR PUMPED SYSTEMS):

- Standard - BS 1566-1, type G; vertical arrangement.
- Connections as BS 1566-1.
- Provide connections for immersion heater and thermostat; and screwed boss for drain cock.
- Features - Immersion heater and thermostat; drain cock.
- Supports - Purpose made feet or support frame.
- Provide protective isolation material to prevent electrolytic action where mild steel is used.

2030C COPPER DOUBLE FEED INDIRECT CYLINDERS (PUMPED SYSTEM):

- Standard - BS 1566-1, Type P; vertical arrangement.
- Connections as BS 1566-1.
- Provide screwed boss for drain cock.

- Features - Drain cock.
- Supports - Purpose made feet or support frame.
- Provide protective isolation material to prevent electrolytic action where mild steel is used.

2030D COPPER DOUBLE FEED INDIRECT CYLINDERS WITH IMMERSION HEATER (PUMPED SYSTEM):

- Standard - BS 1566-1, type P; vertical arrangement.
- Connections as BS 1566-1.
- Provide connections for immersion heater and thermostat; and screwed boss for drain cock.
- Features - Immersion heater and thermostat; drain cock.
- Supports - Purpose made feet or support frame.
- Provide protective isolation material to prevent electrolytic action where mild steel is used.

2040# COPPER SINGLE FEED INDIRECT CYLINDER:

- Standards - BS 1566-2, type reference as indicated.
- Arrangement Vertical.
- Primary heater
 - Coil type - C.
 - Annular type - A.
 - Class 110.
 - Class 180.
- Connections
 - As BS 1566-1.
 - Provide connections for features
 - Combined immersion heater and thermostat.
 - Top entry.
 - Side entry.
 - Screwed boss for draining tap.
 - Gas circulator.
 - As shown on drawing number indicated.
- Features
 - Combined immersion heater and thermostat.
 - Gas circulator.
 - Insulation jacket to BS 5615.
 - Aluminium protector rod.
 - Drain cock.
- Supports
 - Brick or concrete piers.
 - Mild steel cradles with protective isolation material to prevent electrolytic action.
 - Purpose made feet or support frame.

2040A COPPER SINGLE FEED INDIRECT CYLINDER, COIL TYPE C:

- Standard - BS 1566-2; vertical arrangement.
- Primary heater, coil type C.
- Connections as BS 1566-2.
- Provide screwed boss for drain tap.
- Features - Drain cock.
- Supports - Purpose made feet or support frame.
- Provide protective isolation material to prevent electrolytic action where mild steel is used.

2040B COPPER SINGLE FEED INDIRECT CYLINDER, COIL TYPE C, WITH IMMERSION HEATER:

- Standard - BS 1566-2; vertical arrangement.
- Primary heater, coil type C.
- Connections as BS 1566-2.
- Provide connections for immersion heater and thermostat; and screwed boss for drain tap.
- Features - Immersion heater and thermostat; drain cock.
- Supports - Purpose made feet or support frame.
- Provide protective isolation material to prevent electrolytic action where mild steel is used.

2040C COPPER SINGLE FEED INDIRECT CYLINDER, ANNULAR TYPE A:

- Standard - BS 1566-2; vertical arrangement.
- Primary heater, annular type A.
- Connections as BS 1566-2.
- Provide screwed boss for drain tap.
- Features - Drain cock.
- Supports - Purpose made feet or support frame.
- Provide protective isolation material to prevent electrolytic action where mild steel is used.

2040D COPPER SINGLE FEED INDIRECT CYLINDER, ANNULAR TYPE A, WITH IMMERSION HEATER:

- Standard - BS 1566-2; vertical arrangement.
- Primary heater, annular type A.
- Connections as BS 1566-2.
- Provide connections for immersion heater and thermostat; and screwed boss for drain tap.
- Features - Immersion heater and thermostat; drain cock.
- Supports - Purpose made feet or support frame.
- Provide protective isolation material to prevent electrolytic action where mild steel is used.

2045A STAINLESS STEEL INDIRECT CYLINDER:

- Materials
 - Water container - stainless steel; casing - white plastic coated steel; thermal insulation - 40-50mm thick CFC free fire retardant polyurethane.
- Connections - Manufacturer's standard.
- Features
 - Combined immersion heater and thermostat; temperature and pressure relief valve with discharge; drain cock.
- Supports - Purpose made feet or support frame.

2050A DIRECT HOT WATER STORAGE COMBINATION UNIT WITH IMMERSION HEATER:

- Standard - Copper combination unit, domestic service, BS 3198. Direct unit (DIR); vertical arrangement.
- Shape and dimensions - Cylindrical or rectangular as shown on drawings.
- Connections as BS 3198.
- Provide connections for immersion heater; float operated valve; and warning pipe.
- Features - Immersion heater to BS EN 60335-2-73 and thermostat to BS EN 60730-2-9 and BS EN 14597; float operated valve, size and type as indicated; and drain cock.
- Supports - free-standing or with support frame as shown on drawings.

2050B DIRECT HOT WATER STORAGE COMBINATION UNIT WITH GAS CIRCULATOR:

- Standard - Copper combination unit, domestic service, BS 3198. Direct unit (DIR); vertical arrangement.
- Shape and dimensions - Cylindrical or rectangular as shown on drawings.
- Connections as BS 3198.

- Provide connections for gas circulator; float operated valve; and warning pipe.
- Features - Gas circulator to BS 5546; float operated valve, size and type as indicated; and drain cock.
- Supports - free-standing or with support frame as shown on drawings.

2050C DOUBLE FEED INDIRECT HOT WATER STORAGE COMBINATION UNIT WITH F&E CISTERN AND IMMERSION HEATER:

- Standard - Copper combination unit, domestic service, BS 3198. Double feed indirect unit (DF) with integral primary feed and expansion cistern; vertical arrangement.
- Shape and dimensions - Cylindrical or rectangular as shown on drawings.
- Connections as BS 3198.
- Provide connections for immersion heater; float operated valve; and warning pipe.
- Features - Immersion heater to BS EN 60335-2-73 and thermostat to BS EN 60730-2-9 and BS EN 14597; float operated valve, size and type as indicated; and drain cock.
- Supports - free-standing or with support frame as shown on drawings.

2050D DOUBLE FEED INDIRECT HOT WATER STORAGE COMBINATION UNIT WITH IMMERSION HEATER:

- Standard - Copper combination unit, domestic service, BS 3198. Double feed indirect unit (DF) without integral primary feed and expansion cistern; vertical arrangement.
- Shape and dimensions - Cylindrical or rectangular as shown on drawings.
- Connections as BS 3198.
- Provide connections for immersion heater; float operated valve; and warning pipe.
- Features - Immersion heater to BS EN 60335-2-73 and thermostat to BS EN 60730-2-9 and BS EN 14597; float operated valve, size and type as indicated; and drain cock.
- Supports - free-standing or with support frame as shown on drawings.

2050E SINGLE FEED INDIRECT HOT WATER STORAGE COMBINATION UNIT WITH IMMERSION HEATER:

- Standard - Copper combination unit, domestic service, BS 3198. Single feed indirect unit (SF); vertical arrangement.
- Shape and dimensions - Cylindrical or rectangular as shown on drawings.
- Connections as BS 3198.
- Provide connections for immersion heater; float operated valve; and warning pipe.
- Features - Immersion heater to BS EN 60335-2-73 and thermostat to BS EN 60730-2-9 and BS EN 14597; float operated valve, size and type as indicated; and drain cock.
- Supports - free-standing or with support frame as shown on drawings.

2060A GALVANIZED STEEL CALORIFIER/STORAGE VESSEL TO BS 853-1:

- Method of heating - Hot water.
- Inspection opening
 - Size and position as shown on drawings.
 - Horizontal or vertical as shown on drawings.
 - Fixed or bolted end as shown on drawings.
- Type of heater
 - Fixed helical coil; withdrawable helical coil; or U-tube battery as indicated.
- Materials
 - Shell - galvanized steel with sacrificial anode.
 - Material test certificates to BS 853-1
 - Hydraulic test certificates to BS 853-1
- Provide connections and supports as shown on drawings and as indicated.
 - Mountings to BS 853-1

2060B COPPER CALORIFIER/STORAGE VESSELS TO BS 853-1:

- Method of heating - Hot water.
- Inspection opening
 - Size and position as shown on drawings.
- Horizontal or vertical as shown on drawings.
- Fixed or bolted end as shown on drawings.
- Type of heater
 - Fixed helical coil; withdrawable helical coil; or U-tube battery as indicated.
- Shell material - copper.
 - Material test certificates to BS 853-1
 - Hydraulic test certificates to BS 853-1
- Provide connections and supports as shown on drawings and as indicated.
 - Mountings to BS 853-1

3000 WORKMANSHIP

3010 GENERAL:

- Store, handle and erect all in accordance with manufacturer's recommendations and relevant British Standards.
- Make allowance for valves, fittings, access etc., to accommodate insulation/weathering where indicated.

3030 PROTECTION AND CLEANING:

- Ensure protection from damage and ingress of foreign matter to cylinders and calorifiers during storage, installation and testing.

3040 INSPECTION AND CLEANING:

- Install cylinders and calorifiers such that internal surfaces and external surfaces can be readily inspected and cleaned.

BS APPENDIX

BS 1566-1:2002+A1:2011

Copper indirect cylinders for domestic purposes. Part 1 Open vented copper cylinders. Requirements and test methods

BS 1566-2:1984

Copper indirect cylinders for domestic purposes. Part 2 Specification for single feed indirect cylinders

BS 3198:1981

Specification for copper hot water storage combination units for domestic purposes

BS 417-2:1987

Specification for galvanized low carbon steel cisterns, cistern lids, tanks and cylinders. Part 2 Metric units

BS 5546:2010

Specification for installation of hot water supplies for domestic purposes, using gas-fired appliances of rated input not exceeding 70 kW

BS 5615:1985

Specification for insulating jackets for domestic hot water storage cylinders

BS 853-1:1990+A3:2011

Specification for vessels for use in heating systems. Part 1 Calorifiers and storage vessels for central heating and hot water supply

BS EN 14597:2012

Temperature control devices and temperature limiters for heat generating systems

BS EN 60335-2-73:2003+A2:2009

Household and similar electrical appliances. Safety Part 2-73 Particular requirements for fixed immersion heaters

BS EN 60730-2-9:2010

Automatic electrical controls for household and similar use. Part 2-9 Particular requirements for temperature sensing controls

Y25 CLEANING AND CHEMICAL TREATMENT

1000 GENERAL

1010 CONDITIONS FOR CLEANING AND CHEMICAL TREATMENT:

- Ensure treatment complies with statutory authority and health and safety regulations.
- Notify manufacturer's and suppliers of equipment of proposed system cleaning and chemical treatment processes. Establish if any manufacturer or supplier of equipment requires any particular cleaning and chemical treatment process due to size of waterways or materials used.
- All chemicals used are to be compatible with the metallurgy of the systems.
- Obtain local water authority approval for disposal of any waste products.

1015 METHOD STATEMENT:

- Provide a method statement covering the sequence of events, chemicals to be used etc. Statement to be provided at least two months prior to the start of any flushing and/or chemical cleaning works.

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.
- Carry out tests to establish total viable counts and Pseudomonas and sulphate reducing bacteria.
- Minimum water quality - as BSRIA BG 29/2012 Table 8.

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 a suitable inhibited glycol selected by the water treatment specialist is used.
 - Circulation has been demonstrated and approval obtained on all parts of the system. Manipulate and leave fully open all valves other than those used to isolate sections. Carry out balancing and certification after the flushing, cleaning and passivation operations.
 - No damage can occur to any item of plant or equipment due to cleaning and chemical processes.
 - Chemicals used are compatible with system materials.
 - All items of plant and equipment subject to damage or blockage due to cleaning and chemical treatment processes are isolated or removed.
 - Permanent or temporary by-passes are provided as indicated on drawings.
 - Dirt pockets are installed at low points to facilitate solids removal. Supply dirt pockets with drain valves sized to pipework size.

- All drains provided have been tested and approved and that any pumping equipment associated with the drainage system is fully commissioned.
- Dead legs, that are more than 3 pipe diameters in length are looped to allow effective cleaning.
- Strainer baskets and filter media, incorporated within systems, are removed; and where necessary spool or stool pieces are installed.
- Temporary strainers and filters are installed as required for removal of solids during cleaning and chemical treatment processes.
- Strainers are clean prior to the start of the cleaning process, throughout the cleaning and on completion.
- Suitable supply and drainage points are provided with 50mm minimum connections, properly sited and installed, either valved or plugged.
- All automatic/manual air vents are fully commissioned.
- Air vents of a minimum size of 25mm are installed at the tops of large flow risers.
- All requirements of COSHH regulations are complied with during the chemical cleaning and chemical treatment of the system.
- Where required by local water authority, provide effluent tanks for storage of all waste products of cleaning and chemical treatment processes.
- Following local water authority approval, either neutralize and dispose to drain of all waste products; or ensure authorised disposal at registered sites.
- Comply with Waste Management Duty of Care: A Code of Practice and The Hazardous Waste (England & Wales) Regulations 2005 where appropriate.

2040A PROCEDURAL PRECAUTIONS FOR CLEANING AND CHEMICAL TREATMENT:

- Carry out tests to ensure that cleaning and chemical treatment processes are operating as required.
- Carry out tests to ensure that cleaning and chemical treatment processes are operating as required. and detailed in the Method Statement.
- Submit all test and sample results for certification and approval.

2040B PROCEDURAL PRECAUTIONS FOR CLEANING AND CHEMICAL TREATMENT INCLUDING TAKING SAMPLES:

- Take and test samples of the filling/flushing water and the system water, before, during and following chemical treatment and/or cleaning in accordance with BSRIA BG 29/2012, Section 3 and BS 8552.
- Submit samples to an independent specialist for analysis in accordance with BSRIA BG 29.
- Monitor water quality of systems after pre-commission cleaning up to practical completion in accordance with BSRIA BG 29/2012 Section 3.2.
- Submit all test and sample results for certification and approval.
- Ensure all contractually required samples are witnessed.

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

- Corrosion and scale control
 - Chemicals as BSRIA Guide BG 50/2013 Table 5.
- Control of microbiological fouling
 - Chemical.
 - Biocides and biodispersants. Chemicals as BSRIA BG 50/2013 Appendix C and European Biocidal Products Regulation (BPR) 528/2012.

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

- Corrosion control
 - Chemicals as BSRIA Guide BG 50/2013 Table 5.
- Control of microbiological fouling

- Chemical.
- Biocides and biodispersants. Chemicals as BSRIA BG 50/2013 Appendix C and European Biocidal Products Regulation (BPR) 528/2012.

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 and European Biocidal Products Regulation (BPR) 528/2012.
 - Physical - Ultraviolet disinfection units.

2060A CHEMICAL INJECTION AND DOSING METHODS FOR CLOSED SYSTEMS:

- Method of introducing chemicals
 - Dosing pots.

2060B CHEMICAL CLEANING 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.

2060D DOSING POTS - CLOSED SYSTEMS:

- Chemical feed
 - Provide feeder (dosing pots) with a tundish for filling; separate air vent with discharge tube; drain and isolating valves. Fabricate from mild steel tube to BS EN 10255, BS EN 10216 or BS EN 10217 to suit maximum working pressure of system.
- Sampling
 - Install in each water system means of taking samples as clause Y25.2070B and as follows:-
 - Chilled water systems - provide a gate valve and discharge.
 - Heating systems - provide a sample cooler with a copper coil and cooling jacket with cooling water valve and drained to waste.

2060E DOSING - OPEN SYSTEMS:

- Chemical dosing
 - Provide an interface between water treatment plant and system pumps to allow the initiation of water circulation in addition to the requirements of the building services.
 - Where control by-passes are used, set valves to allow reduced circulation but not complete isolation of the equipment.
 - Provide control of chemical inhibitors by linking the dosing pump control unit to operate on a signal from

a water meter.

- Provide skid mounted packaged equipment to feed chemical inhibitors including pre-wired controls and dosing pump, high density polyethylene tank, chemical diaphragm pump complete with all necessary valves and tubing.
- Provide control of total dissolved solids by linking a solenoid purge valve to operate by a signal automatically received from a conductivity sensor.
- Biocide dosing
 - Provide skid mounted packaged equipment to feed two types of biocides on an automatically alternating basis including pre-wired timer controls and twin biocide diaphragm pumps complete with all necessary valves and tubing. Draw biocide chemical direct from the chemical supply drums located on the skid.
- Control
 - Provide low level alarms for all dosing units.
 - Provide BMS connections to monitor dosing and show run and alarm conditions.
- Injection manifold
 - Provide an injection manifold for use with the above water treatment equipment.
 - Connect the manifold across flow and return pipework and mount above the dosing plant modules, unless otherwise indicated.

2065 CHEMICALS - DOSING:

- Provide biocides effective against Legionella Pneumophila, algae, fungi, moulds and slime forming bacteria including pseudomonas and sulphate reducing bacteria.
- Supply biocides as recommended by water treatment specialist.
- Incorporate a bio dispersant in the programme to break up and disperse any slime masses, where required.
- Biocides to comply with European Biocidal Products Regulation (BPR) 528/2012.
- The water treatment specialist shall select the appropriate corrosion inhibitors, to minimise corrosion, and biocides to prevent any proliferation to mild steel, copper and copper alloys.
- Provide a specific inhibitor to protect aluminium when it is present in the system.
- The cleaning agent is to be specified by the water treatment specialist.

2070A MONITORING CLOSED SYSTEMS:

- For closed systems monitor system physical, chemical and bacterial levels from initial fill to practical completion in accordance with BSRIA BG 29/2012 and BS 8552.

2070B SAMPLING:

- For closed systems provide sampling points in accordance with BS 8552 and BSRIA BG 29/2012.
- Provide testing equipment to carry out tests for all inhibitors used in treatment programme indicated.
- Undertake sampling of closed systems in accordance with BSRIA BG 29/2012, Section 3 and Appendices A and B.
- Number and locations of samples in compliance with BG 29/2012, Appendix A.

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.
- For open systems - bacteriology monitoring with use of dipslides.
- Log sheets for recording of test results, bacteriological analysis and any actions required or taken.

2070D MONITORING OPEN SYSTEMS:

- Provide monitoring system to enable online 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.
- For evaporative cooling systems provide facilities to enable system to be monitored and samples taken in accordance with the guidelines in HSG 274 Part 1: The control of legionella bacteria in evaporative cooling.

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.

2090 AVOIDANCE OF STAGNANT WATER IN PRESSURISATION UNIT EXPANSION VESSELS:

- Install pressurisation units with re-circulating circuits, to avoid stationary pockets of water and minimise bacterial growth.

3000 WORKMANSHIP

3010A FLUSHING:

- Carry out flushing of water systems in accordance with BSRIA Guide BG 29/2012 Pre-commission cleaning of pipework systems.
 - Section 4 Installation Considerations.
 - Section 5 System Dynamic Flushing.

3010B FLUSHING:

- Ensure all water used for pressure testing, flushing and system filling is of good quality. Clean and chlorinate temporary site mains to fill and flush closed systems in accordance with BS EN 806-4. Leave remaining pipework sections full and treated after pressure testing.
- Install all necessary pipework ancillaries to enable a specialist to carry out flushing, inspection and witnessing of water systems in accordance with BSRIA Guide BG 29/2012. Pre-commission cleaning of pipework systems. Connections between new and existing systems in accordance with BG 29/2012 Section 7.
- Temporary connection from the mains must be in compliance with
 - WRAS advisory topics B09 or B22.
 - England and Wales - The Water Supply (Water Fittings) Regulations 1999, the Water Act 2014 and the Construction Products Regulations 2013.
 - Scotland - The Water Supply (Water Fittings) Byelaws 2014.
 - Northern Ireland - The Water Supply (Water Fittings) Regulations (Northern Ireland) 2009.
 - BSRIA BG 29/2012 Table 3 for pipe sizes when using mains water for flushing or installation of a temporary tank and pump arrangement shall be provided.
- Domestic water systems are to be flushed and disinfected in accordance with the requirements of BS EN 806-4 and complimentary guidance in BS 8558, and to the satisfaction of the local water supply authority. Flush systems using mains water until the water is clear.

3010C FLUSHING AND CLEANING STEAM AND CONDENSATE SYSTEMS:

- Comply with the requirements of B&ES TR/20, Part 8, Section 10 for system cleanliness.
- Where indicated steam systems shall be scoured using live steam or compressed air in accordance with a

method statement that satisfies the HSE requirements.

3020A TESTING AND PURGING GAS PIPEWORK - INDUSTRIAL AND COMMERCIAL INSTALLATIONS:

- Comply with IGE/UP/1 Strength and tightness testing and direct purging of industrial and commercial gas installations.

3020B TESTING AND PURGING GAS PIPEWORK - SMALL LOW PRESSURE INDUSTRIAL AND COMMERCIAL INSTALLATIONS:

- Comply with IGE/UP/1A Strength and tightness testing and direct purging of small low pressure industrial and commercial natural gas installations.

3020C TESTING GAS PIPEWORK TO BS EN 12327:

- Purge each system using nitrogen or carbon dioxide
 - This operation is to prove the continuity of the pipework, remove any cutting fluid and ensure that the nozzles are clear.
 - Flimsy paper bags are to be attached to all nozzles during the purge and removed upon completion of the purge.

3030A CHEMICAL CLEANING AND SOLIDS REMOVAL - INHIBITED ACID:

- Carry out chemical cleaning procedure in accordance with BSRIA Guide BG 29/2012 Pre-commission Cleaning of Pipework Systems.

3030B CHEMICAL CLEANING AND SOLIDS REMOVAL - FORMULATED PRODUCTS:

- Carry out chemical cleaning procedure in accordance with BSRIA Guide BG 29/2012 Pre-commission Cleaning of Pipework Systems.

3035 CLEANING AND CHEMICAL TREATMENT REGIME:

- The specialist shall submit a method statement prior to commencing work which fully prescribes the proposed regime and sequence for the flushing, cleaning and chemical treatment of all closed and condenser water systems. The following shall be considered in preparation of the method statement:
 - Delay filling the pipework for the first time for as long as possible.
 - If any pipework is to be wet for more than 2 weeks prior to cleaning, treat the fill water with biocide and bio-dispersant.
 - Take samples for microbiological analysis in accordance with BG 29/2012 Section 3.
 - If sample results are poor, undertake a biocide wash on all previously wetted areas after the initial flush. Biocide treated water should be drawn into any previously wetted terminal unit coils slowly (which have been isolated for the clean) to avoid the introduction of debris, after which the coils should be isolated again.
 - During the initial flush flows should be maximised, recorded and witnessed. Batch work on terminal unit by-passes should be carefully undertaken in accordance with BSRIA BG 29/2012, and the correct number of terminal unit by-passes opened at any one time in order to maximise flow along the horizontal runs.
 - Static flushing.
 - Dynamic flushing.
 - Degreasing.
 - Biocide wash.
 - Removal of surface oxides (for systems with carbon steel components).
 - Effluent disposal/final flushing.
 - Neutralisation (for inhibited acid cleans only).

- Passivation.
- Corrosion inhibitor and final biocide dosing.
- Monitoring and sampling of water to practical completion.

3040 STERILIZATION - GENERAL:

- After flushing process, carry out sterilization of water services systems in accordance with BS EN 806-4 and complimentary guidance in BS 8558.
- 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.
- If the building is not occupied immediately after sterilisation, put in hand a system for flushing all outlets to ensure system remains suitable for use when required.
- Repeat disinfection of potable water system immediately prior to handover if required.
- Immediately prior to occupation, retake samples and submit for analysis and report.

3050 STERILIZATION - MAINS WATER SYSTEM:

- Carry out the following operations in accordance with BS EN 806-4 and complimentary guidance in BS 8558.
 - Flush system and introduce sterilisation chemical.
 - Agree a list of sentinel points (outlets in a water system that poses the highest risk from infection) prior to sterilisation and take samples from these points to ensure correct chlorine concentration.
 - Leave system to stand for period of time indicated by the chemical manufacturer.
 - 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 EN 806-4, complementary guidance in BS 8558 and HSE L8 Legionnaires' disease - control of legionella bacteria in water systems ACOP and all parts of HSG 274 (for technical guidance).
- Carry out operations on all water storage tanks and cisterns, cold and hot.
- Carry out procedures as for mains water systems.

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.
 - Undertake a sampling of closed systems in accordance with BS 8552.
 - Carry out micro-biological analysis using dipslides.
 - Frequency of service visits - monthly.
- 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.

BS APPENDIX

BS 8552:2012

Sampling and monitoring of water from building services closed systems. Code of practice

BS 8558:2015

Guide to the design, installation, testing and maintenance of services supplying water for domestic use within buildings and their curtilages. Complimentary guidance to BS EN 806

BS EN 10255:2004

Non-alloy steel tubes suitable for welding or threading. Technical delivery conditions

BS EN 12327:2012

Gas infrastructure. Pressure testing, commissioning and decommissioning procedures. Functional requirements

BS EN 806-4:2010

Specifications for installations inside buildings conveying water for human consumption. Part 4 Installation

Y30 AIR DUCTLINES AND ANCILLARIES

1000 GENERAL

1010 DUCTWORK INSTALLATION STANDARDS:

- Carry out construction and installation of ductwork in accordance with, as appropriate
 - DW/144
 - DW/154
 - DW/172
 - DW/191
 - BS 9999
 - BS EN 1507
 - BS EN 12237
- BS EN 13403

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 is provided suitable for connection of a main protective conductor complying with BS 7671, clause 544.1.

2000 DUCTWORK FABRICATION/MATERIALS

2010A DESIGN INFORMATION - CLASS A POSITIVE:

- Supply ductwork in accordance with classification in DW/144 and DW/154 Table 1, BS EN 1507 Table 1 and BS EN 12237 Table 2.
- Ductwork classification and air leakage limits
 - Low pressure - Class A - Positive. $(0.027 \times p^{0.65})$ l/s/m² duct surface).

2010B DESIGN INFORMATION - CLASS A NEGATIVE:

- Supply ductwork in accordance with classification in DW/144 and DW/154 Table 1, BS EN 1507 Table 1 and BS EN 12237 Table 2.
- Ductwork classification and air leakage limits
 - Low pressure - Class A - Negative. $(0.027 \times p^{0.65})$ l/s/m² duct surface).

2025 SPARK TESTING ON PLASTICS DUCTWORK:

- Carry out spark testing in accordance with DW/154 at land marks identified in the contract programme.

2030C LOW PRESSURE DUCTWORK AIR LEAKAGE TESTING:

- Test indicated or scheduled % of the low pressure ductwork for air leakage. Test at the pressure recommended in DW/144 for the classification of the selected ductwork as procedures set out in DW/143. Carry out the tests as the work proceeds and prior to application of thermal insulation.
- If the test fails, pressure test two further sections as indicated. If the further tests fail, apply remedial action to the complete ductwork system.

- Provide documented evidence of the calculations used to arrive at the allowable loss for the section to be tested and ensure the client or his agent witness and signs the results of the tests.
- Testing plant items as DW/144.

2035 STRENGTH AND LEAKAGE TESTING OF CIRCULAR SHEET METAL DUCTWORK:

- Carry out ductwork strength and air leakage testing on circular sheet metal ductwork in accordance with BS EN 12237.
- Test procedure shall be as detailed in BS EN 12237, Section 7.
- Produce a test report as detailed in BS EN 12237, Section 8.

2036 STRENGTH AND LEAKAGE TESTING OF RECTANGULAR SHEET METAL DUCTWORK:

- Carry out ductwork strength and air leakage testing on rectangular sheet metal ductwork in accordance with BS EN 15727.
- Test procedure shall be detailed in BS EN 15727.
- Produce a test report as detailed in BS EN 15727.

2065 KITCHEN EXTRACT SYSTEMS:

- Comply with HVCA DW/172 Appendix D' and B&ES DW/144.
- Comply with Section 7 of B&ES TR/19 for facilities and specific requirements for cleaning.
- Access doors for cleaning (with grease tight gaskets) shall be installed at every bend and connection and at every 3m on straight lengths of ductwork. All joints shall be grease-tight.
- The entire system installation shall comply with all relevant Building Regulations and any specific requirements of the Building Control and Fire Officer.
- Ductwork - to be fire rated as scheduled or described in work section U12.

2070 MAN ACCESS AND SAFETY BARS:

- Man access is required where indicated on drawings. Ensure that duct floor is of sufficient strength to comply with safety standards.
- Provide safety bars where indicated at the top of risers.

2110A FIRE PROTECTION WITH FIRE DAMPERS:

- Ensure complete ductwork system complies with the requirements of BS 476-24 and BS EN 12101.
- Supply and install fire rated ductwork. Method of protection DW/144 using fire dampers.

2110B FIRE PROTECTION WITH FIRE RESISTING ENCLOSURES:

- Ensure complete ductwork system complies with the requirements of BS 476-24.
- Supply and install fire rated ductwork. Method of protection DW/144 using fire resisting enclosures.

2110C FIRE RATED AND SMOKE EXTRACT DUCTWORK:

- Ensure complete ductwork system complies with the requirements of BS 476-24 for testing, BS EN 12101 and BS 9999.
- Supply and install fire rated ductwork. Method of protection BS 476-24 and BS 9999.
- Drop rods and exposed bearers to be insulated in accordance with manufactures recommendations and instructions.
- Where a vapour barrier is required, all exposed edges and penetrations through the foil should be sealed

using soft self-adhesive aluminium foil tape.

2110D FIRE RATED DUCTWORK:

- Ensure complete ductwork system complies with the requirements of BS EN 12101, BS 476-24 and BS 9999.
- Supply and install fire rated ductwork. B&ES DW/144 using fire resisting ductwork using either fire protection cladding on-site, factory applied fire resisting finish or factory manufactured fire rated ductwork as detailed elsewhere in this specification. Ductwork to be in accordance with B&ES DW/144.
- Insulation system to be independently tested and carry current valid certification to provide fire protection fully in accordance with the requirements of duct 'Type A' and duct 'Type B' of BS EN 12101, BS 476-24 and BS 9999.
- Drop rods and exposed bearers to be insulated in accordance with manufacturers recommendations and instructions.
- Where a vapour barrier is required, all exposed edges and penetrations through the foil should be sealed using soft self-adhesive aluminium foil tape.

2120A INTERNAL THERMAL/ACOUSTIC INSULATION:

- Fit internal linings at works in accordance with DW/144..

2121 EXTERNAL THERMAL/ACOUSTIC INSULATION:

- Acoustic Insulation
 - Material
 - Duct wrap lamellae acoustic insulation.
 - Polymeric mass layer
 - 5 kg/m²
 - 10 kg/m²
 - Acoustic performance
 - Minimum Sound Reduction Index (SRI)

Frequency (Hz)	63	125	250	500	1K	2K	4K
Overall sound reduction index inc 0.8mm steel duct							

- Standards: Tested to BS EN ISO 717-1, and relevant parts of BS EN ISO 10140.
 - To manufacturer's standard.
- Insulation thickness
 - 25mm
 - 50mm
- Insulation thermal conductivity
 - W/mK
- Fire resistance: Class 0 Building Regulations when tested to BS 476-6 and BS 476-7
- Lengths
 - 1m
 - 2m
- Finish
 - Reinforced aluminium foil (outer)
- Installation
- To manufacturer's standard.

2130B PRE-INSULATED ALUMINIUM DUCTWORK:

- External aluminium - Thickness 8mm.
 - Finish - Embossed, protected with polyester lacquer
- Internal aluminium - Thickness 8mm.
 - Finish - Embossed, protected with polyester lacquer
- Insulation - 20mm polyurethane.

2140A HANGERS AND SUPPORTS:

- Provide hangers and supports throughout in accordance with DW/144; DW/154 Part 5; or DW/191 Section 7 as appropriate.
- Comply with BS EN 12236.

2150A SUPPORT OF AIR TERMINAL UNITS:

- Support air terminal units and their plenums by the ceiling grids, as DW/144.

3000 ACCESSORIES AND COMPONENTS

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.
- Ensure casing losses of components are compatible with ductwork in which they are incorporated.

3020A METAL DUCTWORK INSPECTION/SERVICING ACCESS OPENINGS:

- Provide access/inspection openings in accordance with DW/144.

3020D DUCTWORK INSPECTION/SERVICING ACCESS OPENINGS:

- Provide access/inspection openings in accordance with B&ES TR/19.

3030A METAL DUCTWORK TEST HOLES:

- Provide test holes in ductwork system, as shown on drawings, to allow complete testing and balancing of system in accordance with CIBSE Commissioning Code A.
- Site drill test holes in accordance with B&ES DW/144.

3040 HOLES FOR CONTROLS/INSTRUMENTS - METAL DUCTWORK:

- Provide holes in ductwork, in accordance with B&ES DW/144 to accommodate thermostats, humidistats and other control sensors in positions and sizes indicated on drawings.

3041 CONTROLS/SENSING EQUIPMENT - PLASTICS DUCTWORK:

- Install sensors and test points to suit specialist control and sensing equipment in positions and fixing configurations shown on drawings.

3042 INSTALLATION OF INSTRUMENTS AND CONTROLS:

- Instruments and controls should be installed to manufacturers or specialist supplier's requirements. The installation must be checked by the manufacturer or specialist supplier, and rectified as necessary.

3050A CLEANING ACCESS - BASIC LEVEL OF PDI:

- Provide access for cleaning in accordance with B&ES documents DW/144 and TR/19.

3050B CLEANING ACCESS - INTERMEDIATE LEVEL OF PDI:

- Provide access for cleaning in accordance with B&ES documents DW/144 and TR/19.

3050C CLEANING ACCESS - ADVANCED PDI WITH POST INSTALLATION CLEAN:

- Provide access for cleaning in accordance with B&ES documents DW/144 and TR/19.
- The specialist cleaning contractor, in addition to taking advantage of openings fitted by the ductwork installer, shall supply and install any additional cleaning openings to suit their selected specific methods of cleaning and suit the practical site conditions relative to the fabric of the building and position of other services.

3060A STEEL SINGLE-BLADE BALANCING DAMPERS - METAL DUCTS:

- Provide single or double skin steel single blade balancing dampers in accordance with DW/144. Manual operation. Locations and size as shown on drawings.
- Undertake aerodynamic testing of dampers in accordance with BS EN 1751.
- Where required, determination of sound power levels to be by measurement in a reverberation room in accordance with BS EN ISO 5135.

3060B STEEL MULTI-BLADE BALANCING DAMPERS - METAL DUCTS:

- Provide single or double skin steel multi-blade balancing dampers in accordance with DW/144. Parallel or opposed blade, manual operation. Locations and size as shown on drawings.
- Undertake aerodynamic testing of dampers in accordance with BS EN 1751.
- Where required, determination of sound power levels to be by measurement in a reverberation room in accordance with BS EN ISO 5135.

3060C STEEL SINGLE-BLADE CONTROL DAMPERS - METAL DUCTS:

- Provide single or double skin steel single blade control dampers in accordance with DW/144. Locations and size as shown on drawings.
- Aerodynamic testing of dampers in accordance with BS EN 1751.
- Where required, determination of sound power levels to be by measurement in a reverberation room in accordance with BS EN ISO 5135.

3060D STEEL MULTI-BLADE CONTROL DAMPERS - METAL DUCTS:

- Provide single or double skin steel multi-blade control dampers in accordance with DW/144. Parallel or opposed blade, automatic operation. Locations and size as shown on drawings.
- Undertake aerodynamic testing of dampers in accordance with BS EN 1751.
- Where required, determination of sound power levels to be by measurement in a reverberation room in accordance with BS EN ISO 5135.

3060E IRIS CONTROL DAMPERS - METAL DUCTS:

- Provide regulating dampers in accordance with DW/144. Locations and size as shown on drawings.
- Undertake aerodynamic testing of dampers in accordance with BS EN 1751.

- Where required, determination of sound power levels to be by measurement in a reverberation room in accordance with BS EN ISO 5135.

3060F STEEL BACK DRAUGHT REGULATING DAMPERS - METAL DUCTS:

- Provide regulating dampers in accordance with DW/144. Locations and size as shown on drawings.
- Undertake aerodynamic testing of dampers in accordance with BS EN 1751.
- Where required, determination of sound power levels to be by measurement in a reverberation room in accordance with BS EN ISO 5135.

3061A SINGLE BLADE BALANCING DAMPERS - PLASTICS DUCTWORK:

- Provide single blade balancing dampers in accordance with DW/154 Part Six Section 16. Locations and size as shown on drawing.
- Undertake aerodynamic testing of dampers in accordance with BS EN 1751.
- Where required, determination of sound power levels to be by measurement in a reverberation room in accordance with BS EN ISO 5135.

3061B MULTI-BLADE BALANCING DAMPERS - PLASTICS DUCTWORK:

- Provide multi-blade balancing dampers in accordance with DW/154 Part Six Section 16. Locations and size as shown on drawing.
- Undertake aerodynamic testing of dampers in accordance with BS EN 1751.
- Where required, determination of sound power levels to be by measurement in a reverberation room in accordance with BS EN ISO 5135.

3061C SINGLE BLADE CONTROL DAMPERS - PLASTICS DUCTWORK:

- Provide single blade control dampers in accordance with DW/154 Part Six Section 16. Locations and size as shown on drawing.
- Undertake aerodynamic testing of dampers in accordance with BS EN 1751.
- Where required, determination of sound power levels to be by measurement in a reverberation room in accordance with BS EN ISO 5135.

3061D MULTI-BLADE CONTROL DAMPERS - PLASTICS DUCTWORK:

- Provide multi-blade control dampers in accordance with DW/154 Part Six Section 16. Locations and size as shown on drawing.
- Undertake aerodynamic testing of dampers in accordance with BS EN 1751.
- Where required, determination of sound power levels to be by measurement in a reverberation room in accordance with BS EN ISO 5135.

3070A STEEL CURTAIN FIRE DAMPERS - BLADES IN AIR STREAM:

- Supply and install steel folding curtain fire dampers, with blades in the air stream, in accordance with DW/144 and BS EN 15650, size and location as shown on the drawings.
- Where required undertake aerodynamic testing of fire dampers in accordance with BS EN 1751.
- Fire-resistance tests of thermal release mechanism in accordance with BS ISO 10294-4.

3070B STAINLESS STEEL CURTAIN FIRE DAMPERS - BLADES IN AIR STREAM:

- Supply and install stainless steel folding curtain fire dampers, with blades in the air stream, in accordance with DW/144 and BS EN 15650, size and location as shown on the drawings.
- Where required undertake aerodynamic testing of fire dampers in accordance with BS EN 1751.

- Fire-resistance tests of thermal release mechanism in accordance with BS ISO 10294-4.

3070C STEEL CURTAIN FIRE DAMPERS - BLADES OUT OF AIR STREAM:

- Supply and install steel folding curtain fire dampers, with blades out of the air stream in accordance with DW/144 and BS EN 15650, size and location as shown on the drawings.
- Where required undertake aerodynamic testing of fire dampers in accordance with BS EN 1751.
- Fire-resistance tests of thermal release mechanism in accordance with BS ISO 10294-4.

3070D STAINLESS STEEL CURTAIN FIRE DAMPERS - BLADES OUT OF AIR STREAM:

- Supply and install stainless steel folding curtain fire dampers, with blades out of the air stream, in accordance with DW/144 and BS EN 15650, size and location as shown on the drawings.
- Where required undertake aerodynamic testing of fire dampers in accordance with BS EN 1751.
- Fire-resistance tests of thermal release mechanism in accordance with BS ISO 10294-4.

3070E STEEL SINGLE BLADE FIRE DAMPERS:

- Supply and install steel single blade fire dampers in accordance with DW/144 and BS EN 15650, size and location as shown on the drawings.
- Where required undertake aerodynamic testing of fire dampers in accordance with BS EN 1751.
- Fire-resistance tests of thermal release mechanism in accordance with BS ISO 10294-4.

3070F STAINLESS SINGLE BLADE FIRE DAMPERS:

- Supply and install stainless steel single blade fire dampers in accordance with DW/144 and BS EN 15650, size and location as shown on the drawings.
- Where required undertake aerodynamic testing of fire dampers in accordance with BS EN 1751.
- Fire-resistance tests of thermal release mechanism in accordance with BS ISO 10294-4.

3070G STEEL MULTI-BLADE FIRE DAMPERS:

- Supply and install steel multi-blade fire dampers in accordance with DW/144 and BS EN 15650, size and location as shown on the drawings.
- Where required undertake aerodynamic testing of fire dampers in accordance with BS EN 1751.
- Fire-resistance tests of thermal release mechanism in accordance with BS ISO 10294-4.

3070H STAINLESS STEEL MULTI-BLADE FIRE DAMPERS:

- Supply and install stainless steel multi-blade fire dampers in accordance with DW/144 and BS EN 15650, size and location as shown on the drawings.
- Where required undertake aerodynamic testing of fire dampers in accordance with BS EN 1751.
- Fire-resistance tests of thermal release mechanism in accordance with BS ISO 10294-4.

3070I INTUMESCENT FIRE DAMPERS:

- Supply and install intumescent fire dampers in accordance with DW/144 and BS EN 15650, size and location as shown on the drawings.
- Fire resistance tests for intumescent dampers shall be in accordance with BS ISO 10294-5

3070J FIRE DAMPERS ACCESSORIES:

- Provide accessories compatible with fire dampers. Electrical cut-out switches and external visual indication of fire damper blade position.
- Supply spare fusible links for fire dampers to fuse at 72°C as specified in DW/144.

3075 FIRE DAMPERS - GENERAL:

- Types to be as identified elsewhere in the specification, in schedules or on drawings.
 - Fire dampers shall be supplied and fixed in accordance with the manufacturer's recommendations and installation methods which conform to the prevailing Building Regulations (ADB) and are acceptable to the District Surveyor/Building Control Officer and Fire Officer generally in accordance with DW/144 and DW/145 or DW/154. The proposed installation method must be supported by a valid test report or assessment provided by an approved third party notified body.
 - The construction shall allow for all additional framing supports, bracing and fire stopping as may be necessary to adequately attach/install the fire dampers to the structure. The assembly is to be approved by the Building Control Officer/District Surveyor and Fire Officer.
 - Each fire damper and associated installation method shall have at least the same standard of fire integrity as the wall or floor through which the duct passes.
 - Where required undertake aerodynamic testing of fire dampers in accordance with BS EN 1751.
 - The classification of fire dampers is to be in accordance with BS EN 13501-3 and shall have an integrity classification 'E' to meet that of the wall or floor.
 - When a fire integrity of 4 hours is required, either 2 dampers (classified E120) factory assembled in series (if acceptable to the Local Authority) or a single damper having a classification E240, may be used.
 - To achieve these classifications, fire resistance tests shall be in accordance with BS EN 1366-2, undertaken by a notified body.
 - Shutter dampers shall be provided with the shutter blades located outside the air stream (unless otherwise indicated). Each damper shall have a stainless steel curtain in all-welded galvanized steel casing with stainless steel side seal gaskets. The damper blade curtain shall be held in the folded position by a dual safe thermal actuator and fusible link.
- All damper blades shall be tensioned to ensure instantaneous closure on thermal activation at 72°C (unless specified elsewhere). A self-latching reset mechanism shall be provided for easy re-setting of the damper curtain.
- On completion of the installation, the contractor shall be responsible for ensuring the inspection and testing of all fire dampers installed are carried out. Upon completion of the tests, the certificates must be issued for confirming that the dampers have been inspected and that they function correctly in accordance with the manufacturer's data sheets.
 - Access panels with chains shall be provided adjacent to the access side of all fire dampers.
 - In no instances shall flexible duct connections be allowed onto fire dampers through walls or floors. Approved flexible connectors for breakaway joints, or duct expansion in case of fire, may be used in association with fire dampers.
 - Provide local external visual indication of fire damper blade position, unless indicated otherwise.

3100A COATED STEEL FLEXIBLE DUCTS:

- Supply and fasten coated steel flexible duct connections as DW/144. Use flexible duct connections in applications listed in DW/144.
- Comply with BS EN 13180 and provide a test certificate proving compliance with the mechanical characteristics of this standard.
- Ductwork and insulation to have a test certificate proving reaction to fire performance requirements of BS 9999. Materials to conform to Euroclass A1 as specified in BS EN 13501 or when tested to BS 476-6 has a fire propagation index of not more than 12 and a sub-index of not more than 6.
- Maximum length 600mm.

3100B ALUMINIUM FLEXIBLE DUCTS:

- Supply and fasten aluminium flexible duct connections as DW/144. Use flexible duct connections in applications listed in DW/144.
- Comply with BS EN 13180 and provide a test certificate proving compliance with the mechanical

characteristics of this standard.

- Ductwork and insulation to have a test certificate proving reaction to fire performance requirements of BS 9999. Materials to conform to Euroclass A1 as specified in BS EN 13501 or when tested to BS 476-6 has a fire propagation index of not more than 12 and a sub-index of not more than 6.
- Maximum length 600mm.

3100C PVC/POLYESTER LAMINATE FLEXIBLE DUCTS:

- Supply and fasten PVC/polyester laminate flexible duct connections as DW/144. Use flexible duct connections in applications listed in DW/144.
- Comply with BS EN 13180 and provide a test certificate proving compliance with the mechanical characteristics of this standard
- Ductwork and insulation to have a test certificate proving reaction to fire performance requirements of BS 9999. Materials to conform to Euroclass A1 as specified in BS EN 13501 or when tested to BS 476-6 has a fire propagation index of not more than 12 and a sub-index of not more than 6.
- Maximum length 600mm.

3100D ALUMINIUM/POLYESTER FLEXIBLE DUCTS:

- Supply and fasten flexible duct connections as DW/144. Use flexible duct connections in applications listed in DW/144.
- Material - Aluminium/Polyester laminate encapsulating high tensile steel wire helix.
- Comply with BS EN 13180 and provide a test certificate proving compliance with the mechanical characteristics of this standard.
- Ductwork and insulation to have a test certificate proving reaction to fire performance requirements of BS 9999. Materials to conform to Euroclass A1 as specified in BS EN 13501 or when tested to BS 476-6 has a fire propagation index of not more than 12 and a sub-index of not more than 6.
- Maximum length 600mm.

3110A FLEXIBLE JOINT CONNECTIONS:

- Supply and install flexible joint connections as detailed in DW/144 or DW/154 Section 18, as appropriate.
- Use flexible joints, as shown on drawings; on fan inlet/outlets; and on building expansion joints.
- Comply with BS 476-24.

3120A 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.

3130A INSECT GUARDS:

- Provide manufacturer's standard insect guards where indicated. Screens to be factory fitted by the manufacturer.
 - Material: Woven wire cloth.
 - Mesh: 16.
 - Gauge: 28.
 - Wire diameter: 0.375 mm.
 - Aperture: 1.212 mm².
 - Free area: 58%.

3130B INSECT GUARDS:

- Provide insect guards where indicated. Screens to be supplied in kit form for installation on-site.
 - Material: Black PVC coated glass fibre mesh.
 - Aperture size: 1.1 x 1.55 mm.
 - Weight: 155 g/m².
 - Free area: 62%.

3140A STAINLESS STEEL PRESSURE CONTROL FLAPS:

- Supply pressure control flaps with flap and adjustable balance weight assembly manufactured from stainless steel. Construct wall mounting casings from stainless steel.
- Set the balance weight assembly on flap to control at pressure indicated.

3140B NYLON COATED STEEL PRESSURE CONTROL FLAPS:

- Supply pressure control flaps with flap and adjustable balance weight assembly manufactured from stainless steel. Construct wall mounting casings from nylon coated mild steel.
- Set the balance weight assembly on flap to control at pressure indicated.

3150A WALL-MOUNTED PRESSURE RELIEF DAMPERS:

- Supply wall-mounted dampers with subframe.
- Material -
 - Supply frames made from galvanized sheet steel or extruded aluminium section.
 - Supply blades made from aluminium or PVC.

3150B DOOR MOUNTED PRESSURE RELIEF DAMPERS:

- Supply door mounted dampers with subframe.
- Material
 - Supply frames made from galvanized sheet steel or extruded aluminium section.
 - Supply blades made from aluminium or PVC.

3160A SHUT OFF DAMPER:

- Supply shut off dampers to give 100% shut off.
- Manufacture from sheet steel coated with polyurethane lacquer, suitable for pneumatic; electro pneumatic or electric/electronic control.

4000 WORKMANSHIP

4010 GENERAL WORKMANSHIP:

- Install ductwork in accordance with DW/144, DW/154 and DW/191 as appropriate.
- Ensure that there are no sharp edges or corners on cut edges on ductwork, flanges and supports.
- Install pre-insulated ductwork to BS EN 13403 in accordance with manufacturer's instructions.

4015 FLEXIBLE DUCTWORK INSTALLATION:

- Comply with BSRIA Guide BG43. Flexible ductwork.
- Minimum radius ratio (R/D) to be not less than 2, where R is the centre line radius and D is the duct

diameter.

- Maximum support interval – 600mm.
- Support rings to be sized so as not to constrict the cross-sectional area of the ductwork.
- Duct support ring minimum width – 25mm.
- Flexible ducts to overlap rigid duct or terminal device spigot by a minimum of 50mm.
- Make a seal between flexible duct and rigid connection using mastic sealant or duct tape
- Use a mechanical fixing for connection using a duct band.

4020 DUCTWORK SUPPORTS:

- Support ductwork in accordance with DW/144; DW/154 Part 5; or DW/191 Section 7 as appropriate. Install supports to ensure insulation can be applied unless otherwise indicated.

4025 COMPONENT SUPPORT ON PRE-INSULATED ALUMINIUM DUCTWORK:

- Support ducts with dimensions less than 1m at intervals of no more than 4m. Support ducts with dimensions over 1m at intervals of no more than 2m.
- Provide independent support for all accessories.

4030A DUCT SUPPORT FOR VAPOUR SEAL CONTINUITY:

- Where a vapour seal is required, use method of support detailed on drawing as indicated.

4040 EXTERNAL DUCTWORK SUPPORT:

- Support ductwork external to building as indicated.

4050 DUCTWORK FLOOR SUPPORT:

- Support ductwork from floor as indicated.

4060 DRAINAGE OF DUCTWORK:

- Arrange ductwork to drain any entrained moisture and ensure the lapping of joints minimises moisture leakage.

4090A INTERNAL CLEANLINESS - BASIC LEVEL:

- Provide Basic Level of protection, delivery and installation (PDI) as defined in B&ES TR/19.

4090B INTERNAL CLEANLINESS - INTERMEDIATE LEVEL:

- Provide Intermediate Level of protection, delivery and installation as defined in B&ES TR/19.

4090C INTERNAL CLEANLINESS - ADVANCED LEVEL:

Provide Advanced Level of protection, delivery and installation as defined in B&ES TR/19

4090D DRY METHOD OF CLEANING:

- The specialist cleaning contractor shall select and propose for approval the most appropriate cleaning method from table 8 in B&ES TR/19.

4090E WET METHOD OF CLEANING:

- The specialist cleaning contractor shall select and propose for approval the most appropriate cleaning method from table 8 in B&ES TR/19.
- The system should be thoroughly dried prior to commissioning/de-commissioning to prevent moisture assisting in the growth of micro-organisms.
- A risk assessment must be carried out before any cleaning chemicals or biocides are considered. The details of any such chemicals or biocides must be recorded and any adverse effects of the applied chemicals assessed and determined, with appropriate safe procedures set out in a formal method statement.
- Steam cleaning and high pressure waterwash are not recommended for ductwork that is situated above ceilings or in sensitive areas unless carried out in a controlled manner to contain leakage. Procedures to take account of operative safety must be adopted, and should be set out in written form.
- Careful consideration should be given to the use of chemicals and/or water for surfaces that are porous e.g. internally-lined ductwork, attenuators, fibre board ductwork, attenuators, fibre board ductwork etc., to prevent permanent damage.
- Before applying wet cleaning methods care should be taken that condensed vapours and cleaning fluids can be removed from the ductwork system.

4100A WEATHERPROOFING:

- 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.

4110A DUCTWORK SLEEVES:

- Where indicated, enclose ducts passing through building elements, (walls, floors, partitions, etc.) within purpose made sleeves. Cut sleeves of the same material as the duct and pack with mineral fibre or similar non-flammable and fire resistant material to form a fire/smoke stop of adequate rating and to prevent air movement and noise transmission between duct and sleeve.
- Where finished insulation is carried through duct sleeves. Pack space between insulation finish and sleeve with non-flammable and fire resistant material to form fire stop.

4110B DUCTWORK SLEEVES WITH FLANGES:

- Where indicated, enclose ducts passing through building elements, (walls, floors, partitions, etc.) within purpose made sleeves. Cut sleeves of the same material as the duct and pack with mineral fibre or similar non-flammable and fire resistant material to form a fire/smoke stop of adequate rating and to prevent air movement and noise transmission between duct and sleeve.
- Provide flanges on either side of wall where ductwork is exposed in rooms.
- Where finished insulation is carried through duct sleeves. Pack space between insulation finish and sleeve with non-flammable and fire resistant material to form fire stop.

4130 INSTALLATION OF CONTROL EQUIPMENT:

- Fit sensors, damper motors and other control equipment as indicated.
- All control equipment should be installed to manufacturer or specialist supplier's requirements. The installation must be checked by the manufacturer or specialist supplier, and rectified as necessary.

4140 INSTRUMENT CONNECTIONS:

- Provide instrument connections where indicated.
- All instrument connections should be installed to manufacturer or specialist supplier's requirements. The installation must be checked by the manufacturer or specialist supplier, and rectified as necessary.

4160 DAMPER ACCESS:

- Ensure access is provided to damper mechanisms on fire dampers; smoke dampers; combined smoke and fire dampers; and volume control dampers through access doors, false ceilings etc..
- Demonstrate that damper blades close completely.
- Demonstrate 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.

BS APPENDIX

BS 476-24:1987, ISO 6944:1985

Fire tests on building materials and structures. Part 24 Method for determination of the fire resistance of ventilation ducts

BS 476-6:1989+A1:2009

Fire tests on building materials and structures. Part 6 Method of test for fire propagation for products

BS 476-7:1997

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

BS 7671:2008+A3:2015

Requirements for electrical installations. IET Wiring Regulations. Seventeenth edition

BS 9999:2008

Code of practice for fire safety in the design, management and use of buildings

BS EN 12236:2002

Ventilation for buildings. Ductwork hangers and supports. Requirements for strength

BS EN 12237:2003

Ventilation for buildings. Ductwork. Strength and leakage of circular sheet metal ducts

BS EN 13180:2002

Ventilation for buildings. Ductwork. Dimensions and mechanical requirements for flexible ducts

BS EN 13403:2003

Ventilation for buildings. Non metallic ducts. Ductwork made from insulation ductboards

BS EN 13501-3:2005+A1:2009

Fire classification of construction products and building elements. Part 3 Classification using data from fire resistance tests on products and elements used in building service installations: fire resisting ducts and fire

dampers

BS EN 1366-2:2015

Fire resistance tests for service installations. Part 2 Fire dampers

BS EN 1507:2006

Ventilation for buildings. Sheet metal air ducts with rectangular section. Requirements for strength and leakage

BS EN 15650:2010

Ventilation for buildings. Fire dampers

BS EN 15727:2010

Ventilation for buildings. Ducts and ductwork components, leakage classification and testing

BS EN 1751:2014

Ventilation for buildings. Air terminal devices. Aerodynamic testing of damper and valves

BS EN ISO 5135:1999

Acoustics. Determination of sound power levels of noise from air-terminal devices, air-terminal units, dampers and valves by measurement in a reverberation room

BS EN ISO 717-1:2013

Acoustics. Rating of sound insulation in buildings and of building elements. Part 1 Airborne sound insulation

BS ISO 10294-4:2001+A1:2014

Fire-resistance tests. Fire dampers for air distribution systems. Test of thermal release mechanism

BS ISO 10294-5:2005

Fire-resistance tests. Fire dampers for air distribution systems. Part 5 Intumescent fire dampers

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.
- BREEAM New Construction 2014 requirements
 - Comply with Issue ID Hea 02 Indoor Air Quality.
 - Comply with Issue ID Hea 03 Self Containment in laboratories.
- BREEAM Refurbishment and Fit Out 2014 requirements
 - Comply with Issue ID Hea 02 Indoor Air Quality.
- Comply with Issue ID Hea 03 Self Containment in laboratories.

1020 TESTING:

- Provide certified insertion loss data in accordance with BS EN ISO 7235.
- Provide generated sound power levels with insertion loss data.

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

2010A FIRE PROPERTIES, BS 476-7, CLASS 1:

- Use non-flammable adhesives. Ensure that all insulating materials and coverings are non-combustible material covered with a material that complies with flame spread requirements of BS 476-7, Class 1.

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.

2020A CIRCULAR SILENCERS - CASING TO DW144 WITH EXTERNAL FLANGES:

- Provide circular silencers compatible with ductwork installation. Provide infill that is inert, fire proof, inorganic, vermin proof, non-hygroscopic.
- Construct casing to DW/144 with external flanges drilled for bolting to counterflanges on adjacent plant or ductwork.

2020B CIRCULAR SILENCERS - CASING TO DW144 WITH INTERNAL FLANGES:

- Provide circular silencers compatible with ductwork installation. Provide infill that is inert, fire proof, inorganic, vermin proof, non-hygroscopic.
- Construct casing to DW/144 with internal flanges drilled and threaded for bolting to counterflanges on adjacent plant or ductwork.

2020C CIRCULAR SILENCERS - CASING TO DW144 WITH SPIGOT ENDS:

- Provide circular silencers compatible with ductwork installation. Provide infill that is inert, fire proof, inorganic, vermin proof, non-hygroscopic.
- Construct casing to DW/144 with plain spigot ends for connection to adjacent plant or ductwork.

2030A CIRCULAR SILENCERS - NON-METAL WITH EXTERNAL FLANGES:

- Provide circular silencers compatible with ductwork installation.
- Provide with external flanges drilled for bolting to counterflanges on adjacent plant or ductwork.

2030B CIRCULAR SILENCERS - NON-METAL WITH INTERNAL FLANGES:

- Provide circular silencers compatible with ductwork installation.
- Provide with internal flanges drilled and threaded for bolting to counterflanges on adjacent plant or ductwork.

2030C CIRCULAR SILENCERS - NON-METAL WITH SPIGOT ENDS:

- Provide circular silencers compatible with ductwork installation.
- Provide with plain spigot ends for connection to adjacent plant or ductwork.

2040A RECTANGULAR SILENCERS - CASING TO DW144 WITH CONNECTIONS TO MATCH AHU:

- 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 DW/144 with duct connections to match the air handling unit and specified method of assembly.

2040B RECTANGULAR SILENCERS - CASING TO DW144 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 DW/144 with external flanges drilled for bolting to counterflanges on adjacent plant or ductwork.

2040C RECTANGULAR SILENCERS - CASING TO DW144 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 DW/144 with internal flanges drilled and threaded for bolting to counterflanges on adjacent plant or ductwork.

2040D RECTANGULAR SILENCERS - CASING TO DW144 WITH LOW LOSS FAIRINGS AND CONNECTIONS TO MATCH AHU:

- Provide rectangular silencers compatible with ductwork installation. Provide infill that is inert, fire proof, inorganic, vermin proof, non-hygroscopic.
- Construct splitters with low loss fairings.

- Construct casing to DW/144 with duct connections to match the air handling unit and specified method of assembly.

2040E RECTANGULAR SILENCERS - CASING TO DW144 WITH LOW LOSS FAIRINGS AND EXTERNAL FLANGES:

- Provide rectangular silencers compatible with ductwork installation. Provide infill that is inert, fire proof, inorganic, vermin proof, non-hygroscopic.
- Construct splitters with low loss fairings.
- Construct casing to DW/144 with external flanges drilled for bolting to counterflanges on adjacent plant or ductwork.

2040F RECTANGULAR SILENCERS - CASING TO DW144 WITH LOW LOSS FAIRINGS AND INTERNAL FLANGES:

- Provide rectangular silencers compatible with ductwork installation. Provide infill that is inert, fire proof, inorganic, vermin proof, non-hygroscopic.
- Construct splitters with low loss fairings.
- Construct casing to DW/144 with internal flanges drilled and threaded for bolting to counterflanges on adjacent plant or ductwork.

2050A RECTANGULAR SILENCERS - NON-METAL WITH EXTERNAL FLANGES:

- Provide rectangular silencers compatible with ductwork installation.
- Construct splitters with manufacturer's standard ends.
- Provide external flanges drilled for bolting to counterflanges on adjacent plant or ductwork.

2050B RECTANGULAR SILENCERS - NON-METAL WITH INTERNAL FLANGES:

- Provide rectangular silencers compatible with ductwork installation.
- Construct splitters with manufacturer's standard ends.
- Provide internal flanges drilled and threaded for bolting to counterflanges on adjacent plant or ductwork.

2050C RECTANGULAR SILENCERS - NON-METAL WITH SPIGOT ENDS:

- Provide rectangular silencers compatible with ductwork installation.
- Construct splitters with manufacturer's standard ends.
- Provide spigot ends for connection to adjacent plant or ductwork.

2050D RECTANGULAR SILENCERS - NON-METAL WITH LOW LOSS FAIRINGS AND EXTERNAL FLANGES:

- Provide rectangular silencers compatible with ductwork installation.
- Construct splitters with low loss fairings.
- Provide external flanges drilled for bolting to counterflanges on adjacent plant or ductwork.

2050E RECTANGULAR SILENCERS- NON-METAL WITH LOW LOSS FAIRINGS AND INTERNAL FLANGES:

- Provide rectangular silencers compatible with ductwork installation.
- Construct splitters with low loss fairings.
- Provide internal flanges drilled and threaded for bolting to counterflanges on adjacent plant or ductwork.

2050F RECTANGULAR SILENCERS - NON-METAL WITH LOW LOSS FAIRINGS AND SPIGOT ENDS:

- Provide rectangular silencers compatible with ductwork installation.

- Construct splitters with low loss fairings.
- Provide spigot ends for connection to 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/m³.
- Retain infill by perforated galvanized mild steel sheet.

2060B ACOUSTIC SPLITTERS WITH LOW LOSS FAIRINGS:

- 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 low loss fairings.
- 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/m³.
- Retain infill by perforated galvanized mild steel sheet.

2070A AIR TRANSFER/CROSS TALK ATTENUATORS - EXTERNAL FLANGES:

- 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 external flanges drilled for bolting to counterflanges on adjacent ductwork.
- Fixing
 - Interface with building components as indicated.

2070B AIR TRANSFER/CROSS TALK ATTENUATORS - INTERNAL FLANGES:

- 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 internal flanges drilled and threaded for bolting to counterflanges on adjacent ductwork.
- Fixing
 - Interface with building components as indicated.

2070C AIR TRANSFER/CROSS TALK ATTENUATORS - 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.

2080A ACOUSTIC LININGS. PERFORMANCE TO BS EN ISO 354:

- Line internal surfaces of ducts as described in DW/144.
- Provide lining that is inert, fire proof, inorganic, vermin proof, non-hygroscopic.
- Material - polyurethane foam.
- Performance
 - Minimum random incidence absorption coefficients in accordance with BS EN ISO 354, as indicated.
- Protect lining against product migration and erosion.

2090A ACOUSTIC INSULATION:

- Material
 - Lightweight resilient glass fibre or mineral wool held in place with wire mesh.
- Casing
 - Ensure casing is continuous over duct length. Isolate casing from ductwork. Encase with material with mass of not less than 10kg/m².

2090B ACOUSTIC INSULATION FLEXIBLE SYSTEM:

- Continuous quilted glass fibre mat with sandwich layer of lead, minimum 1mm thick, with mass of 7 kg/m². Ensure surface finish complies with BS 476-7, Class 1. Overlap and seal all joints with adhesive and external reinforcing tape.

2100A PLENUMS:

- Provide plenum constructed using acoustic panels in positions indicated. Joint panels with seals to match performance of panels. Provide infill that is inert, fire proof, inorganic, vermin proof, non-hygroscopic.
- Material - polyurethane foam.
- Performance
 - Minimum random incidence absorption coefficients in accordance with BS EN ISO 354, as indicated.

2110 ACOUSTIC FLEXIBLE DUCT CONNECTORS:

- Provide acoustic flexible duct connectors in accordance with DW/144.

2120A ACOUSTIC LOUVRES:

- Performance
 - Provide certified acoustic performance data measured in accordance with BS EN ISO 10140.
 - 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 appropriate. Provide integral drainage channels.
- Screen
 - Fit a bird-screen using mesh no coarser than 12mm, 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.

2120B ACOUSTIC LOUVRES WITH INFILL:

- Performance
 - Provide certified acoustic performance data measured in accordance with BS EN ISO 10140.
 - 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 appropriate. Provide integral drainage channels.
- Provide acoustic infill which is inert, fire proof, inorganic, vermin proof and non-hydroscopic.
- Retain infill on louvre blades by perforated sheet of galvanized mild steel or aluminium as appropriate.
- Screen
 - Fit a bird-screen using mesh no coarser than 12mm, 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.

2130A ACOUSTIC DOORS:

- Provide acoustic doors as indicated.
- Handles
 - Provide latch with handles operable from both sides. If latch is lockable, provide a panic release.

2140A ACOUSTIC ENCLOSURES:

- Construction
 - Construct wall panels, frames and floor panels to meet the performance indicated, from materials suitable for location.
 - Ensure joints provide adequate seal to meet requirements.
- Performance
 - Minimum random incidence absorption coefficients in accordance with BS EN ISO 354, as indicated.
- Provide inspection window as indicated.
- Supply cable access floor panels as indicated.

2150A ACOUSTIC FLOATING FLOOR PANELS:

- Construction
 - Construct floor panels, frames and isolators to meet the performance indicated.
- Supply cable access floor panels as indicated.

2160A ACOUSTIC WALL LINING PANELS:

- Panels
 - Provide panels for fixing to existing walls, or soffit.
- Performance
 - Minimum random incidence absorption coefficients in accordance with BS EN ISO 354, as indicated.

3000 WORKMANSHIP

3030 ACCESS TO ACOUSTIC ENCLOSURES:

- Provide door type openings in enclosures as required for access to items enclosed. Provide openings for inlet and discharge ductwork and for connections as indicated. Provide angle flange connections for mating to ductwork and equipment.

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 BS EN 61672-1 and BS EN 61672-2.

BS APPENDIX

BS 476-7:1997

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

BS EN 61672-1:2003

Electroacoustics - sound level meters. Part 1 Specification

BS EN 61672-2:2003

Electroacoustics - sound level meters. Part 2 Pattern evaluation tests

BS EN ISO 354:2003

Acoustics. Measurement of sound absorption in a reverberation room

BS EN ISO 7235:2003

Acoustics. Laboratory measurement procedures for ducted silencers and air-terminal units. Insertion loss, flow noise and total pressure loss

BS EN ISO 9001:2015

Quality management systems. Requirements

Y46 GRILLES / DIFFUSERS / LOUVRES

1000 GENERAL

1010 PERFORMANCE:

- Maximum mean air velocity in the occupied zone in summer and winter shall not exceed the criteria for a category B thermal environment as defined in BS EN ISO 7730 (PPD<10%) table A.5. unless specified otherwise elsewhere in this specification.
- 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 and ensure louvres are tested in accordance with BS EN 13030 and are subject of on-going factory production control auditing. Performance classes to BS EN 13030 are given elsewhere in this specification.

1020 SIZE:

- Sizes indicated are 'Nominal'.
- Provide size 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.

1033 PROTECTIVE WRAPPING:

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

1040 ELECTRICAL BONDING TERMINAL:

- Ensure an electrical bonding terminal suitable for connection of 6mm² maximum conductor is provided on metal grilles, diffusers and louvres where indicated.

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.

2030A GRILLES - MESH TYPE:

- Core material - Cellular, expanded or perforated as indicated on schedule.
- Frame - Flange mounting frame or plate flange as indicated on schedule.
- Fixing - Permanently fixed or designed for easy removal, as indicated.

2040A GRILLES - EGG-CRATE TYPE:

- Core material - Aluminium or plastic as indicated.
- Style - Flanged or channel frame; or core only as indicated.

2050A GRILLES - LINEAR TYPE:

- Supply linear type grilles with one row of parallel blades. Secure blades within mounting frame or opening. Permanently set at angle indicated.

2060A GRILLES - LINEAR FLOOR TYPE:

- Supply linear type floor grilles with one row of parallel blades. Permanently set at angle indicated.
- Incorporate bar reinforcement.
- Loading - Pedestrian or computer room to special requirements 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.

2080A CONE TYPE CIRCULAR DIFFUSERS:

- Supply circular diffusers manufactured to ensure rigid and smooth outer cone or frame, and inner assembly.
- Space all cones to ensure even distribution of air flow with minimum resistance and noise, and to allow easy cleaning.
- Cone type - Fixed or adjustable deflection cone type as indicated.

2080B PAN TYPE CIRCULAR DIFFUSERS:

- Supply circular diffusers manufactured to ensure rigid and smooth outer cone or frame, and inner assembly.
- Pan type - Fixed or adjustable pan type as indicated.

2080C CIRCULAR DIFFUSERS - CORE ADJUSTMENT:

- Provide core adjustment to obtain required air distribution pattern. Allow inner assembly to move vertically by vertical sliding action or rotation as indicated.

2090A DIFFUSERS - LINEAR TYPE:

- Supply single unit or continuous length linear diffusers manufactured with one or more rigid and smooth line slot units with parallel bars and partitions.
- Fit closing caps at ends of single or multiple continuous length units.
- Provide continuous lengths complete with locating pins or strips with keys to ensure correct alignment of abutted ends.
- Air Controller - Fit each slot with device indicated.

2100 DIFFUSERS - PERFORATED FACE TYPE:

- Supply perforated face diffusers with rigid and smooth inlet spigot expanded to butt and seal against easily removable framed perforated front panel. Incorporate back deflectors above front panel, set to give required performance.
- Supply type and profile of framed perforated front panel to mount flush with surrounding false ceiling panels.

2110A ADJUSTABLE CURVED BLADE DIFFUSER:

- Supply diffusers manufactured from curved cross sectional profile parallel blades pivoted at each end within flanged mounting frame. Ensure that each blade is individually adjustable to give directional control of airstream. Retain blades in set position by tensioners external to airstream.
- Control ways as indicated on drawings.

2120A ADJUSTABLE CURVED BLADE DIFFUSER WITH REMOVABLE INNER CORE:

- Supply diffusers manufactured from curved cross sectional profile parallel blades within removable core frame and include integral multi-blade volume control at each blade set. Ensure assembly is removable from flanged mounting frame. Make provision for volume control adjustment by loose key.
- Ensure that each blade within core is individually adjustable, and that each core is designed to give directional control of airstream through each 90° angle.
- Control ways as indicated on drawings.

2130A STRAIGHT LINE, FIXED LOUVRE DIFFUSER WITH FIXED CORE:

- Supply diffusers manufactured from louvre type parallel blades permanently set and securely fixed within frame.
- Pre-set each blade to give directional control of airstream.
- Control ways as indicated on drawings.

2130B STRAIGHT LINE, FIXED LOUVRE DIFFUSER WITH REMOVABLE CORE:

- Supply diffusers manufactured from louvre type parallel blades permanently set and securely fixed within frame.
- Supply core frames which are easily removable from flanged mounting frame.
- Pre-set each blade to give directional control of airstream.
- Control ways as indicated on drawings.

2140A SPHERICAL PUNKAH LOUVRE DIFFUSERS:

- Supply diffusers manufactured with adjustable core. Supply core in the form of a rotatable sphere with circular outlet nozzle, the whole retained by a flanged cup allowing manual change of discharge air pattern to give an adjustable high velocity jet, full diffusion, or complete shut-off.
- 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.

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.

2150 DIFFUSERS - LINEAR LIGHTING/AIR MODULAR TYPE:

- Supply diffusers complete with connecting unit for installation behind module flanges, ensuring neat and unobtrusive appearance.
- Fit plenum box with integral independent air volume regulating vanes to direct an equal air velocity along complete length of connecting air diffuser slot. Ensure easy access from below to regulating vanes. Retain vanes in set position by tensioners external to air stream.
- Fit spigot, suitable for flexible ducting joint connection to plenum box.
- Ensure that supports are independent, and do not depend upon module casing or flanges.

2160 LAMINAR FLOW PANELS:

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

2170A HIGH INDUCTION DIFFUSERS, SECONDARY AIR INDUCTION:

- Supply high induction diffusers fixed or variable geometry using secondary air induction into diffuser housing.

2170B HIGH INDUCTION DIFFUSERS, TURBULENCE/ROTARY MOTION:

- Supply high induction diffusers fixed or variable geometry using high levels of turbulence or rotary motion in discharge air pattern to accelerate mixing.

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.

2185 FABRIC AIR DUCT DISTRIBUTION DEVICES:

- Supply fabric air distribution devices complete with all necessary stiffening devices, facilities for jointing sections, support system, suspension rails and fixings.
- Manufacturer to provide full performance data for devices selected including air flow rate, pressure loss, throw etc.
- Ducts shall prevent condensation and dust build up.
- Shrinkage to be limited to 1% when washed in accordance with the manufacturers recommendations unless scheduled otherwise.
- Materials to be classified for reaction to fire in accordance with BS EN 13501-1. Classes acceptable are A1, A2 or B having smoke emission classification of s1 and production of flaming droplets/particles classification of d0.
- Test methods
 - BS EN ISO 1182, BS EN ISO 1716, BS EN ISO 11925-2 and BS EN 13823 as appropriate.

2190A LOUVRES - EXTERNAL AIR SUPPLY/EXTRACT TYPE:

- Provide louvres which have been tested in accordance with BS EN 13030, and which are the subject of ongoing factory production control auditing.
- Performance and classification to BS EN 13030
 - Ensure louvres perform to water penetration class as scheduled.
 - Ensure louvres achieve the required coefficient of discharge class at the limiting core velocity as

scheduled.

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

2200 LOUVRES/SCREEN WALLING:

- Provide louvres which have been tested in accordance with BS EN 13030, and which are the subject of ongoing factory production control auditing.
- Performance and classification to BS EN 13030
 - Ensure louvres perform to water penetration class as scheduled.
 - Ensure louvres achieve the required coefficient of discharge class at the limiting core velocity as scheduled.
- Construct with mullions into which blades are fitted and provide blades with aerodynamic profiles and integral drainage channels. Mount assembly within frame. Ensure louvre system is integrated with weather louvres and incorporates doors with concealed hinges and frames where indicated. Where necessary provide mitred corners and slope louvres.
- Ensure adequate space for access and maintenance of louvres and associated equipment is provided.
- Where indicated ensure manufacturers are a firm of Assessed Capability to BS EN ISO 9001 and produce louvre to relevant Quality Assessment schedule.
- Installation - Install louvres strictly in accordance with the manufacturer's instructions.

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.

3000 ACCESSORIES

3010# OPPOSED BLADE VOLUME CONTROL DAMPERS:

- Balance and tension operating mechanisms to give positive setting for blade positions from fully open to fully closed.
- Blade Operation - Local
 - Supply loose key passing through face of grille or diffuser neck.
 - Supply right-angled operator for adjustment through side of ducting.
- Blade Operation - Remote
 - Supply remote control with necessary brackets and linkage at control unit.

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.

3010B OPPOSED BLADE VOLUME CONTROL DAMPERS - REMOTE CONTROL:

- Balance and tension operating mechanisms to give positive setting for blade positions from fully open to fully closed.
- Remote blade operation.
 - Supply remote control with necessary brackets and linkage at control unit.

3030A ANNULAR RING VOLUME CONTROL DAMPERS:

- Provide manual operation by loose key.

3040A BUTTERFLY VOLUME CONTROL DAMPERS:

- Operate via a simple hooked wire key connecting with a lug on the underside of each plate; or by a loose key locating into a control mechanism.

3050A "IRIS" VOLUME CONTROL DAMPERS:

- When in fully open setting ensure that unit inside diameter is equal to full internal diameter of air diffuser spigot, or ducting branch connection. Method of operation as indicated on the schedule.

3060A FIXED AIR FLOW DEFLECTORS:

- Direct airstream evenly from main ducting into branches or spigots serving air grilles and diffusers by using a number of equally spaced curved blades linked together.

3060B ADJUSTABLE AIR FLOW DEFLECTORS:

- Direct airstream evenly from main ducting into branches or spigots serving air grilles and diffusers by using a number of equally spaced curved blades linked together.

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.

3080 PERFORATED BAFFLE PLATES:

- Cover full width or depth of plenum box and extend beyond each side of air inlet to ensure even air distribution.
- Position centrally relative to plenum box air inlet.

3090 PERFORATED SCREENS:

- Fit perforated screens behind grille volume control devices to equalize air flow and pressure. Contain perforated sheet within rigid surrounding frame, incorporating fixing brackets or lugs.

3100 CEILING OR WALL-MOUNTED PLENUM BOXES:

- Supply single plenum box or series of plenum boxes butted together to form continuous length, where 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.

3110 FLOOR MOUNTED PLENUM BOXES:

- Supply single plenum box or series of plenum boxes butted together to form continuous length, where indicated. Ensure sturdy and rigid construction with circular inlet spigots 65 mm minimum length. Ensure box base material and reinforcement is able to withstand pressures of concrete handling and pouring when casting into floor slab.
- Incorporate at least four drilled angle brackets, for fixing to slab soffit, or building ragged ties when casting into a floor slab.

3120A HINGED LOUVRE ACCESS PANELS AND DOORS:

- Incorporate purpose made access panels or doors within body of louvres, manufactured from compatible materials.
- Use hinged access panels or doors of single or double style and with front or rear locking facilities.

3120B LIFT OUT LOUVRE ACCESS PANELS AND DOORS:

- Incorporate purpose made access panels or doors within body of louvres, manufactured from compatible materials.
- Use permanent housed or lockable lift out access panels.

3130 SPARES:

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

3140A OPPOSED BLADE VOLUME CONTROL DAMPERS - LOCAL BLADE OPERATION:

- 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.

3140B OPPOSED BLADE VOLUME CONTROL DAMPERS - REMOTE BLADE OPERATION:

- Balance and tension operating mechanisms to give positive setting for blade positions from fully open to fully closed.
- Remote blade operation.
 - Supply remote control with necessary brackets and linkage at control unit.

3150A BUTTERFLY VOLUME CONTROL DAMPERS:

- Operate via a simple hooked wire key connecting with a lug on the underside of each plate, or by a loose key locating into a control mechanism.

3160A "IRIS" VOLUME CONTROL DAMPERS:

- When in fully open setting ensure that unit inside diameter is equal to full internal diameter of air diffuser spigot, or ducting branch connection. Method of operation as indicated on the schedule.

4000 WORKMANSHIP

4010 GRILLE/DIFFUSER LOCATION:

- Fit at terminal air supply, extract and transfer points indicated, in accordance with the HEVAC Air Diffusion Guide.

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 BUILDERS WORK:

- 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 INSTALLATION OF FABRIC AIR DUCT DISTRIBUTION DEVICES:

- Ducts to be delivered to site in sealed polyethylene bags and stored on-site in a dry, dust free environment in accordance with the manufacturer's recommendations.
- Do not crush or bend devices.
- Install devices and join sections in accordance with the manufacturer's recommendations.
- Commission system in accordance with the manufacturer's recommendations.

BS APPENDIX

BS EN 13030:2001

Ventilation for buildings. Terminals. Performance testing of louvres subjected to simulated rain

BS EN 13501-1:2007+A1:2009

Fire classification of construction products and building elements. Classification using test data from reaction to fire tests

BS EN 13823:2010+A1:2014

Reaction to fire tests for building products. Building products excluding floorings exposed to the thermal attack by a single burning item

BS EN ISO 1182:2010

Reaction to fire tests for products. Non-combustibility test

BS EN ISO 11925-2:2010

Reaction to fire tests. Ignitability of products subjected to direct impingement of flame. Single-flame source test

BS EN ISO 1716:2010

Reaction to fire tests for products. Determination of the gross heat of combustion (calorific value)

BS EN ISO 7730:2005

Ergonomics of the thermal environment. Analytical determination and interpretation of thermal comfort using calculation of the PMV and PPD indices and local thermal comfort criteria

BS EN ISO 9001:2015

Quality management systems. Requirements

Y50 THERMAL INSULATION

1000 GENERAL

1010 TEMPERATURE RANGE:

Refer to insulation manufacturer's recommendations to determine suitability of different insulation materials at different temperature ranges.

1020 STANDARDS:

- Comply in general with
 - BS 5422
 - BS 5970
 - BS EN ISO 12241
- For product clauses comply with
 - BS EN 14303
 - BS EN 14304
 - BS EN 14314
- Use the description of terms as BS 3533.

All insulation products must have a Declaration of Performance (DoP) certificate and be CE marked in accordance with the Construction Products Regulations (CPR).

1030 MATERIALS:

- Employ materials that comply with BS 476-6 and BS 476-7.
- Materials shall have obtained Class 'O' fire rating in accordance with Approved Document B of the Building Regulations or be non-combustible in accordance with BS 476-4.
- Ensure metals and materials that cause galvanic corrosion are not installed in contact.
- Do not use galvanized or zinc coated steel jacketing and accessories on austenitic stainless steel and austenitic nickel steel/alloy equipment and piping.
- Insulants can be selected from BRE Green Guide to Specification.
- All insulation material shall
 - Be non-hydroscopic and in all respects be suitable for continuous use throughout the range of operating temperatures and within the environment indicated.
 - Be wholly compatible with the material it is insulating at the design working temperature and environmental conditions.
 - Be free from chemicals which may contribute to corrosion or degradation of the insulated surface or finish.
 - Have global warming potential (GWP) of less than 5.
 - Have an ozone depletion potential (ODP) of 0.
- BREEAM New Construction 2014 requirement
- Comply with Issue ID Mat 04 Insulation.

1032 PRE-INSULATED EQUIPMENT:

Where fire and surface spread of flame certificates relate to factory made products, ensure that certificates are still valid where products are incorporated in pre-insulated equipment.

1034 PROTECTION APPLIED IN SITU:

Where fire and surface spread of flame certificates relate to factory made products, ensure that the certificate remains valid when the finish is site applied.

1035A EUROPEAN CLASSIFICATION FOR REACTION TO FIRE PERFORMANCE:

- Supply insulating materials classified in accordance with BS EN 13501-1. Classes acceptable are A1/A1_L, A2/A2_L or B/B_L having smoke emission classification of s1 and production of flaming droplets/particles classification of d0.
- Test methods
 - BS EN ISO 1182, BS EN ISO 1716, BS EN 11925-2, BS EN 13823 as appropriate.

1050A SPREAD OF FLAME:

- When completed, ensure surface-finish complies with BS 476-7 Class 1 spread of flame.

1055 SMOKE EMISSION CHARACTERISTICS:

- Ensure only products classified by BS EN 13501-1 as s1 (materials that give off little or no smoke) are used.

1080 ELECTRICAL BONDING TERMINAL:

- Ensure an electrical bonding terminal suitable for connection of 6mm² 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.
- Provide assistance to allow for inspection of all sizes of insulation on all services after installation to determine thickness and compliance with specification. Make good any sections that are cut during inspection for thickness and compliance with specification.

2000 PRODUCTS/MATERIALS

2010 THERMAL CONDUCTIVITY:

- All thermal conductivity figures given in insulation product clauses are typical values at the mean temperature stated, as declared in manufacturer's Declaration of Performance (DoP) certificates in accordance with the CPR.

2015A THERMAL PERFORMANCE LIFE EXPECTANCY FOR PLANT DESIGN LIFE:

- Ensure the insulation will maintain it's thermal performance for a minimum of the plant design life.

2015B THERMAL PERFORMANCE LIFE EXPECTANCY DETAILS:

- Provide manufacturer's details which define the life expectancy of the insulation material. Where appropriate this shall include both 'as manufactured' and 'aged' thermal conductivity values in accordance with BS EN 14314.

2020 RESTRICTIONS ON USE OF MATERIALS:

- Protect insulated stainless steel surfaces from the risk of stress corrosion in accordance with the recommendations in BS 5970.

- For all mineral wool insulation products, test evidence must be available showing that the fibres from which the products are made are not classified as a possible human carcinogen, as detailed by European Directive 97/69/EC and the Approved Supply List of CHIP98, and that the fibres should be bio-soluble.

2030A FOIL FACED ROCK MINERAL WOOL PIPE INSULATION:

- Standard - BS EN 14303.
- Nominal density - 120 kg/m³.
- Thickness - 20mm to 100mm.
- Thermal conductivity - Typical value 0.033 - 0.034 W/mK at a mean temperature of 10°C.
- Finish - Reinforced aluminium foil with at least 25mm overlap.

2030B CANVAS ROCK MINERAL WOOL PIPE INSULATION:

- Standard - BS EN 14303.
- Nominal density - 120 kg/m³.
- Thickness - 20mm to 100mm.
- Thermal conductivity - Typical value of 0.033 - 0.034 W/mK at a mean temperature of 10°C.
- Finish - Canvas covered with at least 25mm overlaps.

2030C FOIL FACED GLASS MINERAL WOOL PIPE INSULATION:

- Standard - BS EN 14303.
- Nominal density - 80 kg/m³.
- Thickness - 20mm to 100mm.
- Thermal conductivity - Typical value of 0.033 W/mK at a mean temperature of 10°C.

2030D CANVAS GLASS MINERAL WOOL PIPE INSULATION:

- Standard - BS EN 14303.
- Nominal density - 80 kg/m³ to 120 kg/m³.
- Thickness - 20mm to 100mm.
- Thermal conductivity - Typical value of 0.033 W/mK at a mean temperature of 10°C.
- Finish - Canvas covered with at least 25mm overlaps.

2040A FOIL FACED ROCK MINERAL WOOL SEMI RIGID DUCT INSULATION:

- Standard - BS EN 14303.
- Nominal density - 45 kg/m³.
- Thickness - 25mm to 100mm.
- Thermal conductivity - Typical value not exceeding 0.034 W/mK at a mean temperature of 10°C.
- Finish - Reinforced aluminium foil.

2040B FOIL FACED GLASS MINERAL WOOL SEMI RIGID DUCT INSULATION:

- Standard - BS EN 14303
- Nominal density - 45 kg/m³.
- Thickness - 25mm to 100mm.
- Thermal conductivity - Typical value of 0.333 W/mK at a mean temperature of 10°C.
- Finish - Reinforced aluminium foil.

2050A FOIL FACED ROCK MINERAL WOOL FLEXIBLE DUCT INSULATION:

- Standard - BS EN 14303
- Nominal density - 28 kg/m³ to 45 kg/m³.
- Thickness - 25mm to 60mm.
- Thermal conductivity - Typical value of 0.034 W/mK at a mean temperature of 10°C.
- Finish - Reinforced aluminium foil.

2050B FOIL FACED GLASS WOOL FLEXIBLE DUCT INSULATION:

- Standard - BS EN 14303
- Nominal density - 25 kg/m³ to 45 kg/m³.
- Thickness - 25mm to 60mm.
- Thermal conductivity - Typical value of 0.033 W/mK at a mean temperature of 10°C.
- Finish - Reinforced aluminium foil.

2060A FOIL FACED ROCK MINERAL WOOL LAMELLA DUCT INSULATION:

- Standard - BS EN 14303
- Nominal density - 24-45 kg/m³.
- Thickness - 25mm to 80mm.
- Thermal conductivity - Typical value of 0.04 W/mK at a mean temperature of 10°C.
- Finish - Reinforced aluminium foil.

2060B KRAFT PAPER FACED ROCK MINERAL WOOL LAMELLA DUCT INSULATION:

- Standard - BS EN 14303
- Nominal density - 24-45 kg/m³.
- Thickness - 25mm to 80mm.
- Thermal conductivity - Typical value of 0.04 W/mK at a mean temperature of 10°C.
- Finish - Plain Kraft paper.

2060C FOIL FACED GLASS MINERAL WOOL LAMELLA DUCT INSULATION:

- Standard - BS EN 14303.
- Nominal density - 24-45 kg/m³.
- Thickness - 25mm to 80mm.
- Thermal conductivity - Typical value of 0.04 W/mK at a mean temperature of 10°C.
- Finish - Reinforced aluminium foil.

2060D KRAFT PAPER FACED GLASS MINERAL WOOL LAMELLA DUCT INSULATION:

- Standard - BS EN 14303.
- Nominal density - 24-45 kg/m³.
- Thickness - 25mm to 80mm.
- Thermal conductivity - Typical value of 0.04 W/mK at a mean temperature of 10°C.
- Finish - Plain Kraft paper.

2065 CRIMPED MAT DUCT INSULATION:

- Standard - BS EN 14303
- Nominal density - 25 to 45 kg/m³.

- Compression resistance - Maximum of 13% compression at a static load of 2 kPa.
- Thickness - 25mm to 80mm.
- Thermal conductivity - Typical value of 0.034 W/mK at a mean temperature of 10°C.
- Finish - Reinforced aluminium foil.

2070A GALVANIZED METAL MESH ON MINERAL WOOL MATTRESSES - ONE FACE:

Standard - BS EN 14303

- Application - High temperature ducts, tanks, vessels and other process equipment.
- Nominal density - 66 - 128 kg/m³.
- Thickness - 25mm to 100mm.
- Thermal conductivity - Typical value of 0.041 W/mK at a mean temperature of 50°C.
- Mesh - Galvanized. Faced, one side.

2070B GALVANIZED METAL MESH ON MINERAL WOOL MATTRESSES - BOTH FACES:

- Standard - BS EN 14303.
- Application - High temperature ducts, tanks, vessels and other process equipment.
- Nominal density - 66 - 128 kg/m³.
- Thickness - 25mm to 100mm.
- Thermal conductivity - Typical value of 0.041 W/mK at a mean temperature of 50°C.
- Mesh - Galvanized. Faced, both sides.

2070C STAINLESS STEEL MESH ON MINERAL WOOL MATTRESSES - ONE FACE:

- Standard - BS EN 14303
- Application - High temperature ducts, tanks, vessels and other process equipment.
- Nominal density - 66 - 128 kg/m³.
- Thickness - 25mm to 100mm.
- Thermal conductivity - Typical value of 0.041 W/mK at a mean temperature of 50°C.
- Mesh - Stainless steel. Faced, one side.

2070D STAINLESS STEEL MESH ON MINERAL WOOL MATTRESSES - BOTH FACES:

- Standard - BS EN 14303
- Application - High temperature ducts, tanks, vessels and other process equipment.
- Nominal density - 66 - 128 kg/m³.
- Thickness - 25mm to 100mm.
- Thermal conductivity - Typical value of 0.041 W/mK at a mean temperature of 50°C.
- Mesh - Stainless steel. Faced, both sides.

2080A FLAT DUCTWORK FIRE PROTECTION INSULATION - MITRED JOINTS:

- Material - Mineral wool, slab for flat ducts, with 45° mitred joints.
- Nominal density - 165 kg/m³.
- Thermal conductivity - Typical value of 0.035 W/mK at a mean temperature of 10°C.
- Facing - Reinforced aluminium foil.

2080B FLAT DUCTWORK FIRE PROTECTION INSULATION - BUTTED JOINTS:

- Material - Mineral wool, slab for flat ducts, with 90° butted joints.
- Nominal density - 165 kg/m³.

- Thermal conductivity - Typical value of 0.035 W/mK at a mean temperature of 10°C.
- Facing - Reinforced aluminium foil.

2080C CIRCULAR DUCTWORK FIRE PROTECTION INSULATION - SECTION:

- Material - Mineral wool
 - Section for circular duct, 17 to 610 mm diameter.
- Nominal density - 165 kg/m³.
- Thermal conductivity - Typical value of 0.035 W/mK at a mean temperature of 10°C.
- Facing - Reinforced aluminium foil.

2080D CIRCULAR DUCTWORK FIRE PROTECTION INSULATION - PSM:

- Material - Mineral wool
 - PSM for circular duct greater than 406mm diameter.
- Nominal density - 165 kg/m³.
- Thermal conductivity - Typical value of 0.035 W/mK at a mean temperature of 10°C.
- Facing - Reinforced aluminium foil.

2080E CIRCULAR DUCTWORK FIRE PROTECTION INSULATION - FLEXIBLE MAT:

- Material - Mineral wool wire faced flexible mattress.
- Nominal density - 66 kg/m³.
- Thermal conductivity - Typical value of 0.035 W/mK at a mean temperature of 10°C.
- Facing - Reinforced aluminium foil.

2110A FOIL FACED CLOSED CELL RIGID PHENOLIC FOAM (PF) PREFORMED SECTIONS:

- Standard - BS EN 14314
- Nominal density - Refer to manufacturer's recommendations.
- Temperature range - Refer to manufacturer's recommendations.
- Thickness - Minimum 15mm.
- Thermal conductivity - Typical value of 0.025 W/mK at a mean temperature of 10°C when fully aged in accordance with BS EN 14314.
- Finish - Reinforced aluminium foil.
- Phenolic foam sections to be completely treated, at the insulation manufacturer's works, with a suitable dust suppressant, acid neutralising and passivating bore coating. This can be either an impregnated permeable liner or a sprayed coating.

2120A FOIL FACED CLOSED CELL RIGID LAMINATED PHENOLIC FOAM (PF), DUCT INSULATION SLAB:

- Standard - BS EN 14314.
- Nominal density - refer to manufacturer's recommendations.
- Thickness - minimum 20mm.
- Thermal conductivity - Typical value of 0.022 W/mK at a mean temperature of 10°C when fully aged in accordance with BS EN 14314.
- Finish - Reinforced aluminium foil.

2120B CLOSED CELL RIGID LAMINATED PHENOLIC FOAM (PF), DUCT INSULATION SLAB:

- Standard - BS EN 14314

- Nominal density - refer to manufacturer's recommendations.
- Thickness - minimum 20mm.
- Thermal conductivity - Typical value of 0.022 W/mK at a mean temperature of 10°C when fully aged in accordance with BS EN 14314.

2130A HIGH DENSITY RIGID PHENOLIC PIPE AND DUCT INSULATION FOR DUCT AND PIPE SUPPORTS:

- Standard - BS EN 14314
- Nominal density - refer to manufacturer's recommendations.
- Temperature range - -180 to +12°C.
- Thermal conductivity - Typical value of 0.045 W/mK at a mean temperature of 50°C when fully aged in accordance with BS EN 14314.
- CFC and HCFC free.

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

- Standard - BS EN 14304
- Nitrile rubber
 - Nominal density - 45 - 100 kg/m³.
 - Temperature range - -50 to +110°C.
- Thickness
 - Sections - 6mm to 32mm for pipe sizes 6mm to 114mm.
 - Sheets - 6mm to 50mm.
 - Thermal conductivity - Typical value of 0.036 W/mK at a mean temperature of 20°C.
- EPDM
 - Nominal density - 45 - 100 kg/m³.
 - Temperature range - -50 to +150°C
- Thickness
 - Sections - 10mm to 25mm for pipe sizes 10mm to 89mm.
 - Sheets - 10mm to 32mm.
 - Thermal conductivity - Typical value 0.045 W/mK at a mean temperature of 40°C.

2170 VAPOUR BARRIER PERMEANCE:

- Comply with requirements of BS 5422 and BS 5970.
- Maximum permitted water vapour permeance in relation to plant temperature at an ambient temperature of +20°C (dry bulb) to be in accordance with BS 5422, Table 1.

2180A BITUMEN VAPOUR BARRIER COATINGS:

- Cut-back bitumens with cotton canvas or open mesh glass cloth to reinforce coatings.

2180B VINYL VAPOUR BARRIER COATINGS:

- Vinyl emulsions with cotton canvas or open mesh glass cloth to reinforce coatings.

2180C SOLVENT POLYMER VAPOUR BARRIER COATINGS:

- Solvent-based polymers with cotton canvas or open mesh glass cloth to reinforce coatings.

2180D BITUMEN EMULSION VAPOUR BARRIER COATINGS:

- Bitumen emulsions (with or without elastomer latex) with cotton canvas or open mesh glass cloth to reinforce coatings.

2190 ADHESIVES:

- Comply with the recommendations of clause 10.1 of BS 5970, for insulation bonding adhesives, lagging adhesives; and facing and film attachment adhesives.

2200A SELF ADHESIVE WEATHER RESISTANT ZERO PERM MULTI-LAYER LAMINATE:

- Apply multi-layer laminate directly over ducts and pipework, ensuring 75mm overlap for a complete vapour barrier.
- Test in accordance with BS 476-6 and BS 476-7.
- Finish - Class O
- Laminate to be puncture and tear resistant and have supporting test data in accordance with ASTM D-1000 and ASTM D-624.
- Normal use -5ply laminate.
- Heavy duty use (e.g. Pipework /ductwork which could be walked on regularly or low level pipework in plant areas) -13ply laminate.
- Installation to be in accordance with the manufacturer's recommendations and may be either factory pre-applied or applied in-situ.

2200B ROOFING FELT PROTECTION:

- Secure in position with galvanized wire netting, of 1mm x 25mm mesh. Finish with two coats of black bituminous paint.

2200C FLAT ALUMINIUM-ZINC COATED STEEL PROTECTION:

- Mild steel sheet continuously hot dipped with 185gm aluminium-zinc coating to BS EN 10346, applied directly to insulating material.
- 0.4mm thick flat sheet.

2200D RIBBED ALUMINIUM-ZINC COATED STEEL PROTECTION:

- Mild steel sheet continuously hot dipped with 185gm aluminium-zinc coating to BS EN 10346, applied directly to insulating material.
- 0.4mm thick ribbed sheet.

2200E ALUMINIUM SHEETING PROTECTION:

- Apply flat (embossed) or profiled aluminium cladding directly to insulating material. 0.56mm thick on pipework; 0.71mm thick on ductwork.

2200G CANVAS PROTECTION:

- 130g covering for ductwork with two coats of water based co-polymer solution.
- Canvas sections for pipework with two coats of water based co-polymer solution.

2200H CANVAS PROTECTION WITH ALUMINIUM BANDS:

- 130g covering for ductwork with two coats of water based co-polymer solution, with aluminium bands.
- Canvas sections for pipework with two coats of water based co-polymer solution, with aluminium bands.

2220A VALVE AND FLANGE INSULATION - ALUMINIUM CASING:

- Install insulation on flanges and valves.
- Use a protected metal split casing fabricated from 0.91mm aluminium sheet fitted with spring clip fasteners, filled with insulating material with same thermal performance as insulation on adjoining pipe.

2220B VALVE AND FLANGE INSULATION - ALUMINIUM-ZINC COATED STEEL CASING:

- Install insulation on flanges and valves.
- Use a protected metal split casing fabricated from 0.7mm aluminium-zinc coated steel sheet fitted with spring clip fasteners, filled with insulating material with same thermal performance as insulation on adjoining pipe.

2220C CLOSED CELL VALVE AND FLANGE INSULATION - COLD APPLICATIONS:

- Install insulation on flanges and valves.
- Enclose cold piping valve bodies and flanges with closed cell insulating material to maintain vapour barrier.

2220D VALVE AND FLANGE INSULATION - COLD APPLICATIONS:

- Install insulation on flanges and valves.
- Enclose cold piping valve bodies and flanges with insulating material to maintain vapour barrier.

2220E VALVE AND FLANGE INSULATION - MULTI-LAYER LAMINATE:

- Install insulation on flanges and valves.
- Use self-adhesive weather resistant zero perm multi-layer laminate to encapsulate insulation, using the taped system as a quick and easy access point.

2230A ALUMINIUM PROTECTION FOR HEAT EXCHANGERS AND OTHER VESSELS:

- Finish with 0.9mm thick aluminium ribbed or embossed sheeting, with lapped, riveted and sealed joints, laps to shed water. Seal all joints at manholes and stools. Fit cut-outs with purpose made over-plates or collars.

2230B ALUMINIUM PROTECTION FOR HEAT EXCHANGERS AND OTHER VESSELS - WITH CHEST AND ACCESS COVERS:

- Finish with 0.9mm thick aluminium ribbed or embossed sheeting, with lapped, riveted and sealed joints, laps to shed water. Seal all joints at manholes and stools. Fit cut outs with purpose made over-plates or collars.
- Enclose chests and access covers in removable covers lined with high density flexible material. Remove manufacturer's name plate and refix on cladding.

2230C ALUMINIUM-ZINC COATED STEEL PROTECTION FOR HEAT EXCHANGERS AND OTHER VESSELS:

- Finish with 0.7mm thick aluminium-zinc coated steel embossed or ribbed sheeting, with lapped, riveted and sealed joints, laps to shed water. Seal all joints at manholes and stools. Fit cut outs with purpose made over-plates or collars.

2230D ALUMINIUM-ZINC COATED STEEL PROTECTION FOR HEAT EXCHANGERS AND OTHER VESSELS - WITH CHEST AND ACCESS COVERS:

- Finish with 0.7mm thick aluminium-zinc coated steel embossed or ribbed sheeting, with lapped, riveted and sealed joints, laps to shed water. Seal all joints at manholes and stools. Fit cut outs with purpose made over-plates or collars.
- Enclose chests and access covers in removable covers lined with high density flexible material. Remove manufacturer's name plate and refix on cladding.

2230E MULTI-LAYER LAMINATE PROTECTION FOR HEAT EXCHANGERS AND OTHER VESSELS - WITH CHEST AND ACCESS COVERS:

- Finish with self-adhesive weather resistant zero perm multi-layer laminate to encapsulate insulation, using the taped system as a quick and easy access point.

2270 CYLINDER JACKETS:

Provide cylinder jackets as indicated.

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.
- Comply with requirements of BS 5970.

2286 CALCULATION OF INSULATION THICKNESS - BUILDING REGULATIONS :

- Provide insulation of thickness conforming with the requirements of the Building Regulations (England and Wales) Part L Approved Documents or the Scottish Technical Handbooks, and the calculation methods given in BS EN ISO 12241 using the standardised assumptions within BS 5422 .

2287 CALCULATION OF INSULATION THICKNESS - ECA ENHANCED:

- The insulation manufacturer selected for a particular project should calculate the minimum required thicknesses of pipework insulation based on the actual conductivity of the product at the relevant temperature and the criteria on the ECA web site for an eligible installation using the methodology set out in BS EN ISO 12241 and the assumptions set out in Table C1 of BS 5422.

2289 INSULATION THICKNESS TABLES:

- Unless stated otherwise the thicknesses given in the tables in this specification are the nearest commercially available material thickness to meet the minimum calculated thickness to BS EN ISO 12241 and the product declared performance data for CE marking. Thicknesses have been calculated by manufacturers for each product and use thermal conductivity values calculated from the mean insulation temperature based on the fluid and air temperatures listed in the relevant tables.
- Should alternative products be offered that may have different performance data the Contractor shall ensure the manufacturer undertakes calculations and submits appropriate thickness table.
- Unless specified otherwise elsewhere, the thicknesses for pipe of greater diameter, flat surfaces or irregular shaped plant items shall not be less than that for the largest pipe size given in the thickness tables.

2290 NON-DOMESTIC HOT WATER SERVICE INSTALLATIONS - BUILDING REGULATIONS ROCK MINERAL WOOL:

- Insulation thickness to achieve the maximum permissible heat loss stated in the Building Regulations Part L Non Domestic Building Services Compliance Guide, Northern Ireland Technical Booklet F2 and Section 6 of

the Scottish Non Domestic Technical Handbook.

Outside diameter of steel pipe (mm)	Thickness of rock mineral wool (mm)	
	0.05	0.9
Surface emissivity	0.05	0.9
17	25	30
21	25	30
27	30	35
34	30	35
42	30	35
48	35	40
60	40	40
76	35	45
89	35	45
114	40	45
140	40	45
168	40	50
219	40	50
273 and above	45	50

• Basis: Horizontal pipe at 60°C in still air at 15°C, thermal conductivity values calculated from the mean insulation temperature based on the fluid and air temperatures.

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

2295 NON-DOMESTIC HOT WATER SERVICE INSTALLATIONS, BUILDING REGULATIONS - GLASS MINERAL WOOL:

• Insulation thickness to achieve the maximum permissible heat loss stated in the Building Regulations Part L Non Domestic Building Services Compliance Guide, Northern Ireland Technical Booklet F2 and section 6 of the Scottish Non Domestic Technical Handbook.

Outside diameter of steel pipe (mm)	Thickness of glass mineral wool (mm)	
	0.05	0.9
Surface emissivity	0.05	0.9
17	25	30
21	25	30
27	30	40
34	30	40
42	30	40
48	40	40
60	40	40
76	40	40
89	40	40
114	40	50
140	40	50
168	40	50
219	40	50
273 and above	40	50

• Basis: Horizontal pipe at 60°C in still air at 15°C, Thermal conductivity calculated from the mean insulation temperature based on the fluid and air temperatures.

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

2305 NON-DOMESTIC HOT WATER SERVICE INSTALLATIONS, BUILDING REGULATIONS - PHENOLIC FOAM:

• Insulation thickness to achieve the maximum permissible heat loss stated in the Building Regulations Part L Non Domestic Building Services Compliance Guide, Northern Ireland Technical Booklet F2 and section 6 of the Scottish Non Domestic Technical Handbook.

Outside diameter of steel pipe (mm)	Thickness of phenolic foam (mm)	
Surface emissivity	(0.05)	(0.9)
17	15	15
21	15	20
27	15	20
34	20	20
42	20	20
48	20	25
60	20	25
76	25	25
89	25	25
114	25	30
140	25	30
168	25	30
219	30	30
273 and above	30	30

• Basis: Horizontal pipe at 60°C in still air at 15°C, aged k value. Thermal conductivity calculated from the mean insulation temperature based on the fluid and air temperatures.

Thicknesses of nitrile rubber are minimum calculated thicknesses

- Use this table for insulation thickness of copper pipework of the nearest equivalent outside diameter.
- Use this table for insulation thickness of plastic pipework of the nearest equivalent outside diameter.
- The above thicknesses relate to Class O rated insulated. the thicknesses may vary for other ratings.

2306 NON-DOMESTIC HOT WATER SERVICE INSTALLATIONS, BUILDING REGULATIONS - NITRILE RUBBER:

• Insulation thickness to achieve the maximum permissible heat loss stated in the Building Regulations Part L Non Domestic Building Services Compliance Guide, Northern Ireland Technical Booklet F2 and section 6 of the Scottish Non Domestic Technical Handbook.

Outside diameter of steel pipe (mm)	Approx. thickness of nitrile rubber (mm)	
Surface emissivity	(0.05)	(0.9)
17	26	31
21	28	33
27	30	35
34	32	37
42	33	38

48	35	41
60	36	42
76	38	44
89	38	44
114	39	45
140	40	47
168	41	48
219	41	48
273 and above	42	49

• Basis: Horizontal pipe at 60°C in still air at 15°C. Thermal conductivity calculated from the mean insulation temperature based on the fluid and air temperatures.

Thicknesses of nitrile rubber are minimum calculated thicknesses.

- Use this table for insulation thickness of copper pipework of the nearest equivalent outside diameter.
- Use this table for insulation thickness of plastic pipework of the nearest equivalent outside diameter.
- The above thicknesses relate to Class O rated insulation. The thicknesses may vary for other ratings.

2307 NON-DOMESTIC HOT WATER SUPPLY SERVICES, ECA ENHANCED:

• The insulation manufacturer selected for a particular project should calculate the minimum required thicknesses of pipework insulation based on the actual conductivity of the product at the relevant temperature and the criteria on the ECA web site for an eligible installation using the methodology set out in BS EN ISO 12241 and the assumptions set out in Table C1 of BS 5422: 2009. The table below defines the maximum permissible heat losses to be used in the calculations.

Non-Domestic Hot Water Supply Maximum Permitted Heat Loss (W/m)	
Temperature	60°C
Outside Pipe Diameter (mm)	
17.2	6.04
21.3	6.45
26.9	7.00
33.7	7.71
42.4	8.46
48.3	9.01
60.3	9.94
76.1	11.25
88.9	12.17
114.3	14.29
139.7	16.09
168.3	18.24
219.1	22.06
273 & above	25.95

2308 DOMESTIC HOT WATER STORAGE VESSELS IN NEW AND EXISTING BUILDINGS- ROCK MINERAL WOOL:

- Provide insulation thicknesses to limit heat losses from DHW storage vessels to the maximum recommended in Table 27 in the Non-domestic Building Services Compliance Guide (NDBSCG):2013.
- Minimum thickness of insulation for vessels of capacity less than those in the table below to be 80mm.

- Insulation thickness for vessels with capacity greater than 2m³ to be 120mm.
- Install insulation in accordance with the manufacturer's recommendations.
- Encase insulation in 1.6mm thick galvanised mild steel sheets.

Nominal Capacity (litres)	Typical vessel Diameter (m)	Typical vessel Height or length(m)	Maximum Heat Loss (kWh/24h)	kW	W/m ²	Rock mineral wool slab thickness mm
700	0.675	1.750	4.1	0.171	38.6	80
800	0.750	1.950	4.3	0.179	32.7	90
900	0.800	2.000	4.5	0.188	31.1	100
1000	0.850	1.950	4.7	0.196	30.9	100
1200	0.900	2.100	4.9	0.204	28.3	100
1500	1.050	1.950	5.1	0.213	26.0	110
2000	1.050	2.500	5.2	0.217	21.7	120

- Basis of table: Part of Table 27 in NDBSCG 2013, rock mineral wool slabs (plain, without foil facing) conforming to BS EN 14303, 45Kg/m³ and thermal conductivity of 0.042W/mK at 50°C mean temperature.

2310 NON-DOMESTIC HEATING INSTALLATIONS, BUILDING REGULATIONS - ROCK MINERAL WOOL:

- Insulation thickness to achieve the maximum permissible heat loss stated in the Building Regulations Part L Non Domestic Building Services Compliance Guide Northern Ireland Technical Booklet F2, and section 6 of the Scottish Non Domestic Technical Handbook.

Outside diameter of steel pipe (mm)	Thickness of rock mineral wool insulation (mm)					
Temperature of contents °C	≤95		96-120		121-150	
Surface emissivity	0.05	0.9	0.05	0.9	0.05	0.9
17	25	30	25	30	25	30
21	30	35	30	35	30	35
27	35	40	40	45	40	45
34	35	40	45	55	55	55
42	35	40	55	60	65	70
48	40	45	55	60	70	75
60	40	45	60	65	75	80
76	45	50	60	65	80	90
89	45	50	65	70	80	90
114	50	55	65	75	90	100
140	50	55	70	75	90	100
168	50	55	70	80	100	100
219	50	60	75	80	100	120

273	50	60	75	90	100	120
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- Basis of calculation of thickness: Horizontal pipe at 75°C (LTHW) or 100°C (MTHW) or 125°C (HTHW) in still air at 15°C. Thermal conductivity calculated from the mean insulation temperature based on the fluid and air temperatures.
- Use this table for insulation thickness of copper or plastic pipework of the nearest equivalent outside diameter.

2315 NON-DOMESTIC HEATING INSTALLATIONS, BUILDING REGULATIONS - GLASS MINERAL WOOL:

- Insulation thickness to achieve the maximum permissible heat loss stated in the Building Regulations Part L Non Domestic Building Services Compliance Guide, Northern Ireland Technical Booklet F2 and section 6 of the Scottish Non Domestic Technical Handbook.

Outside diameter of steel pipe (mm)	Thickness of glass wool insulation (mm)					
Temperature of contents °C	≤95		96-120		121-150	
Surface emissivity	0.05	0.9	0.05	0.9	0.05	0.9
17	25	30	25	30	25	30
21	30	40	30	40	30	40
27	30	40	40	40	40	40
34	40	40	50	50	50	50
42	40	40	50	50	60	60
48	40	50	50	60	60	80
60	40	50	60	60	80	80
76	50	50	60	60	80	80
89	50	50	60	80	80	80
114	50	50	60	80	80	100
140	50	60	80	80	100	100
168	50	60	80	80	100	100
219	50	60	80	80	100	100
273	50	60	80	80	100	100

- Basis of calculation: Horizontal pipe at 75°C (LTHW), 100°C (MTHW) or 125°C (HTHW) in still air at 15°C. Thermal conductivity calculated from the mean insulation temperature based on the fluid and air temperatures.
- Use this table for insulation thickness of copper or plastic pipework of the nearest equivalent outside diameter.

2325 NON-DOMESTIC HEATING INSTALLATIONS, BUILDING REGULATIONS - PHENOLIC FOAM:

- Insulation thickness to achieve the maximum permissible heat loss stated in the Building Regulations Part L Non Domestic Building Services Compliance Guide, Northern Ireland Technical Booklet F2 and section 6 of the Scottish Non Domestic Technical Handbook.

Outside diameter of steel pipe (mm)	Low temperature hot water ≤95°C	
	Thickness of phenolic foam insulation (mm)	
Surface emissivity	(0.05)	(0.9)
17	15	15
21	15	20
27	20	20

34	20	20
42	20	25
48	25	25
60	25	25
76	25	30
89	25	30
114	30	30
140	30	35
168	30	35
219	30	35
273 and above	35	35

- Basis of calculation: Horizontal pipe at 75°C (LTHW), in still air at 15°C, aged k value. Thermal conductivity calculated from the mean insulation temperature based on the fluid and air temperatures.
 - Use this table for insulation thickness of copper pipework of the nearest equivalent outside diameter.
 - Use this table for insulation thickness of plastic pipework of the nearest equivalent outside diameter.

2326 NON-DOMESTIC HEATING INSTALLATIONS, BUILDING REGULATIONS - NITRILE RUBBER:

- Insulation thickness to achieve the maximum permissible heat loss stated in the Building Regulations Part L Non Domestic Building Services Compliance Guide, Northern Ireland Technical Booklet F2 and section 6 of the Scottish Non Domestic Technical Handbook.

Outside diameter of steel pipe (mm)	Thickness of nitrile rubber insulation (mm)					
Temperature of contents °C	≤95		96-120#		121-150#	
Surface emissivity	0.05	0.9	0.05	0.9	0.05	0.9
17	27	31	26	29	32	35
21	31	36	32	36	38	42
27	34	39	40	45	48	52
34	36	42	47	52	59	65
42	38	44	51	57	74	81
48	40	46	52	58	77	84
60	42	48	56	62	82	89
76	44	50	59	66	87	95
89	45	52	61	67	90	98
114	47	54	65	71	96	103
140	48	55	68	74	100	107
168	49	56	70	77	102	110
219	51	58	72	79	106	115
273	51	58	74	81	109	118

- Thicknesses of nitrile rubber are minimum calculated thicknesses.
- Basis: Horizontal pipe at 75°C (LTHW) or 100°C (MTHW) or 125°C (HTHW) in still air at 15°C. Thermal conductivity calculated from the mean insulation temperature based on the fluid and air temperatures.
 - Use this table for insulation thickness of copper or plastic pipework of the nearest equivalent outside diameter.
 - # for service temperatures above 110°C specialist high temperature Foamed EPDM rubber must be used as recommended by the manufacturer.

2327 NON-DOMESTIC HEATING INSTALLATIONS, ECA ENHANCED:

- The insulation manufacturer selected for a particular project should calculate the minimum required thicknesses of pipework insulation based on the actual conductivity of the product at the relevant temperature and the criteria on the ECA web site for an eligible installation using the methodology set out in BS EN ISO 12241 and the assumptions set out in Table C1 of BS 5422. The table below defines the maximum permissible heat losses to be used in the calculations.

Non-Domestic Heating Installations Maximum Permitted Heat Loss (W/m)			
Temperature	Low	Medium	High
	< 95°C	96-120°C	121-150°C
Outside Pipe Diameter (mm)			
17.2	7.78	10.57	13.27
21.3	8.42	11.25	14.06
26.9	9.05	12.06	15.02
33.7	9.86	13.04	16.07
42.4	10.83	14.12	17.34
48.3	11.42	14.80	18.09
60.3	12.61	16.22	19.62
76.1	14.12	17.88	21.41
88.9	15.28	19.20	22.87
114.3	17.51	21.66	25.53
139.7	19.72	23.99	27.98
168.3	22.34	26.63	30.69
219.1	26.61	31.15	35.25
273 & above	30.91	35.83	40.05

2330 DOMESTIC CENTRAL HEATING AND HOT WATER SYSTEMS - ROCK MINERAL WOOL:

- Insulation thickness to achieve the maximum permissible heat loss stated in the Building Regulations Part L Domestic Building Services Compliance Guide Northern Ireland Technical Booklet F1, and section 6 of the Scottish Domestic Technical Handbook.

Outside diameter of copper pipe (mm)	Domestic heating and hot water	
	Thickness of mineral wool insulation (mm)	
Surface emissivity	0.05	0.9
17	-	-
22	20	20
28	20	25
35	20	25
42	20	25
54	20	25

- Basis of calculation of thicknesses: Horizontal pipe at 60°C (LTHW) in still air at 15°C. Thermal conductivity calculated from the mean insulation temperature based on the fluid and air temperatures.
- Mineral wool sections are not available for pipe outside diameters less than 17mm.
 - Use this table for insulation thickness for plastic pipework of the nearest equivalent outside diameter.

2331 DOMESTIC CENTRAL HEATING AND HOT WATER INSTALLATIONS, ECA ENHANCED:

- The insulation manufacturer selected for a particular project should calculate the minimum required

thicknesses of pipework insulation based on the actual conductivity of the product at the relevant temperature and the criteria on the ECA web site for an eligible installation using the methodology set out in BS EN ISO 12241 and the assumptions set out in Table C1 of BS 5422. The table below defines the maximum permissible heat losses to be used in the calculations.

Domestic Heating & Hot Water Maximum Permitted Heat Loss (W/m)	
Temperature	60°C
Outside Pipe Diameter (mm)	
8	5.82
10	6.20
12	6.52
15	7.03
22	8.02
28	8.87
35	9.63
42	10.58
54	11.83

2335 DOMESTIC CENTRAL HEATING AND HOT WATER SYSTEMS - GLASS MINERAL WOOL:

• Insulation thickness to achieve the maximum permissible heat loss stated in the Building Regulations Part L Domestic Building Services Compliance Guide Northern Ireland Technical Booklet F1, and section 6 of the Scottish Domestic Technical Handbook.

Outside diameter of copper pipe (mm)	Domestic heating and hot water	
	Thickness of glass mineral wool insulation (mm)	
Surface emissivity	0.05	0.9
17	20	20
22	20	20
28	20	20
35	20	25
42	20	25
54	20	25

- Basis of calculation: Horizontal pipe at 60°C (LTHW) in still air at 15°C. Thermal conductivity calculated from the mean insulation temperature based on the fluid and air temperatures.
- Glass mineral wool sections are not available for pipe outside diameters less than 17mm.
 - Use this table for insulation thickness for plastic pipework of the nearest equivalent outside diameter.

2336 DOMESTIC CENTRAL HEATING AND HOT WATER SYSTEMS - PHENOLIC FOAM:

• Insulation thickness to achieve the maximum permissible heat loss stated in the Building Regulations Part L Domestic Building Services Compliance Guide, Northern Ireland Technical Booklet F1 and section 6 of the Scottish Domestic Technical Handbook.

Outside diameter of copper pipe (mm)	Domestic heating and hot water	
	Thickness of phenolic foam insulation (mm)	
Surface emissivity	0.05	0.9

15	15	15
22	15	15
28	15	15
35	15	15
42	15	15
54	15	15

- Basis: Horizontal pipe, water at 60°C in still air at 15°C, aged k value. Thermal conductivity calculated from the mean insulation temperature based on the fluid and air temperatures.

2337 DOMESTIC CENTRAL HEATING AND HOT WATER SYSTEMS, BUILDING REGULATIONS - NITRILE RUBBER:

- Insulation thickness to achieve the maximum permissible heat loss stated in the Building Regulations Part L Domestic Building Services Compliance Guide Northern Ireland Technical Booklet F1, and section 6 of the Scottish Domestic Technical Handbook.

Outside diameter of copper pipe (mm)	Domestic heating and hot water	
	Thickness of nitrile rubber insulation (mm)	
Surface emissivity	0.05	0.9
8	9	9
10	13	13
12	13	19
15	19	19
22	19	25
28	19	25
35	25	25
42	25	25
54	25	32

- Basis: Horizontal pipe, water at 60°C in still air at 15°C. Thermal conductivity calculated from the mean insulation temperature based on the fluid and air temperatures.

2340 STEAM AND CONDENSATE SYSTEMS FOR HVAC SYSTEMS - ROCK MINERAL WOOL:

Outside diameter of steel pipe (mm)	Thickness of rock mineral wool insulation (mm)					
Temperature of contents °C	Condensate ≤100°C #		Steam & Condensate Up to 149°C ## (3.6 barg max)		Steam & Condensate 150°C and above ###	
Surface emissivity	0.05	0.9	0.05	0.9	0.05	0.9
17	25	30	25	30	45	50
21	30	35	30	35	55	70
27	40	45	40	45	75	80
34	45	55	55	55	90	100
42	55	60	65	70	120	120
48	55	60	70	75	120	120
60	60	65	75	80	120	130
76	60	65	80	90	130	140
89	65	70	80	90	130	140

114	65	75	90	100	140	140
140	70	75	90	100	140	150
168	70	80	100	100	140	150
219	75	80	100	120	150	150
273	75	90	100	120	150	160
Flat surfaces	75	90	100	120	150	160

- # Basis of calculation of thicknesses: BS 5442 Table 16 for high emissivity outer surfaces (0.9 - painted and other finishes including black rubber) and Table 15 for low emissivity outer surfaces (0.05 - aluminium foil or bright aluminium) - Horizontal pipe at 100°C in still air at 15°C. Thermal conductivity calculated from the mean insulation temperature based on the fluid and air temperatures.
- ## Basis of calculation of thicknesses: BS 5442 Table 16 for high emissivity outer surfaces (0.9 - painted and other finishes including black rubber) and Table 15 for low emissivity outer surfaces (0.05 - aluminium foil or bright aluminium) - Horizontal pipe at 125°C in still air at 15°C. Thermal conductivity calculated from the mean insulation temperature based on the fluid and air temperatures.
- ### Basis of calculation of thicknesses: BS 5442 Table 16 for high emissivity outer surfaces (0.9-painted and other finishes including black rubber) and Table 15 for low emissivity outer surfaces (0.05 - aluminium foil or bright aluminium) - Horizontal pipe at 150°C (but using heat losses for 125°C) in still air at 15°C. Thermal conductivity calculated from the mean insulation temperature based on the fluid and air temperatures.
- These thicknesses are greater than those for process pipework with a hot face temperature of 200°C to control heat loss and limit surface temperature. (Tables 21 and 24 in BS 5224).
- Use this table for insulation thickness of copper pipework of the nearest equivalent outside diameter.

2395 COOLED WATER SUPPLIES, BUILDING REGULATIONS AND CONDENSATION CONTROL ON COOLED AND COLD WATER SUPPLIES - ROCK MINERAL WOOL:

- Insulation thicknesses are the worst case to control heat gain to maximum permissible figures stated in the Building Regulations Part L Non Domestic Building Services Compliance Guide Northern Ireland Technical Booklet F2, and section 6 of the Scottish Non Domestic Technical Handbook and control condensation in accordance with BS 5442.

Outside diameter of steel pipe (mm)	Thickness of mineral wool insulation (mm)					
Temperature of contents °C	>10		4.9 to 10		0 to 4.9	
Surface emissivity	0.05	0.9	0.05	0.9	0.05	0.9
17	20	20	25	25	30	30
21	20	20	25	25	30	30
27	20	20	30	30	35	30
34	20	25	30	30	35	35
42	25	25	30	30	40	35
48	25	25	35	30	40	35
60	25	25	35	35	45	40
76	30	30	40	35	50	45
89	30	30	40	35	50	40
114	30	30	45	35	55	45
140	35	30	45	40	55	45
168	35	30	50	40	60	45
219	35	30	50	40	65	45
273	40	30	55	40	70	45
324	40	40	55	45	70	60
356	40	40	60	50	75	60

406	45	50	60	60	75	70
456	45	60	60	70	80	80
508	45	60	65	80	80	90
610	50	80	70	90	90	110
Flat	50	80	70	90	90	110

- Basis for condensation: control ambient temperature of 25°C and a relative humidity of 80%. Thermal conductivity calculated from the mean insulation temperature based on the fluid and air temperatures.
 - Use this table for insulation thickness of copper pipework of the nearest equivalent outside diameter.
 - Use this table for insulation thickness of plastic pipework of the nearest equivalent outside diameter.

2396 COOLED WATER SUPPLIES, BUILDING REGULATIONS AND CONDENSATION CONTROL ON COOLED AND COLD WATER SUPPLIES - GLASS MINERAL WOOL:

- Minimum insulation thicknesses to control heat gain to maximum permissible figures stated in the Building Regulations Part L Non Domestic Building Services Compliance Guide and section 6 of the Scottish Non Domestic Technical Handbook and control condensation in accordance with BS 5442.

Outside diameter of steel pipe (mm)	Thickness of glass mineral wool insulation (mm)					
Temperature of contents °C	>10		4.9 to 10		0 to 4.9	
Surface emissivity	0.05	0.9	0.05	0.9	0.05	0.9
17	20	20	20	25	25	25
21	20	20	25	25	30	30
27	20	20	25	25	30	30
34	20	20	25	30	40	30
42	20	20	30	30	40	40
48	25	25	30	30	40	40
60	25	25	30	30	50	40
76	25	25	40	40	50	40
89	25	25	40	40	50	40
114	30	30	40	40	50	40
140	30	30	40	40	50	40
168	30	30	40	40	60	50
219	40	30	50	40	60	50
273	40	30	50	40	60	50
324	40	30	50	40	60	50
356	40	30	50	40	60	50
406	40	30	60	40	80	50
456	40	30	60	40	80	50
508	40	30	60	40	80	50
610	40	30	60	40	80	50
Flat	50	30	60	40	80	50

- Basis for condensation: control ambient temperature of 25°C and a relative humidity of 80%. Thermal conductivity calculated from the mean insulation temperature based on the fluid and air temperatures.

2411 COOLED WATER SUPPLIES, BUILDING REGULATIONS AND CONDENSATION CONTROL ON COOLED AND COLD WATER SUPPLIES - PHENOLIC FOAM:

- Insulation thicknesses to control heat gain to maximum permissible figures stated in the Building Regulations Part L Non Domestic Building Services Compliance Guide, Northern Ireland Technical Booklet F2

and section 6 of the Scottish Non Domestic Technical Handbook and control condensation in accordance with BS 5442.

Outside diameter of steel pipe (mm)	Thickness of phenolic foam insulation (mm)					
Temperature of contents °C	>10		4.9 to 10		0 to 4.9	
Surface emissivity	0.05	0.9	0.05	0.9	0.05	0.9
17	15	15	20	15	25	20
21	15	15	20	15	25	20
27	15	15	20	20	25	20
34	20	15	25	20	30	20
42	20	15	25	20	30	25
48	20	20	25	20	30	25
60	20	20	25	25	35	25
76	20	20	30	25	35	30
89	20	20	30	25	40	30
114	25	20	35	25	40	30
140	25	20	35	25	45	30
168	25	20	35	25	45	30
219	30	20	40	30	50	35
273	30	25	40	30	50	35
324	30	25	40	30	55	35
356	30	25	45	30	55	35
406	30	25	45	30	55	35
456	35	25	45	30	60	35
508	35	25	45	30	60	35
610	35	25	50	30	65	35

- Basis for condensation control: ambient temperature of 25°C and a relative humidity of 80%. Thermal conductivity calculated from the mean insulation temperature based on the fluid and air temperatures. Aged k value.

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

2412 COOLED WATER SUPPLIES, BUILDING REGULATIONS AND CONDENSATION CONTROL ON COOLED AND COLD WATER SUPPLIES - NITRILE RUBBER:

- Insulation thicknesses to control heat gain to maximum permissible figures stated in the Building Regulations Part L Non Domestic Building Services Compliance Guide, Northern Ireland Technical Booklet F2 and section 6 of the Scottish Non Domestic Technical Handbook and control condensation in accordance with BS 5442.

Outside diameter of steel pipe (mm)	Thickness of nitrile rubber (mm)					
Temperature of contents °C	>10		4.9 to 10		0 to 4.9	
Surface emissivity	0.05	0.9	0.05	0.9	0.05	0.9
17	15	21	20	26	23	30
21	16	22	21	27	24	31
27	17	23	23	29	2	33
34	18	25	24	31	29	36
42	19	26	25	32	30	38

48	20	27	26	33	31	39
60	20	27	27	35	33	40
76	21	28	28	37	37	45
89	21	29	29	37	37	45
114	22	30	29	37	37	45
140	22	30	30	38	37	45
168	22	30	30	39	38	47
219	22	31	30	39	38	47
273	22	31	30	39	38	47
324	25	35	30	40	40	50
356	25	35	35	40	40	50
406	25	40	35	40	45	50
456	25	40	35	40	45	50
508	25	40	35	40	45	50
610	25	40	35	40	45	50

- Basis for condensation control: ambient temperature of 25°C and a relative humidity of 80%. Thermal conductivity calculated from the mean insulation temperature based on the fluid and air temperatures.
- Thicknesses of nitrile rubber are minimum calculated thicknesses.

2420 PROTECTION AGAINST FREEZING - ROCK MINERAL WOOL:

Outside diameter of pipe (mm)	Indoor condition where freezing might occur	Outdoor condition where freezing might occur
	Thickness of mineral wool insulation (mm)	
Copper		
15	-	-
22	20	50
28	20	25
35	20	20
42	20	20
54	20	20
76	25	25
108	25	25
Steel		
21	40	-
27	20	45
34	20	25
42	20	20
48	20	20
60	20	20
76	25	25
89	25	25

- Basis BS 5422 Table 29: Initial water temperature +2°C, evaluation period 12hrs thermal conductivity calculated from the mean insulation temperature based on the fluid and air temperatures.
- If mineral wool is used on pipes smaller than 20mm NB the required insulation thickness is too large to be applied in practice. To provide the appropriate degree of frost protection a combination of insulation and trace heating will be required.
 - Indoor condition is for ambient air temperature of -6°C, permitted ice formation of 50%.
 - Outdoor condition is for ambient air temperature of -10°C, permitted ice formation of 50%.

2421 PROTECTION AGAINST FREEZING - GLASS MINERAL WOOL:

Outside diameter of pipe (mm)	Indoor condition where freezing might occur	Outdoor condition where freezing might occur
	Thickness of glass mineral wool insulation (mm)	
Copper		
15	-	-
22	25	60
28	20	30
35	20	20
42	20	20
54	20	20
20	20	20
108	20	20
Steel		
21	50	-
27	25	40
34	20	20
42	20	20
48	20	20
60	20	20
76	20	20
89	20	20

- Basis BS 5422 Table 29: Initial water temperature +2°C, evaluation period 12hrs thermal conductivity calculated from the mean insulation temperature based on the fluid and air temperatures.
- If mineral wool is used on pipes smaller than 20mm NB the required insulation thickness is too large to be applied in practice. To provide the appropriate degree of frost protection a combination of insulation and trace heating will be required.
 - Indoor condition is for ambient air temperature of -6°C, permitted ice formation of 50%.
 - Outdoor condition is for ambient air temperature of -10°C, permitted ice formation of 50%.

2430 PROTECTION AGAINST FREEZING - PHENOLIC FOAM:

Outside diameter of pipe (mm)	Indoor condition where freezing might occur	Outdoor condition where freezing might occur
	Thickness of closed cell phenolic foam (mm)	
Steel		
21	30	75
27	15	30
34	15	20
42	15	15
48	15	15
60	15	15

76	15	15
89	15	15
Copper		
15	35	130
22	15	30
28	15	20
35	15	15
42	15	15
54	15	15
76	15	15
108	15	15

- Basis BS 5422 Table 29: Initial water temperature +2°C, evaluation period 12hrs, thermal conductivity calculated from the mean insulation temperature based on the fluid and air temperatures.
 - Indoor condition is for ambient air temperature of -6°C, permitted ice formation of 50%.
 - Outdoor condition is for ambient air temperature of -10°C, permitted ice formation of 50%.
 - Use this table for insulation thickness of copper pipework of the nearest equivalent outside diameter.

2440 PROTECTION AGAINST FREEZING - CLOSED CELL NITRILE RUBBER:

Outside diameter of pipe (mm)	Indoor condition where freezing might occur	Outdoor condition where freezing might occur
	Thickness of closed cell nitrile rubber (mm)	
Steel		
21	54	-
27	21 (25)	59
34	13(13)	31(35)
42	7(9)	17(19)
48	4(6)	10(13)
60	2(6)	6(6)
76	(6)	3(6)
89	(6)	2(6)
Copper		
15	84	-
22	18	59
28	10	31
35	6	17
42	6	10
54	6	6
76	6	6
108	6	6

- Basis BS 5422 Table 29: Initial water temperature +2°C, evaluation period 12hrs, thermal conductivity values calculated from the mean insulation temperature based on the fluid and air temperatures.
- If nitrile runner is used on pipes smaller than 20mm NB for the outdoor condition, the required insulation thickness is too large to be applied in practice. To provide the appropriate degree of frost protection a combination of insulation and trace heating will be required.
- Figures (xx) are nearest commercially available material thicknesses. Greater thicknesses to be achieved by

layering of insulation.

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

2456 INSULATION THICKNESS ON DUCTWORK, BUILDING REGULATIONS:

• Insulation thickness to limit heat gains and heat losses stated in the Building Regulations Part L Non Domestic Building Services Compliance Guide, Northern Ireland Technical Booklet F2 and section 6 of the Scottish Non Domestic Technical Handbook.

Material	Thickness of insulation (mm)					
	Warm air ductwork			Chilled air / dual purpose ductwork		
Surface Emissivity	Low (0.05)	Med (0.44)	High (0.9)	Low (0.05)	Med (0.44)	High (0.9)
Rock Mineral wool	40	40	40	50	60	70
Ductwrap						
Glass mineral wool	40	40	40	50	60	60
Phenolic foam	20	25	25	35	40	40
Nitrile rubber	32	37	40	51	60	62

- Basis:
 - Warm air ductwork - horizontal duct at 35°C, with 600 mm vertical sidewall in still air at 15°C.
 - Chilled air ductwork - horizontal duct at 13°C, with 600 mm vertical sidewall in still air at 25°C.
 - Thermal conductivity values calculated from the mean insulation temperature based on the fluid and air temperatures.
 - Thicknesses of mineral wool and phenolic foam are the nearest commercially available thickness to meet minimum requirements.
 - Thicknesses of nitrile rubber are minimum thicknesses.

2460 CONDENSATION CONTROL ON CHILLED AIR DUCTWORK - ROCK MINERAL WOOL:

• Insulation thickness for condensation control on ductwork carrying chilled air in ambient conditions: indoor still air temperature 25°C, relative humidity 80%, dew point temperature 21.3°C.

Minimum air temperature inside duct °C	Thickness of rock mineral wool insulation (mm)		
Surface emissivity	Low (0.05)	Medium (0.44)	High (0.90)
15	30	25	25
10	50	25	25
5	70	40	25
0	90	50	30

- Basis: Table 12 in BS 5422, thermal conductivity values calculated from the mean insulation temperature based on the fluid and air temperatures.
- All ductwork shall be insulated where were visible (i.e exposed ductwork) when the duct surface temperature is below the dew point of the air within the space served.

2461 CONDENSATION CONTROL ON CHILLED AIR DUCTWORK - GLASS MINERAL WOOL:

- Insulation thickness for condensation control on ductwork carrying chilled air in ambient conditions: indoor still air temperature 25°C, relative humidity 80%, dew point temperature 21.3°C.

Minimum air temperature inside duct °C	Thickness of glass mineral wool insulation (mm)		
Surface emissivity	Low (0.05)	Medium (0.44)	High (0.90)
15	25	25	25
10	40	25	25
5	50	40	25
0	50	50	40

- Basis: Table 12 in BS 5422, thermal conductivity values calculated from the mean insulation temperature based on the fluid and air temperatures.
- All ductwork shall be insulated where were visible (i.e exposed ductwork) when the duct surface temperature is below the dew point of the air within the space served.

2470 CONDENSATION CONTROL ON CHILLED AIR DUCTWORK - PHENOLIC FOAM:

- Minimum insulation thickness for condensation control on ductwork carrying chilled air in ambient conditions: indoor still air temperature 25°C, relative humidity 80%, dew point temperature 21.3°C.

Minimum air temperature inside duct °C	Thickness of phenolic foam insulation (mm)		
Surface emissivity	Low (0.05)	Medium (0.44)	High (0.90)
15	20	20	20
10	30	20	20
5	50	25	20
0	60	30	20

- Basis: Table 12 in BS 5422, thermal conductivity values calculated from the mean insulation temperature based on the fluid and air temperatures.
- All ductwork shall be insulated where were visible (i.e exposed ductwork) when the duct surface temperature is below the dew point of the air within the space served.

2475 CONDENSATION CONTROL ON CHILLED AIR DUCTWORK - CLOSED CELL FEF NITRILE FOAM:

- Minimum insulation thickness for condensation control on ductwork carrying chilled air in ambient conditions: indoor still air temperature 25°C, relative humidity 80%, dew point temperature 21.3°C.

Minimum air temperature inside duct °C	Nominal thickness of FEF Nitrile foam insulation (mm)	
Surface emissivity	low (0.05)	high(0.9)

15	12	6
10	21	11
5	31	17
0	40	22

- Basis: Table 12 in BS 5422, thermal conductivity values calculated from the mean insulation temperature based on the fluid and air temperatures.
- All ductwork shall be insulated where were visible (i.e exposed ductwork) when the duct surface temperature is below the dew point of the air within the space served.
- Thicknesses of nitrile rubber are minimum thicknesses.

2495# THICKNESS OF INSULATION TO BS 5422 FOR REFRIGERATION PIPEWORK AND EQUIPMENT:

- To control heat gain and condensation, comply with the requirements of section 6 of BS 5422 and supply minimum thickness of insulation in accordance with relevant tables below and Annexes F and H in BS 5422.
 - Table 1 – Maximum permitted water vapour permeance in relation to plant temperature at an ambient temperature of +20°C (dry bulb).
 - Table 2 – Minimum insulation thickness for refrigeration applications to control condensation and control heat gain on a high emissivity outer surface (0.90) with an ambient temperature of +20°C and a relative humidity of 70%.
 - Table 3 – Minimum insulation thickness for refrigeration applications to control condensation and control heat gain on a low emissivity outer surface (0.05) with an ambient temperature of +20°C and a relative humidity of 70%.
 - Table 4 – Minimum insulation thickness for refrigeration applications to control condensation and control heat gain on a high emissivity outer surface (0.90) with an ambient temperature of +25°C and a relative humidity of 80%.
 - Table 5 – Minimum insulation thickness for refrigeration applications to control condensation and control heat gain on a low emissivity outer surface (0.05) with an ambient temperature of +25°C and a relative humidity of 80%.

3000 WORKMANSHIP

3010 GENERAL:

- Install insulation in accordance with BS 5970.
- Carry out thermal insulation work using one of the scheduled firms employing skilled craftsmen conversant with class of work.
- In locations where insulation cannot be installed adequately after pipeline or ductline installation, pre-insulated sections shall be installed. Insulation to such sections shall be equivalent in thermal and physical properties to that specified for the remainder of the system including vapour barriers.
- Do not apply thermal insulation until installation has been fully tested and all joints proved sound.
- Ensure all materials are kept dry.
- Ensure all pipework surfaces are dry before the installation of thermal insulation.
- Insulate each unit separately. Do not enclose adjacent units together.
- Ensure there is clearance between insulated pipes.
- Application
 - Apply insulants, facings, coatings and protection strictly in accordance with manufacturer's instructions.
- Finish
 - Neatly finish joints, corners, edges and overlaps and, where possible, arrange overlaps to fall on blind side. Ensure overlaps are neat and even and parallel to circumferential and longitudinal joints.

3020 INSTALLATION OF FOIL FACED MINERAL WOOL INSULATION ON PIPEWORK:

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

3030 INSTALLATION OF FOIL FACED PHENOLIC FOAM INSULATION ON PIPEWORK:

- Ensure joints are close butted together. Secure overlaps with adhesive or matching class 'O' tape, a minimum of 50mm wide, on both longitudinal and circumferential butt joints. Insulate fittings to same standard as adjacent pipework and use mitred segments where necessary, taped as above.
- Before phenolic foam sectional insulation is applied, ensure that all pipework is clean, dry and free of any debris or corrosive substances such as excess soldering flux, building materials.
- Installation shall be by a contractor approved by the manufacturers strictly in accordance with the manufacturer's installation instructions.
- All exposed edges of phenolic foam insulation shall be sealed to the surface being insulated with a suitable vapour sealing mastic.

3040 INSTALLATION OF INSULATION WITH CANVAS FINISH ON PIPEWORK:

- Ensure joints are close butted together and secure overlaps with adhesive and smooth out. Insulate fittings to same standard as adjacent pipework and use mitred segments where necessary, secure with adhesive using a minimum of 50mm wide canvas to cut mitred joints.
- Apply two coats of class 'O' polymer solution.

3050 INSTALLATION OF CLOSED CELL NITRILE RUBBER INSULATION ON PIPEWORK:

- Install closed cell nitrile rubber in accordance with manufacturer's recommendations.
- Check installation procedure when closed cell nitrile rubber is to be installed on stainless steel pipework.

3060 INSTALLATION OF FOIL FACED RIGID OR SLOTTED PHENOLIC INSULATION ON DUCTWORK:

- Secure the insulation with adhesive in accordance with manufacturer's recommendations. Use insulation hangers that are fit for purpose and in accordance with thermal insulation and insulation hanger manufacturers.
- Cut slabs so that the top and bottom pieces overlap the sides. Seal joints and pin penetrations using 100mm wide class 'O' aluminium foil tape.
- Where cut outs for test holes, etc occur tape over insulation membrane and return to the duct surface.
- Where insulation abuts duct support inserts that have integral vapour barriers seal using class 'O' foil tape to continue vapour barrier.

3070 INSTALLATION OF FOIL FACED FLEXIBLE DUCTWORK INSULATION:

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

3080 INSTALLATION OF FOIL FACED LAMELLA ON DUCTWORK:

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

3085 INSTALLATION OF CRIMPED MAT ON DUCTWORK:

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

3090 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.

3100 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.

3110 INSTALLATION OF PHENOLIC FOAM INSULATION ON VESSELS:

- Use pre-formed segments or pre-slotted foil faced insulation to fit the diameter of the vessel, laid with staggered joints. Vapour seal the joint faces. Use jointing compound to fill and seal joints around protrusions.
- Do not use wire to secure insulation.
- Secure insulation segments up to 3500mm outside insulation diameter with filament tape 38mm wide at 300mm centres.
- Secure insulation segments over 3500mm outside insulation diameter with aluminium banding.
- Finish as manufacturer's recommendations.

3120 INSTALLATION OF POLYISOBUTYLENE (PIB) PROTECTION:

- Wrap pipework and fittings, ductwork or tanks and vessels with PIB sheeting lapped at every joint by at least 50mm. Solvent weld joints and support with banding in accordance with manufacturer's
- Arrange joints to shed water and prevent the ingress of water.

3125 INSTALLATION OF MULTI-LAYERED LAMINATE:

- Install laminated foil/film protection, in accordance with manufacturer's instructions.
- Installation may be either factory pre-applied or applied in-situ.
- Ensure all surfaces are dry and clean, free from dust, oil and grease/silicone.
- Arrange joints to give water shed with the lap facing down.

3130A INSTALLATION OF SHEET METAL FINISH ON PIPEWORK:

- Secure insulation with metal bands at each end of section and at maximum centres of 450mm. Form sheet metal to fit tightly over the outer circumference of insulation with a longitudinal overlap of at least 40mm. Secure the outer part of overlap with self tapping screws or rivets at centres of not more than 150mm. Not on pipes with vapour barrier; or metal bands of same material.
- Ensure circumferential overlaps are at least 50mm, secured with self tapping screws or rivets. Make provision to accommodate expansion and contraction at intervals. Ensure all joints are lapped to shed liquids and seal all joints exposed to weather or spillage. Cover all bends and fittings with matching sheet metal, tailored to fit and sealed as appropriate. Fit pre-insulated, purpose-designed boxes to valves, flanges, etc.

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

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

3150 INSTALLATION OF CANVAS PROTECTION:

Cover the whole with 130g (minimum) canvas with at least 50mm overlaps. Seal joints. Give two coats of class 'O' polymer solution. Fit aluminium bands where indicated.

3160 INSTALLATION OF ROOFING FELT PROTECTION:

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

3170 INSTALLATION OF ALUMINIUM SHEETING PROTECTION:

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

3180 INSTALLATION OF ALUMINIUM-ZINC COATED STEEL PROTECTION:

- Install aluminium-zinc coated steel protection, in accordance with manufacturer's instructions.

3190 INSTALLATION OF RIGID PVC PROTECTION:

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

3195 INSTALLATION OF LAMINATED FOIL/FILM PROTECTION:

- Install laminated foil/film protection, in accordance with manufacturer's instructions.
- Ensure all surfaces are dry and clean, free from dust, oil and grease/silicone.

- Arrange joints to give a water shed with the lap facing down.

3210 FLANGES AND VALVES:

- Cut back to allow removal of bolts and nuts, finish with neat bevel or use end caps.

Where boxes are used fit over insulation on adjacent piping. Ensure operation of valve remains unimpaired with box in place.

3220 LINERS:

- Where load bearing insulation is required use segmental liners suitable for temperature. Fit insulant up to liner and carry facing across the pipe ring.

3230A INSTALLATION WHERE INSULATION IS CARRIED THROUGH PIPELINE SUPPORT:

- For load bearing insulation, carry through insulation and finish.
- For non-load bearing insulation on hot pipework close butt to a section of load bearing finished material minimum 100mm long.
- For non-load bearing insulation on cold pipework, close butt to high density phenolic foam pipe supports. Ensure the vapour barrier is maintained.

3230B INSTALLATION WHERE CLOSED CELL INSULATION IS CARRIED THROUGH PIPELINE SUPPORT:

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

3250 INSTALLATION WHERE INSULATION IS CARRIED THROUGH DUCTWORK SUPPORT:

- Provide insulation between duct and support using high density phenolic foam strips. Butt insulation to spacer and carry over finish by 40mm and tape joint. Provide a sheet metal protecting sleeve. Load bearing materials must have a suitable compressive strength for the applied load.

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 protection, submit proposals for securing sheeting without impairing the integrity of the vapour seal for approval.

BS APPENDIX

BS 3533:1981

Glossary of thermal insulation terms

BS 476-4:1970

Fire tests on building materials and structures. Part 4 Non-combustibility test for materials

BS 476-6:1989+A1:2009

Fire tests on building materials and structures. Part 6 Method of test for fire propagation for products

BS 476-7:1997

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

BS 5422:2009

Method for specifying thermal insulating materials for pipes, tanks, vessels, ductwork and equipment operating within the temperature range -40°C to +700°C

BS 5970:2012

Code of practice for thermal insulation of pipework and equipment in the temperature range of -100°C to +870°C

BS EN 10346:2015

Continuously hot-dip coated steel flat products for cold forming. Technical delivery conditions

BS EN 13501-1:2007+A1:2009

Fire classification of construction products and building elements. Classification using test data from reaction to fire tests

BS EN 13823:2010+A1:2014

Reaction to fire tests for building products. Building products excluding floorings exposed to the thermal attack by a single burning item

BS EN 14303:2009

Thermal insulation products for building equipment and industrial installations. Factory made mineral wool products (MW). Specification.

BS EN 14304:2009+A1:2013

Thermal insulation products for building equipment and industrial installations. Factory made flexible elastomeric foam (FEF) products. Specification.

BS EN 14314:2009+A1:2013

Thermal insulation products for building equipment and industrial installations. Factory made phenolic foam (PF) products. Specification.

BS EN ISO 1182:2010

Reaction to fire tests for products. Non-combustibility test

BS EN ISO 12241:2008

Thermal insulation for building equipment and industrial installations. Calculation rules

BS EN ISO 1716:2010

Reaction to fire tests for products. Determination of the gross heat of combustion (calorific value)

Y51 TESTING AND COMMISSIONING

1000 GENERAL

2000 STATIC TESTING:

2010 PRESSURE TESTING - GENERAL:

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

2020 PRESSURE TESTING - WATER CIRCULATING AND SUPPLY SYSTEMS AND STEAM AND CONDENSE LINES:

- Carry out Hydraulic Pressure Testing as described in HVCA TR/6 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 one and a half times operating pressure.
 - 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, whichever is the greater.

2030# PRESSURE TESTING - UNDERGROUND PIPEWORK:

2040 PRESSURE TESTING - WATER MAINS:

- Test to Local Authority requirements. Ensure the provisions laid down in HVCA TR/6 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.

2055# PRESSURE TESTING - REFRIGERANT PIPEWORK:

2055A PRESSURE TESTING - REFRIGERANT PIPEWORK, STRENGTH PRESSURE TEST:

- Test refrigerant pipework using the strength test procedure as detailed in Clause R6.4 of the CIBSE Commissioning Code R: 2002.

2055B PRESSURE TESTING - REFRIGERANT PIPEWORK, LEAK TEST:

- Test refrigerant pipework using the leak test procedure as detailed in Clause R6.5 of the CIBSE Commissioning Code R: 2002.

2055C PRESSURE TESTING - REFRIGERANT PIPEWORK, DEEP VACUUM TEST:

- Test refrigerant pipework using the deep vacuum test method as detailed in Clause R6.6 of the CIBSE Commissioning Code R: 2002.

2060# PRESSURE TESTING - GAS PIPEWORK:

- Carry out a pneumatic leak test followed by a pneumatic pressure test as described in HVCA TR/6 Guide to Good Practice for Site Pressure Testing of Pipework.
- Pressure test gas supply pipework in accordance with BS EN 12327
- Comply with IGE/UP/1 Strength and tightness testing and direct purging of industrial and commercial gas installations.
- Comply with IGE/UP/1A Strength and tightness testing and direct purging of small low pressure industrial and commercial gas installations.

2065 PRESSURE TESTING - OIL PIPEWORK TO BS 5410:

2070 PRESSURE TESTING - PIPED MEDICAL SERVICES:

- Test in accordance with requirements of HTM 02-01.

2080 PRESSURE TESTING - SOIL, WASTE, VENTILATION, ANTI-SYPHON AND RAINWATER PIPEWORK:

- Test section by section as the work proceeds and subsequently on completion with all sanitary fittings fixed and working. Submit systems to two separate tests, Air test and Hydraulic Performance test in accordance with BS EN 12056-2.

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 EN 752.

2100 VACUUM TESTING:

3000 COMMISSIONING

- BREEAM New Construction 2014 requirements
 - Comply with Issue ID Man 04 Commissioning and Handover.
 - Comply with Issue ID Man 05 Aftercare.
- BREEAM Refurbishment and Fit Out 2014 requirements
 - Comply with Issue ID Man 04 Commissioning and Handover.
 - Comply with Issue ID Man 05 Aftercare.

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.

3025 SEASONAL COMMISSIONING:

- Provide appropriately qualified personnel and all necessary equipment and materials to execute the seasonal commissioning works. The same organisation / team that carried out the original construction works shall undertake the seasonal commissioning.
- A schedule of suitable working periods and essential services to be maintained during any work will be provided by the building operator.
- A programme for the works shall be provided at least 1 month prior to the start date. This should account for any phased hand overs, cause as little disruption as possible and ensure essential services are maintained.
- The works shall comply with all statutory and client specific Health and Safety requirements.
- Any performance deficiencies found during seasonal commissioning shall be corrected.
- All seasonal commissioning shall be carried out in accordance with the project commissioning specification, an approved method statement, manufacturers' guidelines and the day-to day operational requirements of the building users.
- Record all seasonal commissioning works and after completion of the works update all building documentation including O&M manuals, Building Manual, Building Log book, Building User Guide and the Building Information Model (BIM). Any changes made to the systems during the works shall be clearly identified.
- BREEAM New Construction 2014 requirements
 - Comply with Issue ID Man 04 Commissioning and Handover.
 - Comply with Issue ID Man 05 Aftercare.
- BREEAM Refurbishment and Fit Out 2014 requirements
 - Comply with Issue ID Man 04 Commissioning and Handover.
 - Comply with Issue ID Man 05 Aftercare

3030 COMMISSIONING WATER DISTRIBUTION SYSTEMS:

- Preliminary checks
 - Carry out checks and procedures as detailed in CIBSE Commissioning Code W. Ensure system is statically complete as defined in Section 4 of BSRIA Guide BG 2/2010 - Commissioning Water Systems.
 - Use pre-commissioning checklist from BSRIA Guide BG 2/2010.
- Setting to work and regulation
 - Set to work and regulate water distribution systems in accordance with CIBSE Commissioning Code W and BSRIA Guide BG 2/2010.
- Measurement
 - Use instruments for measurement detailed in BSRIA Guide BG 2/2010.

3040 COMMISSIONING AIR DISTRIBUTION SYSTEMS:

- Preliminary checks
 - Carry out checks and procedures as detailed in BSRIA Guide BG 49/2015 Commissioning Air Systems.
 - Use pre-commissioning checklist in BSRIA Guide BG 49.
- Setting to work and regulate
 - Set to work and regulate constant and variable flow air distribution systems in accordance with CIBSE Commissioning Code A and BSRIA Guide BG 49.
- Measurement of air flow
 - Use instruments for measurement and methods of measurement detailed in BSRIA Guide BG 49 and

CIBSE Commissioning Code A.

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.

3055 COMMISSIONING OF GAS PLANT AND SYSTEMS:

- Commission gas fired plant on industrial and commercial premises in accordance with IGE/UP/4.
- Commission gas supply systems in accordance with BS EN 12327

3060 COMMISSIONING REFRIGERATING SYSTEMS:

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

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.

3090# INSTRUMENTS AND GAUGES:

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.

3100# COMMISSIONING RECORDS:

3100A AIR SYSTEMS COMMISSIONING RECORDS TO BSRIA BG 49/2015:

- Keep a systematic record of commissioning results and distribute as indicated.
- For air systems
 - Use record sheets as described in BSRIA Guide BG 49/2015 Commissioning Air Systems.

3100B WATER SYSTEMS COMMISSIONING RECORDS TO BSRIA GUIDE BG 2/2010:

- Keep a systematic record of commissioning results and distribute as indicated.
- For water systems
 - Use record sheets as detailed in BSRIA Guide BG 2/2010 Commissioning Water Systems.

3110 BMS COMMISSIONING - CONTROL SYSTEM SPECIFICATION DETAILS REQUIRED FOR COMMISSIONING:

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

- Requirement for post occupancy checks.

3120 BMS COMMISSIONING - PRE-COMMISSIONING:

- Ensure that as much pre-commissioning work as possible is performed off-site:
- Ensure that the following is followed:
 - Table 15 Pre-commissioning requirements

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

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

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

3130# BMS COMMISSIONING - PLANT READY FOR CONTROL SYSTEM COMMISSIONING:

- Confirm that the following plant commissioning has been performed before commencing the final BMS commissioning:

- Water systems
 - The system is cleaned and flushed to remove any debris.
 - All regulating, isolating and control valves in place and operating correctly.
 - That all flow measuring devices are in place and in the correct location for accurate measurement (including pressure tappings).
 - The system is vented.
 - That the proportional balancing is completed to obtain the branch flow rates in the correct ratio to each other (or through the use of and setting of self-balancing valves).
 - That the pump flow rate has been adjusted to provide the specified flow rate.
- Air systems
 - Debris has been removed from the air distribution system.
 - That dampers are in the correct location and fully functional.
 - That fire/smoke dampers open.
 - Test holes have been drilled and sealed with removable plugs.
 - That in-situ flow measuring devices have been installed.
 - Ductwork air leakage testing has been performed (if specified).
 - Completion of proportional balancing of regulating dampers so that terminals share the air flow in the correct proportions.
 - Regulation of the fan(s) to provide the specified flow rate.
- Packaged equipment
 - Ensure that plant and controls have been fully commissioned and are functional, ready for integration with other plant/systems.
 - That control equipment inputs/outputs are in the specified format for connection to the main control system.
- Confirm that the plant is commissioned in accordance with:
 - Air distribution systems, CIBSE Code A
 - Boiler plant, CIBSE Code B
 - Refrigerating systems, CIBSE Code R
 - Water systems, CIBSE Code W
 - BSRIA Guide BG 49/2015 Commissioning Air Systems
 - BSRIA Guide BG 2/2010 Commissioning Water Systems.

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

- Confirm that the following plant commissioning has been performed before commencing the final BMS commissioning:
 - Water systems
 - The system is cleaned and flushed to remove any debris.
 - All regulating, isolating and control valves in place and operating correctly.
 - That all flow measuring devices are in place and in the correct location for accurate measurement (including pressure tappings).
 - The system is vented.
 - That the proportional balancing is completed to obtain the branch flow rates in the correct ratio to each other (or through the use of and setting of self-balancing valves).
 - That the pump flow rate has been adjusted to provide the specified flow rate.
 - Air systems
 - Debris has been removed from the air distribution system.
 - That dampers are in the correct location and fully functional.
 - That fire/smoke dampers open.
 - Test holes have been drilled and sealed with removable plugs.
 - That in-situ flow measuring devices have been installed.
 - Ductwork air leakage testing has been performed (if specified).
 - Completion of proportional balancing of regulating dampers so that terminals share the air flow in the

correct proportions.

- Regulation of the fan(s) to provide the specified flow rate.
- Packaged equipment
 - Ensure that plant and controls have been fully commissioned and are functional, ready for integration with other plant/systems.
 - That control equipment inputs/outputs are in the specified format for connection to the main control system.
- Confirm that the plant is commissioned in accordance with:
 - Air distribution systems, CIBSE Code A
 - Boiler plant, CIBSE Code B
 - Refrigeration systems, CIBSE Code R
 - Water distribution systems, CIBSE Code W
 - BSRIA Guide BG 49/2015 Commissioning Air Systems
 - BSRIA Guide BG 2/2010 Commissioning Water Systems

3140 BMS COMMISSIONING - CONTROL SYSTEM REQUIREMENTS FOR PLANT COMMISSIONING:

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

3150 BMS COMMISSIONING:

- Ensure that the BMS is commissioned in accordance with the following requirements of CIBSE Code C (Commissioning of automatic control systems).
 - Control strategy checking - C6.2
 - Checking procedures for basic control functions - C6.3
 - Lighting controls - C6.4
 - Operator workstations - C6.5
 - Occupant interfaces - C6.6
 - Communication networks - C6.7
 - Integrated systems - gateways - C6.8
 - Integrated systems - direct interoperability - C6.9
 - Integration with fire detection systems - C6.10
 - Security systems - C6.11
 - Interruption of electrical power supplies - C6.12
 - Valves - C7.1
 - Dampers - C7.2
 - Fans - single speed - C7.3
 - Fans - variable speed - C7.4
 - Pumps - C7.5

4000 PERFORMANCE TESTING

4010 SYSTEM PERFORMANCE TESTING:

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

4015 TESTING OF RESIDENTIAL VENTILATION SYSTEMS:

- Demonstrate the performance of residential ventilation systems through performance testing and installation checks in accordance with BS EN 14134.
- Comply with the best practice requirements of BSRIA BG 46/2015 Domestic Ventilation Systems - A guide to measuring air flow rates, for measurement of air flow rates use the unconditional method.

4020# ENVIRONMENTAL TESTS:

- 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.
- Carry out ambient air quality tests in accordance with BS EN 13528-1, BS EN 13528-2 and BS EN 13528-3.

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.

4020B ENVIRONMENTAL TESTS, AMBIENT AIR QUALITY

- Carry out environmental testing to prove the performance of the systems.
- Carry out ambient air quality tests in accordance with BS EN 13528-1, BS EN 13528-2 and BS EN 13528-3.

4030 RECORDERS:

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

4040# TESTING TO SPECIFIED CONDITIONS:

- Rainwater Systems
 - Demonstrate by flow tests that the systems give satisfactory performance.
- Sanitary Systems
 - Comply with performance tests given in BS EN 12056.
- Cold Water Systems
 - Demonstrate that outlets supply adequate rates of flow.
- Fire Fighting Systems
 - Comply with requirements of the local Fire Authority and with the appropriate section of BS 5306.
- Hydraulic Systems -
 - Comply with requirements as indicated.
- Medical Gas and Air Systems
 - Comply with Health Technical Memorandum 02-01.
- Laboratory and Industrial Systems
 - Comply with requirements as indicated.
- Gas Systems
 - Comply with the requirements of the Local Authority.
- Silencers and Acoustic Treatment
 - Demonstrate by measured tests that noise criteria indicated have been achieved.
- Acoustic Enclosures
 - Demonstrate that measured air leakage complies with scheduled values.

BS APPENDIX

BS EN 12056-2:2000

Gravity drainage systems inside buildings. Part 2 Sanitary pipework, layout and calculation

BS EN 12327:2012

Gas infrastructure. Pressure testing, commissioning and decommissioning procedures. Functional requirements

BS EN 13528-1:2002

Ambient air quality. Diffusive samplers for the determination of concentrations of gases and vapours. Requirements and test methods. Part 1 General requirements

BS EN 13528-2:2002

Ambient air quality. Diffusive samplers for the determination of concentrations of gases and vapours. Requirements and test methods. Part 2 Specific requirements and test methods

BS EN 13528-3:2003

Ambient air quality. Diffusive samplers for the determination of concentrations of gases and vapours. Requirements and test methods. Part 3 Guide to selection, use and maintenance

BS EN 14134:2004

Ventilation for buildings. Performance testing and installation checks of residential ventilation systems

BS EN 752:2008

Drain and sewer systems outside buildings

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.

1040 LOCKING FACILITY:

- Where indicated, provide lockable levelling device.

2000 PRODUCTS/MATERIALS

2010A SYNTHETIC MATERIAL CONFIGURED MAT MOUNTINGS:

- Provide configured mat mountings manufactured from neoprene or composite fibre/synthetic rubber.
- Where mats are stacked, bond 1mm steel sheet thickness between each pad without filling voids.

2010B NATURAL RUBBER CONFIGURED MAT MOUNTINGS:

- Provide configured mat mountings manufactured from natural rubber.
- Where mats are stacked, bond 1mm steel sheet thickness between each pad without filling voids.

2010C HIGH TEMPERATURE CONFIGURED MAT MOUNTINGS:

- Provide configured mat mountings manufactured from high temperature synthetic rubber.
- Where mats are stacked, bond 1mm steel sheet thickness between each pad without filling voids.

2010D RESILIENT MAT MOUNTINGS:

- Provide a minimum of 20mm resilient mat and sheet of 1.6 mm steel for incorporation in cast in situ base.

2010E PAD MOUNTINGS:

- Provide pad mountings manufactured from composite synthetic rubber.

2020A SYNTHETIC RUBBER TURRET COMPRESSION MOUNTINGS:

- Provide turret compression mountings fabricated from synthetic rubber between two steel plates.
- Protect the metal from corrosion by painting and fix friction pads to top and bottom. Provide bolt holes to allow fixing.

2020B NEOPRENE TURRET COMPRESSION MOUNTINGS:

- Provide turret compression mountings fabricated from neoprene between two steel plates.
- Protect the metal from corrosion by painting and fix friction pads to top and bottom. Provide bolt holes to

allow fixing.

2030 SPRING COMPRESSION MOUNTINGS:

- Provide spring compression mountings comprising high strength low stress helical spring capped with steel pressure plate, on resilient base pad, mounted on pre-drilled base for bolting down, and enclosed with cap. Protect metal from corrosion.

2040 CAPTIVE SPRING MOUNTINGS:

- Provide captive spring mountings comprising high strength low stress helical spring designed to achieve horizontal and vertical snubbing.
- Mount spring on pre-drilled base plate for bolting down and protect against corrosion. Supply complete with levelling screw.

2060 SPRING COMPRESSION HANGERS:

- 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.

2080 HORIZONTALLY RESTRAINED SPRING MOUNTINGS:

- Provide horizontally restrained spring mountings 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 holes for installing across connection. In addition supply synthetic rubber or neoprene snubber as a horizontal buffer.

2090A CONCRETE/STEEL FORMWORK INERTIA BASES:

Provide purpose built inertia bases constructed using welded steel frame formwork containing concrete reinforced with 12mm minimum diameter bars at 100mm maximum centres, 35mm above the bottom of the base; and mounted on spring compression mountings.

2090B WELDED STEEL FRAME INERTIA BASES:

- Provide purpose built inertia bases constructed using welded steel frame mounted on spring compression

mountings.

2100 VIBRATION ISOLATION HOSES:

- Provide flexible hose couplings for connecting pipework comprising nylon fabric or steel mesh carcass with waterproof cover and internal lining of material to suit fluid conveyed, temperatures and pressures indicated.

2110# PIPEWORK NOISE VIBRATION ISOLATION:

- Incorporate within pipework support ring purpose made isolators manufactured from
 - natural corkwood of density 160 kg/cubic metre, impregnated with fungicide, individually bound with steel strip not more than half depth of isolator.
 - resin bonded reconstituted soft corkwood granules, of density 100 kg/cubic metres.
 - rubber matting.

2110A NATURAL CORKWOOD PIPEWORK NOISE VIBRATION ISOLATION:

- Incorporate within pipework support ring purpose made isolators manufactured from natural corkwood of density 160 kg/cubic metre, impregnated with fungicide, individually bound with steel strip not more than half depth of isolator.

2110B RECONSTITUTED CORKWOOD PIPEWORK NOISE VIBRATION ISOLATION:

- Incorporate within pipework support ring purpose made isolators manufactured from resin bonded reconstituted soft corkwood granules, of density 100 kg/cubic metres.

2110C RUBBER MATTING PIPEWORK NOISE VIBRATION ISOLATION:

- Incorporate within pipework support ring purpose made isolators manufactured from rubber matting.

2120A SPONGE FOAM PIPE WALL AND RISER SEALS:

- Provide pipe sleeves, minimum length 300mm, with minimum 25mm dense sponge foam lining bonded internally.

2120B MINERAL FIBRE PACKING PIPE WALL AND RISER SEALS:

- Provide pipe sleeves, minimum length 300mm, with minimum 52mm mineral fibre packing lining bonded internally.

3000 WORKMANSHIP

3040 HORIZONTALLY RESTRAINED SPRING MOUNTINGS:

- Ensure snubbers for limiting excessive movement are installed out of contact during normal operation.

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.

1045 PERFORMANCE AND DURABILITY:

- Ensure durability of identification for safety purposes is to BS ISO 17398.

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.
 - 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 B&ES DW/144.
- Primary Identification
 - Apply colour bands, 300mm wide, to each duct at least
 - Once in every room or enclosed area.
 - At intervals not exceeding fifteen metres.
 - At every junction.

- At every damper.
- At every inspection and access position into service shafts, false ceilings, bulkheads etc.
- Secondary Identification
 - For ducts with longest side or diameter up to and including 225mm. Paint colour bands 50mm wide and superimpose legends.
 - For ducts with longest side or diameter over 225mm. Paint or apply transfers to identification triangles, or triangular plates. Superimpose or incorporate legends.
- Triangular Plates
 - Attach to buckle bands or stool pieces and fix to ducting, with apex indicating direction of airflow. Submit details of plates and fixings for approval before painting and marking. Use equilateral triangle of side 150mm minimum.
- Legends
 - Apply transfers of an approved type to colour bands or triangles or triangular plates. Identify floor and space served, associated equipment reference and direction of airflow.

2030# PLANT AND EQUIPMENT IDENTIFICATION:

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, BLACK 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.

2035 GRAPHICAL SYMBOLS FOR USE ON EQUIPMENT IN ACCORDANCE WITH BS EN 80416:

- Graphical symbols for use on equipment to be created and applied in accordance with BS EN 80416-1, BS EN 80416-2, BS EN 80416-3.

2040 VALVE AND COCK IDENTIFICATION:

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

2050# MEDICAL GAS TERMINAL UNITS:

2060# LABORATORY OUTLETS:

2070 AIR VOLUME REGULATING AND CONTROL DAMPER IDENTIFICATION:

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

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.

2100# SYSTEM IDENTIFICATION INSTALLATION CHARTS:

2100A SYSTEM IDENTIFICATION INSTALLATION CHARTS, PERSPEX GLAZED FRAME:

- 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
 - Perspex sheet glazing with surrounding frame and mounting attachments.

2100B SYSTEM IDENTIFICATION INSTALLATION CHARTS, ACRYLIC GLAZED HARDWOOD FRAME:

- 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
 - Hardboard 3mm thick set in hardwood frame and glazed with 1.5mm clear acrylic.

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.

BS APPENDIX

BS 1710:2014

Specification for identification of pipelines and services

BS 381C:1996

Specification for colours for identification, coding and special purposes

BS 4800:2011

Schedule of paint colours for building purposes

BS EN 80416-1:2009

Basic principles for graphical symbols for use on equipment. Part 1 Creation of symbol originals

BS EN 80416-2:2001

Basic principles for graphical symbols for use on equipment. Part 2 Form and use of arrows

BS EN 80416-3:2002+A1:2011

Basic principles for graphical symbols for use on equipment. Part 3 Guidelines for the application of graphical symbols

BS ISO 17398:2004

Safety colours and safety signs. Classification, performance and durability of safety signs

Y60 CONDUIT AND CABLE TRUNKING

1000 GENERAL

1010 STANDARDS:

- Provide conduit and cable trunking in accordance with the relevant British Standards and in particular the requirements of BS 7671 Requirements for Electrical Installations (The IET Wiring Regulations).

2000 PRODUCTS/MATERIALS

2010A CONDUIT SYSTEMS METAL RIGID CLASS 2:

- Provide conduit systems to BS EN 61386. Use conduit of each type from one manufacturer.
- Material - Metal, steel.
- Method of connection - Threadable.
- Suitability for bending - Rigid, BS EN 61386-21.
- Electrical characteristics - with electrical continuity.
- Resistance against corrosive or polluting substances
 - Conduits with same protection outside and inside BS EN 61386-1 Table 10 Class 2
 - Medium protection
 - e.g. stoved enamel or air drying paint.

2010B CONDUIT SYSTEMS METAL RIGID CLASS 4:

- Provide conduit systems to BS EN 61386. Use conduit of each type from one manufacturer.
- Material - Metal, steel.
- Method of connection - Threadable.
- Suitability for bending - Rigid, BS EN 61386-21.
- Electrical characteristics - with electrical continuity.
- Resistance against corrosive or polluting substances
 - Conduits with same protection outside and inside
 - High protection - Hot dip zinc coating. BS EN 61386-1 Table 10 Class 4.

2010C CONDUIT SYSTEMS - METAL RIGID STAINLESS STEEL:

- Provide conduit systems to BS EN 61386. Use conduit of each type from one manufacturer.
- Material - Metal, stainless steel.
- Method of connection - Threadable.
- Suitability for bending - Rigid, BS EN 61386-21.
- Electrical characteristics - with electrical continuity.
- Resistance to ingress of water (rating to BS EN 60529)
 - Conduits giving protection against water jets (IPX5).
- Resistance against corrosive or polluting substances
 - Conduits with same protection outside and inside
 - High protection - Stainless steel. BS EN 61386-1 Table 10 Class 4.

2010D CONDUIT SYSTEMS - STEEL FLEXIBLE, LSF SHEATHED:

- Provide conduit systems to BS EN 61386. Use conduit of each type from one manufacturer.
- Material - Metal, steel.
- Method of connection - Non-threadable.

- Suitability for bending - Flexible, BS EN 61386-23.
- Resistance to flame propagation
 - Non-flame propagating conduit.
- Resistance against corrosive or polluting substances
 - Conduits with same protection outside and inside
 - Medium protection
 - Conduits with greater protection outside than inside -Medium/high
 - Stoved enamel inside, LSF sheathed outside. BS EN 61386-1 Table 10 Class 2.

2010E CONDUIT SYSTEMS - NON-METALLIC RIGID:

- Provide conduit systems to BS EN 61386. Use conduit of each type from one manufacturer.
- Material - Insulating, PVC or equivalent material.
- Method of connection - Non-threadable.
- Suitability for bending - Rigid, BS EN 61386-21.
- Electrical characteristics
 - Without electrical insulating characteristics.

2010F CONDUIT SYSTEMS - NON METALLIC FLEXIBLE:

- Provide conduit systems to BS EN 61386. Use conduit of each type from one manufacturer.
- Material - Insulating, PVC.
- Method of connection - Threadable or non-threadable.
- Suitability for bending - Flexible, BS EN 61386-23.
- Electrical characteristics
 - Without electrical insulating characteristics.

2020A RIGID CONDUIT SYSTEM - METALLIC CONDUIT

- Use couplers to match conduit grade and finish.
- Use solid couplers to join lengths of conduit unless inspection couplers are shown on the drawings or schedules.
- Conduit fittings and adaptable boxes
 - Material - Malleable iron adaptable boxes.
 - Do not use factory made bends, inspection bends or inspection couplers unless shown on drawings or schedules.
 - Ensure fittings are same class and finish as associated conduit system.
 - Supply covers for circular or adaptable boxes in the same material and finish as boxes.
 - Use steel dome or cheese headed screws to secure covers for Class 2 finish.
 - Use brass dome or cheese headed screws to secure covers for Class 4 finish.
 - Limit number of entry holes within loop-in boxes to four.
 - Adaptable box, minimum size - 100mm x 100mm x 50mm.
- Connections
 - Use couplers and externally screwed brass bushes to connect conduit to loop-in circular conduit boxes, switchgear, distribution boards, and adaptable boxes. Use flanged couplers with washers and male brass bushings, at both ends of each conduit run/link.
 - Conduit fixing saddles - Spacer bar.
- Plugs - Hexagonal malleable iron.
- Locknuts - Hexagonal steel.

2020C RIGID CONDUIT SYSTEM - STAINLESS STEEL CONDUIT:

- Use couplers to match conduit grade and finish.

- Use solid couplers to join lengths of conduit.
- Conduit fittings and adaptable boxes
 - Material - Stainless steel.
 - Ensure fittings are same class and finish as associated conduit system.
 - Supply covers for circular or adaptable boxes in the same material and finish as boxes.
 - Limit number of entry holes within loop-in boxes to four.
 - Adaptable box, minimum size - 100 mm x 100 mm x 50 mm.
- Connections
 - Use couplers and externally screwed bushes to connect conduit to loop-in circular conduit boxes, switchgear, distribution boards, and adaptable boxes. Use solid couplers.
- Conduit fixing saddles - spacer bar, stainless steel.
- Plugs - Hexagonal stainless steel.
- Locknuts - Hexagonal stainless steel.

2030A RIGID CONDUIT SYSTEM - INSULATING CONDUIT:

- Connections
 - Do not use slip joints. Use expansion couplings as required. Use solvent solution connections.
- Conduit fittings and adaptable boxes
 - Use boxes and connections to suit size of conduit and method of jointing.
 - Use heavy gauge, high impact rigid PVC conduit fittings.
 - Provide all boxes for supporting luminaires or other heavy devices with metal brackets or insert clips to provide a support independent of the box.
 - Provide boxes for flexible conduit, accessories and luminaire connection with a brass earthing terminal and/or steel circular earthing ring.
 - Conduit fixing saddles - Spacer bar or hospital.
- Plugs - Spout entry plug.

2040A PLIABLE OR FLEXIBLE CONDUIT SYSTEMS - METALLIC:

- Type of Packing - Unpacked.
- Type of sheath - Low smoke and fume material.
- Fittings material - Brass adaptors.
- Connections
 - Use brass male adaptors to connect flexible conduit to motors and any other equipment having a threaded entry.
 - Use male adaptors, solid couplers, flanged couplers with washer and externally screwed brass bushes to connect flexible conduit to trunking and equipment not having a threaded entry.

2050A PLIABLE OR FLEXIBLE CONDUIT SYSTEMS - NON-METALLIC:

- Method of connection - Threadable conduit.
- Connections
 - Use plastic adaptors and bushes.
 - Use male adaptors to connect flexible conduit to motors and other equipment having a threaded entry.
 - Use female adaptors and externally screwed bushes to connect flexible conduit to trunking and equipment not having a threaded entry.

2080A CABLE TRUNKING AND FITTINGS:

- Comply with BS EN 50085. Use trunking of each type from one manufacturer.

2090A METAL TRUNKING - FACTORY PAINTED FINISH:

- Material
 - Steel trunking to BS EN 50085. Supply partitions and covers same material as trunking.
- Gauge of metal - BS EN 50085.
- Style
 - Use trunking manufactured with inward return edge flanges and fitted with flange couplers which ensure that when the cover is removed a minimum of 80% of the nominal trunking or compartment width is available for access.
- Protection to BS EN 50085.
 - Electroplated zinc having a minimum thickness of zinc coating of 0.0012mm inside and outside with additional coating of stoved or air drying paint, applied at least to the external surface.
- Finish - Manufacturer's standard, all surfaces.
- Colour
 - Manufacturer's standard or to BS 4800 Shade as approved.
- Fixings
 - Use purpose made brackets to fix to structural steel or suspension rods.
Provide external fixing lugs where specified protection for the installation is IP44 or greater.
- Fittings
 - Use bends, tees and angles of similar gauge, type and finish as trunking body and supplied by same manufacturer.
 - Partitions and Covers
 - Ensure partitions are electrically continuous with the body of the trunking or provide a connector for a circuit protective conductor.
 - Ensure gap between partitions and lids maintains segregation of circuits.
 - Material - Same material as trunking.
- Joints
 - Use purpose made jointing pieces fixed with screws into captive nuts. Ensure screws do not protrude through the nuts.
 - Ensure rigidity of trunking is maintained across joint.
 - Ensure external dimensions of trunking are maintained and not reduced by more than 4% across joints between trunking lengths and/or fittings.
 - Use purpose made fittings of the same manufacture where trunking connects to switchgear and distribution boards.
 - Provide flanges for connection of flush floor trunking to vertical trunking to maintain the cross sectional area of compartments with 50 mm minimum radius.
 - Maintain electrical continuity at each joint by a copperlink, (tinned copper for galvanized trunking), fixed on outside of trunking, secured by screws, nuts and shakeproof washers. Screws must not project through the nut. Make provision for continuity to be achieved without need to remove paint from ferrous metal where trunking has a painted finish.
- Screws, Nuts, Washers
 - Do not use self tapping screws. Use cheese or round head screws except where provision is made for the use of counter-sunk heads.
- Material
 - Use steel zinc coated
 - BS 7371-3.
- Cable supports
 - Provide horizontal trunking with removable cable retainers or bridges to retain cables in situ.
 - Provide vertical trunking with pin racks to support cables at 3000 mm maximum spacing.
 - Use insulated pins or insulation sleeved pins on pin racks.

2090B METAL SURFACE TRUNKING - ZINC FINISH:

- Material

- Steel trunking to BS EN 50085. Supply partitions and covers same material as trunking.
- Gauge of metal - BS EN 50085.
- Trunking type
 - Standard cable trunking with compartments.
- Style
 - Use trunking manufactured with inward return edge flanges and fitted with flange couplers which ensure that when the cover is removed a minimum of 80% of the nominal trunking or compartment width is available for access.
- Protection to BS EN 50085
 - Electroplated zinc having a minimum thickness of zinc coating of 0.0012mm inside and outside.
 - Hot dip zinc coated steel to BS EN 10346 or BS EN 10143.
- Finish - Manufacturer's standard, all surfaces.
- Colour - Self Colour or Manufacturer's standard.
- Fixings
 - Use purpose made brackets to fix to structural steel or suspension rods.
 - Provide external fixing lugs where specified protection for the installation is IP44 or greater.
- Fittings
 - Use bends, tees and angles of similar gauge, type and finish as trunking body and supplied by same manufacturer.
- Partitions and Covers
 - Ensure partitions are electrically continuous with the body of the trunking or provide a connector for a circuit protective conductor.
 - Ensure gap between partitions and lids maintains segregation of circuits.
 - Provide individual mounting plates for each accessory mounted on trunking covers.
 - Material - Same material as trunking.
- Joints
 - Use purpose made jointing pieces fixed with screws into captive nuts. Ensure screws do not protrude through the nuts.
 - Ensure rigidity of trunking is maintained across joint.
 - Ensure external dimensions of trunking are maintained and not reduced by more than 4% across joints between trunking lengths and/or fittings.
 - Use purpose made fittings of the same manufacture where trunking connects to switchgear and distribution boards.
 - Provide flanges for connection of flush floor trunking to vertical trunking to maintain the cross sectional area of compartments with 50 mm minimum radius.
 - Maintain electrical continuity at each joint by a copperlink, (tinned copper for galvanized trunking), fixed on outside of trunking, secured by screws, nuts and shakeproof washers. Screws must not project through the nut. Make provision for continuity to be achieved without need to remove paint from ferrous metal where trunking has a painted finish.
- Screws, Nuts, Washers
 - Do not use self tapping screws. Use cheese or round head screws except where provision is made for the use of counter-sunk heads.
- Material
 - Use steel zinc coated
 - BS 7371-3 or BS 7371-6.
- Cable supports
 - Provide horizontal trunking with removable cable retainers or bridges to retain cables in situ.
 - Provide vertical trunking with pin racks to support cables at 3000 mm maximum spacing.
 - Use insulated pins or insulation sleeved pins on pin racks.

2090C LIGHTING TRUNKING COVER:

- Provide cover strip to prevent ingress of foreign materials, locate cabling in place and act as closure strips

between luminaires. Use trunking cover strip clipped into place in trunking body.

- Cover strip material
 - To match lighting trunking body or high quality colour fast extruded plastic.
- Colour - Manufacturer's standard or to BS 4800
- Shade as approved.

2090D FLUSH FLOOR TRUNKING:

- Trunking bodies
 - Supply trunking bodies complete with flanged connections for service outlet boxes.
 - Screwed levelling device.
 - Secure covers to trunking body using countersunk brass screws with slots, crosshead or hexagon key heads or steel cam locking devices for use with a removable tool.
 - Provide cork gasket or equivalent between cover and flange for sound deadening.
- Trunking lids
 - Provide for trunking body recessed lids to suit applied floor finish.
 - Ensure securing devices on recessed covers are accessible without removing applied floor finish.

2090E STEEL DADO TRUNKING:

- Material steel - BS EN 50085.
- Wall/dado trunking - three compartment.
- Installation - surface.
- Style.
 - Use trunking manufactured within ward return edge flanges and filled with flange couplers, which ensure that when the cover is removed a minimum of 80% of the nominal trunking or compartment width is available for access.
- Colour - manufacturer's standard or BS 4800 shade to be approved.

2090F ALUMINIUM DADO TRUNKING:

- Material extruded aluminium - BS EN 50085.
- Wall/dado trunking - three compartment.
- Installation - surface.
- Style - extrusion as manufacturer's standard.
- Colour - manufacturer's standard or BS 4800 shade to be approved.

2100A UNDERFLOOR STEEL TRUNKING:

- Trunking material
 - Sheet steel trunking to BS 4678-2.
- Gauge of Metal - BS EN 50085.
- Degree of Protection - Class 3.
- Connection to vertical trunking
 - Provide flanges for connection of vertical trunking and temporary blanking plates.
 - Maintain cross sectional area of compartments with 50 mm minimum radius for connections to vertical trunking.
- Trunking bodies
 - Supply trunking bodies complete with flanged connections for service outlet boxes.
 - Use screwed levelling devices.

2110A SERVICE OUTLET BOXES:

- Provide service outlet boxes and junction boxes constructed from sheet steel with same finish as trunking.

- Maintain continuity and segregation of compartments through boxes and fit flyovers where necessary.
- Provide service outlet boxes with separate and segregated access to outlets associated with each wiring compartment. Fit cable guard or grommet to each section.
- Incorporate spigots on boxes for connection to trunking.
- Make frames adjustable on each corner, recess lids.
- Manufacture frame and lids for service outlet boxes and junction boxes of cast metal, and suitable to accept type of floor covering.
- Outlet plates
 - Provide outlet plates for each low voltage compartment equipped with socket outlets.
 - Provide outlet plates for each extra low voltage compartment equipped with items.
 - Provide outlet plates for each information technology compartment that ensures the IT compartment and its outlet plate conform to the requirements of BS EN 50174 and of the IT system installer, equipped with suitable outlets.
 - Provide blank outlet plates for any unused compartments.

2120A POWER POLES:

- Provide service poles complete with associated conduit or trunking fittings. Maintain continuity and segregation of circuits throughout. Provide outlet boxes with separate access to wiring compartments.
- Standard - BS EN 50085-2-4.
- Material - extruded Aluminium.
- Finish - manufacturer's standard.
- Fixings - free-standing or complete with fixing brackets at top.

2130A PVC SERVICE TRUNKING - GENERAL PURPOSE:

- Trunking to BS 4678-4
 - Mechanical properties, trunking for medium mechanical stress.
 - Temperature tolerances - BS 4678-4, Table 1.
- Electrical characteristics
 - Without electrical insulating characteristics.
- Resistance against ingress of solid objects
 - Protected against solid objects greater than 1.0mm (IP4X).
- Resistance to ingress of water
 - Protected against dripping water (IPX2).
- Resistance against corrosive or polluting substances
 - Medium protection.
- Fittings
 - Use fittings from same manufacturer as trunking. Use 'snap-on' covers. Use trunking fittings and accessories suitable for jointing by solvent welding.
 - Use proprietary cable retaining clips at 500 mm maximum intervals on trunking that exceeds 1.8 m in length. Where junctions occur ensure first clip is not more than 300 mm from junctions.

2130B PVC SURFACE TRUNKING - SKIRTING TRUNKING:

- Trunking to BS 4678-4
 - Mechanical properties, trunking for medium mechanical stress.
 - Temperature tolerances - BS 4678-4, Table 1.
- Electrical characteristics
 - Without electrical insulating characteristics.
- Resistance against ingress of solid objects
 - Protected against solid objects greater than 1.0mm (IP4X).
- Resistance to ingress of water

- Protected against dripping water (IPX2).
- Resistance against corrosive or polluting substances
 - Low protection.
- Fittings
 - Use fittings from same manufacturer as trunking. Use 'snap-on' covers. Use trunking fittings and accessories suitable for jointing by solvent welding.
 - Use proprietary cable retaining clips at 500 mm maximum intervals on trunking that exceeds 1.8 m in length. Where junctions occur ensure first clip is not more than 300 mm from junctions.

2130C PVC DADO TRUNKING - GENERAL PURPOSE:

- Trunking to BS 4678-4
 - Mechanical properties, trunking for medium mechanical stress.
 - Temperature tolerances - BS 4678-4, Table 1.
- Electrical characteristics
 - Without electrical insulating characteristics.
- Resistance against ingress of solid objects
 - Protected against solid objects greater than 1.0mm (IP4X).
- Resistance to ingress of water
 - Protected against dripping water (IPX2).
- Resistance against corrosive or polluting substances
 - Medium protection.
- Fittings
 - Use fittings from same manufacturer as trunking. Use 'snap-on' covers. Use trunking fittings and accessories suitable for jointing by solvent welding.
 - Use proprietary cable retaining clips at 500mm maximum intervals on trunking that exceeds 1.8m in length. Where junctions occur ensure first clip is not more than 300mm from junctions.

2140A PVC UNDERFLOOR TRUNKING:

- Material
 - Heavy gauge PVC trunking to BS 4678-4.

2150A SEPARATE OR MULTI-COMPARTMENT TRUNKING:

- Use separate trunking or multi-compartment trunking for segregation of services. Ensure steel partitions have a provision for connecting a circuit protective conductor.
- Provide separation of wiring for circuits as required by BS 7671.

2170 SUPPORTS AND FIXINGS:

- Provide proprietary suspension systems comprising channel sections with return lips and compatible fixing accessories made of material to BS EN 10162, BS EN 10210 and/or slotted angles to BS 4345.
- Ensure support components for Class 4 conduit have the same finishing method as the conduit carried out after manufacture. Ensure components in direct contact with conduit match profile of conduit.
- Ensure all steel components such as studding, bolts and steel screws, bolts, nuts and washers are either cadmium plated and passivated or zinc electroplated to BS 7371 after manufacture. Do not use metal fixing components likely to deteriorate and/or cause damage through electrolytic action.

3000 WORKMANSHIP

3010A GENERAL:

- Ensure entire system is electrically and/or mechanically continuous, to BS 7671.
- Fire barriers
 - Comply with the requirements of BS 7671 wherever the conduit or trunking passes through the perimeter of a fire compartment (wall, floor or ceiling).
- Appearance
 - Arrange conduit, trunking and ducting to present neat appearance, parallel with other service runs and lines of building construction, except where in screed or in-situ concrete. Ensure plumb vertical runs.
- Cable installation
 - Install cable in conduit, trunking or equipment enclosures only when completely erected throughout its length.
 - Do not use framework of partitions or similar unless indicated.
- Building expansion and settlement
 - Make provision in conduit and trunking at expansion and settlement joints to allow for movement of building structure. Provide circular through or adaptable boxes no more than 300 mm either side of expansion or settlement joints for conduit crossing.
 - Join boxes with flexible steel conduit type C or conduits arranged to form a telescopic joint and cover overall with PVC sleeve to provide minimum degree of protection of IP44 or purpose made telescopic joint protected by a PVC sleeve to at least IP44.
- Quality
 - Cut conduit clean and square with axis. Remove any burrs prior to erection.
 - Site form 90° in conduit wherever practical or use circular or adaptable boxes.
 - Construct bends and sets cold with a bending machine. Do not apply heat when forming sets or bends.
 - Use bending tools complying with British Standards appropriate to conduit material.
 - Ensure no indentation or reduction in cross sectional area occurs during installation.
 - Use correct tools to assemble conduit. Ensure no toolmarks or damage to components occurs.

3020 LAYOUT:

- Ensure the maximum circuit lengths and groupings of cables indicated are not exceeded.
- Conduit sizing
 - Where dimensions are not indicated select trunking and conduit sizes in accordance with Appendix A of Guidance Note I Selection and Erection published by the IET.

3030 SPACING:

- Install conduit, trunking and equipment clear of other services. Measure distance from external surface of any thermal insulation. Notify instances where minimum clearance cannot be achieved and bond items concerned. Minimum general spacings between conduits, trunking, equipment and insulated steam services - 300 mm, other services excluding steam - 150 mm, above central heating radiators - 1000 mm, ensure separation is in accordance with Appendix K of Guidance Note I Selection and Erection published by the IET and BS EN 50174.

3040 CONDENSATION PREVENTION:

- Install conduit and trunking systems to ensure internal condensation does not affect operation of associated circuits. Provide drainage points in accordance with BS 7671.
- Where conduit passes through external wall between two areas of different ambient temperatures or in other locations likely to cause condensation, install a conduit or adaptable box. After wiring fill box with inert, permanently plastic compound with high insulation value.

3050A PROTECTION AND REPAIR OF STEEL COMPONENTS:

- Paint joints of conduit and minor damages to finish of conduit and trunking immediately after erection or after damage occurs.
- Use paint compatible with finish as follows
 - Galvanized finish, use two coats zinc rich paint.
 - Black enamelled finish, use two coats of good quality, air drying, black enamel paint.
- Remove grease, oil, dirt and rust before applying protective paint.
- Notify serious damage and repair or replace as instructed.

3060 EQUIPMENT CONNECTIONS:

- Where surface mounted equipment is installed in conjunction with concealed conduit work, terminate concealed conduit at flush mounted conduit or adaptable box. Drill back of equipment, bush for back entry and mount equipment to conceal back box.
- Connect to fixed equipment via conduit box located adjacent to termination point, using either solid or flexible conduit as indicated for final connection to equipment terminations.
- Use conduit box as cable change point to facilitate changed wiring locally to adjacent equipment.
- Connect trunking to equipment by specially fabricated connectors or by couplers and externally screwed brass bushes.

3070 CLEANING BEFORE WIRING:

- Clean inside of conduits and trunking with swabs immediately before wiring.
- Inspect all components and remove any foreign matter, fit temporary plugs to open ends of conduit and trunking to prevent ingress of water and solid material.

3080A WIRING:

- Comply with BS 7671 when wiring installations.
- Segregate circuits as indicated.
- Ensure draw wires are left within empty conduits for use of specialist installers. Use draw wires comprising nylon tapes with fitted eyelets.
- For concealed conduit ensure system is installed to enable re-wiring to be carried out from boxes for fittings or accessories only. Draw-in boxes will only be permitted with prior permission in writing.
- Do not use tallow or any other substances to facilitate drawing-in of cables.

3090 BUILDERSWORK:

- Ensure conduit is not concealed until work has been inspected and approved.
- Obtain permission before horizontally chasing walls.
- Ensure that conduit and fittings buried in concrete or behind plaster are protected against corrosion or electrolytic action prior to rendering.
- Ensure conduit concealed in wall chases is covered by plaster and/or rendering to minimum depth of 12 mm.

4000 WORKMANSHIP FOR CONDUIT

4010 DRAW-IN BOXES:

- Provide draw-in boxes in conduit at maximum intervals of 10 metres or after bends and/or sets totalling 180°.

4020 INSTALLATION OF CAST IN OR BURIED CONDUIT:

- Ensure cast-in conduits are firmly secured to reinforcing steelwork and that accessory and/or conduit boxes are secured so they do not move during subsequent building operations.
- Ensure there is no blockage immediately shuttering is removed.
- Check there is no mechanical damage to conduit in floor screed prior to screeding. Fix securely before screed is poured. Provide temporary protection to conduits until screeds are laid.
- Ensure minimum amount of cross-overs occur dependent upon screed depth. Do not install draw boxes in floors.
- Do not install conduits in screeds in areas indicated within site blinding, in main structural slabs unless prior permission in writing is obtained.

4030 CONDUIT BOXES:

- Ensure that wherever conduit boxes are cast in the face of the box is flush with the face of the concrete or plaster. Fit circular conduit boxes with extension rings to ensure a flush face with plaster or concrete or where terminal blocks are to be accommodated.
- Ensure fixing holes are countersunk where material thickness allows or use round head screws to prevent damage to cables and remove burrs before cables are drawn in.
- Use a minimum of two screw fixing for standard circular conduit boxes and four screws for large conduit boxes and adaptable boxes up to 150 mm x 100 mm.
- Use back outlet boxes where surface conduits pass through walls, to outside accessories or lighting points.
- Secure switch boxes and socket boxes using countersunk steel screws where provision is made for them or if not use round head screws. Use plug inserts and finally grout in position prior to plastering or screeding.

4040 FIXING CONDUIT:

- Support conduit in accordance with Appendix I of Guidance Note I Selection and Erection published by the IET.
- Ensure conduit is not under mechanical stress. Fix conduit boxes independently of conduit. Make allowance for any additional mechanical loading supported by conduit boxes.
- Where protection is specified as IP44 or greater ensure fixings of conduit boxes are suitable to maintain degree of protection.
- Use following methods of fixing conduit:

Location	Type of fixing
Floor screeds	Saddles or crampets
Buried in plaster or render	Crampets or saddles
Above false ceilings	Saddles
Surface	Saddles

-

4050 FLEXIBLE AND PLIABLE CONDUIT:

- Use flexible conduit for final connections to motors, other equipment subject to vibration or adjustment and to thermostats, motorised valves and similar items mounted in pipelines or ducts.
- Use sufficient length between equipment and circular through box at end of conduit run (minimum 450 mm) to allow necessary full range of withdrawal, adjustment or movement.
- Use solid type adapters to terminate flexible conduit.
- Use PVC covered flexible conduit where installed externally, exposed to weather or in any position where ingress of moisture or condensation may occur.

4060 SCREWED STEEL CONDUIT:

- Use materials clean and free from defects, rust, scale and oil. Obtain prior permission in writing for use of

materials subject to remedial work before erection. Repair any damage caused by threading, bending or erection by painting with zinc rich paint before any rust occurs.

- Ensure length of thread on conduit matches that in conduit couplers, fittings or equipment with no thread exposed after erection except at running couplers.
- Ensure conduits butt inside couplers.
- Use lubricant when cutting threads.
- Use minimum number of running couplings
 - For running couplings in Class 2 conduit, use coupler and locknut. Paint exposed thread with zinc rich paint.
 - For running couplings in Class 4 conduit, use three piece conduit unions.

4070# NON-METALLIC CONDUIT:

- Comply with manufacturer's instructions for bending, setting and jointing of conduit. Use plastic conduit only where indicated.
 - Do not install conduit when ambient working temperature is or will be below -5°C or above 60°C.
 - Do not install conduit when ambient working temperature is or will be below -25°C or above 60°C.
- Use solvents recommended by manufacturer of conduit when using solvent welded joints and ensure spigots enter full depth of sockets. Hold joints rigid and in position until weld sets. Remove excess solvent before surface damage occurs.
- Use slip joints as necessary, but not exceeding 6 metres on straight lengths to allow for expansion and contraction over temperature variation as indicated.
- Use semi-mastic adhesive where expansion joints are formed.
- Where fitments do not have shaped or smooth conduit entries connect with male bushes and external couplings.
- Ensure special care is taken to prevent mechanical damage or warping to conduit where mechanical loads are imposed on conduit system, eg. lighting fittings.

4070A NON-METALLIC CONDUIT:

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- Use semi-mastic adhesive where expansion joints are formed.
- Where fitments do not have shaped or smooth conduit entries connect with male bushes and external couplings.
- Ensure special care is taken to prevent mechanical damage or warping to conduit where mechanical loads are imposed on conduit system, eg. lighting fittings.

4080 UNDERGROUND INSTALLATION:

- Where buried below ground, use Class 4 conduit. Do not use any buried conduit boxes unless prior permission in writing has been obtained. Wrap conduit with PVC self-adhesive tape, half lapped. Extend taping 150 mm beyond point where conduit leaves ground. Install circular through conduit boxes at the end of the tape. Fill conduit boxes after cable installation with inert, permanently plastic compound with high insulation value, and wrap in PVC self adhesive tape.

5000 WORKMANSHIP FOR TRUNKING

5020 ACCESS:

- Arrange trunking to allow access to wiring. Locate covers on top or sides of trunking if practicable. Arrange access so covers are on a continuous face and cables can be laid in throughout the length of the trunking. Notify where either condition cannot be achieved.

5030A FIXING TRUNKING:

- Ensure trunking is independently fixed and supported from building fabric. Obtain approval for proposed fixings/supports.
- Support trunking in accordance with the manufacturers requirements and/or Guidance Note 1 Selection and Erection published by the IET.
 - Use two fixings minimum per standard length.

5040A STEEL TRUNKING:

- Install steel trunking in accordance with the manufacturers requirements and those of BS 7671.
- Use trunking to avoid multiple parallel conduit runs, subject to approval.
- Cut trunking clean and square with axis, prepare ends and remove burrs and sharp edges. Ensure inside of trunking is free from anything liable to damage cables either during installation or after covers are fitted.
- When trunking is held in a vice, ensure surfaces remain undamaged and components are not warped.
- Avoid tool marking or damage to trunking system components.
 - Do not site fabricate trunking tees, bends, flanges and other accessories. Use only factory made accessories.
- Form circular holes over 6 mm diameter in trunking body using correctly sized punch sets. Use twist drill for holes up to 6 mm maximum diameter.
- Use only factory formed openings for accessories.
- Line unprotected apertures in trunking with PVC or nylon edging strip.
- Fit ends of runs with removable blanking plates.
- Ensure connections are not made to covers unless indicated or approval obtained.
- Provide fixed section of cover projecting 25 mm either side of fabric where trunking passes through wall, floors or ceiling.
- Fit cable retaining straps at 500 mm intervals except where cover is on top.

5050 UNDERFLOOR AND FLUSH FLOOR TRUNKING INSTALLATION:

- Lay underfloor and flush floor trunking straight and level. Adjust height of services outlets, junction boxes and flush floor trunking to suit top of screed level. Ensure that spaces below trunking are free from voids and correctly packed. Prevent ingress of screed by masking where necessary.
- Ensure trunking levelling and alignment is carried out in co-operation with person(s) responsible for confirming location and finish of floor levels.
- Immediately following installation of trunking fit temporary covers to service outlets, junction boxes and flush floor trunking. Fit temporary blanking plates over open connections to vertical trunking.
- Retain temporary covers until permanent covers are installed.
- Ensure underfloor trunking systems are fully rewirable to final circuit outlets.
- Connect conduits only at inspection or other easy access points.

5060 TRUNKING OF INSULATING MATERIAL:

- Comply with manufacturer's instructions. Do not install trunking where ambient temperature is below - 5°C or working temperature is above 60°C.
- Use solvents recommended by trunking manufacturer when making solvent welded joints. Remove excess

solvent before surface damage occurs. Hold joints rigid and in position until welds set.

- Use manufacturer's standard radiused bends, connector tees, off-sets, end plates and component parts of trunking system assembly.
- Ensure no type of trunking other than that specified is installed without approval.
- Trunking may be substituted for conduit at certain positions subject to approval.

BS APPENDIX

BS 4345:1968

Specification for slotted angles

BS 4678-4:1982

Cable trunking. Part 4 Specification for cable trunking made of insulating material.

BS 4800:2011

Schedule of paint colours for building purposes

BS 7371-3:2009

Coatings on metal fasteners. Part 3 Specification for electroplated zinc coatings

BS 7371-6:1998+A1:2011

Coatings on metal fasteners. Part 6 Specification for sherardized coatings

BS 7671:2008+A3:2015

Requirements for electrical installations. IET Wiring Regulations. Seventeenth edition

BS EN 10143:2006

Continuously hot-dip metal coated steel sheet and strip. Tolerances on dimensions and shape

BS EN 10162:2003

Cold rolled steel sections. Technical delivery conditions. Dimensional and cross-sectional tolerances

BS EN 10346:2015

Continuously hot-dip coated steel flat products for cold forming. Technical delivery conditions

BS EN 50085-2-4:2009

Cable trunking systems and cable ducting systems for electrical installations Part 2-4 Particular requirements for service poles and service posts

BS EN 60529:1992+A2:2013

Degrees of protection provided by enclosures (IP code)

BS EN 61386-1:2008

Conduit systems for cable management. Part 1 General requirements.

BS EN 61386-21:2004+A11:2010

Conduit systems for cable management. Part 21 Particular requirements. Rigid conduit systems

BS EN 61386-23:2004+A11:2010

Conduit systems for cable management. Part 23 Particular requirements. Flexible conduit systems

Y61 CABLES AND WIRING

1000 GENERAL

1010 CABLE MANUFACTURER:

- Use new cables, delivered to site with seals intact, manufactured not more than one year prior to delivery, labelled with manufacturer's name, size, description, BS number, classification, length, grade and date of manufacture.

1020 CABLE CERTIFICATION MARKING:

- Mark all types of cables with CENELEC cable certification marking or if included in British Approvals Service for Cables (BASEC) in accordance with BASEC Regulations.

1030 MEDIUM VOLTAGE CABLE RECORDS:

- Keep records of MV cable drum numbers and supporting information, mark information on record drawings, indicating precise location of each length of cable, and submit copies of manufacturer's cable test certificate.

2000 PRODUCTS / MATERIALS

2005 LSOH SHEATHING:

- Supply cables with Low Smoke zerO Halogen (LSOH) sheathing, tested in accordance with BS EN 50267 or BS EN 60754 and BS EN 60332.

2010A STANDARD ORDINARY FLEXIBLE WIRES - SINGLE COPPER CORE:

- Standard - BS EN 50525-2-31, Clause 4.2, 4.3, 4.4, 5.3 and 5.4

2010B STANDARD LSF FLEXIBLE WIRES - SINGLE COPPER CORE:

- Standard - BS EN 50525-3-41, Clause 4.2 and 4.4

2010C STANDARD HEAT RESISTING (110°C OR MORE) FLEXIBLE WIRES - SINGLE COPPER CORE:

- Standard - BS EN 50525-2-31 Clause 5.2; BS EN 50525-2-41, Class 5 conductors: Clause 4.1 and 4.3. BS EN 50525-2-42, Class 5 conductor: Clause 4.1

2010D STANDARD ORDINARY FLEXIBLE CORDS - MULTI COPPER CORES:

- Standard - BS EN 50525-2-21, Clauses 4.1, 4.2, 4.3 and 6.3

2010E STANDARD HOFr FLEXIBLE CORDS - MULTI COPPER CORES:

- Standard - BS EN 50525-2-21, Clause 6.3

2020A STANDARD POWER SUPPLY CABLES, COPPER CONDUCTORS, THERMOSETTING INSULATION, SHEATHED:

- Standard - BS 5467, Tables 4, 6, 8, and 10.
- Mechanical protection - unarmoured.

2020B STANDARD POWER SUPPLY CABLES, COPPER CONDUCTORS, THERMOSETTING INSULATION, SHEATHED AND ARMoured:

- Standard - BS 5467, Tables 4, 6, 8, and 12.
- Mechanical protection - armour.

2020C STANDARD POWER SUPPLY CABLES, COPPER CONDUCTORS, PVC INSULATION, SHEATHED:

- Standard - BS 6004, Tables 7 and 8.
- Mechanical protection - unarmoured.

2020E STANDARD POWER SUPPLY CABLES, COPPER CONDUCTORS, LSF SHEATHED AND ARMoured:

- Standard - BS 6724, Tables 4, 6, 8, and 10.
- Mechanical protection - armour.

2020F STANDARD CABLES FOR CONDUIT AND TRUNKING, COPPER CONDUCTORS, PVC INSULATED:

- Standard - BS EN 50525-2-31, Clause 4.1, 4.3 and 4.4
- Mechanical protection - conduit and trunking.

2020G STANDARD CABLES FOR CONDUIT AND TRUNKING, COPPER CONDUCTORS, LSF INSULATED:

- Standard - BS EN 50525-3-41, Clauses 4.1 and 4.3
- Mechanical protection - conduit and trunking.

2020H STANDARD CABLES FOR CONDUIT AND TRUNKING, COPPER CONDUCTORS. 90°C PVC INSULATED:

- Standard - BS EN 50525-2-31, Clause 5.1, 5.3 and 5.4
- Mechanical protection - conduit and trunking.

2020I STANDARD FLAT CABLES, 2-CORE OR 3-CORE, COPPER CONDUCTORS, WITH OR WITHOUT CPC, PVC INSULATED, SHEATHED:

- Standard - BS 6004, Tables 7, 8 and 9.

2020J STANDARD FLAT CABLES, 2-CORE OR 3-CORE, COPPER CONDUCTORS WITH OR WITHOUT CPC, LSF INSULATED SHEATHED:

- Standard - BS 7211, Table 5.

2020K STANDARD POWER SUPPLY CABLES, COPPER CONDUCTORS LSF INSULATION, SHEATHED:

- Standard - BS 7211, Tables 3 and 4.
- Mechanical protection - unarmoured.

2020M STANDARD CABLES WITH DEFINITE FIRE PERFORMANCE:

- Standard - BS 7629-1 type as shown on drawings / schedules.
- Fire performance BS 5839-1 - standard.

- Sheath colour - red.
- Mechanical protection, as shown on drawings / schedules.

2020N STANDARD CABLES FOR WALLS, PARTITIONS AND BUILDING VOIDS WHERE PENETRATION BY SHARP OBJECTS IS A HIGH RISK:

- Standard - BS 8436

2030A STANDARD 3.3 KV, COPPER CONDUCTORS, ARMoured AND LSF SHEATHED CABLES:

- Standard - BS 6622, Tables 2 and 3.
- Mechanical protection - armour.

2030B STANDARD 3.3 KV, COPPER CONDUCTORS, ARMoured AND LSF SHEATHED CABLES:

- Standard - BS 6724, Tables 14 and 16.
- Mechanical protection - armour.

2030C STANDARD 11 KV, COPPER CONDUCTORS, ARMoured AND SHEATHED CABLES:

- Standard - BS 6622, Tables 4 and 5.
- Mechanical protection - armour.

2040A LIGHT DUTY MINERAL INSULATED CABLES, THERMOPLASTIC OUTER COVERING:

- Standard - 500V light duty to BS EN 60702-1, section 14.
- Outer covering
 - Thermoplastic to BS EN 60702-1, section 8.2.

2040B LIGHT DUTY MINERAL INSULATED CABLES, LSF OUTER COVERING:

- Standard - 500V light duty to BS EN 60702-1, Section 14.
- Outer covering
 - Halogen free material to BS EN 60702-1, Section 8.3

2040C HEAVY DUTY MINERAL INSULATED CABLES, THERMOPLASTIC OUTER COVERING:

- Standard - 750V heavy duty to BS EN 60702-1, Section 15.
- Outer covering
 - Thermoplastic to BS EN 60702-1, Section 8.2

2040D HEAVY DUTY MINERAL INSULATED CABLES, LSF OUTER COVERING:

- Standard - 750V heavy duty to BS EN 60702-1, Section 15.
- Outer covering
 - Halogen free material to BS EN 60702-1, Section 8.3

2040E HEAVY DUTY MINERAL INSULATED CABLES, LSF OUTER COVERING:

- Standard - 750V heavy duty to BS EN 60702-1, Section 15.
- Outer covering
 - Halogen free material to BS EN 60702-1, Section 15.
- Fire performance BS 5839-1 - enhanced.

- Sheath colour - red.

2050A PAIRED, UNSCREENED CONTROL CABLES WITH OR WITHOUT METALLIC PROTECTION:

- Standard - BS EN 50288-7
- With or without metallic protection.

2050B PAIRED, SCREENED CONTROL CABLES WITH OR WITHOUT METALLIC PROTECTION:

- Standard - BS EN 50288-7
- Paired, screened control cables, with or without metallic protection.

2050C MULTICORE AUXILIARY CABLES WITH OR WITHOUT METALLIC PROTECTION:

- Standard - BS EN 50288-7
- Multicore auxiliary cables with or without metallic protection.

2050G MULTICORE UNARMoured LSF, SHEATHED AUXILIARY CABLES:

- Standard - BS 7211, Table 4.
- Mechanical protection - unarmoured.

2050H MULTICORE ARMoured LSF, SHEATHED AUXILIARY CABLES:

- Standard - BS 6724, Table 18.
- Mechanical protection - armour.

2050I CONTROL AND AUXILIARY CABLES WITH DEFINITE FIRE PERFORMANCE:

- Standard - BS 7629; type as shown on drawings / schedules.
- Fire performance approval - LPCB.
- Sheath colour - red.
- Mechanical protection, as shown on drawings / schedules.

2050K FIRE ALARM CABLE:

- Standard - BS 7629-1.
- Mechanical protection - unarmoured.
- Fire performance - BS EN 50288-1, Clause 5.4

2070B STANDARD COMMUNICATIONS CABLES FOR INDOOR USE:

- Standard - BT CW1308; BT CW1370; BT CW1700; and BT CW1750.

2075 CABLES FOR RESIDENTIAL TELECOMMUNICATION:

- Standard
 - BS EN 50441-1
 - BS EN 50441-2
 - BS EN 50441-3
 - BS EN 50441-4
- Sheath material
 - LSOH - BS EN 50290-2-27
 - BS EN 50290-2-22

2080A STANDARD COAXIAL CABLES, FOR BROADCAST RECEIVING:

- Standard - BS EN 50117. CAI Benchmark status, cable types CT100, CT125, CT165.

2090A OPTICAL FIBRE CABLES:

- Standard - BS EN 60794-2-11 and BS EN 187103. Category of fibre to BS EN 60793-2-10 A1a or A1b.
- Fibre optic interconnecting devices and components to BS EN 61300, BS EN 62148, BS EN 62664-1-1 and PD IEC/TR 62627-03-03

2100A INFORMATION TECHNOLOGY CABLES - STRUCTURED WIRING: CATEGORY 5:

- Provide IT cables in accordance with the IT system suppliers specification.
- Type of system - structured cabling - relevant parts of BS EN 50173
- Standard - for Category 5 and Category 5e, BS EN 50288-3-1 and BS EN 50288-3-2
- Termination reference - EIA/TIA TSB-40.
- Cable construction - multi pair, unshielded (UTP).

2100B INFORMATION TECHNOLOGY CABLES - STRUCTURED WIRING: CATEGORY 6:

- Provide IT cables in accordance with the IT system suppliers specification.
- Type of system - structured cabling - relevant parts of BS EN 50173
- Standard - BS EN 50288-6-1 (Category 6) or BS EN 50288-11-1 (Category 6a).
- Termination reference - EIA/TIA TSB-40.
- Cable construction - multi-pair, unshielded (UTP).
-

2100C INFORMATION TECHNOLOGY CABLES - HBES CLASS 1:

- Provide IT cables in accordance with the IT systems suppliers specification.
- Type of system - HBES Class 1.
- Standard - BS EN 50090-9-1.
- Cable construction - 2 twisted pairs unshielded.

2100D INFORMATION TECHNOLOGY CABLES - INDOOR MULTI-PAIR/QUAD RISER CABLES:

- Provide IT cables in accordance with IT system suppliers specification.
- Application - Multiple Dwelling Units (MDU) shaft supporting universal services, xDSL and applications up to 100 Mbits over IP.
- Standard - BS EN 50407-3
- Type of system -
- Cable construction -

3000 ACCESSORIES

3010A CABLES GLANDS - UNARMoured CABLES, INDOORS:

- Cable type
 - Flexible; wiring and power; control and auxiliary; and communications.
- Standard - BS EN 62680-1 non-metallic, cable retention, IP54; Type A1 as BS 6121-5 Annex A..
- Environment - indoor.

3010B CABLES GLANDS - UNARMoured CABLES, OUTDOORS:

- Cable type
 - Flexible; wiring and power; control and auxiliary; and communications.
- Standard - BS EN 62680-1 non-metallic, cable retention, IP54; Type A2 as BS 6121-5 Annex A.
- Environment - outdoor.

3010C CABLES GLANDS - ARMoured CABLES, DRY INDOORS:

- Cable type
 - Wiring and power; and control and auxiliary.
- Standard - BS EN 62680-1 metallic, cable retention Class A, protective connection to earth, IP54. Type B as BS 6121-5 Annex A.
- Environment - dry indoors.

3010D CABLE GLANDS - ARMoured CABLES, INDOORS:

- Cable type
 - Wiring and power; and control and auxiliary.
- Standard - BS EN 62680-1 metallic, cable retention Class A, protective connection to earth, IP54. Type B as BS 6121-5 Annex A.
- Environment - indoor.

3010E CABLE GLANDS - ARMoured CABLES, OUTDOORS:

- Cable type
 - Wiring and power; and control and auxiliary.
- Standard - BS EN 62680-1 metallic, cable retention Class A, protective connection to earth, IP54 with shroud. Type C as BS 6121-5 Annex A.
- Environment - outdoor.

3020A CABLE SEALS AND GLANDS - HEAVY DUTY MINERAL INSULATED CABLES - PROTECTED FOR 'D' 'I' 'N' HAZARDOUS AREAS:

- Use seals and glands for mineral insulated cables in accordance with BS EN 60702-2, recommended or supplied by cable manufacturer.
- Gland Type
 - Cable grip type, externally threaded for threaded entry. Certified for hazardous areas to BS EN 60079-14, 'd', 'i' or 'n'.
- Gland Shroud
 - Thermoplastic or LSF material to match sheath.
- Seal type
 - Plain or earth tail and self-threading pot.
- Pot closure - Plastic stub cap.
- Pot sealant - Compound, 105°C.
- Conductor insulation sleeving - Plain PVC.
- Seal maximum temperature rating - 105°C.
- Other seal characteristics
 - Certified to BS EN 60079-14 for hazardous areas.

3020B CABLE SEALS - HEAVY AND LIGHT DUTY MINERAL INSULATED CABLES - PROTECTED 'E' FOR HAZARDOUS AREAS:

- Use seals for mineral insulated cables in accordance with BS EN 60702-2, recommended or supplied by cable manufacturer.
- Seal type
 - Plain; or earth tail and self-threading pot; or polymeric one piece.
- Pot closure - plastic disc.
- Pot sealant - epoxy putty.
- Conductor insulation sleeving - headed PTFE.
- Seal maximum temperature rating - 100°C or 85°C.
- Other seal characteristics
 - Certified to BS EN 60079-14 for hazardous areas, 'e'.

3020C CABLE SEALS AND GLANDS - HEAVY OR LIGHT DUTY MINERAL INSULATED CABLES - TEMPERATURES UP TO 105°C:

- Use seals and glands for mineral insulated cables in accordance with BS EN 60702-2, recommended or supplied by cable manufacturer.
- Gland type
 - Cable grip type, externally threaded with lock washer and nut.
- Gland shroud
 - Thermoplastic or LSF material to match sheath.
- Seal type - plain or earth tail and self-threading pot.
- Pot closure - plastic stub cap.
- Pot sealant - compound, 105°C
- Conductor insulation sleeving - plain PVC.
- Seal maximum temperature rating - 105°C.

3020D CABLE SEALS AND GLANDS - LIGHT DUTY MINERAL INSULATED CABLES - TEMPERATURES UP TO 105°C:

- Use seals and glands for mineral insulated cables in accordance with BS EN 60702-2 recommended or supplied by cable manufacturer.
- Gland Type
 - Cable grip type, internally threaded, with bush.
- Gland Shroud
 - Thermoplastic or LSF material to match sheath.
- Seal type - Plain or earth tail and self-threading pot.
- Pot closure - Plastic stub cap.
- Pot sealant - Compound, 105°C
- Conductor insulation sleeving - Plain PVC.
- Seal maximum temperature rating - 105°C.

3035 CABLE CLEATS AND CABLE TIES:

- Use cable cleats to BS EN 61914
- Use cable ties to BS IEC 62275.

3060A CABLE JOINTS AND TERMINATIONS:

- Use only cable joints as supplied or recommended by cable manufacturer.
- Cable type - power or control and auxiliary.
- Joint arrangement - Straight through or tee.
- Joint type - BS 7888, BS EN 50393 or BS EN 61442 were appropriate, cold pour or heat shrink.
- Accessories

- Armour bonds, BS 7197
- Filling compounds.
- Core sleeving, BS EN 60684
- Environment - Underground.

3065 INSTALLATION COUPLERS:

- Use only installation couplers approved by cable manufacturers.
- Standard
 - BS EN 61535
- Rated voltage
 - 230V.
- Current rating
 - 10A.
 - 16A.
- Cable connections
 - Rewirable.
 - Non-rewireable.
- Degree of protection to BS EN 60529
- Location of installation
 - Readily accessible.
 - Non-readily accessible.
- Earthing
 - With earthing contact.
 - Without earthing contact.
- Type of cable conduit
 - Rigid.
 - Flexible.
 - Rigid or flexible.
- Type of terminal
 - Screw-type.
 - Screwless.

3065A LIGHTING INSTALLATION COUPLERS:

- Use only lighting installation couplers approved by cable manufacturers and to BS EN 61535 of rated voltage 230V and current rating 10A with rewirable or non-rewireable connections suitable for readily accessible locations with earth contact and for rigid or flexible cables.

3065B SMALL POWER INSTALLATION COUPLERS:

- Use only small power installation couplers approved by cable manufacturers and to BS EN 61535 of rated voltage 230V and current rating 16A with rewirable or non-rewireable connections suitable for readily accessible locations with earth contact and for rigid or flexible cables.

3110A CABLE DUCTS:

- Standard
 - BS 4660 provided by Electricity Distribution Company.

3120A CABLE SLEEVES:

- Supply and hand to others for installation non-ferrous cable sleeves for incorporation into the structure

where cables pass through fire compartment floors and walls. Sleeving to be in accordance with BS EN 60684

- Packing material
 - Weak mix mortar; intumescent, plaster or mastic; solid intumescent material; or intumescent granule filled bags.

3130A CABLE COVERS AND MARKERS:

- Material - recovered plastic, integral tape.
 - Marking - electricity or telephone.
- Plastic marker tape
 - Yellow, marked electricity or telephone.

4000 WORKMANSHIP

4010 CABLE INSTALLATION - GENERAL:

- Use and install cables only as directed in the appropriate standard or as directed by the manufacturer in writing. Lay cables in one length unless otherwise indicated. Obtain permission from supervising officer for all through joints, and where overall length requirement exceeds practical drum size.
- Handle, install and dispose of cables on wooden drums in accordance with BS 8512
- Install cables when ambient temperature is 5°C or greater, using cables stored at or above this temperature for not less than 24 hours.
- Use drum stands, drum axles, fair leads, rollers, cable stockings and other equipment as recommended by the cable manufacturer and as appropriate to the method of installation.

4020 CABLE INSTALLATION IN LOW TEMPERATURES:

- Install cables at lower installation temperatures when authorised by manufacturer in a written statement.

4030 INSTALLATION OF LSF CABLE:

- Install LSF cables in accordance with manufacturer's instructions. Ensure ambient temperature is above 5°C. Ensure oversheaths are not damaged by abrasion or scuffing.

4030A INSTALLATION OF LSZH / LSOH CABLES:

- Install LSZH/LSOH cables in accordance with the manufacturer's instructions, ensuring the ambient temperatures are above the minimum specified by the manufacturer.
- Install LSZH/LSOH cables so that they are not exposed to concrete or other substances containing products similar to lime.
- Where LSZH/LSOH cables are installed outside containment, directly on concrete floors (e.g. under raised floors in offices, control rooms or data centres) ensure suitable cable mat products with appropriate fire performance are used.

4040 INSTALLATION OF UNARMoured CABLES:

- Install and use unarmoured cable to BS EN 50565-1, BS EN 50565-2, BS 7540-3 or the manufacturer's written instructions.

4060 CABLE INSTALLATION IN TRENCHES:

- Lay cables on newly prepared bedding. Ensure multiple layers of cable are separated vertically by a 50mm layer of hard rammed bedding material.
- When using a power winch ensure tension on the cable is taken by element of the cable designed for that purpose, that is armour or conductor cores as appropriate and not plastic sheath, metal sheath or core insulation.
- When hand pulling cable ensure no kinks are formed and that flaking, when used, is done in the correct direction.
- Do not allow cable to twist during installation. Use swivels to connect pulling bond to cable stocking or equivalent fitting.
- Check drum is suitable for jacking before commencing installation. If drum or reel is unsuitable for jacking, flake cable in correct direction in maximum size turns from drum or reel before commencing installation. Use skilled labour to supervise all unreeling, flaking or running of cable from a drum.
- Lay cables in the formation shown, ensure spacing is not reduced below that indicated.
- Bind trefoil groups at 1m intervals. Bind any associated earth or protective conductor to its cable or trefoil group at 1m intervals.
- Space multiple cables in trenches in accordance with BS 7671.
- Ensure installation radii and permanent bending radii are not less than those recommended by the manufacturer.
- Do not lay cables to BS 7211 or BS EN 50525 direct in the ground.

4080 CABLE INSTALLATION INTO DUCTS:

- Install cables into newly proved and cleaned duct. Use lubricants, recommended by the cable manufacturer in writing, to assist drawing process.
- Flake cable if drums or reels are not suitable for jacking. At intermediate draw pits with exit duct more than 15° off line of entry duct, flake cable before entering or provide comprehensive system of corner plates, roller and blocks. Use maximum practical size of turns when flaking and ensure direction is correct.
- Do not exceed manufacturer's installation tension on cable and ensure the pulling tension is taken on cable elements designed for that purpose, that is armour or conductor cores and not on other elements, such as plastic sheath or conductor insulation.
- Do not allow cables being pulled into ducts to twist. Use appropriate swivel between pulling bond and cable stocking or similar appliance.
- Bind trefoil groups of single core cables installed into a single duct at 1m intervals. Install earth or protective conductors into the same duct as the associated cable where practical, through manholes, draw pits and jointing chambers. Bind the two cables together. Pull all cables in one duct as a group. Ensure group does not twist or cross over. Report any damage to cable sheath during installation and carry out any instructed work to remedy the damage.
- Seal between cable and duct ends after cable installation. Ensure cable ends in jointing chambers are temporarily sealed where required.

4090A CABLE INSTALLATION IN CONDUIT AND TRUNKING:

- Install cables so that they are orderly and capable of being withdrawn.
- Arrange single core wiring generally using the loop-in method.
- Trunking
 - In vertical trunking provide pin racks at 3m intervals. Use ties at 2m intervals for all wires of the same circuit reference. Mark ties with circuit reference number at 10m intervals.
- Conduit
 - Provide cable clamps in conduit boxes at 10m intervals in vertical conduit.
 - Allow for full range of movement at building construction movement joints. Make all joints to wiring at terminal blocks in conduit boxes.

4100 CABLE INSTALLATION ON TRAY AND RACK:

- Place cables side by side or as indicated. Fix using cleats or cable ties so that any cable may be individually removed. Use metallic ties on cables with specified fire performance.

4110A CABLE SURFACE INSTALLATION:

- Dress cables flat, free from twists, kinks and strain; and align parallel to building elements. When glands and clamps are not required, take sheathing of cables into accessory boxes and equipment and protect against abrasion using grommets or similar sharp edge protection.

4120A CABLE EMBEDDED INSTALLATION:

- Dress cables flat, free from twists, kinks and strain; and align parallel to building elements. When glands and clamps are not required, take sheathing of cables into accessory boxes and equipment and protect against abrasion using grommets or similar sharp edge protection.
- Ensure plaster or screed over cable is a minimum of 12mm. Protect embedded cables with metal capping or PVC oval conduit.

4130A CABLE INSTALLATION - MINERAL INSULATED CABLES:

- Straighten and dress cables using methods and tools recommended by cable manufacturer.
- Use thermoplastic or LSF sheathed cables in location indicated, and where cables may come into direct contact with any material that may be corrosive to copper.
- Do not allow extra length on installed cables to allow for cutting back of moisture affected ends. Store mineral insulated cables in the form as supplied by manufacturer.

4140 CABLE INSTALLATION - FLEXIBLE CORDS:

- Grip cords securely at connections. Where they do not form an integral part of the connected accessory or equipment, provide separate proprietary cord grips.

4150A CABLE JOINTING AND TERMINATING GENERALLY:

- Ensure all joints and terminations are made by appropriately qualified cable jointers, using jointing materials, components and workmanship recommended by the cable manufacturer and the jointing accessory manufacturer. Install cable glands in accordance with BS 6121-5
 - Cold pour resin and heat shrink joints.
 - Cut all cable ends immediately prior to jointing or terminating. Seal cables left unconnected for more than 24 hours to prevent the ingress of moisture. Seal plastic sheathed cables using proprietary shrink on end caps. Seal lead sheathed cables by a plumbed dressed lead cap with an airspace to allow conductor movement.
- Strip cables to bring out the cores and expose conductors, for the minimum length required for connection, to leave no exposed length of conductor after termination. Ensure that strands are not damaged when stripping cable cores. Twist strands together. Do not reduce number of strands. Secure all strands at terminations.
- Clean armour thoroughly prior to jointing or terminating.
- At connections to equipment and switchgear without integral cable clamping terminals, use compression or solder type lugs for bolted terminal connections, of correct bore.
- Form all compression connections to components using tools that cannot be released unless the correct degree of compression has been achieved.
 - Install and inspect compression and mechanical connectors on conductors in accordance with BS EN 60228 and BS 7609
- Bolt core terminations with lugs to equipment using washers or proprietary shakeproof devices.

- Do not bunch more than three cores at clamping terminals or bolted connections.
- Mark cable conductor phasing or other core identification at each end of all cables; and at all joints maintaining consistency of marking with any existing system.
- Connect all cores, including multicore cable spare cores, at all joints and terminations. Bond any unused cores or multicore cables to earth at both ends, unless otherwise indicated.

4170 CABLE JOINTING AND TERMINATING - ELASTOMER AND PLASTIC INSULATED CABLES:

- Joint cables using glands of the type indicated, in accordance with the manufacturer's instructions.
- Use shrouds at all glands, unless otherwise instructed.
- At core connections to equipment without integral clamping terminals use compression lugs unless otherwise indicated.

4180A TERMINATING - MINERAL INSULATED CABLES:

- Use terminations in accordance with BS EN 60702-2 and components and materials recommended or supplied by cable manufacturer.
- Use seals with maximum temperature rating indicated stub caps to the largest size available; and drilled caps and headed sleeves for larger sizes.
- Use glands of type indicated. At terminations to accessory boxes within a plaster or render finish, cable clamps fixed to accessory box and firmly gripping cable sheath may be used. Use earth tail seals with sheath grip type accessory boxes.
- At equipment not provided with threaded entries secure glands using lock washers and locknuts or brass conduit bush. Use gland shrouds when plastic covered MI cables are used.
- Using PVC, PIB or LSF material tape to BS EN 60454 to match sheath, tape overall gland any bare copper sheath and form seal to cable sheath under all shrouds.
- Mark core sleeving with appropriate identification.
- Install voltage surge suppressors in accordance with manufacturer's recommendations and surge suppressors to BS 7671, Section 331-01-01.

4190A CABLE JOINTS - MINERAL INSULATED CABLES:

- Joint mineral insulated cables using methods and materials recommended by cable manufacturer. Terminate cables in externally threaded glands using seals with temperature rating indicated. Join conductors using crimped connectors.
- Insulate connectors using PVC tape to BS EN 60454, ensuring good seal to conductor sleeving. Make off glands into either end of internally threaded brass sleeve of correct size. Protect brass sleeve using heat shrink sleeve.

4200A COMMUNICATIONS COAXIAL, OPTICAL FIBRE AND IT CABLE INSTALLATION, JOINTING AND TERMINATING:

- Use methods approved by cable and accessory manufacturers.
- Use methods of fixing and restraint which do not deform the cross-section of cables, which might otherwise affect the data / signal performance of cables.
- Ensure cable protection mats are used in basket in which unarmoured copper cables are installed, where cable deformation may affect signal / data performance (e.g. Category 6 and Category 6a applications).
- Employ labour certified by acceptable body as qualified to install and make joints and terminations in the referenced cable. Obtain in writing approval of cable manufacturer for accessories not supplied by them.
- Identify cables using structured numbering scheme.
- Install communication, coaxial, optical fibre and IT cables in accordance with BS EN 50174-2 and BS EN 50174-3.

BS APPENDIX

BS 4660:2000

Thermoplastics ancillary fittings of nominal sizes 110 and 160 for below ground gravity drainage and sewerage.

BS 5467:1997+A3:2008

Electric cables. Thermosetting insulated, armoured cables for voltages of 600/1000 V and 1900/3300 V

BS 5839-1:2013

Fire detection and fire alarm systems for buildings. Part 1 Code of practice for design, installation, commissioning and maintenance of systems in non-domestic premises

BS 6004:2012

Electric cables. PVC insulated, non-armoured cables for voltages up to and including 450/750 V, for electric power, lighting and internal wiring

BS 6121-5:2005

Mechanical cable glands. Part 5 Code of practice for selection, installation and inspection of cable glands and armour glands

BS 6622:2007

Electric cables. Armoured cables with thermosetting insulation for rated voltages from 3.8/6.6 kV to 19/33 kV. Requirements and test methods.

BS 6724:1997+A3:2008

Electric cables. Thermosetting insulated, armoured cables for voltages of 600/1000 V and 1900/3300 V, having low emission of smoke and corrosive gases when affected by fire

BS 7197:1990

Specification for performance of bonds for electric power cable terminations and joints for system voltages up to 36 kV

BS 7211:2012

Electric cables. Thermosetting insulated and thermoplastic sheathed cables for voltages up to and including 450/750 V, for electric power and lighting and having low emission of smoke and corrosive gases when affected by fire

BS 7540-3:2005

Electric cables. Guide to use for cables with a rated voltage not exceeding 450/750 V. Part 3 National standard cables not included in HD 21 and HD 22

BS 7609:1992+A2:2009

Code of practice for installation and inspection of uninsulated compression and mechanical connectors for

power cables with copper or aluminium conductors

BS 7629-1:2015

Electric cables. Specification for 300/500 V fire resistant screened, fixed installation cables having low emission of smoke and corrosive gases when affected by fire. Part 1 Multicore cables

BS 7671:2008+A3:2015

Requirements for electrical installations. IET Wiring Regulations. Seventeenth edition

BS 8436:2011

Electric cables. Specification for 300/500 V screened electric cables having low emission of smoke and corrosive gases when affected by fire, for use in walls, partitions and building voids. Multicore cables

BS 8512:2008

Electric cables. Code of practice for the storage, handling, installation and disposal of cables on wooden drums

BS EN 187103:2003

Harmonized system of quality assessment for electronic components. Family specification. Optical fibre cables for indoor applications

BS EN 50090-9-1:2004

Home and building electronic systems (HBES). Part 9-1 Installation requirements. Generic cabling for HBES class 1 twisted pair

BS EN 50174-2:2009+A2:2014

Information technology. Cabling installation. Installation planning and practices inside buildings

BS EN 50174-3:2013

Information technology. Cabling installation. Part 3 Installation planning and practices outside buildings

BS EN 50288-1:2013

Multi-element metallic cables used in analogue and digital communication and control. Part 1 Generic specification

BS EN 50288-11-1:2012

Multi-element metallic cables used in analogue and digital communication and control. Sectional specification for un-screened cables characterised up to 500 MHz. Horizontal and building backbone cables

BS EN 50288-3-1:2013

Multi-element metallic cables used in analogue and digital communication and control. Part 3-1 Sectional specification for unscreened cables characterized up to 100 MHz. Horizontal and building backbone cables

BS EN 50288-3-2:2013

Multi-element metallic cables used in analogue and digital communication and control. Part 3-2 Sectional specification for unscreened cables characterized up to 100 MHz. Work area and patch cord cables

BS EN 50288-6-1:2013

Multi-element metallic cables used in analogue and digital communication and control. Sectional specification for unscreened cables characterised up to 250 MHz. Part 6-1 Horizontal and building backbone cables

BS EN 50288-7:2005

Multi-element metallic cables used in analogue and digital communication and control. Part 7 Sectional specification for instrumentation and control cables

BS EN 50290-2-22:2002

Communication cables. Part 2-22 Common design rules and construction. PVC sheathing compounds

BS EN 50290-2-27:2002+A1:2007

Communication cables. Common design rules and construction. Halogen free flame retardant thermoplastic sheathing compounds

BS EN 50393:2015

Test methods and requirements for accessories for use on distribution cables of rated voltage 0,6/1,0 (1,2) kV

BS EN 50407-3:2014

Multi-pair cables used in high bit rate digital access telecommunications networks. Indoor multi-pair/quad riser cables up to 100 MHz for maximum length of connection 100 m supporting universal services, xDSL and applications up to 100 Mbit/s over IP

BS EN 50441-1:2012

Cables for indoor residential telecommunication installations. Part 1 Unscreened cables. Grade 1

BS EN 50441-2:2012

Cables for indoor residential telecommunication installations. Part 2 Screened cables. Grade 1

BS EN 50441-3:2006

Cables for indoor residential telecommunication installations. Screened cables. Grade 3

BS EN 50441-4:2012

Cables for indoor residential telecommunication installations. Part 4 Cables up to 1200 MHz. Grade 3

BS EN 50525-2-21:2011

Electric cables. Low voltage energy cables of rated voltages up to and including 450/750 V (U0/U). Cables for general applications. Flexible cables with crosslinked elastomeric insulation

BS EN 50525-2-31:2011

Electric cables. Low voltage energy cables of rated voltages up to and including 450/750 V (U0/U). Cables for general applications. Single core non-sheathed cables with thermoplastic PVC insulation

BS EN 50525-2-41:2011

Electric cables. Low voltage energy cables of rated voltages up to and including 450/750 V (U0/U). Cables for general applications. Single core cables with crosslinked silicone rubber insulation

BS EN 50525-2-42:2011

Electric cables. Low voltage energy cables of rated voltages up to and including 450/750 V (U0/U). Cables for general applications. Single core non-sheathed cables with crosslinked EVA insulation

BS EN 50525-3-41:2011

Electric cables. Low voltage energy cables of rated voltages up to and including 450/750 V (U0/U). Cables with special fire performance. Single core non-sheathed cables with halogen-free crosslinked insulation, and low emission of smoke

BS EN 50565-1:2014

Electric cables. Guide to use for cables with a rated voltage not exceeding 450/750 V (U0/U). General guidance

BS EN 50565-2:2014

Electric cables. Guide to use for cables with a rated voltage not exceeding 450/750 V (U0/U). Specific guidance related to EN 50525 cable types

BS EN 60079-14:2014

Explosive atmospheres. Electrical installations design, selection and erection

BS EN 60228:2005

Conductors of insulated cables

BS EN 60529:1992+A2:2013

Degrees of protection provided by enclosures (IP code)

BS EN 60702-1:2002+A1:2015

Mineral insulated cables and their terminations with a rated voltage not exceeding 750 V. Cables

BS EN 60702-2:2002+A1:2015

Mineral insulated cables and their terminations with a rated voltage not exceeding 750 V. Terminations

BS EN 60793-2-10:2011

Optical fibres. Part 2-10 Product specification. Sectional specification for category A1 multimode fibres

BS EN 60794-2-11:2012

Optical fibre cables. Part 2-11 Indoor optical cables. Detailed specification for simplex and duplex cables for use in premises cabling

BS EN 61442:2005

Test methods for accessories for power cables with rated voltages from 6 kV ($U_m = 7,2$ kV) up to 36 kV ($U_m = 42$ kV)

BS EN 61535:2009+A1:2013

Installation couplers intended for permanent connection in fixed installations

BS EN 61914:2016

Cable cleats for electrical installations

BS EN 62664-1-1:2013

Fibre optic interconnecting devices and passive components. Fibre optic connector product specifications. LC-PC duplex multimode connectors terminated on IEC 60793-2-10 category A1a fibre

BS EN 62680-1:2013

Universal serial bus interfaces for data and power. Universal serial bus specification, revision 2.0

BS IEC 62275:2006

Cable management systems. Cable ties for electrical installations

Y62 BUSBAR TRUNKING

1000 GENERAL

1010 BUSBAR TRUNKING SYSTEMS STANDARDS:

- Supply and install busbar trunking systems in accordance with BS 7671 Requirements for Electrical Installations (The IET Wiring Regulations).

1020 POWER TRACK SYSTEMS:

- Supply and install busbar trunking systems in accordance with BS EN 61534-1 and in particular the requirements of BS 7671 Requirements for Electrical Installations (The IET Wiring Regulations).

2000 PRODUCTS/MATERIALS

2010A GENERAL PURPOSE BUSBAR :

- System characteristics
 - Electrical Supply - Voltage between phases 400 volts; frequency 50 Hz.
 - Rate system to withstand a short circuit fault current of 21 kA.
 - Short time rating - 0.2 seconds.
- Busbar
 - Use high conductivity busbars and connections.
 - Material - Copper.
 - Number of Poles - 3-phase and full size neutral.

2020A GENERAL PURPOSE STEEL BUSBAR TRUNKING:

- Busbar trunking type
 - Surface; flush; bench or underfloor.
- Busbar
 - Y62.2010A
- Steel enclosure
 - Comply with relevant sections of BS 4678.
 - Apply high standard of finish to busbar trunking. For a painted finish apply a minimum of one coat rust inhibiting primer, one undercoat and two semi-gloss finish coats.
 - Remove rust and degrease metal prior to application of selected finish. Zinc coated steel is acceptable as anti-rust treatment.
 - Use rust-proofed (e.g. cadmium plated) screws, bolts, nuts and washers.
 - Finish - Paint or stoved enamel.
 - Colour- Manufacturer's standard colour.
- Fittings
 - Use trunking fittings of the same type and manufacture as the busbar trunking. Use screw fixed covers. Use manufacturer's purpose made units at changes of direction.
- Supply termination
 - Provide facilities for the correct termination of supply cable.
- Fixings
 - Provide external fixing brackets at not greater than 2m intervals. In accordance with manufacturer's instructions and recommendations.
- Marking
 - Provide clear marking of busbars and tap-off outlet sockets with phase colours to enable sequence

identification throughout system.

2025A WALL/DADO TRUNKING WITH LV SOCKETS:

- Standard - BS EN 61534-21.
- Style - Dado.
- Fittings - Use fittings of same type and manufacturer as trunking with snap on covers.
- Provide facilities for termination of supply.
- Connection of LV sockets - Plug in.

2025B UNDERFLOOR TRUNKING WITH LV SOCKETS:

- Standard
 - BS EN 61534-1
 - BS EN 61534-22.
- Style - Underfloor.
- Fittings - Use fittings of same type and manufacturer as trunking with snap on covers.
- Provide facilities for termination of supply.
- Connection of LV sockets - Plug in.

2030A TAP-OFF UNITS:

- Standard BS EN 61534-1.
- Underfloor systems - BS EN 61534-22.
- Provide tap-off facilities along the busbar system at intervals as indicated.
- Provide tap-off units with fuses, current rating, class and type as indicated; termination points for outgoing cables in every tap-off unit; and isolating switch with number of poles as indicated.

2040A INTERNAL PROTECTIVE CONDUCTORS:

- Standard BS EN 61534-1.
- Provide protective conductor throughout busbar system length to manufacturer's standard.
 - Busbar pole with tap-off at each socket for wall/dado type with integral socket outlets.
- Install protective conductor internally to busbar enclosure.
- Bond protective conductor to trunking enclosure using a method in accordance with BS 7430 at 1.2m maximum intervals.
- Use high tensile brass bolts and locking nuts.
- Complete trunking system before installing the protective conductor.
- Ensure the continuity of protective circuits.

3000 WORKMANSHIP

3010 GENERAL:

- Install busbar trunking in accordance with manufacturer's instructions and the relevant standards.
- Check total length of busbar system required on-site prior to manufacture commencing.
- Fit covers at end of each run or provide proprietary end boxes.

3020 BONDING:

- Bond between adjacent lengths of busbar trunking with approved mechanical means to maintain conductivity, where two or more parallel runs of busbar trunking occur. Tighten bolted connections between

adjacent lengths of busbars to correct torque setting. Avoid damage to conductors.

3030 EXPANSION:

- Anchor busbars rigidly in a minimum of one position and provide means of absorbing maximum expansion and contraction likely to occur in busbars under normal operating conditions.
- Provide expansion joints in each length of run

3050 FIRE BARRIERS:

- Provide barriers of fire-resisting materials within the busbar trunking where vertical runs pass through floors and horizontal runs pass through fire break walls to prevent spread of fire. (BS 7671 Section 527).

BS APPENDIX

BS 7430:2011+A1:2015

Code of practice for protective earthing of electrical installations

BS 7671:2008+A3:2015

Requirements for electrical installations. IET Wiring Regulations. Seventeenth edition

BS EN 61534-1:2011+A1:2014

Powertrack systems. Part 1 General requirements

BS EN 61534-22:2014

Powertrack systems. Part 22 Particular requirements for powertrack systems intended for onfloor or under floor installation

Y63 SUPPORT COMPONENTS - CABLES

1000 GENERAL

1010 APPLICATION:

- Cables referred to in this section are only those types that can be installed without further mechanical protection.

2000 PRODUCTS/MATERIALS

2010A CABLE SUPPORTS AND FINISHES:

- Cable supports
 - Support all cables throughout their length using conduit; or trunking and enclosures; or cable tray; or cable racking; or special support systems; or cleat or clip fixing direct to building fabric as indicated on the drawings/schedules.
 - Ensure tray, racking and special support systems are continuous and firmly fixed to building fabric. Allow space for additional cables as indicated on the drawings/schedules.
 - Ensure cable support system allows for spacing in accordance with BS 7671 for the design current of the cable.
- Fixings finishes
 - Ensure finish for all support components, fixings, hangers and accessories is as cable support system or manufacturer's standard.

2020A CABLE SUPPORT SYSTEM - PERFORATED TRAY:

- Type - Flanged or return flanged.
- Perforations
 - Admiralty pattern for light or medium duty; GDCC pattern standard 23; or manufacturer's standard pattern.
- Thickness - Manufacturer's standard thickness for type.
- Fittings
 - Use factory made fittings throughout of same material, type, pattern, finish and thickness as cable tray.
 - Use reducers, inside angles and outside angles as manufacturer's standard.
 - Use flat bends, equal tees, unequal tees and crosses with corners gusseted.
 - Join lengths of tray and fittings using manufacturer's standard shouldered ends, fish plates, or couplers, with galvanized or zinc plated slotted domed head 'roofing' bolts, nuts, washers and shakeproof washers.
- Material
 - Hot rolled steel galvanized after manufacture to BS EN 10346 or BS EN 10143.
- Finish - Self colour galvanized.

2020B CABLE SUPPORT SYSTEM - CABLE RACK:

- Proprietary system of channel sections with return lip and compatible jointing and fixing accessories
- Fittings
 - Use factory made fittings throughout of same material finish and section as rack, for risers, bends, reducers, tees, crosses and drop outs.
- Material
 - Hot rolled steel galvanized after manufacture to BS EN 10346 or BS EN 10143.
- Finish - Self colour galvanized.

2025A CABLE SUPPORT SYSTEM - PROPRIETARY CABLE TIES:

- Two piece cable tray pattern, on cable tray only. Wrap round self locking non releasable pattern on everything except cable trays.

2025B CABLE SUPPORT SYSTEM - CABLE CLIPS:

- Polypropylene surface type with pre-fixed hardened steel pin for general use except on mineral insulated cables.
- For mineral insulated cables use bright copper one hole 'P' clips for unsheathed mineral insulated cables, PVC covered for sheathed mineral insulated cables.

2025C CABLE SUPPORT SYSTEM - TWO WAY SADDLES:

- Bright copper for unsheathed mineral insulated cables. PVC covered bright copper for sheathed mineral insulated cables.

2025D CABLE SUPPORT SYSTEM - CABLE BASKET:

- Proprietary system of wire basket with compatible jointing and fixing accessories.
- Fittings
 - Use factory made fittings throughout of same material finish as basket, for risers, bends, reducers, tees, crosses and drop outs.

2025E CABLE SUPPORT SYSTEM - CABLE CLEATS:

- One piece or single way pattern or claw pattern or two bolt pattern to BS EN 61914
- Material
 - Die cast aluminium alloy; moulded black polyethylene; or nylon.
- Finish - Self finish.

3000 WORKMANSHIP

3010 CABLE TRAY INSTALLATION:

- Support from building fabric with minimum clearance behind of 20mm. Install fixings at regular intervals to prevent visible sagging when loaded, with maximum spacing 1.2m and 230mm from fittings.
- Keep cutting of cable tray to a minimum. Cut along a line of unperforated metal. Make good finish with zinc rich paint, primer and top coat, or two pack epoxy paste, as appropriate to tray material and finish.
- Fit holes cut in tray for passage of cables with grommets, bushes or other lining.
- Install all bolts, fixings and hangers with threaded portion away from cables. Cable routes to cross at right angles or spacing to BS EN 50374.

3020A CABLE CLEATS, TIES, SADDLES AND CLIPS INSTALLATION:

- For cables on horizontal tray use ties for each circuit. Use tie manufacturer's special tensioning tool where available. Crop off tie ends.
- For cables on vertical tray use cleats bolted to tray for paper, plastic or elastomeric insulated cables and saddles or clips for mineral insulated cables. Use cleats sized to grip cables firmly without undue pressure or strain on cable, but preventing slipping.
- For cables on vertical or horizontal rack use proprietary fixings to rack for paper, plastic or elastomeric insulated cables and saddles or clips for mineral insulated cables. On continuous flat surfaces of wood,

plaster, brick etc.

- Use polypropylene surface fixing clips with prefixed hardened steel pin for PVC insulated and sheathed cables and sheathed or bright mineral insulated cables. Use round or flat or flat twin pattern as appropriate, manufactured specifically for cable being fixed.
- Use one hole 'P' clips or two way saddles of bright copper for unsheathed mineral insulated cable. Use PVC covered for sheathed mineral insulated cables.
- Space cleats, ties, saddles and clips
 - As Appendix G of Guidance Notes 'Selection & Erection' published by the IET.

BS APPENDIX

BS 7671:2008+A3:2015

Requirements for electrical installations. IET Wiring Regulations. Seventeenth edition

BS EN 10143:2006

Continuously hot-dip metal coated steel sheet and strip. Tolerances on dimensions and shape

BS EN 10346:2015

Continuously hot-dip coated steel flat products for cold forming. Technical delivery conditions

BS EN 50374:2004

Conductor cars

BS EN 61914:2016

Cable cleats for electrical installations

Y71 LV SWITCHGEAR AND DISTRIBUTION BOARDS

1000 GENERAL

1020# ELECTRICITY SUPPLY:

- Ensure all electrical equipment supplied and installed is suitable for power supply indicated to BS EN 60038 and relevant parts of BS EN 61558

2000 PRODUCTS/MATERIALS

2010A CUBICLE SWITCHBOARD - LV SWITCHGEAR AND CONTROLGEAR ASSEMBLY:

- Standard - BS EN 61439-1.
- External design - Cubicle type assembly.
- Usage - Switchboard.
- Conditions of installation - Indoors.
- Electrical characteristics
 - Rated operational voltage 400V +10% -6%
- Service conditions
 - Ambient air temperature and altitude to relevant parts of BS EN 61439.

2010B CUBICLE CONTROL PANEL - LV SWITCHGEAR AND CONTROLGEAR ASSEMBLY:

- Standard - BS EN 61439-1.
- External design - Cubicle type assembly.
- Usage - Control panel.
- Conditions of installation - Indoors.
- Electrical characteristics
 - Rated operational voltage 400V +10% -6%
- Service conditions
 - Ambient air temperature and altitude to relevant parts of BS EN 61439.

2010C MULTI-BOX SWITCHBOARD - LV SWITCHGEAR AND CONTROLGEAR ASSEMBLY:

- Standard - BS EN 61439-1.
- External design - Multi-box type assembly.
- Usage - Switchboard.
- Conditions of installation - Indoors.
- Electrical characteristics
 - Rated operational voltage 400V +10% -6%
- Service conditions
 - Ambient air temperature and altitude to relevant parts of BS EN 61439.

2010D MULTI-BOX CONTROL PANEL - LV SWITCHGEAR AND CONTROLGEAR ASSEMBLY:

- Standard - BS EN 61439-1.
- External design - Multi-box type assembly.
- Usage - Control panel.
- Conditions of installation - Indoors.
- Electrical characteristics
 - Rated operational voltage 400V +10% -6%

- Service conditions
 - Ambient air temperature and altitude to relevant parts of BS EN 61439.

2020A FLOOR STANDING ASSEMBLY CONSTRUCTION:

- Enclosure standard - BS EN 62208.
- Material of enclosure - Manufacturer's standard.
- Terminals for external conductors, main power circuits
 - Accommodate cross-sectional area of copper cables in accordance with BS EN 61439-1.
- Terminals for external conductor, control and auxiliary circuits
 - Terminal block. Mounting as manufacturer's standard.
- Size of neutrals on 3-phase supplies - Full sized.
- Degree of protection to BS EN 60529, IP31 for assembly.
- Protection against direct and indirect contact
 - Manufacturer's standard.
- Accessibility for inspection
 - Arrange for following operations to be performed when assembly is in service and under voltage
 - Visual inspection of switching devices and other apparatus; settings and indicators of relays and releases; conductor connections and markings.
 - Adjusting and re-setting of relays, releases and electronic devices.
 - Replacement of fuselinks and indicating lamps.
 - Fault location by voltage and current measuring.
- Accessibility for maintenance
 - Provide space between functional unit or group and adjacent functional units or groups. Provide retainable fastening means for parts likely to be removed for maintenance.
- Removable parts and withdrawable parts as manufacturer's standard.
- Internal separation - Form 4.
- Input voltage variations for electronic equipment supply - BS EN 60439.
- Supply frequency deviation - BS EN 60439.
- Mounting - Floor standing.

2020B WALL-MOUNTED ASSEMBLY CONSTRUCTION:

- Enclosure standard - BS EN 62208.
- Material of enclosure - Manufacturer's standard.
- Terminals for external conductors, main power circuits
 - Accommodate cross-sectional area of copper cables in accordance with BS EN 61439-1.
- Terminals for external conductor, control and auxiliary circuits
 - Terminal block. Mounting as manufacturer's standard.
- Size of neutrals on 3-phase supplies - Full sized.
- Degree of protection to BS EN 60529, IP31 for assembly.
- Protection against direct and indirect contact
 - Manufacturer's standard.
- Accessibility for inspection
 - Arrange for following operations to be performed when assembly is in service and under voltage
 - Visual inspection of switching devices and other apparatus; settings and indicators of relays and releases; conductor connections and markings.
 - Adjusting and re-setting of relays, releases and electronic devices.
 - Replacement of fuselinks and indicating lamps.
 - Fault location by voltage and current measuring.
- Accessibility for maintenance
 - Provide space between functional unit or group and adjacent functional units or groups. Provide retainable fastening means for parts likely to be removed for maintenance.

- Removable parts and withdrawable parts as manufacturer's standard.
- Internal separation - Form 4.
- Input voltage variations for electronic equipment supply - relevant parts of BS EN 61439 and BS EN 60439.
- Supply frequency deviation - relevant parts of BS EN 61439 and BS EN 60439.
- Mounting - Wall-mounted.

2030A ENCLOSURE FINISH:

- Apply high standard finish to enclosure and supporting metalwork. Degrease metal and remove rust prior to applying finish.
- Comply with paint manufacturer's recommendations regarding preparation, stoving times, temperatures, mixing of finishes, application and coat thickness.
- Finish - Manufacturer's standard.
- Colour - Manufacturer's standard colour.

2040# TYPE TESTS:

- Provide certificates of verification of
 - Temperature rise limits.
 - Dielectric properties.
 - Short-circuit strength to relevant parts of BS EN 61439 and BS EN 60439.
 - Continuity of protective circuit.
 - Clearances and creepage distances.
 - Mechanical operation.
 - Degree of protection.
 - Temperature rise limits
 - Temperature rise test for test current greater than 3150 A
 - Temperature rise when ambient temperature exceeds +40°C or is lower than +10°C
 - Value of neutral bar current for short-circuit test 60%.
 - Value of neutral bar current for short-circuit test
- Energy Efficiency Test

2050# ROUTINE TEST:

- Carry out test on-site.
- Repeat test on-site.

2060 SITE BUILT ASSEMBLIES:

- Ensure that components of site assemblies are part of a proprietary system and type tested as appropriate.
- Install assemblies in accordance with manufacturer's drawings and instructions.

2070 SITE MODIFICATION:

- Do not make site alterations unless authorised. Where site modifications to assemblies are authorised make in accordance with manufacturer's certified drawings and instructions. Ensure that modifications made comply with type test certificate obtained for arrangement of components.

2080A WALL-MOUNTED, TOP ENTRY BATTERY CHARGER AND BATTERY UNIT:

- Supply a unit for tripping.
- Input Supply - 230 V single-phase 50 Hz.
- DC Output

- Voltage - 50 Volt -20% +10%
- Operating temperature range - -10°C - 45°C.
- Charger type - Thyristor or transistor.
- Battery type
 - Lead acid (sealed) or Nickel Cadmium (maintenance free).
- Cubicle (sheet steel) - Wall-mounted.
- Cable entry - Top.
- Finish - Manufacturer's standard.
- Colour - Manufacturer's standard.
- Ventilation - Natural.
- Facilities - MCB input protection; float charge.
- Battery over-discharge protection
 - Fuses for battery protection; MCB's for outgoing circuits; automatic selection of boost charge.
- Meters
 - Battery voltage; charging current (dual scale for float and boost); output current.
- Lamp indications
 - Supply on; supply fail (monitor input terminals); floatcharge; boost charge; no charge (when supply is on); battery voltage low; battery voltage high.
- Alarms (connected to operate a relay with shrouded 230V3A a.c. or 0.5A d.c. N/C volt free contacts, closed on any alarm, for remote indication circuit)
- Supply failed; no charge (when supply is on); battery voltage low; battery voltage high.

2080B WALL-MOUNTED, BOTTOM ENTRY, BATTERY CHARGER AND BATTERY UNIT:

- Supply a unit for tripping.
- Input Supply - 230 V single-phase 50 Hz.
- DC Output
 - Voltage - 50 Volt -20% +10%
 - Operating temperature range - -10°C - 45°C.
 - Charger type - Thyristor or transistor.
- Battery type
 - Lead acid (sealed) or Nickel Cadmium (maintenance free).
- Cubicle (sheet steel) - Wall-mounted.
- Cable entry - bottom.
- Finish - Manufacturer's standard.
- Colour - Manufacturer's standard.
- Ventilation - Natural.
- Facilities - MCB input protection; float charge.
- Battery over-discharge protection
 - Fuses for battery protection; MCB's for outgoing circuits; automatic selection of boost charge.
- Meters
 - Battery voltage; charging current (dual scale for float and boost); output current.
- Lamp indications
 - Supply on; supply fail (monitor input terminals); floatcharge; boost charge; no charge (when supply is on); battery voltage low; battery voltage high.
- Alarms (connected to operate a relay with shrouded 230V 3A a.c. or 0.5A d.c. N/C volt free contacts, closed on any alarm, for remote indication circuit)
 - Supply failed; no charge (when supply is on); battery voltage low; battery voltage high.

2080C FLOOR STANDING, TOP ENTRY, BATTERY CHARGER AND BATTERY UNIT:

- Supply a unit for tripping.
- Input Supply - 230 V single-phase 50 Hz.

- DC Output
 - Voltage - 50 Volt -20% +10%
 - Operating temperature range - -10°C - 45°C.
 - Charger type - Thyristor or transistor.
 - Battery type - Lead acid (sealed) or Nickel Cadmium (maintenance free).
 - Cubicle (sheet steel) - Floor standing.
 - Cable entry - Top.
 - Finish - Manufacturer's standard.
 - Colour - Manufacturer's standard.
 - Ventilation - Natural.
 - Facilities - MCB input protection; float charge.
 - Battery over-discharge protection
 - Fuses for battery protection; MCB's for outgoing circuits; automatic selection of boost charge.
 - Meters
 - Battery voltage; charging current (dual scale for float and boost); output current.
 - Lamp indications
 - Supply on; supply fail (monitor input terminals); float charge; boost charge; no charge (when supply is on); battery voltage low; battery voltage high.
 - Alarms (connected to operate a relay with shrouded 230V 3A a.c.or 0.5A d.c. N/C volt free contacts, closed on any alarm, for remote indication circuit)
 - Supply failed; no charge (when supply is on); battery voltage low; battery voltage high.

2080D FLOOR STANDING, BOTTOM ENTRY, BATTERY CHARGER AND BATTERY UNIT:

- Supply a unit for tripping.
- Input Supply - 230 V single-phase 50 Hz.
- DC Output
 - Voltage - 50 Volt -20% +10%
 - Operating temperature range - -10°C - 45°C.
 - Charger type - Thyristor or transistor.
 - Battery type - Lead acid (sealed) or Nickel Cadmium (maintenance free).
 - Cubicle (sheet steel) - Floor standing.
 - Cable entry - bottom.
 - Finish - Manufacturer's standard.
 - Colour - Manufacturer's standard.
 - Ventilation - Natural.
 - Facilities - MCB input protection; float charge.
 - Battery over-discharge protection
 - Fuses for battery protection; MCB's for outgoing circuits; automatic selection of boost charge.
 - Meters
 - Battery voltage; charging current (dual scale for float and boost); output current.
 - Lamp indications
 - Supply on; supply fail (monitor input terminals); float charge; boost charge; no charge (when supply is on); battery voltage low; battery voltage high.
 - Alarms (connected to operate a relay with shrouded 230V 3A a.c.or 0.5A d.c. N/C volt free contacts, closed on any alarm, for remote indication circuit).
 - Supply failed; no charge (when supply is on); battery voltage low; battery voltage high.

2090# CIRCUIT BREAKERS, TRANSFER SWITCHES AND CONTROL AND PROTECTIVE SWITCHES:

- Provide circuit breakers, transfer switches and control and protective switches in accordance with BS EN 60947. Ensure that uninterrupted current rating indicated applies when unit is enclosed and in operating environment at rated operational voltage.

- Standard
 - BS EN 60934
 - BS EN 60947-2
 - BS EN 60947-2 Appendix B. (Circuit breakers incorporating residual current protection)
 - BS EN 60947-6-1
 - BS EN 60947-6-2
 - BS IEC 1008-2-2
 - BS EN 62626-1
- Details of equipment.
 - Equipment.
 - Circuit breaker.
 - Circuit breaker incorporating residual current protection (CBR).
 - Functionally independent of line voltage.
 - Functionally dependent on line voltage.
 - Opening automatically on failure of line voltage.
 - Delay (Seconds)
 - Hazardous situation trip.
 - Phase loss.
 - Voltage drop
 - Earth fault
 - No hazardous situation trip.
 - Automatic transfer switching equipment (ATSE).
 - Control and protective switching device (CPS).
 - Suitable for isolation.
 - Direct on line.
 - Reversing.
 - Two direction.
 - Circuit breaker for equipment (CBE).
 - CBR Classification
 - Single rated
 - Multiple rated.
 - Steps
 - Continuous variation.
 - Range
 - Time delay
 - No delay.
 - With delay.
 - Non-adjustable.
 - Adjustable.
 - Steps
 - Continuous variation.
 - Range
 - ATSE Classification
 - PC
 - CB
 - CBR Characteristics
 - Residual operating current (milliamps)
 - Residual non-operating current (milliamps)
 - Short-circuit capacity.
 - Making (Amps)
 - Breaking (Amps)
 - Maximum break time.
 - Characteristics of circuit breakers, CBR, ATSE and CPS

- Number of poles
- a.c.
- d.c.
- Interrupting medium
 - Air.
 - Oil.
 - Vacuum.
- Circuit breaker and CBR operating condition.
 - Method of operation
 - Method of control
- ATSE Operating sequence
- CPS Operating condition.
 - Method of operation.
 - Electromagnetic.
 - Motor operated.
 - Manual.
 - Method of control.
 - Automatic.
 - Non-automatic.
 - Re-setting after overload.
 - Self.
 - Locate manual.
 - Remote
 - Re-setting after short circuit.
 - Remote.
 - Non-remote
 - Circuit breaker
- Fuse.
- Rated and limiting values for the main circuit.
 - Rated voltage (Volts).
 - Operational
 - Insulation
 - Impulse withstand
 - Currents (Amps).
 - Conventional free air thermal
 - Conventional enclosed thermal
 - Rated operational.
 - Current (Amps)
 - Rated uninterrupted current (Amps)
 - Rated frequency (Hertz)
 - Rated duty.
 - Eight-hour.
 - Uninterrupted.
 - CPS Rated duty.
 - Eight-hour.
 - Uninterrupted.
 - Intermittent.
 - Class
 - Temporary.
 - Value
 - Periodic.
 - Short-circuit characteristics (Amps)
 - Rated short-time withstand current (Amps)

- Short time delay (Seconds)
- Rated short-circuit making current (Amps)
- Rated short-circuit breaking current (Amps)
 - Rated ultimate short-circuit breaking current (Amps)
 - Rated service short-circuit breaking current (Amps)
- Circuit breaker Utilisation category.
 - A (without intentional time delay and a short time withstand current rating).
 - B (with intentional time delay and a short time withstand current rating).
- ATSE Utilisation category.
 - AC 31A
 - AC 31B
 - AC 33A
 - AC 33B
 - AC 35A
 - AC 35B
 - AC 36A
 - AC 36B
 - DC 31A
 - DC 31B
 - DC 33A
 - DC 33B
 - DC 36A
 - DC 36B
- CPS Utilisation category.
 - AC 40.
 - AC 41.
 - AC 42.
 - AC 43.
 - AC 44.
 - AC 45a.
 - AC 45b.
 - DC 40.
 - DC 41.
 - DC 43.
 - DC 45.
 - DC 46.
- Control circuits
 - Electrical
 - ac
 - dc
 - Rated frequency (Hertz)
 - Rated voltage (Volts).
 - 24
 - 48
 - 110
 - 125
 - 127
 - 220
 - 230
 - 250
 - Rated supply voltage (Volts)
 - Air-supply
 - Rated pressure (bar)

- Volume of air at NTP for each closing and opening operation (litres)
 - ATSE Transfer control devices.
 - Transfer voltage (Volts)
 - Transfer current (Amps)
 - Transfer time
 - Contact (Seconds)
 - Operating (Seconds)
 - Return range
 - Off range
 - Auxiliary circuits
 - Relays and releases.
 - Type and characteristics.
 - Shunt
 - Control voltage (Volts)
 - ac
 - Rated frequency (Hertz)
 - dc
 - Over-current.
 - Rated current.
 - ac
 - Rated frequency (Hertz)
 - dc
 - Instantaneous.
 - Definite time
 - Inverse time
 - Load independent.
 - Load dependant.
 - Under-voltage
 - Rated values
 - Current settings (Amps)
 - Range (%)
 - Time/current characteristics
 - Influence of ambient air temperature
 - CPS Relays and releases.
 - Type
 - Rated values
 - Current settings (Amps)
 - Range (%)
 - Time/current characteristics
 - Influence of ambient air temperature
 - Co-ordination with short-circuit protective devices
 - Switching over-voltages (Volts)
 - Enclosure degree of protection IP
 - Pollution degree
 - Industrial (degree 3).
 - Household etc. (degree 2)
 - Integral fuses
- Circuit breakers and switches
 - Provide metal clad withdrawable isolating removable type air circuit breakers with provision for safe maintenance.
 - Provide metal clad demountable type moulded case circuit breakers with provision for safe maintenance.
 - Provide manual closing air-break circuit breakers, (ACB or MCCB).
 - Isolating removable (i.e.demountable).

- Withdrawable.
- Closing mechanism
 - Independent manual spring operated.
 - Motor wound spring operated with anti-pumping circuit.
 - Solenoid operated with anti-pumping ac circuit.
 - Solenoid operated with anti-pumping dc circuit.
 - Fit circuit breaker with an operation counter.
- Provide interlocks to prevent movement of circuit breaker within housing when in "closed" or "service" position.
- Provide automatic shutters to cover all live contacts when circuit breaker is isolated, withdrawn or removed from housing.
- Provide a padlock to lock circuit breaker in isolated/withdrawn position, and to lock automatic shutters covering live contacts when removed from housing.
- Provide moulded case circuit breakers with provision for safe maintenance.
- Provide interlocks to prevent movement of circuit breaker within housing when in "closed" or "service" position.

2090A UTILISATION A, WITHDRAWABLE AIR BREAK CIRCUIT BREAKERS:

- Provide circuit breakers in accordance with BS EN 60947. Ensure that uninterrupted current rating indicated applies when unit is enclosed and in operating environment at rated operational voltage.
- Standard
 - BS EN 60947-2
 - BS EN 62626-1
- Details of equipment - circuit breaker
 - Characteristics of circuit breakers
 - a.c. Interrupting medium - air.
- Rated and limiting values for the main circuit
 - Rated voltage - operational, 400V.
 - Rated frequency 50 Hertz.
 - Circuit breaker utilisation category - A (without intentional time delay and a short time withstand current rating).
 - Enclosure degree of protection IP 31.
- Circuit breakers and switches
 - Provide metal clad withdrawable isolating removable type circuit breakers with provision for safe maintenance.
 - Closing mechanism
 - Independent manual spring operated.
 - Provide automatic shutters to cover all live contacts when circuit breaker is isolated, withdrawn or removed from housing.
 - Provide a padlock to lock circuit breaker in isolated/withdrawn position, and to lock automatic shutters covering live contacts when removed from housing.
 - Provide withdrawable air circuit breakers with provision for safe maintenance.

2090B UTILISATION A, DEMOUNTABLE MCCB AIR BREAK CIRCUIT BREAKERS:

- Provide circuit breakers in accordance with BS EN 60947. Ensure that uninterrupted current rating indicated applies when unit is enclosed and in operating environment at rated operational voltage.
- Standard
 - BS EN 60947-2
 - BS EN 62626-1
- Details of equipment - circuit breaker
 - Characteristics of circuit breakers

- a.c. Interrupting medium - air.
- Rated and limiting values for the main circuit
 - Rated voltage - operational, 400V.
 - Rated frequency 50 Hertz.
 - Circuit breaker utilisation category - A.
 - Enclosure degree of protection IP 31.
- Circuit breakers and switches
 - Provide manual closing air-break circuit breakers, (MCCB).
 - Closing mechanism
 - Independent manual spring operated.
 - Provide automatic shutters to cover all live contacts when circuit breaker is isolated, withdrawn or removed from housing.
 - Provide a padlock to lock circuit breaker in isolated/withdrawn position, and to lock automatic shutters covering live contacts when removed from housing.
 - Provide demountable moulded case circuit breakers with provision for safe maintenance.

2090C UTILISATION B, WITHDRAWABLE AIR BREAK CIRCUIT BREAKERS:

- Provide circuit breakers in accordance with BS EN 60947. Ensure that uninterrupted current rating indicated applies when unit is enclosed and in operating environment at rated operational voltage.
- Standard -
 - BS EN 60947-2
 - BS EN 62626-1
- Details of equipment - circuit breaker
 - Characteristics of circuit breakers
 - a.c. Interrupting medium - air.
- Rated and limiting values for the main circuit
 - Rated voltage - operational, 400V.
 - Rated frequency 50 Hertz.
 - Circuit breaker utilisation category - B (with intentional time delay and a short time withstand current rating).
 - Enclosure degree of protection IP 31.
- Circuit breakers and switches
 - Provide metal clad withdrawable isolating removable type air circuit breakers with provision for safe maintenance.
 - Closing mechanism
 - Independent manual spring operated.
 - Provide automatic shutters to cover all live contacts when circuit breaker is isolated, withdrawn or removed from housing.
 - Provide a padlock to lock circuit breaker in isolated/withdrawn position, and to lock automatic shutters covering live contacts when removed from housing.
 - Provide withdrawable air circuit breakers with provision for safe maintenance.

2090D UTILISATION B, DEMOUNTABLE MCCB AIR BREAK CIRCUIT BREAKERS:

- Provide circuit breakers in accordance with BS EN 60947. Ensure that uninterrupted current rating indicated applies when unit is enclosed and in operating environment at rated operational voltage.
- Standard
 - BS EN 60947-2
 - BS EN 62626-1
- Details of equipment - circuit breaker
 - Characteristics of circuit breakers
 - a.c. Interrupting medium - air.

- Rated and limiting values for the main circuit
 - Rated voltage - operational, 400V.
 - Rated frequency 50 Hertz.
 - Circuit breaker utilisation category - B (with intentional time delay and a short time withstand current rating).
 - Enclosure degree of protection IP 31.
- Circuit breakers and switches
 - Provide manual closing air-break circuit breakers, (MCCB).
 - Closing mechanism
 - Independent manual spring operated.
 - Provide automatic shutters to cover all live contacts when circuit breaker is isolated, withdrawn or removed from housing.
 - Provide a padlock to lock circuit breaker in isolated/withdrawn position, and to lock automatic shutters covering live contacts when removed from housing.
 - Provide demountable moulded case circuit breakers with provision for safe maintenance.

2100A SWITCH DISCONNECTORS:

- Supply switch disconnectors in accordance with BS EN 60947.
- Standard
 - BS EN 60947-3
 - BS EN 62626-1
- Details of equipment - switch-disconnector
 - a.c. Interrupting medium - air.
- Rated and limiting values for the main circuit
 - Rated voltage (Volts) 230/400.
 - Rated frequency 50 Hertz.
 - Utilisation category - AC 23A.
 - Enclosure degree of protection IP 65.
 - Fit each switch with facility to padlock in OFF position.
 - Provide switches with auxiliary contacts as indicated. Where switches isolate final connections between a starter and its motor, fit one set of contacts to open starter coil circuit when switch is opened.

2100B FUSE COMBINATION UNITS:

- Supply fuse combination units in accordance with BS EN 60269 (BS 88).
- Standard
 - BS EN 60947-3
 - BS EN 62626-1
- Details of equipment - fuse combination unit
 - a.c. Interrupting medium - air.
- Rated and limiting values for the main circuit
 - Rated voltage (Volts) 230/400.
 - Rated frequency 50 Hertz.
 - Utilisation category - AC23A.
 - Enclosure degree of protection IP 31.
 - Fit removable neutral link in switches controlling circuits with neutral conductor.
 - Fit solid links in isolating switches.
 - Fit each switch with facility to padlock in OFF position.
 - Ensure that withdrawable chassis isolating type switches are provided with fully shrouded fixed contacts or insulated coverplates, to prevent accidental contact with live parts.
 - Ensure that switches in individual enclosures have an earth terminal, meet the degree of protection for the switchboard and have operating mechanisms interlinked with access door.

- Provide switches with auxiliary contacts as indicated. Where switches isolate final connections between a starter and its motor, fit one set of contacts to open starter coil circuit when switch is opened.

2110A AUTOMATIC RESET PROTECTION DEVICES INTERPOSING RELAYS AND INTER-TRIPPING RELAYS:

Standard - BS EN 61810.

- Housing
 - Flush panel mounting type. House all protection relays, excluding motor protection relays, in draw out cases.
- Reset type - Automatic reset type.
- Overcurrent tripping device
 - Provide overcurrent tripping device with overcurrent characteristic similar to a BS 2692 high voltage cartridge fuse, sized to protect the equipment/load.

2110B MANUAL RESET PROTECTION DEVICES INTERPOSING RELAYS AND INTERTRIPPING RELAYS:

- Standard - BS EN 61810.
- Housing
 - Flush panel mounting type. House all protection relays, excluding motor protection relays, in draw out cases.
- Reset type - Manual reset type.
- Overcurrent tripping device
 - Provide overcurrent tripping device with overcurrent characteristic similar to a BS 2692 high voltage cartridge fuse, sized to protect the equipment/load.

2120 VOLTAGE SENSING RELAYS:

- Provide single-phase inverse time undervoltage type voltage sensing relays to monitor the voltage between respective phases of supply.
- Mounting
 - Supply suitable for flush panel mounting with relay trip indication.
- Voltage settings
 - 50-90% in five equal steps with automatic resetting at 105% of voltage setting.
- Relay Inverse time characteristics
 - When voltage increases from zero to rated voltage with time multiplier set at 1.0, set relay resetting times as follows:

Relay settings %	50	60	70	80	90
Resetting time (secs)	2	4	5	10	12

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2130 TRIP/CLOSE SWITCHES AND CONTROL SELECTOR SWITCHES:

- Provide a panel mounted heavy duty, spring return trip/close switch on each circuit breaker fitted with solenoid or motorized spring closing mechanisms.
- Ensure contacts have a continuous rating of 10A minimum at between 30V to 250V ac and dc, and make and break duty rating of 30A at 250V ac or dc for a minimum period of 3 secs.
- Where remote trip/close control is indicated, supply a panel mounted selector switch to select circuit breaker for local or remote closing. Ensure that selection of remote or local closing does not prevent circuit breaker tripping under operation of local or remote trip switch.

2140 CURRENT TRANSFORMERS:

- Comply with BS EN 61869-2. Provide separate current transformers for each protection device and instrumentation. Ensure current transformers provide appropriate accuracy and are compatible with over current factors, characteristics, performance and VA rating required for satisfactory operation of protection devices, instruments and meters indicated.
- Ensure that current transformers are capable of withstanding maximum short time withstand current of value and duration indicated for assembly.
- Provide test links in secondary connections of all current transformers to facilitate testing of instruments, meters and protection devices.

2150A INSTRUMENTS AND METERS:

- Standards
 - Comply with BS 89 and BS EN 60051-1 for voltmeters, ammeters, watt meters, frequency indicators and power factor indicators.
 - Comply with BS 7856, BS EN 62053-11, BS EN 62053-22 or BS EN 62053-21 for kWh meters, kVA and kW maximum demand meters and polyphase reactive kVA meters, and BS EN 62053-23 for KVAhr meters.
- Protect wiring to voltmeters by separate fuses.
- Protect potential coils of watt meters, frequency indicators, power factor indicators and kWh meters, kVA and kW maximum demand meters and polyphase reactive kVA meters by separate fuses.
- Supply instruments and meters suitable for flush mounting and type, size and accuracy as indicated.
- Ensure that indicating scales for all instruments comply with BS 3693.
- Supply so that normal indication is 50% to 75% of full scale deflection.
- Completely segregate all instruments in instrument compartments. Panel mount meters on front of instrument compartment.

2160A ELECTRICAL RECORDING INSTRUMENTS:

- Provide electrical recording instruments.
- Standard - BS EN 61143.

2170A INDICATOR LIGHTS:

- Supply lamps of same type throughout. Provide indicator lamps with lamp test facility.
- Lamps
 - Supply interchangeable indicators for respective units.
- Protect wiring to indicator lamp units by separate cartridge fuses.
- Lens Colour in accordance with BS EN 60073.

2180 LOW VOLTAGE COILS RATING:

- Ensure coils for switching relays, contactors and other applications are capable of withstanding inherent voltage drop within system without armature or switching apparatus dropping out of position.

2190# FRAMEWORK:

- Construct framework for supporting electrical equipment from mild steel plate and strip, cold and hot rolled steel sections or slotted angles, in accordance with BS EN 10210 and BS 4345 as appropriate. Comply with BS EN 1011-2 for metal arc welding.
- Finish
 - Frameworks mounted inside building
 - galvanized finish in accordance with BS EN 10346 or BS EN 10143.
 - manufacturer's standard finish.
 - Frameworks mounted outside building:-

- hot dip galvanized to BS EN ISO 1461.
- sherardize coated to BS 4921.
- Supply cadmium or zinc electroplated bolts, nuts, washers and screws.

2190A FRAMEWORK:

- Construct framework for supporting electrical equipment from mild steel plate and strip, cold and hot rolled steel sections or slotted angles, in accordance with BS EN 10210 and BS 4345 respectively. Comply with BS EN 1011-2 for metal arc welding.
- Finish
 - Frameworks mounted inside building manufacturer's standard finish.
 - Frameworks mounted outside building hot dip galvanized to BS EN ISO 1461.
- Supply cadmium or zinc electroplated bolts, nuts, washers and screws.

2200A FUSES:

- Supply cartridge fuse links including fuse carrier, bases and associated components that comply with BS EN 60269 (BS 88), fusing factor category gG, unless otherwise indicated.

2210A DISTRIBUTION BOARDS:

- Comply with BS EN 61439-3 as appropriate. Make internal separation Form 1 unless otherwise indicated. Make fuseboards fully shrouded. Fit each distribution board with an isolating switch. Install busbars in same position relative to their fuse carriers or miniature circuit-breakers (MCBs) for each pole. In TPN distribution boards supply neutral busbars with one outgoing terminal for each outgoing circuit.
- Provide a multi-terminal earthing bar for circuit protective conductors for both insulated and metal-cased boards, with one terminal for each outgoing circuit. Connect directly to earthing terminal without dependence on exposed conductive parts of enclosure.
- Identify each fuseway and MCB way by numbering. Identify each terminal on neutral busbar and earthing bar with its respective fuseway or MCB way.
- Where specific ratings are indicated incorporate fuses or MCBs, otherwise leave ways blank for future additions.
- Enclosures finish
 - Finish - Manufacturer's standard.
 - Colour - Manufacturer's standard colour.

2220A CONSUMER UNITS:

- Comply with BS EN 60529, IP 31.
- Provide fuses or miniature circuit-breakers and means of isolation.

2230A MINIATURE CIRCUIT BREAKERS:

- Standard - BS EN 60898-1.
- Supply miniature circuit-breakers with voltage and current ratings, type according to instantaneous tripping current, energy limiting class, category of duty and frequency in accordance with BS EN 60898-1.

2240A RESIDUAL CURRENT DEVICE:

- Comply with BS EN 61008. Supply residual current devices (RCCDs) with rated voltage, rated current, rated tripping current, rated tripping time and rated breaking capacity as indicated.
- DC component
 - Ensure dc component does not affect operation.

- Overcurrent protection
 - Fit RCDs with integral overcurrent protection.

2245 COMBINED RESIDUAL CURRENT/OVER CURRENT OPERATED CIRCUIT BREAKERS:

- Supply combined residual current/over current operated circuit breakers (RCBOs) in accordance with BS EN 61009.

2250 CABLE TERMINATIONS:

- Ensure that switchgear and distribution boards are provided with facilities to terminate size, number and type of cable indicated. Where necessary use fabricated steel extension boxes for glanding large and multiple cables.
- Provide non-ferrous metal glanding plates for single core cable terminations.

2260A FREE-STANDING, WALL-MOUNTED STATIC CAPACITOR:

- Standard - BS EN 61921.
- Voltage rating of capacitor - 400V, 3-phase, 50 Hz. Unit - Free-standing unit.
- Mounting - Wall mounting.
- Capacitor unit
 - Provide assembly housed in sheet steel enclosure complete with main terminals, comprising individual low loss, power capacitor elements and fuses to BS EN 60143-3 or BS EN 60871-4.
- Capacitor unit assembly
 - Incorporate thermal equalizers within assembly of elements.
 - Fill enclosure with inorganic, inert and non-flammable granules.
 - Fit discharge resistors.
 - Ensure all internal and external connections are adequately rated and fully insulated.
- Static capacitor enclosure
 - Material - Manufacturer's standard.
 - Colour - Manufacturer's standard.
 - Finish - Manufacturer's standard.
- Capacitor discharge devices - Manufacturer's standard.

2260B FREE-STANDING, FLOOR MOUNTED STATIC CAPACITOR:

- Standard - BS EN 61921.
- Voltage rating of capacitor - 400V, 3-phase, 50 Hz. Unit - free-standing unit
- Mounting - Floor mounting.
- Capacitor unit
 - Provide assembly housed in sheet steel enclosure complete with main terminals, comprising individual low loss, power capacitor elements and fuses to BS EN 60143-3 or BS EN 60871-4.
- Capacitor unit assembly
 - Incorporate thermal equalizers within assembly of elements.
 - Fill enclosure with inorganic, inert and non-flammable granules.
 - Fit discharge resistors.
 - Ensure all internal and external connections are adequately rated and fully insulated.
- Static capacitor enclosure
 - Material - Manufacturer's standard.
 - Colour - Manufacturer's standard.
 - Finish - Manufacturer's standard.
- Capacitor discharge devices - Manufacturer's standard.

2260C WALL-MOUNTED WITHIN SWITCHBOARD, STATIC CAPACITOR:

- Standard - BS EN 61921.
- Voltage rating of capacitor - 400V, 3-phase, 50 Hz. Unit - Within switchboard.
- Mounting - Wall mounting.
- Capacitor unit
 - Provide assembly housed in sheet steel enclosure complete with main terminals, comprising individual low loss, power capacitor elements and fuses to BS EN 60143-3 or BS EN 60871-4.
- Capacitor unit assembly
 - Incorporate thermal equalizers within assembly of elements.
 - Fill enclosure with inorganic, inert and non-flammable granules.
 - Fit discharge resistors.
 - Ensure all internal and external connections are adequately rated and fully insulated.
- Static capacitor enclosure
 - Material - Manufacturer's standard.
 - Colour - Manufacturer's standard.
 - Finish - Manufacturer's standard.
- Capacitor discharge devices - Manufacturer's standard.

2260D FLOOR MOUNTED WITHIN SWITCHBOARD, STATIC CAPACITOR:

- Standard - BS EN 61921.
- Voltage rating of capacitor - 400V, 3-phase, 50 Hz.
- Unit - Within switchboard.
- Mounting - Floor mounting.
- Capacitor unit
 - Provide assembly housed in sheet steel enclosure complete with main terminals, comprising individual low loss, power capacitor elements and fuses to BS EN 60143-3 or BS EN 60871-4.
- Capacitor unit assembly
 - Incorporate thermal equalizers within assembly of elements.
 - Fill enclosure with inorganic, inert and non-flammable granules.
 - Fit discharge resistors.
 - Ensure all internal and external connections are adequately rated and fully insulated.
- Static capacitor enclosure
 - Material - Manufacturer's standard.
 - Colour - Manufacturer's standard.
 - Finish - Manufacturer's standard.
- Capacitor discharge devices - Manufacturer's standard.

2270A FREE-STANDING, WALL-MOUNTED AUTOMATICALLY CONTROLLED CAPACITOR BANKS:

- Standard - BS EN 61921.
- Voltage rating of capacitor - 400V, 3-phase, 50 Hz.
- Bank unit
 - Provide free-standing modular bank. Include in each module contactors, line fuses and control circuitry.
- Arrangement - Wall mounting.
- Switching - Block contactor switching.
- Control
 - Provide automatic control via an automatic multi-stage kVAR sensitive, solid state relay with stage switches to operate the capacitor contactors.
- Control relay
 - Incorporate relay into cubicle.
 - Fit relay with a loss of voltage no volt release re-setting feature to reset switching sequence to all contacts

- open position following failure of supply.
- Provide visual indication by means of LED's for capacitor stages and capacitor/inductive load.
- Provide Hand/Off/Auto selection switch.
- Isolator - Incorporate on load break isolator.
- Capacitor unit
 - Provide assembly housed in sheet steel enclosure complete with main terminals, comprising individual low loss, power capacitor elements and fuses to BS EN 60143-3 or BS EN 60871-4.
- Capacitor unit assembly
 - Incorporate thermal equalizers within assembly of elements.
 - Fill enclosure with inorganic, inert and non-flammable granules.
 - Fit discharge resistors.
 - Ensure all internal and external connections are adequately rated and fully insulated.
- Automatic bank enclosure
 - Material - Manufacturer's standard.
 - Finish and colour - Manufacturer's standard.
 - Access - Front access.
- Capacitor discharge devices - Manufacturer's standard.

2270B FREE-STANDING, FLOOR MOUNTED AUTOMATICALLY CONTROLLED CAPACITOR BANKS:

- Standard - BS EN 61921.
- Voltage rating of capacitor - 400V, 3-phase, 50 Hz.
- Bank unit
 - Provide free-standing modular bank. Include in each module contactors, line fuses and control circuitry.
- Arrangement - Floor mounting.
- Switching - Block contactor switching.
- Control
 - Provide automatic control via an automatic multi-stage kVAr sensitive, solid state relay with stage switches to operate the capacitor contactors.
- Control relay
 - Incorporate relay into cubicle.
 - Fit relay with a loss of voltage no volt release re-setting feature to reset switching sequence to all contacts open position following failure of supply.
 - Provide visual indication by means of LED's for capacitor stages and capacitor/inductive load.
 - Provide Hand/Off/Auto selection switch.
- Isolator - Incorporate on load break isolator.
- Capacitor unit
 - Provide assembly housed in sheet steel enclosure complete with main terminals, comprising individual low loss, power capacitor elements and fuses to BS EN 60143-3 or BS EN 60871-4.
- Capacitor unit assembly
 - Incorporate thermal equalizers within assembly of elements.
 - Fill enclosure with inorganic, inert and non-flammable granules.
 - Fit discharge resistors.
 - Ensure all internal and external connections are adequately rated and fully insulated.
- Automatic bank enclosure
 - Material - Manufacturer's standard.
 - Finish and colour - Manufacturer's standard.
 - Access - Front access.
- Capacitor discharge devices - Manufacturer's standard.

2270C WALL-MOUNTED WITHIN SWITCHBOARD, AUTOMATICALLY CONTROLLED CAPACITOR BANKS:

- Standard - BS EN 61921.

- Voltage rating of capacitor - 400V, 3-phase, 50 Hz.
- Bank unit
 - Provide modular bank within switchboard. Include in each module contactors, line fuses and control circuitry.
- Arrangement - Wall mounting.
- Switching - Block contactor switching.
- Control
 - Provide automatic control via an automatic multi-stage kVAr sensitive, solid state relay with stage switches to operate the capacitor contactors.
- Control relay
 - Incorporate relay into cubicle.
 - Fit relay with a loss of voltage no volt release re-setting feature to reset switching sequence to all contacts open position following failure of supply.
 - Provide visual indication by means of LED's for capacitor stages and capacitor/inductive load.
 - Provide Hand/Off/Auto selection switch.
- Isolator - Incorporate on load break isolator.
- Capacitor unit
 - Provide assembly housed in sheet steel enclosure complete with main terminals, comprising individual low loss, power capacitor elements and fuses to BS EN 60143-3 or BS EN 60871-4.
- Capacitor unit assembly
 - Incorporate thermal equalizers within assembly of elements.
 - Fill enclosure with inorganic, inert and non-flammable granules.
 - Fit discharge resistors.
 - Ensure all internal and external connections are adequately rated and fully insulated.
- Automatic bank enclosure
 - Material - Manufacturer's standard.
 - Finish and colour - Manufacturer's standard.
 - Access - Front access.
- Capacitor discharge devices - Manufacturer's standard.

2270D FLOOR MOUNTED WITHIN SWITCHBOARD, AUTOMATICALLY CONTROLLED CAPACITOR BANKS:

- Standard - BS EN 61921.
- Voltage rating of capacitor - 400V, 3-phase, 50 Hz.
- Bank unit
 - Provide modular bank within switchboard. Include in each module contactors, line fuses and control circuitry.
- Arrangement - Floor mounting.
- Switching - Block contactor switching.
- Control
 - Provide automatic control via an automatic multi-stage kVAr sensitive, solid state relay with stage switches to operate the capacitor contactors.
- Control relay
 - Incorporate relay into cubicle.
 - Fit relay with a loss of voltage no volt release re-setting feature to reset switching sequence to all contacts open position following failure of supply.
 - Provide visual indication by means of LED's for capacitor stages and capacitor/inductive load.
 - Provide Hand/Off/Auto selection switch.
- Isolator - Incorporate on load break isolator.
- Capacitor unit
 - Provide assembly housed in sheet steel enclosure complete with main terminals, comprising individual low loss, power capacitor elements and fuses to BS EN 60143-3 or BS EN 60871-4.
- Capacitor unit assembly

- Incorporate thermal equalizers within assembly of elements.
- Fill enclosure with inorganic, inert and non-flammable granules.
- Fit discharge resistors.
- Ensure all internal and external connections are adequately rated and fully insulated.
- Automatic bank enclosure
 - Material - Manufacturer's standard.
 - Finish and colour - Manufacturer's standard.
 - Access - Front access.
- Capacitor discharge devices - Manufacturer's standard.

2270E SINGLE CUBICLE WITHIN SWITCHBOARD, AUTOMATICALLY CONTROLLED CAPACITOR BANKS:

- Standard - BS EN 61921.
- Voltage rating of capacitor - 400V, 3-phase, 50 Hz.
- Bank unit
 - Provide modular bank within switchboard. Include in each module contactors, line fuses and control circuitry.
- Arrangement - Single cubicle.
- Switching - Block contactor switching.
- Control
 - Provide automatic control via an automatic multi-stage kVAr sensitive, solid state relay with stage switches to operate the capacitor contactors.
- Control relay
 - Incorporate relay into cubicle.
 - Fit relay with a loss of voltage no volt release re-setting feature to reset switching sequence to all contacts open position following failure of supply.
 - Provide visual indication by means of LED's for capacitor stages and capacitor/inductive load.
 - Provide Hand/Off/Auto selection switch.
- Isolator - Incorporate on load break isolator.
- Capacitor unit
 - Provide assembly housed in sheet steel enclosure complete with main terminals, comprising individual low loss, power capacitor elements and fuses to BS EN 60143-3 or BS EN 60871-4.
- Capacitor unit assembly
 - Incorporate thermal equalizers within assembly of elements.
 - Fill enclosure with inorganic, inert and non-flammable granules.
 - Fit discharge resistors.
 - Ensure all internal and external connections are adequately rated and fully insulated.
- Automatic bank enclosure
 - Material - Manufacturer's standard.
 - Finish and colour - Manufacturer's standard.
 - Access - Front access.
- Capacitor discharge devices - Manufacturer's standard.

2280A HARMONIC FILTER:

- Unit - Filter conditioning to meet G5/4.
- Mounting - Floor mounting. Built-in type.
- Cubicle
 - Incorporating IGBTs, capacitors, reactors, block contactors and control gear.
- Cable termination chamber
 - Mount cable termination chamber on side of cubicle with access through removable plates.

2290A MEDIUM VOLTAGE IRON CORE FILTER REACTOR:

- Provide 3-phase filter reactor in accordance with BS EN 60076 and relevant parts of BS EN 61558
- Reactor
 - Copper foil windings insulated between layers, impregnated under vacuum and in over pressure conditions with polyester resin and dried in furnace temperature of 150°C.
 - Ensure iron core flux density is designed for indicated harmonic loading. Ensure that saturation does not occur at switch-in of filter network.
 - Provide insulation for continuous operation at ambient temperature up to 40°C, temperature class T40/E.
- Electrical connections
 - To copper bars in accordance with DIN 46206.

3000 WORKMANSHIP

3010 FIXING:

- Fix all equipment independently of wiring system. Use cadmium or zinc electroplated bolts, nuts, washers and screws.

3020 MOUNTING HEIGHT:

- Mount single items of equipment 1450mm above finished floor level to centre of equipment, unless otherwise indicated.
- Arrange groups of equipment, other than floor mounted assemblies, so that all parts of equipment requiring access for operation or maintenance are at least 500mm and no more than 2000mm above finished floor level, unless otherwise indicated.

3030 ACCESS:

- Ensure that clearance in front of switchgear and controlgear is not less than 1m, or as indicated.

3040A MARKING AND DRAWING:

- Number terminals, cables and component parts to correspond with manufacturer's certified drawings.

3050 CABLE TERMINATIONS:

- Terminate paper-insulated cable by means of switchboard manufacturer's standard compound filled cable boxes.
- Terminate PVC SWA PVC and MICS cables inside enclosure by securing cables to switchboard with glanding plates or glanding brackets; and outside enclosure with glanding plates or fabricated steel extension boxes.

3060A INSTALLATION AND COMMISSIONING:

- Install and commission switchgear and controlgear in accordance with the appropriate standard and the manufacturer's recommendations. Include CT Polarity check in commission tests.

BS APPENDIX

BS 3693:1992

Recommendations for design of scales and indexes on analogue indicating instruments

BS 4345:1968

Specification for slotted angles

BS 4921:1988

Specification for sherardized coatings on iron and steel

BS 7856:2013

Code of practice for special design and other features of alternating current watthour meters for active energy (MID accuracy classes A and B) for use in the UK

BS EN 1011-2:2001

Welding. Recommendations for welding of metallic materials. Part 2 Arc welding of ferritic steels

BS EN 10143:2006

Continuously hot-dip metal coated steel sheet and strip. Tolerances on dimensions and shape

BS EN 10346:2015

Continuously hot-dip coated steel flat products for cold forming. Technical delivery conditions

BS EN 60038:2011

CENELEC standard voltages

BS EN 60051-1:1999

Instrument transformers. Part 1 Current transformers

BS EN 60073:2002

Basic and safety principles for man-machine interface, marking and identification. Coding principles for indicators and actuators

BS EN 60143-3:2015

Series capacitors for power systems. Part 3 Internal fuses

BS EN 60529:1992+A2:2013

Degrees of protection provided by enclosures (IP code)

BS EN 60871-4:2014

Shunt capacitors for AC power systems having a rated voltage above 1000 V. Internal fuses

BS EN 60898-1:2003+A13:2012

Electrical accessories. Circuit-breakers for overcurrent protection for household and similar installations. Part 1 Circuit-breakers for a.c. operation

BS EN 60934:2001+A2:2013

Circuit-breakers for equipment (CBE)

BS EN 60947-2:2006+A2:2013

Low-voltage switchgear and controlgear. Part 2 Circuit-breakers

BS EN 60947-3:2009+A2:2015

Low-voltage switchgear and controlgear. Part 3 Switches, disconnectors, switch-disconnectors and fuse-combination units

BS EN 60947-6-1:2005+A1:2014

Low-voltage switchgear and controlgear. Multiple function equipment. Transfer switching equipment

BS EN 60947-6-2:2003

Specification for low-voltage switchgear and controlgear. Part 6-2 Multiple function equipment. Control and protective switching devices (or equipment) (CPS)

BS EN 61439-1:2011

Low-voltage switchgear and controlgear assemblies. Part 1 General rules

BS EN 61439-3:2012

Low-voltage switchgear and controlgear assemblies. Distribution boards intended to be operated by ordinary persons (DBO)

BS EN 61869-2:2012

Instrument transformers. Additional requirements for current transformers

BS EN 61921:2003

Power capacitors. Low-voltage power factor correction banks

BS EN 62053-11:2003

Electricity metering equipment (a.c.). Part 11 Particular requirements. Electromechanical meters for active energy (classes 0,5, 1 and 2)

BS EN 62053-21:2003

Electricity metering equipment (a.c.). Particular requirements. Part 21 Static meters for active energy (classes 1 and 2)

BS EN 62053-22:2003

Electricity metering equipment (a.c.). Part 22 Particular requirements. Static meters for active energy (classes 0,2 S and 0,5 S)

BS EN 62053-23:2003

Electricity metering equipment (a.c.). Particular requirements. Part 23 Static meters for reactive energy (classes 2 and 3)

BS EN 62208:2011

Empty enclosures for low-voltage switchgear and controlgear assemblies. General requirements

BS EN 62626-1:2014

Low-voltage switchgear and controlgear enclosed equipment. Enclosed switch-disconnectors outside the scope of IEC 60947-3 to provide isolation during repair and maintenance work

BS EN ISO 1461:2009

Hot dip galvanized coatings on fabricated iron and steel articles. Specifications and test methods

BS IEC 1008-2-2:1990

Specification for residual current operated circuit-breakers with integral overcurrent protection for household and similar uses (RCCBs). Applicability of the general rules to RCCBs functionally dependent on line voltage

Y72 CONTACTORS AND STARTERS

1000 GENERAL

1010A 3-PHASE SUPPLY:

- Ensure all electrical equipment supplied and installed is suitable for 3-phase power supply to BS EN 60038.

1010B SINGLE-PHASE ELECTRICAL SUPPLY:

- Ensure all electrical equipment supplied and installed is suitable for single-phase power supply to BS EN 60038.

1010C 3-PHASE AND NEUTRAL SUPPLY:

- Ensure all electrical equipment supplied and installed is suitable for 3-phase and neutral power supply to BS EN 60038

1020# SURGE SUPPRESSORS:

- Supply surge suppressors to star connected motors and to all motors subject to star-delta starting to limit peak voltage to 1200 volts.
 - Fitted by manufacturer.
- Fitted by installer.

1020A MANUFACTURER FITTED SURGE SUPPRESSORS:

- Supply surge suppressors to star connected motors and to all motors subject to star-delta starting to limit peak voltage to 1200 volts. Fitted by Manufacturer.

1020B INSTALLER FITTED SURGE SUPPRESSORS:

- Supply surge suppressors to star connected motors and to all motors subject to star-delta starting to limit peak voltage to 1200 volts. Fitted by installer.

1030A MANUFACTURER FITTED TRANSIENT SUPPRESSORS:

- Supply transient suppressors in the form of resistor and capacitor networks across the starter contactor coils. Fitted by Manufacturer.

1030B INSTALLER FITTED TRANSIENT SUPPRESSORS:

- Supply transient suppressors in the form of resistor and capacitor networks across the starter contactor coils. Fitted by installer.

2000 PRODUCTS/MATERIALS

2010A CONTROLGEAR ASSEMBLY:

- Standard
 - BS EN 61439-1.
 - BS EN 61439-2.

- External design - Cubicle type assembly.
- Usage - Control panel, Motor Control Centre (MCC) or single starter enclosure.
- Conditions of installation - Indoors.
- Electrical characteristics
 - Rated operational voltage, 400 V. Rated short-time withstand current, 20 times rated current.
- Service conditions - Ambient air temperature and altitude to relevant parts of BS EN 61439 and BS EN 60439.

2020A ASSEMBLY CONSTRUCTION:

- Enclosure standard - BS EN 62208.
- Material of enclosure - Manufacturer's standard.
- Terminals for external conductors, main power circuits
 - Accommodate cross-sectional area of copper cables in accordance with relevant parts of BS EN 61439.
- Terminals for external conductor, control and auxiliary circuits
 - Terminal block. Mounting - top hat rails (35mm) to BS 5584 (EN 50022).
- Size of neutrals on 3-phase supplies
 - Full current-carrying capacity of phase conductor.
- Degree of protection to BS EN 60529
 - IP 31 for units installed inside buildings excluding boiler rooms and pump rooms.
 - IP 55 for units installed in boiler rooms, pump rooms and outside buildings.
- Protection against direct and indirect contact as Manufacturer's standard.
- Accessibility for inspection
 - Arrange for following operations to be performed when assembly is in service and under voltage.
 - Visual inspection of switching devices and other apparatus; settings and indicators of relays and releases; conductor connections and markings.
 - Adjusting and re-setting of relays, releases and electronic devices.
 - Replacement of fuselinks and indicating lamps.
 - Fault location by voltage and current measuring.
- Accessibility for maintenance
 - Provide space between functional unit or group and adjacent functional units or groups. Provide retainable fastening means for parts likely to be removed for maintenance.
 - Use barrier protected sub-sections for each functional unit or group.
 - Use compartments for each functional unit or group.
- Removable parts and withdrawable parts
 - Degree of protection of assembly after removal or withdrawal of part as manufacturer's standard.
- Internal separation - Manufacturer's standard.
- Input voltage variations for electronic equipment supply - relevant parts of BS EN 61439 and BS EN 60439.
- Supply frequency deviation - relevant parts of BS EN 61439 and BS EN 60439.
- Mounting - Floor standing or wall-mounted.

2030A ENCLOSURE FINISH:

- Apply high standard finish to enclosure and supporting metalwork. Degrease metal and remove rust prior to applying finish.
- Comply with paint manufacturer's recommendations regarding preparation, stoving times, temperatures, mixing of finishes, application and coat thickness.
- Finish - Manufacturer's standard.
- Colour - Manufacturer's standard colour.

2040 SITE MODIFICATION:

- Do not make site alterations unless authorised. Where site modifications to assemblies are authorised make in accordance with manufacturer's certified drawings and instructions. Ensure that modifications made

comply with type test certificate obtained for arrangement of components.

2050A EIGHT HOURLY LV CONTACTORS AND MOTOR STARTERS:

- Standard
 - BS EN 60947-4-1
 - BS EN 60947-4-2
 - BS EN 60947-4-3
 - BS EN 62626-1
- Type of equipment - A.c. mechanical contactor. Interrupting medium, air.
 - Operating condition.
 - Method of operation - Electromagnetic.
 - Method of control - Automatic. Rated and limiting values for the main circuit.
- Rated voltage (Volts) - Operational, 400.
 - Rated duty - Eight-hour.
 - Operational performance.
 - One rotation direction, with motor stopping between operations.
- Control circuits
 - Electrical - ac; rated frequency (Hertz), 50; rated voltage (Volts), 230.
- Co-ordination with short-circuit protective devices - Type 1
- Enclosure degree of protection to BS EN 60529, IP 31.
- Minimum mechanical and electrical endurance
 - Mechanical 0.3 million; electrical 15,000.
- Provide mechanical and electrical interlocks to prevent simultaneous closure of paired contactors.

2050B UNINTERRUPTED LV CONTACTORS AND MOTOR STARTERS:

- Standard
 - BS EN 60947-4-1
 - BS EN 60947-4-2
 - BS EN 60947-4-3
 - BS EN 62626-1
- Type of equipment - A.c. mechanical contactor. Interrupting medium, air.
 - Operating condition.
 - Method of operation - Electromagnetic.
 - Method of control - Automatic.
- Rated and limiting values for the main circuit.
 - Rated voltage (Volts) - Operational, 400.
 - Rated duty - Uninterrupted.
 - Operational performance.
 - One rotation direction, with motor stopping between operations.
- Control circuits
 - Electrical - ac; rated frequency (Hertz), 50; rated voltage (Volts), 230.
- Co-ordination with short-circuit protective devices - Type 1
- Enclosure degree of protection to BS EN 60529, IP 31.
- Minimum mechanical and electrical endurance
 - Mechanical 0.3 million; electrical 15,000.
- Provide mechanical and electrical interlocks to prevent simultaneous closure of paired contactors.

2050C CONTINUOUS LV CONTACTORS AND MOTOR STARTERS:

- Standard
 - BS EN 60947-4-1

- BS EN 60947-4-2
- BS EN 60947-4-3
- BS EN 62626-1
- Type of equipment - A.c. mechanical contactor. Interrupting medium, air.
 - Operating condition.
 - Method of operation - Electromagnetic.
 - Method of control - Automatic.
- Rated and limiting values for the main circuit.
 - Rated voltage (Volts) - Operational, 400.
 - Rated duty - Continuous.
 - Operational performance.
 - One rotation direction, with motor stopping between operations.
- Control circuits
 - Electrical - ac; rated frequency (Hertz), 50; rated voltage (Volts), 230.
- Co-ordination with short-circuit protective devices - Type 1
- Enclosure degree of protection to BS EN 60529, IP 31.
- Minimum mechanical and electrical endurance
 - Mechanical 0.3 million; electrical 15,000.
- Provide mechanical and electrical interlocks to prevent simultaneous closure of paired contactors.

2060A CONTROL CIRCUIT DEVICES:

- Standard
 - BS EN 60947-5-1
 - BS EN 62626-1
- Type of equipment.
 - a.c. control circuit device
 - Manual control switches; emergency stop; control relays; pilot switches; position switches; associated equipment; auxiliary contacts and indicating lamps.
 - Interrupting medium, Air.
 - Operating condition.
 - Method of operation - electromagnetic.
 - Method of control - automatic.
- Rated and limiting values for the main circuit.
 - Rated voltage (Volts) - operational, 230.
 - Rated frequency (Hertz), 50.
 - Contact element classification.
 - Enclosure degree of protection IP 31.

2070A ISOLATING SWITCHES:

- Standard
 - BS EN 60947-3.
 - BS EN 62626-1
- Provide independent manual operation type isolating switches with rated duty, rated operational current and utilization category compatible with contactor.

2080A CONTROL SELECTOR SWITCHES:

- Standard
 - BS EN 60947-5-1
 - BS EN 62626-1
- Provide panel mounting independent manual operation rotary type switch to select local/off/remote

control.

- Ensure switch rated thermal current, rated operational current, and utilization category are compatible with contactor control circuit characteristics and circuit protection device.

2090A IN-BUILT PUSH BUTTONS:

- Provide panel mounting type push buttons with actuator colours to BS EN 60073.
- Standard
 - BS EN 60947-5-1.
 - BS EN 62626-1
- Pattern
 - Supply flush button type start/on and reset push buttons. Supply mushroom actuator type stop/off push buttons released by turning the actuator.
- Ensure rated thermal current, rated operational current and utilization category of push button contacts are compatible with contactor control circuit characteristics and circuit protection device.

2100A INDICATOR LIGHTS:

- Supply lamps of same type throughout. Provide indicator lamps with lamp test facility.
- Standard
 - BS EN 842
 - BS EN 60947-5-1.
 - BS EN 62626-1
- Details
 - Supply interchangeable indicators for respective units. Provide neon indicators. Provide 230V indicator circuits and lamps.
- Protect wiring to indicator lamp units by separate cartridge fuses.
- Lens colour - In accordance with BS EN 60073.

2110A CONTACTOR CONTROL RELAYS:

- Standard BS EN 60947-5-1, install relays in contactor enclosure.
- Provide isolation during repair and maintenance work in accordance with BS EN 62626-1
- Relay enclosure protection to BS EN 60529
 - Compatible with contactor enclosure.

2120A CONTROL AND INDICATOR LIGHT CIRCUIT FUSES:

- Provide in contactor enclosure separate low voltage fuse bases, fuse carriers and cartridge fuses for protection of control circuits and indicator light circuits.
- Fuses
 - Fully shrouded impact resistant moulded plastic fuse bases and carriers in accordance with BS EN 60269 (BS 88).

2130A MOTOR STARTERS - MOTORS BELOW 0.37 KW:

- Provide fuses or circuit breakers for motors below 0.37 kW.

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 3-phase equipment.

- Provide isolation during repair and maintenance work in accordance with BS EN 62626-1

2140 CURRENT LIMITING MOTOR STARTERS:

- Use static type thyristor voltage control starter to provide reduced current starting.
- Provide adjustable ramp times.
- Provide contactor for switching and disconnect for isolation.
- Provide details of harmonic distortion content prior to ordering.

2150 DIRECT-ON-LINE MOTOR STARTERS:

- Use direct-on-line starter to BS EN 60947-4-1, with single-phase motors and 3-phase motors.
- Provide isolation during repair and maintenance work in accordance with BS EN 62626-1

2160 STAR DELTA MOTOR STARTERS:

- Use star delta starter to BS EN 60947-4-1 with 3-phase motors.
- Provide isolation during repair and maintenance work in accordance with BS EN 62626-1
- Incorporate adjustable time delay contactor relays, to control star delta changeover, ensuring electrical endurance compatible with starter contactors. Ensure starting sequence activated on voltage restoration.

2170A AUTO-TRANSFORMER MOTOR STARTERS:

- Use auto-transformer starter to BS EN 60947-4-1 with 3-phase motors.
 - Provide 2 step closed transition auto transformers suitable for 3 operating cycles per hour.
- Provide isolation during repair and maintenance work in accordance with BS EN 62626-1
- Provide auto transformers with three tapings for selection of motor starting voltage. Arrange tapings to limit motor starting current to 80 per cent, 65 per cent and 50 per cent of full voltage starting current.
- Incorporate adjustable time delay contactor relays, to control automatic changeover from selected reduced voltage to full voltage, having an electrical endurance compatible with starter contactors. Ensure starting sequence activated on voltage restoration.

2180A STATOR ROTOR MOTOR STARTERS:

- Use stator rotor starter to BS EN 60947-4-1 with 3-phase motors.
 - Provide starter resistors suitable for indicated operating cycles per hour.
- Provide isolation during repair and maintenance work in accordance with BS EN 62626-1
- Incorporate adjustable time delay contactor relays, to control starter resistor short circuiting contactors, having electrical endurance compatible with starter contactors. Ensure starting sequence activated on voltage restoration.

2190A VARIABLE SPEED MOTOR DRIVES - LOCATED IN LOCAL CONTROL PANEL OR EXPOSED WALL OR FRAME MOUNTED:

- Supply VSD's tailor made for HVAC application with two built in PID controllers, built in HVAC application macros and real-time clock and calendar to control speed of standard AC squirrel cage motors.
- VSD type - digital Pulse Width Modulation PWM.
- Location - control panel.
- Control range - 0.5 to 120 Hz.

- Power factor - 0.97 lagging or better.
- Starting current - not to exceed 1 x FLC.
- Provide integrated, lockable incoming mains isolation switch.
- Characteristics
 - Ensure acceleration and deceleration ramps are independently adjustable.
 - Allow connection to a turning motor without braking to a standstill.
 - Allow connection to a reverse windmilling fan without causing tripping and return fan to correct speed.Ensure VSD's require no additional means for starting. Supply VSD's that do not require electrical matching to motor. Ensure VSD's are capable of running motors in parallel.
- EMC characteristics to BS EN 61800-3, Category C2.
- Standards
 - Comply with relevant parts of BS EN 60204 for safety of electrical equipment.
 - Comply with relevant parts of BS EN 61800
 - Comply with relevant parts of BS EN 60068 for environmental testing.
- Harmonics
 - Comply with BS EN 61000-3-12
 - Incorporate facilities into the drive to minimise harmonics generated at partial loads to ENA Engineering recommendation G5/4 limits.
- Mains interruption
 - Ensure VSD does not cause tripping through a mains interruption of 200 msec.
- Protection
 - Ensure VSD incorporates the following protection to cause electronic shut down without operating circuit protective devices.
 - Motor phase to phase fault; motor phase to earth fault; overvoltage; undervoltage; inverter overheat; motor overheat; loss of control signal; loss of auxiliary control voltage; current limit.
- VSD controls - local/remote facility to be provided where appropriate for operational and maintenance use.
- Display
 - Make provision for inverter to display externally, external and internal faults following a failure.
 - Show 1st, 2nd and 3rd up sequential faults.
 - Provide digital readout to show output frequency Hz; reference 1 (Hand); reference 2 (Auto); motor current (% or Amps); fault memory.
 - Provide volt free remote signalling contacts to indicate common fault; running/stopped conditions; healthy/tripped conditions.
 - Ensure parameters can be set and fault memory interrogated with door closed, and without additional instrumentation.
- Mounting
 - Wall mount vertically in accordance with the manufacturer's recommendations or mount within a control panel cabinet in accordance with the manufacturer's recommendations.
- Cooling
 - Ensure the free space around the drive is in accordance with the manufacturer's recommendations for ventilation and maintenance.
 - When installing a VSD in a control panel cabinet, provide ventilation openings and if required cooling fans in the cabinet to ensure air cannot be recirculated such that the cooling air does not exceed the unit ambient maximum operating temperature.

2190B VARIABLE SPEED MOTOR DRIVES (LOCATED IN MOTOR CONTROL CENTRES) :

- Supply frequency converters (inverters) tailor made for HVAC application with two built in PID controllers, built in HVAC application macros and real-time clock and calendar to control speed of standard AC squirrel cage motors.
- Inverter type - digital Pulse Width Modulation PWM.
- Location - Motor Control Centre (MCC) (MCC).

- Control range - 0.5 to 120 Hz power factor - 0.97 lagging or better.
- Starting current - not to exceed 1 x FLC.
- Provide integrated, lockable incoming mains isolation switch.
- Characteristics
 - Ensure acceleration and deceleration ramps are independently adjustable.
 - Allow connection to a turning motor without braking to a standstill.
 - Allow connection to a reverse windmilling fan without causing tripping and return fan to correct speed.Ensure VSD's require no additional means for starting. Supply VSD's that do not require electrical matching to motor. Ensure VSD's are capable of running motors in parallel.
- EMC characteristics to BS EN 61800-3, Category C2.
- Standards
 - Comply with relevant parts of BS EN 60204 for safety of electrical equipment.
 - Comply with relevant parts of BS EN 61800
 - Comply with relevant parts of BS EN 60068 for environmental testing.
- Harmonics
 - Comply with BS EN 61000-3-12
 - Incorporate facilities into the drive to minimise harmonics generated at partial loads to ENA Engineering recommendation G5/4 limits.
- Mains interruption
 - Ensure VSD does not cause tripping through a mains interruption of 200 msec.
- Protection
 - Ensure VSD incorporates the following protection to cause electronic shut down without operating circuit protective devices.
 - Motor phase to phase fault; motor phase to earth fault; overvoltage; undervoltage; VSD overheat; motor overheat; loss of control signal; loss of auxiliary control voltage; current limit.
- VSD controls - local/remote facility to be provided where appropriate for operational and maintenance use.
- Display
 - Make provision for inverter to display externally, external and internal faults following a failure.
 - Show 1st, 2nd and 3rd up sequential faults.
 - Provide digital readout to show output frequency Hz; reference 1 (hand); reference 2 (auto); motor current (% or Amps); fault memory.
 - Provide volt free remote signalling contacts to indicate common fault; running/stopped conditions; healthy/tripped conditions.
 - Ensure parameters can be set and fault memory interrogated with door closed, and without additional instrumentation.
- Mounting
 - Flange mount vertically within the MCC in accordance with the manufacturer's recommendations.
- Cooling
 - Ensure the free space around the drive is in accordance with the manufacturer's recommendations for ventilation and maintenance.
 - When installing a VSD in a cabinet to ensure air cannot be recirculated such that the cooling air does not exceed the unit ambient maximum operating temperature.

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 where 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.

2210 AUTOMATIC CHANGEOVER FOR RUN/STANDBY DUTY - DUAL POWER SUPPLY:

- Fit a control switch to starter enclosure arranged to select either motor for "run" or "standby" duty.
- Indicate selection of respective motor and availability of the two power supplies 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 where indicated.
- Arrange for selected "run" duty motor to operate in response to system controls, and on loss of power supply to "run" duty motor or operation of motor starter overcurrent trip, for automatic changeover to "standby" motor.
- Control the two power supplies by a single air break multiple isolating switch interlocked with starter enclosure access door.

2220 CONTROL CIRCUIT TRANSFORMERS:

- Provide control circuit transformers to supply power at voltages to suit control components.
- Standard
 - Use transformers in accordance with BS EN 61558-2-9 or BS EN 61558-1 and provide an external label of approved type and size.
- Protection - Primary and secondary fuses.

2230A SWITCHING AND INDICATION:

- Provide switches, indicating lamps, instruments and controls of uniform appearance and physically protected.
- Switches and indicators
 - Fit on panel or access doors Stop/Start/Reset push buttons; Auto/Off/Manual control selector switch; run and trip indicator lights.

2240 AUDIBLE ALARMS:

- Ensure that operation of any starter trip lamp, safety circuit lamp or alarm lamp operates a common audible alarm with mute and test facilities and terminals for remote alarm signal.
- When an alarm condition has had the audible alarm muted, ensure that terminals for a remote "alarm accepted" light are energised. The audible alarm circuit and terminals for remote alarm signal must still be capable of indicating another fault occurring even though original fault has not been cleared. The test facilities are to test momentarily both the audible alarm and all alarm indicator lamps, whilst the push button is depressed.
- Use alarms that interface with a sensor or controller to sense set-point and measured value. Provide adjustable upper and lower limits on face of unit. Provide unit with indicating lamps to show which limit has been exceeded. Provide each unit with connections for remote alarm.

2250A PROGRAMMABLE LOGIC CONTROLLERS:

- Provide programmable logic controllers in accordance with the manufacturer's recommendations and the specified control requirements.
- Standard - BS EN 61131.
 - Provide fuse and isolator for the Programmable Logic Controller. Install PLC with control components.
 - Programming language standard - BS EN 61131-3

2260A STARTER AND CONTROL PANEL INTERNAL WIRING:

- Standard - BS 6231.
- Wiring coding - Random colours and CPC green/yellow.
- Control wiring
 - Segregate control wiring from power circuits. Contain control wiring in ventilated plastic trunking. Identify each end of each wire with a unique number.
- Power wiring
 - Take account of thermal effects of grouping when routing power wiring. Identify each end of each wire with a unique number.

2270A COMPONENT MOUNTING:

- Mount all components of the switchgear and controlgear in accordance with the manufacturer's instructions.
- Mount control components on top hat rails (35mm) to BS 5584 (EN 50022).

2280A CONTROL SYSTEM FUNCTION CHARTS:

- Prepare function charts for the control system in accordance with BS EN 60848. Obtain approval of function chart before design of system hardware or writing control software.
 - Function chart format - Combined function chart/circuit diagram.

3000 WORKMANSHIP

3010 INSTALLATION:

- Install control panels, Motor Control Centre (MCC)s, contactors and starters in accordance with BS EN 60947 and manufacturer's recommendations.

BS APPENDIX

BS 6231:2006

Electric cables. Single core PVC insulated flexible cables of rated voltage 600/1000V for switchgear and controlgear wiring.

BS EN 60038:2011

CENELEC standard voltages

BS EN 60073:2002

Basic and safety principles for man-machine interface, marking and identification. Coding principles for indicators and actuators

BS EN 60529:1992+A2:2013

Degrees of protection provided by enclosures (IP code)

BS EN 60848:2002

GRAFCET specification language for sequential function charts

BS EN 60947-3:2009+A2:2015

Low-voltage switchgear and controlgear. Part 3 Switches, disconnectors, switch-disconnectors and fuse-combination units

BS EN 60947-4-1:2010+A1:2012

Low-voltage switchgear and controlgear. Part 4-1 Contactors and motor-starters. Electromechanical contactors and motor-starters

BS EN 60947-4-2:2012

Low-voltage switchgear and controlgear. Part 4-2 Contactors and motor-starters. A.C. semiconductor motor controllers and starters

BS EN 60947-4-3:2014

Low-voltage switchgear and controlgear. Contactors and motor-starters. AC semiconductor controllers and contactors for non-motor loads

BS EN 60947-5-1:2004+A1:2009

Specification for low-voltage switchgear and controlgear. Part 5-1 Control circuit devices and switching elements. Electromechanical control circuit devices

BS EN 61000-3-12:2011

Electromagnetic compatibility (EMC). Limits. Limits for harmonic currents produced by equipment connected to public low-voltage systems with input current $> 16\text{ A}$ and $\leq 75\text{ A}$ per phase

BS EN 61131-3:2013

Programmable controllers. Part 3 Programming languages

BS EN 61439-1:2011

Low-voltage switchgear and controlgear assemblies. Part 1 General rules

BS EN 61439-2:2011

Low-voltage switchgear and controlgear assemblies. Power switchgear and controlgear assemblies

BS EN 61558-1:2005+A1:2009

Safety of power transformers, power supplies, reactors and similar products. Part 1 General requirements and tests

BS EN 61558-2-9:2011

Safety of transformers, reactors, power supply units and combinations thereof. Particular requirements and tests for transformers and power supply units for class III handlamps for tungsten filament lamps

BS EN 61800-3:2004+A1:2012

Adjustable speed electrical power drive systems. Part 3 EMC requirements and specific test methods

BS EN 62208:2011

Empty enclosures for low-voltage switchgear and controlgear assemblies. General requirements

BS EN 62626-1:2014

Low-voltage switchgear and controlgear enclosed equipment. Enclosed switch-disconnectors outside the scope of IEC 60947-3 to provide isolation during repair and maintenance work

BS EN 842:1996+A1:2008

Safety of machinery. Visual danger signals. General requirements, design and testing

Y73 LUMINAIRES AND LAMPS

1000 GENERAL

1010 STANDARDS:

- BREEAM New Construction 2014 requirements
 - Comply with Issue ID Ene 01 Reduction of Energy Use and Carbon Emissions
 - Comply with Issue ID Ene 04 Low Carbon Design
 - Comply with Issue ID Hea 01 Visual Comfort.
 - Comply with Issue ID Wst 05 Adaptation to Climate Change
- BREEAM Refurbishment and Fit Out 2014 requirements
 - Comply with Issue ID Ene 01 Reduction of Energy Use and Carbon Emissions
 - Comply with Issue ID Ene 04 Low Carbon Design
 - Comply with Issue ID Hea 01 Visual Comfort.
- Comply with Issue ID Wst 05 Adaptation to Climate Change

2000 PRODUCTS/MATERIALS

2005 LAMP EFFICACY:

- For non-domestic buildings, the system is designed to achieve an average initial circuit of at least 60 lumens/watt for fixed lighting equipment within the building.

2010A LUMINAIRES - GENERAL PURPOSE:

- Standards
 - Supply luminaires with photometric data in accordance with BS EN 13032-1.
 - Supply luminaires in accordance with BS EN 60598
- Classification - To BS EN 60598-1.
- Safety Support for Components
 - Provide secondary support for translucent covers, diffusers and gear trays so they are prevented from falling when their primary fixing is released.
- Photometric performance
 - Ensure luminaires of similar type have same photometric performance as published data within the tolerances defined by BS EN 13032-1.
- Electromagnetic compatibility
 - Ensure luminaires comply with BS EN 61547 for EMC immunity.

2010B LUMINAIRES - GENERAL PURPOSE WITH SAFETY GLASS:

- Standards
 - Supply luminaires with photometric data in accordance with BS EN 13032-1.
 - Supply luminaires in accordance with BS EN 60598
- Classification - to BS EN 60598-1.
- Safety
 - Fit luminaire with cover glass to protect against ultra-violet emission and risk from explosion of lamps.
- Safety Support for Components
 - Provide secondary support for translucent covers, diffusers and gear trays so they are prevented from falling when their primary fixing is released.
- Photometric performance
 - Ensure luminaires of similar type have same photometric performance as published data within the

tolerances defined by BS EN 13032-1.

- Electromagnetic compatibility
 - Ensure luminaires comply with BS EN 61547 for EMC immunity.

2010C LUMINAIRES - SPECIAL APPLICATIONS:

- Standards
 - Supply luminaires with photometric data in accordance with BS EN 13032-1.
 - Supply luminaires in accordance with BS EN 60598
- Classification - to BS EN 60598-1.
- Electromagnetic compatibility
 - Ensure luminaires comply with BS EN 61547 for EMC immunity.

2020A EMERGENCY LIGHTING LUMINAIRES:

- Comply with BS EN 60598-2-22.
- Comply with ICEL:1001. Ensure emergency lighting luminaires are marked with ICEL certification label.

2040 HAZARDOUS AREA LUMINAIRES

- Standard - BS EN 60079

2050A SIGNS AND HIGH VOLTAGE INSTALLATIONS:

- Comply with BS 559 and BS EN 50107-1.
- Neon transformers
 - Supply transformers for tubular discharge lamps with no-load output voltage exceeding 1000 V in accordance with BS EN 61050.
 - Secondary protection to BS EN 50107-2.

2055 OPTICAL FIBRE LUMINAIRES:

- Provide optical fibre luminaires
- Optical fibre
- Optical fibre connection to BS EN ISO 11149.

2057 LED LUMINAIRES:

- Standards
 - Supply luminaires with photometric data in accordance with BS EN 13032-1
 - Supply luminaires in accordance with BS EN 60598
 - Supply luminaires with performance in accordance with BS EN 62722-2-1
- Classification to BS EN 60598-1
- Safety support for components
 - Provide secondary support for translucent covers, diffusers and gear trays so they are prevented from falling when their primary fixing is released.
- Photometric performance
 - Ensure luminaires of similar type have same photometric performance as published data within the tolerances defined by BS EN 13032-1
- Electromagnetic compatibility
- Ensure luminaires comply with BS EN 61547 for EMC immunity.

2060A LAMPHOLDERS - GENERALLY:

- Lamp caps - BS EN 60061-1.
- Lamp holders - BS EN 60061-2.
- Lampholders with enhanced safety features - BS 7895.
- Bayonet lampholders - BS EN 61184.
- Lampholders for tubular fluorescent lamps and starter holders - BS EN 60400.
- Edison screw lampholders - BS EN 60238.
- Interchangeability
 - Ensure lampholders in luminaires of similar type and rating are identical.
- Earthing
 - Ensure metal lampholders incorporate an earthing terminal.

2070 LAMPHOLDERS - TUNGSTEN FITTINGS:

- Use following lampholders for tungsten filament lamps unless indicated otherwise.
 - Lamp Lampholder.
 - Up to 150 W bayonet B22d.
 - 200 W edison screw E27 2A.
 - 300 W edison screw 16A.
- Shade rings
 - Provide a shade carrier ring for separately mounted lampholders for GLS tungsten filament lamps.
- Polarity of Edison Screw Lampholders
 - Ensure phase conductor is connected to centre contact.

2080A LAMPHOLDERS - MOUNTING:

- Securely mount lampholder in luminaire when it is sole support for lamp.
- Cord grip
 - Provide integral cord grip type when lampholders are suspended by cord.
- Conduit Mounted
 - When mounted directly to conduit system use backplate lampholder for conduit box.

2090A CONTROL GEAR AND COMPONENTS:

- Compatibility
 - Ensure control gear and components are suitable for lamp type, wattage and starting characteristics.
 - Obtain from manufacturers written confirmation of compatibility.
- Efficiency tested in accordance with the relevant parts of BS EN 62442
-

2095 CIRCUIT LOSSES:

- Use high frequency ballasts to ensure the installed circuit load does not exceed $3 \text{ W/m}^2 / 100 \text{ lux}$.
- Efficiency tested in accordance with relevant parts of BS EN 62442

2100A FLUORESCENT LAMP BALLASTS AND STARTERS:

- Ballasts
 - BS EN 61347-2-8
 - BS EN 60921
 - For d.c. supplied electronic ballasts

- BS EN 61347-2-3
- BS EN 61347-2-7
- BS EN 60929
- BS EN 60081
- BS EN 60901
- Supply thermal protectors for ballasts for tubular fluorescent lamps to BS EN 60730-2-3.
- Starters
 - BS EN 61347-2-1
 - BS EN 60927
- Use low distortion type.

2110A DISCHARGE LAMP BALLASTS AND STARTERS:

- Ballasts
 - BS EN 61347-2-9
 - BS EN 60923.
- Starters
 - BS EN 61347-2-1
 - BS EN 60927

2115 LED MODULE CONTROL GEAR:

- Provide LED module control gear to BS EN 61347-2-13 and BS EN 62384.

2120A CAPACITORS:

- Use capacitors in accordance with BS EN 61048 and BS EN 61049 in tubular fluorescent, high pressure mercury and low pressure sodium vapour discharge lamp circuits.

2130 SUPPLY TERMINALS:

- Use screw terminals for supply cables and circuit protective conductors, sized to terminate up to three 2.5mm² conductors. Provide separate terminal blocks for each incoming circuit, with marking to identify each circuit.

2140 FUSE:

- Include a fuse holder and BS 1362 fuse in each incoming circuit phase connection.

2160 REMOTE GEAR:

- Locate control gear in separate lockable cabinet of sheet steel with same degree of protection and finish specified for luminaire. Comply with manufacturer's recommendations for maximum cable length between gear and lamp.

2165 TYPES OF HIGH EFFICIENCY LAMP FOR NON-DAYLIT AREAS:

Light Source	Type
High pressure sodium	All ratings above 70W
Ceramic metal halide	All ratings above 20W
LED	Refer to lm/W efficacy

Metal halide	All ratings above 70W
Tubular fluorescent	16mm (T5) lamps rated above 11W
Compact fluorescent	All ratings above 26W

2170A TUNGSTEN FILAMENT LAMPS:

- Comply with
 - BS EN 60064
 - BS EN 60432-1
 - BS EN 60630.
- Supply electronic step-down converters for filament lamps to
 - BS EN 61047
 - BS EN 61347-2-2.
- Comply with BS EN 61549 for double capped and ELV lamps.

2180A FLUORESCENT LAMPS:

- Internationally specified tubular fluorescent lamps to BS EN 60081.
- UK tubular fluorescent lamps to BS 1853-2.
- Single capped fluorescent lamps to
 - BS EN 60901
 - BS EN 61199
- Double capped fluorescent lamps to
 - BS EN 60081
 - BS EN 61195
- Self ballasted lamps to BS EN 60968

2185A TUNGSTEN HALOGEN LAMPS:

- Comply with
 - BS EN 60432-2
 - BS EN 60357

2190 HIGH PRESSURE MERCURY VAPOUR LAMPS:

- Comply with
 - BS EN 60188
 - BS EN 62035

2215A LED LAMPS:

- Comply with
 - BS EN 62031
 - DD IEC/PAS 62612
 - BS EN 62386-207
 - BS EN 61347-2-13

2215B LED MODULES:

- Comply with
 - BS EN 62384

2220A TRANSFORMERS FOR LV LUMINAIRES:

- Type
 - Electronic.
 - Single luminaire.
- Duty
 - Input voltage 230 volts.
 - Output voltage to suit lamp.
 - Single-phase.
 - Frequency 50 Hz.
 - Rating (kVA) to suit lamp.
- Standards
 - Relevant parts of BS EN 55014.
 - BS EN 61000.
 - BS EN 61047.
 - BS EN 61347-2-2.
 - or BS EN 61558 as appropriate.
- Construction
 - Manufacturer's standard.
- Protection
 - Thermal cut out with automatic reset.
- Location
 - Be accessible.
- Cabling
 - Secondary maximum cable length as manufacturer's recommendations.
 - Separate transformer from secondary low voltage cables (m)
- Connections to luminaires
 - Hard wired
 - Plug and socket

2240A SUPPORT SYSTEM - CONDUIT:

Use not less than 20mm conduit of same type as main conduit system.

Material - steel.

2250A SUPPORT SYSTEM - ROD:

- Use continuously threaded rods with matching washers and nuts.
- Diameter - 6mm.
- Material - Cadmium plated steel.

2260A SUPPORT SYSTEM - CHAIN:

- Use cadmium plated steel chain with load carrying capacity of not less than twice weight of complete luminaire.

2270A SUPPORT SYSTEM - FLEXIBLE CORD:

- Use size and type as indicated.

- Confirm temperature rating is suitable for operating temperature of luminaire or lampholder. Confirm that cord is adequate for mass to be supported.

2280A SUPPORT SYSTEM - WALL BRACKETS:

- Provide wall brackets. Confirm wall brackets are suitable for supporting luminaire.

2290 SUPPORT SYSTEM - BALL AND SOCKET:

- Provide ball and socket as top support, complete with cover fixed to circular conduit box.

2295 SUPPORT SYSTEM - WIRE ROPE:

- Provide wire rope support system. Confirm wire rope is suitable for supporting luminaires.

2300A STEEL COLUMNS AND BOLLARDS:

- Standards
 - BS EN 40-2
 - BS EN 40-5
- Material - Steel.
- Bracket - Match column.
- Earthing
 - Include earthing terminal fixed within service compartment.
- Column base plate - Standard.

2300B COLUMNS AND BOLLARDS:

- Standard - BS EN 40-2.
- Material - Reinforced or prestressed concrete.
- Bracket - Match column.
- Earthing
 - Include earthing terminal fixed within service compartment.
- Column base plate - Standard.

2300C ALUMINIUM COLUMNS AND BOLLARDS:

- Standards
 - BS EN 40-2
 - BS EN 40-6
- Material - Aluminium.
- Bracket - Match column.
- Earthing
 - Include earthing terminal fixed within service compartment.
 - Column base plate - Standard.

2300D FIBRE REINFORCED POLYMER COLUMNS:

- Standards
 - BS EN 40-2
 - BS EN 40-7
- Material
- Earthing
 - Include earthing terminal fixed within service compartment.
- Column base plate - Standard

2300E COLUMNS WITH BREAKAWAY ARRANGEMENT:

- Standards
 - BS EN 40-2
 - BS EN 12767
- Material - Steel.
- Bracket - Match column.
- Earthing
 - Include earthing terminal fixed within service compartment.
- Column base plate - Manufacturer's standard

2305 LIGHTING COLUMN/BOLLARD SWITCHGEAR:

- Service compartment
 - Standards
 - BS EN 40-2
 - BS 7671
 - Accessible only by use of a key or tool
 - Type
 - IP Rating to BS EN 60529.
 - IP44.
- Switchgear and circuit protection
 - Enclosure
 - Standard BS EN 61439
 - IP Rating to BS EN 60529
 - Drip-proof to a minimum of IP31.
 -
 - Circuit protective devices/Isolators
 - Standard
 - BS EN 60898
 - BS EN 61008
 - BS EN 61009
 - BS EN 60269
 - BS EN 60947
 -
 - Means of isolation
 - Double-pole isolator switch with key-lockable lock off facility.
 - Double-pole mcb or RCBO with key-lockable lock off facility.
 - Fuse.
 - Ensure fuse can be extracted without the use of special tools or protective measures.
 - Key-lockable lock off facility.
 -
 - Overcurrent protective device rating
 - 6 A.
 -

3000 ACCESSORIES

3010A TRACK LIGHTING:

- Where indicated provide track for fixing fittings in accordance with BS EN 60570.

3030A AIR HANDLING LUMINAIRES:

- Provide assembly of luminaire and exhaust air device or luminaire and supply air device to meet design requirements for illumination and air flow. Ensure assembly can be integrated into a false ceiling, flush mounted.
- Diffuser
 - Allow for the path of exhaust air in the diffuser.
 - Exhaust air outlet
 - Provide an outlet for the air via a series of circular openings in top of assembly casing.
- Supply air diffuser
 - Supply the air diffuser as a component of the assembly.
- Fixing
 - Ensure the fixing is capable of carrying the weight of the whole assembly.

4000 WORKMANSHIP

4060 MATERIAL OF SUPPORTING SURFACE:

- Ensure classification of luminaires is appropriate. Do not mount luminaires on readily flammable surfaces.

4080 LUMINAIRES IN AREAS WITH INFRARED CONTROL SYSTEM:

- Install luminaires in areas with infrared control systems or data bearers so as to cause minimum disturbance to the infrared transmission system in accordance with BS 7693.

4100 INSTALLATION OF EXTRA LOW VOLTAGE TUNGSTEN HALOGEN LAMPS:

- Use same wattage lamp on luminaires fed from common transformer. Supply each luminaire on common transformer by separate cable of same cross-sectional area.

4110 SUPPORT:

- Ensure support is adequate for weight of luminaires.
- Number
 - Provide the following minimum number of supports for each luminaire longer than 600mm.

Luminaire width (mm)	Minimum number of supports
Up to and including 300	2
Over 300	4

•

4110A SUPPORT:

- Ensure support is adequate for weight of luminaires.
- Number
 - Provide the following minimum number of supports for each luminaire longer than 600mm.

Luminaire width (mm)	Minimum number of supports
Up to and including 300	2

Over 300	4
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4120 SUPPORT FROM CONDUIT:

- Where luminaire is supported from conduit, provide a conduit box forming an integral part of conduit system at each point of suspension. Ensure suspensions are vertical.
- Where conduit enters luminaire use back-nuts and washers to secure luminaire body to conduit support. Provide tube with corrosion resistance equal to conduit system.
- Do not support luminaires directly from conduit boxes made from non-metal or heat sensitive materials, where the temperature of the material may exceed 60°C or the mass suspended exceeds 3kg.

4130 SUPPORT FROM TRUNKING:

- Where luminaire is supported from trunking use propriety clamps or brackets appropriate to the luminaire and trunking.
- Do not support luminaires directly from trunking made from non-metal or heat sensitive materials, where the temperature of the material may exceed 60°C or the mass suspended exceeds 3kg.

4140A SUPPORT BY DIRECT FIXING:

- Refer to fixing methods, use luminaire supporting coupler to follow manufacturer's recommendations.

4160 SUSPENSION:

- Suspend luminaires at height indicated. Ensure suspension hang vertically unless otherwise indicated.

4170 SUSPENSION BY ROD:

- Use washers, nut and lock-nut at top and bottom of rod. Paint cut ends with calcium plumbate primer or zinc rich paint.

4180 SUSPENSION BY CHAIN:

- Use hook cover for suspension from circular conduit box. For connection to luminaires use luminaire manufacturer's own chain hook, but if not available use hook with standard screw threaded body to be secured to luminaire body with nuts and washers. Where indicated use captive hooks.

4210A COLUMNS AND BOLLARDS:

- Location - Confirm location before excavation.
- Bases - Install bases in accordance with bollard or column manufacturer's instructions.
- Mounting
 - Mount column or bollard on base as recommended by manufacturer.
 - Ensure columns and bollards are vertical unless otherwise indicated.
- Earthing
 - Install circuit protective conductor to connect luminaire to earthing terminal in service compartment; size circuit protective conductor same as live conductors. Bond accessible metal parts of column or bollard to earthing terminal.

4220 CONNECTIONS TO LUMINAIRES

- Cable Protection

- Use appropriate size of grommet where cables enter through hole in luminaire body.
- Earthing
 - Ensure that the earthing terminal of Class 1 luminaires is connected to the conduit protective conductor of the supply circuit.
- Loose Wiring
 - Clip or tie back with suitable proprietary devices loose wiring within luminaire, at 300mm intervals.

4230A CONNECTIONS TO LUMINAIRES - DIRECT TO CONDUIT - TERMINAL BOX:

- Terminate circuit wiring in terminal block within supporting conduit box. Use flexible cord from terminal block to luminaire.

4230B CONNECTIONS TO LUMINAIRES - DIRECT TO CONDUIT - AT LUMINAIRE:

- Terminate circuit wiring at supply terminals of luminaire. Take all conductors through same cable entry into luminaire.

4240A CONNECTIONS TO LUMINAIRES - DIRECT TO TRUNKING - TERMINAL BOX:

- Terminate circuit wiring in terminal block in an adaptable box located on side of trunking. Use flexible cord from terminal block to luminaire.

4240B CONNECTIONS TO LUMINAIRES - DIRECT TO TRUNKING - AT LUMINAIRE:

- Terminate circuit wiring at supply terminals of luminaire. Take all conductors through same cable entry into luminaire.

4250 CONNECTIONS TO LUMINAIRES - SUSPENDED FROM TRUNKING:

- Where luminaires are suspended from trunking, secure plug and socket to BS 546, adjacent to, or on side of, trunking. Terminate circuit wiring at socket. Take flexible cord from plug of ceiling rose to supply terminals of luminaire.

4260A CONNECTIONS TO LUMINAIRES - RECESSED FITTINGS - PLUG AND SOCKET:

- Where luminaires are recessed in a suspended ceiling, terminate circuit wiring at plug and socket to BS 546, located not more than 500mm from the access through the ceiling. Use flexible cord from plug of ceiling rose to supply terminals of luminaire.

4260B CONNECTIONS TO LUMINAIRES - RECESSED FITTINGS - TERMINAL BOX:

- Where luminaires are recessed in a suspended ceiling, terminate circuit wiring in terminal block within conduit box. Install wiring to luminaire as indicated in wiring diagram.

4270 CONNECTIONS TO LUMINAIRES - CONDUIT SUSPENSION:

- Terminate circuit wiring in terminal block within supporting conduit box. Use flexible cable from terminal block to luminaire, installed within tube.

4280 CONNECTIONS TO LUMINAIRES - ROD OR CHAIN SUSPENSION:

- Terminate circuit wiring in terminal block within supporting conduit box. Use flexible cord from terminal block to luminaire and clip cable to one of the rods or chains, do not weave cable through links of the chain.

4290 CONNECTIONS TO LUMINAIRES - MICS CABLE:

- Fix cable gland to luminaire and continue conductors to supply terminals of luminaire.

4300A SEPARATE LIGHTING SWITCHES ON DIFFERENT PHASES:

- Install lighting switches on different phases at least 2m apart.

4300B PHASE BARRIER LIGHTING SWITCHES ON DIFFERENT PHASES:

- When lighting switches on different phases are in a common box, use phase barrier switches in accordance with BS 7671.

BS APPENDIX

BS 1362:1973

Specification for general purpose fuse links for domestic and similar purposes (primarily for use in plugs)

BS 1853-2:1995

Tubular fluorescent lamps for general lighting service. Part 2 Specification for lamps used in the UK not included in BS EN 60081, BS EN 60901, BS EN 61195 and BS EN 61199

BS 546:1950

Specification. Two-pole and earthing-pin plugs, socket-outlets and socket-outlet adaptors. If required, see also Supplement No 1:1960 Specification for plugs made of resilient material

BS 559:2009

Specification for the design and construction of signs for publicity, decorative and general purposes

BS 7671:2008+A3:2015

Requirements for electrical installations. IET Wiring Regulations. Seventeenth edition

BS 7693:1993

Guide to uses of infra-red transmission and the prevention or control of interference between systems

BS 7895:1997

Specification for bayonet lampholders with enhanced safety

BS EN 12767:2007

Passive safety of support structures for road equipment. Requirements, classification and test methods

BS EN 13032-1:2004+A1:2012

Light and lighting. Measurement and presentation of photometric data of lamps and luminaires. Part 1 Measurement and file format

BS EN 40-2:2004

Lighting columns. Part 2 General requirements and dimensions

BS EN 40-5:2002

Lighting columns. Part 5 Requirements for steel lighting columns

BS EN 40-6:2002

Lighting columns. Part 6 Requirements for aluminium lighting columns

BS EN 40-7:2002

Lighting columns. Part 7 Requirements for fibre reinforced polymer composite lighting columns

BS EN 50107-1:2002

Signs and luminous-discharge-tube installations operating from a no-load rated output voltage exceeding 1 kV but not exceeding 10 kV. Part 1 General requirements

BS EN 50107-2:2005

Signs and luminous-discharge-tube installations operating from a no-load rated output voltage exceeding 1 kV but not exceeding 10 kV. Part 2 Requirements for earth-leakage and open-circuit protective devices

BS EN 60061-1:1993+A50:2014

Lamp caps and holders together with gauges for the control of interchangeability and safety. Lamp caps

BS EN 60061-2:1993+A47:2014

Lamp caps and holders together with gauges for the control of interchangeability and safety. Part 2 Lampholders

BS EN 60064:1995+A5:2009

Tungsten filament lamps for domestic and similar general lighting purposes. Performance requirements

BS EN 60081:1998+A5:2013

Double-capped fluorescent lamps. Performance specifications

BS EN 60188:2001

High-pressure mercury vapour lamps. Performance specifications

BS EN 60238:2004+A2:2011

Edison screw lampholders

BS EN 60357:2003

Tungsten halogen lamps (non-vehicle). Performance specifications

BS EN 60400:2008+A2:2014

Lampholders for tubular fluorescent lamps and starterholders

BS EN 60432-1:2000+A2:2012

Safety specification for incandescent lamps. Part 1 Tungsten filament lamps for domestic and similar general lighting purposes

BS EN 60432-2:2000+A2:2012

Safety specification for incandescent lamps. Part 2 Tungsten halogen lamps for domestic and similar general lighting purposes

BS EN 60529:1992+A2:2013

Degrees of protection provided by enclosures (IP code)

BS EN 60570:2003

Electrical supply track systems for luminaires

BS EN 60598-1:2015

Luminaires. Part 1 General requirements and tests

BS EN 60598-2-22:2014

Luminaires. Part 2-22. Particular requirements. Luminaires for emergency lighting

BS EN 60630:1998+A7:2015

Maximum lamp outliners for incandescent lamps

BS EN 60730-2-3:2007

Specification for automatic electrical controls for household and similar use. Part 2-3 Particular requirements. Thermal protectors for ballasts for tubular fluorescent lamps

BS EN 60901:1996+A5:2012

Specification for single-capped fluorescent lamps. Performance specifications

BS EN 60921:2004

Ballasts for tubular fluorescent lamps. Performance requirements

BS EN 60923:2005

Auxiliaries for lamps. Ballasts for discharge lamps (excluding tubular fluorescent lamps). Performance

requirements

BS EN 60927:2007+A1:2013

Auxiliaries for lamps. Starting devices (other than glow starters). Performance requirements

BS EN 60929:2011

AC and/or DC-supplied electronic control gear for tubular fluorescent lamps. Performance requirements

BS EN 60968:2015

Self-ballasted fluorescent lamps for general lighting services. Safety requirements

BS EN 61047:2004

D.C. or A.C. supplied electronic step-down convertors for filament lamps. Performance requirements

BS EN 61048:2006

Auxiliaries for lamps. Capacitors for use in tubular fluorescent and other discharge lamp circuits. General and safety requirements

BS EN 61049:1993

Specification for capacitors for use in tubular fluorescent and other discharge lamp circuits. Performance requirements

BS EN 61050:1992

Specification for transformers for tubular discharge lamps having a no-load output voltage exceeding 1000 V (generally called neon-transformers). General and safety requirements

BS EN 61184:2008+A1:2011

Bayonet lampholders

BS EN 61195:1999+A2:2015

Double-capped fluorescent lamps. Safety specifications

BS EN 61199:2011+A2:2015

Single-capped fluorescent lamps. Safety specifications

BS EN 61347-2-1:2001+A2:2014

Lamp controlgear. Part 2-1 Particular requirements for starting devices (other than glow starters)

BS EN 61347-2-13:2014

Lamp controlgear. Particular requirements for d.c. or a.c. supplied electronic controlgear for LED modules

BS EN 61347-2-2:2012

Lamp controlgear. Part 2-2 Particular requirements for D.C. or A.C. supplied electronic step-down convertors for filament lamps

BS EN 61347-2-3:2011

Lamp control gear. Part 2-3 Particular requirements for A.C. and/or D.C. supplied electronic control gear for fluorescent lamps

BS EN 61347-2-7:2012

Lamp controlgear. Part 2-7 Particular requirements for D.C. supplied electronic ballasts for emergency lighting

BS EN 61347-2-8:2001+A1:2006

Lamp controlgear. Part 2-8 Particular requirements for ballasts for fluorescent lamps

BS EN 61347-2-9:2013

Lamp controlgear. Part 2-9 Particular requirements for electromagnetic controlgear for discharge lamps (excluding fluorescent lamps)

BS EN 61547:2009

Specification for equipment for general lighting purposes. EMC immunity requirements

BS EN 61549:2003

Miscellaneous lamps

BS EN 62031:2008+A2:2015

LED modules for general lighting. Safety specifications

BS EN 62035:2014

Discharge lamps (excluding fluorescent lamps). Safety specifications

BS EN 62384:2006+A1:2009

DC or AC supplied electronic control gear for LED modules. Performance requirements

BS EN 62386-207:2009

Digital addressable lighting interface. Particular requirements for control gear. LED modules (device type 6)

BS EN 62722-2-1:2015

Luminaire performance. Particular requirements for LED luminaires

BS EN ISO 11149:1997

Optics and optical instruments. Lasers and laser related equipment. Fibre optic connectors for non-telecommunication laser applications

Y74 ACCESSORIES FOR ELECTRICAL SERVICES

1000 GENERAL

1010 APPLICATION:

Supply fixed electrical wiring accessories for use with fixed and portable peripheral equipment using either power or signalling cables.

1020 SAMPLES:

Submit samples of proposed materials and equipment for approval before work is started. Label each sample with name, catalogue number and reference to the use or services.

2000 PRODUCTS/MATERIALS

2010A ACCESSORIES COMMON REQUIREMENTS - WHITE PLASTIC PLATES GRID, FLUSH INSTALLATION:

- Area of installation - Interior.
- Enclosure pattern - Flush.
- Accessory mounting
 - Adjustable steel grid for grid switches or direct to enclosure for all other accessories.
- Enclosure material - Pressed steel.
- Enclosure finish - Galvanized.
- Coverplate finish, all accessories to match
 - Moulded plastic, colour - white.
- Coverplate pattern - Overlapping; with architrave where indicated.
- Ancillaries
 - Earthing terminal integral within switch box.
 - Neon indicator with red lens, illuminated in "ON" position, for connection units.
 - Switch rocker bar colour - white.
 - Operating keys for key operated switches, minimum number 2.
 - Fuses to BS 1362.
 - Blank inserts for spare ways on grid switches.
- Marking
 - Method - engraving. Mark front plate to indicate equipment served on connection units.
- Conduit and cable entries
 - Knockouts side, top and rear.
- Cable termination - Manufacturer's standard.

2010B ACCESSORIES COMMON REQUIREMENTS - MATT CHROME FINISH METAL PLATES, FLUSH INSTALLATION:

- Area of installation - Interior.
- Enclosure pattern - Flush.
- Accessory mounting
 - Adjustable steel grid for grid switches or direct to enclosure for all other accessories.
- Enclosure material - Pressed steel.
- Enclosure finish - Galvanized.
- Coverplate finish, all accessories to match
 - Brass with matt chrome surface.
- Coverplate pattern - Overlapping; with architrave where indicated.

- Ancillaries
 - Earthing terminal integral within switch box.
 - Neon indicator with red lens, illuminated in "ON" position, for connection units.
 - Switch rocker bar colour as indicated.
 - Operating keys for key operated switches, minimum number 2.
 - Fuses to BS 1362.
 - Blank inserts for spare ways on grid switches.
- Marking
 - Method - engraving. Mark front plate to indicate equipment served on connection units.
- Conduit and cable entries
 - Knockouts side, top and rear.
- Cable termination - Manufacturer's standard.

2010C ACCESSORIES COMMON REQUIREMENTS - WHITE PLASTIC PLATES, EMBEDDED CABLES, SURFACE INSTALLATION:

- Area of installation - Interior.
- Enclosure pattern - Surface.
- Accessory mounting - Direct to enclosure.
- Enclosure material - White moulded plastic.
- Coverplate finish, all accessories to match
 - Moulded plastic, colour - white.
- Coverplate pattern - Surface type.
- Ancillaries
 - Earthing terminal integral within switch box.
 - Neon indicator with red lens, illuminated in "ON" position, for connection units.
 - Switch rocker bar colour as indicated.
 - Operating keys for key operated switches, minimum number 2.
 - Fuses to BS 1362.
- Marking
 - Method - engraving. Mark front plate to indicate equipment served on connection units.
- Conduit and cable entries
 - Knockouts side, top and rear.
- Cable termination - Manufacturer's standard.

2010D ACCESSORIES COMMON REQUIREMENTS - METAL CLAD PLATES, SURFACE STEEL CONDUIT INSTALLATION:

- Area of installation - Interior.
- Enclosure pattern - Surface.
- Accessory mounting - Direct to enclosure.
- Enclosure material
 - Pressed steel or cast iron.
- Enclosure finish
 - As conduit system or galvanized.
- Coverplate finish, all accessories to match
 - Metal clad.
- Coverplate pattern - Surface type.
- Ancillaries
 - Earthing terminal integral within switch box.
 - Neon indicator with red lens, illuminated in "ON" position, for connection units.
 - Switch rocker bar colour as indicated.
 - Operating keys for key operated switches, minimum number 2.

- Fuses to BS 1362.
- Marking
 - Method - engraving. Mark front plate to indicate equipment served on connection units.
- Conduit and cable entries
 - Threaded entries, top, bottom or side to suit conduit system.
- Cable termination - Manufacturer's standard.

2010E ACCESSORIES COMMON REQUIREMENTS - SURFACE, STEEL CONDUIT, WEATHERPROOF INSTALLATION:

- Area of installation - Exterior.
- Enclosure pattern - Surface and weatherproof.
- Accessory mounting - Direct to enclosure.
- Enclosure material - Cast iron.
- Enclosure finish - As conduit system or galvanized.
- Coverplate finish, all accessories to match
 - As enclosure.
- Coverplate pattern - Surface type.
- Ancillaries
 - Earthing terminal integral within switch box.
 - Neon indicator with red lens, illuminated in "ON" position, for connection units.
 - Screwed weathering cap and chain for socket outlets.
 - Operating keys for key operated switches, minimum number 2.
 - Fuses to BS 1362.
- Marking
 - Method - engraving. Mark front plate to indicate equipment served on connection units.
- Conduit and cable entries
 - Threaded entries, top, bottom or side to suit conduit system.
- Cable termination - Manufacturer's standard.

2010F ACCESSORIES COMMON REQUIREMENTS - SURFACE, PLASTIC, WEATHERPROOF INSTALLATION:

- Area of installation - Exterior.
- Enclosure degree of protection to BS EN 60529, IP54.
- Enclosure pattern - Surface and weatherproof.
- Accessory mounting - Direct to enclosure.
- Enclosure material - Impact resistant plastic.
- Enclosure finish - Natural or self coloured.
- Coverplate finish, all accessories to match
 - Moulded plastic, colour as indicated.
- Coverplate pattern - Surface type.
- Ancillaries
 - Earthing terminal integral within switch box.
 - Neon indicator with red lens, illuminated in "ON" position, for connection units.
 - Protective shrouds to rocker bars.
 - Screwed weathering cap and chain for socket outlets.
 - Switch rocker bar colour as indicated.
 - Operating keys for key operated switches, minimum number 2.
 - Fuses to BS 1362.
- Conduit and cable entries
 - Threaded entries to suit cable/conduit system.
- Cable termination - Manufacturer's standard.

2010G ACCESSORIES COMMON REQUIREMENTS - BRONZE FINISH METAL PLATES GRID, FLUSH INSTALLATION:

- Area of installation - Interior.
- Enclosure pattern - Flush.
- Accessory mounting
 - Adjustable steel grid for grid switches or direct to enclosure for all other accessories.
- Enclosure material - Pressed steel.
- Enclosure finish - Galvanized.
- Coverplate finish, all accessories to match
 - Brass with BMA/bronze surface.
- Coverplate pattern - Overlapping; with architrave where indicated.
- Ancillaries
 - Earthing terminal integral within switch box.
 - Neon indicator with red lens, illuminated in "ON" position, for connection units.
 - Switch rocker bar colour as indicated.
 - Operating keys for key operated switches, minimum number 2.
 - Fuses to BS 1362.
 - Blank inserts for spare ways on grid switches.
- Marking
 - Method - engraving. Mark front plate to indicate equipment served on connection units.
- Conduit and cable entries
 - Knockouts side, top and rear.
- Cable termination - Manufacturer's standard.

2020A INTERIOR LIGHTING SWITCHES - GENERAL PURPOSE MOULDED PLASTIC:

- Standard
 - BS EN 60669-1
 - Enclosure box to BS 4662
- Switch type - Rocker bar - moulded plastic.
- Rating - 6A.
- Gangs as indicated.
- Switch mechanism - Snap action microgap.
- Pole configurations
 - Single pole.
 - Double pole.
 - 2 way.
 - Intermediate.

2020B INTERIOR LIGHTING SWITCHES - GRID MOULDED PLASTIC:

- Standard
 - BS EN 60669-1
 - Enclosure box to BS 4662
- Switch type - Rocker bar - moulded plastic.
- Rating - 6A.
- Switch mechanism - Snap action microgap.
- Pole configurations
 - Single pole.
 - 1 way.
 - 2 way.
 - Intermediate.

2020C INTERIOR LIGHTING SWITCHES - PULL CORD:

- Standard
 - BS EN 60669-1
 - Enclosure box to BS 4662
- Switch type - Cord to BS EN 61058-2-1
- Rating - 6A. Pole configurations - Single pole.

2020D INTERIOR LIGHTING SWITCHES - GENERAL PURPOSE SECRET KEY:

- Standard
 - BS EN 60669-1
 - Enclosure box to BS 4662
- Switch type - Rocker bar - secret key.
- Rating - 6A.
- Gangs as indicated.
- Switch mechanism - Snap action microgap.
- Pole configurations
 - Single pole.
 - Double pole.
 - 2 way.
 - Intermediate.

2020E INTERIOR LIGHTING SWITCHES - GENERAL PURPOSE DIMMER:

- Standard
 - BS EN 60669-1
 - Enclosure box to BS 4662
- Switch type - Rocker bar - dimmer.
- Rating - 6A.
- Gangs as indicated.
- Switch mechanism - Snap action microgap.
- Pole configurations
 - Single pole.
 - Double pole.
 - 2 way.
 - Intermediate.

2020F INTERIOR LIGHTING SWITCHES - GRID SECRET KEY:

- Standard
 - BS EN 60669-1
 - Enclosure box to BS 4662
- Switch type - Rocker bar - secret key.
- Rating - 6A.
- Switch mechanism - Snap action microgap.
- Pole configurations
 - Single pole.
 - 1 way.
 - 2 way.
 - Intermediate.

2030A EXTERIOR LIGHTING SWITCHES - METAL CLAD ROTARY:

- Standard
 - BS EN 60669-1

- Enclosure box to BS 4662
- Switch type - Rotary disc or lever operating through sealing gland.
- Rating - 6A.
- Gangs as indicated.
- Action - Two position.
- Pole configurations as indicated.

2030B EXTERIOR LIGHTING SWITCHES - SEALED ROCKER BAR:

- Standard
 - BS EN 60669-1
 - Enclosure box to BS 4662
- Switch type - Rocker bar with sealed in plastic membrane.
- Rating - 6A.
- Gangs as indicated.
- Action - Two position.
- Pole configurations as indicated.

2040# TIME SWITCHES:

- Wire timer and switch circuits to separate terminals.
- Standard - BS EN 60730-2-7.
- Time switch type
 - Synchronous motor 30 hour spring reserve.
 - Quartz stabilized motor 30 hour spring reserve.
 - Quartz stabilized solid state 50 hour nickel cadmium battery backup.
- Timer accuracy
- Contacts duty
 - Inductive.
 - Resistive.
- Contacts rating
 - 3A.
 - 15A.
 - 20A.
- Special programme facilities
 - Solar dial calibrated for site latitude.
 - Day omit.
 - Contacts manual status advance to next operation.
 - Manual bypass continuous "ON" for each separate switch circuit.
 - Manual bypass continuous "OFF" for each separate switch circuit.
 - Number of "ON" and "OFF" operations
- Programme repeat cycle
 - 24 hour.
 - 7 day.
 - 28 day.
 - 365 day.
- Provide number of independently programmable contact circuits indicated.

2040A TIME SWITCHES - 24 HOUR:

- Wire timer and switch circuits to separate terminals.
- Standard - BS EN 60730-2-7.
- Time switch type - Quartz stabilized solid state 50 hour nickel cadmium battery backup.

- Contacts duty - Inductive.
- Contacts rating - 15A.
- Special programme facilities
 - Number of 'ON' and 'OFF' operations - 4.
- Programme repeat cycle - 24 hour.

2040B TIME SWITCHES - 7 DAY:

- Wire timer and switch circuits to separate terminals.
- Standard - BS EN 60730-2-7.
- Time switch type
 - Quartz stabilized solid state 50 hour nickel cadmium battery backup.
- Contacts duty - Inductive.
- Contacts rating - 15A.
- Special programme facilities
 - Number of "ON" and "OFF" operations - 4.
- Programme repeat cycle - 7 day.

2050A LUMINAIRE CONNECTORS - GENERAL AND EMERGENCY LIGHTING:

- Rating - 2A.
- Connector type
 - Fixed terminal strip, screw cover and cord grip to BS 67.
- Load carrying capacity to match selected luminaire.

2050B LUMINAIRE CONNECTORS - GENERAL LIGHTING:

- Rating - 2A.
- Connector type
 - 3 pin plug/socket to BS 546.
- Load carrying capacity to match selected luminaire.

2050C LUMINAIRE CONNECTORS - CORD GRIP GENERAL AND EMERGENCY LIGHTING:

- Rating - 2A.
- Connector type
 - Cord grip type plug/socket and screw on retaining cover to BS 5733 3 pin or 4 pin.
- Load carrying capacity to match selected luminaire.

2060A LAMPHOLDERS - BC TYPE:

- Standard - BS EN 61184.
- Lampholder type
 - Bayonet clip.
 - B22.
- Fixing - Bracket
 - Straight.
 - Angle.
 - Suspension.
- Finish - Manufacturer's standard.
- Material - Heat resistant moulded plastic.
- Ancillaries
 - Cord grip.

- Lampshade ring.
- Protective lampshade ring.

2060B LAMPHOLDERS - ES TYPE:

- Standard - BS EN 60238.
- Lampholder type
 - Edison screw.
 - E27.
- Fixing - Bracket
 - Straight.
 - Angle.
 - Suspension.
- Finish - Manufacturer's standard.
- Material - Heat resistant moulded plastic.
- Ancillaries
 - Cord grip.
 - Lampshade ring.
 - Protective lampshade ring.

2060C LAMPHOLDERS - BC TYPE WITH ENHANCED SAFETY:

- Standard
 - BS EN 61184
 - BS 7895
- Lampholder type - bayonet clip B22.
- Fixing - Bracket
 - Straight.
 - Angled.
 - Suspension.
- Finish - manufacturer's standard.
- Ancillaries
 - Cord grip.
 - Lamp shade ring.
 - Protective lampshade ring.

2070A ISOLATING SWITCHES - BS EN 60669-1:

- Provide isolating switches for fixed appliances.
- Utilization category as indicated.
- Making capacity as indicated.
- Standard
 - BS EN 60669-1
 - Enclosure box to BS 4662.
- Switch type - Rocker bar.
- Rating as indicated on schedule.
- Pole configuration
 - DP.
 - Three pole.
 - TPN.

2070B ISOLATING SWITCHES - BS EN 60947-3:

- Provide isolating switches for fixed appliances.
- Utilization category as indicated on schedule.
- Making capacity as indicated.
- Standard
 - Enclosure box - BS 4662, BS EN 60947-3.
 - Isolation during repair and maintenance - BS EN 62626-1
- Switch type - Rocker bar.
- Rating as indicated on schedule.
- Pole configuration
 - DP.
 - Three pole.
 - TPN.

2080A FUSE CONNECTION UNITS - SWITCHED:

- Standard
 - BS 1363-4
 - Enclosure box to BS 4662 and switched.
- Unit type - Rocker bar - plastic.
- Pole configuration - DP.
- Ancillaries
 - Cord outlet.
 - Cord grip and fuse.

2080B FUSE CONNECTION UNITS - UNSWITCHED:

- Standard
 - BS 1363-4
 - Enclosure box to BS 4662 and unswitched.
- Pole configuration - DP.
- Ancillaries
 - Cord outlet
 - Cord grip and fuse.
 - Lockable fuse carrier.

2090A SOCKET-OUTLETS - SINGLE, SWITCHED:

- Standard
 - 13A socket-outlet to BS 1363
 - Enclosure box to BS 4662
- Switching - Switched.
- Switch type - Rocker bar - plastic.
- Rating - 13A.
- Ancillaries
 - Plug tops 25% of number of sockets, fused as indicated.
- Gangs - 1.

2090B SOCKET-OUTLETS - SINGLE WITH INTEGRAL RCD, SWITCHED:

- Standard - Enclosure box to BS 4662, BS 7288.
- Switching - Switched
- Switch type - Rocker bar - plastic.
- Rating - 13A.
- Ancillaries

- RCD, BS 7288
- Mains failure trip, sensitivity 30mA.
- Plug tops 25% of number of sockets, fused as indicated.
- Gangs - 1.

2090C SOCKET-OUTLETS - DOUBLE SWITCHED:

- Standard
 - 13A socket-outlet to BS 1363
 - Enclosure box to BS 4662
- Switching - Switched
- Switch type - Rocker bar - plastic.
- Rating - 13A.
- Ancillaries
 - Plug tops 25% of number of sockets, fused as indicated.
- Gangs - 2.

2090D SOCKET-OUTLETS - SINGLE, UNSWITCHED:

- Standard
 - 13A socket-outlet to BS 1363
 - Enclosure box to BS 4662
- Switching - Unswitched.
- Rating - 13A.
- Gangs - 1

2090E SOCKET-OUTLETS - SINGLE WITH INTEGRAL RCD, UNSWITCHED:

- Standard
 - Enclosure box to BS 4662, BS 7288.
 - HBES systems BS EN 50428, enclosure box to BS 4662.
- Switching - Unswitched.
- Rating - 13A.
- Ancillaries
 - RCD, BS 7288
 - Mains failure trip, sensitivity 30mA.
- Gangs - 1.

2100A COOKER CONTROL UNIT - WITH INTEGRAL SOCKET:

- Standard
 - BS 4177
 - Enclosure box to BS 4177
- Unit type - With integral 13A switched socket-outlet and pilot lamp.
- Pole configuration - DP.
- Rating - 45A.

2100B COOKER CONTROL UNIT - WITHOUT SOCKET:

- Standard
 - BS 4177
 - Enclosure box to BS 4177
- Unit type - With pilot lamp.

- Pole configuration - DP.
- Rating - 45A.

2110A CORD OUTLETS - COOKER CONNECTION UNIT:

- Standard
 - BS 5733
 - Enclosure box to BS 4662
- Format - Cooker connection.
- Rating - 45A
- Pole configuration - DP&E.

2120A CABLE AND APPLIANCE COUPLERS - 16A, 240V SINGLE-PHASE, GENERAL PURPOSE:

- Standard
 - BS EN 60309-2
- Material - Polycarbonate male and female connectors.
- Rating - Voltage 220 - 240V; Current 16A.
- Configuration - 2PE.
- Colour - 220 - 240V, Blue.
- Ancillaries as indicated.
 - ON/OFF switch; gang combinations 1, 2, 3 and 4; RCD. BS 7288 sensitivity 30mA.

2125 REMOTE CONTROL STATIONS:

- Provide remote control stations for system controlling
- Standard
 - BS EN 60947-5-1.
 - BS EN 62626-1
- Provide remote control station containing command devices
 - Push button switches
 - Illuminated
 - Key operated switches
 - Indicator lamps
 - Lamp types
- Label remote control stations
 - Actuator colours and marking to BS EN 60073.
- Push switches
 - Start switches
 - Colour
 - Illuminated
 - Head
 - Marking
 - Contacts
 - NO
 - NC
 - Stop switches
 - Autolock
 - Release
 - Colour.
 - Illuminated.
 - Head
 - Mushroom

- Marking
- Contacts
 - NO
 - NC
- Reset switches
 - Colour.
 - Illuminated.
 - Marking
 - Contacts
 - NO
 - NC
- Inching switches
- Control voltage (V)
- Ensure rated thermal current, rated operational current and utilisation category of contacts are compatible with control circuit characteristics and circuit protection device.

2130A TELEPHONE AND DATA OUTLET SOCKETS - GENERAL PURPOSE:

- Standard
 - For jack socket to telephone service provider requirements and enclosure box to BS 4662.
- Size - Standard.
- Circuit configurations as indicated.

2140A TELEPHONE CORD OUTLETS - GENERAL PURPOSE:

- Standard - BABT approved.
- Circuit configurations - Single or twin as indicated.

2150A D TYPE MULTIPIN CONNECTORS - GENERAL PURPOSE:

- Circuit configurations - Single or twin as indicated.
- Size - 25 pin.

2160A BNC SOCKETS - GENERAL PURPOSE:

- Circuit configurations - Single or twin as indicated.
- Impedance - 50 ohm.
- Mounting - Insulated.
- Ancillaries - Dust caps for sockets.

2170A AERIAL SOCKETS - TV AND DAB AERIALS:

- Circuit configurations - Dual TV and DAB.
- Ancillaries
 - Safety isolation to CAI recommendations for communal aerial systems.

2170B AERIAL SOCKETS - SINGLE TV AERIALS:

- Circuit configurations - Single TV.
- Ancillaries
 - Safety isolation to CAI recommendations for communal aerial systems.

2180A LOW VOLTAGE ISOLATING TRANSFORMER UNITS - 240/25V:

- Standard

- BS EN 61558-1
- BS EN 61558-2-23
- Configuration - single-phase, double wound.
- Rating - Input 240V; output 25V; (VA) as indicated.
- Ancillaries
 - Plug and socket for 25V; DP switch primary supply; secondary side fusing.

2190A SHAVER POINTS - BATHROOM AND WASHROOM USE:

- Provide shaver points, internally switched by plug insertion.
- Standard
 - BS EN 61558-2-9
 - BS EN 61558-1
 - BS EN 61558-2-23
 - Enclosure box to BS 4662
- Rating - 20VA.
- Components
 - Double wound single-phase transformer 240/240V and 110V to
 - BS EN 61558-2-9
 - BS EN 61558-1
 - BS EN 61558-2-23
 - Internal overload protection.
- Marking - Input and output voltages and "SHAVERS ONLY".

2200A INDICATOR LAMPS - GENERAL PURPOSE LED:

- Standard BS EN 62094-1.
- Lamp - LED.
- Lamp rating - 230V supply.
- Lens cover - Moulded plastic.
- Lens colour - BS EN 60073.
- Lens retaining rings - Moulded plastic.

3000 WORKMANSHIP

3010 EARTHING:

- Ensure metal framework of equipment is bonded to main earth point. Ensure that cable CPC's are connected to earth bar.
- Provide earth CPC between earth lug on metal box and accessory casing except where accessory is encased in plastic.

3020 PROTECTION:

- Ensure there is no physical or electrical damage to accessories when they are removed from their packaging and during installation.
 - Provide masking covers for surface mounted accessories to protect surface from paint.
- Where accessories are flush mounted install front plate after painting is finished.

3030 FIXING:

- Align accessories horizontally and vertically. Where accessories are grouped, mount horizontally in line and

parallel to each other and equidistant.

- Fix cover plates to boxes with brass fixing screws.

3040 MEASURING MOUNTING HEIGHTS:

- Take measurement for position of electrical accessories to the centre line of equipment from either finished floor or worktop. Where specified height coincides with top of tiling, leave a clear gap of 50mm above tiling.
- Mount equipment below a worktop 100mm below underside of worktop.

3050 STANDARD ACCESSORIES MOUNTING HEIGHTS:

Accessory	Location	Height (mm)
Lighting switch		1200
Socket outlet	General	450
	Kitchen	1000
	Above worktop	200
Shaver socket outlet		1000
Fused connection unit	General	450
	Above worktop	200
Fused connection unit controlling	Radiator heater, wall	1800
	Radiator heater, focal point	450
	Tubular heater	450
	Clock	1900
Cooker control unit	Above worktop	200
Cooker connection unit		600
Safety isolating transformer		1200
Room thermostat		1400
Telephone outlet		450
Radio/TV outlet		450
Push button		1200
Fire alarm manual call point		1200
Bell or buzzer		2000
Visible alarm indicator		2000

- In car parks and garages comply with appropriate petroleum regulation for mounting heights of socket outlets.

3070 ACCESSORIES MOUNTING HEIGHTS:

- Provide switches and socket outlets for lighting and other equipment in habitable rooms at appropriate heights between 450mm and 1200mm from finished floor level, in accordance with Building Regulations Approved Document M and BS 8300.

BS APPENDIX

BS 1362:1973

Specification for general purpose fuse links for domestic and similar purposes (primarily for use in plugs)

BS 1363-4:1995+A4:2012

13 A plugs, socket-outlets, adaptors and connection units. Part 4 Specification for 13A fused connection units switched and unswitched

BS 4177:1992

Specification for cooker control units

BS 4662:2006+A1:2009

Boxes for flush mounting of electrical accessories. Requirements and test methods and dimensions

BS 546:1950

Specification. Two-pole and earthing-pin plugs, socket-outlets and socket-outlet adaptors. If required, see also Supplement No 1:1960 Specification for plugs made of resilient material

BS 5733:2010+A1:2014

General requirements for electrical accessories. Specification

BS 67:1987

Specification for ceiling roses

BS 7288:1990

Specification for socket outlets incorporating residual current devices (S.R.C.D.s)

BS 7895:1997

Specification for bayonet lampholders with enhanced safety

BS 8300:2009+A1:2010

Design of buildings and their approaches to meet the needs of disabled people. Code of practice

BS EN 50428:2005+A2:2009

Switches for household and similar fixed electrical installations. Collateral standard. Switches and related accessories for use in home and building electronic systems (HBES)

BS EN 60073:2002

Basic and safety principles for man-machine interface, marking and identification. Coding principles for indicators and actuators

BS EN 60238:2004+A2:2011

Edison screw lampholders

BS EN 60309-2:1999+A2:2012

Plugs, socket-outlets and couplers for industrial purposes. Part 2 Dimensional interchangeability requirements for pin and contact-tube accessories

BS EN 60529:1992+A2:2013

Degrees of protection provided by enclosures (IP code)

BS EN 60669-1:1999+A2:2008

Switches for household and similar fixed electrical installations. Part 1 General requirements

BS EN 60730-2-7:2010

Automatic electrical controls for household and similar use. Part 2-7 Particular requirements for timers and time switches

BS EN 60947-3:2009+A2:2015

Low-voltage switchgear and controlgear. Part 3 Switches, disconnectors, switch-disconnectors and fuse-combination units

BS EN 60947-5-1:2004+A1:2009

Specification for low-voltage switchgear and controlgear. Part 5-1 Control circuit devices and switching elements. Electromechanical control circuit devices

BS EN 61058-2-1:2011

Switches for appliances. Part 2-1 Particular requirements for cord switches

BS EN 61184:2008+A1:2011

Bayonet lampholders

BS EN 61558-1:2005+A1:2009

Safety of power transformers, power supplies, reactors and similar products. Part 1 General requirements and tests

BS EN 61558-2-23:2010

Safety of transformers, reactors, power supply units and combinations thereof. Particular requirements and tests for transformers and power supply units for construction sites

BS EN 61558-2-9:2011

Safety of transformers, reactors, power supply units and combinations thereof. Particular requirements and tests for transformers and power supply units for class III handlamps for tungsten filament lamps

BS EN 62094-1:2003

Indicator light units for household and similar fixed-electrical installations. Part 1 General requirements

BS EN 62626-1:2014

Low-voltage switchgear and controlgear enclosed equipment. Enclosed switch-disconnectors outside the scope of IEC 60947-3 to provide isolation during repair and maintenance work

Y80 EARTHING AND BONDING

1000 GENERAL

1010 GENERAL:

- Use materials and installations methods in accordance with BS EN 62305, BS 7671, BS 7430, Electricity Safety, Quality and Continuity Regulations and local Distribution Network Operator requirements as appropriate.

2000 PRODUCTS/MATERIALS

2010A CONDUCTORS FOR LIGHTNING PROTECTION SYSTEMS - HORIZONTAL AIR TERMINATIONS:

- Use - Horizontal air termination or down conductor.
- Minimum dimension - BS EN 62561-2.
- Form - Strip.
- Material - Copper, annealed.
- Coverings - None or PVC.
- Accessories - Ridge Saddle; conductor clips - non-metallic; glazing bar holdfast; slate holdfast; backplate holdfast; all accessories sized to suit conductors.

2010B CONDUCTORS FOR LIGHTNING PROTECTION SYSTEMS - SELF SUPPORTING AIR TERMINATIONS:

- Use - Air termination, vertical.
- Minimum dimension - BS EN 62561-2.
- Form - Rod.
- Material - Copper, hard drawn.
- Coverings - None.
- Accessories - Terminal base; ridge saddle; rod brackets; rod to tape coupling.

2010C CONDUCTORS TO EARTHING SYSTEMS TO BS 7430:

- Use - Earthing conductor.
- Minimum dimension - BS 7430, current density 50A/mm².
- Form - Strip.
- Material - Copper, annealed.
- Coverings - None.
- Accessories - Conductor clips, metallic.

2020A LIGHTNING PROTECTION CONDUCTOR JOINTS:

- First Conductor
 - Form - strip; material - copper.
 - Dimensions - To BS EN 62561-2.
- Second conductor
 - Form - rod; material - copper.
 - Dimensions - To BS EN 62561-2.
- Solid joint - Brazed or welded, thermic.
- Disconnecting test joint
 - Square clamp, oblong clamp, plate clamp or screw-down clamp.

2020B EARTHING SYSTEMS CONDUCTOR JOINTS:

- First Conductor
 - Form - strip; material - copper.
 - Dimensions - For conductor current density 50A/mm² earthing systems.
- Second conductor
 - Form - rod; material - copper.
 - Dimensions - For conductor current density 50A/mm² earthing systems.
- Solid joint - Brazed or welded, thermic.
- Disconnecting test joint
 - Square clamp, oblong clamp, plate clamp or screw-down clamp.

2030A TAPE FIXING DEVICES:

- Secure bare conductor tape to structure with fixing devices which avoid piercing tape and ensure 3mm (minimum) clearance of tape from structure, at 450mm maximum, centres.
- Material for lightning protection systems
 - Non-conducting.
- Material for system earthing
 - Bronze.

2040A ROD EARTH ELECTRODES FOR LIGHTNING PROTECTION SYSTEMS:

- Standard - BS EN 62561-2. Form - Roll threaded rod.
- Dimensions
 - Rod Diameter - 15 mm - nominal.
 - Rod Length - 2.4m (2 x 1.2) minimum.
- Earth electrode couplings
 - Use silicon bronze alloy or aluminium bronze alloy, counter bored to completely enclose rod threads. Ensure rods meet in centres of coupling.
 - Use high strength driving cap in contact with driven rod and couplings of compatible material fully enclosing the rod threads.
- Interconnect electrodes using 25 x 3 mm bare copper tape.
- Earth electrodes in drawpits
 - Provide concrete cover, permanently labelled, for electrodes installed through cable drawpit bases.
- Material, minimum size as BS 7430 Table 4
 - Molecularly bonded copper clad steel rods to BS 7430 or BS EN 62305.
- Accessories
 - Rod to tape clamp or U-bolt clamp. Accessories sized to suit earth rod and connector.

2040B ROD EARTH ELECTRODES FOR SYSTEM EARTHING:

- Standard - BS 7430.
- Form - rod with female thread each end.
- Dimensions
 - Rod Diameter - 15 mm - nominal.
 - Rod Length - 2.4m (2 x 1.2) minimum.
- Earth electrode couplings
 - Use high strength driving cap in contact with driven rod and couplings of compatible material fully enclosing the rod threads.
- Interconnect electrodes using bare copper tape 25mm x 6mm.
- Earth electrodes in drawpits
 - Provide concrete cover, permanently labelled, for electrodes installed through cable drawpit bases.

- Main earth conductor connection
 - Connect main earth conductor to first electrode using heavy duty purpose made silicon aluminium bronze body conductor clamp and high tensile phosphor bronze bolt.
- Material, minimum size as BS 7430 Table 4 - Copper.
- Accessories
 - Rod to tape clamp. Sized to suit earth rod and connector.

2040C BUILDING OR STRUCTURAL ELEMENT EARTH ELECTRODES FOR LIGHTNING PROTECTION SYSTEMS:

- Standard - BS EN 62305.
- Form - Building or structural element, as shown on the drawings.
- Interconnect electrodes using 25 x 3 mm bare copper tape.

2040D BUILDING OR STRUCTURAL ELEMENT EARTH ELECTRODES FOR SYSTEM EARTHING:

- Standard - BS 7430.
- Form - Building or structural element, as shown on the drawings.
- Interconnect electrodes using bare copper tape 25mm x 6mm.

2050 EARTH ELECTRODES FOR CATHODICALLY PROTECTED STRUCTURES:

- Provide earth electrode for cathodically protected structures to BS EN 13636 as indicated.

2060A EARTH ELECTRODE CLAMPS:

- Connect tape to electrode head using heavy duty purpose made silicon aluminium bronze body connector clamps or leaded gunmetal body connector clamps, and high tensile phosphor bronze bolts to BS EN 12163.

2070A EARTH ELECTRODE INSPECTION FACILITIES:

- Provide enclosure for each connection between earth conductor and associated earth electrode system. Install so that top is flush with finished ground or floor level. Ensure enclosure provides adequate access for testing purposes. Provide pit details for builders work.
- Labelling - Wording, Earth.

2080A EARTH ELECTRODE TANK PENETRATION SEAL:

- Dimensions
 - Screed depth (mm) 54 minimum.
 - Slab depth (mm) 158 maximum.
 - Flange area (m²) 0.125 minimum.
- Form - Earth rod to tube seal by compression ring and seal.
- Slab former - Standard earth rod pit.

2090A MAIN EQUIPOTENTIAL BONDS:

- Provide main equipotential bonds in accordance with BS 7671.
- Material - Insulated cable, single core to BS 6004.
- Use no joints in main equipotential bonds.

2100A SUPPLEMENTARY EQUIPOTENTIAL BONDS:

- Provide supplementary equipotential bonds to BS 7430, BS 7671 and BS EN 50310. Do not use joints in supplementing bonds.
- Material - Insulated cable, single core to BS 6004.

2110A CIRCUIT PROTECTIVE CONDUCTORS:

- Material
 - Insulated cable, single core to BS 6004 as indicated; metallic screwed conduits (excluding flexible); metallic trunking with tinned copper links; armouring and/or metallic sheathing of armoured cables or integral conductor of multi-core cable.
- Size
 - Provide protective conductors sized in accordance with BS 7671 (IET Regulations) 543.1.4 and Table 54.7.

2120 EARTHING CLAMPS:

- Use clamps complying with BS 951, for bonding pipes and earthing of conductors. For bonding of lead sheathed cables use soldered or spring clamps.

2130A EARTH BUSBARS:

- Material
 - Manufacture earth busbars from hard drawn, tinned, high conductivity copper bar.
- Substation Earth busbar
 - 75 x 13mm cross section 600mm minimum length.
- Main Earth Terminal busbar
 - 25 x 6 mm minimum for incoming live conductor not exceeding 50mm and 50 x 6 mm minimum for incoming live conductor over 50mm².

2140 TEST LINKS:

- Provide two test links, in connections between main earth conductors and earth busbar. Fabricate each from two additional sections of earth busbar. Mount one section on stand-off insulators matching earth busbar; use remaining section as removable test link. Secure 12mm high tensile brass studs to fixed sections of busbar and drill corresponding clearance holes in test links and provide brass washers, nuts and locking devices to secure frame/neutral earthing and test links.

2150 LUGS/TAGS:

- Provide lugs or tags to enable connection of bonding conductors to equipment earth terminals.

2160 PROTECTIVE CABLE TERMINATIONS:

- For bolted connections use crimp type lugs compressed by automatic tool to achieve correct pressure and crimp depth.

2170 PROTECTIVE CONDUCTOR WARNING NOTICES/LABELS:

- Provide a permanent label durably marked in letters 4.75mm minimum height "SAFETY ELECTRICAL CONNECTION - DO NOT REMOVE", in visible position, at each bonding conductor connection to extraneous conductive parts.

2180 MAIN EARTH CONDUCTOR - WARNING TAPES:

- Provide green/yellow PVC tapes labelled "EARTHING CONDUCTOR" over complete external lengths of main earth conductors at 300mm depth below finished ground.

2190 EARTH BAR LABEL:

- Label earth bar "SAFETY ELECTRICAL CONNECTION - DO NOT REMOVE" with wall-mounted laminated plastic tablet engraved in 10mm high red letters on white ground.

3000 WORKMANSHIP

3010 LOW NOISE EARTH DISTRIBUTION:

- Install low noise earth distribution in double insulated cables from earth electrodes to equipment points. Mount all busbars with insulators and separate from other earthing systems.

3020 DISSIMILAR METALS:

- Ensure, where dissimilar metals are used for system, that purpose made jointing materials are used such that corrosion and deterioration of the electrical connection are not caused.
- Ensure bonding connections to other metal parts of building are electrolytically compatible with those metal parts. Use the guidance given in BS 7430 Table 8 when bonding dissimilar materials.

3030# TAPE JOINTS:

- Provide waterproof protection at joints subject to moisture.
- Joint copper tapes by
 - Naval brass bolts or copper rivets (two minimum) and sweat solid whole joint.
 - Brazing, using zinc-free brazing metal with melting point at least 600°C.
 - Thermic welding.
 - Cold pressure welding.
- Joint aluminium tapes by
- Welding to BS EN 1011-4.

3030A COPPER TAPE JOINTS:

- Provide waterproof protection at joints subject to moisture.
- Joint copper tapes by brazing, using zinc-free brazing metal with melting point at least 600°C or thermic welding.

3030B ALUMINIUM TAPE JOINTS:

- Provide waterproof protection at joints subject to moisture.
- Joint aluminium tapes by welding to BS EN 1011-4.

3040 STRANDED CONDUCTOR JOINTS:

- Provide waterproof protection at joints subject to moisture.
- Joint copper stranded conductors with compression joints to BS EN 61284.

3050A PROTECTIVE CABLE TERMINATIONS:

- For bolted connections use crimp type lugs compressed by automatic tool to achieve correct pressure and

crimp depth.

- Make connections between tape and equipment using high tensile grade brass bolts with brass nuts, washers and locking devices. Use phosphor bronze bolts, nuts and washers where connections are liable to corrosion.

3060A EARTH ELECTRODES:

- Location
 - Locate electrodes not less than 2m distant from building/structure protected, and away from telecommunication and pilot cables and metallic fences.
- Driving
 - Drive rods vertically into ground with purpose designed electric hammer. (Where impenetrable strata encountered at shallow depth, drive at 30° to horizontal).
- Depth of rod
 - 2.4m minimum below finished ground surface.
- Depth of Electrode heads
 - Locate electrode heads just below ground level.
- Spacing
 - Where electrodes are installed in a group ensure minimum distance between electrodes is twice depth of rods. Where rods for clean earth are installed ensure distance from any other system rods is six times depth of clean rods.
- Tape Depth
 - Install interconnecting or electrode tape 750mm below finished ground level, rising vertically at each electrode.
- Connect groups of electrodes to main earth conductor via bolted link in inspection pit as BS 7430 for test purposes.

BS APPENDIX

BS 6004:2012

Electric cables. PVC insulated, non-armoured cables for voltages up to and including 450/750 V, for electric power, lighting and internal wiring

BS 7430:2011+A1:2015

Code of practice for protective earthing of electrical installations

BS 7671:2008+A3:2015

Requirements for electrical installations. IET Wiring Regulations. Seventeenth edition

BS 951:2009

Electrical earthing. Clamps for earthing and bonding. Specification

BS EN 1011-4:2000

Welding. Recommendations for welding of metallic materials. Part 4 Arc welding of aluminium and aluminium alloys

BS EN 12163:2011

Copper and copper alloys. Rod for general purposes

BS EN 13636:2004

Cathodic protection of buried metallic tanks and related piping

BS EN 50310:2010

Application of equipotential bonding and earthing in buildings with information technology equipment

BS EN 61284:1998

Overhead lines. Requirements and tests for fittings

BS EN 62561-2:2012

Lightning Protection System Components (LPSC). Part 2 Requirements for conductors and earth electrodes

Y81 TESTING AND COMMISSIONING OF ELECTRICAL SERVICES

1000 GENERAL

1010 INSPECTION AND TEST PROCEDURE:

- Comply with BS 7671 IET Wiring Regulations, IET Guidance Notes Number 3 Inspection & Testing and other British Standards as appropriate.

1020 SUPPLY CHARACTERISTICS:

- Obtain information called for in BS 7671 about supply characteristics from Supplier, other than where to be measured as part of testing procedure.

1030 DESIGN INFORMATION:

- Obtain all design assumptions, calculations and any other information to enable compliance with BS 7671 to be verified.

2000 TESTING

2010A INCORPORATED EQUIPMENT CHARACTERISTICS:

- Obtain and use information from manufacturers of equipment provided.
- Use information provided, for equipment supplied by others and incorporated into installation.

2020A PROSPECTIVE SHORT CIRCUIT CURRENT:

- Determine values of I_p by measurement, unless other means are indicated. Determine I_p at all necessary points within installation to confirm correct equipment selections.
- Obtain from supply undertaker written confirmation of maximum and minimum values of I_p at origin of installation. Adjust subsequent measured values of I_p accordingly.

2030A INITIAL VERIFICATION:

- Carry out detailed inspection to verify the requirements of BS 7671, Section 611 in the order given in clause 611.3.

2040# TEST EQUIPMENT AND CONSUMABLES:

- Provide test equipment and consumables in accordance with BS EN 61557 to complete tests satisfactorily, and to retest any failed installations following corrective measures.
 - Test equipment quality assurance requirements to BS EN ISO 10012.

2040A TEST EQUIPMENT AND CONSUMABLES:

- Provide test equipment and consumables to complete tests satisfactorily, and to retest any failed installations following corrective measures.
 - Test equipment quality assurance requirements to BS EN ISO 10012.

2050A TESTING

- Carry out in the same order as published the tests required by BS 7671, Section 612 for New Installation or Altered or Added Installation as appropriate.

2070A EARTH FAULT LOOP IMPEDANCE:

- Use 25 A test current. Measure and record source impedance (Z_E).
- If alternative LV supply arrangements are available, measure Z_S when using supply with highest impedance.
- Measure Z_S with main equipotential bonding conductors connected. Do not summate values of several parts of each loop.

2080 SETTINGS AND ADJUSTMENTS:

- Confirm characteristics and settings of protective devices are within maximum and minimum specified tripping times. Check correct operation of devices. Confirm interlocks and sequences operate safely and as indicated.

2090A STANDBY GENERATORS:

- Perform works tests on standby generators and provide test certificates. Comply with BS 5000-3 and BS 5000-11 or BS EN 60034-3 as appropriate.

2100A HV AND LV SWITCHGEAR:

- Perform works tests on HV and LV switchgear in accordance with BS EN 62271-200 and BS EN 61439-1, as appropriate, and provide test certificates.

2110A HV POWER TRANSFORMERS:

- Perform works tests on HV power transformers in accordance with BS EN 60076-3, BS EN 60076-4 and BS EN 60076-5. Provide test certificates.
- Perform all routine tests.
- Perform energy efficiency test.

2120A FIRE DETECTION AND ALARM INSTALLATIONS:

- Carry out site testing and inspection and provide test certificates for fire detection and alarm systems in accordance with BS 5839-1.

2120B LIGHTNING PROTECTION INSTALLATIONS:

- Carry out site testing and inspection and provide test certificates for lightning protection installations in accordance with BS EN 62305.

2120C FIRE PROTECTION OF ELECTRONIC DATA PROCESSING INSTALLATIONS:

- Carry out site testing and inspection and provide test certificates for fire protection of electronic data processing installations in accordance with BS 6266.

2120E EMERGENCY LIGHTING INSTALLATIONS:

- Carry out site testing and inspection and provide test certificates for emergency lighting installations in accordance with BS EN 50172.

2130 CALIBRATION:

- Provide current certificates of calibration for all instruments used during test procedures. Record particular instrument identity on record sheets.

2140A CERTIFICATION AND REPORTING:

- Complete and hand over to the Client a Completion and Inspection Certificate to BS 7671 Appendix 6 for New Installation or Altered or Added Installation as appropriate.

2150A INSTALLATION CERTIFICATES:

- Provide installation certificates for electrical installations in accordance with BS 7671 (IET Regulations).
- Record details of departures from BS 7671 (IET Wiring Regulations) on certificate.
- Provide copies of calculations justifying departure from BS 7671 (IET Wiring Regulations) and attach to certificates.

2160 RECORDS:

- Record all results and instrument readings on approved Record Sheets and hand over to the client two copies for each inspection and test.
- Hand over copies of complete Record Sheets to
 - Client.
- Provide copies of Record Sheets
 - 2.

3000 WORKMANSHIP

3010 CONDUCTIVE PARTS:

- Test conductive parts simultaneously accessible with exposed conductive parts of extraneous conductive parts. Establish that they are either not an extraneous conductive part, or that they are reliably connected by metal to main equipotential bonding.
- Confirm conductive parts which are not extraneous conductive parts are separated from earth by an impedance greater than 50,000 Ohms. Confirm other conductive parts are bonded to equipotential zone earthbar by an impedance not exceeding 0.1 Ohms.

3030A HIGH VOLTAGE TESTS:

- Conduct high voltage tests for equipment indicated. Comply with BS 923-1, BS EN 61180 and BS EN 60060-2. Comply with BS EN 61180.

3040A LV BURIED CABLES:

- Test continuity and insulation of buried cables immediately after back-filling. Test continuity and insulation of buried cables prior to handover.

3040B HV AND LV BURIED CABLES:

- Test continuity and insulation of buried cables immediately after back-filling. Test continuity and insulation of buried cables prior to handover. Perform HV tests on buried HV cables prior to handover.

BS APPENDIX

BS 5000-11:1973

Specification for rotating electrical machines of particular types or for particular applications. Part 11 Small-power electric motors and generators

BS 5000-3:2006

Rotating electrical machines of particular types or for particular applications. Part 3 Generators to be driven by reciprocating internal combustion engines. Requirements for resistance to vibration

BS 5839-1:2013

Fire detection and fire alarm systems for buildings. Part 1 Code of practice for design, installation, commissioning and maintenance of systems in non-domestic premises

BS 6266:2011

Code of practice for fire protection for electronic equipment installations

BS 7671:2008+A3:2015

Requirements for electrical installations. IET Wiring Regulations. Seventeenth edition

BS 923-1:1990

Guide on high-voltage testing techniques. Part 1 General

BS EN 50172:2004

Emergency escape lighting systems

BS EN 60034-3:2008

Rotating electrical machines. Part 3 Specific requirements for synchronous generators driven by steam turbines or combustion gas turbines

BS EN 60060-2:1995

High-voltage test techniques. Part 2 Measuring systems

BS EN 60076-3:2013

Power transformers. Part 3 Insulation levels, dielectric tests and external clearances in air

BS EN 60076-4:2002

Power transformers. Part 4 Guide to the lightning impulse and switching impulse testing. Power transformers and reactors

BS EN 60076-5:2006

Power transformers. Part 5 Ability to withstand short circuit

BS EN 61439-1:2011

Low-voltage switchgear and controlgear assemblies. Part 1 General rules

BS EN 62271-200:2012

High-voltage switchgear and controlgear. Part 200 AC metal-enclosed switchgear and controlgear for rated voltages above 1 kV and up to and including 52 kV

BS EN ISO 10012:2003

Measurement management systems. Requirements for measurement processes and measuring equipment

Y82 IDENTIFICATION - ELECTRICAL

1000 GENERAL

2000 PRODUCTS/MATERIALS

2010A LABELS AND NOTICES:

- Apply identification labels and notices in accordance with BS 7671 (IET Wiring Regulations), section 514 to all electrical cables plant and equipment including components of mechanical systems.
- Identification of protective devices.
 - Diagrams, charts or tables to comply with Clauses 514.9 and 560.7.9.
 - Warning notices, voltages in excess of 250 volts.
 - Periodic inspection and test notices.
 - Residual current device notices.
 - Earth electrode safety electrical connection label.
 - Bonding conductor connector point to extraneous conductive parts label.
 - Earth free local equipotential bonding areas warning notice.
 - Electrical separation areas warning notice.
 - Outdoor equipment socket outlet notice.

2020A MATERIALS:

- Use materials for labels and notices with a predicted life equal to or greater than the design life of the electrical cables, plant, equipment or installation to which it refers.
- External
 - Signwritten, or stencil in paint compatible with surface.
 - Colour - Background, plant standard finish. Lettering, white.
- Internal
 - Engraved thermosetting plastic laminate.
 - Colour - Background, white or red. Lettering, red or white.

2030A FIXING - INTERNAL:

- Fix labels and notices using materials compatible with label or notice and surface to which it is fixed by screws into tapped hole or bolted complete with washer nut and locking device.

2040A ARRANGEMENT:

- Obtain approval prior to manufacture, with regard to style, colour, lettering, size and position of all labels and notices.
 - Provide sample showing style, colour, lettering and size, for approval.

2050A LETTERING AND SIZE OF LABELS AND NOTICES:

- Ensure that all lettering and symbols comply with the requirements laid out in BS ISO 3864-1 for height of lettering where not otherwise indicated. Ensure labels and notices of adequate size for the lettering required, and allow a minimum margin around all lettering of one line space vertically and two letter spacing horizontally.
- Font - Helvetica Medium.
- Size - BS EN ISO 7010 or 5mm minimum high letters.

2060A CONDUCTOR ARRANGEMENT:

- Arrange circuit polarity so that phases read in phase rotation order followed by the neutral, if any, from top to bottom in horizontal conductor layouts and left to right in vertical conductor layouts. Ensure flat horizontal arrays have leading phase to the left and neutral to the right from left to right when viewed from supply point. Arrange phase or live pole of two wire apparatus at top or left hand and neutral and earth both at bottom or right hand side. In all cases, ensure conductor arrangements defined are when viewed from front face of all equipment and terminating facilities. Apply identification markers in accordance with BS 7671 (IET Wiring Regulations), section 514 to all conductor termination points.

2070A SAFETY SIGNS:

- Label all electrical plant and equipment using safety sign 8.A.0044 of BS 5499-5 where voltages above ELV exist.
- Provide supplementary or text signs complying with BS 5499-5 with each safety sign 8.A.0044 as indicated.
- Label all electrical plant and equipment with the labels specified in the appropriate British Standards for that plant or equipment.
- Identify each substation and main switchroom with safety sign 8.A.0044 to BS 5499-5 for any fire extinguishing system and notice giving details of,
 - Name of the Substation or switchroom
 - The presence of Medium and Low Voltages.
 - Administrative instructions for access.
 - Location and method of contacting controlling authority.
 - Actions to be taken in an emergency.

2080A PLANT AND EQUIPMENT LABELS:

- Fit labels on all items of plant, equipment, switches, etc., include the following information: service controlled, circuit reference, voltage, type of supply and phase etc., circuit protection type and rating.

2085 GRAPHICAL SYMBOLS FOR USE ON EQUIPMENT IN ACCORDANCE WITH BS EN 80416:

- Graphical symbols for use on equipment to be created and applied in accordance with BS EN 80416-1, BS EN 80416-2, BS EN 80416-3.

2090 MAINTENANCE NOTICES:

- Fix notices giving warning of, and instructions on, any special maintenance procedures to plant and equipment.

2100 COLOUR CORRECTED LIGHT FITTINGS:

- Fix a warning or identification disc to light fittings containing colour corrected fluorescent tubes or other colour corrected light sources to ensure that maintenance staff install the correct lamps.

2110A MOTORS AND STARTERS LABELS:

- Fit identification labels to all motors, starters and starter panels. Ensure positive identification of respective motors and starters. Provide motors with non-corrodible labels attached adjacent to each bearing giving details of the lubricant to be used. Mark direction of normal rotation on motor casing. Provide labels to identify motor equipment fitted with surge suppressors and thermistors stating that insulation test voltages must not be applied to thermistors and thermistor control units. Ensure labelling is compatible with schematic and wiring diagrams, and complies with BS EN 60034-8.

2120A LABELLED ACCESSORY PLATES - ENGRAVED:

- Label accessory plates, including lighting switches, socket outlets and connection units to indicate their use. Label by engraving, lettering 6mm high colour red.

2120B LABELLED FIRE ALARM ACCESSORIES:

- Label fire alarm accessory plates to indicate address. Label using permanent stick on labels, lettering 6mm high colour black.

2120C LABELLED NURSE/PATIENT CALL SYSTEM ACCESSORY PLATES:

- Label nurse/patient call system accessory plates, including bedhead units and call system units.
- Label by engraving, lettering 6mm high colour red.

2130A SWITCHGEAR:

- Fit labels on switchgear to relevant parts of BS EN 61439 and BS EN 60439 to indicate duty of unit, its voltage, phase and current rating, protective device rating size of conductor involved, and all other necessary details.
- Use an agreed serial coding system, provide at the switch a key to the coding system.

2140 DISTRIBUTION BOARDS:

- On each distribution board identify every outgoing way with a renewable circuit chart in a transparent plastic envelope permanently fitted inside distribution board cover. Clearly indicate in typed script, circuit identification number, cable size, fuse or circuit breaker rating and a description of item supplied and area supplied by circuit.

2150A SCHEMATIC DIAGRAMS:

- Provide a purpose made schematic diagram permanently fixed showing the connections of the equipment and plant.
- Locations and materials as indicated in contract preliminaries.

2160A SPECIAL PURPOSE EARTHING:

- Fit labels to special purpose earthing conductors and connection points, describing their purposes and any instructions necessary for their operation and maintenance.
- IT equipment "Clean Earths".
- Telecommunications functional earths as BS 6701.

2170A INDICATOR LAMPS AND PUSH BUTTONS FOR POWER SYSTEMS:

- Use indicator lamp and push button colours in accordance with BS EN 60073.
Indicator lamp
 - Red, danger or alarm; yellow, caution; green, safety.
- Push buttons
 - Red, emergency action; red, stop or off; yellow, intervention; green, start or on.
- Illuminated push buttons - Type a.

2180A CONDUIT AND TRUNKING COLOUR CODING:

- In areas of mechanical plant or voids accommodating mechanical services, or where otherwise indicated, identify electrical conduits and ducts in accordance with BS 1710. Apply colour orange to BS 4800 by painting on service as a band over 150mm or applying an adhesive tape type wrap around services over a length of 150mm.
- Place identification colours at bulkheads, wall penetrations and any other place where identification is necessary.

2190A CABLE IDENTIFICATION:

- Provide all cables, other than final sub-circuit wiring enclosed in conduits or trunking, with labels fixed at each end of cable either side of wall and floor penetrations at approximately 12m intervals at convenient inspection points by means of non-releasable plastic straps, minimum width 4mm.
- Ensure labels show the reference number of cable.

2200A TERMINAL MARKING AND CONDUCTOR IDENTIFICATION:

- Provide for switchgear and control gear elements whose terminals are marked in accordance with BS 5472 (EN 50005) and BS 6272 (EN 50042). Use a unique reference to identify each element in the switchgear or control gear. Mark on or adjacent to each element its reference. Identify each terminal for connection to external wiring or cabling using a reference system complying with BS EN 60445 based on the element reference and the appropriate element terminal reference.
 - Adjacent to terminals.
- Use lettered or numbered ferrules or sleeves to BS 3858 to mark each auxiliary conductor or control cable core with the identity of the terminal to which it is connected and the reference of plant or equipment to which it is connected and the identity of the terminal at the remote end. Ensure that main circuit conductors are identified in accordance with BS 7671 (IET Wiring Regulations) Section 514. Ensure that all identification of terminals and conductors is recorded and included on record drawings and in operation and maintenance documentation.

2210A UNDERGROUND CABLE IDENTIFICATION:

- Identify external underground cable routes by means of approved markers along their length at distances not exceeding 50m and where a change of direction occurs on such routes. Provide cables markers with a brass plate or impress concrete to clearly indicate the reference of group of cables or reference number of cable and operating voltage of cable. Provide key to any reference system used at switchgear. Mark and protect direct buried cables with plastic tape yellow printed black "DANGER ELECTRIC CABLES" elsewhere.

2220A CABLE CONDUCTOR COLOUR CODING:

- Identify cable conductors in accordance with BS 7671 (IET Wiring Regulations) Section 514 and Appendix 7, note that a lighting sub-circuit switch wire is a phase conductor in a single-phase circuit.

2230 CABLE JOINTING AND TERMINATION:

- Connect all cables in the installation so that the correct sequence of phase rotation is maintained throughout. Where straight through joints are approved joint medium voltage conductors as they lie, ensuring their complete length is phased out on completion. Ensure connections at terminations of MV cables are made in the correct phase rotation and ensure cable conductor termination marking if any, complies with this phase sequence. Where straight through joints are approved on low voltage cables, whether power cables or control or auxiliary cables, joint conductors strictly in accordance with their colour or numeric coding. Where such joints are approved on mineral insulated or other non-coded conductor cables, identify each core at the joint and make the joint core to core.

2240A CABLE SHEATH IDENTIFICATION - INTERNAL:

- Use to identify coloured cables sheaths for various services as follows.
 - Fire alarm, red;
 - Clock circuits, brown;
 - Telecommunications, grey;
 - Data as system suppliers requirements;
 - Control, black;
 - LV, black;
 - LV mineral insulated, orange;
 - MV red.
- Code cables for various services using alpha numeric symbols as follows.
 - Code letters preceding cable reference.
 - Fire alarm, FA.
 - Clock, CL.
 - Telecommunications, T.
 - Data, D.
 - Control, C.
 - Low voltage, LV.
 - Extra low voltage, ELV.
 - LV Essential circuits EM.
 - Medium voltage, HV.

2250A CABLE SHEATH IDENTIFICATION - EXTERNAL:

- Identify cable sheaths for various services in accordance with NJUG Guidelines on the Positioning and Colour Coding of Utilities' Apparatus, as follows.
 - MV Red; LV Black; telecommunications and data, Grey.

2250B CABLE SHEATH IDENTIFICATION - EXTERNAL, SCOTLAND:

- Identify cable sheaths for various services in accordance with NJUG Guidelines on the Positioning and Colour Coding of Utilities' Apparatus, as follows.
 - MV Red; LV Purple; telecommunications and data, Grey.

2260A ADDITIONAL SAFETY SIGNS:

- Provide at locations shown or as appropriate safety signs to BS ISO 3864-1.
- Application
 - For main switch and electrical plant room access doors, BS EN ISO 7010 complete with supplementary signs as shown with "Authorised persons only".
 - For use with permit to work systems, BS EN ISO 7010 complete with supplementary signs as shown "Do not operate. Work in progress".
 - For use at each emergency stop, BS EN ISO 7010 complete with supplementary signs as shown "Emergency stop push-button".

BS APPENDIX

BS 1710:2014

Specification for identification of pipelines and services

BS 3858:1992

Specification for binding and identification sleeves for use on electric cables and wires

BS 4800:2011

Schedule of paint colours for building purposes

BS 5472:1977

Specification for low voltage switchgear and controlgear for industrial use. Terminal marking and distinctive number. General rules

BS 6272:1982

Specification for low voltage switchgear and controlgear for industrial use. Terminal marking. Terminals for external associated electronic circuit components and contacts

BS 6701:2010

Telecommunications equipment and telecommunications cabling. Specification for installation, operation and maintenance

BS 7671:2008+A3:2015

Requirements for electrical installations. IET Wiring Regulations. Seventeenth edition

BS EN 60034-8:2007+A1:2014

Rotating electrical machines. Terminal markings and direction of rotation

BS EN 60073:2002

Basic and safety principles for man-machine interface, marking and identification. Coding principles for indicators and actuators

BS EN 60445:2007

Basic and safety principles for man-machine interface, marking and identification. Identification of equipment terminals and conductor terminations

BS EN 80416-1:2009

Basic principles for graphical symbols for use on equipment. Part 1 Creation of symbol originals

BS EN 80416-2:2001

Basic principles for graphical symbols for use on equipment. Part 2 Form and use of arrows

BS EN 80416-3:2002+A1:2011

Basic principles for graphical symbols for use on equipment. Part 3 Guidelines for the application of graphical symbols

BS EN ISO 7010:2012+A5:2015

Graphical symbols. Safety colours and safety signs. Registered safety signs

BS ISO 3864-1:2011

Graphical symbols. Safety colours and safety signs. Design principles for safety signs and safety markings

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:

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

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.

2080 NON-PENETRATIVE SUPPORT SYSTEMS FOR ROOF MOUNTED EQUIPMENT:

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

3000 WORKMANSHIP

3010 DRILLING:

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

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 or, as appropriate, 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.

BS APPENDIX

BS 1210:1963

Specification for wood screws.

Current, Work In Hand, Obsolescent

BS 5080-1:1993

Structural fixings in concrete and masonry. Part 1 Method of test for tensile loading

Contact Details

Enquiries

Name

"Direct Dial"

Email

Visit us online

avisonyoung.co.uk