

KINGDOM OF BAHRAIN



STANDARD SPECIFICATIONS FOR CONSTRUCTION WORKS 2008

Module – 07 – Internal Finishes including Thermal Insulation

Introduction

The Standard Specification is published in a series of 21 stand-alone modules each addressing single distinct areas of the construction process. This stand-alone module 07 addresses the main aspects of internal finishes in general.

The purpose of the MoW STANDARD SPECIFICATIONS FOR CONSTRUCTION is to provide the design professional with a guide for accepted construction practices for Ministry of Works projects. As an aid to the designer, these Standard Specifications are provided for the inclusion in proposed development projects for ease, efficiency and cost savings.

The Standard Specifications are not intended to limit the design responsibility of the design professional. However, they establish a minimum acceptable criterion and/or quality for use within Ministry of Works projects.

The design professional may increase the requirements of an item contained in the Standard Specifications to meet job requirements, but when this is done, there should be no reference for that item on the drawings to the Ministry of Works Standard Specifications and a new specification should be included with the drawings or project contract documents.

The design professional must review all Standard Specifications to be sure that they are adequate for the proposed project based on the job site conditions; the design professional is solely responsible for the designs submitted under his seal.

In order to keep design standards current with changing regulations and improved construction materials and practices this section will be updated and maintained by the concerned authorities of the Ministry of Works. Prior to starting a new project, the design professional should contact the concerned Directorate of the Ministry of Works to verify that he/she has the latest document revisions.

Module List

<u>Module No</u>	<u>Module Title</u>
1	Guidance and General Specifications
2	Concrete
3	Earthworks
4	Glass and Glazing
5	Joinery and Carpentry
6	Ironmongery
7	Internal Finishes including Thermal Insulation
8	Painting and Decorating (Internal & External)
9	Metalwork
10	Roofing
11	Structural Steel (and Coatings)
12	Structural Timber
13	Masonry
14	Plumbing and Sanitary
15	Mechanical Installation in Buildings
16	Electrical Installation
17	Sewerage, Pipelines and Pipework
18	Sewerage M&E Works
19	Roadworks
20	Landscaping
21	Dredging, Reclamation and Shoreline Protection

Table of Contents

<u>CLAUSE</u>	<u>DESCRIPTION</u>	<u>PAGE</u>
	Introduction	1
	Module List	2
	Table of Contents	3
	Foreword	4
1.	PART 1 MATERIALS	5
1.1	Source Approvals.....	5
1.2	Product Delivery, Storage & Handling.....	15
2.	PART 2 METHODOLOGY AND WORKMANSHIP	15
2.1	Bonded or Unbonded Screeds.....	15
2.2	Floor Finishes.....	16
2.3	Walls – Internal.....	23
2.4	Walls – External.....	26
2.5	Ceilings.....	26
3.	PART 3 SUMMARY	28
3.1	Protection.....	28
3.2	Reference Documents.....	28
4.	PART 4 APPENDICES	32
4.1	Appendix A: Thermal Insulation.....	32
	Abbreviations	35

Foreword

This specification provides the basis for internal finishes in building construction. It includes the provision of all plant, labour, materials and scaffolding involved in the installation of floor, wall and ceiling finishes, both internal and external.

This specification must be read in its entirety, as it is structured in order of work-flow, which means that items or activities appear in several places in the specification corresponding to the progression of the construction process.

For larger or more complex or specialist projects, a project-specific Particular Specification for internal finishes may also be provided.

Absence of clauses for materials and methods does not necessarily signify that they can not be used. Proposals for use of innovative methods and materials are encouraged and are subject to review and approval by the Client.

Where the word approved is used in this specification, this means that the Client or Engineer has been consulted and has confirmed that the item or procedure is acceptable in the specific context for which approval has been requested.

1. PART 1 MATERIALS

This section includes the provision of all plant, labour and materials involved in the installation of floor, wall and ceiling finishes both internal and external.

The Contractor shall not place an order for any materials unless a sample has been submitted to, and approved in writing, by the Engineer. Materials delivered to site shall be of the same standard and quality as the approved sample.

1.1 Source Approvals

1.1.1 Submittals

The following shall be submitted for approval:

- Documented formal materials requests
- Samples
- Samples in accordance with the specifications
- Technical data demonstrating compliance with this standard specification for each item or material to be incorporated in the Works
- Manufacturer's technical data for each material and fabricated product required, including installation and maintenance instructions
- Finishes schedules

1.1.2 Cement

Cement shall be OPC, and shall conform to BS EN 197: Part 1 and BS EN 413: Part 1.

1.1.3 Water

Water shall be clean and potable to BS 5328 and BS EN 1008.

1.1.4 Sand

Sand shall be to BS EN 13139.

1.1.5 Lime

Lime shall be dry hydrated, high calcium lime or hydrated semi-hydraulic lime complying with BS EN 459: Part 1. Tests for lime shall be carried out at temperature mid-point of 27°C.

1.1.6 Aggregate

Aggregate shall be 10 mm single-sized, selected to avoid high shrinkage (in excess of 0.0575% when tested to BS EN 1367: Part 4).

1.1.7 Bonding Agent

Bonding agent shall be poly vinyl acetate based, to the approval of the Engineer.

1.1.8 Proprietary Screed

Proprietary screed products shall have current Agrément Certificates issued by a recognized authority. Product data are to be submitted with material submittal.

Self-levelling floor compound shall be a cementations free-flowing compound capable of being laid to any thickness in the range 1 mm to 20 mm, For thicknesses greater than 10 mm, a clean sharp sand filler complying with BS EN 12620 Table 4 Grading M, may be

incorporated into the mix. The material shall have a minimum 28 days' compressive strength of 30 N/mm² when tested as 50 mm cubes cured at 35°C.

1.1.9 Crack Control Reinforcement

Crack control reinforcement shall be A142 to BS 4483, steel mesh shall be to BS 405, and wire shall be to BS EN 10223: Part 2 and not less than 150 mm wide. Alternatively, Fibre Polypropylene mesh shall be used as specified on the drawings.

1.1.10 Surface Hardener

Surface hardener shall be of the penetrating type that reacts chemically with lime and other soluble particles in the concrete to form hard crystals permanently bound into the concrete matrix.

1.1.11 Ceramic Floor Tiles

Ceramic floor tiles shall be glazed or unglazed and shall comply with BS EN 14411. Tiles shall be of the low water absorption type, that is, Group A1 or Group B1.

1.1.12 Ceramic Wall Tiles

Glazed ceramic wall tiles shall comply with BS EN 14411 and BS EN ISO 10545. Tiles shall be of the low water absorption type, that is, Group A1 or B1.

Edge and corner stops shall be coloured vinyl, ceramic, aluminium and stainless steel preformed type.

1.1.13 Porcelain Floor / Wall tiles

Glazed/unglazed porcelain tiles shall comply with BS EN 14411. Tiles shall have low water absorption below 0.5% (B1a), cushioned edge, and coefficient of friction greater than or equal to 0.60 but less than 0.70 when tested to ASTM C 1006.

1.1.14 Terrazzo Tiles

Terrazzo tiles shall be to BS EN 13748, generally 300 mm x 300 mm, and minimum thickness 20 mm.

1.1.15 Natural Stone

Natural granite, marble, travertine, slate, quartzite, limestone and sandstone classified as suitable for flooring shall be as BS 5385: Part 5.

1.1.16 Carpet Tiles

Carpet tiles shall be to BS EN 1307, woven, fusion bonded, tufted or needle punch, as follows:

- 80:20 polypropylene: nylon
- 100% nylon loop pile
- 100% Antron loop pile
- 100% Antron fusion bonded cut pile

1.1.17 Carpet

Carpet tiles shall be to BS EN 1307, woven, knitted, bonded pile, needle felt, tufted with backing, as follows:

- 80:20 wool: nylon cut and loop pile.
- 70:30 polypropylene: nylon fibre bonded
- 100% polypropylene tufted

1.1.18 Underlay (Cushion) Material

Rubber coated hair and jute felt shall comply with BS 5808, minimum 38 oz/yd².

Sub-floor filler shall be white premix latex type, recommended by carpet manufacturer.

Carpet gripper shall be the type recommended by carpet manufacturer to suit application, with attachment devices,

Edge strips shall be as shown on drawings and as per approved shop drawings.

Adhesive shall be compatible with cushion material, and recommended by cushion manufacturer.

1.1.19 Vinyl Flooring

Vinyl flooring shall be homogeneous and monolayer construction (with static dissipative properties if used in conjunction with raised floors, and so on). The properties of the flooring shall be at least:

- Thickness: 2 mm minimum (BS EN 428)
- Width: 1.5 m – 2.0 m (BS EN 426)
- Material: BS EN 649
- Flame spread: Class BFL-S1 (BS EN 13501)
- Slip resistance: Classified D
- Abrasion test: Group M (BS EN 660: Part 2)
- Electrostatic: (ASTM F150/ NFPA 99)
- Colour fastness: Level 7 (BS 2782: Part 5)
- Use Area classification: 34/43 (BS EN 685)
- Weight: 3,300 g/m² min (BS EN 430) (if required)
- Electrostatic properties: (BS EN 1081 R1/R2) 5 x 10 to 2 x 10 ohms
- Vinyl flooring must not contain PVC, halogens, CFC, cadmium, asbestos, formaldehyde or plasticizers.

1.1.20 Linoleum

Standard linoleum shall comply with BS EN 12104 and be supplied in sheet or tile form with jute hessian backing.

1.1.21 Rubber Flooring

Rubber flooring shall comply with BS 1711 and shall be in sheet or tile form, to Engineer's approval.

- Size: 600 mm x 600 mm or as specified in drawings.
- Thickness: 10 mm
- Weight: 12 pounds (5.4 kg), each tile.
- Static coefficient of friction, when tested in accordance with ASTM D 2047: Dry 0.84; Wet 0.90.
- Tile-to-tile interlock: Hidden interlock feature, which hides interlocks beneath tile surface; five interlocks per side.
- Surface: Polished top surface/To Engineer's Approval
- Colour: To Engineer's Approval

- Flammability tested in accordance with ASTM E 648: Critical Radiant Flux 0.62 watts/cm², Class 1.

1.1.22 Engineered or Laminated Wood Floors

Multi-layer construction of timber shall be to BS EN 13489. Manufacturer's instructions shall be referred for the preparation of substrate and laying laminated/engineered wood floors.

1.1.23 Marble or Granite Tiles or Slabs

Marble or granite tiles shall be free from cracks, seams, starts and other defects and shall be laid with matching or staggered butt joints. Tiles shall be fixed, bedded and grouted in accordance with the supplier's recommendations and requirements of BS 5385: Part 5. Size of the tiles shall be as shown on the drawings with a minimum thickness of 25 mm.

The marble or granite shall be polished, honed or flamed, and shall have the following minimum physical properties:

- Compressive strength: 160 MPa
- Ultimate tensile strength: 14 MPa
- Coeff. thermal expansion: 0.0078 mm/m °C
- Water absorption: 0.5%
- Impact test: min fall height: 65 cm
- Bulk density: 2,600 kg/m³
- Abrasion coefficient: 1.38
- Colour uniformity: Very good

1.1.24 Static Flooring

1.1.24.1 Sheet Flooring

Static dissipative anti-static flooring shall be 2 mm thick sheet, for use in areas with electronics workshops and specialized storage, as indicated on the finishes schedule and shall be to BS EN 61340: Part 5-1.

Properties shall be as follows:

- Sheet: 2 mm thick
- Sheet or tile weight: 3.5 kg/m²
- Flame spread: Class 2 to BS 476: Part 7

Alternatively, sheet flooring shall be to BS 2050 Static Conductive Sheet (2 mm).

For use in manufacturing areas and operating theatres as indicated on the finishes schedule, static flooring shall be to BS EN 61340: Part 5.

1.1.24.2 Epoxy Flooring

Epoxy-resin flooring shall be submitted for the Engineer's approval, and shall comprise moisture cured, concrete/sand/cement, sealer and hardener based on non-toxic polyisocyanate system.

The material shall penetrate and seal the concrete surface and polymerise to form a colourless film which acts as an efficient water and vapour barrier. The polymer mass shall also bind efficiently within the cement/sand matrix, increasing surface durability and reducing dusting.

Properties shall be as follows:

- Appearance: Coloured film
- Thickness: 2 mm to 4 mm
- Specific gravity: 1.17 at 20°C
- Viscosity: 49 sec at 20 °C
- Cure initial: 2 to 3 hours at 20°C, full 5 to 7 hours at 20°C
- Temperature resistance: up to 85°C
- Chemical resistance: alkalis, oils, grease, and so on.

Application shall be strictly to the written instructions of the manufacturer and the approval of the Engineer, by an approved specialist sub-contractor.

1.1.25 Plasterboards

1.1.25.1 Gypsum Board – General

Gypsum core panel surfaced with paper on front and back edges shall be to BS EN 520 Type A, minimum 12.5 mm thick, 1,200 mm x 2,400 mm boards with tapered edges.

1.1.25.2 Water Resistant Gypsum Board

Gypsum core panel with additives to enhance water resistance of core, surfaced with paper on front and back edges, shall be to BS EN 520 Type D & H, minimum 12.5 mm thick, 1,200 mm x 2,400 mm boards with tapered edges.

1.1.25.3 Mould and Mildew Resistant Gypsum Board

Gypsum core panel surfaced with mould and mildew resistant paper on front and back edges shall be to BS EN 520 Type D & H, minimum 12.5 mm thick, 1,200 mm x 2,400 mm boards with tapered edges.

1.1.25.4 Fire Rated Gypsum Area Separation Walls

Shall be to BS EN 520 Type D, F & I, minimum 12.5 mm thick 1,200 mm x 2,400 mm boards with tapered edges.

1.1.25.5 Gypsum (lift) Shaft Liner

Gypsum for lift shaft lining shall be a panel with fire-resistant core, with water-repellent additives, surfaced with paper on front and back edges, to BS EN 520 Type D, F & I, minimum 12.5 mm thick, 1,200 mm x 2,400 mm boards or larger.

1.1.25.6 Thermal Insulation

Thermal insulation shall be to BS EN 520: Part 1 Type 1 with bonded layer of insulation. Polystyrene shall be to BS 3837: Part 1 & 2 and shall include flame-retardant additive.

1.1.25.7 Sound Dampening Area Separation Walls

Sound dampening for area separation walls shall be to BS EN 520 Types E, D & I, minimum 12.5 mm thick, 1,200 mm x 2,400 mm boards with tapered edges.

1.1.25.8 Gypsum Soffit Board

Gypsum soffit boards shall be gypsum core soft panels, with additives to enhance sag resistance of core, surfaced with paper on front and back.

1.1.25.9 Gypsum Sheathing Board

Gypsum sheathing board shall be to BS EN 520, reduced water absorption, for backing at

external walls. Accessories for the installation and trimming of gypsum board partitions (and ceilings) shall be to BS 7364.

1.1.26 Metal Framing Systems

Metal framing systems shall comply with the following requirements:

- All metal components shall be manufactured to BS 7364 for galvanized studs, channels, and so on, using screw-fixed gypsum wallboard. Studs are to be made from cold formed galvanized metal into C channels or U tracks, and so on, minimum 0.50 mm up to 1.2 mm metal thickness in sizes from 50 mm to 72 mm (for standard walls), and spaced at 400 mm to 600 mm centres depending on situation.
- Zinc coating to cold formed channels shall be minimum 0.65 mm thick.
- Jointing tape shall be to manufacturer's recommendation.
- Jointing compound shall be to manufacturer's recommendation.
- Acoustic sealant shall be of non-drying, non-hardening, non-skinning, non-staining, non-bleeding, gunable type, as recommended by manufacturer.
- Screws and nails shall be to manufacturer's recommendation.
- Corner bead/casing bead shall be to BS EN 13658: Part 1.

1.1.27 High Pressure Laminates

High pressure laminates shall be flat panels of thermosetting resins, homogeneously reinforced with cellulose fibres and manufactured under high pressure and temperature, with an integrated decorative surface to a colour and texture required by finishes schedule. Thickness shall be from 6 mm to 25 mm.

High pressure laminates shall have good resistance to wear, moisture, organic solvents, detergents, food juices, dyes and UV. Thermal properties shall be 0.3 W/mK. The panels shall have Class 0 fire resistance to BS 476: Part 6 & 7.

1.1.28 Worktops and Vanities

Worktops and vanities shall be manufactured from a homogeneous filled acrylic resin, marble, granite, or other materials as approved and to the thickness shown on the drawings. This board shall have fire-retardant fillers and a proprietary colouring agent through the entire thickness. The material shall have minimum physical performance properties as in particular specifications or on drawings. Units are to be supplied with one good face and backing prepared for bonding/fixing to substrate/framing.

Worktops shall be minimum 19 mm thick adhesively joined with inconspicuous seams if necessary. Edge details shall be as shown on drawings.

Vanities shall be minimum 19 mm thick with over counter, integral bowl or under counter bowl suitably fixed.

1.1.29 Framing

Supporting framework shall be provided as shown on drawings, suitably fixed to structure. Joint adhesive shall be as manufacturer's standard kit.

1.1.30 Wallpaper

All wall coverings shall be cadmium and mercury free. Vinyl wall covering shall be backed vinyl only.

1.1.31 Fabric Wall Covering

Fabric wall covering shall have facing of polypropylene fibre and backing of 100%

acrylic, and shall have a flame spread rating of 0-20 and smoke development rating of 0-25 when tested in accordance with ASTM E84.

Fabric wall covering shall have the following properties:

- Mildew resistant
- Width: 1,300 mm minimum
- Roll: 50 m
- Weight: 360 g/m²
- Cotton backing: 55 g/m²
- PVC layer: 300 g/m²

All adhesives shall contain bactericides and mildew inhibitors.

Products shall be lightfast to BS EN ISO 105-B02, heat resistant, tear resistant, water vapour permeable, anti-static to DIN 51953 and non hazardous regarding toxicity to DIN 53436.

The supplier shall provide additional material for each type of wall covering installed in an amount equal to 5% of the installed amount.

1.1.32 Render to External Walls

Render to external walls shall consist of Portland cement plaster materials, compositions, and mixes, complying with ASTM C 926 or BS EN 13914: Part 1. Three-coat work shall be used over metal lath. Two-coat work shall be used over concrete when cast-in-place or pre-cast, and when surface complies with ASTM C 926 or BS EN 13914: Part 1 for plaster bonded direct to solid base.

External plaster (render) shall be applied in 3 coats, to a thickness of 25 mm over metal lath, and with smooth wood float finish.

Plastering accessories shall be grade 316 stainless steel.

Portland cement plaster base and finish coats shall be moist cured to comply with ASTM C 926 or BS EN 13914: Part 1.

1.1.33 Stone Cladding

The Contractor shall provide a proprietary external wall cladding system to satisfy the general requirements of weather-tightness, insulation and structural support of the stone cladding around the external face of the buildings as well as requirements in the particular specification. The design shall be carried out by a specialist supplier/sub contractor who can demonstrate a successful record of supply, installation and performance of similar buildings in the Bahrain over the last ten years.

The system shall achieve the following specific performance parameters:

- Exterior finish: Granite/marble as specified on drawings.
- Stone thickness: As shown on drawings or minimum 25 mm.
- Water infiltration: Provision shall be made in the design to drain from the exterior face of the wall any occurrence of water or condensation, with no damage to the adjacent construction or finishes.
- Structural strength: The system shall be capable of transferring the vertical loads safely back to the structure of the building at each floor level. The system shall be able to withstand forces from wind to a minimum of 1.2 kN/m² applied as suction or pressure.
- Sound insulation. To achieve a minimum noise reduction, when calculated as part of the external envelope, of 45 dB.

If required by the engineer, the contractor shall provide a mock-up of the cladding system providing a panel approximately 4 m x 5 m showing the following aspects of the design:

- Wall construction
- Attachment system
- External corner detail
- Junction with window/curtain walling
- Connection to building structure
- Finishes of stone and sealant system

Shop drawings: The contractor shall submit shop drawings which will fabrication details, cutting and setting drawings showing sizes, dimensions, sections, profiles, jointing, supports, anchoring, bonding and junction to adjacent structures or finishes.

Stone anchors shall be stainless steel, as required to securely anchor and fasten stonework in place. Anchors and dowels shall be fabricated from AISI type 316/316 Tiu or 304/321 stainless steel.

Sealant shall be to BS 6213 non staining silicone or to BS EN ISO 11600.

1.1.34 Acrylic Panels

Acrylic panels shall be fabricated in accordance with BS 4965.

1.1.35 Fixings for Gypsum Board Ceiling

Ceiling main runner channels shall be cold rolled steel channel, minimum base steel thickness of 1.4 mm, 38 mm deep, 70.7 kg/100 mm. Steel channels shall be treated with rust-inhibitive paint finish, and shall be hot or cold-rolled, complying with BS EN 10279 and BS 10162.

Ceiling cross furring channels shall be cold rolled steel channel, 19 mm deep, weighing 44.6 kg/100 mm with minimum base steel thickness of 1.4 mm.

Rigid furring channels shall be hat-shaped channels, 22 mm deep, weighing 42.7 kg/100 m with minimum base steel thickness of 0.45 mm, galvanized, and complying with ASTM C 645.

Resilient furring channels shall be hat-shaped channels, 12 mm deep, with resilient legs, weighing 32.7 kg/100 mm with minimum base steel thickness of 0.48 mm and galvanized.

Z furring channels shall be Z-shaped channels complying with ASTM C 645, with minimum base steel thickness of 0.45 mm, and galvanized, as follows:

- 25 mm deep: 29.9 kg/100 m.
- 38 mm deep: 35.1 kg/100 m.
- 51 mm deep: 39.9 kg/100 m

Jointing tape shall be to manufacturer's recommendation.

Jointing compound shall be to manufacturer's recommendation.

Acoustic sealant shall be to non-drying, non-hardening, non-skinning, non-staining, non-bleeding, type as recommended by manufacturer.

Screws and nails shall be to manufacturer's recommendation.

Movement/control joints shall be preformed zinc sheet or vinyl.

Corner bead/casing bead shall be to BS 13658: Part 1.

1.1.36 Mineral Fibre Ceiling Tiles

Tiles shall be manufactured from bio-degradable mineral wool, inorganic fillers and binders, 12 mm to 15 mm thick in sizes of 600 mm x 600 mm or larger. The surface finish shall be paint (free of organic solvents) over a surface pattern of fissures and needling according to the manufacturer's range. The tiles shall provide a fire resistance of Class "O" to BS 476: Part 6 and 7, and shall have an acoustic absorption of at least NRC 0.65 and light reflectance factor of 86%. The minimum weight of tiles shall be 5 kg/m².

1.1.37 Gypsum Soffit Board – External

Calcium silicate board ceiling shall be installed in humid areas and external soffits, and shall comply with the following requirements and properties:

- Class 'O' Building Regulations 1985
- BS 476: Part 20, 21, 22 and 23
- BS 476: Part 4
- BS EN ISO 9001
- Thickness: 6 mm to 12 mm
- Density: 875 kg/m³ to 900 kg/m³
- Weight: 11.5 kg/m²
- Thermal conductivity: 0.17 W/mK
- Moisture movement: + 0.04%

1.1.38 Access Flooring Materials

Structural steel shall conform to ASTM A 36/A 36M.

Galvanized coatings shall conform to ASTM A 123/A 123M.

Cold rolled steel shall conform to ASTM A 335/A335M.

Hot rolled steel shall conform to ASTM A 1011/A1011M.

Adhesives shall be as recommended by floor system manufacturer.

Aluminium sections shall conform to ASTM B 85/B 85 M.

1.1.39 Render Coats

Render coats shall be in masonry cement or Portland cement plus an air entraining admixture to BS EN 934: Part 3.

Fine aggregate (sand) shall conform to BS EN 13139. Sand shall be obtained from natural sources or crushed aggregate. Beach sand will not be permitted for rendering purposes.

1.1.40 Cement-Sand Plaster

Materials shall conform to relevant requirements of the concrete specification.

Admixtures should not contain calcium chloride.

Plastering accessories shall be stainless steel for internal work.

In situ concrete and block walls shall be kept dry and allowed to dry out fully and complete drying shrinkage before beginning the cement-sand render, and at least 14 days.

Biocides, if required, shall be recommended for the purpose and cleared under the Pesticides Safety Precautions Scheme.

1.1.41 Fabric Ceiling Canopies

Structures shall be fabricated in accordance with approved shop drawings, and using the following fabrics:

- Cotton
- PVC coated glass mesh
- Polyurethane coated glass cloth

Fabrics shall comply with BS 476 Part 7 Class 1 and Part 6 Class 0, normal requirement for internal finishes.

1.1.42 Membrane Structures Shades & Canopies

Structures shades and canopies shall be fabricated in accordance with drawings and specifications of individual materials.

- GRP canopies: BS EN ISO 9001
- Stainless Steel Bars and Shapes: ASTM A276.
- Stainless Steel Wire Strand: ASTM A368.
- Cleaning, Descaling and Passivation of Stainless Steel Parts: ASTM A380.
- Stainless Steel Wire Rope: ASTM A492.
- Stainless Steel Wire and Wire Rods: ASTM A555/A555M.
- Free Machining of Stainless Steel Wire and Wire Rods: ASTM A581/A581M.
- Free Machining of Stainless Steel Bars: ASTM A582/A582M.
- Polyester Fabric membrane coated with PVC additives like fire retardants, UV stabilizers, colouring and anti fungicides. Fabric properties shall conform to BS 7837 for flammability performance, and shall be environmentally safe and recyclable.
- Teflon or Poly Tetra Fluoro Ethylene-coated glass cloth. Components of PTFE/glass shall be inert and are therefore good for permanent structures (25-30 years).

1.1.43 Skylights

Structures shall be fabricated in accordance with drawings and specifications of individual materials, and shall comply with the following requirements:

- Compression seal, gaskets, setting blocks and spacers shall comply with ASTM C 864.
- Structural aluminium profiles shall comply with ASTM B 308/B 308M.
- Carbon Structural Steel shall comply with ASTM A 36/A 36M.
- Glazing shall comply with BS 5713 for Insulated/Low Solar Gain Glass.

1.1.44 Plain or Perforated Metal Tiles or Strip Ceiling

Perforated/plain aluminium ceiling tiles shall be 600 mm x 600 mm and 0.7 mm thick, or as indicated on the drawings with lay in or clip in regular (15 mm or 24 mm wide) polyester powder coated grid.

The selected colour for the ceiling tiles should be matched with the finish and colour to be used for the air conditioning grilles, outlets and light fittings to ensure match.

The suspension system shall conform with ASTM C 636/ C636M.

The installed system shall provide a flame spread of 0 – 25, complying with certified testing to ASTM E 84.

1.2 Product Delivery, Storage & Handling

All branded materials shall be delivered to site in their original packages, bearing trade names of the material concerned. Cement, hydrated lime, and gypsum plaster shall be stored off the ground, under cover and away from all possible sources of damp and rain damage or sea spray.

Mineral fibre ceiling tiles are particularly vulnerable to damage at corners and should be stored flat in delivery condition in a clean, dry area until required. Once installed they should not be removed unless absolutely necessary.

2. PART 2 METHODOLOGY AND WORKMANSHIP

2.1 Bonded or Unbonded Screeds

Screeds shall be installed on bases that are sound, free from cracks, clean and free from any oils or contaminants. The base shall be flat and within the tolerances for deviation in order to achieve minimum screed thickness required. Screeds in wet areas shall be laid on a separating layer. Pneumatic scabbling or sand blasting shall be used to remove laitance, debris, and so on, to expose the aggregate. The base shall be well wetted for several hours before laying screed.

If specified, the bonding agent shall be laid while the base is still wet to ensure a good bond. The screed shall be laid in alternating bays to the areas prescribed. The surface shall be floated with either a wood float (coarse finish), steel trowel (smooth finish), power float or vibrating beam (polished finish). Maximum deviation shall be 3 mm in 3 m straight edge. If non-slip finish is required, grains shall be applied at an even rate and trowel into surface whilst the screed is still plastic.

Immediately after laying, the screed surface shall be protected from wind and strong sunlight. The floor shall be protected from sudden increases in ambient temperature and as soon as the surface has set, it should be covered with polythene sheeting (sealed at edges) or a depth of water to permit curing for not less than seven days.

2.1.1 Lightweight Roof Screed

Lightweight roof screed shall be mixed and laid in accordance with the manufacturer's instructions. The minimum density of screed shall be 700 kg/m³. Air entrained screeds shall have a maximum density of 550 kg/m³.

2.1.2 Self-Levelling Screed

Prior to laying floor compound, the concrete substrate, which shall be at least 14 days old, shall be sweep-blasted to remove laitance.

The blast-cleaned surface shall be prepared and primed in accordance with the floor compound manufacturer's requirements. Floor compound shall be laid and finished in one layer, strictly in accordance with the manufacturer's printed instructions.

2.1.3 Screed Minimum Thickness

Minimum thickness of screed shall be 65 mm with 50 mm minimum at localized points, e.g. rainwater outlets. Minimum fall shall be 1:80, laid in alternating bays.

2.1.4 Crack Control Reinforcement

Where mesh reinforcement is required by the structural drawings, type shall be A142 to

BS 4483 at mid depth of screed, lapped at edges by 100 mm and tied securely with stainless steel wire.

2.1.5 Structural Movement Joints and Control Joints

Bays shall not exceed 16 m² with maximum length of 5 m. Perimeter movement joints shall be formed by a continuous 6 mm compressible polyethylene strips. Where conduits are present, these must be covered with steel mesh to BS 405 or wire to BS EN 10223: Part 2 not less than 150 mm wide. The minimum thickness of screed over conduits shall be 20 mm.

2.1.6 Surface Hardener

Surface hardener shall be applied strictly in accordance with the manufacturer's instructions.

2.2 Floor Finishes

2.2.1 Ceramic Tiles

Spacer tiles shall generally be used, but special round edge tiles shall be used on step nosing and column corners.

Ceramic floor and skirting tiles shall be fixed and grouted in accordance with the manufacturer's requirements and BS 5385: Parts 3 and 4. Grout shall be coloured as directed, using proprietary colour mix.

The maximum area of tiling shall not exceed 10 m² without a movement joint. Unless otherwise stated a 10 mm movement joint is to be formed at the perimeter of all tiled floor and where the tiling meets structural features such as columns, beams, and so on. The joint cavities shall extend through the bedding and be filled and sealed with approved sealants.

Setting out of tiles to floor and walls shall be designed to achieve full or equal tiles at edges. No edge tile shall be less than 100 mm. As far as possible, the joints of the wall tiles and the skirting floor tile should align if the same size/manufacturer is used. Dividing strips shall be used at cubicle thresholds to allow symmetrical setting out inside each cubicle. Setting out shall be to the approval of the Engineer.

Adhesive shall be compatible with the background/base. Tiles shall be fixed so that there is adhesion over the whole of the background/base and the tile backs.

All tile adjustments shall be made within 10 minutes of fixing. Surplus bedding material shall be cleaned from joints and faces of tiles without disturbing tiles on completion of any 1 m² area.

All edges of cut tiles shall be ground smooth before bedding without affecting the glaze. Where cut tiles abut movement joints the tile must be turned so the cut edge is facing away from movement joints.

Tiling in wet areas such as kitchens, pantries, toilets and the like shall be bedded on and in-filled with approved proprietary waterproof epoxy tiling grout, incorporating an anti-fungicide additive.

Where tiles abut sanitary fittings, gullies, pipes, and so on, joints shall be sealed with an approved silicone sealant.

Finished tiling shall be true to level or shall fall smoothly to gullies without any discernible irregularity, and joint lines shall be true to line without discernible deviations.

Ceramic skirting tiles shall be of the same type and from the same manufacturer as the floor tiles. If metric cove tiles with round tops are detailed where the wall finish is other than tiling, then square top cove tiles shall be fixed to meet wall tiling over. Internal and external corners of skirting shall have proprietary corner tiles if included in the tile range.

2.2.2 Porcelain Tiles

Stoneware floor and skirting tiles shall be fixed and grouted in accordance with the manufacturer's requirements and BS 5385: Parts 3 and 4. Grout shall be coloured as directed, using proprietary colour mix. Grout shall meet the requirements of BS EN 13888 should be applied as defined in BS 5385.

The maximum area of tiling shall not exceed 10 m² without a movement joint. Unless otherwise stated, a 10 mm movement joint is to be formed at the perimeter of all tiled flooring and where the tiling meets structural features such as columns, beams, and so on. The joint cavities shall extend through the bedding and be filled and sealed with approved sealants.

Setting out tiles to floor and walls should be designed to achieve full or equal tiles at edges. No edge tile should be less than 100 mm. As far as possible the joints of the wall tiles and the skirting floor tile should align if the same size/manufacturer is used. Dividing strips are to be used at cubicle thresholds to allow symmetrical setting out inside each cubicle. Setting out shall be to the approval of the Engineer.

Adhesive shall be compatible with the background/base (C2 adhesive defined in BS EN 12004). Tiles shall be fixed so that there is adhesion over the whole of the background/base and the tile backs.

All tile adjustments shall be made within 10 minutes of fixing. Surplus bedding material shall be cleaned from joints and faces of tiles without disturbing tiles on completion of any 1 m² area.

2.2.3 Terrazzo Tiles

Terrazzo tiles shall be laid over smooth cement sand screed. A thin layer of cement grout of about 2 mm shall be applied over the screed prior to the laying of tiles and the tiles shall be tapped firmly into position with a wooden or rubber hammer.

All joints shall be grouted on completion, with the colour of the grout matching that of the tiles. Skirting shall be fixed in such a way that the vertical joints match with the horizontal joints of the floor tiles. Tile movement joints shall be provided as manufacturer's recommendations.

Terrazzo tiles shall be protected by crystallization process in accordance with manufacturer's recommendations. Chemical solution shall be applied following a steel wool buffing to give high polish but non slip finish.

2.2.4 Marble/Granite

Marble or granite shall be allowed to soak thoroughly in clean fresh water prior to laying. Mortar bedding of 1:3 cement: sand semi dry mix shall be laid approx 20 mm thick as a minimum, and well compacted. The stones shall be tamped firmly into setting bed until required level and uniform plane are obtained. Any excess mortar shall be removed. Stones shall be lifted again and paste of neat OPC applied to back of stone before tamping back in place.

2.2.4.1 Grout

Grout shall comply with the following requirements:

- Grout colours shall match architect's samples.
- Sand-Portland cement grout: ANSI A108.10.
- Commercial Portland cement grout (sanded): ANSI A118.6, for joints 3 mm (¹/₈ inch) and wider.
- Dry-set grout (unsanded): ANSI A118.6.
- Latex-Portland cement grout: ANSI A118.6.

Factory-prepared mixtures of Portland cement, dry, redispersible, ethylene vinyl acetate additive, and other ingredients, shall be used to produce unsanded grout mixture for joints 3 mm ($\frac{1}{8}$ inch) and narrower.

Mixture of dry-grout mix and latex additive shall be mixtures of factory-prepared, dry-grout mix and latex additive, complying with ANSI A118.6, for materials specified for joints 3 mm ($\frac{1}{8}$ inch) and narrower.

Surfaces of stones shall be sponged off during installation to prevent mortar stains from forming. Stone floors shall be allowed to set for 14 days.

Newly installed stone flooring shall be protected by covering with 13 mm plywood sheets or polythene sheet and gypsum layer.

Brass, stainless steel or mastic sealant joints shall be provided as shown on drawings.

2.2.5 Stone

Mortar bedding of 1:3 cement:sand semi dry mix shall be laid approx 20 mm thick as a minimum. The stones shall be tamped firmly into setting bed until required level and uniform plane are obtained. Any excess mortar shall be removed. Stone shall be lifted again and paste of neat OPC applied to backs of stones before tamping back in place.

Joints shall be pointed with a 1:2 waterproof, non-shrink grout mix on the same day that the flooring is installed. Sealant type expansion joints shall be provided where indicated on approved drawings. Surfaces of stones shall be sponged off during installation to prevent mortar stains from forming. Stone floors shall be allowed to set for 14 days.

Newly installed stone flooring shall be protected by covering with 13 mm plywood sheets or polythene sheet and gypsum layer.

Brass, stainless steel or mastic sealant joints shall be provided as shown on drawings.

2.2.6 Carpet Tiles

Carpet tiles shall be installed in accordance with the requirements of BS 5325. Carpet tiles are generally available in 500 x 500 mm size, and shall be loose laid direct on the concrete/screed background. Where there are areas of heavy traffic, double sided tape or spot adhesion may be used. Tiles shall be set out from the centre of the room in pattern as indicated on finishes schedule and cut to fit around edges. Small pieces less than 100 mm wide shall be avoided.

2.2.7 Carpet

Carpets shall be laid in accordance with the requirements of BS 5325

The base shall be clean, sound, and level. Carpets shall be laid in a controlled environment which approximates the humidity and temperature levels of the completed building. Carpets shall be cut approximately 50 mm oversize to allow for trimming at the perimeter. If specified, the underlay shall be installed allowing 1% to 2% expansion and fully anchored to the floor by adhesive which is compatible with the floor covering or by stapling. Flooring with polyethylene backings shall not be adhered to the sub floor.

Woven textile flooring shall receive an even tension applied by power stretching or by hand during installation. Carpet grippers shall be fixed by adhesive or staples to the edges of the area being carpeted approx 6 mm to 8 mm from the wall. Grippers shall not be fixed across unobstructed doorways or at the nosing of stairs.

Carpeted areas shall be allowed to bed and set for at least 24 hours before allowing pedestrian traffic or furniture.

Positions of carpet joints shall be planned before installation, shall run in line with direction of foot traffic, and joints shall be either sewn by machine or hand to BS 3870 or, by use of bonding tape, hot or cold applied as manufacturer's instructions.

Where carpets are terminated against other finishes, the carpet shall be stretched and fitted to a metal gripper fixed to the floor.

2.2.8 Underlay (Cushion) Material

Underlay material shall be installed as follows:

- Verify that substrate surfaces are smooth and flat with maximum variation in 6 mm in 3 m ($\frac{1}{4}$ inch in 10 ft) and are ready to receive work. Beginning of installation means acceptance of existing substrate and site conditions.
- Remove sub-floor ridges and bumps. Fill low spots, cracks, joints, holes, and other defects with sub-floor filler.
- Apply, trowel, and float filler to leave smooth, flat, hard surface.
- Prohibit traffic until filler is cured.
- Vacuum floor surfaces.
- Install in accordance with manufacturer's instructions.
- Install cushion using maximum size pieces. Securely adhere to floor.
- Lay carpet so that carpet seams will not fall directly over cushion seams.
- Butt edges together and tight to edge of carpet gripper.
- Tape all joints.
- Remove air pockets and ridges and slightly stretch. Anchor securely around projections and contours.

2.2.9 Vinyl Flooring

Vinyl flooring shall be installed in accordance with BS 8203. Sub floors shall be smooth, hard, clean and dry before laying. Vinyl sheet shall be allowed to relax 24 hours at room temperature prior to installation. Vinyl sheet shall be hot seam-welded using manufacturers recommended welding rods to provide a smooth, hygienic sealed finish.

Sheets shall be laid to manufacturer's instructions and colour/pattern selection to Engineer's approval.

Vinyl finish for staircases shall include an extra thick anti-slip ribbed rounded stair nosing, of minimum 15 mm radius.

In non-slip or wet areas, surface finish of vinyl flooring shall be contoured to provide an anti-slip finish, studded or decorative effect in accordance with the finishes schedules.

2.2.9.1 Linoleum

Linoleum shall be installed with adhesives on clean surfaces as per the manufacturer's instructions. Surfaces shall be prepared using methods recommended by the manufacturer for achieving the best result for the substrate.

Toughened linoleum shall be installed where higher resistance to point loads and common chemicals are required.

2.2.9.2 Rubber

Rubber flooring shall be applied to subfloor with contact adhesive or two parts epoxy, as specified by the manufacturer.

2.2.10 Engineered or Laminated Wood Floors

Engineered or laminated wood floors shall be multi-layer construction of timber and/or other composite materials, with real wood wearing surface and balancing veneer to underside composed of 3 to 5 layers total. Overall thickness shall be 7 mm to 22 mm. Top/wearing layer shall be 5 mm to 6 mm thick, tongued and grooved construction over floating or overlay sub-frame.

2.2.11 Solid Timber Floors

Solid timber floors shall be minimum 22 mm solid wood planks with tongued and grooved jointing on all four sides. Wood shall be minimum 34 N/mm² resistance to indentation. A polypropylene moisture balancing coat shall be applied to the underside.

Fixing to substrate shall be by adhesive, secret fixing to counter battens or proprietary system. Space of 12 mm to 15 mm for movement/expansion shall be allowed at the perimeter of the installation where adjacent to walls. For larger areas of flooring expansion shall be permitted at every joint or a slightly larger gap every 4 to 5 boards. The width-to-thickness ratio of flooring elements should be 4:1 and no greater than 6:1 to avoid shrinkage gaps.

A check shall be made of the moisture content of the concrete substrate to ensure that it is not more than 5% or as recommended by the timber supplier.

Where timber planks are tight together, an expansion joint shall be introduced in the length of the plank every 10 m.

2.2.12 Epoxy Flooring

Epoxy flooring shall be resin or cementitious self-smoothing compound, non-oxidizing, wear resistant, heavy duty, dust proof, fast curing, and suitable for heavy trafficked areas, and shall be applied as manufacturer's recommendations.

A control sample of approximately 1 m² shall be provided on site for approval by the Engineer for finish, colour and texture.

Primer shall be mixed and applied over properly prepared substrate with strict adherence to manufacturer's coverage rates and written instructions. Primer application shall be coordinated with application of base coat and/or topping as instructed by the manufacturer.

Top coat shall be applied by trowel or squeegee blades as recommended by the manufacturer. This activity shall be carried out by experienced operatives who have received training by the local agent or who are supervised by the manufacturer's representatives.

2.2.13 Access Floors

The access floor system shall consist of an assembly of metal panels or metal composite panels, and floor covering, supported by structural components, closures, and framed cut-outs where required on the drawings.

The supplying of fastenings, accessory features, connections to the building structure and other items not specifically mentioned herein and which are necessary to make a complete installation, shall also be included.

2.2.13.1 Pedestals

Pedestals shall operate with no distortion, distress, deformation, or malfunction of any part.

2.2.13.2 Ramps and Slopes

Ramps shall be installed as indicated on drawings and provide all additional closing pieces as required.

2.2.13.3 Tolerances

The maximum deflection under the above loading conditions shall be 2.03 mm.

The maximum permanent deflection under the above loading conditions shall be 0.25 mm. Floor panel tolerances shall be as follows:

- Flatness, ± 0.13 mm
- Surface dimensions, ± 0.13 mm.

The entire access floor system shall be constructed in accordance with NFPA standards No. 75 and No. 101. All components of the floor system, other than wearing surface and vinyl edge, shall be of non-combustible construction. Systems containing metal-faced, wood-cored panels will not be acceptable. The access floor system, exclusive of floor covering, shall have a maximum flame spread rating of 0, a maximum smoke density factor of 10 and a maximum rating of 0 for fuel contributed when tested in accordance with ASTM E 84.

2.2.13.4 Pedestal Assemblies

Pedestals shall be the adjustable type.

Pedestal bases shall be 3.2 mm thick galvanized steel or manufacturer's standard aluminum material and shall provide a minimum bearing area of 100 mm x 100 mm.

Pedestal caps, shall be galvanized steel or die cast aluminum alloy A-380, and shall be designed to accommodate the under structure as hereinafter specified and shall provide a firm interlock with the under structure as hereinafter specified and shall provide a firm interlock with the under structure to hold panels in proper alignment.

Metal steel column shall be a 35 mm diameter structural tube column of length to achieve floor height indicated on drawings, when assembled with pedestal components.

2.2.13.5 Under Structure System

Under structure shall be bolted stringer system. The system shall be constructed to provide lateral locking of the panels even though adjacent panels are removed. The stringers shall be welded rectangular steel tubing, cold formed and steel galvanized. Stringers shall be identical and interchangeable with any other stringer in any direction.

2.2.13.6 Floor Panels

Panels shall be 600 mm x 600 mm nominal size with CRS strength performance.

Floor panels shall be dying formed after assembly to squareness as specified under clause 2.2.13.3. Panels shall be constructed of a pre-formed metal bottom pan section and a flat top sheet to receive the floor covering as specified. The sections shall be welded together to form an integral unit, and the assembly shall be spray cleaned, phosphate dipped, and given a baked enamel finish, so when a panel is cut, no unpainted surfaces are exposed.

Finish specified to floor panels shall be applied at the factory before shipment to site. Panel grades as designed herein shall be distinguishable by means of an obvious colour-coded mark factory applied to the underside of the panel.

2.2.13.7 Grounding Requirements

Each panel shall receive a grounding connector for positive electrical continuity to under structure, to a maximum of 2 Ohm resistance.

2.2.13.8 Spare Materials

Ten spare finished floor panels and 4 m² of under structure system shall be provided for each type used in the project for maintenance stock.

2.2.14 Parquet/Blocks

Parquet or blocks shall be solid interlocking softwood or hardwood blocks 200 mm to 500 mm long, 90 mm wide and thickness of 13 mm to 20 mm, fully supported on a rigid, level base, profiled t & g on each edge/face embedded on an appropriate adhesive, and laid in pattern as shown on drawings to BS EN 13228.

2.2.15 Sports Flooring

Synthetic sports surfacing shall comprise a pure vinyl surface layer, calendared and grained, combined with a median layer reinforced by non-woven fibre glass mesh and high density polyurethane foam with thickness of at least 9.1 mm, high elasticity, shock absorption, and minimum density 6.8 kg/m² and sound insulation minimum 20 Db. Flooring shall have treatment for fungi, static and anti-bacterial with a fire resistance to BS EN 13501: Part 1 and flame spread treatment to BS EN ISO 11925: Part 2.

2.2.16 Sports Flooring - Wood

2.2.16.1 Sprung Floor

Finish shall be certified as impact energy absorbing under BS 7044: Part 4 and classified as A1 Heavy Duty under the Sports Council specification for Artificial Sports Surfaces (DIN 18032).

Sprung floor shall be minimum 10 mm thick fixed on a resilient sub frame supported on resilient pads, machine sanded after installation and sealed with polyurethane sealer with 20 mm expansion gap around all edges.

Games line markings shall be applied as follows:

- Badminton – white
- Tennis – yellow
- Basketball – black
- Netball – red
- Volleyball – green
- Hockey – blue/orange.

2.2.16.2 Solid Floor

Solid floor shall be minimum 12 mm thick wood composition flooring blocks composed of wood granules, fillers, pigments, and so on, hydraulically pressed, with thermal resistance of 0.028 m²k/w and with zero fuel contribution factors, laid in a block pattern as shown on drawings.

Solid floor shall be fixed to floor by cementitious, water-resistant ceramic tile adhesive on wood floated concrete sub-floor. The whole floor surface shall be machine sanded and sealed with polyurethane sealer.

2.2.17 Mosaics

Mosaics shall be small decorative individual hexagonal, circular or square tiles in glass, crystal glass, metal, marble or granite powder approx 20 x 20 mm and 4 mm thick, mounted on mesh backing into panels of approximately 200 mm to 350 mm square. Tiles shall be chemical, acid and water resistant. Colours shall be non fading and UV resistant. Application shall be to walls or floors as for ceramic tiles. Grouting shall be as for ceramic tiles.

2.2.18 Skirting

Skirting shall be installed as follows:

- Vinyl: 2 mm thick preformed skirting accessory approx 100 mm high bonded by adhesive to wall.
- Wood: 120 mm x 12 mm thick softwood skirting to profile shown, screwed or nailed to wall with filler, and finished as painted, stained or natural (sealed).
- Ceramic tiles: Coved or special edge tiles to match floor type, 120 mm high.
- Paint: Epoxy paint to continue up wall to 100 mm – 200 mm high or as indicated on drawings.

2.3 Walls – Internal

2.3.1 Cement – Sand Plaster

Preparation for render shall be in accordance with BS 13914; Part 1 and BS 5385: Part 1 Table 4.

In situ concrete shall be mechanically scabbled to a depth of 3 mm by hand scabbler, bush hammer, or shot blast as appropriate. Resulting surfaces shall be washed clean of dirt and loose debris and allowed to dry completely. Any inconsistencies shall be treated with a bonding agent before rendering.

Alternatively, with written permission from the Engineer, the application of a spatter coat or proprietary bonding agent may be used in place of a mechanical preparation.

Bonding agents must be used strictly in accordance with the manufacturer's instructions.

Junctions of dissimilar backgrounds, e.g. concrete columns and block work, must be protected from excess cracking by application of an expanded metal mesh (galvanized internally, stainless steel externally) rib lath in accordance with BS 13658: Part 1 fixed at least 200 mm both sides of the junction with stainless steel hammer screws to BS 13914: part 1.

2.3.2 Render Coats

2.3.2.1 Mix Proportions

Render mix proportions shall be as in Table 1 below.

Table 1 – Mix Proportions Rendering

Sr. No.	Type	Cement	Sand	Lime
1	Cement/Sand undercoats	1	4	
2	Masonry Cement/Sand	1	4	
3	Smooth Cement/Sand render	1	4½	½
4	Metal lathing	1	3	¼

2.3.2.2 Application

Admixtures other than air-entraining and water-retaining shall not be used unless specified or approved.

Proportions of specified mixes are by volume and for damp sand. Proportions shall be adjusted if dry or saturated sand is used.

Mortar-mill type mixers shall not be used for mixing gypsum plasters.

2.3.2.3 Movement Joints

The plastered/rendered coats shall accommodate all necessary expansion and construction joints required by the structure.

2.3.2.4 Curing

Each undercoat and final coat shall be kept damp for the first 4 days by covering with polyethylene sheet and / or spraying with water, then prevented from drying out too rapidly. The Contractor shall ensure that the work is protected from direct sunlight during execution and curing, and that the surrounding building work and paving is protected from cement or Tyrolean splashes. Each coat shall be allowed to dry out thoroughly to ensure that drying shrinkage is substantially complete before applying next coat.

Proprietary renders with permanent, through colour finish shall be applied in thicknesses and coats according to the manufacturer's recommendations. The background must be free of dust, loose mortar, release oil or any other contaminants that may affect bonding to the surface.

The base coat and finish coat shall be applied consistently in order to avoid colour discoloration. The colour and finish will be selected by the Engineer.

The Contractor shall coordinate and complete all electrical, water and drainage outlets in areas of rendered wall.

Any patching required shall be done in a matching colour and the area cut back in a rectangular shape to minimize the impact of the repair. The contractor shall indicate on the elevations the day work joints proposed.

The completed render shall be fully cured by keeping moist for at least 3 days.

A penetrating sealer shall be applied after curing to prevent staining by following trades.

2.3.3 Tyrolean Render

Tyrolean mix shall be 1:1:6 by volume of cement/lime/sand, applied as a 13 mm plaster backing with a scratch finish. The final tyrolean finish shall be applied by a hand operated or power driven machine to provide an even textured finish with a minimum of 3 mm thickness. Curing shall be for 48 hours minimum.

Alternative cement sand and bonding admixtures are subject to submission for approval.

2.3.4 Gypsum Plaster

Gypsum plaster shall be applied in accordance with BS EN 13279: Part 1 and 2. Gypsum plaster shall be 15 mm thick applied in two coats. The first coat shall be browning plaster 12 mm thick and finished with a uniform rough scratch surface to provide good bonding for the finish coat. The second coat shall be of finishing plaster 3 mm thick finished with a steel float.

2.3.5 Acoustic Plaster

Acoustic plaster shall be sprayed plaster (hydraulically hardening) applied directly to substrate in several coats to achieve total thickness of at least 15 mm. Average sound absorption value shall be 0.51 (250-2,000 Hz). Finish shall be either trowelled or textured.

Installation shall be in accordance with BS 8212: Code of Practice for dry lining and partitioning using gypsum plasterboard.

2.3.6 Wood Paneling

Dado paneling shall be constructed from hardwood or softwood (decorated) with mouldings as shown on details. Fixings shall be hidden or filled before decoration.

2.3.7 Venetian Plaster

Venetian plaster shall be decorative plaster or stucco with marble grains for effect or integral colour depending on finishes schedule. Materials shall be premixed and bagged for consistency. Application shall be in accordance with manufacturer's instructions.

2.3.8 Marble/Stone

Wall linings and facings shall generally be minimum 20 mm thick. They shall be set square, true and with face joint edges rubbed true, straight and even. The marble/stone panels shall be set clear of the sub structure and secret fixed in place with anchors, clamps, dowels, and so on (made of brass, copper or stainless steel). Gypsum or non-staining cement mortar shall be used to fill the cavity behind the panel to avoid movement. Grouting of joints shall be in non staining cement mortar (colour to selection) to match marble/stone.

2.3.9 Laboratory Tiling

Laboratory tiling shall be porcelain or ceramic glazed tiles with high surface hardness, chemical and heat resisting properties, minimum 8 mm thick complete with edge and corner profiles. Bedding and grouting shall be in two-component acid-resistant epoxy. Sinks, and so on, shall be ceramic or polypropylene injection moulded.

2.3.10 Acrylic Panels

Fixing of acrylic panels shall be carried out as per the Drawings. Installation shall not commence until substrates have been properly prepared. Protective film shall be removed immediately upon completion of installation.

2.3.11 Framing

Supporting framework shall be provided as shown on drawings suitably fixed to structure.

Joint adhesive shall be as recommended by manufacturers.

2.3.12 Wallpaper

Wallpaper shall be installed in accordance with the manufacturer's installation instructions. The project conditions shall meet or exceed the manufacturer's requirements with regard to humidity, temperature, and substrate moisture.

The substrate shall be cleaned of all dirt, grease, mildew or other surface defect. All surfaces shall be primed according to manufacturer's recommendations.

2.4 Walls – External

2.4.1 Render

Beads or stops shall be provided at all external angles and stop ends, except where specified otherwise, cut neatly, with mitres at return angles, and sharp edges, sward and other potentially dangerous edges removed.

Beads or stops shall be fixed securely, using the longest possible lengths, plumb, square and true to line and level, ensuring full contact of wings with background. Mechanical fixings shall be used for external beads or stops.

After coatings have been applied, coating material shall be removed while still wet from surfaces of beads or stops, which are to be exposed to view.

External render shall reflect the movement joints of the structure with stainless steel render stops on both sides of the joint with compressible joint filler covered by a 20 mm sealant, and colour matched to the final finish coat.

Render shall be applied in accordance with BS 8000.

2.4.2 Stone Cladding

Stone cladding shall be delivered on pallets properly separated by wooden strips or wedges. The stones shall be carefully handled and stored in a vertical position clear of any contact with the ground.

Stone cladding shall be set in accordance with the contract documents and approved shop drawings. Shims and anchors, supports and accessories shall be set and adjusted to give a uniform joint of the widths indicated with edges and faces aligned according to agreed tolerances.

Cladding that requires patching or repairing shall be replaced. Cladding not matching the approved samples shall be replaced. Cladding that does not meet other requirements indicated on the contract drawings shall be removed and replaced at no cost to the Owner.

2.5 Ceilings

2.5.1 Decorative Gypsum

Decorative coving, mouldings, architraves, columns, niches, archways, and so on, shall be formed in reinforced gypsum from a range of catalogue selections from the manufacturer and fixed to the background with brass screws (in filled). Painting decoration shall be as finishes schedule.

2.5.2 Plain or Perforated Metal Tiles or Strip Ceiling

Care shall be taken to avoid narrow cut tiles and the ceiling shall be symmetrical about the centreline of the room or space as far as possible. Work above the ceiling shall be completed prior to the installation of ceiling tiles. Ceiling tiles shall be integrated with modular light fittings.

Tiles shall be installed with proper acoustic and thermal insulation, and the ceiling shall be terminated with approved edge trims. Additional supports shall be provided around access panels, and the tiles shall be cut accurately if required to accommodate fixtures like lights, A/C diffusers, and so on. Under no circumstances shall fixtures be supported by the tiles.

Undulations on the finished ceiling shall not be acceptable and the tiles shall follow true line and flatness. The joints shall be parallel to the walls unless mentioned otherwise.

The supporting system for the ceiling shall be from an approved manufacturer and the Contractor shall obtain prior approval from the Engineer for the installation. Site-made wire suspensions shall not be accepted.

Protective plastic finish shall not be removed until final commissioning and handover.

The suspension system shall conform with ASTM C 636/ A636M.

The installed system shall provide a flame spread of 0 – 25, complying with certified testing to ASTM E 84.

2.5.3 Mineral Fibre Ceiling Tiles

Tiles shall be laid in a lay in or clip in metal ceiling grid of 15 mm or 24 mm with square or regular edges. Installation shall be in accordance with BS EN 13964.

Mineral fibre ceiling tiles are particularly vulnerable to damage at corners and shall be stored flat in delivery condition in a clean, dry area until required. Once installed they should not be removed unless absolutely necessary.

2.5.4 Membrane Structures – Shades & Canopies

Substrates shall be prepared prior to installation of the structure.

Inserts and anchoring devices shall be provided and must be set in concrete for installation of work.

Anchorage devices and fittings shall be provided to secure to in-place construction, including threaded fittings for concrete inserts, toggle bolts and through-bolts. Dissimilar metals shall be separated with bushings, grommets or washers to prevent electrolytic corrosion.

Cutting, drilling and fitting shall be performed, and work shall be set in location, alignment and elevation, plumb and level, true and free of rack, measured from established lines and levels.

2.5.5 Skylights

Installation shall only be started after the preparation of substrates.

Surfaces shall be cleaned prior to installation.

Skylight system shall be installed in accordance with approved shop drawings and manufacturer's instructions.

Dissimilar metals shall be separated using nonconductive tape, paint, or other material not visible in finished work.

Components shall be anchored securely in place, allowing for required movement, including expansion and contraction.

Glazing and sealants shall be installed in accordance with manufacturer's instructions without exception, including surface preparations.

3. PART 3 SUMMARY

3.1 Protection

The contractor is responsible for protecting the work from damage until the building is turned over to the owner. All damaged work will be repaired by the contractor at no cost to the owner.

All items of work shall be protected from overhead or following trades.

3.2 Reference Documents

3.2.1 Standards

Reference	Title
ASTM A36/A36M	Standard Specification for Carbon Structural Steel
ASTM A123/A123M	Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A276	Standard Specification for Stainless Steel Bars and Shapes
ASTM A335/A335M	Standard Specification for Seamless Ferritic Alloy-Steel Pipe for High-Temperature Service
ASTM A368	Standard Specification for Stainless Steel Wire Strand
ASTM A380	Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems
ASTM A492	Standard Specification for Stainless Steel Rope Wire
ASTM A555/A555M	Standard Specification for General Requirements for Stainless Steel Wire and Wire Rods
ASTM A581/A581M	Standard Specification for Free-Machining Stainless Steel Wire and Wire Rods
ASTM A582/A582M	Standard Specification for Free-Machining Stainless Steel Bars
ASTM A1011/A1011M	Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
ASTM B85/B85M	Standard Specification for Aluminum-Alloy Die Castings
ASTM C308/C308M	Standard Test Methods for Working, Initial Setting, and Service Strength Setting Times of Chemical-Resistant Resin Mortars
ASTM C636/C636M	Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels
ASTM C645	Standard Specification for Nonstructural Steel Framing Members
ASTM C854	Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers
ASTM C926	Standard Specification for Application of Portland Cement-Based Plaster
ASTM C1006	Standard Test Method for Splitting Tensile Strength of Masonry Units
ASTM D2047	Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine
ASTM E84	Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM E648	Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source

ASTM F150	Standard Test Method for Electrical Resistance of Conductive and Static Dissipative Resilient Flooring
BS 405	Specification for uncoated expanded metal carbon steel sheets for general purposes
BS 476: Part 4	Fire tests on building materials and structures. Non-combustibility test for materials
BS 476: Part 6	Fire tests on building materials and structures. Method of test for fire propagation for products
BS 476: Part 7	Fire tests on building materials and structures. Method of test to determine the classification of the surface spread of flame of products
BS 476: Part 20	Fire tests on building materials and structures. Method for determination of the fire resistance of elements of construction (general principles)
BS 476: Part 21	Fire tests on building materials and structures. Methods for determination of the fire resistance of loadbearing elements of construction
BS 476: Part 22	Fire tests on building materials and structures. Methods for determination of the fire resistance of non-loadbearing elements of construction
BS 476: Part 23	Fire tests on building materials and structures. Methods for determination of the contribution of components to the fire resistance of a structure
BS 1006	Methods of test for colour fastness of textiles and leather
BS 1449	Steel plate, sheet and strip
BS 1711	Specification for solid rubber flooring
BS 2050	Specification for electrical resistance of conducting and antistatic products made from flexible polymeric material
BS 2782: Part 5	Methods of testing plastics. Optical and colour properties, weathering. Determination of changes in colour and variations in properties after exposure to daylight under glass, natural weathering or laboratory light sources
BS 3837: Part 1	Expanded polystyrene boards. Boards and blocks manufactured from expandable beads. Requirements and test methods
BS 3837: Part 2	Expanded polystyrene boards. Specification for extruded boards
BS 3870	Stitches and seams
BS 4483	Steel fabric for the reinforcement of concrete. Specification
BS 4965	Decorative laminated plastics sheet veneered boards and panels
BS 5325	Installation of textile floor coverings. Code of practice
BS 5713	Specification for hermetically sealed flat double glazing units
BS 5808	Specification for underlays for textile floor coverings
BS 6213	Selection of construction sealants. Guide
BS 7044: Part 4	Artificial sports surfaces. Specification for surfaces for multi-sports use
BS 7364	Specification for galvanized steel studs and channels for stud and sheet partitions and linings using screw fixed gypsum wallboards
BS 7837	Specification for flammability performance for textiles used in the construction of marquees and similar textile structures
BS 8203	Code of practice for installation of resilient floor coverings
BS 8500: Part 1	Concrete. Complementary British Standard to BS EN 206-1. Method of specifying and guidance for the specifier
BS EN 197: Part 1	Cement. Composition, specifications and conformity criteria for common cements

BS EN 413: Part 1	Masonry cement. Composition, specifications and conformity criteria
BS EN 426	Resilient floor coverings. Determination of width, length, straightness and flatness of sheet material
BS EN 428	Resilient floor coverings. Determination of overall thickness
BS EN 430	Resilient floor coverings. Determination of mass per unit area
BS EN 459: Part 1	Building lime. Definitions, specifications and conformity criteria
BS EN 520	Gypsum plasterboards. Definitions, requirements and test methods
BS EN 649	Resilient floor coverings. Homogeneous and heterogeneous polyvinyl chloride floor coverings. Specification
BS EN 660: Part 2	Resilient floor coverings. Determination of wear resistance. Frick-Taber test
BS EN 685	Resilient, textile and laminate floor coverings. Classification
BS EN 934: Part 3	Admixtures for concrete, mortar and grout. Admixtures for masonry mortar. Definitions, requirements, conformity, marking and labelling
BS EN 998: Part 1	Specification for mortar for masonry. Rendering and plastering mortar
BS EN 1081	Resilient floor coverings. Determination of the electrical resistance
BS EN 1307	Textile floor coverings. Classification of pile carpets
BS EN 1367: Part 4	Tests for thermal and weathering properties of aggregates. Determination of drying shrinkage
BS EN 1008	Mixing water for concrete. Specification for sampling, testing and assessing the suitability of water, including water recovered from processes in the concrete industry, as mixing water for concrete
BS EN 10162	Cold rolled steel sections. Technical delivery conditions. Dimensional and cross-sectional tolerances
BS EN 10223: Part 2	Steel wire and wire products for fences. Hexagonal steel wire netting for agricultural, insulation and fencing purposes
BS EN 10279	Hot rolled steel channels. Tolerances on shape, dimension and mass
BS EN 12004	Adhesives for tiles. Requirements, evaluation of conformity, classification and designation
BS EN 12104	Resilient floor coverings. Cork floor tiles. Specification
BS EN 12620	Aggregates for concrete
BS EN 13139	Aggregates for mortar
BS EN 13228	Wood flooring. Solid wood overlay flooring elements including blocks with an interlocking system
BS EN 13279: Part 1	Gypsum binders and gypsum plasters. Definitions and requirements
BS EN 13279: Part 2	Gypsum binders and gypsum plasters. Test methods
BS EN 13489	Wood flooring. Multi-layer parquet elements
BS EN 13501	Fire classification of construction products and building elements
BS EN 13658: Part 1	Metal lath and beads. Definitions, requirements and test methods. Internal plastering
BS EN 13748	Terrazzo tiles
BS EN 13888	Grouts for tiles. Definitions and specifications
BS EN 13914: Part 1	Design, preparation and application of external rendering and internal plastering. External rendering
BS EN 13964	Suspended ceilings. Requirements and test methods

BS EN 14411	Ceramic tiles. Definitions, classification, characteristics and marking
BS EN 61340: Part 5-1	Electrostatics. Protection of electronic devices from electrostatic phenomena. General requirements
BS EN ISO 105-B02	Textiles. Tests for colour fastness. Colour fastness to artificial light: Xenon arc fading lamp test
BS EN ISO 9001	Quality management systems. Requirements
BS EN ISO 10545	Ceramic tiles
BS EN ISO 11600	Building construction. Jointing products. Classification and requirements for sealants
BS EN ISO 11925: Part 2	Reaction to fire tests. Ignitability of building products subjected to direct impingement of flame. Single-flame source test
DIN 18032-1	Halls and rooms for sports and multi-purpose use - Part 1: Planning principles
DIN 51953	Testing of Organic Floor Coverings; Testing of the Ability of Floor Coverings in Explosion-hazard Rooms to Dissipate Electrostatic Charges
DIN 53431-1	Producing thermal decomposition products from materials in an air stream and their toxicological testing; decomposition apparatus and determination of test-temperature

3.2.2 Codes of Practice

Reference	Title
BS 5325	Installation of textile floor coverings. Code of practice
BS 5385: Part 1	Wall and floor tiling. Code of practice for the design and installation of internal ceramic and natural stone wall tiling and mosaics in normal conditions
BS 5385: Part 2	Wall and floor tiling. Design and installation of external ceramic and mosaic wall tiling in normal conditions. Code of practice
BS 5385: Part 3	Wall and floor tiling. Code of practice for the design and installation of ceramic floor tiles and mosaics
BS 5385: Part 4	Wall and floor tiling. Code of practice for tiling and mosaics in specific conditions
BS 5385: Part 5	Wall and floor tiling. Code of practice for the design and installation of terrazzo tile and slab, natural stone and composition block floorings
BS 8000: Part 11	Workmanship on building sites. Code of practice for wall and floor tiling
BS 8212	Code of practice for dry lining and partitioning using gypsum plasterboard

3.2.3 Publications

ANSI A108.10	Specifications for Installation of Grout in Tilework
ANSI A118.6	Specifications for Ceramic Tile Grouts
Contract Flooring Association	Manual for textile flooring
Mortar Industry Association	Guide to External Rendering
NFPA 75	Standard for the Protection of Information Technology Equipment
NFPA 99	Standard for health care facilities. National Fire Protection Association
NFPA 101	Life Safety Code

4. PART 4 APPENDICES

4.1 Appendix A: Thermal Insulation

4.1.1 Source Approvals

4.1.1.1 Submittals

The following items shall be submitted to the Engineer for approval:

- Manufacturer's printed specification and installation instructions, including product data sheets.
- All relevant Standards documentation.
- Samples of product at least 300 mm x 300 mm.

4.1.1.2 Bat and Blanket Type Insulation

Bat and blanket-type insulation of rock, slag, or glass fibrous materials shall have a minimum rating of R-11 ASTM C167 for walls in the stud space on the Drawings and conform to ASTM C 665 "Standard Specification for Mineral Fibre Blanket Thermal Insulation for Wood Frame and Light Construction Buildings", with the additional requirements that the vapour barrier membrane facing shall have a flame-spread rating not exceeding 25 without evidence of continued progressive combustion, and a smoke-developed rating not exceeding 50. Flame-spread and smoke-developed test procedures shall conform to ASTM E 84, in areas not covered by gypsum board. Installation shall be provided complete with foil vapour barrier.

4.1.1.3 Rigid Insulation

Rigid insulation shall be a continuously extruded polystyrene plastic board with a closed cell construction nominally 50 mm unless otherwise indicated. Insulation shall be applied to concrete surfaces or block walls where indicated on drawings.

Insulation shall meet or exceed the following test requirements and results:

- Five-year aged average thermal conductivity (K) of 0.03 W/mK when tested at 23.9°C mean temperature in accordance with ASTM C 518.
- Water vapour transmission of maximum 1.0: (perm-inch) in accordance with ASTM E96.
- Compressive strength of 280 kPa in accordance with ASTM D 1621.
- Maximum water absorption of 0.10% in accordance with ASTM C272
- Density of 35 kg/m³ in accordance with ASTM D 1622.
- Linear coefficient thermal expansion 0.000063 mm/mm°C in accordance with ASTM D 696.

4.1.1.4 Expanded Polyurethane

Spray-applied polyurethane in wall; roof and floor cavities shall be injected by hose by injection equipment supplied by the manufacturer. The required thickness shall be built up in a series of passes to ensure that the required R-Value has been reached. All work shall be protected from sunlight at all times.

4.1.1.5 Sprayed Acoustic Insulation

Sprayed insulation shall be two-component type (Rockwool fibres + binder) containing neither asbestos nor cement and/or soluble silicates. It shall be moisture resistant. Its density shall be around 150 kg/m³ to 180 kg/m³. Sabine ration shall range from 125 at 6,400 Hz to 0.07 at 100 Hz. It shall have MO fire resistance. The system shall include anti erosion surface treatment as recommended by the manufacturer, such as acrylic and mineral based resin, anti insect.

4.1.1.6 Fastening Devices

Fastening devices and/or adhesives shall be as standard or as recommended by the manufacturer.

4.1.1.7 Saving Insulation

Saving insulation shall be a mineral fibre product conforming to ASTM C 665 or a ceramic fibre conforming to ASTM C 892 of thickness tested for application as shown on the drawings.

Insulation sample shall be submitted for the approval of the Engineer.

4.1.1.8 Vapour Barrier

Vapour barrier shall be 1,000 gauge polyurethane sheets lapped 150 mm at joints and taped.

4.1.2 Product Delivery, Storage & Handling

Materials shall be delivered in unopened/unbroken containers bearing the manufacturer's name, brand name, and description of contents.

Membrane, flashing and adhesives shall be stored in clean, dry areas.

Storage temperature for adhesives shall be between 16°C and 27°C.

Protection boards shall be stored flat and above the ground surface.

4.1.3 Methodology and Workmanship

4.1.3.1 Installation

Insulation shall only be installed when construction has advanced to the point that remaining construction operations will not damage the insulation. Damaged insulation shall be removed and replaced..

All joints shall be set between closed-cell (non-breathing) rigid insulation units by applying mastic sealer to the edges of each unit to form a tight seal as units are installed. Voids shall be filled in complete installation with mastic or sealant.

Where electric outlets, ducts, pipes, vents, or other utility items occur, insulation shall be placed on the cold or weather side of the obstruction.

Bat or blanket-type insulation shall be installed where indicated on the Drawings in accordance with the manufacturer's instruction.

Flanges shall be fastened to the sides of the framing members.

Insulation shall be stapled or otherwise secured to ensure a continuous insulation blanket.

Special care shall be given to the installation of the insulation. Vapour barriers shall form complete overlapped envelope of enclosure except for openings at exterior windows, doors, louvers, vents, and sky domes.

Bats and vapour barrier shall be tight at top and bottom plates and not compressed into cavities between studs. Cracks shall be filled with insulation around window frames and exterior door frames. All corners and joints shall be wrapped with Type 1 asphalt-impregnated felt to seal against air infiltration.

Saving insulation shall be installed in all void spaces between floor slabs and curtain walls, unless otherwise indicated, by impaling on clips at 600 mm centre or by inserting in support brackets in accordance with manufacturer's printed instructions.

4.1.4 Summary

4.1.4.1 Protection

The contractor is responsible for protecting the work from damage until the building is handed over to the owner. All damaged work will be repaired by the contractor at no cost to the owner.

All items of work shall be protected from overhead or following trades.

4.1.4.2 Standards

Reference	Title
ASTM C167	Standard Test Methods for Thickness and Density of Blanket or Batt Thermal Insulations
ASTM C272	Standard Test Method for Water Absorption of Core Materials for Structural Sandwich Constructions
ASTM C518	Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
ASTM C665	Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
ASTM C892	Standard Specification for High-Temperature Fiber Blanket Thermal Insulation
ASTM D696	Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between -30 °C and 30 °C With a Vitreous Silica Dilatometer
ASTM D1621	Standard Test Method for Passing Ability of Self-Consolidating Concrete by J-Ring
ASTM D1622	Standard Test Method for Apparent Density of Rigid Cellular Plastics
ASTM E84	Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM E96/E96M	Standard Test Methods for Water Vapor Transmission of Materials

Abbreviations

ACB	Air Circuit Breakers	EMC	Electromagnetic Compatibility
ACOP	Approved Code of Practice	EPDM	Ethylene-propylene-diene-monomer copolymer
ACRIB	Air Conditioning and Refrigeration Industry Board	FA	Fresh Air
ADCM	Acoustic Doppler Current Meters	FBA	Factory Built Assembly
AFMA	Australian Fisheries Management Authority	FRP	Fibre Reinforced Polymer
AGMA	American Gear Manufacturers' Association	FSC	Forest Stewardship Council
AISI	American Iron and Steel Institute	GANA	Glass Association of North America
AS	Acceptance Strength	GGBS	Ground Granulated Blast-furnace Slag
ASTA	Association of Short-circuit Testing Authorities	GMS	Galvanized Mild Steel
ASTM	American Society for Testing Materials	GRC	Glass Reinforced Cement/Glass Reinforced Concrete
ATS	Automatic Transfer Switch	GRP	Glass Reinforced Plastics
AWS	American Welding Society	HCFC	Hydrofluorocarbons
BASEC	British Approval Service for Electric Cables	HDPE	High Density Polyethylene
BOCA	Building Officials and Code Administrators	HEPA	High Efficiency Particulate Air
BRE	Building Research Establishment Ltd.	HFC	HydroFluoroCarbon
BS	British Standards	HPL	High Pressure Laminate
BSRIA	Building Service Research and Information Association	HPPE	Higher Performance Polyethylene
CBR	California Bearing Ratio	HRC	High Rupturing Capacity
CCTV	Close Circuit Television	HSE	Health and Safety Executive
CECOMAF	Comité Européen des Constructeurs de Matériel Frigorifique	HSFG	High Strength Friction Grip
GENELEC	Comité Européen de Normalisation Electrotechnique	HV	High Voltage
CFC	Chlorofluorocarbons	HVCA	Heating and Ventilating Contractors' Association
CIBSE	Chartered Institution of Building Services Engineers	ICBO	International Conference of Building Officials
CHW	Chilled Water	IGCC	Insulating Glass Certification Council
CI	Cast Iron	IGE/UP	Institution of Gas Engineers – Utilization Procedures
CLW	Cooling Water	IP	Ingress Protection
CM	Current Margin / Communication cable	ISAT	Initial Surface Absorption Test
CMP	Communication cable (Plenum)	ISO	International Standard Organization
CP	Code of Practice	ITP	Inspection Testing Plan
CPC	Circuit Protection Conductor	KD	Kiln Dried
CPT	Cone Penetration Testing	kVA	Kilovolt Ampere
CRS	Categorised Required Strength	LCD	Liquid Crystal Display
CRT	Cathode Ray Tube	LED	Light Emitting Diode
CRZ	Capillary Rise Zone	LPG	Liquid Petroleum Gas
CT	Current Transformer	LS0H	Low Smoke Zero Halogen
c(UL)	Underwriters Laboratories Incorporated (Canada)	LSF	Low Smoke and Fume
DEO	Defence Estate Organisation	LV	Low Voltage
DFT	Dry Film Thickness	MCB	Miniature Circuit Breaker
DI	Ductile Iron	MCC	Motor Control Centre
DIN	Deutsches Institut für Normung	MCCB	Moulded Case Circuit Breakers
DPC	Damp Proof Course	MDF	Medium Density Fireboard
DPDT	Differential Pressure, Differential Temperature	MDD	Maximum Dry Density
DS	Durability Strength	MDPE	Medium Density Polyethylene
DVR	Digital Video Recorder	MEP	Mechanical Electrical Plumbing
DW	Ductwork Specification	MICC	Mineral Insulated Copper Covered Cable
EA	Exhaust Air	MIO	Micaceous Iron Oxide
ECMA	European Computer Manufacturers Association	MMI	Man Machine Interface
EA	Exhaust Air	MOD	Ministry of Defence
ECMA	European Computer Manufacturers Association	MS	Micro-silica
ECR	Extra Chemical Resistant	MSDS	Material Safety Data Sheet
EIA	Environmental Impact Assessment/ Electronic Industries Alliance	MSRPC	Moderate Sulphate Resistance Portland Cement
		N	Nitrogen
		NDFT	Nominal Dry Film Thickness
		NEMA	National Electrical Manufacturers' Association
		NFPA	National Fire Protection Association
		NRC	Noise Reduction Coefficient
		NS	Norwegian Standard

O/D	Outside Diameter
ODP	Ozone Depletion Potential
OFS	Oil Fired (Appliance/Equipment) Standard
OFTEC	Oil Firing Technical Association
O&M	Operation and Maintenance
OPC	Ordinary Portland Cement
PD	Published Documents
PE	Polyethylene
PFA	Pulverised Fuel Ash
PFC	Power Factor Correction
PM	Project Manager
PTFE	Polytetrafluoroethylene
PVC	Polyvinylchloride
PVC-u	Unplasticised Polyvinylchloride
PWTAG	Pool Water Treatment Advisory Group
QA/QC	Quality Assurance/Quality Control
RA	Return/Recycled Air
RCCD	Residual Current Circuit Breaker
RCD	Residual Current Device
R&D	Research and Development
REFCOM	Register of Companies Competent to handle refrigerants
RPM	Reinforced Plastic Mortar
RPZ	Reduced Pressure Zone
RTD	Resistant Temperature Detector
RTR	Reinforced Thermosetting Resin
SA	Supply Air
SBCCI	Southern Building Code Congress International (Incorporated)
SDR	Standard Dimension Ratio
SIS	Swedish Institute of Standards
SP	Super-plasticizing
SPDT	Single Pole Double Throw
SRPC	Sulphate Resistance Portland Cement
SS	Structural Strength
SSPC	Steel Structures Painting Council
TIA	Telecommunication Industry Association
TRA	Trussed Rafter Association
UL	Underwriters Laboratories Incorporated
ULPA	Ultra Low Penetration Air
UP	Unsaturated Polyester Resin
UPS	Uninterruptible Power Supply
UTP	Unshielded Twisted Pair
UV	Ultra Violet
VC	Vitrified Clay
VR	Video Recorder
WBP	Weather and Boil Proof
W/C	Water Cement Ratio
WIS	Water Industry Specification
WP	Water Proofing
WRAS	Water Regulations Advisory Scheme
XLPE	Cross Linked Polyethylene