Meath Heat Pump
Bundle 8

Volume A.2.3 Specification

Part 3 of 4: Standard Clauses

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1 PIPELINES

210.010 GENERAL:

Comply with work section general clauses reference Y10.1000 and those detailed below.

210.020A STEEL PIPES AND FITTINGS:

Type:	Stainless Steel Pipework to IS EN 10217-7
	Used in all areas above ground - 15-108mm
Application:	**Domestic cold water distribution**
Fittings:	15-108mm press fit
Support/fixings:	Up to 50mm - single screw hinged rubber lined zinc plated clip.
	Over 50mm - two piece rubber lined zinc plated clip
Working pressure:	Varies; hydraulic test pressure 7 bar for 1 hour
Working temperature:	10 ^{o}C

Austenitic stainless steel tubes for pressure purposes - Reference Y10.2250A

Carbon & stainless steel compression couplings to BS 4368-1.

Jointing materials:

- Use press fitting jointing system for stainless steel pipe for pressure purposes.
- Jointing equipment for press fitting jointing system - reference Y10.3125

210.020B STEEL PIPES AND FITTINGS:

Type:	Stainless steel pipework to IS EN 10217-7
Application:	**Domestic hot water distribution**
	Used in all areas above ground 15-108mm
Fittings:	15-108mm press fit
Support/fixings:	Up to 50mm single screw hinged rubber lined zinc plated clip.
	Over 50mm two piece rubber lined zinc plated clip
Working pressure:	Varies; hydraulic test pressure 7 Bar for 1 hour
Working temperature:	55-65 ^{o}C

Austenitic stainless steel tubes for pressure purposes - Reference Y10.2250A

Carbon & stainless steel compression couplings to BS 4368-1.

Jointing materials:

- Use press fitting jointing system for stainless steel pipe for pressure purposes.
- Jointing equipment for press fitting jointing system - reference Y10.3125

210.020C STEEL PIPES AND FITTINGS:

Type:	Galvanised steel pipework
Application:	**Compressed air distribution**
	Used for all areas above ground - sizes 15-150mm
Fittings:	screwed, and welded flanged
Jointing:	15-50mm - screwed; 65-150mm - welded and flanged
Supports/fixings:	Up to 50mm - single screw hinged rubber lined zinc plated clip.
	Over 50mm - two piece rubber lined zinc plated clip
Working pressure:	Varies - hydraulic test pressure 7 bar for 1 hour

Carbon steel pipes to IS EN 10255

Fittings, grooved for mechanical joints:

- Galvanised - reference Y10.2080D
- Galvanised cast iron - reference Y10.2080E

Jointing materials:

- Circular flanges - Flanges to IS EN 1092-1 PN16
- Welding flanges - reference Y10.3010A
- Screwed flanges - reference Y10.3010B

Jointing rings for circular flanges:

- Non-metallic flat for flanges to IS EN 1092-1 - reference Y10.3020A
- Non-metallic flat for flanges to IS EN 1092-1 - reference Y10.3020A

Screwed joints to IS EN 10226 - Paste and hemp and PTFE tape - reference Y10.3030A

Union connections - Navy pattern - spherical seating bronze to bronze.

Welding rods - Reference Y10.3050A

210.020D STEEL PIPES AND FITTINGS:

Type:	Black iron steel pipework
Application:	**Natural gas distribution**
	Used for all areas above ground - sizes - 15-200mm
Fittings:	screwed or welded and flanged
Jointing:	15-50mm screwed; 65-200mm welded and flanged
Supports/fixings:	Up to 50mm single screw hinged rubber lined zinc plated clip.
	Over 50mm two piece rubber lined zinc plated clip
Working pressure:	Varies; hydraulic test pressure 2 Bar for 1 hour

Carbon steel pipes to IS EN 10255

Malleable cast iron fittings, screwed

Black - reference Y10.2070A

Jointing materials:

- Circular flanges - Flanges to IS EN 1092-1 PN16
- Welding flanges - reference Y10.3010A

Screwed flanges - reference Y10.3010B
Jointing rings for circular flanges - Non-metallic flat for flanges to IS EN 1092- reference Y10.3020A
Screwed joints to IS EN 10226 - Paste and hemp and PTFE tape - reference Y10.3030A
Union connections - Navy pattern - spherical seating bronze to bronze.
Welding rods - Reference Y10.3050A

210.020E STEEL PIPES AND FITTINGS:

Type:	Black iron steel pipework
Application:	**LPG distribution**
	Used for all areas above ground; sizes - 15-200mm
Fittings:	screwed, or welded and flanged
Jointing:	15-150mm - screwed; 65-200mm - welded and flanged
Supports/fixings:	Up to 50mm - single screw hinged rubber lined zinc plated clip. Over 50mm - two piece rubber lined zinc plated clip
Working pressure:	Varies; hydraulic test pressure 2 bar for 1 hour

Carbon steel pipes to IS EN 10255
Heavy, black - reference Y10.2010A
Malleable cast iron fittings, screwed
Black - reference Y10.2070A
Jointing materials

- Flanges to IS EN 1092-1 PN16
- Welding flanges - reference Y10.3010A

Screwed flanges - reference Y10.3010B
Jointing rings for circular flanges - Non-metallic flat for flanges to IS EN 1092-1 - reference Y10.3020A
Screwed joints to IS EN 10226-1 - Paste and hemp and PTFE tape - reference Y10.3030A
Union connections - Navy pattern - spherical seating bronze to bronze.
Welding rods - Reference Y10.3050A

210.020F STEEL PIPES AND FITTINGS:

Type:	Black Iron Steel Pipework
Application:	**Fuel Oil Distribution**
	Used for all areas above ground, sizes: 15-150mm
Fittings:	screwed, and welded and flanged
Jointing:	15-50mm - screwed; 65-150mm - welded and flanged
Supports/fixings:	Up to 50mm - single screw hinged rubber lined zinc plated clip. Over 50mm - two piece rubber lined zinc plated clip
Working pressure:	Varies; hydraulic test pressure 2 Bar for 1 hour

Steel pipes to IS EN 10255 Medium, black - reference Y10.2010B

Malleable cast iron fittings, screwed
Black - reference Y10.2070A
Jointing materials:

- Circular flanges - Flanges to IS EN 1092-1 PN16
- Welding flanges - reference Y10.3010A
- Screwed flanges - reference Y10.3010B

Jointing rings for circular flanges - Non-metallic flat for flanges to IS EN 1092-1 - reference Y10.3020A
Screwed joints to IS EN 10226-1 - Paste and hemp and PTFE tape - reference Y10.3030A
Union connections - Navy pattern - spherical seating bronze to bronze.
Welding rods - Reference Y10.3050A

210.020G STEEL PIPES AND FITTINGS:

Type:	Black Iron Steel Pipework
Application:	**Low Pressure Hot Water (LPHW) heating distribution**
	Used for all areas above ground, sizes: 15-200+mm
Fittings:	screwed or welded and flanged
Jointing:	15-50mm - screwed;
	65mm and above - welded and flanged
Supports/fixings:	Up to 100mm DST two piece zinc plated clip.
	Over 100mm type 100 split band clip.
Working pressure:	Varies; hydraulic test pressure 7 Bar for 1 hour
Working temperature:	up to 90 ^{o}C

Pipes to IS EN 10255
Medium, black - reference Y10.2010B
Fittings to IS EN 10253-1 or IS EN 10253-2, Medium weight - reference Y10.2060B
Malleable cast iron fittings, screwed
Black - reference Y10.2070A
Jointing materials:
Circular flanges
Flanges to IS EN 1092-1 PN16
Welding flanges - reference Y10.3010A
Screwed flanges - reference Y10.3010B
Jointing rings for circular flanges - Non-metallic flat for flanges to IS EN 1092-1 - reference Y10.3020A
Screwed joints to IS EN 10226-1 - Paste and hemp and PTFE tape - reference Y10.3030A
Union connections - Navy pattern - spherical seating bronze to bronze.
Welding rods - Reference Y10.3050A

210.020H STEEL PIPES AND FITTINGS:

Type:	Carbon Steel Press-fit Pipework System

Application:	**Low Pressure Heating Water (LPHW) heating distribution**
	Used for all concealed areas above ground, sizes: 15-108mm
Fittings:	15-108mm - press fit
Jointing:	15-108mm - press fit
Support/fixings:	Up to 50mm single screw hinged rubber lined zinc plated clip.
	Over 50mm two piece rubber lined zinc plated clip
Working pressure:	Varies: hydraulic test pressure 7 Bar for 1 hour

Carbon steel pipes to IS EN 10255 and IS EN 10305:

- Medium, galvanized - reference Y10.2010C
- Medium, galvanized, grooved ends - reference Y10.2010H

Carbon & stainless steel compression couplings to BS 4368-1.

Jointing materials:

- Use press fitting jointing system for thin walled carbon steel pipe.
- Jointing equipment for press fitting jointing system - reference Y10.3125
- Press fittings for thin walled carbon steel pipe.

Mechanical joints, grooved steel pipes - Reference Y10.3140A

Mechanical joints, plain end steel pipes - Reference Y10.3150A

210.020I STEEL PIPES AND FITTINGS:

Type:	Black Iron Steel Pipework
Application:	**Chilled water distribution**
	Used for all areas above ground, sizes - 15-200+mm
Fittings:	screwed, and welded and flanged
Jointing:	15-50mm - screwed; 65mm and above - welded and flanged
Supports/fixings:	Up to 100mm DST two piece zinc plated clip.
	Over 100mm type 100 split band clip
Working pressure:	Varies; hydraulic test pressure 7 Bar for 1 hour
Working temperature:	6 ^{o}C - 12 ^{o}C

Carbon steel pipes to IS EN 10255. Medium, galvanized, grooved ends - reference Y10.2010H

Carbon steel fittings to IS EN 10253-1 or IS EN 10253-2. Medium weight - reference Y10.2060B

Malleable cast iron fittings, screwed.

Black - reference Y10.2070A.

Jointing materials:

- Circular flanges - Flanges to IS EN 1092-1 PN16
- Welding flanges - reference Y10.3010A
- Screwed flanges - reference Y10.3010B

Jointing rings for circular flanges - Non-metallic flat for flanges to IS EN 1092-1 - reference Y10.3020A

Screwed joints to IS EN 10226-1 - Paste and hemp and PTFE tape - reference Y10.3030A

Union connections - Navy pattern - spherical seating bronze to bronze.

Welding rods - Reference Y10.3050A

210.030A COPPER PIPES AND FITTINGS:

Type:	Copper pipework to IS EN 1057
Application:	**Domestic cold & hot water**
	Used for all areas above ground, sizes 15-159mm
Fittings:	15-54mm - capillary; 67mm and above - brazed
Jointing:	15-54mm - capillary; 67mm and above - brazed
Supports/fixings:	Up to 54mm - single screw hinged rubber lined zinc plated clip.
	Over 54mm - two piece rubber lined zinc plated clip
Working pressure:	Varies; hydraulic test pressure 4 Bar for 1 hour
Working temperature:	10 ^{o}C

Copper pipe, half hard (Class X), Uncoated - reference Y10.2270A

Capillary fittings for copper tubing:

- General potable range - reference Y10.2310A
- Brazed capillary fittings for copper tubing - reference Y10.2322

Jointing materials:

- Brazed joints -Use filler metals to IS EN ISO 17672.
- Capillary joints - For potable water - reference Y10.3070B

210.030B COPPER PIPES AND FITTINGS:

Type:	Copper pipework, chrome plated to IS EN 1057
Application:	**Domestic cold & hot water**
	Used for exposed areas, sizes 15-159mm
Fittings:	15-54mm - capillary; 67mm and above - brazed, chrome plated
Jointing:	15-54mm - capillary; 67mm and above - brazed, chrome plated
Supports/fixings:	Up to 54mm - single screw hinged rubber lined zinc plated clip. Over 54mm - two piece rubber lined zinc plated clip
Working pressure:	Varies; hydraulic test pressure 4 Bar for 1 hour
Working temperature:	10 - 75 ^{o}C

Copper pipe, half hard (Class X)

Chromium plated - reference Y10.2270B

Capillary fittings for copper tubing:

- Chrome plated potable range - reference Y10.2310B
- Brazed capillary fittings for copper tubing - reference Y10.2322

Brazed joints - Use nickel bearing zinc free grades of filler metals to IS EN 1044.

Capillary joints - For potable water - reference Y10.3070B

210.030C COPPER PIPES AND FITTINGS:

Type:	Copper Pipework Press Fit System to IS EN 1057
Application:	**Domestic hot & cold water**
	Used for exposed areas - sizes 15-108mm
Fittings:	15-108mm - press fit
Jointing:	15-108mm - press fit
Supports/fixings:	Up to 54mm single screw hinged rubber lined zinc plated clip.
	Over 54mm two piece rubber lined zinc plated clip
Working pressure:	Varies; hydraulic test pressure 4 Bar for 1 hour
Working temperature:	10 - 90 ^{o}C

Copper pipe, half hard (Class X) - Uncoated - reference Y10.2270A

Press fittings for copper tubing - Copper - reference Y10.2315A

Jointing materials:

- Jointing equipment for press fitting system - reference Y10.3125
- Use press fitting jointing system for copper to IS EN 1057.

210.030G COPPER PIPES AND FITTINGS:

Type:	Phosphorous de-oxidised non arsenical copper pipework in accordance with HTM 02-01 and IS EN 1412:1996 grade CW024A (Cu-DHP).
Application:	**Medical gases distribution**
	Used for exposed areas: sizes 15-159mm
Pipework:	Up to 54mm - BS EN 13348:2001 – R250 (half hard)
	Over 54mm - BS EN 13348:2001 – R220 (annealed)
Fittings:	15-54mm - capillary; 67mm and above - brazed
Jointing:	15-54mm - capillary; 67mm and above - brazed
Supports/fixings:	Up to 54mm - single screw hinged rubber lined zinc plated clip.
	Over 54mm - two piece rubber lined zinc plated clip
Working pressure:	Varies; hydraulic test pressure 7 Bar for 1 hour

Capillary fittings for copper tubing:

- General potable range - reference Y10.2310A
- Brazed capillary fittings for copper tubing - reference Y10.2322

Brazed joints - Use filler metals to IS EN 1044.

Capillary joints - Lead free solder - reference Y10.3070A

210.030H COPPER PIPES AND FITTINGS:

Type:	Copper pipework to IS EN 1057
Application:	**Condensate distribution**
	Used for all areas above ground, sizes 15-159mm
Fittings:	15-54mm - capillary; 67mm and above - brazed
Jointing:	15-54mm - capillary; 67mm and above - brazed

Supports/fixings: Up to 54mm - single screw hinged rubber lined zinc plated clip.
Over 54mm - two piece rubber lined zinc plated clip
Working pressure: Varies; hydraulic test pressure 4 Bar for 1 hour
Working temperature: 10 - 75 ^{o}C
Copper pipe, half hard (Class X) - Chromium plated - reference Y10.2270B
Capillary fittings for copper tubing - Waste system range - reference Y10.2310E
Compression fittings for copper tubing:

- Type A compression fittings - reference Y10.2320A
- Brazed capillary fittings for copper tubing - reference Y10.2322

Jointing materials - Capillary joints - Lead free solder - reference Y10.3070A

210.050A PLASTICS PIPES AND FITTINGS:

Type: PEX plastic pipe-in-pipe systems
Application: **LPHW, domestic hot & cold water**
Used for concealing in solid walls and floors, sizes 15-63mm
Fittings: 15-63mm - press fit
Jointing: 15-63mm - press fit
Supports/fixings: 15-63mm - single screw, hinged, rubber-lined, zinc-plated clip.
Working pressure: Varies; hydraulic test pressure 7 Bar for 1 hour
Working temperature: 10^{o}C - 80^{o}C
Plastics piping systems for water supply:

- Pipes to IS EN 1452 - reference Y10.2455A
- Fittings to IS EN 1452 - reference Y10.2475A

Compression fittings for polyethylene - Reference Y10.2510A
Polyethylene pipe - reference Y10.2520
Polyethylene pipe to IS EN 1555 - reference Y10.2528
Polyethylene fittings - reference Y10.2530
Plastics piping systems for hot and cold water systems within buildings - Crosslinked polyethylene pipes to IS EN ISO 15875 - reference Y10.2597A
Plastics pipes to IS EN ISO 15875:1-7, IS EN ISO 15875-2, IS EN ISO 15875-3 - reference Y10.2705A and IS EN ISO 15875-4 - reference Y10.2705B
Plastics fittings to IS EN ISO 15875:1-7, IS EN ISO 15875-2, IS EN ISO 15875-3 -reference Y10.2706A and IS EN ISO 15875-4 - reference Y10.2706B
Jointing materials:

- Jointing equipment for multi-layer pipe system - reference Y10.3080.
- Jointing materials for plastics pipes to IS EN ISO 15875:1-7
- Compression to IS EN ISO 15875:1-7 - reference Y10.3095A
- Jointing equipment for press fitting jointing system - reference Y10.3125

210.050B PLASTICS PIPES AND FITTINGS:

Type:	Multi-layer composite PE-RT & Aluminium pipework
Application:	**Drinking Water**
	Sizes 15-63mm
	Fittings - 15-63mm metal press fit
	Jointing - 15-63mm metal press fit
Supports/fixings:	single screw hinged rubber lined zinc plated clip
Fluid conveyed:	Cold water
Working pressure:	Varies; hydraulic test pressure 7 Bar for 1 hour
Working temp.:	0 ^{o}C -20 ^{o}C

Layered pipe and fittings for hot and cold water - reference Y10.2430

Jointing materials:

- Jointing equipment for multi-layer pipe system - reference Y10.3080.
- Jointing equipment for press fitting jointing system - reference Y10.3125
- Press fittings for plastic and multi-layered pipe - reference Y10.3133

210.050C PLASTICS PIPES AND FITTINGS:

Type:	Pre-insulated HDPE (PEX) piping system (single & dual)
Application:	**LPHW & Domestic Hot Water**
	Used for underground pipework - sizes 15-150mm
Fittings:	15 - 150mm electro-fused
Jointing:	15 - 150mm electro-fused
Supports/fixings:	Pipework to be buried in trench in accordance with manufacturer's recommendations
Insulation:	Polyurethane foam fully bonded to pipe & covering
Protective Covering:	LDPE c/w UV protection (black)
Working pressure:	LPHW: 0-6 bar, DHW: 0-10 bar
Working temperature:	10 ^{o}C - 90^{o}C

Polyethylene fusion fittings to IS EN 1555 - reference Y10.2538

Jointing materials for plastics pipes to IS EN ISO 12201

Thermal fusion - reference Y10.3095D

210.050D PLASTICS PIPES AND FITTINGS:

Type:	High Density Polyethylene (HDPE) plastic pipe (blue)
Application	**Domestic mains water service**
	Used for external areas, buried. Sizes 15-310mm
Fittings:	15-310mm - electrofusion welding
Jointing:	15-310mm - electrofusion welding

Supports/fixings:	pipework to be buried in trench in accordance with manufacturers recommendations
Working pressure:	0 - 10 bar
Working temperature:	10 °C

Polyethylene to IS EN 12201, Reference Y10.2668A

Jointing materials:

- Jointing materials for plastics pipes to IS EN ISO 12201
- Thermal fusion - reference Y10.3095D

210.050E PLASTICS PIPES AND FITTINGS:

Type	High Density Polyethylene (HDPE) plastic pipe (yellow)
Application:	**Natural Gas & Liquid Petroleum Gas (LPG)**
	Used for external areas, buried, sizes 15-310mm
Fittings:	15-310mm - electrofusion welding
Jointing:	15-310mm - electrofusion welding
Supports/fixings:	pipework to be buried in trench in accordance with manufacturers recommendations
Working pressure:	Varies - pipework to meet system pressure; hydraulic test pressure 7 Bar for 1 hour

Polyethylene pipe to IS EN 1555 - reference Y10.2528

Polyethylene fusion fittings to IS EN 1555 - reference Y10.2538

Polyethylene to IS EN 12201 - Reference Y10.2668A, Reference Y10.2668B

Jointing materials:

- Jointing materials for plastics pipes to IS EN ISO 15875:1-7
- Compression to IS EN ISO 15875:1-7 - reference Y10.3095A
- Pushfit - reference Y10.3095B
- Thermal fusion - reference Y10.3095D

210.050F PLASTICS PIPES AND FITTINGS:

Type:	Plastic PVC-U pipework
Application:	**Internal soils and wastes above ground**
	Up to 75mm dia.
Supports/fixings:	two piece rubber lined zinc plated clip.
Working pressure:	0 - 2 bar
Working temperature:	10 °C - 70°C

Pipes to IS EN 1451-1 and IS EN 15012 - reference Y10.2545A

Fittings to IS EN 1451-1 and IS EN 15012 - reference Y10.2555A

Jointing materials:

- Jointing materials for plastics pipes to BS 7291
- Pushfit - reference Y10.3095B

- Solvent cement - reference Y10.3095C

Solvent cement joints on all pipework in ceiling voids.

Manufacturer's proprietary push fit joints on all pipework above floor level and below ceiling level

210.050G PLASTICS PIPES AND FITTINGS:

Type: PVC-U plastic pipework

Application: **Internal soils and wastes**

above ground - 75mm dia and above.

Supports/fixings: two-piece, rubber-lined, zinc-plated clip.

Working pressure: 0 - 2 bar

Working temperature: 10 °C - 60°C

PVC-U pipes to IS EN 1329-1 - reference Y10.2580A

PVC-U fittings to IS EN 1329-1 - reference Y10.2585A

Jointing materials:

- Jointing materials for plastics pipes to IS EN 1329-1
- Pushfit - reference Y10.3095B
- Solvent cement - reference Y10.3095C

Solvent cement joints on all pipework in ceiling voids.

Manufacturer's proprietary push fit joints on all pipework above floor level and below ceiling level

210.050H PLASTICS PIPES AND FITTINGS:

Type: Polypropylene acid-resistant plastic pipework (black)

Application: **Internal wastes - science laboratories**

above ground - 75mm dia and above.

Supports/fixings: two-piece, rubber-lined, zinc-plated clip.

Working pressure: 0 - 2 bar

Working temperature: 10 °C - 60°C

Polypropylene to IS CEN TS 1852-3 - reference Y10.2540

Polypropylene fittings to IS CEN TS 1852-3 - Reference Y10.2550A

Jointing materials:

- Jointing materials for plastics pipes to IS CEN TS 1852-3
- Pushfit - reference Y10.3095B
- Solvent cement - reference Y10.3095C

Solvent cement joints on all pipework in ceiling voids.

Manufacturer's proprietary push fit joints on all pipework above floor level and below ceiling level

210.080 GENERAL WORKMANSHIP

Appearance - reference Y10.4010

Spacing - reference Y10.4020

Gradients - reference Y10.4030
Air venting requirements - Automatic air vents - reference Y10.4040B
Drain requirements - reference Y10.4050
Expansion and contraction - reference Y10.4060
Pipe fittings - Bends/swept tees - reference Y10.4070A
Fabricated junctions - reference Y10.4080
Fabricated fittings: Non-ferrous - reference Y10.4100
Pipes through walls and floors - reference Y10.4110
Pipe sleeves - reference Y10.4120A
Insulation carried through - reference Y10.4120B
Pipe sleeves through fire barriers - reference Y10.4125
Connect to equipment.
Use distribution headers.
Temporary plugs, caps and flanges - reference Y10.4150A.
Flanged joints general - reference Y10.4160
Dissimilar metals - reference Y10.4170
Pipe rings and clips - reference Y10.4180
Anchors - reference Y10.4190
Slide guides - reference Y10.4200
Pipe supports - reference Y10.4205
Support spacing - reference Y10.4220
Isolation and regulation - reference Y10.4230A
Maintenance and renewal - reference Y10.4240
Clean by removing cement and clean off all pipework and brackets.
Non-ferrous components - thoroughly clean and degrease.

210.090 WORKMANSHIP, STEEL PIPEWORK:
Welding, general: Class 2 - reference Y10.5010B
Welded joints - reference Y10.5020
Painting welded joints - reference Y10.5030
Flanged joints - reference Y10.5040
Screwed joints - reference Y10.5050
Mechanical joints - reference Y10.5060
Anchors - U-bolts - reference Y10.5070A
Press fitting joints - reference Y10.5080
Pipework painting - reference Y10.5090
Installation of stainless steel pipework

- Brazed joints - reference Y10.5120
- Mechanical joints - Y10.5060

210.100 WORKMANSHIP, COPPER PIPEWORK:

Welding general - reference Y10.6010
Compression joints - reference Y10.6030
Brazed joints - reference Y10.6050
Anchors - Saddle clamps - reference Y10.6060B
Mechanical joints, copper pipes - reference Y10.6070
Press fitting system - reference Y10.6080
Push-fit fitting system - reference Y10.6090

210.120 WORKMANSHIP, PLASTIC PIPES:

Solvent welded joints, PVC - reference Y10.8010
Fusion joints, PE - reference Y10.8020
Mechanical fittings, PE - reference Y10.8030
Anchors, PVC - reference Y10.8040
Jointing polybutylene pipes and fittings - reference Y10.8050
Compression fittings on multi-layer pipes - reference Y10.8060
Plastic pipes and fittings with secondary containment - reference Y10.8070

210.130 WORKMANSHIP, BURIED PIPES

Flexible couplings and flange adapters, sleeve type - reference Y10.9010
Protection of buried pipes:

- Unmarked - reference Y10.9040A
- Marked - reference Y10.9040B

Protection of pipes in screed - Sheath with PVC
Corrosion protective tape - reference Y10.9100
Mechanical protective tape - reference Y10.9110
Steelwork painting - reference Y10.9120A

2 PIPELINE ANCILLARIES

211.010 GENERAL:

Comply with work section general clauses reference Y11.1000 and those detailed below.

211.030A STOP VALVES:

Type:	Ball / butterfly valves
Application	**Domestic hot and cold water**
	General isolation above ground, sizes 15mm and above
	15mm to 54mm - ball valve lever type with compression ends 67mm and above - butterfly valve lever type with flanged ends
Operating temp.:	up to 80°C
PN rating:	PN16

WRAS approved.

Kitemark certified.

Pipe material:

- To suit copper tube.
- To suit plastic tube.

Ball type, copper alloy to IS EN 13828:

- Lever operated
- Compression to IS EN 1254-2 - reference Y11.2080D

Butterfly valves to IS EN 593:

- Between flanges to IS EN 1092-2
- Lever operated - reference Y11.2090A

211.030B STOP VALVES:

Type:	Miniball Valve (Ballofix)
Application	**Domestic hot and cold water**
	Final isolation to appliances - 15mm & 22mm
Operating temp.:	up to 65°C
PN rating:	PN16

WRAS approved.

Kitemark certified.

Pipe material - To suit copper tube.

Ball type, copper alloy to IS EN 13828.

Screw driver/key operated - Compression to IS EN 1254-2 - reference Y11.2080B

Chrome plated.

211.030C STOP VALVES:

Type:	Gate valve (sluice valve)
Application:	**Mains water isolation**
	Below ground, sizes - 15mm to 315mm
Operating temp.:	10°C
PN rating:	PN16

WRAS approved.

Kitemark certified.

Pipe material - To suit plastic tube.

Sluice type to IS EN 1074

Key operated type A - reference Y11.2110A

Flanged to IS EN 1092-2, PN 16

N.B. Two tee keys to be provided for each valve type. Each valve to be complete with suitably sized heavy duty surface box suitable for grade A loading. Surface box to complete with SV badging

211.030D STOP VALVES:

Type:	Ball valves, lever operated
Application:	**Natural gas, LPG, fuel oil, LPHW heating, domestic hot & cold water and chilled water isolation**
	15mm to 50mm - screwed ends
	65mm and above - flanged ends
Operating temp.:	up to 90°C
PN rating:	PN16

Kitemark certified.

Pipe material - To suit steel tube

Ball type, copper alloy to IS EN 13828.

Lever operated.

Screwed to IS EN 10226-1 - reference Y11.2080C

Between flanges to IS EN 1092-2.

211.050A DOUBLE REGULATING VALVES:

Type:	Lockable globe valves for balancing
Application	**Domestic hot water return, LPHW and boosted cold water regulation**
	15mm to 50mm - bronze bodied with screwed ends
	65mm and above - cast iron bodied with flanged ends
Operating temp.:	up to 80°C
PN rating:	PN16

WRAS approved.

Kitemark certified.

Pipe material:

- To suit copper tube.
- To suit steel tube.

Globe valves to IS EN 13709,

Copper alloy:

- Screwed to IS EN 10226-1 - reference Y11.2220A
- Flanged to IS EN 1092-2 - reference Y11.2220B

Cast Iron:

- Flanged to IS EN 1092-2 – reference Y11.2220C

211.060A FLOW MEASUREMENT VALVES:

Type:	Commissioning set
Application:	**LTHW heating system proportional balancing & isolation**
	Fixed orifice measuring station close coupled to double regulating valve
	15mm to 50mm - bronze bodied screwed ends
	65mm and above - cast iron bodied flanged ends
Operating temp.:	-5°C to +90°C
PN Rating:	PN16

WRAS approved.

Kitemark certified.

Pipe material - To suit steel tube.

Flow measurement devices to BS 7350:

- Section 3.2 Type 3
    - Copper alloy - Screwed to IS EN 10226-1 - reference Y11.2230A
    - Cast iron - Flanged to IS EN 1092-2 - reference Y11.2230C
- Section 3.2 Type 4
    - Copper alloy - Screwed to IS EN 10226-1 - reference Y11.2230E
    - Cast iron - reference Y11.2230G

211.080 TEST PLUGS:

Type:	Pipe plug
Application	**LTHW heating and chilled water systems**
	Provide on either side of all strainers and inlet and outlet connections to all plant and equipment

Self-sealing test points - reference Y11.2670A

Valve controlled test points - reference Y11.2670B

211.091A RADIATOR VALVES:

Type:	Manually operated copper alloy radiator valves

Application: **LTHW heating radiator isolation**

Kitemark certified.

Type 4 - reference Y11.2260A

Finish - Chromium plated.

211.095 RADIATOR VALVES:

Type: Manually operated lockshield radiator valves

Application **LTHW heating radiator presetting and isolating**

Kitemark certified.

Type 4 - reference Y11.2260A

Finish - Chromium plated.

211.100A PIPELINE STRAINERS:

Type: Y-pattern strainers

Application: **Domestic hot & cold water and LPHW systems**

Installed on inlet connections to all plant, equipment and water meters and as indicated on drawings

Bronze - Flanged to IS EN 1092-3 - reference Y11.2680BB

Cast iron - Flanged to IS EN 1092-2 - reference Y11.2680D

211.100B PIPELINE STRAINERS:

Type: Oil cartridge filter

Application: **Fuel oil systems**

Installed on main pipework serving oil burners

Bronze reference Y11.2680A

Flanged to IS EN 1092-3 - reference Y11.2680B

211.111 THERMOSTATIC RADIATOR VALVES TO IS EN 215:

Type: Self-regulating radiator valve

Application: **LPHW radiators**

To be installed on the flow connection

Kitemark certified.

Table A.1 - Series D - reference Y11.2270A

Pattern – Straight (Angle only where space restrictions apply)

211.120 TUNDISHES:

Application: **LPHW heating and domestic hot & cold water systems**

Copper - reference Y11.2690A

Mild steel, galvanized - reference Y11.2690B

211.130 FLOAT OPERATED VALVES:

Type: Ballcock / ball tap / float valve

Application: **Cold water storage tank inlet control**

Operating temp.: 10°C

WRAS approved.

Kitemark certified.

WRc approved.

To BS 1212 - Piston type 1

Copper float - reference Y11.2280A

Plastic float - reference Y11.2280B

211.140A GAUGES:

Type Temperature gauge

Application: **Domestic hot & cold water, chilled water and LPHW heating systems.**

To be installed on:

Hot water storage cylinders and calorifiers

Cold water storage tanks (each compartment) and as indicated on drawings.

LPHW sub-circuit flow and return pipework

Main LPHW header flow and return pipework

Inlet and outlet connections to heater batteries and as indicated on drawings.

General - reference Y11.2700A

150mm black stove enamel finish

Direct mounting - reference Y11.2700C

211.140B GAUGES:

Type: Pressure gauge (0-6 bar)

Application: **LPHW heating, boosted cold water and chilled water systems.**

To be installed on:

Inlet and outlet connections to all pumps and as shown on drawings

Inlet and outlet connections to heater batteries

General - reference Y11.2700A

150mm black stove enamel finish

Direct mounting - reference Y11.2700C

Pressure and altitude gauges - reference Y11.2720

211.150A CONTROL VALVES:

Type: Actuated ball valves

Application **Domestic cold water, LPHW heating and chilled water systems.**

To be installed on:

- Cold water supplies to toilet areas controlled via PIR and as indicated on drawings
- Modulated radiator circuits
- Zoned circuits
- Constant temperature circuits serving radiant panels, heater batteries, calorifiers and underfloor heating manifolds and as indicated on drawings
- Circuits serving cooling coils and as indicated on drawings

WRAS approved.

Kitemark certified.

Further details provided on equipment schedule where appropriate.

Ball control valves:

- Two way - reference Y11.2315B
- Three way - reference Y11.2315C

211.170A CHECK VALVES:

Type:	Non-return / swing check valve
Application:	**LPHW heating, chilled water and domestic hot & cold water systems**
	15mm to 50mm - screwed ends
	65mm and above - flanged ends
To be installed on:	connections to all plant items and mains water connections to all appliances
	LPHW heating return header connections
	Downstream of all pumps in twin pump set arrangements
Operating temp.:	up to 90°C
PN rating:	PN16

WRAS approved.

Kitemark certified.

Pipe material:

- To suit copper tube.
- To suit plastic tube.
- To suit steel tube

Swing check type to IS EN 1074-3:

- Screwed to IS EN 10226-1 - reference Y11.2320A

Check valve to IS EN 12334.

Swing check.

Flanged - reference Y11.2330A

Wafer body - reference Y11.2330B

211.170B CHECK VALVES:

Type: Non-return / swing check valve

Application: **Fuel oil distribution systems**
To be installed on all pump discharge connections
PN rating: PN16
WRAS approved.
Kitemark certified.
Pipe material:

- To suit copper tube.
- To suit plastic tube.
- To suit steel tube.

Check valve to IS EN 12334.
Swing check.
Flanged - reference Y11.2330A
Wafer body - reference Y11.2330B

211.180 WORKMANSHIP:
Installation - reference Y11.4010
Location - reference Y11.4020
Location of thermostatic radiator valves - reference Y11.4025
Positioning of components:

- Flow/pressure measurement valves - reference Y11.4030
- Double regulating variable orifice valves - reference Y11.4040

Install control ball valves in accordance with manufacturer's recommendations.
Provide outlets of vent cocks with discharge pipes.
Valve stuffing boxes - reference Y11.4070
Discharge connections:

- Safety and Relief valves - reference Y11.4080A
- Vent cocks - reference Y11.4080B
- Air bottles - reference Y11.4080C
- Automatic air vents - reference Y11.4080D

Expansion devices - reference Y11.4090
Expansion compensators - reference Y11.4100
Flexible connections installation - reference Y11.4110
Terminal unit connections - install hose connections strictly in accordance with manufacturer's instructions.

211.200A DIRECT ACTING SAFETY VALVES TO IS EN ISO 4126-1:
Type: Spring loaded pressure relief valve

Application: **Pressurised domestic hot & cold water and LPHW heating systems**
To be installed as indicated on drawings
PN rating: PN16
Copper alloy - Double spring - reference Y11.2430B
Cast iron - Double spring - reference Y11.2430D

211.210 DRAIN COCKS:
Application: **Domestic water systems, LPHW heating systems and chilled water systems**
To be installed on all system low points and isolated side of all connections to plant items
WRAS approved.
Kitemark certified.
Throughway gland cock type - reference Y11.2440A
Ball type - reference Y11.2460

211.230 AUTOMATIC AIR VENTS:
Application: **Domestic hot & cold and LPHW heating systems**
Provide on all system high points
Float type - reference Y11.2510A

211.240 DEAERATORS AND SEPARATORS:
Application: **LPHW heating and chilled water systems**
To be installed as indicated on drawings
Gravitation dirt separators - reference Y11.2522A

211.260A EXPANSION ARRANGEMENTS/DEVICES:
Type: Expansion loops & bellows
Application: **Thermal expansion of domestic hot water and LPHW heating pipework**
To be installed on all straight runs of 10m and greater and as shown on drawings
15mm to 50mm - screwed ends
63mm upwards - flanged ends
PN rating: PN16
Expansion loops: Steel - reference Y11.2610A
Expansion compensators: Axial bellows
Screwed to IS EN 10226-1 - reference Y11.2630A
Flanged to IS EN 1092-1 - reference Y11.2630B

211.260B EXPANSION ARRANGEMENTS/DEVICES:
Type: Flexible couplings

Application:	**Domestic hot & cold water, LPHW heating, fuel oil and chilled water systems**
	To be installed on all pump and equipment terminal connections
	15 to 50mm - screwed ends
	63mm upwards - flanged connections
PN rating:	PN16
Flexible connections:	EPDM rubber, up to 100^{o}C

Flanged to IS EN 1092-1 - reference Y11.2650A

Screwed to IS EN 10226-1 - reference Y11.2650B

Terminal unit connections:

- Heating services - Rubber - reference Y11.2660C
- Chilled water services - Rubber - reference Y11.2660F

3 PUMPS

220.010 GENERAL:

Comply with work section general clauses reference Y20.1000 and those detailed below.

Provide pumps as schedule reference - equipment schedule

220.030 PUMP:

Centrifugal pumps:

- Horizontally mounted belt driven. Reference Y20.2010A
- Vertically mounted belt driven. Reference Y20.2010B
- Close coupled. Reference Y20.2010C
- Direct drive in-line. Reference Y20.2010D
- Direct drive, immersed rotor. Reference Y20.2010E
- Variable flow control - reference Y20.2015

220.040 PUMP MOTOR DRIVE - ELECTRIC:

Comply with reference section general clauses reference Y92.1000 and those detailed below.

Electrical supply to IS EN 50160 - Single phase or Three phase as indicated in equipment schedule.

Surge suppressors: Manufacturer fitted - reference Y92.1040A

Transient suppressors: Manufacturer fitted - reference Y92.1050A

Operating conditions: Standard operating conditions - reference Y92.2010A

Motors:

- General - Reference Y92.2020
- Slide rails - Reference Y92.2030
- Plinths - Reference Y92.2040

Motor efficiency - Class Eff 1 - reference Y92.2025A

Motor rating:

- Up to and including 0.75kW - reference Y92.2050A
- Above 0.75kW up to and including 4kW - reference Y92.2050B
- Above 4kW squirrel cage, drip-proof - reference Y92.2050C
- Above 4kW wound rotor, drip-proof - reference Y92.2050D
- Above 4kW squirrel cage, totally enclosed - reference Y92.2050E
- Above 4kW wound rotor, totally enclosed - reference Y92.2050F
- Above 4kW squirrel cage, smokespill - reference Y92.2050G
- Above 4kW squirrel cage, energy efficient design - reference Y92.2050H

Motors - over temperature protection - Thermistors - reference Y92.2060A

Drives:

- Indirect drives:

    - Toothed belt - reference Y92.2070A
    - Flat belt - reference Y92.2070B
- Direct coupled drives - reference Y92.2080A
- Variable speed drive - reference Y92.2085
- Guards - reference Y92.2090A

220.060 WORKMANSHIP:

General - reference Y20.4010

Pipeline connections - reference Y20.4020

Mount motors and pumps for belt drive pumps resiliently.

Alignment - reference Y20.4040

Access - reference Y20.4050

Maintenance requirements for sewage pumps - reference Y20.4060

4 HEAT EXCHANGERS

222.010 GENERAL:

Comply with work section general clauses reference Y22.1000 and those detailed below.

Supply heat exchangers as schedule reference - equipment schedule

222.020 CALORIFIER TO BS 853:

Application: **Domestic Hot Water Generation**

Copper calorifier - reference Y22.2010B

Aluminium protector rod

Thermal insulation: Provide heat exchanger pre-insulated at manufacturer's works.

Spares - reference Y22.3020A

222.030 HEAT EXCHANGER:

Type: Tubular Heat Exchanger

Application: **Domestic Hot Water Generation**

Heat exchanger to BS 3274:

- Type 1 - reference Y22.2020A
- Type 2 - reference Y22.2020B
- Type 3 - reference Y22.2020C

Alignment facilities - Fit eye bolts to tube frame for ease of lifting.

Condense cooler - reference Y22.2030A

Thermal insulation - reference Y22.3010A

Spares - reference Y22.3020A

222.040 PLATE HEAT EXCHANGERS:

Type: Packaged LTHW to Water Instant Hot Water System

Application: **Domestic Hot Water Generation**

Duty as schedule reference - equipment schedule

222.050 WORKMANSHIP

General - reference Y22.4010

Flange drillings - ensure flange drillings are uniform to facilitate interchange of tube assemblies.

Protection and cleaning - reference Y22.4030

Inspection - reference Y22.4040

Rust protection - reference Y22.4050

5 STORAGE CYLINDERS AND CALORIFIERS

223.010 GENERAL:

Comply with work section general clauses reference Y23.1000 and those detailed below.

Provide storage cylinders and calorifiers as schedule reference - equipment schedule

223.030 STEEL DIRECT CYLINDERS:

Application: **Domestic Hot Water Generation & Storage**

BS 417-2

Supply insulation jacket to BS 5615

Reference Y23.2010A

With immersion heater - reference Y23.2010B

223.040 DIRECT COPPER CYLINDERS:

Application: **Domestic Hot Water Generation & Storage**

BS 1566-1

Provide insulation jacket to BS 5615.

Reference Y23.2020A

With immersion heater - reference Y23.2020B

223.050 COPPER DOUBLE FEED INDIRECT CYLINDERS:

Application: **Domestic Hot Water Generation & Storage - Solar Thermal Systems**

BS 1566-1

DF C type reference

Provide insulation jacket to BS 5615.

Gravity fed and pumped systems - reference Y23.2030A

Gravity fed and pumped systems with immersion heater - reference Y23.2030B

Side entry.

Pumped systems only - reference Y23.2030C

Pumped systems only, with immersion heater - reference Y23.2030D

223.060 COPPER SINGLE FEED INDIRECT CYLINDERS:

Application: **Domestic Hot Water Generation & Storage**

BS 1566-2

SF type reference 9E.

Provide insulation jacket to BS 5615.

Primary coil type C - reference Y23.2040A

Primary coil type C with immersion heater - reference Y23.2040B

Side entry

223.070 STAINLESS STEEL FEED INDIRECT CYLINDER:

Application: **Domestic Hot Water Generation & Storage**

Reference Y23.2045A

223.090 CALORIFIER AND STORAGE VESSELS TO BS 853:

Application: **Domestic Hot Water Generation & Storage**

Copper - reference Y23.2060B, Aluminium protector rod

Secondary circuit – Vented or Unvented as per requirements of equipment schedule

Independent inspection requirements:

- Welding as BS 853 clause 6.1.
- Factory inspection as BS 853 clause 11.2.

Factory applied insulation - Insulation jacket to BS 5615

223.110 WORKMANSHIP:

General - reference Y23.3010

Flange drillings - ensure flange drillings are uniform to facilitate interchange of tube assemblies.

Protection and cleaning - reference Y23.3030

Inspection and cleaning - reference Y23.3040

6 CLEANING AND CHEMICAL TREATMENT

225.010 GENERAL:
Comply with work section general clauses reference Y25.1000 and those detailed below.

225.020 CLEANING AND CHEMICAL TREATMENT SPECIALIST:
Reference Y25.2010

225.030 MAINS WATER ANALYSIS:
Reference Y25.2020A

225.040 PRELIMINARY CHECKS:
Reference Y25.2030A

225.050 PROCEDURAL PRECAUTIONS:
Reference Y25.2040A
Including taking samples - reference Y25.2040B

225.060 CHEMICAL INJECTION AND DOSING METHODS:
Method of introducing chemicals into closed systems - reference Y25.2060A
Method of introducing chemicals into open recirculating systems - reference Y25.2060B
Packaged plant - reference Y25.2060C
Dosing for closed systems - reference Y25.2060D
Dosing for open systems - reference Y25.2060E
Dosing chemicals - reference Y25.2065

225.070 MONITORING AND SAMPLING:
Monitoring - reference Y25.2070A
Sampling - reference Y25.2070B
Sampling kits - reference Y25.2070C

225.080 CHEMICAL PROVISION:
Standard arrangement - reference Y25.2080A

225.085 AVOIDANCE OF STAGNANT WATER IN PRESSURISATION UNIT EXPANSION VESSELS:
Reference Y25.2090

225.090 FLUSHING:
BSRIA Application Guide 1/2001 - reference Y25.3010A

System filling - Temporary connection from mains in compliance with the Water Supply (Water Fittings) Regulations 1999, and the Water Supply (Water Fittings) (Amendment) Regulations 1999.

Flushing - reference Y25.3010B

Flush system until discharge water is clear and free from stones or other rubble.

225.100 PURGING:

Testing and purging gas pipework:

- Industrial and commercial installation - reference Y25.3020A
- Small low pressure industrial and commercial installations - reference Y25.3020B

Testing gas pipework to IS EN 12327 - reference Y25.3020C

225.110 CHEMICAL CLEANING AND SOLIDS REMOVAL:

BSRIA Application Guide 1/2001

Formulated products - reference Y25.3030B

225.120 STERILIZATION:

General - reference Y25.3040

Mains water system - reference Y25.3050

Water storage systems - reference Y25.3060

225.140 SERVICE VISITS:

Reference Y25.3080

Special requirements:

- Adopt procedures as indicated in HSE National Guidelines for the Control of Legionellosis in Ireland, 2009.
- Include for 6 visits during the first 2 months commissioning.
- Provide one annual review of system.
- Include for carrying out all necessary maintenance and inspections during the first twelve months following the agreed date of practical completion.
- Use only fully qualified operatives for any maintenance carried out.

225.150 DOCUMENTATION:

Reference Y25.3090

7 THERMAL INSULATION

250.010 GENERAL:

Comply with work section general clauses reference Y50.1000 and those detailed below.

250.015 ZERO GLOBAL WARMING POTENTIAL (GWP):

Use insulating materials with a Global Warming Potential (GWP) of zero.

250.017 ZERO OZONE DEPLETION POTENTIAL (ODP):

Use insulating materials with an Ozone Depletion Potential (ODP) of zero.

250.018 F GAS REGULATION:

Use insulating materials that comply with EC Regulation 842/2006 The F Gas Regulation, on certain fluorinated greenhouse gases.

250.019 OZONE REGULATION:

Use insulating materials that comply with EC Regulation 1005/2009 The Ozone Regulation, on substances that deplete the ozone layer.

250.020 INSTALLER SELECTION:

Use a contractor specialising in the supply and installation of thermal insulation.

Use thermal insulation materials supplied by a manufacturer assessed and registered in accordance with IS EN ISO 9000-2.

250.040 CLOSED CELL MATERIALS THERMAL INSULATION - PIPEWORK:

Application: All pipework services

European Classification for Reaction to Fire Performance

Class A1 - reference Y50.1035A

Spread of flame as BS 476-7 - Reference Y50.1050A

Smoke emission characteristics - Reference Y50.1055A

Electrical bonding terminal - reference Y50.1080

Inspection and testing - reference Y50.1090

Thermal conductivity - reference Y50.2010

Thermal performance life expectancy for plant design life - reference Y50.2015A

Restrictions on use of materials - reference Y50.2020

Closed cell rigid phenolic foam (PF) preformed sections:

- Obtain written confirmation from the manufacturer that the material is CFC and HCFC free.
- Foil faced - reference Y50.2110A
- Reference Y50.2110B

Vapour barrier permeance - Reference Y50.2170A

Vapour barrier coatings:

- Vinyl - reference Y50.2180B
- Solvent polymers- reference Y50.2180C

Adhesives - reference Y50.2190

Protection:

- Application: **all pipework installed in boilerhouses, plantrooms and externally**
- Aluminium sheeting - reference Y50.2200E

Valve and flange insulation:

- Application: **all valves installed in boilerhouses, plantrooms and externally**
- Aluminium casing - reference Y50.2220A
- Cold applications - reference Y50.2220D

Thickness table: Insulation thickness calculation methods - reference Y50.2285

Non-domestic hot water service areas - reference Y50.2300

Non-domestic heating installations - reference Y50.2320

Chilled and cold water supplies to prevent condensation

- High emissivity - reference Y50.2360
- Low emissivity - reference Y50.2380

Chilled water services:

- Phenolic foam - reference Y50.2400
- Protection against freezing: Phenolic foam - reference Y50.2430

Thickness of insulation to BS 5422.

250.060 MINERAL FIBRE THERMAL INSULATION - DUCTWORK:

Type: Fibreglass foil-backed sheeting

Application: **Circular ductwork**

European Classification for Reaction to Fire Performance: Class A1 - reference Y50.1035A

Spread of flame as BS 476-7 - Reference Y50.1050A

Smoke emission characteristics - Reference Y50.1055A

Electrical bonding terminal - Reference Y50.1080

Inspection and testing - Reference Y50.1090

Thermal conductivity - Reference Y50.2010

Thermal performance life expectancy for plant design life - Reference Y50.2015A

Restrictions on use of materials - reference Y50.2020

Mineral fibre duct insulation: Flexible, foil faced - Glass mineral fibre reference Y50.2050B

Vapour barrier coatings:

- Vinyl - reference Y50.2180B
- Solvent polymers- reference Y50.2180C

Adhesives - reference Y50.2190

Protection:

- Application: all circular ductwork installed in plantooms and externally
- Aluminium sheeting - reference Y50.2200E

Thickness table:

- Insulation thickness calculation methods - reference Y50.2285
- Environmental thickness on warm air ductwork- reference Y50.2450
- Condensation control on chilled air ductwork - reference Y50.2460
- Thickness of insulation to BS 5422.

250.070 CLOSED CELL MATERIALS THERMAL INSULATION - DUCTWORK:

Type: Phenolic foam slabs

Application: **All rectangular ductwork**

European Classification for Reaction to Fire Performance:

- Class A1 - reference Y50.1035A
- Class C - reference Y50.1035D
- Spread of flame as BS 476-7 - Reference Y50.1050A
- Smoke emission characteristics - Reference Y50.1055A

Electrical bonding terminal - Reference Y50.1080

Inspection and testing - Reference Y50.1090

Thermal conductivity - Reference Y50.2010

Thermal performance life expectancy for plant design life - Reference Y50.2015A

Restrictions on use of materials - reference Y50.2020

Closed cell rigid phenolic foam (PF) slab:

- Obtain written confirmation from the manufacturer that the material is CFC and HCFC free.
- Foil faced - reference Y50.2120A
- Reference Y50.2120B

Vapour barrier coatings:

- Vinyl - reference Y50.2180B
- Solvent polymers- reference Y50.2180C

Adhesives - reference Y50.2190

Protection:

- Application: **All rectangular ductwork installed in plantrooms and externally**
- Aluminium sheeting - reference Y50.2200E

Reinforcement: Aluminium bands

- 300mm centres - reference Y50.2210A
- 450mm centres - reference Y50.2210B

Thickness table:

- Environmental thickness on warm air ductwork - reference Y50.2450
- Condensation control on chilled air ductwork - phenolic foam - reference Y50.2470
- Insulation thickness calculation methods - reference Y50.2285

- Thickness of insulation to IS 289.

250.090 WORKMANSHIP PIPEWORK INSULATION:

General - reference Y50.3010

Installation of foil faced phenolic foam insulation - reference Y50.3030

Installation of protection:

- Polyisobutylene (PIB) - reference Y50.3120
- Aluminium sheeting - reference Y50.3170
- Flanges and valves - reference Y50.3210

Installation where insulation is carried through pipeline support - Reference Y50.3230A

Closed cell insulation - reference Y50.3230B

Liquid vapour barriers - reference Y50.3260

Integrity of vapour barriers - reference Y50.3270

250.100 WORKMANSHIP DUCTWORK INSULATION:

General - reference Y50.3010

Installation of foil faced semi-rigid slab insulation - reference Y50.3060

Installation of foil faced flexible insulation - reference Y50.3070

Installation of protection: Polyisobutylene (PIB) - reference Y50.3120

Aluminium sheeting - reference Y50.3170

Installation where insulation is carried through ductwork support - reference Y50.3250

Liquid vapour barriers - reference Y50.3260

Integrity of vapour barriers - reference Y50.3270

8 TESTING AND COMMISSIONING OF MECHANICAL SERVICES

251.010 GENERAL:

Comply with work section general clauses reference Y51.1000 and those detailed below.

251.030 STATIC TESTING:

Application: This section of the specification details the requirements for testing and pre-commissioning of the plant, equipment and systems.

The testing of systems under the various sections of the specification may be required to be carried out in parts or as a whole.

All pressure tests as specified shall be carried out before the application of thermal insulation, except where this procedure may prejudice the completion of the installation and approval is given in by the Contract Administrator, which case the sections concerned shall be individually tested before the application of insulation.

Before any installation is subjected to site testing or commissioning it shall be thoroughly cleaned both internally and externally.

Any test result applicable to a partially complete system will not be considered for acceptance.

Testing and pre-commissioning of each individual system shall be complete and certified, by the Commissioning Manager prior to the commencement of commissioning.

Tests

The following tests shall be carried out as appropriate:

- Works tests of plant items.
- Air leakage tests of ductwork.
- Inspection of pipework welds.
- Non-destructive testing of pipework welds.
- Water flushing of pipework.
- Hydraulic tests of pipework.

Water Flushing of Piped Services

The distribution systems shall be completely clear internally of any obstructions, debris and superfluous matter, prior to any test being applied and also upon its completion.

Systems shall be flushed in accordance to the procedures set out in the BSRIA Application Guide 1/89 'Flushing and Cleaning of Water Systems'.

Once the systems have been thoroughly cleaned, the hydraulic static pressure test shall be applied.

Hydraulic Testing Of Piped Services

Hydraulic testing of piped services systems, or any section of a completed system, shall be completed prior to the application of any thermal insulation to the pipe surfaces.

All plugs, caps, tees and drain fittings required to enable the tests to be carried out shall be supplied.

Tests on lengths of pipe or portions of systems shall be applied by filling the section to be tested with water and raising its pressure to twice the working pressure, or 5 bar g whichever is the greater.

The section shall then be left fully isolated without further strokes of the pump and all joints shall remain watertight for a period of at least two hours.

Any fault discovered during such tests shall be at once remedied and the test re-applied until the Engineer is satisfied that the section under test is sound. Remedial work shall conform with all the requirements of the specification for materials and standards of workmanship.

On completion of the test, the water shall be released and drained away as rapidly as possible, into the appropriate drain, using pumping plant if necessary. The section shall then be thoroughly sluiced through to ensure the removal of as much dirt and dross as possible before being refilled and put into service.

Particular care shall be taken to ensure that all parts liable to damage such as pumps, control valves, etc, are adequately protected and hydraulically isolated, where necessary from the pipework test. Care shall be taken to ensure all coils and pipework that are liable to frost damage are drained down.

Pressure testing

General - reference Y51.2010

Water circulating and supply systems and steam and condense lines - reference Y51.2020

Water mains - Reference Y51.2040

Fire risers - Reference Y51.2050

Refrigerant pipework:

- Strength pressure test - Reference Y51.2055A
- Leak test - Reference Y51.2055B

Deep vacuum test - Reference Y51.2055C

Oil pipework - Reference Y51.2065

Piped medical gases - Reference Y51.2070

Soil, waste, ventilation, anti-syphon and rainwater pipework - Reference Y51.2080

Underslab drainage - Reference Y51.2090

Vacuum testing - Reference Y51.2100

Provide an air compressor and subject the pipework to sectional testing by air at low pressure (not exceeding .5 bars) before commencing any flushing or testing with water.

On completion of all cleaning, flushing and air testing operations, recharge each system with clean water and subject them to sectional hydraulic tests of one and a half times the working pressure.

There is to be no loss of pressure for a period of not less than 30 minutes for each test.

Preparation for Commissioning

Commissioning shall not commence until the installation has been tested for integrity and completeness, correctly and adequately cleaned, has been subjected to pre-commissioning checks and signed off by the Commissioning Manager as being ready and suitable for the commencement of commissioning.

Four weeks prior to the programmed commencement of the commissioning period, the Contract Administrator shall be provided with a report on the state of the project. This shall detail all works which affect the commissioning and performance testing. This shall include the cleanliness of the site and provision of access to and from services, if scaffolding or ladders are required.

Inspection visits by all suppliers of all items of plant shall be arranged to ensure that the plant has been installed strictly in accordance with the supplier's own recommendations, that the plant or equipment is not damaged or misaligned in any way and that it is ready and safe to operate. The suppliers shall ensure that all necessary installation and operating instructions are attached to the plant and that further copies are handed to the Commissioning Manager who shall be present during their visit. All defects and outstanding works shall be enumerated in report form which shall include a standard check list.

Full support services shall be available at the commencement of Commissioning.

These shall include but not be limited to:

- Design data such as air and water flow rates
- Power and fuel supplies
- Proven external controls and safety interlocks
- Provision for load testing
- Functional schematics
- Plant schedules
- Test certificates
- Performance curves
- Wiring diagrams
- Panel wiring diagrams
- Control schematics
- Control equipment schedules
- Current working drawings

At the completion of commissioning all strainers shall be cleaned and clean filter media shall be installed on all air systems.

Acoustic Tests

Tests shall be carried out to prove the system meets the acoustic performance set out in this specification.

Sound level readings shall be taken using a sound analyser to provide an octave band analysis of the sound spectrum and to determine the frequency values of peak sound levels or 'annoyance' frequencies.

The spaces in which the readings shall be taken shall be approved by the Contract Administrator.

Test Equipment

All necessary apparatus for conducting tests on the installations shall be provided by the individual companies responsible for testing and commissioning.

A list of the equipment which is proposed for use in the testing and commissioning of the services shall be submitted for approval.

All instruments that require periodic re-calibration shall be re-calibrated before work is commenced. If instruments require to be rechecked for accuracy during the commissioning period, this re-calibration shall be carried out. Finally the instruments shall have a calibration check at the completion of the commissioning.

All calibration certificates shall be submitted and checked by the Commissioning Manager who shall then issue the certificates to the Contract Administrator.

Data sheets shall be submitted on each test instrument to be used, indicating the manufacturer's name, model number, serial number, latest date of calibration, and correction factors.

If the installation of additional equipment will facilitate the carrying out of the commissioning works, approval shall be obtained Contract Administrator before proceeding to install any such equipment.

No such equipment shall be left in the system after completion of the testing and commissioning work without approval.

Tolerances

Unless otherwise stated all tolerances shall be as stated in the relevant Commissioning Codes specified.

On water distribution systems the pump shall provide 100% (one hundred percent) of its design duty and the tolerance allowed shall be +10%/-0% (plus ten percent and minus nil percent). Branches off the Main Circuit shall be proportionately balanced to a tolerance of +5%/-0% (plus five percent and minus nil percent).

On air distribution systems the tolerances shall be as stated in the BSRIA Application Guide 3/89 Fig 4.

All measurements shown on the Test Sheets shall indicate the instrument used. A Schedule of Instruments providing all details including accuracy shall be appended to the Test Sheets. All tolerances allowed on any performance testing in this specification shall include the instrument accuracy, e.g. if a tolerance is given as +5%/-0% (plus five percent and minus nil percent) and the accuracy of the instrument is +2% (plus or minus two percent) then the measured quantity may only vary between 102% (one hundred and two percent) and 103% (one hundred and three percent) of the design quantity.

Commissioning codes - reference Y51.3020

Commissioning:

Water distribution including BSRIA pre-commissioning check list - Reference Y51.3030A

Air distribution including BSRIA pre-commissioning check list - Reference Y51.3040A

VAV systems including BSRIA pre-commissioning checklist - reference Y51.3040B

Boiler plant - reference Y51.3050

Gas plant and systems - reference Y51.3055

Refrigerating systems - Reference Y51.3060

Automatic control systems - Reference Y51.3070

Instruments and gauges - Reference Y51.3090A

Commissioning records:

- For air systems to BSRIA Application Guide 3/89.3 - Reference Y51.3100A

- For water systems to BSRIA Application Guide 2/89.3 - reference Y51.3100B

BMS commissioning:

- Control system specification details required for commissioning - reference Y51.3110
- Pre-commissioning - Reference Y51.3120
- Plant ready for control system commissioning - Reference Y51.3130A
- Control system requirements for plant commissioning - Reference Y51.3140
- Commissioning - reference Y51.3150

251.050 PERFORMANCE TESTING:

Environmental Checks

As if required as part of the Commissioning and Performance Testing procedures in the particular specification, environmental and space condition checks shall be made on the fully operational systems. Space conditions shall be monitored using thermohydrographs and sling psychrometers for a period of 2 weeks prior to contract completion. Ambient conditions shall be monitored also, during this time.

Because ambient loads prevailing at the time of commissioning may be transient and may not coincide with design maximum conditions, this test shall not be interpreted as a test of the full load capability of a particular system but as an indication only of the plant's overall rate of response and stability under varying load conditions.

Within specialised areas of the building eg: computer rooms, a 48 hour full load test shall be carried out. The load test may be carried out utilising industrial type portable heaters. Thermohydrographs shall record the entire load test. All necessary temporary electrical supplies shall be provided during the 2 weeks of environmental checks, noise level readings shall be taken as detailed elsewhere in this specification. Relative air movement shall also be checked throughout the conditioned space.

System performance testing - reference Y51.4010

Testing of residential ventilation systems - reference Y51.4015

Environmental tests:

- Artificial loads - reference Y51.4020A
- Ambient Air Quality - reference Y51.4020B

9 VIBRATION ISOLATION MOUNTINGS

252.010 GENERAL:

Comply with work section general clauses reference Y52.1000 and those detailed below.

252.050 PIPEWORK HANGERS:

Spring compression hangers - reference Y52.2060

Lockable facility - reference Y52.1040

252.090 PIPEWORK NOISE VIBRATION ISOLATION:

Natural corkwood - reference Y52.2110A

Reconstituted corkwood granules - reference Y52.2110B

Rubber matting - reference Y52.2110C

252.100 WORKMANSHIP:

Horizontally restrained spring mountings - reference Y52.3040

252.110 PIPE, WALL AND RISER SEALS:

Sponge foam packing - reference Y52.2120A

Mineral fibre packing - reference Y52.2120B

10 IDENTIFICATION - MECHANICAL

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

254.020 PIPEWORK IDENTIFICATION:
Reference Y54.2010

254.030 DUCTWORK IDENTIFICATION:
Reference Y54.2020

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

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

254.050 VALVE AND COCK IDENTIFICATION:
Reference Y54.2040

254.080 AIR VOLUME REGULATING AND CONTROL DAMPER IDENTIFICATION:
Reference Y54.2070

254.090 INSTRUMENT IDENTIFICATION:
Reference Y54.2080

254.100 DANGER AND WARNING NOTICES:
Reference Y54.2090

254.110 SYSTEM IDENTIFICATION INSTALLATION CHARTS:
Perspex sheet glazing with frame - reference Y54.2100A

11 FIXING TO BUILDING FABRIC

290.010 GENERAL:

Comply with work section general clauses reference Y90.1000 and those detailed below.

290.020 FIXINGS:

Standards - reference Y90.2010

Plugs - reference Y90.2020

Screws - reference Y90.2030

Non-penetrative support systems - reference Y90.2080

290.030 WORKMANSHIP:

Drilling - reference Y90.3010

Fixing to timber rails - Reference Y90.3050

Fixing to hollow stud/tile/block wall - Reference Y90.3060A

Fixing to concrete, brickwork or blockwork - Reference Y90.3070A

Fixing to metalwork - Reference Y90.3080A

Fixing to structural steelwork and concrete structures - Reference Y90.3090A

12 OFF-SITE PAINTING AND ANTI-CORROSION TREATMENT

291.010 GENERAL:

Comply with work section general clauses reference Y91.1000 and those detailed below.

291.020 PAINT MATERIALS:

Paint materials - Reference Y91.2010A

Paint quality - reference Y91.2020

291.030 WORKMANSHIP:

Weather and other conditions - reference Y91.3020

Cleaning and preparing for painting:

- Steel surfaces - reference Y91.3030A
- Surfaces - reference Y91.3030B

Application off-site - reference Y91.3040

Application - reference Y91.3050

Cold galvanizing - reference Y91.3060

Protection of bright machine parts - reference Y91.3070

13 RELATED Y CLAUSES

13.1 HEAT PUMP

13.2 Y10 PIPELINES

1010 PRE-FABRICATED PIPEWORK:

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

1020 FITTINGS:

For changes in direction use centreline radius/nominal bore of not less than 1.5 unless otherwise directed.
For reductions and enlargements use easy transition type with inclined angle not exceeding 30 degrees.

1030 FABRICATED FITTINGS:

Use only with approval, if manufacturer's standard fittings are not available.

1040 PIPE JOINTS

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

2010A HEAVY BLACK STEEL PIPES TO IS EN 10255:

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

2010B MEDIUM BLACK STEEL PIPES TO IS EN 10255:

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

2010C MEDIUM GALVANISED STEEL PIPES TO IS EN 10255:

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

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

Material - Steel

Standard - IS EN 10255

Dimensions - Medium. Random single lengths, 4m to 7m.

Ends - Grooved for mechanical joints.

Finish - Galvanised.

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

Material

Carbon steel, grade 430, electric resistance welded.

Standard - IS EN 10253-1 or IS EN 10253-2.

Size range - 25mm to 400mm.

Dimensions - IS EN 10253-1 or IS EN 10253-2 Medium.

Ends - Bevelled.

Finish - Varnished.

2070A MALLEABLE CAST IRON FITTINGS, SCREWED:

Material - Cast iron to IS EN 1562.

Standard - BS 143 & 1256 or IS EN 10242.

Size range - 10mm to 164mm.

Dimensions - BS 143 & 1256 or IS EN 10242.

Ends - screwed to BS 21 and IS EN 10226-1.

Finish - Black

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.l

Standard - Manufacturer's.

Size range - 20mm to 600mm.

Ends - Grooved or mechanical joints.

Finish - Galvanised.

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

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

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

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

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

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

Material - Copper or DZR copper alloy.
Standard - IS EN 1254-1.
Size range - 28mm to 54mm.
Dimensions - IS 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 IS 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 - IS EN 1254-2, type A, non-manipulative.
Size range - 6mm to 54mm.
Dimensions - IS EN 1254-2, table 2 and 3.
Ends - Socket.
Finish - Natural.

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

2430 LAYERED PIPE AND FITTINGS FOR HOT AND COLD WATER TO IS EN ISO 21003:
Material - To IS EN ISO 21003 & DIN 16833.
Standard - Manufacturer's standard.
Size range - 16mm to 50mm.
Dimension - Manufacturer's standard.
Ends - compression.
Finish – Black or White.

2510A COMPRESSION FITTINGS FOR POLYETHYLENE PIPES:

Material - Copper/copper alloy (dezincifiable resistant).

Standard - IS EN 1254-3 or BS 864-5.

Size range - 20mm to 63mm.

Dimensions - To suit pipes to IS EN 12201.

Ends - Socket.

Finish - Cast.

2528 POLYETHYLENE PIPES TO IS EN 1555:

Material - Polyethylene.

Standard - IS EN 1555-1, IS EN 1555-2 and IS EN 1555-5.

Dimensions - IS EN 1555-2

Lengths - straight pipe 6m or 12m.

Lengths - coiled pipe multiples of 50m.

Marking - IS EN 1555-2

Ends - Plain.

Finish: Black, Yellow or Black with yellow identification stripes.

2538 POLYETHYLENE FUSION FITTINGS TO IS EN 1555:

Material - Polyethylene.

Standard - IS EN 1555-1, IS EN 1555-3 and IS EN 1555-5.

Dimensions - IS EN 1555-3, Section 6, to suit pipes to IS EN 1555-2.

Marking - IS EN 1555-3, table 7.

Ends - Sockets with heating elements for fusion jointing.

Finish – Black or Yellow.

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

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

Material - Polypropylene (PP).

Standard - IS EN 1451-1 and IS EN 15012.

Dimensions - Length - manufacturer's standard range. IS 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 5254:

Material - Polypropylene.

Standard - BS 5254.

Size range - 32 to 50mm.

Dimensions - BS 5254, table 1.

Ends - Plain; or ring seal, multi-vane or compression sockets.

Finish - Natural self-colour.

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

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

Material - Polypropylene (PP).

Standard - IS EN 1451-1 and IS EN 15012.

Size range - 32mm to 315mm.

Dimensions - IS 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.

2585A PVC-U PIPING SYSTEMS TO IS 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 IS EN 1329-1.

Size range - 32mm to 315mm.

Dimensions - IS 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.

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

Plastics piping systems for hot and cold water systems, including heating, within buildings.

Material - Crosslinked polyethylene (PE-X).

Standard - IS EN ISO 15875-5.

Size range - 16mm to 160mm.

Dimensions - IS 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.

2668A POLYETHYLENE TO IS EN 12201:

Plastic piping system for water under pressure up to 20^{0}C and 25bar.

Material - Polyethylene.

Standard - IS EN 12201-1, IS EN 12201-2, IS EN 12201-5.

Dimensions - IS EN 12201-2, table 2.

Marking - IS 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 IS EN 12201:

Plastic piping system for drainage/sewerage under pressure.

Material - Polyethylene.

Standard - IS EN 12201-1, IS EN 12201-2 and IS EN 12201-5.

Dimensions - IS EN 12201-2, table 2.

Marking - IS 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 cross-linked 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); Table 1 (CU) or Table 2 in accordance with BS ISO 11922-1, BS ISO 4065 or to BS 2782-11: Method 1121B.

Ends - Plain.

Finish - Natural.

2705B PLASTICS PIPES TO BS 7291-4:

Material - Chlorinated polyvinyl chloride (PVC-C) and solvent cement BS 7291-4.

Standard - BS 7291.Classification H unless otherwise indicated.

Dimensions - BS 7291-4 (PVC-C), or Table 1 in accordance with BS ISO 11922-1, BS ISO 4065 or to BS 2782-11: Method 1121B.

Ends - Plain.

Finish - Natural.

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

Material - IS 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 IS EN 1092-1.

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

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

3020A JOINTING RINGS - NON-METALLIC FLAT GASKETS:
Non-metallic flat gaskets for flanges to IS EN 1092-4.
Standard - IS EN 1514-1
Gasket type - Full face for type B.

3030A SCREWED JOINTS TO BS 21 AND IS EN 10226-1:
Use PTFE tape to BS 7786 or use hemp and jointing compound to BS 6956-5, or IS EN 751-2.

3050A WELDED JOINTS, WELDING RODS FOR STEEL PIPES:
Gas welding, BS 1453 type A2 or A3; electric arc welding BS 2971.

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

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

3125 COMPRESSION JOINTING SYSTEM ON PLASTIC AND MULTI-LAYERED PIPE:

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

3133 PRESS FITTING JOINTING SYSTEM ON PLASTIC AND MULTI-LAYERED PIPE:

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

3140A MECHANICAL JOINTS, GROOVED STEEL PIPES:

Material - Ductile cast iron to ASTM A-536, grade 65-45-12.

Joint - Standard, flexible or rigid; or reducing joint.

Size range - 20mm to 600mm.

Gaskets - Grade 'E' EPDM.

Finish - Painted to manufacturer's standard.

3150A MECHANICAL JOINTS, PLAIN END STEEL PIPES:

Material - Malleable cast iron to IS EN 1562; or ductile cast iron to IS EN 1564.

Size range - 40mm to 400mm.

Gaskets - Grade 'E' EPDM.

Finish - Manufacturer's standard.

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.

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.

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.

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.

4100 FABRICATED FITTINGS - NON-FERROUS:

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

Pattern - Bends, springs, offsets and branches.

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

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

4110 PIPES THROUGH WALLS AND FLOORS:

Enclose pipes passing through building elements, (walls, floors, partitions, etc.) concentrically within purpose made sleeves. Fit masking plates where visible pipes pass through building elements, including false ceilings of occupied rooms.

4120A PIPE SLEEVES:

Where pipe insulation is not carried through pipe sleeve, cut sleeves from material same as pipe one or two sizes larger than pipe to allow clearance. Do not use sleeves as pipe supports.

Install sleeves flush with building finish. In areas where floors are washed down install with a 100mm protrusion above floor finish.

4120B PIPE SLEEVES WITH INSULATION CARRIED THROUGH:

Where pipe insulation is carried through pipe sleeve, cut sleeves from material same as pipe one or two sizes larger than pipe and insulation to allow clearance. Do not use sleeves as pipe supports.

Install sleeves flush with building finish. In areas where floors are washed down install with a 100mm protrusion above floor finish.

4125 PIPE SLEEVES THROUGH FIRE BARRIERS:

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

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.

4220 SUPPORT SPACING:

Space supports as tables.

Pipe Bore (mm)	**Maximum Support Spacing (m)**					
Nominal	**Steel Pipe**		**Copper Pipe**		**Iron Pipe**	
	horizontal	**vertical**	**horizontal**	**vertical**	**horizontal**	**vertical**
Up to 15	1.8	2.4	1.2	1.8	-	-
20	2.4	3.0	1.4	2.1	-	-
25	2.4	3.0	1.8	2.4	-	-
32	2.7	3.0	2.4	3.0	-	-

40	3.0	3.6	2.4	3.0	-	-
50	3.0	3.6	2.7	3.0	1.8	1.8
65	3.7	4.6	3.0	3.6	-	-
80	3.7	4.6	3.0	3.6	2.7	2.7
100	3.7	4.6	3.0	3.6	2.7	2.7
125	3.7	5.4	3.0	3.6	-	-
150	4.5	5.4	3.6	4.2	3.7	3.7
200	5.6	6.0	-	-	3.7	3.7
250	5.0	6.0	-	-	4.5	5.4
300	6.1	10.0	-	-	8.0	10.0
350	10.0	12.0	-	-	-	-
400	10.5	12.6	-	-	-	-
450	11.0	13.2	-	-	-	-
500	12.0	14.4	-	-	-	-
600	14.0	16.8	-	-	-	-

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

Vertical support spacing:

- Check total self-weight and pressure loading against manufacturer's recommendations when using mechanical joints or end load capable flexible couplings. Ensure adequate pipe support when using non-end load capable flexible couplings.
- Space vertical support intervals for plastics pipe at not greater than twice horizontal intervals tabulated.
- Where multiple pipe runs of differing bores are supported from a common point, use support spacing of pipe requiring closest spacing.
- Spacings give for PVC-U pipe to IS 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.

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 - Specification for class II arc welding of carbon steel pipework for carrying fluids - includes amendment 9773 Feb 98", 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 machine. 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. Assemble joint in accordance with manufacturer's instructions.

Making and Sealing - Ensure gasket material is suitable for service. 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 and electrical continuity clip if required. Tighten bolts to manufacturer's instructions. Check alignment of joint and pipework.

Earth continuity - Use manufacturer's earth continuity clips to ensure compliance with IET regulations.

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.

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.

5120 BRAZED JOINTS, STAINLESS STEEL JOINTS:

Preparation - Prepare for brazing in accordance with IS EN 14324.

Making and Sealing - Use flame heat and make in accordance with IS EN 14324. Use nickel bearing zinc free filler metals.

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 IS 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.

6050 BRAZED JOINTS, COPPER/COPPER ALLOY PIPES:

Preparation - Prepare for brazing in accordance with IS EN 14324. Use manufactured fittings not subject to dezincification and suitable for application.

Making and Sealing - Use flame heat and make in accordance with IS EN 14324. Use silver brazing filler alloy suitable for application.

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 manufacturer's grooving machine. 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. Assemble joint in accordance with manufacturer's instructions.

Making and Sealing - Ensure gasket material is suitable for service. 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 and electrical continuity clip if required. Tighten bolts to manufacturer's instructions. Check alignment of joint and pipework.

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.

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.

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.

9040A PROTECTION OF BURIED PIPES, UNMARKED:

Provide earth cover as follows:

- Water pipework - 900 mm minimum; 1200 mm maximum where practicable.
- Fuel oil and gas - 500 mm minimum.

Under roadways provide minimum cover of 900 mm.

9040B PROTECTION OF BURIED PIPES, MARKED:

Provide earth cover as follows:

- Water pipework - 900 mm minimum; 1200 mm maximum where practicable.
- Fuel oil and gas - 500 mm minimum.

Under roadways provide minimum cover of 900 mm.

Provide a marker tape to identify buried pipe services as indicated.

9100 CORROSION PROTECTIVE TAPE:

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

9110 MECHANICAL PROTECTIVE TAPE:

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

9120A STEELWORK 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.

13.3 Y11 PIPELINE ANCILLARIES

1010 SAFETY AND RELIEF VALVES, SELF OPERATED, APPLICATION:

Safety - To discharge with rapid opening action to prevent pre-determined safe pressure being exceeded.

Relief - To discharge with opening action proportional to increase in pressure above set pressure.

1020 EXPOSED VALVES:

Fit easy-clean covers over glands and bonnets to small copper alloy valves exposed in areas other than plant rooms. Fit thermoplastic valve wheels. Fit dust caps to lockshield valves.

1030 TESTING:

Ensure that valves and cocks are pressure tested at manufacturer's works, in accordance with appropriate British Standards specification. Test valves in accordance with IS EN 12266-1 and IS EN 12266-2.

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

Materials - Bronze or DZR copper alloy body.

Ends - Compression fittings to IS 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.

2080D COMPRESSION END BALL TYPE VALVES - LEVER OPERATED:

Materials - Bronze or DZR copper alloy body.

Ends - Compression fittings to IS 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.

2090A LEVER OPERATED BUTTERFLY VALVES TO IS 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 IS 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.

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.

2220A THREADED DOUBLE REGULATING VALVES TO BS7350, COPPER ALLOY:

BS 7350, section 3.1

Ends – Threaded to BS21 and IS EN 10226-1

Material:

- Bronze of DZR copper alloy to BS5154, Series B
- Oblique or Y pattern – copper allow, nickel alloy or resilient valve face
- Rising stem outside screw or non-rising stem inside screw
- Manufacturer’s standard materials.

Options – Provide test plug facility, independent means for positive isolation on pressure tapping or adapter & test and manufacturer’s certificates as indicated.

2220B FLANGED DOUBLE REGULATING VALVES TO BS7350, COPPER ALLOY:

BS 7350, section 3.1

Ends - Flanged to IS EN 1092-2.

Material:

- Bronze of DZR copper alloy to BS5154, Series B
- Oblique or Y pattern – copper allow, nickel alloy or resilient valve face
- Rising stem outside screw or non-rising stem inside screw
- Manufacturer’s standard trim materials.

Options – Provide test plug facility, independent means for positive isolation on pressure tapping or adapter & test and manufacturer’s certificates as indicated.

2220C FLANGED DOUBLE REGULATING VALVES TO BS7350, CAST IRON:

BS 7350, section 3.1

Ends - Flanged to IS EN 1092-2.

Material:

- Cast iron to IS EN 13789
- Oblique or Y pattern – copper allow, nickel alloy or resilient valve face
- Rising stem outside screw or non-rising stem inside screw
- Manufacturer’s standard materials.

Options – Provide test plug facility, independent means for positive isolation on pressure tapping or adapter & test and manufacturer’s certificates as indicated.

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

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

Ends - Flanged to IS EN 1092-2.

Material - Variable orifice, double regulating globe valve, cast iron to IS 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 IS EN 10226-1 or compression to IS EN 1254-2 to suit pipework as indicated.

Angle - Threaded to BS 21 and IS EN 10226-1 with one end internal and other end external with union nut and tail pipe; or compression joint to IS EN 1254-2 one end and other end externally threaded to BS 21 and IS 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 IS 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.

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.

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 IS 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 IS EN 10226-1.

Ancillaries - Lever for manual operation.

2330A FLANGED SWING CHECK VALVES TO IS EN 12334:

Check valve type to IS EN 736-1 - Swing.

Body type - Flanged.

Ends - Flanged to IS 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 IS EN 12334:

Check valve type to IS EN 736-1 - Swing.

Body type - Wafer.

Body and cover materials - Grey cast iron or SG cast iron.

Orientation of pipework - Horizontal or vertical.

2430B SAFETY VALVES TO IS EN ISO 4126-1, COPPER ALLOY, DOUBLE SPRING:

Material - Bronze or DZR copper alloy body.

Ends - Threaded to BS 21 and IS EN 10226-1.

Spring type - Double spring loaded, high lift type.

2430D SAFETY VALVES TO IS EN ISO 4126-1, CAST IRON, DOUBLE SPRING:

Material - Cast iron body.

Ends - Flanged to IS 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 IS 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.

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.

2510A AUTOMATIC AIR VENTS, FLOAT TYPE:

Construction - Bronze or DZR copper alloy body with threaded inlet to BS 21 and IS EN 10226-1. Solid polypropylene float and air release valve. Ensure valve is self closing.

Operating Conditions - Maximum temperature 130^{O}C. Maximum pressure 10 bar.

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

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 IS EN 1092-1, PN 16.

Operating conditions - Maximum temperature 110^{O}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.

2630A THREADED END EXPANSION COMPENSATORS, AXIAL BELLOWS:

Ends - Threaded to BS 21 and IS 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.

2630B FLANGED EXPANSION COMPENSATORS, AXIAL BELLOWS:

Ends - Flanged to IS 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.

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^{O}C.

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^{O}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.

2680B FLANGED PIPELINE STRAINERS, BRONZE:

Material - Bronze to IS EN 1982.

Ends - Flanged to IS 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 IS EN 10226-1.

2680D PIPELINE STRAINERS, CAST IRON:

Material - Cast iron.

Ends - Flanged to IS 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 IS EN 10226-1.

2690A TUNDISHES, COPPER:

Provide tundishes located adjacent to equipment, as indicated.

Use 3mm minimum thickness copper sheet. Form sheet into a tapered reducing cone with a minor diameter to suit drain line.

Major diameter nominally 50 mm larger than minor diameter, tapering at approximately 30 degrees.

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 degrees.

2700A GAUGES, GENERAL:

Use dial type gauges of robust construction, enclosed in dust tight metal cases. Retain dial glass with bezels screwed to case. Finish with chromium plating.

Use white dial scales indelibly and clearly marked with black lettering to indicate measured values. Select scale ranges which indicate `Normal' when pointer is vertical or central on scale.

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.

2710A TEMPERATURE GAUGES, GENERAL:

Mercury in steel type, mounted direct in pocket.

Use temperature gauges with pocket and provided with gland attachment on thermometer stem.

Use separable type pockets, threaded 15/19mm BSP and manufactured from stainless steel.

Screw pockets into tapped bosses or stools set in pipelines or vessels.Fill pockets with oil to BS 7207 to ensure contact with thermometer bulb.

Provide gauges with dial graduation in degrees celsius marked on alogarithmic 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.

2710C TEMPERATURE GAUGES, VAPOUR PRESSURE TO BS 5235 FOR DIRECT MOUNTING:

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

2720 PRESSURE AND ALTITUDE GAUGES:

Use vapour pressure type gauges to IS 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.

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.

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.

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.

13.4 Y20 PUMPS

1010 PUMPS:

Provide pumps manufactured and tested in accordance with appropriate British Standard, in particular IS EN 809, IS EN 60335-2-41 and IS EN 60335-2-51 where applicable.

1020 PUMP SELECTION:

Select pump at or near most efficient part of performance curve for duty required.

1030 SAFETY GUARDS:

Fit safety guards around revolving parts on close coupled and belt drive pumps.

1040 PUMP TESTING:

Ensure pumps comply with IS EN ISO 5198 and IS EN ISO 9906 as appropriate.

2010A CENTRIFUGAL PUMP - HORIZONTALLY MOUNTED BELT DRIVEN:

Configuration: Casing and motor side by side mounted on bedplate (belt drive).

Casing: Provide casing with drain connection fitted with plug. Provide threaded connections in accordance with BS 21 and IS EN 10226-1 for drains, vents, water jackets, cooling lines, etc. Provide pump with split casing to allow access to the impeller for service and maintenance.

Impeller: Ensure impellers are accurately machined and finished smooth, free from blowholes and other defects and designed to be in dynamic balance at all speeds. Provide open or semi-open type impellers for removal of sludge or other foreign material to prevent clogging. Fix impellers to shafts to ensure that they remain firm if direction of rotation is reversed. Indicate direction of rotation on pump casing.

Shaft: Ensure shaft is of adequate diameter to withstand all imposed loading and has a critical speed when assembled with its impeller at least 10% above normal operating speed.

Material:

- Casing - Cast iron to IS EN 1561.
- Impeller - Manufacturer's standard
- Shaft - Stainless steel to IS EN 10088.
- Seal Housing - Cast iron to IS EN 1561.
- Bearings - Sealed-for-life.
- Glands and seals - Mechanical.

2010B CENTRIFUGAL PUMP - VERTICALLY MOUNTED BELT DRIVEN:

Configuration: Motor mounted vertically above casing on a common bedplate (belt drive).

Casing: Provide casing with drain connection fitted with plug. Provide threaded connections in accordance with BS 21 and IS EN 10226-1 for drains, vents, water jackets, cooling lines, etc. Provide pump with split casing to allow access to the impeller for service and maintenance.

Impeller: Ensure impellers are accurately machined and finished smooth, free from blowholes and other defects and designed to be in dynamic balance at all speeds. Provide open or semi-open type impellers for removal of sludge or other foreign material to prevent clogging. Fix impellers to shafts to ensure that they remain firm if direction of rotation is reversed. Indicate direction of rotation on pump casing.

Shaft: Ensure shaft is of adequate diameter to withstand all imposed loading and has a critical speed when assembled with its impeller at least 10% above normal operating speed.

Material:

- Casing - Cast iron to IS EN 1561.
- Impeller - Manufacturer's standard
- Shaft - Stainless steel to IS EN 10088.
- Seal Housing - Cast iron to IS EN 1561.
- Bearings - Sealed-for-life.
- Glands and seals - Mechanical.

2010C CENTRIFUGAL PUMP - CLOSE COUPLED:

Configuration: Pump casing and motor mounted on a bedplate in line (close coupled).

Casing: Provide casing with drain connection fitted with plug. Provide threaded connections in accordance with BS 21 and IS EN 10226-1 for drains, vents, water jackets, cooling lines, etc. Provide pump with split casing to allow access to the impeller for service and maintenance.

Impeller: Ensure impellers are accurately machined and finished smooth, free from blowholes and other defects and designed to be in dynamic balance at all speeds. Provide open or semi-open type impellers for removal of sludge or other foreign material to prevent clogging. Fix impellers to shafts to ensure that they remain firm if direction of rotation is reversed. Indicate direction of rotation on pump casing.

Shaft: Ensure shaft is of adequate diameter to withstand all imposed loading and has a critical speed when assembled with its impeller at least 10% above normal operating speed.

Material:

- Casing - Cast iron to IS EN 1561.
- Impeller - Manufacturer's standard.
- Shaft - Manufacturer's standard.
- Seal Housing - Cast iron to IS EN 1561.
- Bearings - Sleeve.
- Glands and seals - Mechanical.

2010D CENTRIFUGAL PUMP - DIRECT DRIVE IN-LINE:

Configuration: Direct driven unit with pump body incorporating inlet and outlet connections in line, to allow pump to be mounted in pipework.

Casing: Provide casing with drain connection fitted with plug. Provide threaded connections in accordance with BS 21 and IS EN 10226-1 for drains, vents, water jackets, cooling lines, etc. Provide pump with split casing to allow access to the impeller for service and maintenance.

Impeller: Ensure impellers are accurately machined and finished smooth, free from blowholes and other defects and designed to be in dynamic balance at all speeds. Provide open or semi-open type impellers for removal of sludge or other foreign material to prevent clogging. Fix impellers to shafts to ensure that they remain firm if direction of rotation is reversed. Indicate direction of rotation on pump casing.

Shaft: Ensure shaft is of adequate diameter to withstand all imposed loading and has a critical speed when assembled with its impeller at least 10% above normal operating speed.

Material:

- Casing - Cast iron to IS EN 1561.
- Impeller - Manufacturer's standard.
- Shaft - Stainless steel to IS EN 10088.
- Seal Housing - Cast iron to IS EN 1561.
- Bearings
- Sealed-for-life or pre-packed type requiring no maintenance (in-line pumps).
- Glands and seals - Mechanical.

2010E CENTRIFUGAL PUMP - DIRECT DRIVE, IMMERSED ROTOR:

Configuration: Sealed unit with immersed rotor with pump body incorporating inlet and outlet connections in line, to allow pump to be mounted in pipework.

Casing: Provide casing with drain connection fitted with plug. Provide threaded connections in accordance with BS 21 and IS EN 10226-1 for drains, vents, water jackets, cooling lines, etc. Provide pump with split casing to allow access to the impeller for service and maintenance.

Impeller: Ensure impellers are accurately machined and finished smooth, free from blowholes and other defects and designed to be in dynamic balance at all speeds. Provide open or semi-open type impellers for removal of sludge or other foreign material to prevent clogging. Fix impellers to shafts to ensure that they remain firm if direction of rotation is reversed. Indicate direction of rotation on pump casing.

Shaft: Ensure shaft is of adequate diameter to withstand all imposed loading and has a critical speed when assembled with its impeller at least 10% above normal operating speed.

Material:

- Casing - Cast iron to IS EN 1561, or cast gunmetal to IS EN 1982.
- Impeller - Manufacturer's standard.
- Shaft - Stainless steel to IS EN 10088.
- Seal Housing - Manufacturer's standard.
- Bearings
- Sealed-for-life or pre-packed type requiring no maintenance (in-line pumps).
- Glands and seals - Manufacturer's standard.

2015 VARIABLE FLOW CONTROL:

Supply centrifugal pump with variable speed drive for variable flow control. Variable speed drive to meet the safety requirements of IS EN 61800-5-1.

4010 GENERAL:

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

4020 PIPELINE CONNECTIONS:

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

4040 ALIGNMENT:

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

4050 ACCESS:

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

4060 MAINTENANCE REQUIREMENTS FOR SEWAGE PUMPS:

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

13.5 Y22 HEAT EXCHANGERS

1010 HEAT EXCHANGER DESIGN:

Supply heat exchangers designed in accordance with British Standards.

2010B COPPER CALORIFIER TO BS 853:

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 clause 5.3.

Hydraulic test certificates to BS 853 clause 11.2.

Provide connections and supports as shown on drawings and as indicated.

Mountings to BS 853.

Pressure relief devices as clause 10.2; stop valves as clause 10.3; pressure gauge as clause 10.4; thermometer as clause 10.5; draining taps as clause 10.6; and vacuum breaker valve as clause 10.7.

2020A HEAT EXCHANGER TO BS 3274 TYPE 1:

Standard - BS 3274

Type 1 - fixed tube-plate (non-removable bundle).

Materials:

- Construct heat exchangers from cast iron or carbon steel to PD 5500 "Specification for unfired fusion welded pressure vessels - includes amd16422 Sep 06".
- Fabricate heat exchanger tubes from seamless steel tubes to IS EN 10217-1; welded steel tubes to IS EN 10217-2; seamless, round copper tubes to IS EN 12451; rolled, finned, seamless copper tubes to IS EN 12452; wrought aluminium and aluminium alloys, drawn tube to IS EN 754, with IS EN 515 and IS EN 573; or nickel and nickel alloy tube to BS 3074.

Connection type:

- Primary and secondary pipe connections up to and including 50 mm nominal diameter - screwed to BS 21 and IS EN 10226-1 or flanged to IS EN 1092-4.
- Primary and secondary pipe connections of 65 mm nominal diameter and above - flanged to IS EN 1092-4.

Mountings - Provide pads, blocks or pipe stools for acceptance of piping connections and mountings attached to shell. Make all connections to project clear of finished face of insulation.

Alignment:

- Make provision for easy removal of heating surface from shell.

- Provide sufficient set bolts to enable tube bundle to be withdrawn without breaking joint between tube plate and chest cover plate.
- Support tubes internally to relieve tube plate of any strain.

Testing and Marking:

- Inspection, testing, marking and certification to comply with BS 3274.
- Test shell and battery of each heat exchanger.
- Display duty of heat exchanger, identify rating, primary temperature and pressure, and secondary temperature and pressure.
- Raise data plate indicating duty and other relevant information from surface of shell to project above insulation to remain visible.

2020B HEAT EXCHANGER TO BS 3274 TYPE 2:

Standard - BS 3274

Type 2 - U-tube (removable tube bundle).

Materials:

- Construct heat exchangers from cast iron or carbon steel to PD 5500 “Specification for unfired fusion welded pressure vessels - includes amd16422 Sep 06".
- Fabricate heat exchanger tubes from seamless steel tubes to IS EN 10217-1; welded steel tubes to IS EN 10217-2; seamless, round copper tubes to IS EN 12451; rolled, finned, seamless copper tubes to IS EN 12452; wrought aluminium and aluminium alloys, drawn tube to IS EN 754, with IS EN 515 and IS EN 573; or nickel and nickel alloy tube to BS 3074.

Connection type:

- Primary and secondary pipe connections up to and including 50 mm nominal diameter - screwed to BS 21 and IS EN 10226-1 or flanged to IS EN 1092-4.
- Primary and secondary pipe connections of 65 mm nominal diameter and above - flanged to IS EN 1092-4.

Mountings:

- Provide pads, blocks or pipe stools for acceptance of piping connections and mountings attached to shell.
- Make all connections to project clear of finished face of insulation.

Alignment:

- Make provision for easy removal of heating surface from shell.
- Provide sufficient set bolts to enable tube bundle to be withdrawn without breaking joint between tube plate and chest cover plate.
- Support tubes internally to relieve tube plate of any strain.

Testing and Marking:

- Inspection, testing, marking and certification to comply with BS 3274.
- Test shell and battery of each heat exchanger.
- Display duty of heat exchanger, identify rating, primary temperature and pressure, and secondary temperature and pressure.

- Raise data plate indicating duty and other relevant information from surface of shell to project above insulation to remain visible.

2020C HEAT EXCHANGER TO BS 3274 TYPE 3:

Standard - BS 3274

Type 3 - Floating head (removable tube bundle).

Materials:

- Construct heat exchangers from cast iron or carbon steel to PD 5500/" alt="Specification for unfired fusion welded pressure vessels - includes amd16422 Sep 06">PD 5500.
- Fabricate heat exchanger tubes from seamless steel tubes to IS EN 10217-1; welded steel tubes to IS EN 10217-2; seamless, round copper tubes to IS EN 12451; rolled, finned, seamless copper tubes to IS EN 12452; wrought aluminium and aluminium alloys, drawn tube to IS EN 754, with IS EN 515 and IS EN 573; or nickel and nickel alloy tube to BS 3074.

Connection type:

- Primary and secondary pipe connections up to and including 50 mm nominal diameter - screwed to BS 21 and IS EN 10226-1 or flanged to IS EN 1092-4.
- Primary and secondary pipe connections of 65 mm nominal diameter and above - flanged to IS EN 1092-4.

Mountings:

- Provide pads, blocks or pipe stools for acceptance of piping connections and mountings attached to shell.
- Make all connections to project clear of finished face of insulation.

Alignment:

- Make provision for easy removal of heating surface from shell.
- Provide sufficient set bolts to enable tube bundle to be withdrawn without breaking joint between tube plate and chest cover plate.
- Support tubes internally to relieve tube plate of any strain.

Testing and Marking:

- Inspection, testing, marking and certification to comply with BS 3274.
- Test shell and battery of each heat exchanger.
- Display duty of heat exchanger, identify rating, primary temperature and pressure, and secondary temperature and pressure.
- Raise data plate indicating duty and other relevant information from surface of shell to project above insulation to remain visible.

2030A CONDENSE COOLER:

Materials - Fabricate condense cooler shells, chests, tubes and tube plates and baffles from same materials as heat exchanger.

Interconnections - Interconnect the non-storage heat exchanger and condense cooler by pipework complete with steam trap, sight glass, valves, unions and strainer.

3020A SPARES:

Provide spare tube and plate assembly. Provide spare jointing rings for chest and tube assembly.

4010 GENERAL:

Store, handle and erect all equipment in accordance with manufacturer's recommendations and relevant British Standards. Make due allowance for valves, fittings, access etc., to accommodate insulation where specified. Support equipment such that all component parts, connections or insulation have clearance from supports.

4030 PROTECTION AND CLEANING:

Provide protection from damage and ingress of foreign matter to heat exchangers and condense coolers during storage, installation and testing.

4040 INSPECTION:

Install heat exchangers and condense coolers such that internal and external surfaces can be readily inspected and cleaned.

4050 RUST PROTECTION:

Ensure heat exchanger and condense cooler shells are completely free of rust and corrosion and coated with factory applied primer.

13.6 Y23 STORAGE CYLINDERS AND CALORIFIERS

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 the 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.

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.

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.

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.

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.

2060B COPPER CALORIFIER/STORAGE VESSELS TO BS 853:

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 clause 5.3.

Hydraulic test certificates to BS 853 clause 11.2.

Provide connections and supports as shown on drawings and as indicated.

Mountings to BS 853

Pressure relief devices as clause 10.2; stop valves as clause 10.3; pressure gauge as clause 10.4; thermometer as clause 10.5; draining taps as clause 10.6; and vacuum breaker valve as clause 10.7.

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.

13.7 Y24 TRACE HEATING

1010 STANDARDS:

Comply with BS 7671 (IET Wiring Regulations) and BS 6351, IS EN 62395-1.

2010D ELECTRIC TRACE HEATING, SELF REGULATING TAPE, MCB PROTECTION:

Supply electric trace heating complete with fixing tape, shrink sleeves, crimps, junction boxes and controls.

Tape – Self-regulating heating tape.

Insulation - Thermoplastic elastomer or modified polyolefin.

Jacket - Tinned copper braid.

Electrical protection - Protect circuits with MCB's.

3010 INSTALLATION OF ELECTRIC TRACE HEATING:

Install electric surface heating in accordance with BS 6351-3 and manufacturer's instructions.

Ensure pipe is cleaned of all abrasive material prior to application.

3020D INSTALLATION OF PIPED TRACE HEATING, STAINLESS BANDS:

Secure trace heating pipelines in close contact with pipework to be heated. Attach by stainless steel bands.

Locate trace heating pipelines along under-side of pipework to be heated.

Single pipeline on centreline.

Two pipelines at 30^{o} to centreline.

Three pipelines on centreline and at 45^{o} to centreline.

Ensure minimum spacing of bands is 10mm pipe - 0.30 metre apart; 15mm pipe - 0.45 metre apart; 20mm & over - 0.60 metre apart.

Isolating valves - Install isolating valves on each section of trace heating pipelines.

3030 INSTALLATION OF HEATING BLANKETS:

Ensure vessel is cleaned of any abrasive material and remove any dirt and oil prior to application. Install blanket in accordance with manufacturer's instructions.

3040 THERMAL INSULATION:

Enclose pipework to be heated and trace heating elements in common thermal insulation. Use oversized insulation.

13.8 Y25 CLEANING AND CHEMICAL TREATMENT

1010 CONDITIONS FOR CLEANING AND CHEMICAL TREATMENT:

Ensure treatment complies with statutory authority and health and safety regulations.

Notify manufacturers and suppliers of equipment of proposed system cleaning and chemical treatment processes. Establish if any manufacturer or supplier of equipment requires any particular cleaning and chemical treatment process due to size of waterways or materials used.

All chemicals used are to be compatible with the metallurgy of the systems.

1015 METHOD STATEMENT:

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

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.

2030A PRELIMINARY CHECKS:

Prior to carrying out cleaning or chemical treatment process, ensure that

All foreign matter is removed.

Certified pressure tests have been carried out in the parts of the system to be cleaned. Carry out further pressure tests on the isolated sections of the system independently.

All water used for pressure testing is inhibited. Leave remaining pipework sections full after testing.

Where there is a risk of freezing inhibited mono-ethylene glycol is used.

Circulation has been demonstrated and approval obtained on all parts of the system. Manipulate and leave fully open all valves other than those used to isolate sections. Carry out balancing and certification after the flushing, cleaning and passivation operations.

No damage can occur to any item of plant or equipment due to cleaning and chemical processes.

Chemicals used are compatible with system materials.

All items of plant and equipment subject to damage or blockage due to cleaning and chemical treatment processes are isolated or removed.

Permanent or temporary by-passes are provided as indicated on drawings.

Dirt pockets are installed at low points to facilitate solids removal. Supply dirt pockets with drain valves sized to pipework size.

All drains provided have been tested and approved and that any pumping equipment associated with the drainage system is fully commissioned.

Dead legs that are more than 3 pipe diameters in length are looped to allow effective cleaning.

Strainer baskets and filter media, incorporated within systems, are removed; and where necessary spool or stool pieces are installed.

Temporary strainers and filters are installed as required for removal of solids during cleaning and chemical treatment processes.

Strainers are clean prior to the start of the cleaning process, throughout the cleaning and on completion.

Suitable supply and drainage points are provided with 50mm minimum connections, properly sited and installed, either valved or plugged.

All automatic/manual air vents are fully commissioned.

All requirements of COSHH regulations are complied with during the chemical cleaning and chemical treatment of the system.

Where required by local water authority, provide effluent tanks for storage of all waste products of cleaning and chemical treatment processes.

Following local water authority approval, either neutralise 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 samples during and following chemical treatment and/or cleaning.

Submit samples to an independent analyst.

Use sterile containers to take samples.

Carry out tests to ensure that cleaning and chemical treatment processes are operating as required.

Submit all test and sample results for certification and approval.

Ensure all samples are witnessed.

2060A CHEMICAL INJECTION AND DOSING METHODS FOR CLOSED SYSTEMS:

Method of introducing chemicals - Dosing pots; manually initiated timer controlled dosing; or proportional dosing as appropriate.

2060B CHEMICAL 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.

- Biocide dosing - automatic dosing control.

2060C PACKAGED CHEMICAL INJECTION AND DOSING PLANT:

Provide packaged monitoring and treatment plants.

2060D DOSING - CLOSED SYSTEMS:

Chemical feed: Provide feeder (dosing pots) with a tundish for filling; separate air vent with discharge tube; drain and isolating valves.

Install in each water system a means of taking a sample 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 Pnueumophilia, 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.

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:

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

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

2070B SAMPLING:

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

2070C SAMPLING KITS:

Provide the following test kits as appropriate.

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

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

Bacteriological monitoring with use of dipslides.

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

2080A CHEMICAL PROVISION, STANDARD ARRANGEMENT:

Provide consumables for a period of 12 months.

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

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

- Open circuit systems operating at 100 % load for 2080 hours per annum.
- Closed circuit systems make-up 1% system volume/month.

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.

3010A FLUSHING:

Carry out flushing of water systems in accordance with BSRIA Application Guide 1/01 Pre-commission cleaning of pipework systems.

- Section 2 Installation considerations
- Section 2.1 Management
- Section 2.2 Pipework installation
- Section 2.3 Preparation for flushing and cleaning
- Section 2.4 Procedure for filling, pressure testing and static flushing.
- Section 3 System dynamic flushing.
- Section C1 Flushing objectives
- Section C2 Dynamic flushing procedure.
- Section 1.4 Inspection and witnessing

3010B FLUSHING:

All water used for pressure testing, flushing and system filling is of good quality. Leave remaining pipework sections full and treated after pressure testing.

Install all necessary pipework ancillaries to enable a specialist to carry out flushing, inspection and witnessing of water systems in accordance with BSRIA Guide BG 29/2011. Pre-commission cleaning of pipework systems.

Temporary connection from the mains must be in compliance with the Water Supply (Water Fittings) Regulations 1999 and amendment, or by installation of a temporary tank and pump arrangement.

Domestic water systems are to be flushed and disinfected in accordance with the requirements of IS EN 806-4 and complimentary guidance in IS EN 8558, and to the satisfaction of the local water supply authority. Flush systems using mains water until the water is clear.

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.

3030B CHEMICAL CLEANING AND SOLIDS REMOVAL - FORMULATED PRODUCTS:

Carry out chemical cleaning procedure in accordance with BSRIA Application Guide 1/01 Pre-commission cleaning of pipework systems.

- Section 4.1 Introduction.
- Section 4.2 Cleaning options.
- Section 4.2.1 Degreasing.
- Section 4.2.2 Biocide wash.

- Section 4.2.3 Removal of surface oxides - Inhibited acid cleaning.
- Section 4.2.4 Effluent disposal/final flushing.
- Section 4.2.5 Neutralisation.
- Section 4.2.6 Passivation
- Section 4.2.7 Corrosion inhibitor/biocide dosing.
- Section 4.2.8 Treatment up to system handover.
- Section 4.3 On-going water treatment.
- Section 1.4 Inspection and witnessing

3040 STERILIZATION - GENERAL:

After flushing process, carry out sterilization in accordance with IS EN 806-4 and complimentary guidance in IS EN 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.

3050 STERILIZATION - MAINS WATER SYSTEM:

Carry out the following operations in accordance with IS EN 806-4 and complimentary guidance in IS EN 8558.

Flush system and introduce sterilisation chemical.

Take samples from all sentinel points to ensure correct chlorine concentration.

Leave system to stand for period of time indicated.

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

Submit samples to registered laboratory for microbiological analysis and report.

Certificate of conformity - Immediately prior to handover, retake samples and submit for analysis and report. Where necessary repeat sterilisation of potable water system immediately prior to handover.

3060 STERILIZATION - WATER STORAGE SYSTEMS:

Carry out the following operations in accordance with BS 6700 and IS EN 806-4, and HSE L8 Legionnaires' disease - control of legionella bacteria in water systems ACOP and 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.
Carry out micro-biological analysis using dipslides.
Special requirements as indicated.

3090 DOCUMENTATION:

Provide number of copies as indicated of hard cover binders containing details of:

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

Provide a complete training programme for site operatives covering:

- Methods of basic water testing.
- Explanation of results obtained.
- Actions to be taken on test results.

13.9 Y50 THERMAL INSULATION

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 IS EN ISO 12241. Use the description of terms as BS 3533.

1030 MATERIALS:

Employ materials that comply with BS 476-7.

Ensure metals and materials that cause galvanic corrosion are not installed in contact.

Do not use galvanized or zinc coated steel jacketing and accessories on austenitic stainless steel and austenitic nickel steel/alloy equipment and piping.

Insulants can be selected from BRE Green Guide to Specification (www.bre.co.uk/greenguide).

New build: BREEAM 2011 requirements

Comply with BREEAM 2011 Issue ID Mat 4.

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.

1050A SPREAD OF FLAME:

When completed, ensure surface-finish complies with BS 476-7 Class 1 spread of flame.

1055A SMOKE EMISSION CHARACTERISTICS:

Supply materials classified as less than 5% smoke obscuration rating when tested in accordance with IS EN ISO 5659-2.

1080 ELECTRICAL BONDING TERMINAL:

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

1090 INSPECTION AND TESTING:

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

2010 THERMAL CONDUCTIVITY:

Ensure values are in accordance with IS EN 12664, IS EN 12667, IS EN 12939 or IS EN ISO 8990.

2015A THERMAL PERFORMANCE LIFE EXPECTANCY FOR PLANT DESIGN LIFE:

Ensure the insulation will maintain its thermal performance for a minimum of the plant design life.

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.

2050A FOIL FACED ROCK MINERAL FIBRE FLEXIBLE DUCT INSULATION:

Nominal density - 28 kg/m^3 to 45 kg/m^3.

Thickness - 25mm to 60mm.

Thermal conductivity - Not exceeding 0.04 W/mK at a mean temperature of 50^{o}C.

Finish - Reinforced aluminium foil.

2110A FOIL FACED CLOSED CELL RIGID PHENOLIC FOAM (PF) PREFORMED SECTIONS:

Nominal density - Refer to manufacturer's recommendations.

Temperature range - Refer to manufacturer's recommendations.

Thickness - Minimum 15mm.

Thermal conductivity - Not exceeding 0.021 W/mK at a mean temperature of 10^{o}C.

Finish - Reinforced aluminium foil.

2110B CLOSED CELL RIGID PHENOLIC FOAM (PF) PREFORMED SECTIONS:

Nominal density - Refer to manufacturer's recommendations.

Temperature range - Refer to manufacturer's recommendation.

Thickness - Minimum 15mm.

Thermal conductivity - Not exceeding 0.021 W/mK at a mean temperature of 10^{o}C.

2120A FOIL FACED CLOSED CELL RIGID LAMINATED PHENOLIC FOAM (PF), DUCT INSULATION SLAB:

Standard - IS EN 13166.

Nominal density - refer to manufacturer's recommendations.

Thickness - minimum 20mm.

Thermal conductivity - Not exceeding 0.021 W/mK at a mean temperature of 10^{o}C.

Finish - Reinforced aluminium foil.

2120B CLOSED CELL RIGID LAMINATED PHENOLIC FOAM (PF), DUCT INSULATION SLAB:

Nominal density - refer to manufacturer's recommendations.

Thickness - minimum 20mm.

Thermal conductivity - Not exceeding 0.021 W/mK at a mean temperature of $10^{O}C$.

2170A VAPOUR BARRIER PERMEANCE:

Do not exceed the following permeance values for vapour barriers.

Permeance values

Cold water pipework - 0.05g/sMN.

Chilled water pipework - 0.015g/sMN.

Refrigeration pipework - 0.010g/sMN.

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.

2190 ADHESIVES:

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

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.

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.

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.

2285 CALCULATION OF INSULATION THICKNESS:

Provide insulation of thickness conforming with calculations in accordance with IS EN ISO 12241 using the standardised assumptions within BS 5422 Table 13 - Warm air ductwork and Table 14 - Chilled and dual-purpose ductwork.

2300 NON-DOMESTIC HOT WATER SERVICE AREAS - PHENOLIC FOAM:

Environmental insulation thickness for non-domestic hot water service areas to control heat loss, aged K-value.

Outside diameter of steel pipe (mm)	Thickness of phenolic foam (mm)
17 mm	15 mm
21 mm	15 mm
27 mm	15 mm
34 mm	20 mm
42 mm	20 mm
48 mm	20 mm
60 mm	20 mm
76 mm	25 mm
89 mm	25 mm
114 mm	25 mm
140 mm	25 mm
168 mm	25 mm
219 mm	30 mm
273 mm	30 mm
Above 273 mm & flat surfaces	30 mm

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.

2320 NON-DOMESTIC HEATING INSTALLATIONS - PHENOLIC FOAM:

Environmental insulation thickness for non-domestic heating installations to control heat loss, aged K-value. Adjust thicknesses to comply with BS 5422.

	Temperature of contents	
	75 ^{O}C	100 ^{O}C
Outside diameter of steel pipe	**Thickness of rigid phenolic insulation**	
17 mm	15 mm	20 mm
21 mm	15 mm	20 mm
27 mm	20 mm	20 mm
34 mm	20 mm	25 mm

42 mm	25 mm	25 mm
48 mm	20 mm	25 mm
60 mm	25 mm	30 mm
76 mm	25 mm	30 mm
89 mm	25 mm	35 mm
114 mm	30 mm	35 mm
140 mm	30 mm	40 mm
168 mm	30 mm	40 mm
219 mm	30 mm	40 mm
273 mm	35 mm	45 mm

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

2360 CHILLED AND COLD WATER SUPPLIES TO PREVENT CONDENSATION - PHENOLIC FOAM, HIGH EMISSIVITY:

Minimum insulation thickness for chilled and cold water supplies to prevent condensation on a high emissivity outer surface (0.6) with an ambient temperature of 25^{O}C and a relative humidity of 80%.

	Temperature of contents		
	10 ^{O}C	5 ^{O}C	0 ^{O}C
Outside diameter of steel pipe	**Thickness of rigid phenolic insulation**		
17 mm	15 mm	15 mm	15 mm
21 mm	15 mm	15 mm	15 mm
27 mm	15 mm	15 mm	15 mm
33 mm	15 mm	15 mm	15 mm
42 mm	15 mm	15 mm	15 mm
48 mm	15 mm	15 mm	15 mm
60 mm	15 mm	15 mm	15 mm
76 mm	15 mm	15 mm	15 mm
89 mm	15 mm	15 mm	15 mm
102 mm	15 mm	15 mm	15 mm
114 mm	15 mm	15 mm	15 mm
140 mm	15 mm	15 mm	15 mm
168 mm	15 mm	15 mm	15 mm

219 mm	15 mm	15 mm	15 mm
245 mm	15 mm	15 mm	15 mm
273 mm	15 mm	15 mm	20 mm
324 mm	15 mm	15 mm	20 mm
356 mm	15 mm	15 mm	20 mm
406 mm	15 mm	15 mm	20 mm
456 mm	15 mm	15 mm	20 mm
508 mm	15 mm	15 mm	20 mm
610 mm	15 mm	15 mm	20 mm

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.

2380 CHILLED AND COLD WATER SUPPLIES TO PREVENT CONDENSATION - PHENOLIC FOAM, LOW EMISSIVITY:

Minimum insulation thickness for chilled and cold water supplies to prevent condensation on a low emissivity outer surface (0.05) with an ambient temperature of 25^{O}C and a relative humidity of 80%.

	Temperature of contents		
	10 ^{O}C	5 ^{O}C	0 ^{O}C
Outside diameter of steel pipe	**Thickness of rigid phenolic insulation**		
17 mm	15 mm	20 mm	20 mm
21 mm	15 mm	20 mm	20 mm
27 mm	15 mm	20 mm	25 mm
33 mm	15 mm	20 mm	25 mm
42 mm	15 mm	20 mm	25 mm
48 mm	15 mm	25 mm	30 mm
60 mm	20 mm	25 mm	30 mm
76 mm	20 mm	25 mm	30 mm
89 mm	20 mm	25 mm	35 mm
102 mm	20 mm	25 mm	35 mm
114 mm	20 mm	30 mm	35 mm
140 mm	20 mm	30 mm	35 mm
168 mm	25 mm	30 mm	40 mm

219 mm	25 mm	35 mm	40 mm
245 mm	25 mm	35 mm	45 mm
273 mm	25 mm	35 mm	45 mm
324 mm	25 mm	35 mm	45 mm
356 mm	25 mm	35 mm	45 mm
406 mm	30 mm	40 mm	50 mm
456 mm	30 mm	40 mm	50 mm
508 mm	30 mm	40 mm	50 mm
610 mm	30 mm	40 mm	55 mm

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.

2400 CHILLED WATER SERVICES - PHENOLIC FOAM:

Environmental insulation thickness for chilled water supplies to control heat gain.

	Temperature of contents	
	5 ^{O}C	0 ^{O}C
Outside diameter of steel pipe	**Thickness of phenolic foam insulation**	
17 mm	15 mm	15 mm
21 mm	15 mm	15 mm
27 mm	15 mm	15 mm
34 mm	15 mm	15 mm
42 mm	15 mm	15 mm
48 mm	15 mm	15 mm
60 mm	15 mm	15 mm
76 mm	15 mm	20 mm
89 mm	15 mm	20 mm
114 mm	15 mm	20 mm
140 mm	20 mm	20 mm
168 mm	15 mm	20 mm
219 mm	15 mm	20 mm
273 mm	20 mm	25 mm

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.

2430 PROTECTION AGAINST FREEZING - PHENOLIC FOAM:

Within the scope of BS 5422 Table 23.

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

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

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

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

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^{O}C, relative humidity 80%, dew point temperature 21.3^{O}C.

Minimum air temperature inside duct	**Thermal conductivity of 0.021 W/mK at a mean temperature of 10 ^{O}C Surface coefficients**		
	Low (0.05)	Medium (0.44)	High (0.90)
	Thickness of phenolic foam insulation		
15 ^{O}C	20 mm	20 mm	20 mm
10 ^{O}C	30 mm	20 mm	20 mm
5 ^{O}C	40 mm	20 mm	20 mm
0 ^{O}C	50 mm	30 mm	20 mm

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.

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.

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.

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.

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.

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.

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.

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 120oC, close butt to a high density phenolic or polyisocyanurate pipe support.

For non-load bearing insulation on cold pipework, close butt to high density phenolic foam pipe supports.

Ensure the vapour barrier is maintained.

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.

13.10 Y51 TESTING AND COMMISSIONING

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.

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.

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.

2065 PRESSURE TESTING - OIL PIPEWORK TO BS 5410:

Test oil pipework in accordance with BS 5410-2, Section 39.

2070 PRESSURE TESTING - PIPED MEDICAL SERVICES:

Test in accordance with requirements of HTM-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 IS 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 IS EN 752.

2100 VACUUM TESTING:

Test vacuum mains in accordance with HVCA TR/6 Guide to Good Practice for Site Pressure Testing of Pipework, Table 1.

3020 COMMISSIONING CODES:

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

3030A COMMISSIONING WATER DISTRIBUTION SYSTEMS INCLUDING BSRIA PRE-COMMISSIONING CHECKLIST:

Preliminary checks - Carry out checks and procedures as detailed in CIBSE Commissioning Code W. Ensure system is statically complete as defined in section B4 of BSRIA Application Guide 2/89 Commissioning of water systems in buildings. Use pre-commissioning checklist from BSRIA Application guide 2/89.

Setting to work and regulation - Set to work and regulate water distribution systems in accordance with CIBSE Commissioning Code W, Sections W2 and W3, and sections C3 and C4 in BSRIA Application Guide 2/89.

Measurement - Use instruments for measurement detailed in BSRIA Application Guide 2/89.

3040A COMMISSIONING AIR DISTRIBUTION SYSTEMS INCLUDING BSRIA PRE-COMMISSIONING CHECKLIST:

Preliminary checks - Carry out checks and procedures as detailed in BSRIA Application Guide 3/89 Commissioning of air systems in buildings. Use pre-commissioning checklist in BSRIA Application guide 3/89.

Setting to work and regulation - Set to work and regulate air distribution systems in accordance with CIBSE Commissioning Code A, Section A2, and sections C3, C4 and C5 in BSRIA Application Guide 3/89.

Measurement of air flow - Use instruments for measurement and methods of measurement detailed in BSRIA Application Guide 3/89 and CIBSE commissioning guide, section A3.

3040B COMMISSIONING VAV AIR DISTRIBUTION SYSTEMS INCLUDING BSRIA PRE-COMMISSIONING CHECKLIST:

Preliminary checks - Carry out checks and procedures as detailed in CIBSE Commissioning Code A, Section A1. Ensure system is statically complete as defined in section B4 of BSRIA Application Guide 3/89 Commissioning of air systems in buildings. - Use pre-commissioning checklist in BSRIA Application guide 3/89.

Setting to work and regulation - Set to work and regulate air distribution systems in accordance with CIBSE Commissioning Code A, Section A2, and sections C3, C4 and C5 in BSRIA Application Guide 3/89. For regulation of Variable Air Volume Systems follow routine in BSRIA Application Guide 1/91 The Commissioning of VAV Systems.

Measurement of air flow - Use instruments for measurement and methods of measurement detailed in BSRIA Application Guide 3/89 and CIBSE commissioning guide, section A3.

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 manufacturer’s 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 IS 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.

3090A INSTRUMENTS AND GAUGES:

Ensure instruments are correctly calibrated. Record details of instruments on record sheets.

Submit evidence of correct calibration of instruments to be used in connection with commissioning and testing.

3100A AIR SYSTEMS COMMISSIONING RECORDS TO BSRIA AG 3/89.3:

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

For air systems - Use record sheets as described in BSRIA Application Guide 3/89.3 Commissioning air systems in buildings.

3100B WATER SYSTEMS COMMISSIONING RECORDS TO BSRIA AG 2/89.3:

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

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

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

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

Confirm that the following plant commissioning has been performed before commencing the final BMS commissioning:

Water systems:

- The system is cleaned and flushed to remove any debris.
- All regulating, isolating and control valves in place and operating correctly.
- That all flow measuring devices are in place and in the correct location for accurate measurement (including pressure tappings).
- The system is vented.
- That the proportional balancing is completed to obtain the branch flow rates in the correct ratio to each other (or through the use of and setting of self-balancing valves).

- That the pump flow rate has been adjusted to provide the specified flow rate.

Air systems:

- Debris has been removed from the air distribution system.
- That dampers are in the correct location and fully functional.
- That fire/smoke dampers open.
- Test holes have been drilled and sealed with removable plugs.
- That in-situ flow measuring devices have been installed.
- Ductwork air leakage testing has been performed (if specified).
- Completion of proportional balancing of regulating dampers so that terminals share the air flow in the correct proportions.
- Regulation of the fan(s) to provide the specified flow rate.

Packaged equipment:

- Ensure that plant and controls have been fully commissioned and are functional, ready for integration with other plant/systems.
- That control equipment inputs/outputs are in the specified format for connection to the main control system.

Confirm that the plant is commissioned in accordance with:

- Air distribution systems, CIBSE Code A
- Boiler plant, CIBSE Code B
- Refrigeration systems, CIBSE Code R
- Water distribution systems, CIBSE Code W
- Commissioning water systems. Application principles, AG 89.3/2, BSRIA
- Commissioning air systems. Application systems for buildings, AG 89.3/3, BSRIA.

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

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 IS EN 14134.

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 IS EN 13528-1, IS EN 13528-2 and IS EN 13528-3.

13.11 Y52 VIBRATION ISOLATION MOUNTINGS

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.

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.

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 re-constituted 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.

3040 HORIZONTALLY RESTRAINED SPRING MOUNTINGS:

Ensure snubbers for limiting excessive movement are installed out of contact during normal operation.

13.12 Y54 IDENTIFICATION - MECHANICAL

1010 REQUIREMENTS:

Identify all pipework, ductwork, equipment, appliances and ancillaries comprising the various systems.

1020 NEW SYSTEMS:

Comprehensively label and colour code throughout works as indicated.

1030 EXISTING SYSTEMS:

Where identification details are incompatible with those required for new systems, obtain approval to mode of cross referencing.

1040 COLOURS:

As indicated to colour ranges given in BS 381C and BS 4800.

1045 PEFORMANCE AND DURABILITY:

Ensure durability of identification for safety purposes is to BS ISO 17398.

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 HVCA Specification DW 144 (Appendix B).

Primary Identification - Apply colour bands, 300mm wide, to each duct at least:

- Once in every room or enclosed area.
- At intervals not exceeding fifteen metres.
- At every junction.
- At every damper.
- At every inspection and access position into service shafts, false ceilings, bulkheads etc.

Secondary Identification:

- For ducts with longest side or diameter up to and including 225mm - Paint colour bands 50mm wide and superimpose legends.
- For ducts with longest side or diameter over 225mm - Paint or apply transfers to identification triangles, or triangular plates. Superimpose or incorporate legends.

Triangular Plates:

- Attach to buckle bands or stool pieces and fix to ducting, with apex indicating direction of airflow.
- Submit details of plates and fixings for approval before painting and marking.
- Use equilateral triangle of side 150mm minimum.

Legends:

- Apply transfers of an approved type to colour bands or triangles or triangular plates.
- Identify floor and space served, associated equipment reference and direction of airflow.

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.

2035 GRAPHICAL SYMBOLS FOR USE ON EQUIPMENT IN ACCORDANCE WITH IS EN 80416:

Graphical symbols for use on equipment to be created and applied in accordance with IS EN 80416-1, IS EN 80416-2, IS 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.

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.

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.

13.13 Y90 FIXING TO BUILDING FABRIC

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.

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.

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.

3**080A 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.

13.14 Y91 PAINTING AND ANTI-CORROSION TREATMENTS

2010A PAINT MATERIALS:

Use the following materials as appropriate:

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

2020 PAINT QUALITY:

Ensure paints used are of quality and type to suit application and that:-

- primers have good adhesion, covering power, rust-inhibiting and grain filling properties.
- gloss finishing paints are of machine finish grade having high adhesion and high resistance to solvents, mineral oils, cutting oils, detergents, chipping and impact damage.

3020 WEATHER AND OTHER CONDITIONS:

Do not apply paints where weather, temperature, humidity or other conditions may have a damaging effect upon finish or paint.

3030A CLEANING AND PREPARING STEEL SURFACES FOR PAINTING:

Ensure metal surfaces are thoroughly cleaned, all mill and weld scale removed and finally degreased. Clean steel surfaces in accordance with IS EN ISO 8503 and prepare surfaces for painting in accordance with IS EN ISO 4618.

3030B CLEANING AND PREPARING SURFACES FOR PAINTING:

Ensure metal surfaces are thoroughly cleaned, all mill and weld scale removed and finally degreased.

Prepare surfaces for painting in accordance with IS EN ISO 4618.

3040 APPLICATION OFF-SITE:

Wherever possible ensure paint finishes applied by component manufacturers are spray applied.

3050 APPLICATION:

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

3060 COLD GALVANIZING:

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

3070 PROTECTION OF BRIGHT MACHINE PARTS:

Apply a protective coating to all bright machined parts before despatch from works.

Do not remove protective coatings unless required for installation, testing or commissioning purposes and in such cases reinstate upon completion.

Repair any damaged protective coating or bright machined part, or where necessary replace damaged component.

Use and apply metal coatings in accordance with manufacturer's instructions.

Complete where possible all welding, drilling, bending and other work before metal coating.

13.15 Y92 MOTOR DRIVES - ELECTRIC

1040A 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.

1050A MANUFACTURER FITTED TRANSIENT SUPPRESSORS:

Supply transient suppressors in the form of resistor and capacitor networks across the starter contactor coils. Fitted by manufacturer.

2010A STANDARD OPERATING CONDITIONS:

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

2020 MOTORS - GENERAL:

Standard - Use motors which conform to IS EN 60034, as applicable, which operate at lowest possible speed, compatible with performance requirements.

Ratings - Select maximum continuous rating (MCR) such that:

- Driven machine operates at correct speed or speeds at design duty.
- When running continuously at design rated duty, the temperature of the motor parts is within limits defined in IS EN 60034-1.
- When provided with excess motor current (over-load) protection of thermal overcurrent release type, ensure operation is within tolerances of tripping as defined in IS EN 60947-4-1.

Insulation - Use motors with Class 130 or 155 to IS EN 60085 insulation, with temperature rise as defined in IS EN 60085.

Conduit entry - Fit motor bodies with conduit entry terminal box or cable gland as required, and to suit type and size of cable being terminated.

2025A MOTOR EFFICIENCY:

Supply a IE2 High Efficiency Motor with a minimum efficiency compliant with IEC 60034-30:2008 as shown in the table below.

Motors Efficiencies (%): IEC 60034-3 (50 Hz)			
Rating (kW)	**IE2 High Efficiency**		
	No. of poles		
	2	**4**	**6**
0.75	77.4	79.6	75.9
1.1	79.6	81.4	78.1

1.5	81.3	82.8	79.8
2.2	83.2	84.3	81.8
3	84.6	85.5	83.3
4	85.8	86.6	84.6
5.5	87.0	87.7	86.0
7.5	88.1	88.7	87.2
11	89.4	89.8	88.7
15	90.3	90.6	89.7
18.5	90.9	91.2	90.4
22	91.3	91.6	90.9
30	92.0	92.3	91.7
37	92.5	92.7	92.2
45	92.9	93.1	92.7
55	93.2	93.5	93.1
75	93.8	94.0	93.7
90	94.1	94.2	94.0
110	94.3	94.5	94.3
132	94.6	94.7	94.6
160	94.8	94.9	94.8
200 up to 375	95.0	95.1	95.0

2030 SLIDE RAILS:

Fit motors on slide rails or other suitable means of adjustment to facilitate correct alignment and belt tension.

2040 PLINTHS:

Where plinths are built in by others, provide all necessary assistance and information.

2050A MOTOR RATINGS - UP TO AND INCLUDING 0.75KW:

Single or three phase, totally enclosed, frame cooled or fan cooled. For duty and torque requirements of driven machine.

2050B MOTOR RATINGS - ABOVE 0.75KW UP TO AND INCLUDING 4KW:

Three phase, squirrel cage induction type, totally enclosed, frame cooled or fan cooled. To IS EN 60034-5 and IS EN 60034-6 IP44 - IC 01.411.

2050C MOTOR RATINGS - ABOVE 4KW SQUIRREL CAGE, DRIP-PROOF:

Three phase, squirrel cage, induction type, drip-proof enclosure. To IS EN 60034-5 and IS EN 60034-6 IP22S - IC 01.

2050D MOTOR RATINGS - ABOVE 4KW WOUND ROTOR, DRIP PROOF:

Three Phase, wound rotor, slip type, drip-proof enclosure. To IS EN 60034- 5 and IS EN 60034-6 IP22S -IC 01.

2050E MOTOR RATINGS - ABOVE 4KW SQUIRREL CAGE, TOTALLY ENCLOSED:

Three phase, squirrel cage, induction type, totally enclosed, frame or fan cooled. To IS EN 60034-5 and IS EN 60034-6 IP44 - IC 01.411.

2050F MOTOR RATINGS - ABOVE 4KW WOUND ROTOR, TOTALLY ENCLOSED:

Three phase, wound rotor, slip ring type, totally enclosed, fan cooled. To IS EN 60034-5 and IS EN 60034-6 IP44 - IC 01.411 or IC 01.511 as applicable.

2050G MOTOR RATINGS - ABOVE 4KW SQUIRREL CAGE, SMOKESPILL:

Three phase squirrel cage, induction type for smokespill applications. To IS EN 60034-5 and IS EN 60034-6 IP55, cooling as applicable.

2050H ABOVE 4KW SQUIRREL CAGE, ENERGY EFFICIENT DESIGN:

Three phase, squirrel cage, induction type energy efficient design, totally enclosed, fan cooled to IS EN 60034-5 and IS EN 60034-6 IP55 - IC 01.411.

2060A MOTORS - OVER TEMPERATURE PROTECTION, THERMISTORS:

Fit positive temperature coefficient thermistors to IS EN 60034-11. Provide a minimum of 3 PTC thermistors in each motor with 2 ends terminated in motor terminal box clearly and permanently marked.

For motors rated between 30kW and 75kW provide a single thermistor in each phase.

For motors rated above 75kW provide two thermistors in each phase.

Provide control unit to IS EN 60034 to motors fitted with thermistors. Interconnect control unit with thermistors and starter to trip starter when one or all of thermistors detect overheating.

2070A INDIRECT DRIVES WITH TOOTHED BELTS:

Belts - Use toothed wedge belts to BS 3790. Provide at least two matched belts for any drive, of anti-static type and rated to transmit full machine power with one belt removed.

Pulleys - Construct pulleys from approved materials and statically balance. Lock close limit bores by keys fitting into machinery shaft keyway.

Pulley Adjustment - Adjust pulley to give alignment and correct belt tension.

2070B INDIRECT DRIVES WITH FLAT BELTS:

Belts - Use flat wedge belts to BS 3790. Provide at least two matched belts for any drive, of anti-static type and rated to transmit full machine power with one belt removed.

Pulleys - Construct pulleys from approved materials and statically balance. Lock close limit bores by keys fitting into machinery shaft keyway.

Pulley Adjustment - Adjust pulley to give alignment and correct belt tension.

2080A DIRECT COUPLED DRIVES:

Use an extended motor shaft coupled to machine or a flexible coupling connecting driving and driven shafts, incorporate suitable arrangements for aligning the two shafts.

Mount motors on a substantial mild steel bed plate fixed to machine casing separately supported or supported entirely from the machine casing.

2085 VARIABLE SPEED DRIVE:

Use variable speed drive to match design and installed flow volumes.

2090A GUARDS:

Totally protect drives and couplings. Fit purpose made guards around all exposed or otherwise accessible drive shafts, pulleys, 'V' belts or couplings.

Ensure guards comply with National or Local Safety Codes, Acts and Bye-Laws and incorporate following features.

Construction to IS EN ISO 12100 and generally of galvanized steel wire mesh.

Stiffening within the guards to ensure rigidity and freedom from vibration.

Allowance for prime mover adjustment during belt tensioning procedures.

Temporary access to all shafts for use of Tachometer.