

(30) A07-060 FLOOR TILING

1 GENERAL

Read this Section with G01-010 "General Requirements" and all other contract documents.

1.1 Scope

This Section covers the requirements for adhesive fixed tiling on internal walls and floors. It covers ceramic, homogenous and stone tiled finishes.

1.2 Related Sections

Read this Section in conjunction with the relevant requirements of the following sections:

A04-030	Stone Cladding
A02-030	Plaster and Render
A07-010	Floor Screeds and Hardeners
A14-010 A14-020 A14-030	Damp-proof Membranes Liquid-applied Membrane System Cementitious System

1.3 Standards, Codes, Regulations and Technical References

1.3.1 Standards and Codes

Unless otherwise agreed by the SO, ensure all of the Works comply with the relevant requirements of the standards and codes listed below or referenced in the body of the Specification. Alternative standards and codes may be proposed for approval by the SO, provided it can be demonstrated that the alternative standards and codes comply with the requirements of the standards specified. All standards and codes quoted are the current version, unless specific year references are noted.

In the event that the standards or codes are partially superseded or have become obsolete, refer to the current edition or the approved substitution for the relevant clauses.

Singapore Standards	
SS EN 12620	Specification for aggregates for concrete
SS CP 68	Code of practice for ceramic wall and floor tiling
SS 32	Welded steel fabric for the reinforcement of concrete
SS 485	Slip resistance classification of public pedestrian space surface materials
Other Standards	
AS 3958.1	Guide to the installation of ceramic tiles
BS EN 197-1	Cement. Composition, Specifications and Conformity Criteria for Common Cements

BS EN 998-2	Specification for mortar for masonry. Masonry mortar
BS EN 12004-1	Adhesives for Ceramic Tiles. Requirements, Assessment and Verification of Constancy of Performance, Classification and Marking
BS EN 12004-2	Adhesives for ceramic tiles. Test methods
BS EN 12808-2	Grouts for tiles. Determination of resistance to abrasion
BS EN 12808-3	Grouts for tiles. Determination of flexural and compressive strength
BS EN 12808-4	Grouts for tiles. Determination of shrinkage
BS EN 12808-5	Grouts for tiles. Determination of water absorption
BS EN 13888	Grout for Tiles. Requirements, Evaluation of Conformity, Classification and Designation
BS EN 14411	Ceramic Tiles. Definitions, Classification, Characteristics, Assessment and Verification of Constancy of Performance and Marking
BS EN 14617-12	Agglomerate stone. Test methods. Determination of dimensional stability
BS EN ISO 11600	Building construction – jointing products – classification and requirements for sealants
BS 4483	Steel Fabric for the Reinforcement of Concrete. Specification
BS 4551	Mortar. Methods of Test for Mortar and Screed. Chemical Analysis and Physical Testing
BS 5385	Wall and Floor Tiling
BS 6093	Design of joints and jointing in building construction – Guide
BS 6213	Selection of construction sealants – Guide
BS 7976	Pendulum testers
ISO 10545	Ceramic tiles
ISO 13006	Ceramic Tiles- definitions, Classifications, Characteristics and Marking
ISO 13007-1	Ceramic tiles. Grouts and adhesives. Terms, definitions and specifications for adhesives

ASTM C920	Standard specification for elastomeric joint seal
AS 3958.1	Guide to the installation of ceramic tiles
ANSI A108-A118-A136.1	American National Specifications for the Installation of Ceramic Tile
CEN/TS 15209	Tactile Paving Surface Indicators Produced from Concrete, Clay and Stone

1.3.2 Regulations

Refer to the following regulations for compliance in carrying out the Works:

Building and Construction Authority à Approved Document ("Approved Document")
Building and Construction Authority à Building Control Regulations
Code of Practice for Fire Precautions in Buildings ("Fire Code")

The above regulations refer to the latest edition (including any amendments) that are currently in use.

1.1.1 Technical References

Refer to the following technical references for guidance in carrying out the Works:

Building and Construction Authority à CONQUAS 21 Enhancement Series, Good Industry Practices Guide Books
Building and Construction Authority à Good Industry Practice Guide for Ceramic Tiles
UKSRG 2005 - The Assessment of Floor Slip Resistance Issue No. 3 by United Kingdom Slip Resistance Group, 2005

1.4 Trade Preamble

1.4.1 Contractor's Submissions

The intended types of applied tiled finishes for the project are set out in the Section A07-060:Clause:3.1 and locations are indicated in the drawings. Engage qualified and experienced personnel to carry out and submit the following items to the SO:

- (a) Develop all necessary details for the tiling layout based on the design drawings.
- (b) Submit the tiles, tile bedding, adhesive, sealant and grout. Submit technical literature on the products selected.

- (c) Submit suitable method of laying and fixing tiles to meet with specified performance requirements.
- (d) Submit suitable proprietary product and supplier when called for.

1.4.2 Co-ordination with Other Works

Co-ordinate the internal tiling works, in particular interfacing with the following work packages and trades:

- (a) Floor screeds
- (b) Internal service runs and outlets

Liaise and co-ordinate with services engineer for location of all services buried beneath tiling in either floor or walls.

1.4.3 Provision of Spare Materials

Deliver to site in strong protective packages marked for identification, and store where directed, components and materials for future replacements and repairs.

Allow for sufficient quantities of the various individual tiles from the same production batch for timely rectification works during construction and Defects Liability Period.

Provide the following spare material and store in an area agreed with the SO:

Item	Quantity
	-
-	-

1.4.4 Quality Control Plan

Provide an Inspection and Test Plan as described in the Building and Construction Authority's Good Industry Practice Guide for Ceramic Tiles and/or as agreed with the SO.

1.4.5 Warranty

Provide a 5-year warranty in accordance with contract conditions for the bonding of tiles for the scope shown in the drawings or as agreed with SO.

1.4.6 Maintenance Manual

Provide a maintenance manual including methods for maintaining the installed products and precautions against cleaning materials and methods detrimental to finishes and performance.

1.5 Definitions and Abbreviations

No item.

2 PERFORMANCE REQUIREMENTS

2.1 Contractor's Brief

When carrying out the proposals as set out in Section A07:060:Clause:1.4.1, take account of the performance requirements listed below.

2.1.1 Dead Loads

The self-weight and other associated dead loads of the complete tiling layer-tiles and sublayer are to be supported and transferred to the main building structure.

2.1.2 Floor Loads

Take account of the schedule of imposed loads designed for the floors and walls as indicated in the drawings. Also take cognisance and request from the SO the likely concentrated load which will be imposed on the floors. Account for the dynamic effects of the imposed loads where applicable.

2.1.3 Slip Resistance

Comply with SS 485 for slip resistance requirements for public pedestrian surfaces.

Refer to the Project Specific Data for slip resistance requirements for non-public pedestrian surfaces.

Slip resistance requirements for non-public pedestrian surfaces are as follows:

	Minimum Coefficient of Friction
Under Wet Conditions	R9 or R10
Under Dry Conditions	R9
Levelled Areas	R9
Ramps	R9

2.1.4 Structural Movement and Movement Between Works by Others

Take into account, that the performance, appearance and proper functioning of the Works are not affected by any movements, settlement or deflection in the building structure which can reasonably be expected to occur. Also take into account the construction accuracy of works by others to which the tiling works are attached.

3 MATERIALS

3.1 Types of Tiled Finishes

Refer to the Project Specific Data for the specific types and component requirements of internal tiling works and in areas as indicated for the project.

Floor tiling (HT) shall consist of the following types:

Type: HT-01		
Item	Product/Manufacturer	Clause Reference
Tile	Bossa Nova (Matt)	.
Type	Homogeneous Tile	.
Size	300 x 600 x 10mm	.
Base	.	.
Adhesion method	.	.
Adhesive	.	.
Joint width	+/- 1mm	.
Grout	To Architect's selection	.
Movement joint sealant	.	.
Terminations	.	.
Waterproofing	Ref to drawings	.
Tests certificates required	Skid Resistance Slipperiness	.
Preformed movement joint	.	.

3.2 Tiles

3.2.1 Ceramic Tiles

Comply with the requirements of ISO 13006.

The bottom of a tile shall be free of any webbing or fabric mesh that interferes with bonding effectiveness of adhesive or mortar.

3.2.2 Stone Tiles

Refer to Section A04-030:Clause:3.3 for requirements of various types of stone.

3.2.3 Agglomerates/Reconstituted Stone Tiles

Refer to Section A04-030:Clause:3.3 for requirements of various types of agglomerates and reconstituted stone tiles.

3.2.4 Joint Width

Refer to BS ISO 13006 for guidance on tile joint widths. Joint width shall be consistent throughout the installation unless specified otherwise.

If joint width is not stated, the minimum shall be as stated below:

Dry pressed tiles: 3 mm

Adjusted extruded tiles: 6 mm

3.3 Sand

Use clean and graded natural sand, free from efflorescing salts, complying with SS EN 12620.

3.4 Aggregate

Comply with SS EN 12620

3.5 Cement

Comply with BS EN 197-1

3.6 Water

All water to be potable.

3.7 Adhesive

3.7.1 General

Provide adhesives compatible with the materials and surfaces to be adhered. Adhesives shall be of an approved brand and used strictly in accordance with the manufacturer's instructions.

Where appropriate, when using agglomerate or reconstituted tiles, check for moisture effect on dimension stability based on EN 14617-12 to determine the type of adhesive to be used for fixing.

3.7.2 Cementitious Adhesive

Mixture of hydraulic binding agents, aggregates and organic additives. Mix with water or liquid admix (latex) before use. Where used in wet areas, consult the manufacturer's literature and mix with latex admixture rather than water.

Comply with BS EN 12004.

Latex Portland cement mortar shall comprise modified Portland cement mortar with polymer additive suitable for use as thin bed mortar. Comply with BS EN 12004-1, 2. Follow manufacturer's instructions for use.

3.7.3 Dispersion Adhesive

Use ready-to-use mixtures. Do not use in wet areas.

Comply with BS EN 12004-1, 2.

3.8 Screed

For requirement of screed materials, refer to Section A07-010:Clause:3.

3.9 Grout

3.9.1 Joints: Up to 3 mm

Use proprietary unsanded grout with polymer additive and colouring pigment. Colour to the SOs selection.

Comply with BS EN 13888

3.9.2 Joints: 3 mm 12mm

Use proprietary sanded grout with polymer additive and colouring pigment. Colour to the SOs selection.

Comply with BS EN 13888.

3.10 Sealant and Accessories

3.10.1 Sealant

Refer to A07-060:Clause:3.1 for proprietary product selected for the project.

Type F comply with BS EN ISO 11600.

3.10.2 Joint Filler

Compressible non-adhesive polyethylene backer rod. Submit proprietary product to the SO.

3.10.3 Trims and Nosing Tiles

Submit proprietary product to the SO.

3.11 Waterproof Membrane

Submit suitable product to the SO. Refer to Section A14-02 "Liquid Applied Membrane System" and Section A14-030 "Cementitious System" for general requirements of waterproofing materials. Refer to Section A07-060:Clause:3.1 for particular waterproofing product specified under the tiles, if any.

3.12 Separating Membrane

Minimum 0.125 mm thick polyethylene sheet.

3.13 Crack Control Reinforcement

Type: galvanised 25 mm mesh centre, wire no less than 1.0 mm diameter, to SS 32 or BS 4483.

3.14 Movement Joint

Proprietary preformed metal channel with compressible infill and anchorage to substrate

4 WORKMANSHIP

4.1 Preparation of Floor Bases for Tiling

4.1.1 Preparing Concrete Bases for Fully Bonded Bedding

Completely remove mortar matrix from surface to expose coarse aggregate over entire area of hardened base (including any associated minor areas such as skirtings, treads and risers), using a pneumatic scabbler or abrasive blasting. Remove all dust and debris and wash clean.

Keep surface well wetted for several hours before laying bedding. Remove free water then brush in a slurry bonding coat of creamy consistency as recommended by manufacturer. Lay screeded bed while slurry is still wet to ensure a good bond.

4.1.2 Preparing Concrete Bases for Partially Bonded Bedding

The surface of the base (including any associated minor areas such as skirtings, treads and risers) shall be clean with no surface laitance.

Shortly before laying bedding, thoroughly wash clean the surface and keep well wetted for several hours. Remove free water, then brush in a slurry bonding coat of creamy consistency.

Lay screeded bed while slurry or bonding agent is still wet to ensure a good bond.

4.1.3 Preparing Concrete Bases for Unbonded Bedding

Unless the bedding is laid over a suitable sheet DPM, lay separating layer of polythene sheet on clean base lapping 100 mm at joints. Lay wire mesh in to the centre of bedding.

4.1.4 Smoothing Underlayment

Apply underlayment as recommended by the adhesive manufacturer. Apply to the base and allow to dry before fixing tiles.

4.2 Fixing

4.2.1 Setting-out

Joints shall be true to line, continuous and without steps.

Joints on walls shall be truly horizontal, vertical and in alignment round corners.

Joints in floors shall be parallel to the main axis of the space or specified features.

Cut tiles/slabs shall be kept to the minimum, as large as possible and in unobtrusive locations.

Joints in walls and floors shall be in alignment.

Where positions of movement joints are not specified, they are to be agreed with the SO.

Before laying tiles obtain approval of setting out drawings.

4.2.2 Fixing Generally

Check that no unintended colour/shade variations are within the tiles for use in each area or room. Thoroughly mix variegated tiles.

Check that adhesive is compatible with background/base. Use a primer where recommended by the adhesive manufacturer.

Cut tiles neatly and accurately.

Unless specified otherwise, fix tiles so that there is adhesion over the whole of the background/base and tile backs.

Before bedding material sets, make adjustments necessary to give true and regular appearance to tiles and joints when viewed under final lighting conditions.

Clean surplus bedding material from joints and face of tiles without disturbing tiles.

4.2.2.1 Adverse Weather

Do not fix tiles in wet conditions.

Comply with manufacturer's recommendations for maximum temperatures when using proprietary adhesives.

Take adequate precautions to protect work from inclement weather, and premature drying out.

4.2.3 Fixing Floor Tiles

4.2.3.1 Floors Laid to Fall

Backfalls or areas where water can pond shall not be accepted.

4.2.3.2 Mortar for Bedding

Use prepacked Portland cement to BS EN 197-1.

Sand for floors: To BS EN 12620 with not more than 10% passing a 150 micrometre sieve and not more than 3% passing a 75 micrometre sieve. Where fine sand is specified, grading limit F applies.

Mix materials thoroughly to a uniform consistency in a suitable forced action mechanical mixer. Do not use a free fall type (tilting drum) mixer. Use the minimum amount of water necessary to give required workability.

Use mortar within 2 hrs of mixing at normal temperatures. Do not use after the initial set has taken place and do not re-temper.

4.2.3.3 Crack Control Reinforcement

Place centrally in depth of bed, lap edges not less than 100 mm and tie together with galvanised steel wire.

4.2.3.4 Porous Tiles

If to be bedded in cement:sand, soak in clean water for at least 30 mins, and fix as soon as surface water has drained.

4.2.3.5 Coved Tile Skirtings

Bed solid to wall with adhesive before laying floor tiles. Ensure joints in skirtings. Match and align with joints in floor tiling.

4.2.3.6 Thin Bed Adhesive à Solid Bedding

Apply floated coat of adhesive to dry base and comb the surface with the recommended notched trowel. Apply adhesive to backs of tiles as necessary to fill any depressions or keys. Press tiles firmly into position to give finished bed thickness within the range recommended by the manufacturer.

4.2.3.7 Cement and Sand Mortar Bedding

Use prepacked mortar mixed to a stiff plastic consistency.

Lay suitably small working areas of screeded bed and thoroughly compact to level with a finished thickness not less than 15 mm, and not more than 25 mm.

Within 2 hours and before bedding sets, evenly coat the entire back of each tile with the mortar. Press tiles firmly into position to give a finished adhesive thickness within the range recommended by the manufacturer.

4.2.3.8 Semi-dry Cement and Sand Mortar Bedding

Prepacked mortar mixed to give a water content such that a sample squeezed in the hand will retain its shape and not crumble, and such that a film of water does not form on the surface of the bed when compacted.

For unbonded bedding, lay a separating layer with 100 mm laps at each joint.

Dampen the base, then lay suitably small working areas of semi-dry mortar screeded bed and compact thoroughly to the required level, insert crack control mesh into bedding layer.

Within 2 hrs and before bedding sets, evenly coat the entire back of each tile with the specified adhesive and beat firmly into position to give a finished adhesive thickness within the range recommended by the manufacturer.

Joint width as indicated in the drawings or Section A07-

060:Clause:3.1. Grout tiles as specified in Section A07-

060:Clause:3.1

4.2.4 Checking Tile Adhesion

As work proceeds and before the bedding has set, carefully remove random tiles to verify that there is full surface coverage of adhesive to tile. Remove the initial adhesive and butter the removed tiles with fresh adhesive and refix.

4.2.5 Tolerance

4.2.5.1 Level of Floor Tiling

Permissible deviation in level from datum for 3 mm shall be ± 1.0 mm.

4.2.5.2 Flatness/Regularity of Tiling

Sudden irregularities is not permitted. When checked with a 2-metre straightedge with 3 mm thick feet at each end, placed anywhere on the surface, the straightedge shall not be obstructed by the tiles and no gaps shall be greater than 6 mm.

4.2.5.3 Level of Tiling Across Joints

Maximum deviation between tile or slab surfaces either side of a joint, including movement joints to be:

- (a) 1 mm for joints less than 6 mm wide.
- (b) 2 mm for joints 6 mm or greater in width.

4.2.6 Floor Slope

Adjust tiles to accommodate slope/fall requirements to floor drains or outlets, especially at wet areas, or as indicated in the drawings.

4.2.6.1 Sealant

4.2.7 Sealant Movement Joints with Metal Edgings

Edging material: 1.4401 (formerly 316) grade stainless steel

Size: As agreed with the SO.

Fixing: Bed in adhesive to exact finished level of floor. Fix securely to base with stainless steel screws

Ensure that joints coincide with any movement joints in the base.

Joint width: Match as required. Prepare joints and apply sealant as manufacturer's instructions.

4.2.8 Sealant Movement Joints Through Floor Joint

Ensure that joints extend through tiles and bedding to substrate and that they coincide with any movement joints in the substrate. Refer to Section A07-060:Clause:3.1 for joint width, sealant and sealant colour.

4.2.9 Movement Joints Between Tiles

Provide preformed movement joints at approximately 6.0 m apart or to spacing as indicated in the drawings depending on the locations of such joints.

4.3 Grouting

Grout tiles as soon as possible after bedding has set sufficiently to prevent disturbance of tiles.

Ensure that joints are 6 mm deep (or the depth of the tile if less), and are free from dust and debris.

Fill joints completely, tool to an approved profile, clean off surface and leave free from blemishes.

Clean the grouted surface with a with a damp sponge before the grout hardens on the tile surface. Rinse sponge with clean water and continue the cleaning process until the tile surface is free of grout traces.

4.4 Coloured Grout

Check the potential risk of staining by applying the grout to a few tiles in a small trial area. If discolouration occurs, apply a protective sealer to the tiles and repeat the trial.

4.5 Protection/Completion

4.5.1 Protection Generally

Adequately protect and keep clean all completed areas. Clean off any droppings immediately.

4.5.2 Protection in Wet Areas

Tiles/slabs type(s) kitchens and bathrooms shall be kept dry and not brought into service for at least 3 weeks after grouting or jointing.

4.5.3 Protection of Floors

Keep completed floors clear of traffic for at least 7 days and permit only light traffic for the next 10 days.

5 VERIFICATION AND SUBMISSION

5.1 Submissions

5.1.1 Technical Submissions

Include in the construction programme, event for submission of the following information:

- (a) The name of the stone and tile manufacturer and other components, including copies of technical data relating to each of the tile and component types. Refer to Section A04- 030:Clause:5.3 for the tests to be selected for the selection of stone.
- (b) Information of current or completed similar jobs during the previous 5 years and details of quality control procedures adopted.

5.1.2 Works Submissions

5.1.2.1 General information

Submit the following to the SO, prior to the preparation of detailed shop drawings:

- (a) Copies of technical certificates for each tile bedding mortar, tile type, adhesive, admixture and component.
- (b) Means of accommodating movement in the tiles and substrate.
- (c) Specimen of warranty, if any.
- (d) Drawing list setting out the drawings to be prepared.

5.1.2.2 Shop Drawings

Prepare shop drawings, which shall include:

- (a) Drawings to show all tiles on elevation and floor plans at 1:20 with movement joints, falls, service outlets and termination details.
- (b) Details of tiles junctions at all terminations, junction with drainage outlets, skirting and any other element puncturing the tiles.

Do not commence laying tiles until shop drawings have been reviewed and permission to proceed has been obtained from the SO.

5.1.3 Test Reports and Certificate Submissions

5.1.3.1 Certification of Materials

Provide the SO with certification from the manufacturer of the following materials/ components:

- (a) Tiles
- (b) Adhesive
- (c) Grout
- (d) Sealant

5.1.4 Quality Control Plan Submission

Submit quality control plan as specified.

5.1.5 Warranty

Submit the warranty upon completion of the Works.

5.1.6 Maintenance Submissions

Submit maintenance manual as specified.

5.2 Samples and Mock-ups

5.2.1 Samples

Note requirement for sample submission in the Project Specific Data. When required, submit the following samples:

- (a) At tender stage, three samples of each tile.
- (b) The SO may request samples at any time for testing.

Submission of the samples is required.

5.2.2 Mock-ups

A wall approximately 3 m x 2.4 m (location to be agreed with the SO) and adjacent floor area approximately 2 m x 2 m to be tiled, including termination at head, skirting, movement joint and drainage outlet.

Do not undertake any more internal wall or floor tiling until the SO has approved the mock-up.

The mock-up may form part of the final building; if not, it is to be retained until the SO agrees for its removal.

Refer to the Project Specific Data for any additional requirements and timeframe of mock-up.

Provide additional mock-ups for the project as follows:

Mock-up	Additional Requirements	Due Date
.	.	.
.	.	.

5.3 Inspections

No item.

5.4 On-Site Tests

5.4.1 Schedule of Tests

Where requested in the Project Specific Data, undertake the following tests on the tiles.

Provide certificates by a test laboratory accredited under SINGLAS to cover the following, as described in ISO 13006:

- (a) Dimensional tolerances
- (b) Straightness of sides
- (c) Rectangularity
- (d) Flatness of surface
- (e) Surface condition
- (f) Craze resistance
- (g) Modulus of rupture
- (h) Scratch hardness of surface (Mohs Scale)
- (i) Resistance to acids and alkalis

- (j) **Water absorption**
- (k) **Colour fastness and lightfastness.**
- (l) **Reverse staining test.**
- (m) **Stain resistance, method as ISO 10545-14, stain resistance to be class 3.**

Submit the test certificate to the SO prior to bulk ordering. Tiles, which do not comply, are to be rejected. Laid tiles, which do not comply, are to be hacked up and replaced.

Carry out the following tests for the project and submit the results or certification:

Test	Requirement (Indicate: Yes/No)	Specific Requirement
Dimensional Tolerances	Yes	.
Straightness of Sides	Yes	.
Rectangularity	Yes	.
Flatness of Surface	Yes	.
Surface Condition	Yes	.
Crazing Resistance	Yes	.
Modulus of Rupture	Yes	.
Scratch Hardness hardness of Surface	Yes	.
Resistance to Acids and Alkalis	Yes	.
Water Absorption	No	.
Colour Fastness and Lightfastness	Yes	.
Reverse Staining	No	.
Stain Resistance	Yes	.

(35) A08-050 SKIM COAT TO EXPOSED SLAB SOFFIT

1 GENERAL

Read this Section with G01-010 "General Requirements" and all other contract documents

1.1 Scope

The Specification covers application of skim coat to exposed slab soffit.

1.2 Related Sections

Read this Section in conjunction with the relevant requirements of the following sections:

1.3 Standards, Codes, Regulations and Technical References

1.3.1 Standards

Unless otherwise agreed by the SO, ensure all of the Works comply with the relevant requirements of the standards and codes listed below or referenced in the body of the Specification. Alternative standards and codes may be proposed for approval by the SO, provided it can be demonstrated that the alternative standards and codes comply with the requirements of the standards specified. All standards and codes quoted are the current version, unless specific year references are noted.

In the event that the standards or codes are partially superseded or have become obsolete, refer to the current edition or the approved substitution for the relevant clauses.

Singapore Standards	
SS EN 197-1	Cement – Part 1: Composition, specifications and conformity criteria for common cement
SS EN 197-2	Cement – Part 2: Conformity evaluation
SS EN 934	Admixtures for concrete, mortar and grout
CP 56	Code of practice for internal plastering

1.3.2 Regulations

Refer to the following regulations for compliance in carrying out the Works:

1.3.3 Technical References

No item.

1.4 Trade Preamble

1.4.1 Contractor's Submissions

The intended types of skim coat are set out in Section A08-050:Clause:3.1 and locations are indicated in the drawings.

Submit the following items to the SO:

- (a) Names of suitable manufacturers or suppliers.
- (b) Technical information on products of pre-packed and/or pre-mixed skim coat.

1.4.2 Co-ordination with Other Works

Co-ordinate the Works, particularly the interfacing with the following work packages and trades, where applicable:

- (a) RC slabs and beams
- (b) Masonry walls and partitions
- (c) Other finishes such as tiles, textured coatings, cladding, etc.

1.4.3 Provision of Spare Materials

No item.

1.4.4 Quality Control Plan

Prepare and submit a quality control plan to the SO.

1.4.5 Warranty

Provide the following warranties in accordance with the specimen warranty, or otherwise as agreed with the SO:

Item of Works to be Warranted	Period of Warranty Required
Skim Coat and painted areas	5yrs from issuance of completion certificate
.	.

1.4.6 Maintenance Manual

No item.

1.5 Definitions and Abbreviations

The following definitions and abbreviations apply within this Section.

1.5.1 Definitions

1.5.1.1 plaster

Cement-based products applied on internal walls and soffits.

1.5.1.2 render

Cement-based products applied on external walls and soffits.

1.5.1.3 skim coat

A thin coat (maximum 6 mm) of pre-mixed or pre-packed mortar with polymer additive to achieve a smooth surface.

1.5.2 Abbreviations

No item.

2 PERFORMANCE REQUIREMENT

2.1 Contractor's Brief

When carrying out the proposals as set out in Section A08-050:Clause:1.4.1, ensure there is no undue shrinkage cracks in the Works and take account of the following performance requirements:

2.1.1 Structural Movement and Movement Between Other Works

Take into account that performance, appearance and proper functioning of the Works are not affected by any movements, settlement, deflection, or expansion or contraction which can be expected to occur in the building or during the construction process.

Junctions between the Works and adjacent work shall be formed to take into account possible structural deflection or movement in the adjacent element without distortion to the Works, or compromise to or disintegration of joints between works.

2.1.2 Acoustic Performance

No Item.

2.1.3 Fire Performance

Comply with requirements of the Fire Code and any additional requirements of other statutory authorities having jurisdiction over the Works.

2.1.3.1 Fire Rating

No item.

2.1.3.2 Combustibility

To be non-combustible when tested to BS 476-4 and not contain any substance which will emit toxic fumes as a result of heating or combustion.

2.1.4 Thermal Performance

No item.

2.1.5 Durability and Maintenance Criteria

Take into account the environment for which the Works shall be applied, paying particular attention to the following environmental effects:

- (a) Daily variations in humidity and temperature resulting from air-conditioning within the building.
- (b) For areas not air-conditioned, daily and seasonal variations in rainfall, humidity and temperature.
- (c) Humidity or damp variations or other consequences resulting from the activities occurring within the spaces for which the Works are applied or are in proximity.

2.1.6 Appearance

Include any measures necessary to ensure that the surface finishes are uniform in colour, texture and appearance throughout.

3 MATERIALS

3.1 Types of Skim Coat

Skim coat (SC) shall consist of the following types:

Type: PT-1		
Item	Specific Requirements	Clause Reference
Location	External / internal	.
Substrate	.	.
Manufacturer	.	.
Product	.	.
Type	Cement-based / gypsum-based	.
3.2	Materials Use proprietary pre-packed skim coat as specified in Section A08-050:Clause:3.1.	

3.2.1	<p>Cement</p> <p>Ordinary Portland cement: Grey or white to SS EN 197-1, 2. Coloured cement for integral coloured plaster or render may have colouring additive not exceeding 5% of the cement by weight incorporated. Colours shall be directed by the SO.</p> <p>Sustainable construction: Use green cements with approved industrial by-product to replace Ordinary Portland Cement by at least 10% by mass.</p>
3.2.2	<p>Gypsum Plaster</p> <p>To BS 8481.</p>
3.3	<p>Water</p> <p>Potable, clean and fresh, and free from mineral and organic substances.</p>
3.4	<p>Beads</p> <p>Provide at all external corners, control joints, expansion joints and drips. Type, gauge and size shall be in accordance with manufacturer's recommendations, to suit thickness of skim coat.</p> <p>For plastering, galvanised steel (450g) to BS EN 13658-1; stainless steel to BS EN 10088-1 Grade 1.4401 (or AISI 316); or PVC to BS EN 13658-1 and BS EN 13914-2, as specified in Section A08-050:Clause:3.1.</p> <p>For rendering, stainless steel shall comply with BS EN 10088-1 Grade 1.4401 (or AISI 316) or PVC, to BS EN 13658-2 and BS EN 13914-1, as specified in Section A08-050:Clause:3.1. Galvanised steel shall not be used.</p>
3.5	<p>Paint and Coatings</p> <p>Refer to Section A02-020:Clause:3.1 for requirements under different substrate materials.</p>
4	WORKMANSHIP
4.1	General
4.1.1	<p>Method of Work</p> <p>Carry out the Works in accordance with the manufacturer's recommendations and the method statement as submitted to the SO.</p> <p>Ensure that the application achieves the specified performance requirements as set out in Section A08-050:Clause:2.</p> <p>Moisture Content of Substrate</p> <p>Do not apply skim coat if substrate is wet.</p> <p>If there are wet areas (kitchens, toilets, roofs, etc.) above, carry out waterproofing works and conduct water test to the slab prior to application of skim coat, in accordance with Section A14-020 "Liquid Applied Membrane System" and Section A14-030 "Cementitious System".</p>
4.1.1	Not In Use
4.1.2	Delivery, Storage and Handling

	(a)	All materials shall be delivered to Site in original packaging or containers bearing manufacturer's brand name and identification.
	(b)	Materials shall be stored inside, under cover and kept dry at all times, protected from the weather, other elements and damage from construction operations and other causes.
	(c)	Protect all components and accessories from being bent or damaged.
4.1.3	Preparation for Plastering and Rendering Clean the substrate of dust, dirt, oil and any other residue or contaminants. Verify that the substrate is flat and free of irregularities greater than 6.4 mm in 3 m. Fill pinholes, honeycombs, etc., and correct form joints, protrusions or other irregularities which cannot be covered by the skim coat. If plane and level surface is not possible within the tolerance allowed by the thickness of the skim coat, submit to the SO remedial measures to account for the inaccuracies of substrate (slab soffit, beams, etc.). Plaster or render may be applied, if necessary, to achieve a plane and level surface, if agreed by the SO.	
4.1.1	Not In Use	
4.1.2	Mixing Mechanically mix pre-packed skimming materials to the manufacturer's recommendations.	
4.2	Beads Install beads at all external corners, control joints, expansion joints and drips prior to application of skim coat. Ensure that all beads are accurately located and properly secured to the manufacturer's recommendations. Use longest lengths to minimise joints.	
4.3	Application Apply skim coat in accordance with the manufacturer's recommendations. Thickness of skim coat to not exceed that specified in Section A08-050:Clause:3.1. Finish coat shall be smooth, level, true finish and free of waves, trowel or brush marks, telegraphing or other defects. Skim coat shall be properly cured to the manufacturer's recommendations. Protect against rapid drying until the whole surface is thoroughly cured. Completed skim coat surface to be suitable to receive paint, unless otherwise specified in Section A08-050:Clause:3.1.	
4.4	Defects Cracks or uneven surface due to shrinkage, crumbly plaster/render or damp surfaces will not be accepted.	
5	VERIFICATION AND SUBMISSION	
5.1	Submission	

5.1.1	Technical Submissions Include in the construction programme, events for submission of the following information:										
	(a)	Name of the manufacturer(s) of all specified or proposed pre-mixed plaster/render for each of skim coat types, additives, beads, etc., and relevant technical data.									
	(b)	All other submissions specified below:									
5.1.2	Work Submissions										
5.1.2.1	Method Statements Submit method statement(s) to the SO, consistent with the manufacturer's recommendations, in order to achieve the performance requirements set out in Section A08-050:Clause:2.1, covering the following aspects:										
	(a)	Surface preparation									
	(b)	Method of determining moisture content of substrate									
	(c)	Method of securing beads									
	(d)	Application procedure									
	(e)	Curing									
5.1.2.2	Co-ordinated Services Ceiling Drawings Co-ordinated services ceiling plans, drawn to appropriate scale and indicating ceiling mounted items shall also be submitted for review by the SO.										
5.1.3	Test Reports and Certificate Submissions Submit relevant test reports and certificates from a recognised Certification Body to demonstrate compliance with all required material characteristics specified.										
	(a)	Tests									
	Carry out tests as follows: <table border="1"> <thead> <tr> <th>Material</th><th>Test</th><th>Description</th></tr> </thead> <tbody> <tr> <td>Skim Coat</td><td>Combustibility</td><td>To BS 476-4</td></tr> <tr> <td>Skim Coat</td><td>Adhesion test</td><td>To BS EN 1015-12</td></tr> </tbody> </table> <p>[Note 2: Check the required tests under the BCA Approved Document, Code for Environmental Sustainability of Buildings, Fire Code, etc.]</p>		Material	Test	Description	Skim Coat	Combustibility	To BS 476-4	Skim Coat	Adhesion test	To BS EN 1015-12
Material	Test	Description									
Skim Coat	Combustibility	To BS 476-4									
Skim Coat	Adhesion test	To BS EN 1015-12									
	(b)	Certificates									

	<p>Provide certificates as follows:</p> <table border="1"> <tr> <th>Material</th><th>Certificate</th><th>Description</th></tr> <tr> <td>Skim Coat</td><td>SGBC Green Label</td><td>Sustainable Product Certification</td></tr> <tr> <td>.</td><td>.</td><td>.</td></tr> </table> <p>[Note 2: Check the required certification under the BCA Approved Document, Code for Environmental Sustainability of Buildings, Fire Code, etc.]</p>		Material	Certificate	Description	Skim Coat	SGBC Green Label	Sustainable Product Certification	.	.	.			
Material	Certificate	Description												
Skim Coat	SGBC Green Label	Sustainable Product Certification												
.	.	.												
5.1.4	<p>Quality Control Plan Submissions</p> <p>Prepare and submit the quality control plan to the SO prior to starting work.</p>													
5.1.5	<p>Warranty</p> <p>Submit the warranty to the SO upon completion of the Works, if required under Clause 1.4.4.</p>													
5.1.6	<p>Maintenance Submissions</p> <p>No item.</p>													
5.2	<p>Samples and Mock-Ups</p>													
5.2.1	<p>Samples</p> <p>Submit the following samples:</p>													
	(a)	1 m length of all beads.												
	<p>[Note: State other samples required.].</p>													
5.2.2	<p>Mock-Ups</p> <p>One slab soffit, location to be agreed with the SO, to be completed for each of the types of skim coat specified in Section A08-050:Clause:3.1.</p> <p>Provide additional mock-ups as follows:</p> <table border="1"> <tr> <th>Mock-Up</th><th>Size of panel (mm)</th><th>Description</th></tr> <tr> <td>.</td><td>.</td><td>.</td></tr> <tr> <td>.</td><td>.</td><td>.</td></tr> <tr> <td>.</td><td>.</td><td>.</td></tr> </table> <p>Do not proceed with other plastering or rendering works until the SO has approved the mock-ups. If approved by the SO, the mock-up(s) may form part of the works.</p>		Mock-Up	Size of panel (mm)	Description
Mock-Up	Size of panel (mm)	Description												
.	.	.												
.	.	.												
.	.	.												
5.3	<p>Inspections</p> <p>Give at least 7 days' notice to the SO when the first section of the following is ready for inspection:</p>													

	(a)	Preparation of the substrate
	(b)	Completion of any skim coat type. Proceed with other areas only after approval by the SO.
	The SO will determine the extent of first section.	
5.4	On-Site Tests Tap test and adhesion tests to be carried out to skim-coated soffits where required by the SO. Refer to Section A02-030 "Pasters and Renders" for testing procedure and required	

(36) A09-010 DOORS

1 General

Read this Section with G01-010 "General Requirements" and all other contract documents

1.1 Scope

This Section covers the requirements for doors including fire doors and associated ironmongery. Household shelter doors are not included. Roller Shutter Doors are covered in Section A09-020.

1.2 Related Sections

Read this Section in conjunction with the relevant requirements of the following sections:

A01-010	Brickwork
A01-020	Blockwork
A01-030	Lightweight Concrete Panels
A01-040 A01-050	Precision Blocks Precast Vent Blocks
A02-010	Dry Wall Partitions
A02-020	Paintings and Coatings
A02-030	Plasters and Renders
A02-040	Wall Tiling
A02-050	Glass Partitions
A12-010	Ironmongery

1.3 Standards, Codes, Regulations and Technical References

1.3.1 Standards and Codes

Unless otherwise agreed by the SO, ensure all of the Works comply with the relevant requirements of the standards and codes listed below or referenced in the body of the Specification. Alternative standards and codes may be proposed for approval by the SO, provided it can be demonstrated that the alternative standards and codes comply with the requirements of the standards specified. All standards and codes quoted are the current version, unless specific year references are noted.

In the event that the standards or codes are partially superseded or have become obsolete, refer to the current edition or the approved substitution for the relevant clauses.

Singapore Standards	
SS EN 1991-1-4	Actions on structures – Part 1-4: General actions – Wind Actions
NA to SS EN 1991-1-4	Singapore National Annex to Eurocode 1 – Actions on structure – Part 1-4: General actions – Wind actions
SS 71	Nomenclature of commercial timbers

SS 72	Specification for treatment of timber and plywood with copper/chrome/arsenic wood preservatives
SS 173	Glossary of terms relating to timber and woodwork
SS 332	Specification for fire doors
SS 341	Specification for Safety glazing materials for use in buildings (human impact considerations)
SS 347	Timber doors
SS 572	Code of practice for the use of timber in buildings
Other Standards	
BS EN 179	Building hardware – Emergency exit devices operated by a lever handle or push pad, for use on escape routes. Requirements and test methods
BS EN 438 Series	High-pressure laminates (HPL) – Sheets based on thermosetting resins (usually called laminates)
BS EN 485-1	Aluminium and aluminium alloys – Sheet, strip and plate – Part 1: Technical conditions for inspection and delivery
BS EN 485-2+A1	Aluminium and aluminium alloys – Sheet, strip and plate – Part 2: Mechanical properties
BS EN 485-3	Aluminium and aluminium alloys – Sheet, strip and plate – Part 3: Tolerances on dimensions and form for hot- rolled products
BS EN 486	Aluminium and aluminium alloys – Extrusion ingots. Specifications
BS EN 572 Series	Glass in building – Basic soda-lime silicate glass products
BS EN 573-3	Aluminium and aluminium alloys – Chemical composition and form of wrought products – Part 3: Chemical composition and form of products
BS EN 755	Aluminium and aluminium alloys – Extruded rod/bar, tube and profiles.
BS EN 942	Timber in joinery – General requirements

BS EN 951	Door leaves – Method for measurement of height, width, thickness and squareness
BS EN 1026	Windows and doors – Air permeability – Test method
BS EN 1027	Windows and doors – Water tightness – Test method
BS EN 1125	Building hardware – Panic exit devices operated by a horizontal bar, for use on escape routes – Requirements and test methods
BS EN 1154	Building hardware – Controlled door closing devices – Requirements and test methods
BS EN 1155	Building hardware – Electrically powered hold-open devices for swing doors – Requirements and test methods
BS EN 1158	Building hardware – Door coordinator devices – Requirements and test methods
BS EN 1294	Door leaves. Determination of the behaviour under humidity variations in successive uniform climates
BS EN 1303	Building hardware. Cylinders for locks. Requirements and test methods
BS EN 1363-1	Fire resistance tests – Part 1: General requirements
BS EN 1363-2	Fire resistance tests – Part 2: Alternative and additional procedures
BS EN 1634	Fire resistance and smoke control tests for door and shutter assemblies, openable windows and elements of building hardware
BS EN 1863-2	Glass in building – Heat strengthened soda lime silicate glass – Part 2: Evaluation of conformity – Product standard
BS EN 1906	Building hardware – Lever handles and knob furniture – Requirements and test methods
BS EN 1935	Building hardware – Single-axis hinges – Requirements and test methods.
BS EN 1999-1-1	Design of aluminium structures – Part 1: General Structural Rules
BS EN 1999-1-4	Design of aluminium structures – Part 1-4: Cold-formed structural sheeting

BS EN 10029	Hot-rolled steel plates 3 mm thick or above – Tolerances on dimensions and shape
BS EN 10048	Hot rolled narrow steel strip – Tolerances on dimensions and shape
BS EN 10051	Continuously hot-rolled strip and plate/sheet cut from wide strip of non-alloy and alloy steels – Tolerances on dimensions and shape
BS EN 10088	Stainless steels
BS EN 10095	Heat resisting steels and nickel alloys
BS EN 10111	Continuously hot rolled low carbon steel sheet and strip for cold forming – Technical delivery conditions
BS EN 10132	Cold rolled narrow steel strip for heat treatment – Technical delivery conditions.
BS EN 10139	Cold rolled uncoated low carbon steel narrow strip for cold forming – Technical delivery conditions
BS EN 10143	Continuously hot-dip metal coated steel sheet and strip – Tolerances on dimensions and shape
BS EN 10149 Series	Hot rolled flat products made of high yield strength steels for cold forming.
BS EN 12020-1	Aluminium and aluminium alloys – Extruded precision profiles in alloys EN AW-6060 and EN AW-6063 – Part 1: Technical conditions for inspection and delivery
BS EN 12020-2	Aluminium and aluminium alloys – Extruded precision profiles in alloys EN AW-6060 and EN AW-6063 – Part 2: Tolerances on dimensions and form
BS EN 12051	Building hardware. Door and window bolts – Requirements and test methods
BS EN 12150-2	Glass in building – Thermally toughened soda lime silicate safety glass – Part 2: Evaluation of conformity/Product standard
BS EN 12207	Windows and doors – Air permeability – Classification
BS EN 12208	Windows and doors – Watertightness – Classification
BS EN 12209	Building hardware – Mechanically operated locks and locking plates – Requirements and test methods

BS EN 12210	Windows and doors – Resistance to wind load – Classification
BS EN 12211	Windows and doors. Resistance to wind load – Test method
BS EN 12600	Glass in building. Pendulum test – Impact test method and classification for flat glass
BS EN 13501-1	Fire classification of construction products and building elements – Part 1: Classification using data from reaction to fire tests
BS EN 13637	Building hardware – Electrically controlled exit systems for use on escape routes – Requirements and test methods
BS EN 13823+A1	Reaction to fire tests for building products – Building products excluding floorings exposed to the thermal attack by a single burning item
BS EN 14179	Glass in building – Heat-soaked thermally-toughened soda lime silicate safety glass
BS EN 14351-2	Windows and doors – Product standard, performance characteristics – Part 2: Internal pedestrian doorsets
BS EN 14846	Building hardware – Locks and latches – Electromechanically operated locks and striking plates – Requirements and test methods
BS EN 15269 Series	Extended application of test results for fire resistance and/or smoke control for door, shutter and openable window assemblies, including their elements of building hardware
BS EN 15684	Building hardware – Mechatronic cylinders – Requirements and test methods
BS EN 15752-1	Glass in building – Adhesive backed polymeric film – Part 1: Definitions and requirements
BS EN 15755-1	Glass in building – Adhesive backed polymeric filmed glass – Part 1: Definitions and requirements
BS EN 16005	Power operated pedestrian doorsets – Safety in use. Requirements and test methods
BS EN 16034	Pedestrian doorsets, industrial, commercial, garage doors and openable windows – Product standard, performance characteristics – Fire resisting and/or smoke control characteristics
BS EN 17257	Glass in building – Acid etched glass

BS EN 17258	Glass in building – Sand blasted glass
BS EN ISO 2081	Metallic and other inorganic coatings – Electroplated coatings of zinc with supplementary treatments on iron or steel
BS EN ISO 9445-2	Continuously cold-rolled stainless steel – Tolerances on dimensions and form Part 2: Wide strip and plate/sheet
BS EN ISO 12543	Glass in building – Laminated glass and laminated safety glass
BS EN ISO 14021	Environmental labels and declarations – Self-declared environmental claims (Type II environmental labelling)
BS EN ISO 18286	Hot-rolled stainless steel plates – Tolerances on dimensions and shape
BS 438-2+A1	High-pressure decorative laminates (HPL) – Sheets based on thermosetting resins (usually called laminates) – Part 2: Determination of properties
BS 459	Specification for matchboarded wooden door leaves for external use
BS 476	Fire tests on building materials and structures
BS 476-22	Fire tests on building materials and structures – Part 22: Method for determination of the fire resistance of non- loadbearing elements of construction
BS 476-23	Fire tests on building materials and structures – Part 23: Methods for determination of the contribution of components to the fire resistance of a structure
BS 1161	Specification for aluminium alloy sections for structural purposes
BS 1245	Pedestrian doorsets and door frames made from steel sheet. Specification
BS 4255-1	Rubber used in preformed gaskets for weather exclusion from buildings – Part 1: Specification for non- cellular gaskets
BS 4787	Internal and external wood doorsets, door leaves and frames – Specification for dimensional requirements
BS 4965	Decorative laminated plastics sheet veneered boards and panels
BS 5277	Doors – Measurement of defects of general flatness of door leaves

BS 6375 s	Performance of windows and doors
BS 6510	Steel-framed windows and glazed doors – Specification
BS 8214	Timber-based fire door assemblies – Code of practice
EN ISO 1182	Reaction to fire tests for products – Non-combustibility test
EN ISO 1716	Reaction to fire tests for products – Determination of gross heat of combustion (calorific value)
EN ISO 11925-2	Reaction to fire tests – Ignitability of products subjected to direct impingement of flame – Part 2: Single-flame source test
ISO 834	Fire-resistance tests – Elements of building construction
ISO 3008	Fire resistance tests – Door and shutter assemblies
ISO 10140	Acoustics – Laboratory measurement of sound insulation of building elements
ISO 12465	Plywood – Specifications
AAMA 2604	Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminium Extrusions and Panels
AAMA 2605	Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminium Extrusions and Panels
ASTM C509	Standard Specification for Elastomeric Cellular Preformed Gasket and Sealing Material
ASTM C1036	Standard Specification for Flat Glass
ASTM C1048	Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass
ASTM C1172	Standard Specification for Laminated Architectural Flat Glass
ASTM D1056	Standard Specification for Flexible Cellular Materials – Sponge or Expanded Rubber
ASTM D3715	Standard Practice for Quality Assurance of Pressure-Sensitive Tapes
ASTM E90	Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements

ASTM E119	Standard Test Methods for Fire Tests of Building Construction and Materials
ASTM E336	Standard Test Method for Measurement of Airborne Sound Insulation in Building
ASTM E1105	Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference
AS 1231	Aluminium and aluminium alloys – Anodic oxidation coatings
AS 1530	Methods for fire tests on building materials, components and structures
AS 1530.4	Methods for fire tests on building materials, components and structures – Part 4: Fire-resistance test of elements of construction
AS 1905	Components for the protection of openings in fire-resistant walls – Fire resistant doorsets
AS 2208	Safety glazing materials in buildings
AS 3715	Metal finishing – Thermoset powder coating for architectural applications of aluminium and aluminium alloys
NFPA 257	Standard on Fire Test for Window and Glass Block Assemblies

1.3.2 Regulations

Refer to the following regulations for compliance in carrying out the Works:

Building and Construction Authority – Approved Document ("Approved Document")
Code for Environment Sustainability of Buildings
Code on Accessibility in the Built Environment
Code of Practice for Fire Precautions in Buildings ("Fire Code")

The above regulations refer to the latest edition (including any amendments) that are currently in use.

1.3.3 Technical References

No item.

1.4 Trade Preamble

1.4.1 Contractor's Submissions

The design intent and locations of doors are shown in the drawings, and the door types and associated ironmongery specified in door schedules and Section A09-010:Clause:3.1.

Engage qualified and experienced personnel to carry out and submit the following items to the SO:

- (a) Shop drawings with all necessary developed details based on the design drawings, for the fabrication and installation of the doors.
- (b) Names of suitable manufacturers for door leaves, door sets (if specified) and ironmongery.

1.4.2 Co-ordination with Other Works

Co-ordinate the Works, particularly the interfacing with the following work packages and trades, where applicable:

- (a) All walls including masonry, dry walls and glass partitions
- (b) Raised floor
- (c) Suspended ceiling
- (d) All wall finishes
- (e) Floor finishes (for doors with threshold)

Liaise and co-ordinate services shop drawings to include location of all doors linked to security and/or fire alarm systems.

1.4.3 Provision of Spare Materials

Deliver to Site in appropriate protective packaging marked for identification, and store where directed by the SO, the following spare components and materials for future replacement and repair:

Item	Description	Quantity
.	.	.
.	.	.

1.4.4 Quality Control Plan

Prepare and submit a quality control plan to the SO.

1.4.5 Warranty

Provide the following warranties in accordance with the specimen warranty, or otherwise as agreed with the SO:

Item of Works to be Warranted	Period of Warranty Required
Metal Doors and Frames	10 Yr from issuance of completion cert
Timber Doors and Frames	10 Yr from issuance of completion cert
Metal Gates	10 Yr from issuance of completion cert

1.4.6 Maintenance Manual

Prepare and submit a maintenance manual covering all components, accessories and ironmongery. Refer to Section G01-010:Clause:1.4.5 for details.

Include the following information in the maintenance manual:

- (a) An outline description of the completed door systems.
- (b) A detailed description of specific materials, components and ironmongery with product names, types, etc.
- (c) Sealants for external doors to be inspected every 2 years.
- (d) Fire rated doors to be inspected once a month and maintained in accordance with SS 332.

1.5 Definitions and Abbreviations

The following definitions and abbreviations apply within this Section.

1.5 1

1.5.2 Definitions

1.5.2.1 Manifestation

Treatment applied to glass to make it apparent, to prevent collision, enhance privacy or as decoration.

1.5.3 Abbreviations

1.5.3.1 STC

Sound Transmission Class

2 Performance Requirements

2.1 Contractor's Brief

When carrying out the proposals as specified in Section A09-010:Clause:1.4.1, take account of the following performance requirements.

2.1.1 Dead Loads

The self-weight and other associated dead loads of the complete door and frames shall be supported and transferred to the main building structure.

2.1.2 Fire Resistance

Comply with the requirements of SS 332 and the Fire Code, and any additional requirements of other statutory authorities having jurisdiction over the Works.

Refer to Section A09-010:Clause:3.1 for the required fire rating of the door systems and the drawings for the location of each of the door types.

2.1.3 Fire Doors

- (a) Fire doors, as shown in drawings/schedules, shall have construction identical to door system submitted for fire tests, and comply with requirements of SS 332.
- (b) Construction for fire doors shall be consistent with design of doors shown in drawings/schedules.
- (c) Vision panels in fire doors shall comply with SS 332.
- (d) Surface spread of flame of glazing components shall conform to BS 476 Class 1.
- (e) Ensure that the fire door assembly complete with vision panel achieves the fire rating specified in drawings, schedules and/or Section A09-010:Clause:3.1.
- (f) Where fire-rated doors are set below suspended ceilings or above raised floors, include for infilling void above or below door with fire-rated infill of the same rating as the door. The construction of the infill shall be to the approval of the SO

2.1.4 Thermal Performance

External doors shall achieve U-value as specified in Section A09-010:Clause:3.1.

Such doors to be used for 24-hour air-conditioned spaces shall be adequately insulated to prevent any condensation.

2.1.5 Acoustic Rating

2.1.5.1 Sound Insulation

Attain STC rating as specified in Section A09-010: Clause:3.1.

2.1.6 Airtightness

External door systems enclosing air-conditioned spaces shall achieve airtightness to BS EN 12207 Class 4 (600Pa) unless otherwise specified in Section A09-010:Clause:3.1 and tested to BS EN 1026.

2.1.7 Watertightness

External doors shall achieve watertightness to BS EN 12208 Class 7A (300Pa) unless otherwise specified in Section A09-010:Clause:3.1, and tested to BS EN 1027.

2.1.8 Wind Loading

External doors shall achieve wind loading resistance to SS EN 1991-1-4 and tested to BS EN 12211.

3 Materials

3.1 Types of Doors

Internal doors shall be read in conjunction with the door schedule in the drawings for door types:

Type: Steel Doors – MD.01, MD.02, MD.03, MD.04, MD.05 and MD.06		
Item	Requirements	Clause Reference
Location	Internal / External	.
Manufacturer	.	.
Fire Rating	Refer to Architect's drawings	.
Acoustic Rating	STC 44 to STC 50	.
U-value	[applicable to external doors only]	.
Airtightness	Class 1 / 2 / 3 / 4 to BS EN 12207	.
Watertightness	Class 1 / 2 / 3 / 4 / 5 / 6 / 7 / 8 / 9 to BS EN 12208	.
Door Frame	.	.
-Material	.	.
-Finish as Delivered	.	.
-Finish on Site	To use low VOC coating for internal doors with Singapore Green Label cert.	.
Door	.	.
-Size	Refer to drawings	.
-Overall Door Thickness	.	.
-Face Finish as Delivered	.	.
-Finish on Site	To use low VOC coating for internal doors with Singapore Green Label cert.	.

-Core Material	.	.
Glazed Vision Panel	.	.
-Glass Type/Thickness	.	.
-Manifestation	.	.
Louvred Panel	.	.
-Bird Mesh	.	.
-Insect Screen	.	.
Ironmongery Set	High quality heavy duty to Architect's approval	.
-Manufacturer	.	.
-Finish	.	.
-Hinge Classification	.	.
-Door Closer	For all fire rated doors with approved PSB cert	.
-Perimeter Seals	.	.
Door accessories	.	.

Type: Timber Doors – TD.01 & TD.02		
Item	Requirements	Clause Reference
Location	<i>Internal</i>	.
Manufacturer	.	.
Fire rating	<i>Refer to Architect's drawings</i>	.
Acoustic Rating	<i>STC 44 to STC 50</i>	.
U-value	<i>[applicable to external doors only]</i>	.
Airtightness	<i>Class 1 / 2 / 3 / 4 to BS EN 12207</i>	.
Watertightness	<i>Class 1 / 2 / 3 / 4 / 5 / 6 / 7 / 8 / 9 to BS EN 12208</i>	.
Door frame	<i>Timber in laminated finish</i>	.
-Material	.	.
-Finish as Delivered	.	.
-Finish on Site	<i>To use Singapore Green Label cert. material</i>	.
Door	.	.
-Size	<i>Refer to drawings</i>	.
-Overall Door Thickness	.	.
-Face Finish as Delivered	.	.
-Finish on Site	<i>To use Singapore Green Label cert. material</i>	.
-Core Material	.	.
Preservative Treatment	.	.
Glazed Vision Panel	.	.
-Glass Type/Thickness	.	.
-Manifestation	.	.
Louvred Panel	.	.
-Bird Mesh	.	.
-Insect Screen	.	.
Ironmongery Set	High quality heavy duty to Architect's approval	.
-Manufacturer	.	.

-Ironmongery Finish	.	.
-Hinge Classification	.	.
-Door Closer	For all fire rated doors with approved PSB cert	.
-Perimeter Seals	.	.
Door Accessories	.	.
Architraves	Refer to drawings	.

Type: Glass Doors – GD-1		
Item	Requirements	Clause Reference
Location	Internal / External	.
Manufacturer	.	.
Fire Rating	.	.
Acoustic Rating	.	.
U-value	[applicable to external doors only]	.
Airtightness	Class 1 / 2 / 3 / 4 to BS EN 12207	.
Watertightness	Class 1 / 2 / 3 / 4 / 5 / 6 / 7 / 8 / 9 to BS EN 12208	.
Door Frame	.	.
Material	.	.
Finish as Delivered	.	.
-Finish on Site	To use low VOC coating for internal doors	.
Door	.	.
-Size	Refer to drawings	.
-Glass Type	.	.
-Glass Thickness	.	.
-Grade	A or B	.
-Heat Soaking	Yes / No [applicable to tempered glass only]	.
-Manifestation	.	.
Ironmongery Set	.	.
-Manufacturer	.	.
-Finish	.	.
-Hinge Classification	.	.
-Door Closer	.	.
-Floor Spring	.	.
-Perimeter Seals	.	.
Door Accessories	.	.

Type: Aluminium Doors – AL -1		
Item	Requirements	Clause Reference
Location	Internal / External	.
Manufacturer	.	.

Acoustic Rating	.	.
U-value	<i>[applicable to external doors only]</i>	.
Airtightness	<i>Class 1 / 2 / 3 / 4 to BS EN 12207</i>	.
Watertightness	<i>Class 1 / 2 / 3 / 4 / 5 / 6 / 7 / 8 / 9 to BS EN 12208</i>	.
Door Frame	.	.
-Material	.	.
-Finish as Delivered	<i>To use low VOC coating for internal doors</i>	.
Door	.	.
-Size	<i>Refer to drawings</i>	.
-Finish as Delivered	<i>To use low VOC coating for internal doors</i>	.
Glazed Vision Panel	.	.
-Glass Type/Thickness	.	.
-Manifestation	.	.
Louvred Panel	.	.
-Bird Mesh	.	.
-Insect Screen	.	.
Ironmongery Set	.	.
-Manufacturer	.	.
-Ironmongery ffnish	.	.
-Hinge Classification	.	.
-Door Closer	.	.
.	.	.
.	.	.
-Perimeter Seals	.	.
Door Accessories	.	.

3.2 Fire Doors

Materials used for fire doors shall be identical with the door system described in the test certificates.

All fire doors shall be of types and construction identical to door systems submitted for fire resistance tests, complying with SS 332.

Changes to the core material or specified thickness are not allowed.

Any variation/substitution in the door and frame size, construction material, ironmongery, and method of fixing/installation shall be subjected to further approval by the relevant Authority.

Ironmongery and door accessories, such as door closer(s), shall be compatible with the fire rating of the door and shall comply with requirements of SS 332.

Doors and frames shall comply with the Certification Scheme and Surveillance Regime required in the Fire Code and shall bear a label issued by a Certification Body recognised by the relevant Authority.

3.3 Timber

Unless otherwise specified, all timber shall be Kapur, Nyatoh or Meranti for internal doors and Kapur, Chengal or Balau for external doors.

Moisture content when fitted to be between 10% and 15%. Difference in moisture content between adjacent timbers shall be no more than 3%.

Pressure impregnate preservative to all timber as specified in Section A09-010:Clause:3.1, or otherwise approved by the SO.

Fire retardant treatment system shall be submitted to the SO. Season and kiln-dry timber after treatment.

Select materials and construct timber doors in accordance with SS 347.

3.4 Plywood

All plywood shall be bonded using WBP (Water Boil Proof) adhesive Type D or better, in accordance with SS 347.

Grade 1: For use in natural state or for transparent finish. Free from knots, boreholes, splits and glue stains.

Grade 2: For painting or similar treatment.

Grade 3: For elements not normally visible.

Exposed veneered finish plywood shall be Grade 1 plain sliced veneer random matched. On double doors, veneer pattern shall be as shown in drawings or otherwise approved by the SO.

Timber doors exposed to sheltered external environment, such as open corridors or car porches, shall be marine grade plywood.

3.5 Paint and Finishes

Refer to Section A02-020 "Paintings and Coatings", and Section A09-010:Clause:3.1.

Refer to drawings and/or Section A09-010:Clause:3.1 for finishes on each door type.

3.6 Facing

3.6.1 Stainless Steel Facing

Type 1.4301 (closest to former grade 304) for internal doors and type 1.4401 (closest to former grade 316) for external doors shall be according to BS EN 10048, and thickness 1.5 mm to BS EN ISO 9445-2 and BS EN ISO 18286.

Finish of stainless steel shall be as specified in drawings and/or Section A09-010:Clause:3.1.

3.6.2 Plastic Laminate Facing

To BS EN 438, and BS 4965 durability class D4. Thickness shall in accordance with manufacturer's recommendation.

For external doors, plastic laminate shall be warranted against UV deterioration by the manufacturer.

Fire performance to comply with the requirements of the Fire Code.

3.6.3 Veneer Facing

Veneer species and layout as shown in the drawings and/or specified in Section A09- 010:Clause:3.1 and to the SO's approval.

3.7 Aluminium Frames

3.7.1 Extrusions

Alloy 6063 to BS EN 12020-1,2, temper T5 or T6 to manufacturer's recommendations, unless otherwise approved by the SO.

Comply with BS EN 486, BS EN 573-3, BS 1161 and BS EN 755.

Minimum wall thickness:

- (i) Structural parts to be 2.5 mm
- (ii) Extruded frames to be 2 mm
- (iii) Louvre blades to be 1.5 mm

Platforms, webs, flanges, races and screw flutes of sufficient size to satisfy all structural requirements and eliminate distortion of elements in the Works.

3.7.2 Sheets, Strips and Plates

Alloy complying with BS EN 485-3.

Not less than 1.6 mm thick for hidden flashings, not less than 3 mm thick for components exposed to view or to impact stainless steel components.

3.7.3 Finishes to Aluminium

3.7.3.1 Anodic Oxidation

To comply with AS 1231 thickness Grade AA 25.

3.7.3.2 PVF2

For external doors only; do not use for internal doors due to high VOC content. Wet-applied, oven-cured, and to comply with AAMA 2605.

Kynar 500 / Hylar 5000 resin content shall be at a minimum of 70%. Minimum thickness shall be 35 microns.

Refer to Section A02-020 "Paintings and Coatings", and Section A09-010:Clause:3.1.

3.7.3.3 Polyester Powder Coating

Polyester powder coating shall comply with AS 3715, and with AAMA 2605 for externally exposed surfaces, and with AAMA 2604 minimum for internal-facing surfaces only.

Minimum thickness of 60 microns for external doors and 50 microns for internal doors. Gloss level as specified in Section A09-010:Clause:3.1, or otherwise approved by the SO.

Refer to Section A02-020 "Paintings and Coatings", and Section A09-010:Clause:3.1.

3.8 Glass

3.8.1 General

Refer to Section A02-0510 "Glass Partitions".

To BS EN 572 Series or ASTM C1036, and type, thickness and characteristics as indicated in the drawings and/or specified in Section A09-010:Clause:3.1.

Each glass type shall be sourced from a single supplier.

Grade shall be as specified in Section A09-010:Clause:3.1 to SS 341.

Glass panes shall be factory cut to required sizes to BS EN 572-8, without significant edge faults (including feathered edges, shells or other imperfections) and free from bubbles, inclusions, cracks, rippling, dimples, sleeks or other defects.

3.8.1.1 Fire Rating

Vision panels in fire doors shall comply with SS 332 and achieve the specified fire-rating. shall be not more than BS 476 Class 1, unless otherwise approved by the competent authority.

3.8.1.2 Defects

Glass shall be assessed for optical and/or visual faults to BS EN 572. Acceptance level of spot faults to BS EN 572, Category C. Linear/extended faults shall not be accepted.

Only faults visible when viewed from a distance of 3 m or more are considered to be defects.

3.8.2 Float Glass

To BS EN 572-2.

Use only to make up laminated glass. Glass or glazed doors using float glass on its own shall not be permitted.

3.8.3 Laminated

To BS EN ISO 12543 or ASTM C1172, and permanently marked to SS 341.

Thickness as shown in drawings and/or specified in Section A09-010:Clause:3.1. Use identical or approximately equal glass thicknesses and type, unless otherwise approved by the SO, on both sides of the laminate.

Protect inter-layer from effects of moisture absorption in service including clouding, shrinking back and delamination.

3.8.4 Heat-strengthened

To BS EN 1863-2 or ASTM C1048.

Only use to make up laminated glass, and to be permanent marked to SS 341. Glass or glazed doors using heat strengthened glass on its own shall not be permitted.

3.8.5 Fire-Rated Glass

To be part of a system certified by a Certification Body recognised by the competent authority, setting out compliance with the fire rating as specified in drawings and/or in Section A09-010:Clause:3.1.

3.8.6 Tempered

To BS EN 12150-2 or ASTM C1048, and permanently marked to SS 341.

Glass or glazed doors in excess of 2.4 m height shall comply with the requirements of BCA Approved Document.

Heat soaking, if specified in Section A09-010:Clause:3.1, shall comply with BS EN 14179-2.

3.8.7 Patterned Glass

To BS EN 572-5.

Use as part of laminated glass. Glass or glazed doors using patterned glass on its own shall not be permitted unless the patterned glass is tempered.

3.8.8 Manifestation

Provide markings to glass as indicated on drawings or specified in Section A09-010:Clause:3.1, and where there is risk of collision. The markings shall be visually contrasting against the background seen through the glass.

Not required for patterned glass.

3.8.8.1 Ceramic Frit

Pigmented glass enamel applied to glass using a silkscreen or digital printing process, and heated to $> 600^{\circ}\text{C}$ to fuse with the glass.

3.8.8.2 Sand Blasting

To BS EN 17258.

If glass is specified as tempered in Section A09-010:Clause:3.1, sand blasting shall be done prior to tempering.

3.8.8.3 Acid Etching

To BS EN 17257.

If glass is specified as tempered in Section A09-010:Clause:3.1, acid etching shall be done prior to tempering.

3.8.8.4 Film

To BS EN 15752. Filmed glass shall comply with BS EN 15755-1.

Not to be used in areas exposed to direct sunlight.

Use for decorative purposes only, and not to be relied on to satisfy structural or safety requirements.

3.9 Gaskets

3.9.1 Gaskets

Extruded ethylene propylene diene monomer (EPDM) to BS 4255-1, shore hardness 35 to 45 Shore A.

3.9.2 Cellular Rubber

Comply with ASTM C509.

3.9.3 Push-in Gaskets

Silicone-free dry PVC push-in gaskets mitred at corners.

3.10 Seals

3.10.1 Junction Sealant

Sealant for junctions between walls and fire doors shall conform and be consistent with conditions of fire test. Submit documents testifying conformity.

3.10.2 Fire Stops and Smoke Barrier Seals

Ensure intumescent fire stops and smoke barrier seals are certified by a Certification Body recognised by the relevant Authority and comply with the Certification Scheme and Surveillance Regime required in the Fire Code.

3.10.3 Acoustic Seals

To manufacturer's recommendations, to achieve acoustic rating specified in Section A09-010:Clause:3.1.

3.11 Mesh

GGrade 316 (Grade 1.4401) stainless steel mesh, unless otherwise specified in Clause Section A09-010:Clause:3.1.

Bird screen shall be 12.5 mm x 12.5 mm x 1.4 mm, unless otherwise specified in Section A09-010:Clause:3.1.

Insect screen shall be 12 mesh (1.659 mm), unless otherwise specified in Section A09-010:Clause:3.1.

3.12 Ironmongery

3.12.1 General

Refer to Section A12-010 "Ironmongery".

In the case of fire door, provide ironmongery with the same fire rating integrity as the doorset and comply with SS 332.

Where a brand name is specified, this is a guide to the respective quality, design and profile required. Submit suitable ironmongery products to the SO.

All ironmongery to accessible areas shall comply with the Code on Accessibility in the Built Environment.

Ironmongery including door closer(s) to conform to requirements of endurance test as recommended by the manufacturer.

3.12.2 Hinges

Unless otherwise specified, hinges shall be fully mortised Grade 316 (Grade 1.4401) stainless steel for external doors and Grade 304 (Grade 1.4301) stainless steel for internal doors, with non-removable stainless steel pins and in compliance with BS EN 1935, and classification as specified in Section A09-010:Clause:3.1. All doors shall have minimum 1.5 pairs of hinges.

3.12.3 Door Closers

To comply with BS EN 1154, and to achieve fire rating as specified in Section A09-010:Clause:3.1.

3.13 Door Accessories

3.13.1 Fixings

Fixings shall be to manufacturer's recommendations and shall be grade 1.4401 stainless steel for external doors and galvanised for internal doors.

3.13.2 Rubber Silencers

Provide 10 mm diameter 2 mm thick rubber silencers.

3.13.3 Weather-stripping

Proprietary weather-stripping shall be provided for all external doors. Ensure compatibility with internal and external floor finishes.

Jamb and stile weather-stripping shall consist of closed-cell neoprene conforming to ASTM D1056 Type II Grade A, and shall be oil-resistant and self-extinguishing.

Use A4 grade stainless steel self-tapping or machine screws at minimum 300 mm centres.

4 Workmanship

4.1 Site Management

Measure, calculate and indicate in shop drawings all structural openings to receive doors. Door frame dimensions shall include allowance for the door / door frame tolerances. Take into account expansion and contraction of doors as well as base structure tolerances.

4.2 Door Construction

4.2.1 Steel Door

4.2.1.1 General

Door leaf skins shall be 1.5 mm thick electro-galvanised steel sheet with galvanised "V" stiffeners at maximum 200 mm centres.

Provide 1.5 mm thick galvanised reinforcement at ironmongery positions.

Shop prime doors with a minimum of 20 microns zinc phosphate paint.

Pack core of door with mineral wool at a density of 150 kg/m³.

Fit double doors with 1.5 mm astragal at overlap on pull side; doors shall be seamless at push side.

Integrate ironmongery and seals into body of door.

Do not cut door skin to allow for the installation of ironmongery.

Finish of doors shall be as specified in drawings and/or Section A09-010:Clause:3.1.

Fire doors shall comply with SS 332.

4.2.1.2 Door Frames

Frames to be formed from hot-dip galvanised steel, minimum thickness 1.6mm (16 gauge) complying with BS EN 10143 Class 2A or 1.6mm thick Grade 1.4401 stainless steel. Finish as specified in drawings and/or Section A09-010:Clause:3.1.

Cut-outs for ironmongery shall be completed prior to galvanizing.

Treat frames with one coat of zinc phosphate primer paint (minimum of 20 microns).

Mitre and weld corners, and install L-shaped corner reinforcement at head jamb junction.

Provide 70 mm (minimum) long, 2.5 mm thick reinforcement plates at hinge, door closer, lock and panic hardware positions.

4.2.2 Timber Door

4.2.2.1 General

Comply with SS 347. Fire doors shall comply with SS 332.

Unless otherwise specified or shown in drawings, construct timber door frames with tight fitting mortise, mitre or tenon joints, wedged and fixed with 10 mm diameter hardwood pins.

Connect framing of flush doors with corrugated stainless steel fasteners. Other metal fasteners may be used for internal doors. Other jointing method may be used, subject to the SO's approval.

Unless otherwise specified or shown in drawings, provide 12 mm hardwood lipping, mechanically fixed or adhesive-fixed to all faces of door.

Form laminated cores with timber battens adhesive-fixed together. Lay battens with grain in alternate and opposite direction to balance stress and reduce distortion.

Install hardwood blocking within doors to receive installation of ironmongery.

4.2.2.2 Solid Core

Glue hardwood battens together vertically to form solid core doors. Lay with grain in alternate and opposite direction to balance stress and reduce distortion.

Minimum thickness of battens: 44 mm.

Minimum density of battens: 420 kg/m³.

4.2.2.3 Mineral Core

Mineral core of aerated magnesium oxychloride with a density of 700 kg/m³ and 38 mm thickness. Install hardwood blockings within door core for installation of all ironmongery. Hardwood blockings shall have same density as mineral core.

4.2.2.4 Plastic Laminate Facing

Bond laminate facing to face of door with adhesive recommended by the laminate manufacturer. Provide balancing laminate in all instances. Laminate shall be terminated 12 mm from face of door at hardwood lipping.

4.2.2.5 Veneer Facing

Where door face is wood face veneer, door edges shall be supplied with matching stiles and rails.

4.2.2.6 Timber Louvred Doors

Provide the following minimum sizes of hardwood for door frame:

- (a) Top rail and stiles: 100 mm x 35mm,
- (b) Intermediate rails: 75 mm x 35mm
- (c) Bottom rail: 150 mm x 35 mm.

Hardwood louvres shall be a minimum of 33 mm x 10 mm round edged hardwood fixed at 45° and recessed into the frame by a minimum of 12 mm. Bird or insect screen shall be fixed to frame with cover strip.

4.2.3 Aluminium Door

Extruded frames to Section A09-010:Clause:3.7.1, corners reinforced with cast aluminium inserts. Determine size of framing based on the size, location and use of the door.

4.2.3.1 Louvre blades to Section A09-010:Clause:3.7.1, set at an angle of 45 degrees to the frame and fixed to the frame with self-tapping screws.

4.2.3.2 Finish of frame as specified in drawings and/or Section A09-010:Clause:3.1.

4.2.3.3 Bird or insect screen shall be fixed to frame with cover strip.

4.2.4 Door Accessories

4.2.4.1 Fixings

Provide a minimum of three fixings for each jamb and one L-shaped floor anchor to each jamb.

Fixings for face-fixed frames shall be recessed into the frame and concealed with a metal face cap fabricated from metal finished to match the frame.

4.2.4.2 Rubber silencers

Fixed to frame rebate.

On single doors, place 3 silencers adjacent to lock plate and the 2 others approximately 450 mm from the first.

4.2.4.3 Weather stripping

Fix with stainless steel self-tapping screws at 300 mm centres or insert within continuous groove.

4.2.5 Storage

Store doors and frames in a dry protected area. Provide appropriate wrapping for protection and racks to prevent twisting and warping during storage.

Protect veneered doors from direct sunlight during storage.

4.2.6 Site Conditions

Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

Do not install interior products until installation areas are enclosed and conditioned.

4.3 Installation of Ironmongery

4.3.1 General

Refer to Section A12-010 "Ironmongery".

Assemble and carefully fix using fasteners supplied by the manufacturers with equivalent corrosion protection and matching finish.

4.3.2 Fixing

Holes for components shall be no larger than the minimum required for satisfactory fit / operation.

Ensure that when fixed the ironmongery does not compromise the integrity of the assembly as established by testing/assessment.

Do not use through-bolt fixing for face-fixed items.

Ensure that acoustic stripping is not interrupted by ironmongery.

Where intumescent strips are interrupted by ironmongery, provide additional intumescent paste around ironmongery to maintain fire rating.

Adjust all ironmongery and doors to achieve the following:

- (a) Door frame gap of 5 mm maximum.
- (b) Door floor finish gap of 6 mm maximum.
- (c) Door closing in accordance with BS EN 1154. For accessible areas, door opening force shall comply with the Code on Accessibility in the Built Environment.

4.3.3 Hinges

Unless otherwise specified, install 1.5 pairs of hinges or 3 hinges per door.

Install panic bolts and latches in accordance with BS EN 1125.

4.3.3.1 Location

Position hinges 250 mm from top and bottom of the door leaf, or otherwise recommended by the manufacturer. For fire doors, the position of hinges shall be consistent with the door systems submitted for fire resistance tests complying with SS 332 and the Fire Code.

4.4 Installation of Doors

4.4.1 General

Install internal doors only when the building is weathertight.

Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

For timber doors, maintain moisture content to suit specified moisture content during delivery, storage and fixing to completion of the works. When instructed by the SO, test components with an approved moisture meter.

Prime or seal surfaces of timber frames that will be inaccessible after fixing.

Allow sufficient tolerance for steel doors to expand due to temperature increase and timber doors due to moisture changes.

Include a minimum of 25 mm rebate in frame for all fire doors, or otherwise submitted for fire resistance tests, complying with SS 332.

4.4.2 Fixing

Fit door frames neatly and vertically into openings, with allowable tolerance of $\pm 1.5\text{mm}$.

Fix timber frames at 150 mm from each end, adjacent to each hanging point and at a maximum of 600 mm in between.

Method of fixing shall be demonstrated on the prototype doors. Do not fix doors until the SO has approved the method.

Install fire doors complete with ironmongery in accordance with manufacturer's instructions and SS 332.

Adjust doors and ironmongery to provide a smooth operation during the door swing.

4.4.3 Grouting for Metal Door Frames

Refer to Section A02-030 "Plasters and Renders".

4.4.4 Sealants

4.4.4.1 Non-Fire Doors

For non-fire doors, seal all junctions between walls and doors with silicone sealant. Allow for insertion of bond-breaker tape or backing rod, and apply primer to face of surfaces as recommended by manufacturer of sealant.

4.4.4.2 Fire Doors

For fire doors, fill all voids between fire door frame and wall with a ratio of 1:3 cement to sand mix or proprietary grout, or pack and seal with mineral fibre. The method of sealing shall be identical to door systems submitted for fire resistance tests complying with SS 332.

4.4.5 Architraves

Install where shown in drawings and/or specified in Section A09-010:Clause:3.7.1. No fixing screws, nails, or other fixing shall be visible, unless otherwise shown in drawings.

4.4.6 Manifestation

Where film is specified, clean the glass panes thoroughly and apply film in accordance with manufacturer's recommendations.

4.5 Painting

Touch up all abraded surfaces with priming paint to match factory-applied priming coat.

Refer to Section A02-020 "Paintings and Coatings" for surface preparation and painting.

4.6 Completion

Leave all items of ironmongery oiled and properly adjusted.

At completion, hand over 3 sets of all keys (or other quantity as specified), each to be marked/labelled.

Present confirmation from manufacturer of the number of keys supplied.

Maintain agreed security protocol for items such as master keys or common keys. These shall be officially handed over without opportunity for deliberate or accidental breach of security.

4.7 Cleaning

Clean as recommended by manufacturer. Do not use materials or methods which may damage installed work or surrounding construction.

4.8 Protection

Protect installed work from damage due to subsequent construction activity, including temperature and humidity limitations and dust control, so that the work will be without damage and deterioration at the time of project completion.

Remove and legally dispose of protective covering at time of project completion.

5 Verification and Submission

5.1 Submissions

5.1.1 Technical Submissions

Include in the construction programme, events for submission of the following information:

- (a) Name of the door manufacturer, technical data relating to each of the door types, for both doors and doorsets.

- (b) Names of the ironmongery, intumescent strip, smoke baffles and acoustic seals manufacturer(s), technical data of all the items. Wherever possible all ironmongery and inserts shall be obtained from the same manufacturer.
- (c) Information of current or completed similar jobs during the previous 5 years and details of Quality Control Procedures adopted.
- (d) All other submissions specified below.

5.1.2 Work Submissions

5.1.2.1 General

Submit the following prior to the preparation of detailed shop drawings:

- (a) Copies of test reports and certificates setting out the fire rating of each door type
- (b) Means of accommodating acoustic rating
- (c) Format of door and ironmongery schedule agreed on with the SO.

5.1.2.2 Shop Drawings

Prepare shop drawings, including:

- (a) Elevations of all doors.
- (b) Section showing door jamb, head, fanlights, skirting, at scales as agreed with the SO, for both fire and non-fire doors. Include door leaf junctions for double leaf doors.
- (c) Ironmongery and door schedule in the format agreed as with the SO. Include lock set schedule demonstrating security policies such as master key or common key requirements as shown in the drawings / door schedules.
- (d) Key schedule and format as agreed with the SO.
- (e) Layout location of all ironmongery.

Do not commence fabrication until shop drawings have been reviewed and approved by the SO.

5.1.3 Test Reports and Certificate Submissions

Submit relevant test reports and certificates for installed fire door systems, fire stops, smoke barrier seals, etc. from a Certification Body recognised by the relevant Authority, and any other relevant documents to demonstrate compliance with the Certification Scheme and Surveillance Regime required in the Fire Code.

Fire doors and frames shall bear a label issued by a Certification Body recognised by the competent authority.

Submit test reports that the fire resistance and acoustic properties of the doorsets (including the door in its frame with associated ironmongery) comply with requirements as specified in Section A09-010:Clause:2.1. Include hinges, locks and latches, etc. in place.

Submit documentation of endurance test for ironmongery.

(a) Tests

Carried out tests as follows:

Material	Test	Description
Fire rated door	PSB COC	Certificate of Conformity
.	.	.

[Note 2: Check the required tests under the BCA Approved Document, Code for Environmental Sustainability of Buildings, Fire Code, etc.]

(b) Certificates

Provide the SO with certification from the manufacturers of the following materials/components, certifying that the respective material is of the correct grade, strength, size, finish, etc. and is in accordance with the relevant codes and standards specified for:

(a) Doors

(b) Frame finish

(c) Ironmongery finish

Provide certificates as follows:

Material	Certificate	Description
Fire rated door	PSB COC	Certificate of Conformity
Finishes	Singapore Green Label	.

[Note 2: Check the required certification under the BCA Approved Document, Code for Environmental Sustainability of Buildings, Fire Code, etc.]

5.1.4 Quality Control Plan Submission

Prepare and submit the Quality Control Plan to the SO prior to starting work.

5.1.5 Warranty

Submit the warranty to the SO upon completion of the Works, if required under Section A09-010:Clause:1.4.4.

5.1.6 Maintenance Submissions

Submit maintenance manual upon completion of the Works, in accordance with Section A09-010:Clause:1.4.5.

5.2 Samples and Mock-ups

5.2.1 Samples

Provide Samples as follows:

Samples	Requirements
.	.
.	.
.	.

[Note: Customise table to reflect project specific requirements.]

5.2.2 Mock-ups

Provide Mock-ups as follows:

Mock-up	Requirements / Location
.	.
.	.
.	.

[Note: Customise table to reflect project specific requirements.]

Do not proceed with construction until the SO has approved the mock-ups.

5.3 Inspections

Refer to Section A01-010 "Brickwork", Section A01-020 "Blockwork", Section A01-030 "Lightweight Concrete Panels", Section A01-040 "Precision Blocks", A01-050 "Precast Vent Blocks" and Section A02-010 "Dry Wall Partitions".

5.4 On-Site Tests

5.4.1 Acoustic Tests

Conduct field tests and measurements at locations to be agreed with the SO, as part of the acoustic tests required for partitions, to verify that the acoustic rating specified in Section A09-010:Clause:3.1 is achieved.

5.4.2 Watertightness Test

To external doors.

5.4.2.1 General

Carry out tests on external doors in unsheltered conditions, or in conjunction with testing of external walls or wall systems, or as determined by the SO.

5.4.2.2 Method of Testing

To ASTM E1105, testing parameters to local weather data, to achieve the performance requirements specified in Section A09-010:Clause:2.1.7 and Section A09-010:Clause:2.1.8.

Provide the following information to the SO for acceptance 8 weeks, or otherwise as determined by the SO, before carrying out the test:

- (a) Equipment set up to conduct the test
- (b) Procedure of the water test
- (c) Pump capacity to deliver the required flow rate
- (d) Method to suspend the nozzle

The door will be considered to have passed the test if no dampness or seepage appears on the internal surface of the door assembly, or at joints between the door assembly and adjacent construction, during the spraying and within half an hour of completion of the spraying.

5.4.2.3 Further Testing

Should any tested doors fail the test, the SO shall determine such other doors to be tested.

(38) A10-010 STEEL WORKS

1 GENERAL

Read this Section with G01-010 "General Requirements" and all other contract documents.

1.1 Scope

This Section covers the requirements for steel works such as gates and fences, railings, decorative screens and framing to carry non-load bearing elements, etc. Proprietary metal fixtures and fittings, and furniture such as lamp posts, benches, bins, are not covered in this Section.

1.2 Related Sections

Read this Section in conjunction with the relevant requirements of the following sections:

A02-010	Dry Wall Partitions
A02-020	Paintings and Coatings
A02-050	Glass Partitions
A03-010	Semi-Unitised and Cassette System
A03-020	Stick Curtain Wall System
A04-010	Metal Cladding
A04-020	Precast Concrete Cladding
A04-030	Stone Cladding
A10-020	Aluminium Works
A11-010	Timber Works
A15-010	Hardscape
C05-010	Structural Steelwork

1.3 Standards, Codes, Regulations and Technical References

1.3.1 Standards

Unless otherwise agreed by the SO, ensure all of the Works comply with the relevant requirements of the standards and codes listed below or referenced in the body of the Specification. Alternative standards and codes may be proposed for approval by the SO, provided it can be demonstrated that the alternative standards and codes comply with the requirements of the standards specified. All standards and codes quoted are the current version, unless specific year references are noted.

In the event that the standards or codes are partially superseded or have become obsolete, refer to the current edition or the approved substitution for the relevant clauses.

Singapore Standards	
SS EN 1991-1-1	Actions on structures – Part 1-1: General actions – Densities, self-weight, imposed loads for buildings
SS EN 1991-1-4	Actions on structures – Part 1-4: General actions – Wind Actions

NA to SS EN 1991-1-4	Singapore National Annex to Eurocode 1 – Actions on structure. Part 1-4: General actions – Wind actions
SS EN 1998-1	Design of structures for earthquake resistance – Part 1: General rules, seismic actions and rules for buildings
SS 30	Manhole tops and surface-box tops
SS 551	Code of practice for earthing
SS 555 Series	Protection against lightning
Other Standards	
BS EN 1011	Welding – Recommendations for welding of metallic materials
BS EN 1090	Execution of steel structures and aluminium structures.
BS EN 1369	Founding – Magnetic particle testing
BS EN 1559	Founding – Technical conditions of delivery
BS EN 1993-1	Design of steel structures – Part 1-1: General Rules and Rules for Buildings
BS EN 1993-1-8	Design of steel structures – Part 1-8: Design of joints
BS EN 1994-1-1	Design of composite steel and concrete structures – Part 1-1: General rules and rules for buildings
BS EN 10025	Hot rolled products of structural steels
BS EN 10029	Hot-rolled steel plates 3 mm thick or above – Tolerances on dimensions and shape
BS EN 10048	Hot rolled narrow steel strip – Tolerances on dimensions and shape
BS EN 10051	Continuously hot-rolled strip and plate/sheet cut from wide strip of non-alloy and alloy sheets – Tolerances on dimensions and shape
BS EN 10055	Hot rolled steel equal flange tees with radiused root and toes – Dimensions and tolerances on shape and dimensions
BS EN 10056-1	Structural steel equal and unequal leg angles – Part 1: Dimensions
BS EN 10056-2	Specification for structural steel equal and unequal angles – Part 2: Tolerances on shape and dimensions

BS EN 10088	Stainless steels
BS EN 10095	Heat resisting steels and nickel alloys
BS EN 10111	Continuously hot rolled low carbon steel sheet and strip for cold forming – Technical delivery conditions
BS EN 10130	Cold rolled low carbon steel flat products for cold forming – Technical delivery conditions
BS EN 10131	Cold rolled uncoated and zinc or zinc-nickel electrolytically coated low carbon and high yield strength steel flat products for cold forming – Tolerances on dimensions and shape
BS EN 10132 Series	Cold rolled narrow steel strip for heat treatment – Technical delivery conditions.
BS EN 10139	Cold rolled uncoated low carbon steel narrow strip for cold forming – Technical delivery conditions
BS EN 10140	Cold rolled narrow steel strip – Tolerances on dimension and shape
BS EN 10143	Continuously hot-dip metal coated steel sheet and strip – Tolerances on dimensions and shape
BS EN 10149 Series	Hot rolled flat products made of high yield strength steels for cold forming.
BS EN 10152	Electrolytically zinc coated cold rolled steel flat products for cold forming – Technical delivery conditions
BS EN 10162	Cold rolled steel sections – Technical delivery conditions. Dimensional and cross-sectional tolerances
BS EN 10169+A1	Continuously organic coated (coil coated) steel flat products – Technical delivery conditions
BS EN 10209	Cold rolled low carbon steel flat products for vitreous enameling – Technical delivery conditions
BS EN 10210-1	Hot finished structural hollow sections of non-alloy and fine grain steels – Part 1: Technical delivery requirements
BS EN 10210-2	Hot finished steel structural hollow sections – Part 2: Tolerances, dimensions and sectional properties
BS EN 10218	Steel wire and wire products – General

BS EN 10219-2	Cold formed welded steel structural hollow sections – Part 2: Tolerances, dimensions and sectional properties
BS EN 10223-4	Steel wire and wire products for fencing and netting – Part 4: Steel wire welded mesh fencing
BS EN 10223-6	Steel wire and wire products for fencing and netting _ Part 6: Steel wire chain link fencing
BS EN 10223-7	Steel wire and wire products for fencing and netting _ Part 7: Steel wire welded panels for fencing
BS EN 10250	Open steel die forgings for general engineering
BS EN 10263-5	Steel rod, bars and wire for cold heading and cold extrusion – Part 5: Technical delivery conditions for stainless steels
BS EN 10268:A1	Cold rolled steel flat products with high yield strength for cold forming – Technical delivery conditions
BS EN 10296-1	Welded circular steel tubes for mechanical and general engineering purposes – Technical delivery conditions – Part 1: Non-alloy and alloy steel tubes
BS EN 10296-2	Welded circular steel tubes for mechanical and general engineering purposes – Technical delivery conditions – Part 2: Stainless steel
BS EN 10297-1	Seamless circular steel tubes for mechanical and general engineering purposes – Technical delivery conditions – Part 1: Non-alloy and alloy steel tubes
BS EN 10297-2	Seamless circular steel tubes for mechanical and general engineering purposes – Technical delivery conditions – Part 2: Stainless steel
BS EN 10305	Steel tubes for precision applications – Technical delivery conditions
BS EN 10340	Steel castings for structural uses
BS EN 10346	Continuously hot-dip coated steel flat products for cold forming. Technical delivery conditions
BS EN 12680 Series	Founding – Ultrasonic examination
BS EN 12681	Founding – Radiographic testing
BS EN 13438	Paints and varnishes – Powder organic coatings for hot dip galvanised or sherardised steel products for construction purposes

BS EN 13501-1	Fire classification of construction products and building elements – Part 1: Classification using data from reaction to fire tests
BS EN 15773	Industrial application of powder organic coatings to hot dip galvanized or sherardized steel articles [duplex systems] – Specifications, recommendations and guidelines
BS EN 16623	Paints and varnishes – Reactive coatings for fire protection of metallic substrates – Definitions, requirements, characteristics and marking
BS EN 17636-1	Non-destructive testing of welds – Radiographic testing – Part 1: X- and gamma-ray techniques with film
BS EN 17636-2	Non-destructive testing of welds. Radiographic testing – Part 2: X- and gamma-ray techniques with digital detectors
BS EN ISO 898-1	Mechanical properties of fasteners made of carbon steel and alloy steel – Part 1: Bolts, screws and studs with specified property classes – Coarse thread and fine pitch thread
BS EN ISO 1456	Metallic and other inorganic coatings – Electrodeposited coatings of nickel, nickel plus chromium, copper plus nickel and of copper plus nickel plus chromium
BS EN ISO 1461	Hot dip galvanized coatings on fabricated iron and steel articles – Specifications and test methods
BS EN ISO 2081	Metallic and other inorganic coatings – Electroplated coatings of zinc with supplementary treatments on iron or steel
BS EN ISO 2560	Welding consumables – Covered electrodes for manual metal arc welding of non-alloy and fine grain steels – Classification
BS EN ISO 3452	Non-destructive testing – Penetrant testing
BS EN ISO 3506	Mechanical properties of corrosion resistant stainless steel fasteners
BS EN ISO 4136	Destructive tests on welds in metallic materials – Transverse tensile test
BS EN ISO 5173	Destructive tests on welds in metallic material – Bend tests
BS EN ISO 9444-2	Continuously hot-rolled stainless steel – Tolerances on dimensions and form – Part 2: Wide strip and sheet/plate

BS EN ISO 9445	Continuously cold-rolled stainless steel – Tolerances on dimensions and form
BS EN ISO 10642	Fasteners – Hexagon socket countersunk head screws with reduced loadability
BS EN ISO 14021	Environmental labels and declarations – Self-declared environmental claims (Type II environmental labelling)
BS EN ISO 14343	Welding consumables – Wire electrodes, strip electrodes, wires and rods for arc welding of stainless and heat resisting steels – Classification
BS EN ISO 15609-2	
BS EN ISO 17638	Non-destructive testing of welds – Magnetic particle testing
BS EN ISO 17639	Destructive tests on welds in metallic materials – Macroscopic and microscopic examination of welds
BS EN ISO 17640	Non-destructive testing of welds – Ultrasonic testing – Techniques, testing levels, and assessment
BS EN ISO 18286	Hot-rolled stainless steel plates – Tolerances on dimensions and shape
BS EN ISO 23278	Non-destructive testing of welds – Magnetic particle testing. Acceptable levels.
BS EN ISO 28722	Vitreous and porcelain enamels – Characteristics of enamel coatings applied to steel panels intended for architecture
BS 476	Fire tests on building materials and structures
BS 499	Welding terms and symbols
BS 1052	Specification for mild steel wire for general engineering purposes
BS 1449-1.1	Steel plate, sheet and strip – Part 1: Carbon and carbon-manganese plate, sheet and strip – Section 1: General specification
BS 1449-1.8	Steel plate, sheet and strip – Part 1: Carbon and carbon-manganese plate, sheet and strip – Section 8: Specification for hot rolled narrow strip based on formability

BS 1449-1.14	Steel plate, sheet and strip – Part 1: Carbon and carbon-manganese plate, sheet and strip – Section 14: Specification for hot rolled narrow strip supplied in a range of conditions for heat treatment and general engineering purposes
BS 1722-1	Fences – Part 1: Specification for chain link fences
BS 3692	ISO metric precision hexagon bolts, screws and nuts – Specification
BS 4190	ISO metric black hexagon bolts, screws and nuts – Specification
BS 4320	Specification for metal washers for general engineering purposes – Metric series
BS 4464	Specification for spring washers for general engineering and automobile purposes – Metric series
BS 4652	Specification for zinc-rich priming paint (organic media)
BS 6180	Barriers in and about Buildings – Code of Practice – Section 8
BS 7668	Weldable structural steels – Hot finished structural hollow sections in weather resistant steels – Specification
BS 8000-0	Workmanship on construction sites – Introduction and general principles
EN 13823	Reaction to fire tests for building products. Building products excluding floorings exposed to the thermal attack by a single burning item
EN ISO 1182	Reaction to fire tests for products – Non-combustibility test
EN ISO 1716	Reaction to fire tests for products – Determination of gross heat of combustion (calorific value)
EN ISO 11925-2	Reaction to fire tests – Ignitability of products subjected to direct impingement of flame – Part 2: Single-flame source test
ISO 834	Fire-resistance tests – Elements of building construction
AS 1530	Methods for fire tests on building materials, components and structures
ASTM B816	Standard Specification for Coatings of Cadmium-Zinc Mechanically Deposited

ASTM D610	Standard Practice for Evaluating Degree of Rusting on Painted Steel Surfaces
ASTM D3222	Standard Specification for Unmodified Poly(Vinylidene Fluoride) (PVDF) Molding Extrusion and Coating Materials
ASTM D6386	Standard Practice for Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Painting
ASTM D7396	Standard Guide for Preparation of New, Continuous Zinc-Coated (Galvanized) Steel Surfaces for Painting
ASTM D7803	Standard Practice for Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Powder Coating
ASTM E119	Standard Test Methods for Fire Tests of Building Construction and Materials
ASTM E903	Standard Test Method for Solar Absorptance, Reflectance, and Transmittance of Materials Using Integrating Spheres

1.3.2 Regulations

Refer to the following regulations for compliance in carrying out the Works:

Building and Construction Authority â Approved Document ("Approved Document")
Building and Construction Authority â Building Control Regulations
Code of Practice for Fire Precautions in Buildings ("Fire Code")

The above regulations refer to the latest edition (including any amendments) that are currently in use.

1.1.1 Technical References

Refer to the following technical references for guidance in carrying out the Works:

Building and Construction Authority â CONQUAS 21 Enhancement Series, Good Industry Practices Guide Books
ETAG 001 â Guideline for European Technical Approval of Metal Anchors for Use in Concrete
Land Transport Authority, Standard Details of Road Elements

1.4 Trade Preamble

1.4.1 Contractor's Submissions

The design intent and locations of steel works are indicated in the drawings and the types of steel works are specified in Section A10-010:Clause:3.1.

Engage qualified and experienced personnel to carry out and submit the following items to the SO:

- (a) Shop drawings with all necessary developed details based on the design drawings, for the fabrication and installation of the works, and to meet with the performance requirements as set out in Section A10-010:Clause:2 below; Details to develop include shape and sizing of components, members, accessories and connections.
- (b) Design of appropriate structural support, anchorage, fixing, etc. for the Works including structural connection to the building structure, and footings or foundations, if not shown in the structural drawings, endorsed by a PE (Structural), including submission to the relevant authorities where the works are to serve as barriers or to be fixed at heights.
- (c) Statement of suitable methods of installation of steel works.
- (d) Names of manufacturer(s) and product information for proprietary items.

1.4.2 Co-ordination with Other Works

Co-ordinate the Works, particularly the interfacing with the following work packages and trades, where applicable:

- (a) Walls, partitions and parapets
- (b) Timber works
- (c) Cladding
- (d) Foundation/footings for steel works
- (e) Hard landscape
- (f) Soft landscape
- (g) Lightning protection
- (h) Services

1.4.3 Provision of Spare Materials

No item.

1.4.4 Quality Control Plan

Prepare and submit a quality control plan to the SO.

1.4.5 Warranty

Provide the following warranties in accordance with the specimen warranty, or otherwise as agreed with the SO:

Item of Works to be Warranted	Period of Warranty Required
PVF2	10 years
Polyester Powder Coating	10 years
.	.
.	.

1.4.6 Maintenance Manual

Prepare and submit a maintenance manual covering all steel works including components and accessories, and frequency of inspections to check for corrosion. Refer to Section G1-010:Clause:1.4.5 for details.

1.5 Definitions and Abbreviations

The following definitions and abbreviations apply within this Section.

1.5.1 Definitions

No item.

1.5.2 Abbreviations

1.5.2.1 IC

Inspection chamber

1.5.2.2 PVF2

Polyvinylidene Fluoride

1.5.2.3 SWG

Standard wire gauge

1.5.2.4 VOC

Volatile Organic Compound

2 PERFORMANCE REQUIREMENTS

2.1 Contractor's Brief

When carrying out the proposals as set out in Section A10-010:Clause:1.4.1, take account of the following requirements.

2.1.1 Structural Criteria

2.1.1.1 Dead Loads

The self weight and other associated dead loads of the Works shall be supported and transferred to the main building structure or into the ground in accordance with the Approved Document.

2.1.1.2 Loading Capacity

All steel works shall sustain and withstand as a minimum, the gravity and lateral loadings as set out in the BCA Approved Document, including crowd loads and impact loads.

2.1.1.3 Wind Loads

The whole of the Works shall be able to withstand repeatedly imposed wind pressures based on a design wind speed in accordance with NA to SS EN 1991-1-4.

2.1.2 Structural Movement and Movement between Other Works

Take into account that performance, appearance and proper functioning of the Works are not affected by any movement, settlement, deflection, expansion or contraction which can be expected to occur in the building or the construction process.

Junctions between the Works and adjacent work shall be formed to take into account possible structural deflections or movement in that adjacent element without distortion to the Works, or compromise to or disintegration of joints between the Works.

2.1.3 Fire Performance

Comply with the requirements of the Fire Code and any additional requirements of other statutory authorities having jurisdiction over the Works.

2.1.3.1 Fire Rating

Achieve fire-rating where specified in Section A10-010:Clause:3.1.

2.1.3.2 Combustibility

Structural supports shall be non-combustible.

Surface material to achieve the flame spread rating as specified in Section A10-010:Clause:3.1 to BS 476-7 or BS EN 13501-1.

2.1.4 Environmental

Take into account the environment of the Works in use, paying particular attention to corrosive environments.

Provide necessary corrosion protection to the Works, including components, accessories, fixings and structural supports, to prevent deterioration, and to satisfy the performance requirements within the anticipated design life.

2.1.5 Electrical Continuity and Earthing

Conductive parts of the Works that may come in contact with electrical current shall be earthed to SS 551 to ensure safety of building occupants and maintenance personnel.

3 MATERIALS

3.1 Types of Steel Works

Steel works (SW) shall consist of the following types:

3.1.1 Gates

Type: M.01, M.02, M.02A, M.03, M.04 & M.05		
Item	Requirements	Clause Reference
Material	Rectangular hollow section	.
Grade	.	.
Finish	Low VOC paint with green label cert	.
Lock	Assa Abloy pad lock	.
Latch	.	.
Hinges	.	.
Electrically Operated	.	.
Security Link	.	.
.	.	.
.	.	.

3.1.2 Fence

Type: <i>refer to Architect's drawings</i>		
Type	Requirements	Clause Reference
Post material	.	.
Post finish	.	.
Mesh	.	.
.	.	.
.	.	.

3.1.3 Railing

Type: <i>refer to Architect's drawings</i>		
Type	Requirements	Clause Reference
Manufacturer	.	.
Material	.	.
Grade	.	.
Post material	.	.
Post finish	.	.
.	.	.
.	.	.

3.1.4 Handrails

Type: <i>refer to Architect's drawings</i>		
Type	Requirements	Clause Reference
Material	.	.
Grade	.	.
Finish	.	.
Fixing to wall	.	.
Fixing to ground	.	.
.	.	.
.	.	.

3.1.5 Decorative Screens

Type: <i>SW-5</i>		
Type	Requirements	Clause Reference
Material	.	.
Grade	.	.
Finish	.	.
Fixing to wall	.	.
.	.	.
.	.	.

3.1.6 Miscellaneous Items

Type: <i>refer to Architect's drawings</i>		
Type	Requirements	Clause Reference
<i>Infilled manhole / IC covers</i>	<i>To match adjacent floor finish</i>	.
Drain gratings	Heavy duty type	.
Bicycle stands	.	.
.	.	.
.	.	.

3.2 Stainless Steel

Stainless steel shall comply with BS EN 10088.

Unless otherwise specified in A10-010:Clause:3.1, Grade 316 shall be used where exposed to weather. In sheltered circumstances, Grade 304 may be used, if agreed by the SO.

3.2.1 Plate, Sheet and Strip

To BS EN 10029, BS EN 10048, BS EN 10088 Series, BS EN ISO 9444-2, BS EN ISO 9445 and BS EN ISO 18286 as appropriate.

Finishes

- (a) 1G or 2G â Ground: Coarse, unidirectional texture; low reflectivity.
- (b) 1J or 2J â Brushed or dull polished: Unidirectional texture; smoother than 1G/2G; low reflectivity.
- (c) 1K or 2K â Satin polished: Smoother than 1J/2J. Suitable for marine and external architectural applications.

- (d) 1P or 2P â Bright polished: Non-directional finish with high degree of reflectivity. Achieved by mechanical polishing.

The finish shall be achieved on the exposed surface only unless otherwise specified.

3.2.2 Sections

To BS EN 10088-3.

Refer to Section A10-010:Clause:3.2.1 for finishes of sections.

3.2.3 Welding

- (a) Welding shall be in accordance with BS EN 1011-1, BS EN 1011-3 and BS EN ISO 14343. Use electric arc fusion welding methods. Carbon-arc or gas welding is not permitted. Undertake in a thorough manner, with edging rod of the same composition as sheets or part welded.
- (b) Weld completed welds, strong and ductile, with excess metal ground off and joints finished smooth to match adjoining surface. Welds shall be free of mechanical imperfections such as gas holes, pits, runs, cracks, etc., and to have same colour as adjoining surfaces. All sheets shall be continuously butt-welded together with welds ground smooth and polished. Butt welds made by spot welding strips under beams and filling in the voids with solder and finishing by grinding shall not be acceptable.
- (c) Where welds occur on surfaces not finished by grinding and polishing, such welds and the accompanying discolouration shall be suitably coated in the factory by means of metallic base paint to prevent the possibility of progressive corrosion to such joints.

3.2.4 Fixings and Fasteners

Fixings and fasteners shall be in accordance with BS EN ISO 3506.

Unless otherwise specified or approved by the SO, manufacture from stainless steel grade 1.4401 shall be according to BS EN 10088, or AISI 316.

3.3 Carbon Steel

3.3.1 Generally

Steel components shall be hot dip galvanised after fabrication, unless alternative corrosion protection is approved by the SO.

Do not cut, drill or work galvanised members, unless agreed with the SO.

3.3.2 Components

- (a) Steel Plates and Shapes: To BS EN 10029
- (b) Bolts and Nuts: To BS 3692 (Grade 8.8) / BS 4190 (Grade 4.6)
- (c) High friction grip bolts: To BS EN 1993-1-8
- (d) Cold Rolled Steel: To BS 1449-1.1, matte finish
- (e) Hot-dipped Galvanized Steel sheets: To BS EN 10143
- (f) Cold Formed Steel Hollow Section: To BS EN 10219-2
- (g) Welding Materials: To BS EN ISO 14343, BS EN ISO 15609-2 and BS EN ISO 24373
- (h) Concrete Inserts: Cast steel or malleable bolts, washers, and shims, hot-dipped galvanised.
- (i) Washers â To BS 4320 and BS 4464

3.3.3 Welding of Steel

To BS EN 1011-1 and BS EN 1011-2.

3.4 Aluminium Alloy Components

Refer to Section A10-020 Aluminium

3.5 Pre-finished Metals

Pre-finished metals may be used if methods of fabrication do not damage or alter appearance of finish.

3.6 Anchors, Fixing and Fasteners

3.6.1 Generally

Unless shown or fully detailed in the drawings, to PEâs design under A10_010:Clause:1.4.1.2, and to BS 3692 and BS EN ISO 898-1, and, when anchoring to concrete, to ETAG 001.

Fasteners shall be of the same metal as the component with matching coating and finish.

3.6.2 Appearance

Concealed fixings shall be adopted unless otherwise shown in the drawings, or agreed with the SO.

Locate face fixings in unobtrusive positions.

3.6.3 Strength

Allow minimum safety factor of 2.5 in addition to the anchorage design safety factor.

Where requested in the drawings, supply a torque setting for bolted or screwed fastenings.

Structural anchorage shall be by 2 or more fixing devices.

3.7 Grout

Grout between base/face plates and concrete shall have a minimum compressive strength at 28 days of 40 N/mm².

3.8 Protective Coatings

3.8.1 Galvanising

To BS EN ISO 1461.

Provide all necessary vent and drain holes in approved locations and seal to approval after galvanising.

3.8.2 Electrolytic Zinc Coating

To BS EN 10152.

3.8.3 Cadmium/Zinc Plating

To ASTM B816.

3.8.4 Chromium Plating

To BS EN ISO 1456.

3.8.5 Vitreous Enamelling

To BS EN ISO 28722.

3.8.6 Painting

Painting shall be in accordance with ASTM D6386 and ASTM D7396. Refer to Section A02-020:Clause:3.1.

3.8.7 Powder Coating

To BS EN 13438, BS EN 15773 and ASTM D7803.

Thickness to manufacturer's recommendation, to meet performance requirements under Section A10-010:Clause:2.1.4.

3.8.8 PVF2 Coating

To ASTM D3222.

For external steel works only, not to be used for internal steel works due to high VOC content. Wet-applied and oven-cured, Kynar 500 / Hylar 5000 resin content to be minimum 70%.

Thickness to manufacturer's recommendation, to meet performance requirements under Section A10-010:Clause:2.1.4.

3.9 Standard Elements

Unless otherwise specified or approved by the SO, adopt the following general requirements for standard elements:

3.9.1 Fences

3.9.1.1 Chain Link Fence

To BS 1722-1 and BS EN 10223-6.

Unless otherwise shown in the drawings or specified in Section A10-010:Clause:3.1, fence shall be formed of the following:

- (a) 50 mm square PVC coated galvanised mesh made from 9 SWG wire galvanised before weaving; 16 SWG including PVC
- (b) 3 mm thick, 75 mm diameter galvanised steel hollow section top, bottom and bracing rails
- (c) 4 mm thick 100 mm square galvanised hollow section posts
- (d) Mesh attachment 20 x 10 x 3 galvanised U bolts

Height above ground shall be as indicated in the drawings.

Steel posts shall be bedded in concrete footing to PE's design under Section A10-010:Clause:1.4.1.2, set 100 mm below finished ground level.

3.9.1.2 Galvanised Welded Mesh Fence

To BS EN 10223-4 or BS EN 10223-7.

Unless otherwise shown in the drawings or specified in Section A10-010:Clause:3.1, fence shall be formed of the following:

- (a) 50 mm x 100 mm galvanised weld mesh, made from minimum 4 mm diameter wire, and mesh panel rolled into a wedge at the top and bottom for rigidity
- (b) 50 mm x 50 mm fence posts complete with square fence post cap

- (c) Square clamps and/or clips to secure the mesh
panel Height above ground as indicated in the
drawings.

Steel posts shall be bedded in concrete footing to PEâs design under Section A10-010:Clause:1.4.1.2, set 100 mm below finished ground level.

3.9.2 PUB Drainage and Sewerage Elements

Unless otherwise shown in the drawings or specified in Section A10-010:Clause:3.1, be in accordance to standard details published by PUB for the following:

- (a) Standard safety railings
- (b) Approved special railings
- (c) Drainage reserve mMarker, bollard, and posts and chains
- (d) Gratings and chequer plate for drop-Inlet chambers
- (e) Manhole / IC / sump frames and covers
- (f) Grease trap cover

3.9.3 LTA Road Elements

Unless otherwise shown in the drawings or specified in Section A10-01:Clause 3.1, be in accordance to standard details published by LTA for the following:

- (a) Gratings and manhole covers
- (b) Vehicle impact guardrails
- (c) Supports for road signs
- (d) Metal bollards

4 WORKMANSHIP

4.1 Delivery, Storage and Handling

All materials, components and accessories shall be stored under cover and kept dry at all times, protected from the weather, other elements and damage from construction operations or other causes.

4.2 Fabrication

Verify dimension and clearances on site prior to shop fabrication.

Fabricate items with joints tightly fitted and secured.

Fit and shop assemble in largest practical sections for delivery to site. Locate joints only as indicated in the drawings, unless otherwise agreed with the SO.

4.3 Setting Out

4.3.1 Gates and Fences

Set out boundary in accordance with topographical and boundary survey, and the drawings.

Verify location with a registered surveyor to ensure that there is no encroachment into adjacent property.

Set out location of gates and fencing showing top of fence and post with agreed ground profile.

4.3.2 Post

Submit all post locations for approval by the SO.

Excavate and set out footings for the posts as indicated in the drawings.

Erect shuttering to approved height, taking into account final ground level.

4.4 Installation

Properly separate steel from other metals to prevent galvanic action.

4.5 Grinding, Polishing and Finishing

Welded exposed joints shall be suitably ground flush with adjoining material. All ground surfaces shall be smooth and consistent with good workmanship.

Exercise care in all grinding operations to avoid excessive heating of metal and metal discolouration.

Remove grain of rough grinding by successive polishing operations. Texture of final polishing operation shall be uniform and smooth.

4.6 Joints

Butt joints and contact joints, wherever they occur, shall be close fitting and not require filler.

Sheared edges shall be free of burrs, fins or irregular projections.

Neatly finish mitres or bull nose with under edges of material ground to uniform condition. Do not overlap materials.

4.7 Shims

Separate all pairs of moving surfaces with friction reducing pads. Pads shall:

- (a) be minimum 3 mm thick
- (b) sufficiently reduce friction to permit movement
- (c) be resistant to wear
- (d) be positively retained in position (open-ended slots are not acceptable)
- (e) not be subjected to heat damage from welding, cutting or to excessive pressure from over-tightening of bolts.

Plastic shims are acceptable at static connections for which the shims transfer only compressive forces.

Wood shims shall not be used.

4.8 Protective Coatings

4.8.1 Galvanised Surfaces

Damaged galvanized surfaces shall be treated with low-melting-point zinc alloy repair rods, or powders made for this purpose, and/or at least 2 coats zinc rich paint to BS 4652. Apply sufficient thickness to provide a zinc coating at least equal to the thickness specified.

4.8.2 Painting

Refer to Section A02-020 "Paintings and Coatings".

Application to be in accordance with manufacturer's instructions.

Apply coats after completion of fabrication and drilling of all fixing holes.

Remove all burrs and sharp arrises prior to coating.

5 VERIFICATION AND SUBMISSION

5.1 Submission

5.1.1 Technical Submissions

Include in the construction programme, events for submission of the following information:

- (a) Name of the manufacturer(s) and technical data relating to all specified items of each of the steel works types.

- (b) All other submissions specified below.

5.1.2 Work Submissions

5.1.2.1 Structural Submissions

Submit to the SO structural calculations for the design of structural supports, anchorage, fixings, etc., by the PE, to A10-010:Clause:1.4.1.2 and where the works shall serve as barriers or be fixed at heights, with approval from relevant authorities.

5.1.2.2 Shop Drawings

Prepare and submit to the SO shop drawings including the following:

- (a) Developed design details of all steel works at scales as agreed with the SO.
- (b) Details of connections or interfacing works.

Do not commence fabrication until the SO has approved the submissions.

5.1.2.3 Method Statement

State installation and fixing methods, including procedures and sequence to produce distortion-free components and assemblies.

State provisions made to accommodate all horizontal and vertical variations and permitted deviations at interfaces with other works.

5.1.3 Test Reports and Certificate Submissions

Submit relevant test reports and certificates from a recognised certification body to demonstrate compliance with all required characteristics specified in A10-010:Clause:3.1, and any other relevant documents to demonstrate compliance with the Certification Scheme and Surveillance Regime required in the Fire Code.

- (a) Tests

Carry out tests as follows:

Material / Characteristic	Test	Description
.	<i>State to what standard</i>	.
.	.	.
.	.	.

[Note: Check the required tests under the Approved Document, Code for Environmental Sustainability of Buildings, Fire Code, etc.]

- (b) Certificates

Provide certificates as follows:

System / Material	Certificate	Description
.	.	.
.	.	.

[Note: Check the required certification under the Approved Document, Code for Environmental Sustainability of Buildings, Fire Code, etc.]

5.1.4 Quality Control Plan Submission

Prepare and submit the Quality Control Plan to the SO prior to starting work.

5.1.5 Warranty

Submit the warranty upon completion of the Works, if required under Section A10-010:Clause:1.4.5.

5.1.6 Maintenance Submissions

Submit a maintenance manual upon completion of the Works to Section A10-010:Clause:1.4.6.

5.2 Samples and Mock-ups

5.2.1 Samples

Provide samples as follows:

Sample	Requirements
.	.
.	.

[Note: Customise table to reflect project specific requirements.]

5.2.2 Mock-ups

Provide mock-ups as follows:

Mock-up	Requirements	Location
M.01	Mock up to be used on site once SZG approved	Contractor to propose
M.02	Mock up to be used on site once SZG approved	Contractor to propose
M.03	Mock up to be used on site once SZG approved	Contractor to propose
M.04	Mock up to be used on site once SZG approved	Contractor to propose
M.05	Mock up to be used on site once SZG approved	Contractor to propose
1.5m high railing with Tensar geogrid	Mock up to be used on site once SZG approved	Contractor to propose
Full height Tensar geogrid fencing	Mock up to be used on site once SZG approved	Contractor to propose
1m high wiremesh railing	Mock up to be used on site once SZG approved	Contractor to propose

The mock-up may form part of the final construction, if approved.

Do not proceed with construction until the SO has approved the mock-ups.

5.3 Inspections

Inform the SO on completion of the "first section" of each type. Proceed after approval by the SO. The SO will determine the extent of "first section".

5.4 On-Site Tests

Carry out the following on-site tests when required by the SO, at locations to be agreed on with the SO.

5.4.1 Tensile Pull-Out test

Conduct pull out test on anchors for works installed at heights, at locations to be determined by the SO. Test results shall exceed loads to the PE's design under Section A10-010: Clause: 1.4.1.2. 1.4.1.2.

5.4.2 Electrical Continuity Test

Verify that conductive parts of the Works that may come in contact with electrical current, and may be a risk to building occupants or maintenance personnel, are earthed.