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SECTION 21 - UNIT MASONRY ASSEMBLIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section covers the work of concrete masonry assemblies and includes:

1. Non-fire rated masonry assemblies.
2. Fire rated masonry assemblies.
3. Reinforced masonry assemblies.

B. This Section includes unit masonry assemblies consisting of the following:

1. Concrete Masonry Units.
2. Mortar and Grout Materials.
3. Ties and Anchors.
4. Miscellaneous Masonry Accessories.
5. Mortar and Grout Mixes.
6. Joint Reinforcement.
    a. Horizontal reinforcement.
    b. Vertical reinforcement.

C. Related Sections include the following:

1. Division 3 Section "Cast-In-Place Concrete" for cast-in-place reinforced concrete lintels and other work items as indicated on Drawings.
2. Division 5 Section "Steel Structural" for coordinating welding requirements with steel alloy used for structural steel works.
3. Division 5 Section "Metal Fabrications" for steel lintels.

4. Division 7 Section "Sheet Metal Flashing and Trim" for exposed sheet metal flashing.

5. Division 7 Section "Through-Penetration Firestop Systems" for sealing systems of penetrations and opening in fire rated masonry assemblies.

6. Division 7 Section "Joint Sealants".

7. Division 9 Section “Portland Cement Plaster” for Portland Cement Plaster finish.

D. Products installed, but not furnished, under this Section include the following:

1. Hollow-metal frames in unit masonry openings, furnished under Division 8, Section "Custom Steel Doors and Frames."

2. Steel Lintels for Unit Masonry Specified in Division 5 “Metal Fabrications”.

3. Manufactured reglets in masonry joints for metal flashing specified in Division 7 Section "Sheet Metal Flashing and Trim."

1.3 PERFORMANCE REQUIREMENTS

A. Provide unit masonry that develops the net-area compressive strengths (f’m) at 28 days indicated in part 2.

1. For Concrete Unit Masonry: As follows, based on net area:

a. f’m = 10.3 MPa.

1.4 SUBMITTALS

A. **Product Data**: For each different masonry unit, accessory, and other manufactured product specified.

B. **Shop Drawings**: Shop drawings including full details of masonry works for different assemblies and covering anchorage to concrete elements cavity walls and flashings, masonry reinforcement, bond pattern, joints, horizontal joint reinforcement, openings, lintels and other details as the Engineer may require.

C. **Samples**: For the following:

1. Full-size units for each different exposed masonry unit required, showing the full range of exposed colors, textures, and dimensions to be expected in the completed construction.

2. Accessories embedded in the masonry.

3. Reinforcing bars and accessories.

D. **Qualification Data**: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

E. **Material Test Reports**: From a qualified independent testing agency employed and paid by contractor or manufacturer indicating and interpreting test results relative to compliance of the following proposed masonry materials for compliance with requirements indicated:

1. Each type of masonry unit required.

    a. Include size-variation data for brick, verifying that actual range of sizes falls within specified tolerances.

    b. Include test results, measurements, and calculations establishing net-area compressive strength of masonry units.

2. Mortar complying with property requirements of ASTM C 270.

3. Grout mixes, Include description of type and proportions of grout ingredients.

F. **Material Certificates**: Signed by manufacturers certifying that each of the following items complies with requirements:

1. Each type of masonry unit required.

    a. Include size-variation data for brick, verifying that actual range of sizes falls within specified tolerances.

    b. Include test data, measurements, and calculations establishing net-area compressive strength of masonry units.

2. Each cement product required for mortar and grout, including name of manufacturer, brand, type, and weight slips at time of delivery.

3. Each combination of masonry unit type and mortar type. Include statement of net-area compressive strength of masonry units, mortar type, and net-area compressive strength of masonry determined according to test methods stated in Clause 1.5/F of this Section.

4. Each material and grade indicated for reinforcing bars.

5. Each type and size of anchor, tie, and metal accessory.

6. Each type and size of joint reinforcement.

1.5 QUALITY ASSURANCE

A. Contractor shall perform a survey and inspection of foundations for compliance with dimensional tolerances. Full comprehensive report shall be submitted to the Engineer prior to commencing building masonry assemblies on foundations.

B. **Quality System**: Comply with ISO 9001/9002 Quality System as a minimum. Incorporate all the standard procedures supplied by the Engineer and the Employer.

C. **Testing Agency Qualifications**: To qualify for acceptance, an independent testing agency shall demonstrate to Engineer's satisfaction, based on evaluation of agency-submitted criteria conforming to ASTM C 1093, that it has the experience and compatibility to satisfactorily conduct the testing indicated without delaying the work.

D. **Preconstruction Testing**: Employ and pay a qualified independent testing agency to perform the following preconstruction testing to establish compliance of proposed materials and construction with specified requirements:

1. Concrete Masonry Unit Test: For each concrete masonry unit indicated, test units for strength, absorption, and moisture content per ASTM C 140.

2. Prism Test: For each type of wall construction indicated, test masonry prisms per ASTM E 447, Method B.

3. Mortar Test: For mortar properties per ASTM C 270.

4. Grout Test: For compressive strength per ASTM C 1019.

5. Evaluate mortar composition and properties per ASTM C780.

E. **Fire-Resistance Ratings**: Where indicated on Drawings, provide materials and construction identical to those of assemblies with fire-resistance ratings determined per ASTM E 119 by a testing and inspecting agency, by equivalent concrete masonry thickness, or by another means, as acceptable to Engineer.

F. Minimum fire rating for concrete unit masonry assemblies, including 15 mm cement plaster facing on both sides shall be as follows:

a. 100 mm solid blocks: 2 hrs.

b. 150 mm solid blocks: 4 hrs.

c. 100 mm hollow blocks: 1 hrs.

d. 150 mm hollow blocks: 1-1/2 hrs.

e. 200 mm hollow blocks: 3 hrs.

G. **Mockups**: Before installing unit masonry, build mockups to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for the completed Work:

1. Locate mockups in the locations indicated or, if not indicated, as directed by Engineer.

2. Build mockups of reinforced assembly, double walls, typical cavity wall and single-wythe wall areas as shown on Drawings.

3. Notify Engineer seven days in advance of dates and times when mockups will be constructed.

4. Protect accepted mockups from the elements with weather-resistant membrane.

5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.

6. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups, unless such deviations are specifically approved by Engineer in writing.

7. Approved mockups will become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are in an air-dried condition.

1. Protect Type I concrete masonry units from moisture absorption so that, at the time of installation, the moisture content is not more than the maximum allowed at the time of delivery.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Deliver preblended, dry mortar mix in moisture-resistant containers designed for lifting and emptying into dispensing silo. Store preblended, dry mortar mix in

delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.

E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.7 PROJECT CONDITIONS

A. **Protection of Masonry**: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

1. Extend cover a minimum of 600 mm down both sides and hold cover securely in place.

2. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 600 mm down face next to unconstructed wythe and hold cover in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.

C. **Stain Prevention**: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

1. Protect base of walls from rain-splashed mud and from mortar splatter by coverings spread on ground and over wall surface.

2. Protect sills, ledges, and projections from mortar droppings.

3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.

4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

D. **Hot-Weather Requirements**: Protect unit masonry work when temperature and humidity conditions produce excessive evaporation of water from mortar and grout. Provide artificial shade and wind breaks and use cooled materials as required.

1. When ambient temperature exceeds 35 deg C, or 32 deg C with a wind velocity greater than 13 km/h, do not spread mortar beds more than 1200 mm ahead of masonry. Set masonry units within one minute of spreading mortar.

PART 2 - PRODUCTS

2.1 CONCRETE MASONRY UNITS

A. **General**: Provide shapes indicated and as follows for each form of concrete masonry unit required.

1. Provide special shapes for lintels, corners, jambs, sash, control joints, headers, bonding, and other special conditions.

2. Provide square-edged units for outside corners, unless indicated as bullnose.

3. Provide bullnose units for outside corners, unless otherwise indicated.

4. Types of concrete masonry shall be as follows:

   a. Use solid blocks for all below-grade assemblies.

   b. Use solid blocks for walls, partitions or wythes to be finished with mechanically attached dimension stone cladding.

   c. Use solid blocks or units for 4” thick partitions.

   d. Use units open from both sides for reinforced masonry assemblies.

   e. Use cellular blocks (open from one side) for other assemblies.

B. **Concrete Masonry Units**: ASTM C 90 and as follows:

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength specified in Clause 1.3/A of this Section.

2. Weight Classification: Normal weight.

3. Provide moisture-controlled units. All masonry units shall be factory cured.

4. Exposed Faces: Manufacturer’s standard color and texture, unless otherwise indicated.

   a. Where units are to receive a direct application of plaster, provide textured-face units made with gap-graded aggregates.

5. Cement: ASTMC 150, Type I, Gray color.

6. Aggregates: Do not use aggregates made from pumice, scoria, or tuff.

2.2 MORTAR AND GROUT MATERIALS

A. **Portland Cement**: ASTM C 150, Type I. Provide gray color.

B. **Hydrated Lime**: Do not use Lime.

C. **Pre-Packaged Portland Cement Mix**: Pre-Packaged blend of Portland cement, water, and aggregate complying with requirements specified in this Article combined with set-controlling admixtures to produce a ready-mixed mortar complying with ASTM C 1142. Compressive strength at 28 days shall not be less than 5 MPa (minimum cement sand ratio 1:3-4 by volume).

D. **Aggregate for Mortar**: ASTM C 144.

1. White-Mortar Aggregates: Natural white sand or ground white stone.

E. **Aggregate for Grout**: ASTM C 404.

F. **Water**: Potable.

2.3 REINFORCED STEEL BARS

A. **Deformed High Yield Steel Bars**: BS 4449, Grade 460.

B. **Reinforcing Bar Positioners**: Wire units designed to fit into mortar bed joints spanning masonry unit cells with loops for holding reinforcing bars in center of cells. Units are formed from 4.8-mm steel wire, hot-dip galvanized after fabrication.

a. Provide units with either two loops or four loops as needed for number of bars indicated or calculated.

2.4 TIES AND ANCHORS, GENERAL

A. **General**: Provide ties and anchors, specified in subsequent articles that comply with requirements for metal and size of this Article, unless otherwise indicated.

B. **Wire**: As follows:

1. Stainless-Steel Wire: ASTM A 580, Type 304.

2. Wire Diameter: 6.4 mm.

C. **Stainless Steel Sheet**: As follows:

1. Stainless-Steel Sheet: ASTM A 167, Type 304.

2. Stainless-Steel Sheet Thickness: 2.8 mm.

D. **Stainless-Steel Plates, Bars, and Dowels**: ASTM A 167, ASTM A 276, or ASTM A 666, Type 304; temper as required to support loads imposed without exceeding allowable design stresses.

2.5 ADJUSTABLE ANCHORS FOR CONNECTING TO STRUCTURAL STEEL FRAME

A. **General**: Provide two-piece assemblies as described below, allowing vertical or horizontal differential movement between wall and frame parallel to plane of wall but resisting tension and compression forces perpendicular to it.

1. Manufacturer's standard anchors with crimped 6.4 mm diameter wire anchor section for welding to steel and triangular-shaped wire tie section sized to extend within 25 mm of masonry face and as follows:

2. Welding to Steel Structural Framing: Comply with requirements specified in Division 5, Section "Structural Steel".

3. Touch-Up Painting: Paint welds with two coats of zinc rich paint to ASTM A 780.

B. **Wire Diameter**: 6.4 mm.

2.6 ANCHORS FOR CONNECTING TO CONCRETE

A. **General**: Provide two-piece assemblies that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

1. Anchor Section: Dovetail anchor section formed from 1.6-mm thick, stainless-steel sheet.

2. Tie Section: Triangular-shaped wire tie, sized to extend within 25 mm of masonry face, made from 6.4-mm diameter.

2.7 MISCELLANEOUS ANCHORS

A. **Unit Type Inserts in Concrete**: Cast-iron or malleable-iron inserts of type and size indicated.

B. **Anchor Bolts**: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563M hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153, Class C; of diameter and length indicated and in the following configurations:

1. Headed bolts.

2. Nonheaded bolts, straight.

C. **Postinstalled Anchors**: Anchors as described below, with capability to sustain, without failure, load imposed within factors of safety indicated, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

1. Type: Expansion anchors.

2. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (5 microns) for Class SC 1 service condition (mild).

3. For Postinstalled Anchors in Concrete: Capability to sustain, without failure, a load equal to four times the loads imposed by masonry.

4. For Postinstalled Anchors in Grouted Concrete Masonry Units: Capability to sustain, without failure, a load equal to six times the loads imposed by masonry.

2.8 MISCELLANEOUS MASONRY ACCESSORIES

A. **Compressible Filler**: Premolded filler strips complying with ASTM D 1056, Type 2, Class A, Grade 1; compressible up to 35 percent; of width and thickness indicated; formulated from the following material:

1. Urethane.

B. **Firestop Joint Filler**: UL classified R 9073, fire rating to match masonry assembly, smoke seal material in the form of boards, easy cut and fit and meeting the following requirements:

1. Service range: up to 1260 deg. C.

2. Melting point: 1760 deg. C

3. Flame spread: 5 to ASTM E 84

4. Smoke developed: 0 to ASTM E 84

5. Fuel contributed: 0 (non-combustible to ASTM E 136)

6. Compression strength: 2.46 kg/cm2 minimum at 10% deformation.

7. Intensity: 224/256 kg/m^3.

Thickness is to be manufacturer's standard to fit for thickness of joints indicated on Drawings.

C. **Preformed Control-Joint Gaskets**: Material as indicated below, designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

1. Styrene-Butadiene-Rubber Compound: ASTM D 2000, Designation M2AA-805.

2. PVC: ASTM D 2287, Type PVC-65406.

D. **Bond-Breaker Strips**: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

E. **Rectangular Plastic Weep/Vent Tubing**: Clear butyrate, 9 by 40 by 90 mm.

2.9 MORTAR AND GROUT MIXES

A. **General**: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.

2. All cement used shall be ordinary Portland (ASTM C 150, Type I).

B. **Pre-blended, Dry Mortar Mix**: Furnish dry mortar ingredients in the form of a pre-blended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

1. Standard: ASTM C270, lime-free Portland cement based.

2. Wet Mix Life: Less than 1.5 hours.

3. Initial Adhesion at 28 days: Not less than 0.3 N/mm2.

4. Bending Strength: Around 1 N/ mm2.

5. Compressive Strength: Not less than 5 ±1 N/ mm2.

6. Minimum Cement Sand Mix: 1:3

7. Testing: ASTM C 780.

C. **Job-Mixed Mortar**: Comply with ASTM C 270 as follows:

1. Bending Strength: Around 1 N/ mm2.

2. Compressive Strength: Not less than 5 ±1 N/ mm2.

3. Minimum Cement Sand Mix: 1:3.

4. Testing: ASTM C 780.

5. Limit Cementitious materials in mortar to Portland cement and lime.

6. Do not add lime to the mix. Approved liquid admixtures that substitute the performance of lime may be added to the mix.

D. **Grout for Unit Masonry**: Comply with ASTM C 476. Unless otherwise specified, use grout of consistency indicated or, if not otherwise indicated, of consistency (fine or coarse) at time of placement that will completely fill spaces intended to receive grout.

1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with ASTM C 476 for dimensions of grout spaces and pour height.

2. Provide grout with a slump of 200 to 275 mm as measured according to ASTM C 143.

3. Use fine grout (maximum size of coarse aggregate is 10 mm) in grout spaces less than 100 mm in least horizontal dimension, unless otherwise indicated.

4. Use coarse grout in grout spaces 100 mm or more in least horizontal dimension, unless otherwise indicated.

5. The Contractor shall submit laboratory design mix of concrete grout to obtain performance specified in of this Sub-Clause. Minimum cement content shall be 300 kg/m^3.

6. Compressive Strength: Minimum 17.5 MPa at 28 days.

7. Grout shall be mixed in proportions according to approved design mix to obtain compressive strength specified using the minimum quantity of water to ensure the necessary fluidity and to render it capable of penetrating the work.

8. Concrete grout shall be used or filling hollow cells in bond beams, under concrete lintels and bond beams, in window and door jambs and other locations for reinforced masonry assemblies as specified. Grout shall be mechanically mixed in drum mixers in volumetric proportions with only enough water shall be added to the mixture to produce a mixture which is flowable, but which will not show an excess of water when placed.

2.10 JOINT REINFORCEMENT

A. **General**: Provide joint reinforcement formed from the following:

1. Stainless-steel wire, ASTM A 580, Type 304.

B. **Description**: Welded-wire units prefabricated with deformed continuous side rods and plain cross rods into straight lengths of not less than 3 m, with prefabricated corner and tee units, and complying with requirements indicated below:

1. Wire Diameter for Side Rods: 4.8 mm.

2. Wire Diameter for Cross Rods: 4.8 mm.

C. For single-wythe masonry, provide type as follows with single pair of side rods:

1. Truss design with continuous diagonal cross rods spaced not more than 407 mm o.c.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with installer present for compliance with requirements for installation tolerances and other conditions affecting performance of unit masonry. Do not proceed with installation until unsatisfactory conditions have been corrected.

1. For the record, prepare written report, listing conditions detrimental to performance.

2. Verify that foundations are within tolerances specified.

3. Verify that reinforcing dowels are properly placed.

4. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Before installation, examine rough-in and built-in construction to verify actual locations of piping connections.

3.2 INSTALLATION, GENERAL

A. **Thickness**: Build cavity and composite walls and other masonry construction to the full thickness shown. Build single-wythe walls to the actual widths of masonry units, using units of widths indicated.

B. Build chases and recesses to accommodate items specified in this Section and in other Sections of the Specification.

C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to the opening.

D. Cut masonry units with motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide a continuous pattern and to fit adjoining construction. Where possible, use full-size units without cutting, where possible. Allow units cut with water-cooled saws to dry before placing, unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.

1. Mix units from several pallets or cubes as they are placed.

F. **Wetting of Brick**: Wet brick before laying. Allow units to absorb water so they are damp but not wet at the time of laying.

3.3 CONSTRUCTION TOLERANCES

A. Comply with tolerances in ACI 530.1/ASCE 6/TMS 602 and the following:

1. Variation from Plumb: For vertical lines and surfaces of columns, walls, and arrises, do not exceed 3 mm in 3 m, nor 5 mm in 6 m, nor 6 mm in 12 m or more. For external corners, expansion joints, control joints, and other conspicuous lines, do not exceed 3 mm in 6 m, nor in 12 m or more. For vertical alignment of head joints, do not exceed plus or minus 3 mm in 3 m, nor 6 mm maximum.

2. Variation from Level: For bed joints and lines of exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines, do not exceed 3 mm in 6 m, nor 6 mm in 12 m or more. For top surface of bearing walls, do not exceed 2 mm in 3 m, nor 1.0 mm within width of a single unit.

3. Variation of Linear Building Line: For position shown in plan and related portion of columns, walls, and partitions, do not exceed 6 mm in 6 m, nor 10 mm in 12 m or more.

4. Variation in Cross-Sectional Dimensions: For columns and thickness of walls, from dimensions shown, do not exceed minus 5 mm nor plus 10 mm.

Variation in Mortar-Joint Thickness: Do not vary from bed-joint thickness indicated by more than plus or minus 3 mm, with a maximum thickness limited to 12 mm. Do not vary bed-joint thickness from bed-joint thickness of adjacent course by more than 3 mm. Do not vary from head-joint thickness indicated by more than plus or minus 3 mm. Do not vary head-joint thickness from adjacent head-joint thickness by more than 3 mm. Do not vary from collar-joint thickness indicated by more than minus 3 mm or plus 10 mm.

3.4 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. **Bond Pattern for Exposed Masonry**: Lay exposed masonry in the following bond pattern; do not use units with less than nominal 100-mm horizontal face dimensions at corners or jambs.

1. One-half running bond with vertical joint in each course centered on units in courses above and below.

C. **Connection Between Walls And Partitions**: walls and partitions should generally be bonded, tied or dowelled to one another at angles and junctions. Where it is necessary for a partition to be connected to an adjacent wall, this should be done by toothing or block bonding unless otherwise specified

D. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 50 mm. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 100-mm horizontal face dimensions at corners or jambs.

E. **Stopping and Resuming Work**: In each course, rack back one-half-unit length for one-half running bond or one-third-unit length for one-third running bond; do not tooth. Clean exposed surfaces of set masonry, wet clay masonry units lightly if required, and remove loose masonry units and mortar before laying fresh masonry.

F. **Built-in Work**: As construction progresses, build in items specified under this and other Sections of the Specifications. Fill in solidly with masonry around built-in items.

G. Fill space between hollow-metal frames and masonry solidly with mortar, unless otherwise indicated.

1. At exterior frames, insert extruded polystyrene board insulation around perimeter of frame in thickness indicated, but not less than 19 mm to act as a thermal break between frame and masonry.

H. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath in the joint below and rod mortar or grout into core.

I. Fill cores in hollow concrete masonry units with grout 600 mm under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.

J. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above, unless otherwise indicated.

1. Install compressible filler in joint between top of partition and underside of structure above.

2. Wedge non-load-bearing partitions against structure above with small pieces of tile, slate, or metal. Fill joint with mortar after dead-load deflection of structure above approaches final position.

3. At fire-rated walls or partitions, install firestopping joint filler as specified in this Section in joint between top of partition and underside of structure. Fill joints at both faces with fire rated elastomeric silicone sealants to comply with a UL-listed joint system at head of wall. Comply with requirements of Division 7, Section “Joint Sealants”.

K. Lay walls to comply with specified construction tolerances, with courses accurately spaced and coordinated with other construction.

3.5 MORTAR BEDDING AND JOINTING

A. Lay hollow masonry units as follows:

1. With full mortar coverage on horizontal and vertical face shells.

2. Bed webs in mortar in starting course on footings and in all courses of piers, columns, and pilasters, and where adjacent to cells or cavities to be filled with grout.

3. For starting course on footings where cells are not grouted, spread out full mortar bed, including areas under cells.

4. Maintain joint widths indicated, except for minor variations required to maintain bond alignment. If not indicated, lay walls with 10-mm joints.

B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

C. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint), unless otherwise indicated.

3.6 MASONRY JOINT REINFORCEMENT

A. **General**: Provide continuous masonry joint reinforcement as indicated below. Install entire length of longitudinal side rods in mortar with a minimum cover of 16 mm on exterior side of walls, 13 mm elsewhere. Lap reinforcement a minimum of 150 mm.

1. Space reinforcement not more than 406 mm o.c.

2. Space reinforcement not more than 203 mm o.c. in foundation walls and parapet walls.

3. Provide reinforcement in mortar joint 1 block course above and below wall openings and extending 305 mm beyond openings.

a. Reinforcement above is in addition to continuous reinforcement.

B. Cut or interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.

C. Provide continuity at corners and wall intersections by using prefabricated "L" and "T" sections. Cut and bend reinforcing units as directed by manufacturer for

continuity at returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.7 CONTROL JOINTS

A. **General**: Install control joints in unit masonry at maximum intervals of 6.00 meters length and where indicated. Build-in related items as masonry progresses. Do not form a continuous span through movement joints unless provisions are made to prevent in-plane restraint of wall or partition movement.

B. Form control joints in concrete masonry as follows:

1. Fit bond-breaker strips into hollow contour in ends of concrete masonry units on one side of control joint. Fill resultant core with grout and rake joints in exposed faces.

2. Install preformed control-joint gaskets designed to fit standard sash block.

3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar or rake joint.

4. Install temporary foam-plastic filler in head joints and remove filler when unit masonry is complete.

3.8 FIRE RATED MASONRY ASSEMBLIES

A. **Fire Rating**: As indicated on Drawings.

B. **Thickness**: As required to satisfy fire rating indicated but not less than thickness indicated on Drawings.

C. **Unit Type**: As required to satisfy fire rating indicated in compliance with requirements specified in this Section.

D. Care shall be exercised to solidly fill all joints, vertical and horizontal, with mortar.

E. Joints: To structure above or adjoining are to be prefabricated, fire rated joint system comprising fire rated compressible filler and fire rated joint sealant on each face of the assembly, labeled by UL as rated for fire rating indicated.

F. Penetrations through fire rated masonry walls shall be sealed and treated with material systems as specified in Division 7, Section “Through Penetration Fire Stop Systems”.

G. Where required, expansion joints through fire rated concrete masonry walls or at the intersection between concrete masonry walls and other walls or partition shall be 60 or 120 minutes fire rated construction. Use firestop joint filler as specified in this Section and fire rated joint sealant on each face of the assembly. Comply with Division 7, Section “Joint Sealants”.

H. All accessories used in construction of fire rated assemblies shall be certified as suitable for use in fire rated masonry assemblies of rating indicated.

3.9 REINFORCED UNIT MASONRY INSTALLATION

A. **Temporary Formwork and Shores**: Construct formwork and shores to support reinforced masonry elements during construction.

1. Construct formwork to conform to shape, line, and dimensions shown. Make it sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.

2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.

B. **Placing Reinforcement**: Comply with requirements of requirements of Division 3, Section “Cast-In-place concrete”.

C. **Grouting**: Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist grout pressure.

1. Comply with requirements of ACI 530.1 or Section 2104.6 in the Uniform Building Code (UBC) for cleanouts and for grout placement, including minimum grout space and maximum pour height.

3.10 ANCHORING MASONRY TO STRUCTURAL MEMBERS

A. Anchor masonry to structural members where masonry abuts or faces structural members to comply with the following:

1. Provide an open space not less than 15 mm in width between masonry and structural member, unless otherwise specified. Keep open space free of mortar or other rigid materials.

2. Anchor masonry to structural members with flexible anchors embedded in masonry joints and attached to structure.

3. Space anchors as indicated, but not more than 620 mm o.c. vertically and 920 mm o.c. horizontally.

4. Fill space with compressible joint filler and seal edges flush with joint sealant, unless otherwise indicated. Comply with Division 7, Section "Joint Sealants".

3.11 ANCHORING MASONRY TO CONCRETE COLUMNS AND WALLS

A. Anchor masonry to concrete where masonry abuts or faces concrete columns or walls, comply with the following:

1. Anchor masonry to concrete with metal anchors embedded as specified in masonry joints and attached to concrete.

2. Space anchors as indicated, but not more than 420 mm o.c. vertically and 915 mm o.c. horizontally.

3.12 FIELD QUALITY CONTROL

A. Engage a qualified independent testing agency to perform field quality-control testing indicated below.

1. Retesting of materials failing to meet specified requirements shall be done also at Contractor's expense.

B. **Concrete Masonry Unit Tests**: For each type of concrete masonry unit indicated, units shall be sampled and tested for strength and absorption, according to ASTM C 140.

C. **Testing Frequency**: Tests and Evaluations listed in Sub-clause D, E and F of this Article will be performed during construction for each 460 sq. m of wall area or portion thereof.

D. Mortar properties will be tested per ASTM C 270.

E. Grout will be sampled and tested for compressive strength per ASTM C 1019.

F. **Prism-Test Method**: For each type of wall construction indicated, masonry prisms will be tested per ASTM E 447, Method B, and as follows:

1. Prepare 1 set of prisms for testing at 7 days and 1 set for testing at 28 days.

G. Mortar composition and properties will be evaluated per ASTM C 780.

H. **Evaluation of Quality-Control Tests**: In the absence of other indications of noncompliance with requirements, masonry will be considered satisfactory if results from construction quality-control tests comply with minimum requirements indicated.

3.13 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. **Pointing**: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application.

C. **In-Progress Cleaning**: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

3.14 LINTELS

A. **Steel Lintels**: As specified in division 5, Section “Metal Fabrications”.

B. **Concrete Lintels**:

1. Precast lintels: Comply with requirements of Division 3, Section “Plant Precast Structural Concrete”.

2. Cast-In-Place Concrete lintels: Comply with requirements of Division 3, Section “Cast-In-Situ Concrete”.

C. Provide steel lintels where openings up to 610 mm wide are indicated.

D. Provide reinforced concrete lintels where shown and where openings of more than 610 mm are shown without structural steel or other supporting lintels.

E. Provide minimum bearing of 200 mm at each jamb, unless otherwise indicated.

END OF DOCUMENT

SECTION 22 - PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Steel pipe and tube handrails and railings.

B. Related Sections include the following:

1. Division 9 Section "Painting" for field-applied finish paints.

1.3 PERFORMANCE REQUIREMENTS

A. **General**: In engineering handrails and railings to withstand structural loads indicated, determine allowable design working stresses of handrail and railing materials based on the following:

1. Structural Steel: AISC S335, "Specification for Structural Steel Buildings Allowable Stress Design and Plastic Design with Commentary."

2. Cold-Formed Structural Steel: AISI SG-673, Part I, "Specification for the Design of Cold-Formed Steel Structural Members."

B. **Structural Performance of Handrails and Railings**: Provide handrails and railings complying with requirements of ASTM E 985 for structural performance, based on testing performed according to ASTM E 894 and ASTM E 935.

C. **Thermal Movements**: Provide exterior handrails and railings that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 35 deg. C, ambient; 65 deg. C, material surfaces.

D. **Control of Corrosion**: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.4 SUBMITTALS

A. **Product Data**: For the following:

1. Manufacturer's product lines of mechanically connected handrails and railings.

2. Grout, anchoring cement, and paint products.

B. **Shop Drawings**: Show fabrication and installation of handrails and railings. Include plans, elevations, sections, component details, and attachments to other Work.

1. For installed handrails and railings indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. **Samples for Initial Selection**: Manufacturer's color charts showing the full range of colors available for products with factory-applied color finishes.

D. **Samples for Initial Selection**: Short sections of railing or flat, sheet metal samples showing available mechanical finishes.

E. **Samples for Verification**: For each type of exposed finish required, prepared on components indicated below and of same thickness and metal indicated for the Work. If finishes involve normal color and texture variations, include sample sets showing the full range of variations expected.

1. 150 mm long sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters.

2. Fittings and brackets.

3. Assembled sample of railing system, made from full-size components, including top rail, post, handrail, and infill. Show method of finishing members at intersections. Sample need not be full height.

F. **Qualification Data**: For firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects/engineers and owners, and other information specified.

G. Product Test Reports: From a qualified testing agency indicating handrails and railings comply with ASTM E 985, based on comprehensive testing of current products.

1.5 QUALITY ASSURANCE

A. **Quality System**: Comply with ISO 9001/9002 Quality System as a minimum. Incorporate all the standard procedures supplied by the Engineer and the Employer.

B. **Engineering Responsibility**: Engage a qualified structural consulting engineer to prepare design calculations, Shop Drawings, and other structural data.

C. **Consulting Engineer Qualifications**: A consulting engineer who is legally registered and qualified to practice and is experienced in providing engineering services of the kind

indicated. Engineering services are defined as those performed for installations of handrails and railings that are similar to those indicated for this Project in material, design, and extent.

D. **Testing Agency Qualifications**: An independent testing agency, acceptable to the Engineer, with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.

E. **Source Limitations**: Obtain each type of handrail and railing through one source from a single manufacturer.

F. **Welding**: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."

1.6 STORAGE

A. Store handrails and railings in a dry, well-ventilated, weather tight place, and protect from damage.

1.7 PROJECT CONDITIONS

A. **Field Measurements**: Verify handrail and railing dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.8 COORDINATION

A. Coordinate installation of anchorages for handrails and railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.9 SCHEDULING

A. Schedule installation so handrails and railings are mounted only on completed walls. Do not support temporarily by any means that does not satisfy structural performance requirements.

PART 2 - PRODUCTS

2.1 METALS

A. **General**: Provide metal free from pitting, seam marks, roller marks, stains, discolorations, and other imperfections where exposed to view on finished units.

B. **Steel and Iron**: Provide steel and iron in the form indicated, complying with the following requirements:

1. Steel Pipe: ASTM A 53; finish, type, and weight class as follows:

a. Black finish, for welded assemblies

b. Galvanized finish for mechanical assemblies.

c. Type F, or Type S, Grade A, Schedule 80, unless higher grade and weight are required by structural loads.

2. Steel Tubing: Cold-formed steel tubing, ASTM A 500, Grade A, unless another grade is required by structural loads.

3. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

4. Iron Castings: Malleable iron complying with ASTM A 47M, Grade 22010.

C. **Fittings, Brackets, Flanges, and Anchors**: Cast or formed metal of same type of material and finish as supported rails, unless otherwise indicated.

1. For Welded Assemblies: Provide non-galvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors to be embedded in exterior concrete or masonry.

2. For Mechanical Assemblies: Provide galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.

2.2 WELDING MATERIALS, FASTENERS, AND ANCHORS

A. **Welding Electrodes and Filler Metal**: Provide type and alloy of filler metal and electrodes as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.

B. **Fasteners for Anchoring Handrails and Railings to Other Construction**: Select fasteners of type, grade, and class required to produce connections suitable for anchoring handrails and railings to other types of construction indicated and capable of withstanding design loads.

1. For steel handrails, railings, and fittings, use plated fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating.

C. **Fasteners for Interconnecting Handrail and Railing Components**: Use fasteners fabricated from same basic metal as fastened metal, unless otherwise indicated. Do not use metals that are corrosive or incompatible with materials joined.

1. Provide concealed fasteners for interconnecting handrail and railing components and for attaching them to other work, unless exposed fasteners are unavoidable or are the standard fastening method for handrails and railings indicated.

2. Provide Phillips flat-head machine screws for exposed fasteners, unless otherwise indicated.

D. **Cast-in-Place, chemical and Post-installed Anchors**: Anchors of type indicated below, fabricated from corrosion-resistant materials with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency acceptable to the Engineer.

1. Cast-in-place anchors.

2. Chemical anchors.

3. Expansion anchors.

2.3 GROUT AND ANCHORING CEMENT

A. **Non-shrink, Nonmetallic Grout**: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by the manufacturer for interior and exterior applications.

2.4 FABRICATION

A. **General**: Fabricate handrails and railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

B. Assemble handrails and railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

C. Form changes in direction of railing members as follows:

1. As detailed.

2. By bending.

3. By radius bends of radius indicated.

4. By flush radius bends.

5. By mitering at elbow bends.

6. By inserting prefabricated flush-elbow fittings.

7. By any method indicated above, applicable to change in direction involved.

D. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cylindrical cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of handrail and railing components.

E. **Welded Connections**: Fabricate handrails and railings for connecting members by welding. Cope components at perpendicular and skew connections to provide close fit, or use fittings designed for this purpose. Weld connections continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2. Obtain fusion without undercut or overlap.

3. Remove flux immediately.

4. At exposed connections, finish exposed surfaces smooth and blended so that no roughness shows after finishing and welded surface matches contours of adjoining surfaces.

F. **Non-welded Connections**: Fabricate handrails and railings by connecting members with concealed mechanical fasteners and fittings, unless otherwise indicated. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.

1. Fabricate splice joints for field connection using an epoxy structural adhesive where this is manufacturer's standard splicing method.

G. **Brackets, Flanges, Fittings, and Anchors**: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect handrail and railing members to other work, unless otherwise indicated.

H. Provide inserts and other anchorage devices for connecting handrails and railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by handrails and railings. Coordinate anchorage devices with supporting structure.

I. For railing posts set in concrete, provide preset sleeves of steel not less than 150 mm long with inside dimensions not less than 12 mm greater than outside dimensions of post, and steel plate forming bottom closure.

J. Shear and punch metals cleanly and accurately. Remove burrs from exposed cut edges.

K. Ease exposed edges to a radius of approximately 1 mm, unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing the Work.

L. Cut, reinforce, drill, and tap components, as indicated, to receive finish hardware, screws, and similar items.

M. Provide weep holes or other means to drain entrapped water in hollow sections of handrail and railing members that are exposed to exterior or to moisture from condensation or other sources.

N. Fabricate joints that will be exposed to weather in a watertight manner.

O. Close exposed ends of handrail and railing members with prefabricated end fittings.

P. **Toe Boards**: Where indicated, provide toe boards at railings around openings and at edge of open-sided floors and platforms. Fabricate to dimensions and details indicated.

Q. **Fillers**: Provide fillers made from steel plate, or other suitably crush-resistant material, where needed to transfer wall bracket loads through wall finishes to structural supports. Size fillers to suit wall finish thicknesses and to produce adequate bearing area to prevent bracket rotation and overstressing of substrate.

2.5 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. **Appearance of Finished Work**: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Provide exposed fasteners with finish matching appearance, including color and texture, of handrails and railings.

2.6 STEEL FINISHES

A. General: Unless otherwise indicated on Drawings, pipe and tube railings specified under this Section shall be galvanized and factory painted.

B. **Galvanizing After Fabrication**: Hot-dip galvanize items as indicated to comply with applicable standard listed below:

1. ASTM A 123, for galvanizing steel and iron products.

2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.

C. Fill vent and drain holes that will be exposed in finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

D. Preparation for Shop Priming: After galvanizing, thoroughly clean handrails and railings of grease, dirt, oil, flux, and other foreign matter, and treat with metallic-phosphate process.

E. Apply shop primer to prepared surfaces of railings, unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.

1. Shop Primer for Galvanized Steel: Zinc-dust, zinc-oxide primer formulated for priming zinc-coated steel and for compatibility with finish paint systems indicated, and complying with SSPC-Paint 5.

2. Stripe paint corners, crevices, bolts, welds, and sharp edges.

F. Factory-Applied Finish: Immediately after cleaning and pre-treating, apply manufacturer's standard two-coat, air-dried-enamel or baked-enamel finish consisting of prime coat and top coat that complies with ANSI A250.3 acceptance criteria. Comply with paint manufacturer's

instructions for applying and baking to achieve a minimum dry film thickness of 0.03 mm for topcoat.

1. Color and Gloss: As selected by Engineer from manufacturer's full range.

2. Use air-dried enamel for welded assemblies.

3. Use baked on enamel for mechanical assemblies.

4. Use UV resistant enamel for exterior applications.

5. Use scratch and abrasion resistant enamel for all applications.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements have been clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.2 INSTALLATION, GENERAL

A. Fit exposed connections together to form tight, hairline joints.

B. Perform cutting, drilling, and fitting required to install handrails and railings. Set handrails and railings accurately in location, alignment, and elevation; measured from established lines and levels and free from rack.

1. Do not weld, cut, or abrade surfaces of handrail and railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.

2. Set posts plumb within a tolerance of 2 mm in 1 m.

3. Align rails so that variations from level for horizontal members and from parallel with rake of steps and ramps for sloping members do not exceed 5 mm in 3 m.

C. Adjust handrails and railings before anchoring to ensure matching alignment at abutting joints. Space posts at interval indicated, but not less than that required by structural loads.

D. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing handrails and railings and for properly transferring loads to in-place construction.

3.3 RAILING CONNECTIONS

A. **Non-welded Connections**: Use mechanical or adhesive joints for permanently connecting railing components. Use wood blocks and padding to prevent damage to railing members and fittings. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of handrails and railings.

B. **Welded Connections**: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.

C. **Expansion Joints**: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 50 mm beyond joint on either side, fasten internal sleeve securely to one side, and locate joint within 150 mm of post.

3.4 ANCHORING POSTS

A. Unless otherwise indicated on drawings, use steel pipe sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with the following material, mixed and placed to comply with anchoring material manufacturer's written instructions:

1. Non-shrink, nonmetallic grout.

B. Cover anchorage joint with flange of same metal as post, attached to post as follows:

1. By set screws.

C. Leave anchorage joint exposed; wipe off surplus anchoring material; and leave 3 mm build-up, sloped away from post.

D. Anchor posts to metal surfaces with oval flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:

1. For steel pipe railings, weld flanges to post and bolt to metal supporting surfaces.

E. Install removable railing sections, where indicated, in slip-fit metal sockets cast in concrete.

3.5 ANCHORING RAILING ENDS

A. Anchor railing ends into concrete and masonry with round flanges connected to railing ends and anchored into wall construction with post installed anchors and bolts.

B. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces.

1. Connect flanges to railing ends using non-welded connections.

3.6 ATTACHING HANDRAILS TO WALLS

A. Attach handrails to wall with wall brackets. Provide brackets with 38-mm clearance from inside face of handrail and finished wall surface.

B. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

C. Secure wall brackets to building construction as follows:

1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.

2. For hollow masonry anchorage, use toggle bolts.

3. For steel-framed gypsum board assemblies, use hanger or lag bolts set into wood backing between studs. Coordinate with stud installation to locate backing members.

4. For steel-framed gypsum board assemblies, fasten brackets directly to steel framing or concealed steel reinforcements using self-tapping screws of size and type required to support structural loads.

3.7 CLEANING

A. **Touchup Painting**: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material.

B. **Galvanized Surfaces**: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

3.8 PROTECTION

A. Protect finishes of handrails and railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at the time of Substantial Completion.

B. Restore finishes damaged during installation and construction period so that no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF DOCUMENT

SECTION 23 - ORNAMENTAL HANDRAILS AND RAILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Stainless steel ornamental handrails and railings.

B. Related Sections include the following:

1. Division 5 Section "Pipe and Tube Railings" for handrails and railings fabricated from pipe and tube components.

2. Division 7 Section “Joint Sealants".

1.3 PERFORMANCE REQUIREMENTS

A. **General**: In engineering handrails and railings to withstand structural loads indicated, determine allowable design working stresses of materials based on the following:

1. Stainless Steel: ASCE 8, "Specification for the Design of Cold-Formed Stainless Steel Structural Members."

B. **Structural Performance of Handrails and Railings**: Provide handrails and railings capable of withstanding structural loads required by ASCE 7 without exceeding allowable design working stress of materials for handrails, railings, anchors, and connections.

C. **Structural Performance of Handrails and Railings**: Provide handrails and railings capable of withstanding the following structural loads without exceeding allowable design working stress of materials for handrails, railings, anchors, and connections:

1. Handrails Not Serving As Top Rails: Capable of withstanding the following loads applied as indicated:

a. Concentrated load of 890 N applied at any point and in any direction.

b. Uniform load of 730 N/m applied in any direction.

c. Concentrated and uniform loads above need not be assumed to act concurrently.

2. Infill Area of Guards: Capable of withstanding a horizontal concentrated load of 890 N applied to 0.09 sq. m at any point in system, including panels, intermediate rails, balusters, or other elements composing infill area.

a. Load above need not be assumed to act concurrently with loads on top rails in determining stress on guard.

3. Demonstrate capability of proposed handrail systems by:

a. Submission of structural calculations.

b. Submission of laboratory test report conducted on the proposed product during the last three years.

D. **Thermal Movements**: Provide handrails and railings that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 35 deg. C, ambient; 65 deg. C, material surfaces.

E. **Control of Corrosion**: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.4 SUBMITTALS

A. **Product Data**: For manufacturer's product lines of handrails and railings assembled from standard components.

1. Include Product Data for grout, anchoring cement, and paint products.

B. **Shop Drawings**: Show fabrication and installation of handrails and railings. Include plans, elevations, sections, details, and attachments to other Work.

1. For installed handrails and railings indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. **Samples for Initial Selection**: Short sections of railing or flat sheet metal Samples showing available mechanical finishes.

D. **Samples for Verification**: For each type of exposed finish required, prepared on components indicated below and of same thickness and metal indicated for the Work. If finishes involve normal color and texture variations, include sample sets showing the full range of variations expected.

1. 150 mm long sections of each different linear railing member, including handrails, top rails, posts, and balusters.

2. Fittings and brackets.

3. Welded connections.

4. Assembled Samples of railings, made from full-size components, including top rail, post, handrail, and infill. Show method of finishing members at intersections. Samples need not be full height.

E. Samples of exposed fasteners, where exposed fasteners are indicated.

F. **Qualification Data**: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects/engineers and owners, and other information specified.

G. **Product Test Reports**: Indicating products comply with requirements, based on comprehensive testing of current products.

1.5 QUALITY ASSURANCE

A. **Quality System**: Comply with ISO 9001/9002 Quality System as a minimum. Incorporate all the standard procedures supplied by the Engineer and the Employer.

B. **Structural/Consulting Engineer Qualifications**: A structural consulting engineer who is legally qualified to practice, and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of handrails and railings that are similar to those indicated for this Project in material, design, and extent.

C. **Testing Agency Qualifications**: To qualify for acceptance, an independent testing agency shall demonstrate to the Engineer's satisfaction, based on evaluation of agency-submitted criteria conforming to ASTM E 699, that it has the experience and capability to satisfactorily conduct the testing indicated.

D. **Source Limitations**: Obtain each type of railing through one source from a single manufacturer.

E. **Mockups**: Before installing handrails and railings, build mockups to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for the completed Work:

1. Build mockups in the location as directed by the Engineer.

2. Build mockups for each form and finish of railing consisting of three posts, top rail, infill area, and anchorage system components that are full height and are not less than 600 mm in length.

3. Demonstrate the proposed range of aesthetic effects and workmanship.

4. Notify the Engineer seven days in advance of dates and times when mockups will be constructed.

5. Obtain the Engineer's approval of mockups before fabricating ornamental handrails and railings.

6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.

7. Demolish and remove mockups when directed.

8. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 STORAGE

A. Store handrails and railings in a dry, well-ventilated, weathertight place.

1.7 PROJECT CONDITIONS

A. **Field Measurements**: Verify handrail and railing dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.8 COORDINATION

Coordinate installation of anchorages for handrails and railings. Furnish Setting Drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be

embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.9 SCHEDULING

A. Schedule installation so that handrails and railings are mounted only on completed walls. Do not support temporarily by any means that do not satisfy structural performance requirements.

PART 2 - PRODUCTS

2.1 METALS

A. **General**: Provide metal free from pitting, seam marks, roller marks, stains, discolorations, and other imperfections where exposed to view on finished units.

B. **Stainless Steel**: Grade or type designated below for each form required.

1. Tubing: ASTM A 554, Grade MT 304.

2. Pipe: ASTM A 312/A 312M, Grade TP 304.

3. Castings: ASTM A 743/A 743M, Grade CF 8 or CF 20.

4. Plate: ASTM A 666, Type 304.

C. **Brackets, Flanges, and Anchors**: Cast or formed metal of same type of material and finish as supported rails, unless otherwise indicated.

1. Provide formed steel brackets with predrilled hole for bolted anchorage and with snap-on cover that matches rail finish and conceals bracket base and bolt head.

2.2 MISCELLANEOUS MATERIALS

A. **Filler Metal and Electrodes**: Provide type and alloy of filler metal and electrodes as recommended by producer of metal to be welded or brazed and as required for color match, strength, corrosion resistance, and compatibility in fabricated items.

2.3 FASTENERS

A. **Fasteners for Anchoring Handrails and Railings to Other Construction**: Select fasteners of type, grade, and class required to produce connections suitable for anchoring handrails and railings to other types of construction indicated and capable of withstanding design loads.

1. For stainless-steel handrails and railings, use fasteners fabricated from Type 304 stainless steel.

B. **Fasteners for Interconnecting Handrail and Railing Components**: Use fasteners fabricated from same basic metal as fastened metal, unless otherwise indicated. Do not use metals that are corrosive or incompatible with materials joined.

1. Provide concealed fasteners for interconnecting railing components and for attaching them to other Work, unless exposed fasteners are unavoidable or are standard fastening method for handrail and railing indicated.

C. **Cast-in-Place and Postinstalled Anchors**: Anchors of type indicated below, fabricated from corrosion-resistant materials with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

1. Chemical anchors.

2. Expansion anchors.

2.4 PAINT

A. **Bituminous Paint**: Cold-applied asphalt mastic complying with SSPC-Paint 12 but containing no asbestos fibers, or cold-applied asphalt emulsion complying with ASTM D 1187.

2.5 GROUT AND ANCHORING CEMENT

A. **Nonshrink, Nonmetallic Grout**: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.6 FABRICATION

A. **General**: Fabricate handrails and railing systems to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of hollow members, post spacings, and anchorage, but not less than that required to support structural loads.

B. Assemble handrails and railings in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

C. Form changes in direction of railing members as follows:

1. By bending.

2. By flush radius bends.

3. By radius bends of radius indicated.

4. By mitering at elbow bends.

5. By inserting prefabricated flush elbow fittings.

6. By any method indicated above, applicable to change in direction involved.

D. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain profile of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of handrail and railing components.

E. **Welded Connections**: Fabricate handrails and railings for connecting members by welding. Cope components at perpendicular and skew connections to provide close fit, or use fittings designed for this purpose. Weld connections continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2. Obtain fusion without undercut or overlap.

3. Remove flux immediately.

4. At exposed connections, finish exposed surfaces smooth and blended so that no roughness shows after finishing and welded surface matches contours of adjoining surfaces.

F. **Mechanical Connections**: Fabricate handrails and railings by connecting members with railing manufacturer's standard concealed mechanical fasteners and fittings, unless otherwise indicated. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.

1. Fabricate splice joints for field connection using epoxy structural adhesive where this is manufacturer's standard splicing method.

G. **Brackets, Flanges, Fittings, and Anchors**: Provide manufacturer's standard wall brackets, flanges, miscellaneous fittings, and anchors to connect handrail and railing members to other construction.

H. Provide inserts and other anchorage devices to connect handrails and railings to concrete or masonry. Fabricate anchorage devices capable of withstanding loads imposed by handrails and railings. Coordinate anchorage devices with supporting structure.

I. For railing posts set in concrete, provide preset sleeves of steel not less than 150 mm long with inside dimensions not less than 13 mm larger than outside dimensions of post, and steel plate forming bottom closure.

1. Provide chain with eye, snap hook, and staple across gaps formed by removable railing sections at locations indicated. Fabricate from same metal as railings.

J. Shear and punch metals cleanly and accurately. Remove burrs from exposed cut edges.

K. Ease exposed edges to a radius of approximately 1 mm, unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing the Work.

L. Cut, reinforce, drill, and tap components, as indicated, to receive finish hardware, screws, and similar items.

M. Close exposed ends of railing members with prefabricated end fittings.

N. **Toe Boards**: Where indicated, provide toe boards at railings around openings and at edge of open-sided floors and platforms. Fabricate to dimensions and details indicated.

O. **Fillers**: Provide fillers made from steel plate, or other suitably crush-resistant material, where needed to transfer wall bracket loads through wall finishes to structural supports. Size fillers to suit wall finish thicknesses and to produce adequate bearing area to prevent bracket rotation and overstressing of substrate.

P. Provide sleeves, inserts, and other anchorage devices to connect handrails and railing systems to concrete, masonry, embedded steel plates, and structural steel work. Fabricate anchorage devices capable of withstanding loads imposed by handrails and railing systems. Coordinate anchorage devices with supporting structure.

2.7 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipment.

C. **Appearance of Finished Work**: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance

of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.8 STAINLESS-STEEL FINISHES

A. Remove or blend tool and die marks and stretch lines into finish.

B. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.

C. Mirrorlike Reflective, Nondirectional Polish: No. 8 finish.

D. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements have been clearly marked for Installer. Locate reinforcements and mark locations if not already done.

B. Coordinate setting drawings, diagrams, templates, instructions, and directions for installing anchorages, such as sleeves, concrete inserts, anchor bolts, and miscellaneous items having integral anchors that are to be embedded in concrete, masonry, and terrazzo construction. Coordinate delivery of such items to Project site.

3.2 INSTALLATION, GENERAL

A. Fit exposed connections together to form tight, hairline joints.

B. **Cutting, Fitting, and Placement**: Perform cutting, drilling, and fitting required for installing handrails and railings. Set handrails and railings accurately in location, alignment, and elevation, measured from established lines and levels and free from rack.

1. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.

2. Set posts plumb within a tolerance of 2 mm in 1 m.

3. Align rails so that variations from level for horizontal members and from parallel with rake of steps and ramps for sloping members do not exceed 5 mm in 3 m.

C. Adjust handrails and railings before anchoring to ensure alignment at abutting joints. Space posts at interval indicated, but not less than that required by structural loads.

D. **Fastening to In-Place Construction**: Use anchorage devices and fasteners where necessary for securing handrails and railings and for properly transferring loads to in-place construction.

E. **Field Welding**:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2. Obtain fusion without undercut or overlap.

3. Remove welding flux immediately.

4. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness or discoloration shows after finishing and welded surface matches contours and finish of adjoining surfaces.

F. **Non-welded Connections**: Use mechanical or adhesive joints for permanently connecting railing components. Use wood blocks and padding to prevent damage to railing members and fittings. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of handrails and railings.

G. **Welded Connections**: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in shop or in field.

H. **Expansion Joints**: Install expansion joints at locations indicated but not further apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 50 mm beyond joint on either side; fasten internal sleeve securely to one side; locate joint within 150 mm of post.

3.3 ANCHORING POSTS

A. Use steel pipe sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with the following anchoring material, mixed and placed to comply with anchoring material manufacturer's written instructions.

1. Nonshrink nonmetallic grout.

B. Form or core-drill holes not less than 125 mm deep and 20 mm greater than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with the following anchoring material,

mixed and placed to comply with anchoring material manufacturer's written instructions:

1. Nonshrink, nonmetallic grout.

C. Cover anchorage joint with a flange of same metal as post, attached to post as follows:

1. Welded to post after placing anchoring material.

2. By set screws.

3. Set flange in clear silicone sealant / adhesive flow surface.

D. Leave anchorage joint exposed, wipe off surplus anchoring material, and leave 3 mm build-up, sloped away from post.

E. Anchor posts to metal surfaces with flanges, angle or floor type as required by conditions, connected to posts and to metal supporting members as follows:

1. For stainless-steel railings, weld flanges to post and bolt to metal supporting members.

F. Where shown on Drawings, fasten posts to face of spandrel construction as indicated and in accordance with manufacturer's instructions.

3.4 ANCHORING RAIL ENDS

A. Anchor rail ends to concrete and masonry with flanges connected to rail ends and anchored with postinstalled anchors and bolts.

3.5 CLEANING

A. Clean stainless steel by washing thoroughly with clean water and soap and rinsing with clean water.

3.6 PROTECTION

A. Protect finishes of handrails and railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at the time of Substantial Completion.

B. Restore finishes damaged during installation and construction period so that no evidence remains of correction work. Return items that cannot be refinished in field to shop; make required alterations and refinish entire unit, or provide new units.

END OF DOCUMENT

SECTION 24 - ARCHITECTURAL JOINT SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Types of joints for which architectural joint systems are specified include the following:

1. Interior pedestrian and vehicular traffic joints.

2. Interior wall and ceiling joints.

B. Related Sections include the following:

1. Division 3 Section "Cast-in-Place Concrete" for block-outs and cast-in anchorage and frames for architectural joint systems in concrete floors, parking decks, and walls.

2. Division 7 Section “Traffic Coating”.

3. Division 9 Section “Ceramic Tiles”.

1.3 DEFINITIONS

A. **Architectural Joint System**: Any filler or cover used to span, fill, cover, or seal a joint, except expanding foam seals and poured or foamed in-place sealants.

B. **Cyclic Movement**: Periodic change between widest and narrowest joint widths in an automatically mechanically controlled system.

C. **Fire Barriers**: Any material or material combination, when fire tested after cycling, designated to resist passage of flame and hot gases through a movement joint.

D. **Maximum Joint Width**: Widest linear gap a joint system tolerates and performs its designed function without damaging its functional capabilities.

E. **Minimum Joint Width**: Narrowest linear gap a joint system tolerates and performs its designed function without damaging its functional capabilities.

F. **Movement Capability**: Value obtained from the difference between widest and narrowest widths of a joint opening typically expressed in numerical values (mm or inches) or a percentage of nominal value of joint width.

1.4 PERFORMANCE REQUIREMENTS

A. **General**: Provide factory-fabricated architectural joint systems capable of withstanding the types of loads and of accommodating the kinds of movement, and the other functions for which they are designed including those specified below, without failure. Types of failure include those listed in Appendix X3 of ASTM E 1399.

1. Vehicular Traffic Joints: Support vehicular traffic across joint.

2. Pedestrian Traffic Joints: Support pedestrian traffic across joint.

3. Joints in Fire-Resistance-Rated Assemblies: Maintain fire-resistance ratings of assemblies.

4. Seismic Joints: Remain in place on exposure to seismic activity (movement).

5. Other Requirements:

    a. Provide joint systems that prevent penetration of water, moisture, and other substances deleterious to building components or content.

    b. Joints in Surfaces with Architectural Finishes: Serve as finished architectural joint closures.

B. **Movement Joints**: Provide 10 mm wide, non-structural, intermediate or peripheral movement joint in floor tiling of all tiled areas, based on TCA handbook, extending to the full depth of the finishing layer:

1. at 9 m in any direction for ceramic tiles bedded in semi dry mix

2. at 15 m in any direction for other types of rigid floor tiles or slabs.

3. Peripheral joints shall be at vertical boundary walls or at columns boundaries.

4. Use prefabricated joint and edging sections of approved frame material and filler.

1.5 SUBMITTALS

A. **Product Data**: Include manufacturer's product specifications, construction details, material and finish descriptions, and dimensions of individual components and seals.

B. **Shop Drawings**: For each joint system specified, provide the following:

1. Placement Drawings: Include line diagrams showing entire route of each joint system, plans, elevations, sections, details, joints, splices, locations of joints and splices, and attachments to other Work. Where joint systems change

   planes, provide Isometric Drawings depicting how components interconnect to achieve continuity of joint covers and fillers.

C. **Samples for Verification**: Full-size units 150 mm long of each type of joint system indicated; in sets for each finish, color, texture, and pattern specified, showing the full range of variations expected in these characteristics.

D. **Product Test Reports**: From a qualified testing agency indicating architectural joint systems comply with requirements, based on comprehensive testing of current products.

E. **Research/Evaluation Reports**: Evidence of architectural joint system's compliance with building code in effect for Project, from a model code organization acceptable to Engineer.

1.6 QUALITY ASSURANCE

A. **Quality System**: Comply with ISO 9001/9002 Quality System as a minimum. Incorporate all the standard procedures supplied by the Engineer and the Employer.

B. **Source Limitations**: Obtain architectural joint systems through one source from a single manufacturer. Coordinate compatibility with adjoining joint systems specified in other Sections.

C. **Fire-Test-Response Characteristics**: Where indicated, provide joint systems incorporating fire barriers that are identical to those of assemblies tested for fire resistance per ASTM E 119 and ASTM E 814 or UL 2079, including hose-stream test of vertical wall assemblies, by a testing and inspecting agency acceptable to Engineer.

D. **Product Options**: Drawings indicate size, profiles, and dimensional requirements of architectural joint systems

1. Do not modify intended aesthetic effects, as judged solely by the Engineer, except with the Engineer's approval. If modifications are proposed, submit comprehensive explanatory data to the Engineer for review.

1.7 DELIVERY, STORAGE AND HANDLING

A. Exercise proper care in the handling of all work so as not to injure the finished surface, and take proper precautions to protect the work from damage after it is in place.

B. Deliver materials to the job site ready for use, and fabricated in as large sections and assemblies as practical. Assemblies shall be identical to submitted and reviewed shop drawings, samples and certificates.

C. Store materials under cover in a dry and clean location off the ground. Remove materials that are damaged or otherwise not suitable for installation from the job site and replace with acceptable materials at no additional cost.

PART 2 - PRODUCTS

2.1 MATERIALS

A. **Aluminum**: ASTM B 221M, alloy 6063-T5 for extrusions; ASTM B 209M, alloy 6061-T6 for sheet and plate.

1. Apply manufacturer's standard protective coating on aluminum surfaces to be placed in contact with cementitious materials.

B. **Stainless Steel**: ASTM A 666, Type 316L.

C. **Fire Barriers**: Any material or material combination, when fire tested after cycling, designated to resist the passage of flame and hot gases through a movement joint.

D. **Preformed Seals**: Single or multicellular extruded elastomeric seals designed with continuous, longitudinal, internal baffles, formed to be installed in frames or with anchored flanges.

E. **Accessories**: Manufacturer's standard anchors, clips, fasteners, set screws, spacers, flexible moisture barrier and filler materials, drain tubes, lubricants, adhesives, and other accessories compatible with material in contact, as indicated or required for complete installations.

2.2 ARCHITECTURAL JOINT SYSTEMS

A. **General**: Provide joint systems of design, basic profile, materials, and operation indicated. Provide units with the capability to accommodate joint widths indicated and variations in adjacent surfaces.

1. Furnish units in longest practicable lengths to minimize number of end joints. Provide hairline mitered corners where joint changes directions or abuts other materials.

2. Include closure materials and transition pieces, tee-joints, corners, curbs, cross-connections, and other accessories as required to provide continuous joint systems.

3. Frames for Strip Seals: Designed with semiclosed cavity that provides a mechanical lock for seals of type indicated.

4. Public Arena Seals: Non-slip seals designed for installation on treads and risers and to lie flat with adjacent surfaces, and complying with ADA guidelines for public areas.

B. **Interior Vehicular and Pedestrian Traffic Joints**:

1. Type: Floor-to-floor.

2. Nominal Joint Width: As indicated on Drawings.

3. Movement Capability: ± 50%.

4. Type of Movement Capability: Expansion and contraction.

5. Cyclic-Movement-Test-Response Characteristics: No evidence of visual fatigue, inability to cycle between designated joint widths, or other types of failure as determined by testing products identical to those indicated per ASTM E 1399 including Appendix X3.

6. Frame Material: Aluminum.

7. Cover Material: Preformed seals, EPDM.

8. Additional Exposed Cover: Stainless steel.

9. Fire-Resistance Ratings: Not less than that of adjacent construction.

10. Provide assemblies with waterstops.

C. **Interior Vehicular and Pedestrian Traffic Joints**:

1. Type: Floor-to-wall.

2. Nominal Joint Width: As indicated on Drawings.

3. Movement Capability: ± 50%.

4. Type of Movement Capability: Expansion and contraction.

5. Cyclic-Movement-Test-Response Characteristics: No evidence of visual fatigue, inability to cycle between designated joint widths, or other types of failure as determined by testing products identical to those indicated per ASTM E 1399 including Appendix X3.

6. Frame Material: Aluminum.

7. Cover Material: Preformed seals, EPDM, color as selected by Engineer.

8. Fire-Resistance Ratings: Not less than that of adjacent construction.

9. Provide assemblies with waterstops.

D. **Interior Wall and Ceiling Joints**:

1. Type: Ceiling-to-ceiling or wall-to-ceiling.

2. Nominal Joint Width: As indicated on Drawings.

3. Movement Capability: ± 50%

4. Type of Movement Capability: Expansion and contraction.

5. Cyclic-Movement-Test-Response Characteristics: No evidence of visual fatigue, inability to cycle between designated joint widths, or other types of failure as determined by testing products identical to those indicated per ASTM E 1399 including Appendix X3.

6. Frame Material: Extruded aluminum retainer. Match color of ceiling runners if exposed.

7. Center Cover: Extruded vinyl.

E. **Divider Strips and Edging**: Use for providing control movement joints through tiled architectural finishes and screeds.

1. Combination of metal and EPDM or neoprene base, designed specifically for flooring applications, in longest lengths available, and as follows:

a. Exposed-Edge Material: Stainless steel; ASTM A 666, Type 302, clear anodized aluminum or half-hard brass, as selected by Engineer to harmony with color of adjoining floor.

b. Cross-Section Profile: Angle or L-shape for interspan dividers and T-shape, Straight shape for edging (perimeter joints).

c. Height: Equal to thickness of floor finish (natural stone or ceramic tiles) plus depth of setting bed (mortar or preset screed).

d. Width: 10 mm maximum.

c. Control-Joint Filler: EPDM or neoprene, in color selected by Engineer from manufacturer's full range.

2.3 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

2.4 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating but not less than 0.025 mm or thicker) complying with AAMA 611.

2.5 STAINLESS-STEEL FINISHES

A. Remove tool and die marks and stretch lines or blend into finish.

B. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.

C. Bright, Directional Polish: No. 4 finish.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare substrates according to architectural joint system manufacturer's written instructions.

B. Coordinate and furnish anchorages, Placement Drawings, and instructions for installing joint systems to be embedded in or anchored to concrete or to have recesses formed into edges of concrete slab for later placement and grouting-in of frames.

C. **Fastening to In-Place Construction**: Provide anchorage devices and fasteners where necessary to secure joint systems to in-place construction, including threaded fasteners with drilled-in expansion shields for masonry and concrete

where anchoring members are not embedded in concrete. Provide fasteners of metal, type, and size to suit type of construction indicated and to provide for secure attachment of joint systems.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for handling and installing architectural joint assemblies and materials, unless more stringent requirements are indicated.

B. Coordinate installation of architectural joint assembly materials and associated work so complete assemblies comply with assembly performance requirements.

C. **Cutting, Fitting, and Placement**: Perform cutting, drilling, and fitting required to install joint systems.

1. Install joint cover assemblies in true alignment and proper relationship to joints and adjoining finished surfaces measured from established lines and levels.

2. Allow adequate free movement for thermal expansion and contraction of metal to avoid buckling.

3. Set covers in horizontal surfaces at elevations that place exposed surfaces flush with adjoining finishes.

4. Securely attach in place with required accessories.

5. Locate anchors at interval recommended by manufacturer, but not less than 75 mm from each end and not more than 600 mm o.c.

D. **Continuity**: Maintain continuity of joint systems with a minimum number of end joints and align metal members. Cut and fit ends to produce joints that will accommodate thermal expansion and contraction of metal to avoid buckling of frames.

E. **Fire Barriers**: Install fire barriers to provide continuous, uninterrupted fire resistance throughout length of joint, including transitions and end joints.

3.3 CLEANING AND PROTECTION

A. Do not remove protective covering until finish work in adjacent areas is complete. When protective covering is removed, clean exposed metal surfaces to comply with manufacturer's written instructions.

END OF DOCUMENT

SECTION – 25 – ROUGH CARPENTRY

PART-1 GENERAL

RELATED WORK

1. Architectural Wood Work
2. Gypsum Board System

1.1 THIS SECTION INCLUDES

This Section specifies incidental rough carpentry required for support or attachment of other construction and not specified in other sections and includes, but is not limited to, the following items:

a. Wood grounds, blockings, nailers.

b. Temporary and permanent grounds, blockings and supports required by other trades.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

a. Wood grounds, nailers, and blocking.

b. Wood furring.

c. Wood sub-frames.

1.3 PRESERVATIVE TREATMENT

a. Application is to be carried out after cutting and machining, but before assembly, by a processor licensed by the treatment solution manufacturer.

b. Solution strengths and treatment by pressure, vacuum or immersion process are to be selected to achieve service life and to suit wood treatability.

c. Moisture content of wood at time of treatment is to be as specified for use in the work.

d. After treatment, allow wood to dry before use.

e. For each batch of wood, provide certificate of assurance that treatment has been carried out as specified.

f. Re-treat all treated wood which is sawn along the length, plouged, thicknessed, planed or otherwise extensively processed.

g. Treat wood surfaces exposed by minor cutting and drilling with two flood coats of solution recommended for the purpose by the treatment solution manufacturer.

1.4 SUBMITTALS

a. Samples of all materials used in the work of this Section.

b. Shop drawings for furring including details, sizes of wood sections, panel, spacings and method of attachment.

1.5 QUALITY ASSURANCE

A. **Quality System:** Comply with ISO 9001/9002 Quality System as a minimum. Incorporate all the standard procedures supplied by the Engineer and the Employer.

1.6 DELIVERY, STORAGE, AND HANDLING

Keep materials under cover and dry. Protect from weather and contact with damp or wet surfaces. Stack lumber, plywood, and other panels. Provide for air circulation within and around stacks and under temporary coverings.

PART-2 PRODUCTS

TIMBER

a. Timber shall be well seasoned and free from decay, insect attack except pinhole borers, and knots wider than half of the width of the section.

b. Timber shall be kiln dried to a maximum moisture content of 12% by weight.

c. Timber required to be treated with preservatives or fire retardant shall be seasoned and kiln dried before treatment, and re-dried after treatment.

d. Softwood shall be free from decay and insect attack, except pinhole borers, with no knots wider than half the width of the section. Softwood shall comply with BS EN 942 softwood spices to be used in external locations are to be recommended for the purpose.

e. Hardwood shall comply with BS EN 942. Hard wood to be used in internal locations are to be recommended for the purpose.

f. Wood used for exterior applications or for interior applications in wet areas shall be factory treated to prevent moisture absorption.

SOFTWOOD

To be either:

a. Douglas Fir (Standard Grade)

b. European Redwood

c. Or as suggested by the Architect.

HARDWOOD

a. Teakwood

b. White American Oakwood

c. Or as suggested by the Architect.

RIGID SHEETS

2.1 MDF (Fire Resistance)

a. Medium density fiberboard's for fabric panels, 8-10mm thick.

b. Strips of MDF around fabric panels edging.

c. All MDF components to be fire resistant.

2.3 PLY WOOD

a. Plywood: BS EN 636: Part 1, face grade for general use. Bonding is to be to BS 1203, type WBP for external use and type MR or INT for internal use.

b. Marine Quality Plywood: to BS 1088 and BS 4079, excluding plywood made from gaboon.

2.4 CORK BOARD

Are to be preformed sheets that have been formed from clean granulated cork particles securely bound together by a synthetic resin of an insoluble nature. Minimum thickness of sheets is to be 25 mm, width and length are to be as indicated on Drawings.

2.5 FASTENERS

a. Nails: to BS 1202, Part 1, 2 or 3 generally, but non-ferrous types to Parts 2 or 3 for external use.

b. Wood Screws: to BS 1210 generally, but non-ferrous types for external use.

c. Self-Tapping Screws: to BS 4174.

d. Dowels: mild steel, 10 mm diameter, 100 mm long, galvanized to BS EN ISO 1461 after fabrication.

e. Cramps: mild steel, 25 x 3 x 250 mm girth, turned up at one end and twice drilled for 3 mm screws, fish-tailed at other end for building in and galvanized to BS 729 after fabrication.

f. Plugs: either traditional hardwood plugs, shaped to twist and grip when driven, or proprietary fibre or plastics plugs, or other approved type.

2.6 TREATMENTS, ADHESIVES AND FINISHES

a. Preservative Treatment: shall be type listed in BS 1282 (except coal tar creosote), obtained from an approved manufacturer, to give suitable protection against termites and other wood destroying organisms.

b. Adhesive for Joinery: shall be close contact type to BS EN 301 or BS EN 302 suitable for the purpose. Obtain manufacturer's confirmation that adhesive is compatible with preservative treatment.

PART-3 EXECUTION

3.1 INSTALLATION, GENERAL

a. Discard units of material with defects that impair quality of rough carpentry and that are too small to use with minimum number of joints or optimum joint arrangement.

b. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted.

c. Fit rough carpentry to other construction; scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds, and similar supports to allow attachment of other construction.

d. Apply field treatment to cut surfaces of preservative-treated lumber and plywood.

e. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated.

f. Use common wire nails, unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood; predrill as required.

g. Use hot-dip galvanized nails.

h. Countersink nail heads on exposed carpentry work and fill holes with wood filler.

3.2 WOOD GROUNDS, NAILERS, BLOCKING, AND SLEEPERS

a. Install wood grounds, nailers, blocking, and sleepers where shown and where required for screeding or attaching other work. Form to shapes shown and cut as required for true line and level of attached work. Coordinate locations with other work involved.

b. Attach to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated. Build into masonry during installation of masonry work. Where possible, anchor to formwork before concrete placement.

c. Install permanent grounds of dressed, preservative-treated, key-beveled lumber not less than 1-38 mm wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.3 WOOD FURRING

a. Install plumb and level with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.

b. Firestop furred spaces of walls at each floor level and at ceiling with wood blocking or noncombustible materials, accurately fitted to close furred spaces.

c. Furring to Receive Wood or Plastic Sheets or Boards: Install 19-by-63-mm actual-size furring at 600 mm o.c., horizontally and vertically. Select furring with no knots capable of producing bent-over nails and damage to paneling.

d. Furring to Receive Gypsum Board: Install 19-by-38-mm actual-size furring at 400 mm o.c., vertically.

e. Furring to Receive Plaster Lath: Install 19-by-38-mm actual-size furring at 400 mm o.c., vertically.

END OF DOCUMENT

SECTION 26 - INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Pantry cupboard.

2. Laboratory bench.

2. Vanities constructed from solid surfacing.

3. Wood base.

B. Related Sections include the following:

1. Division 6 Section "Rough Carpentry".

3. Division 9 Section "Painting" for field finishing of interior architectural wood works components that need finishing.

1.3 SUBMITTALS

A. **Product Data**: For each type of product indicated, including finishing materials and processes.

1. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.

B. **Shop Drawings**: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

1. Show details full size.

2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.

3. Show locations and sizes of cutouts and holes for items installed in architectural woodwork.

C. **Samples for Initial Selection**: Manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available for each type of material indicated.

1. Shop-applied transparent finishes.

2. Solid-surfacing materials.

D. Samples for Verification: For the following:

1. Wood with or for transparent finish, 300 sq. cm, 125 mm wide by 600 mm long, finished on 1 side and 1 edge.

2. Solid-surfacing materials, 150 mm square.

3. Pantry hardware.

4. Plastic-laminate-clad panel products, 200 by 250 mm, for each type, color, pattern, and surface finish, with separate samples of un-faced panel product used for core.

E. **Product Certificates**: Signed by suppliers of used woods and rigid sheets certifying that products comply with requirements specified.

1.4 QUALITY ASSURANCE

A. **Installer Qualifications**: An experienced installer who has completed architectural woodwork similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. **Fabricator Qualifications**: A firm experienced in producing architectural woodwork similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

C. **Source Limitations**: Engage a qualified woodworking firm to assume undivided responsibility for production and installation of interior architectural woodwork.

1.5 PROJECT CONDITIONS

A. **Field Measurements**: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication

and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed and indicate measurements on Shop Drawings.

1.6 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 WOOD

A. Softwood shall be free from decay and insect attack, except pinhole borers, with no knots wider than half the width of the section. Softwood shall comply with BS EN 942 softwood species to be used in external locations are to be recommended for the purpose.

B. Hardwood shall comply with BS EN 942. Hardwood to be used in the works are to be recommended for the purpose.

C. Wood shall be treated to prevent absorption of moisture.

D. Plastic Laminate: to BS EN 438, color and pattern as follows:

1. Color and Pattern: Shall be selected by Engineer from manufacturer's full range of colors and patterns.

2. Minimum Thickness: 1.20 mm.

3. Where indicated, select plastic laminate type suitable for post forming application.

2.2 RIGID SHEETS

A. Plywood: BS EN 636: Part 1, face grade for general use. Bonding is to be to BS 1203, type WBP for external use and type MR or INT for internal use.

2.3 FASTENERS

A. **Nails**: to BS 1202, Part 1, galvanized steel.

B. **Wood Screws**: to BS 1210 generally, galvanized steel.

C. **Self-Tapping Screws**: to BS 4174.

D. **Dowels**: mild steel, 10 mm diameter, 100 mm long, galvanized to BS EN ISO 1461 after fabrication.

E. **Cramps**: mild steel, 25 x 3 x 250 mm girth, turned up at one end and twice drilled for 3 mm screws, fish-tailed at other end for building in and galvanized to BS EN ISO 1461 after fabrication.

F. **Plugs**: either traditional hardwood plugs, shaped to twist and grip when driven, or proprietary fiber or plastics plugs, or other approved type.

2.4 FIRE-RETARDANT-TREATED MATERIALS

A. **General**: Where indicated, use materials impregnated with fire-retardant chemical formulations indicated by a pressure process or other means acceptable to Engineer to produce products with fire-test-response characteristics specified.

1. Do not use treated material that does not comply with requirements of referenced woodworking standard or that is warped, discolored, or otherwise defective.

2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants in solution to distinguish treated material from untreated material.

B. **Fire-Retardant-Treated Lumber and Plywood by Pressure Process**: Comply with BS 5589. Use the following treatment type:

1. Type: Organic-resin-based formulation thermally set in wood by kiln-drying.

2. Mill lumber before treatment and implement special procedures during treatment and drying processes that prevent lumber from warping and developing discolorations from drying sticks or other causes, marring, and other defects affecting appearance of treated woodwork.

3. Kiln-dry material before and after treatment to levels required for untreated material.

C. All lumber, wood, fir, plywood or boards used in the works of this Section are to be preservative and fire-retardant treated.

2.5 SOLID SURFACE MATERIAL

A. **Solid-Surfacing Material for Counter Top**: Homogeneous solid sheets of filled plastic resin complying with material and performance requirements in ANSI Z124.3, for Type 5 or Type 6, without a pre-coated finish.

2.6 INSTALLATION MATERIALS, GENERAL

A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln-dried to less than 15 percent moisture content.

2.7 FABRICATION, GENERAL

A. **General**: Comply with requirements of BS 1186-2.

B. **Wood Moisture Content**: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.

C. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.

D. Fabricate woodwork to dimensions, profiles, and details indicated.

E. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible, before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

1. Notify Engineer seven days in advance of the dates and times woodwork fabrication will be complete.

2. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements indicated on Shop Drawings before disassembling for shipment.

Shop cut openings, to maximum extent possible, to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

F. Fabricated; cabinets and similar items are to be of robust firm neat construction with:

1. Shutters, sashes, drawers and other opening or moving parts working smooth without bound conditions.

2. Clearance between sashes and between jambs and sashes uniform.

3. Level horizontal surfaces and plumb vertical surfaces when installed.

2.8 SHOP PRIMING

A. **General**: Priming of interior architectural woodwork required to be performed at fabrication shop are specified in this Section. Refer to Division 9 Section "Painting" for final finishing of installed architectural woodwork and for priming materials to be used.

B. **Preparations for Priming**: Comply with Division 9, Section "Painting" for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for priming woodwork, as applicable to each unit of work.

1. **Back-priming**: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of woodwork. Apply two coats to end-grain surfaces.

2.9 PANTRY CUPBOARD AND BENCHES

A. Base counters and upper cabinets units shall be pre-fabricated units constructed to dimensions and details indicated on Drawings.

B. Construct units from the following materials so as to have all exposed or semi-exposed surfaces of plastic laminate finish:

1. 19 mm thick plywood with post-formed plastic laminate finish at both faces for front doors, bottoms and top of upper cabinet and shelves.

2. 19 mm thick solid surfacing material with integral factory formed back splash top of base counter with integral back splash.

3. 6 mm thick plywood of plastic laminate finish at one face for units backs and drawer base.

4. 19 mm thick plywood with post-formed plastic laminate finish for drawers front, sides and back

C. Plastic laminate sheet veneers shall be as specified in Clause 2.1 of this Section, color and pattern to the selection of the Engineer. Units are to be assembled in manufacturer's standard system to provide neat and robust construction.

D. Construct socle of base counter, consisting of perimeter sides and intermediate struts, from hardwood solid blocks and finish exposed fronts to match finish of surrounding floors.

E. Provide metal pre-slotted shelf holders of baked enamel finish complete with removable brackets for shelf supporting. Color is to be to the selection of the Engineer.

F. Provide manufacturer's standard hardware including hinges, drawer slides, latches and knobs of finish to the selection of the Engineer. All hardware shall be manufactured from stainless steel, alloy 304, of satin finish.

G. Blocking wood shall be from approved hardwood type.

H. Construct top of base cabinet units integral with coved back splash from solid surfacing material as specified. Color or colors shall be selected by the Engineer from manufacturer's full range. To the maximum possible extent provide seamless construction. Where seams are unavoidable, align adjacent solid surfacing-material units and factory form seams. Joints are to be dressed smooth with surface scratches removed and entire surface cleaned.

2.10 WOOD BASES

A. Are to be constructed from White Oak hardwood.

B. Fabricate to dimensions and details indicated.

C. Furnish in length as long as practice.

D. Corners are to be mitred at 45 degrees.

E. Finish of bases shall be transparent stained varnish as specified in Division 9, section "Painting".

2.11 VANITIES

A. Furnish vanities pre-fabricated in the workshop from solid surfacing material. Color(s) shall be selected by the Engineer.

B. Fabricate vanities to dimensions indicated on Drawings and details indicated on approved shop drawings. Comply with the following sheet thickness:

- Vanity: 20.0 mm
- Aprons and backsplash: 13.0 mm.

C. Provide seamless vanity construction with pre-opened holes for assembly of lavatories. Use approved samples of lavatories for fixing size of holes. Comply with manufacturer's printed instructions for fabrication of vanities.

PART 3 - EXECUTION

3.1 PREPARATION

A. Condition woodwork to average prevailing humidity conditions in installation areas before installation.

B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and back priming.

3.2 INSTALLATION

A. **Quality Standard**: Install woodwork to comply with BS 1186-2 and details indicated on Drawings and approved shop drawings.

B. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops).

C. Scribe and cut woodwork to fit adjoining work, and refinish cut surfaces and repair damaged finish at cuts.

D. Fire-Retardant-Treated Wood: Handle, store, and install fire-retardant-treated wood to comply with recommendations of chemical treatment manufacturer, including those for adhesives used to install woodwork.

E. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.

F. Fix wood bases with pre-drilled, expansion-type wall plugs fabricated from hard nylon and galvanized-steel wood screws of suitable length and diameter at maximum intervals of 750 mm. Counter sink heads of screws in wood and overfill with approved wood filler of matching color as adjacent finished stained wood.

G. Refer to Division 9 Section “Painting” for final finishing of installed architectural woodwork components that need finishing.

3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

B. Clean woodwork on exposed and semi exposed surfaces.

END OF DOCUMENT

SECTION 27 – LIQUID APPLIED WATERPROOFING

PART 1 -GENERAL

1.01 RELATED WORK

A. Section - Concrete.

B. Section - Membrane Waterproofing for external application

C. Division 15 - Drain flashing flanges.

1.02 WORK INCLUDED

A. Fluid applied cold applied one or two component polyurethane membrane waterproofing. For internal application.

B. Protective covering.

1.03 REFERENCES

A. ANSI/ASTM D412 - Rubber Properties in Tension.

B. ANSI/ASTM D746 - Test for Brittleness Temperature of Plastics and Elastomerics by Impact.

C. ASTM C836 - High Solids Content, Cold Liquid-applied Elastomeric Waterproofing Membrane for Use With Separate Wearing Course.

D. ASTM D624 - Rubber Property - Tear Resistance.

E. ASTM D2240 - Rubber Property - Durometer Hardness.

F. ASTM E96 - Water Vapour Transmission of Materials.

1.04 QUALITY ASSURANCE

A. **Membrane Manufacturer**: Company specializing in liquid waterproofing membrane systems with eight years minimum experience.

B. **Applicator**: Company specializing in application of specified waterproofing with five years minimum experience and approved by manufacturer.

1.05 FIELD SAMPLE

A. Provide field sample of installed membrane.

B. Field sample to represent conditions of finished work including internal and external corners, seam jointing, attachment method, sealing and counter flashing cover, and control and expansion joints.

C. Approved sample may be incorporated as part of the Work.

1.06 SUBMITTALS

A. Submit shop drawings and product data under provisions of General Requirements.

B. Submit shop drawings detailing special joint or termination conditions and conditions of interface with other materials.

C. Submit product data for liquid membrane compound, flexible flashing, joint cover sheet, and joint and crack sealants, with temperature range for application of waterproofing membrane.

D. Submit manufacturer's installation instructions under provisions Contract Documents

1.07 ENVIRONMENTAL REQUIREMENTS

A. Do not apply waterproofing during inclement weather or when air substrate temperature is below 5 degrees C.

B. Liquid water proofing should be non toxic

1.08 WARRANTY

A. Provide (10) ten years warranty under provisions of General Conditions of Contract.

B. Warranty includes coverage of materials and installation and resultant damage from failure of installation to resist penetration of moisture.

C. Warranty includes coverage of waterproofing failure to resist penetration of water

except where such failures are the result of structural failures of building. Hairline cracking of concrete due to temperature change or shrinkage is not considered as structural failure.

PART 2 -PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Carisle Corporation System Liquiseal

B. Chevron USA (Asphalt Div)System C.I.M.

C. Floorlite - Andek System Rooftex

D. Tremco Ltd System Tremproof 60

E. Fosroc Nitoproof 10

F. Or approved equal**.**

Note: The products and manufacturer specified herein are specified for the purpose of establishing minimum quality standards. Products equal to or better than those specified will be considered acceptable. The decision of acceptability shall rest with Engineer/Engineer Representative.

2.02 MATERIAL

A. **General**: Provide liquid applied waterproofing, and other required materials produced by one manufacturer.

B. **Waterproofing Membrane**: Pitch Modified, High Polymer one part Polyurethane Elastomeric Membrane Type. Trowel apply membrane at areas indicated on Drawings to receive "Waterproofing", consisting of a high polymer and polyurethane applied in multiple layers forming a seamless waterproofing membrane to a minimum thickness of 1.5mm.

C. The Physical properties of the membrane must satisfy the following criteria:

1 Specific Gravity : 1.2

2 Solid Contents : 92% minimum

3 Application Temperature : 5 degrees C to 45 degrees C

4 Cure Time : 4 – 6 Hour

5 Store "A" Hardness : 30 degrees C

6 Tensile Strength : 20N/mm^2

7 Ultimate Elongation : 680%

8 Accelerated Weathering: 12000 Hours. No appreciable deterioration.

D. Sealer (For Substrate): As recommended by manufacturer.

E. Cant Strips: As recommended by manufacturer.

2.03 ACCESSORIES

A. Surface Conditioner: as recommended by membrane manufacturer.

B. Elastic Flashings: 1.2 as recommended by membrane manufacturer.

C. Joint and Crack Sealant: As recommended by membrane manufacturer.

D. Cant: as detailed on drawings.

2.04 PROTECTIVE MATERIALS

A. Protection Board: 3mm thick, asphalt impregnated board manufactured by W.R. Meadows.

B. Tack-free Surfacer: Normal Portland Cement.

C. Separation Sheet: Sheet polyethylene, 0.15 mm thick.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify surfaces are solid, free of frozen matter, loose particles, cracks, pits, rough projections, and foreign matter detrimental to adhesion and application of waterproofing.

B. Do not apply waterproofing to damp, frozen, dirty, dusty, or deck surfaces unacceptable to manufacturer and applicator.

C. Verify items, which penetrate surfaces to receive waterproofing, are securely installed.

D. Beginning of installation means acceptance of substrate.

3.02 PREPARATION

A. Clean and prepare surfaces to receive waterproofing, in accordance with manufacturer's instructions.

B. Apply mastic to seal penetrations, small cracks, and honeycomb in substrate.

C. Protect adjacent surfaces not designated to receive waterproofing.

D. Apply surface conditioner at a rate recommended by membrane manufacturer.

3.03 APPLICATION

A. Apply membrane in accordance with manufacturer's instructions.

B. Apply and spread membrane to minimum 2mm thickness, averaging 2.5mm in thickness.

C. Continue membrane up vertical surfaces minimum 150mm or as indicated on drawings.

D. Seal items projecting through membrane.

E. Install membrane flashing and seal into membrane.

F. Reinforce membrane over static or moving joints.

3.04 FIELD QUALITY CONTROL

A. On completion of horizontal membrane installation, dam installation in preparation for flood testing.

B. Flood to minimum depth of 30mm. with clean water. After 48 hours, check for leaks.

C. If leaking is found, patch using new waterproofing materials; repeat flood-test. Repair damage to building.

D. When area is proved watertight, drain water and remove dam.

3.05 PROTECTION

A. Immediately after cooling, dust membrane with Portland Cement at rate of approximately 4 kg/10 sq m.

B. Apply protection boards over cured membrane surface. Scribe boards around pipes and projections.

C. Close off area to prevent un-authorized traffic or work over membrane until final concrete topping is applied.

PART 4 – LOCATION OF THE WORKS

1 - In toilets, pantries and preparation areas, below tiling 2 – Below screed at delivery yard area 3 – Below cold rooms flooring in structurally recessed areas.

END OF DOCUMENT

SECTION 28 - ROOF ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Pressure plate.
2. Strainers.
3. Reglet.
4. Spout.
5. Roof access hatch.

B. Related Sections include the following:

1. Division 7 Section "Sheet Metal Flashing and Trim" for shop- and field-fabricated metal flashing and downspouts, fasciae and miscellaneous sheet metal trim and accessories.
2. Division 7 Section "EPDM Single-Ply Membrane Roofing ".

1.3 SUBMITTALS

A. **Product Data**: For each type of product indicated. Include construction details, materials, dimensions of individual components and profiles, and finishes.

B. **Shop Drawings**: Show fabrication and installation details. Indicate dimensions, weights, loadings, required clearances, method of field assembly, and components. Include plans, elevations, sections, details, and attachments to other Work.

C. **Coordination Drawings**: Roof plans drawn to scale and coordinating penetrations and roof-mounted items. Show the following:

1. Size and location of roof accessories specified in this Section.
2. Method of attaching roof accessories to roof or building structure.

3. Other roof-mounted items including mechanical and electrical equipment, ductwork, piping, and conduit.

D. Samples of all products covered in this Section.

1.4 QUALITY ASSURANCE

A. **Quality System**: Comply with ISO 9001/9002 Quality System as a minimum. Incorporate all the standard procedures supplied by the Engineer and the Employer.

B. **Installer Qualifications**: A qualified firm specializing in performing the work of this Section with minimum three years documented experience and that is approved, authorized, or licensed by the product manufacturer to install his product and that is eligible to receive manufacturer's warranty. Include project names and addresses, names and addresses of Engineers and Employers, and other information specified

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle components so they will not be damaged or deformed.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. **Aluminum Sheets and Plates**: ASTM B 209M for alclad alloy 3005H25 or alloy and temper required to suit forming operations, with mill finish, unless otherwise indicated.

B. **Extruded Aluminum**: ASTM B 221M alloy 6063-T52 or alloy and temper required to suit structural and finish requirements, with mill finish, unless otherwise indicated.

C. **Galvanized Steel Sheet**: ASTM A 653/A 653M with Z275 coating designation; commercial quality, unless otherwise indicated.

1. Structural Quality: Grade 275, where indicated or as required for strength.

D. **Insulation**: Manufacturer's standard rigid or semi rigid glass-fiber board of thickness indicated.

E. **Wood Nailers**: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, complying with AWPA C2; not less than 38 mm thick.

F. **Fasteners**: Same metal as metals being fastened, or nonmagnetic stainless steel or other non corrosive metal as recommended by manufacturer. Match finish of exposed fasteners with finish of material being fastened.

1. Where removing exterior exposed fasteners affords access to building, provide non removable fastener heads.

G. **Gaskets**: Manufacturer's standard tubular or fingered design of neoprene, EPDM, or PVC; or flat design of foam rubber, sponge neoprene, or cork.

H. **Bituminous Coating**: SSPC-Paint 12, solvent-type bituminous mastic, nominally free of sulfur and containing no asbestos fibers, compounded for 0.4-mm dry film thickness per coating.

I. **Mastic Sealant**: Polyisobutylene; nonhardening, nonskinning, nondrying, nonmigrating sealant.

J. **Elastomeric Sealant**: Generic type recommended by unit manufacturer that is compatible with joint surfaces; ASTM C 920, Type S, Grade NS, Class 25, and Uses NT, G, A, and, as applicable to joint substrates indicated, O.

2.3 ALUMINUM PRESSURE PLATE

A. Shall be aluminum section, 40 x 3 mm thick. Comply with details indicated.

2.4 ALUMINUM STRAINERS

A. Shall be fabricated from aluminum alloy extruded sections and bars to in welded constructions. Strainers are to be of dimensions and type approved by the Engineer.

2.5 CHANNEL (REGLET)

A. Shall be fabricated from galvanized steel sheets 0.8 mm thick, dovetailed channel section for casting into concrete, as shown on the Drawings, to receive edges of water proofing membrane and sealant.

2.6 SPOUTS

A. Shall be uPVC pipes, of diameter and details as indicated on Drawings.

2.7 ROOF HATCHES

A. **General**: Fabricate units to withstand 1.9- kPa external and 0.95-kPa internal loading pressure. Frame with minimum 225-mm- high, integral-curb, double-wall construction with 38- mm insulation, formed cants and cap flashing (roofing counterflashing), with welded or sealed mechanical corner joints. Provide double-wall cover (lid) construction with 25-mm- thick insulation core. Provide gasketing and equip with corrosion-resistant or hot-dip galvanized hardware including pintle hinges, hold-open devices, interior padlock hasps, and both interior and exterior latch handles.

B. **Type**: Single-leaf personnel access.

1. For Ladder Access: dimensions as indicated on Drawings.

C. **Material**: Galvanized steel sheets.

1. Finish: Prime painted.

2.8 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

2.9 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. **Class I, Clear Anodic Finish**: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating but 0.025 mm or thicker) complying with AAMA 611.

2.10 GALVANIZED STEEL SHEET FINISHES

A. Surface Preparation: Clean surfaces with non petroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas, and apply galvanizing repair paint specified below to comply with ASTM A 780.

1. Galvanizing Repair Paint: High-zinc-dust-content paint for re-galvanizing welds in steel, complying with SSPC-Paint 20.

B. Factory Priming for Field-Painted Finish: Where field painting after installation is indicated, apply the air-dried primer specified below immediately after cleaning and pre-treating.

1. Shop Primer: Exterior galvanized metal primer per Division 9 Section "Painting."

PART 3 - EXECUTION

3.1 INSTALLATION

A. **General**: Comply with manufacturer's written instructions. Coordinate installation of roof accessories with installation of roof deck, roof insulation, flashing, roofing membranes, penetrations, equipment, and other construction involving roof accessories to ensure that each element of the Work performs properly and that combined elements are waterproof and weather tight. Anchor roof accessories

securely to supporting structural substrates so they are capable of withstanding lateral and thermal stresses, and inward and outward loading pressures.

B. Install roof accessory items according to indicated on Drawings and approved shop drawings.

C. **Separation**: Separate metal from incompatible metal or corrosive substrates, including wood, by coating concealed surfaces, at locations of contact, with bituminous coating or providing other permanent separation.

D. **Flange Seals**: Unless otherwise indicated, set flanges of accessory units in a thick bed of roofing cement to form a seal.

E. **Cap Flashing**: Where required as component of accessory, install cap flashing to provide waterproof overlap with roofing or roof flashing (as counter flashing). Seal overlap with thick bead of mastic sealant.

3.2 CLEANING AND PROTECTION

A. Clean exposed surfaces according to manufacturer's written instructions. Touch up damaged metal coatings.

END OF DOCUMENTS

SECTION 29 – JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Related Drawing and Detail.

1.2 SUMMARY

A. This Section includes sealants for the applications indicated on Drawings and applications specified by reference to this Section.

B. Related Sections include the following:

1. Division 4 Section "Unit Masonry Assemblies" for masonry control and expansion joint fillers and gaskets.

2. Division 7 Section "Through-Penetration Fire-stop Systems" for fire-resistant building joint-sealant systems.

3. Division 7, "Sheet Metal Flashing and Trim" for sealing joints related to flashing and sheet metal for roofing.

4. Division 8 Section "Glazing" for glazing sealants.

5. Division 9 Section "Gypsum Board Assemblies" for sealing perimeter joints of gypsum board assemblies to reduce sound transmission.

6. Division 9 "Ceramic Tile" for sealing joints in ceramic tile.

7. Division 9 Section "Acoustical Panel Ceilings" for sealing edge moldings at perimeters of acoustical ceilings.

1.3 DEFINITIONS

A. **TRAFFICABLE SEALANT**: To qualify for traffic use under ASTM C 920 requirements, elastomeric sealants must demonstrate a shore A hardness of not less than 25 nor more than 50

B. **LOW MODULUS**: Tensile strength of 310 kPa or less.

C. **MEDIUM MODULUS**: Tensile strength of not less than 310 kPa or more than 517 kPa. Movement capabilities of ±50%

D. **HIGH MODULUS**: Tensile strength of more 517 kPa. Joint movement is limited to ±25% or less

1.4 PERFORMANCE REQUIREMENTS

A. Provide joint sealants that have been produced and installed to establish and maintain airtight continuous seals, that are water resistant and cause no staining or deterioration of joint substrates.

B. Sealant shall be compatible for adhesion with specified aluminum finishes, resin base paint, glass, stone, metal, ceramic tiles, anodized aluminum, galvanized steel and plastics such as polycarbonate and pvc etc.

C. Sealant shall be capable of withstanding dynamic movement of ± 50 %.

D. Bond width of the sealant shall be minimum 10 mm.

E. All exterior joints shall be filled with self expanding “Compriband”

F. Where required, use acoustical foam tape in conjunction with sealant.

G. Sealant shall be non-chalking and non-cracking. Based on performance, the sealant shall be non-fire hazard.

H. Sealants for joints that may be exposed to direct sun rays shall be UV-resistant.

I. Fire-Resistive Joint Sealants: Provide joint sealants with fire-resistance ratings indicated, as determined per ASTM E 119, but not less than that equaling or exceeding the fire-resistance rating of the construction in which the joint occurs.

1.5 SUBMITTALS

A. **Product Data**: For each joint-sealant product indicated.

B. **Samples for Initial Selection**: Manufacturer’s color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

C. **Samples for Verification**: For each type and color of joint sealant required. Install joint sealants in 13-mm- wide joints formed between two 150-mm- long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

D. **Product Certificates**: Signed by manufacturers of joint sealants certifying that products furnished comply with requirements and are suitable for the use indicated.

E. **Installer Certificates**: Signed by product manufacturer certifying that Installer is approved, authorized, or licensed by manufacturer to install his products.

F. **Installer Experience**: List of five projects (minimum) of a similar nature carried out successfully by the installer with the same product endorsed by the manufacturer's representative.

G. **Qualification Data**: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects/Consultants and owners, and other information specified.

H. **Preconstruction Field Test Reports**: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on preconstruction testing specified in "Quality Assurance" Article.

I. **Field Test Report Log**: For each elastomeric sealant application. Include information specified in "Field Quality Control" Article.

J. **Product Test Reports**: From a qualified testing agency indicating sealants comply with requirements and are compatible with joint substrates, shims, joints sealant backings, secondary seals and miscellaneous materials, based on comprehensive testing of current product formulations.

K. **Warranties**: Special warranties specified in this Section.

1.6 QUALITY ASSURANCE

A. **Quality System**: Comply with ISO 9001/9002 Quality System as a minimum. Incorporate all the standard procedures supplied by the Consultant and the Employer.

B. **Installer Qualifications**: An experienced installer who has specialized in installing joint sealants similar in material, design, and extent to those indicated for this Project and whose work has resulted in joint-sealant installations with a record of successful in-service performance.

C. **Source Limitations**: Obtain each type of joint sealant through one source from a single manufacturer.

D. **Product Testing**: Obtain test results for "Product Test Reports" Paragraph in "Submittals" Article from a qualified testing agency based on testing current sealant formulations within a 36-month period.

1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated, as documented according to ASTM E 548.

2. Test elastomeric joint sealants for compliance with requirements specified by reference to ASTM C 920, and where applicable, to other standard test methods.

3. Test elastomeric joint sealants according to SWRI's Sealant Validation Program for compliance with requirements specified by reference to ASTM C 920 for adhesion and cohesion under cyclic movement, adhesion-in peel, and indentation hardness.

4. Test other joint sealants for compliance with requirements indicated by referencing standard specifications and test methods.

5. Include test results performed on joint sealants after they have cured for 1 year.

E. **Preconstruction Field-Adhesion Testing**: Before installing elastomeric sealants, field test their adhesion to joint substrates as follows:

1. Locate test joints where indicated or, if not indicated, as directed by Consultant.

2. Conduct field tests for each application indicated below:

   a. Each type of elastomeric sealant and joint substrate indicated.

   b. Each type of non-elastomeric sealant and joint substrate indicated.

3. Notify Consultant seven days in advance of dates and times when test joints will be erected.

4. Arrange for tests to take place with joint sealant manufacturer's technical representative present.

5. Test Method: Test joint sealants by hand-pull method described below:

   a. Install joint sealants in 1500-mm- long joints using same materials and methods for joint preparation and joint-sealant installation required for the completed Work. Allow sealants to cure fully before testing.

   b. Make knife cuts from one side of joint to the other, followed by two cuts approximately 50 mm long at sides of joint and meeting cross cut at one end. Place a mark 25 mm from cross-cut end of 50-mm piece.

   c. Use fingers to grasp 50-mm piece of sealant between cross-cut end and 25-mm mark; pull firmly at a 90-degree angle or more in direction of side cuts while holding a ruler along side of sealant. Pull sealant out of joint to the distance recommended by sealant manufacturer for testing adhesive capability, but not less than that equaling specified maximum movement capability in extension; hold this position for 10 seconds.

   d. For joints with dissimilar substrates, check adhesion to each substrate separately. Do this by extending cut along one side, checking adhesion to opposite side, and then repeating this procedure for opposite side.

6. Report whether sealant in joint connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.

7. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

F. **Mockups**: Before installing joint sealants, apply elastomeric sealants as follows to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution:

1. Joints in mockups of assemblies specified in other Sections that are indicated to receive elastomeric joint sealants, which are specified by reference to this Section.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multicomponent materials.

B. Store and handle materials in compliance with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.8 PROJECT CONDITIONS

A. **Environmental Limitations**: Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer.

2. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 4.4 deg C.

3. When joint substrates are wet.

B. **Joint-Width Conditions**: Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.

C. **Joint-Substrate Conditions**: Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

1.9 SEQUENCE AND SCHEDULING

A. Sequence installation of joint sealants to occur not less than 21 nor more than 30 days after completion of waterproofing, unless otherwise indicated.

1.10 WARRANTY

A. **General Warranty**: Special warranties specified in this Article shall not deprive Employer of other rights Employer may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. **Special Installer's Warranty**: Written warranty, signed by Installer agreeing to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

C. **Special Manufacturer's Warranty**: Written warranty, signed by elastomeric sealant manufacturer agreeing to furnish elastomeric joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: 10 years from date of Substantial Completion.

D. Special warranties specified in this Article exclude deterioration or failure of elastomeric joint sealants from the following:

1. Movement of the structure resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression caused by structural settlement or errors attributable to design or construction.

2. Disintegration of joint substrates from natural causes exceeding design specifications.

3. Mechanical damage caused by individuals, tools, or other outside agents.

4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. **Compatibility**: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.

B. **Colors of Exposed Joint Sealants**: As selected by Consultant from manufacturer's full range for this characteristic.

2.2 SOLVENT-RELEASE-CURING JOINT SEALANTS

A. **Acrylic Sealant**: Manufacturer's standard one-part, nonsag, solvent-release-curing acrylic terpolymer sealant complying with AAMA 808.3 or FS TT-S-00230 or both, with capability when tested for adhesion and cohesion under maximum cyclic movement per ASTM C 719, to withstand the following percentage change in joint width existing at time of application and remain adhered to joint substrates indicated for Project without failing cohesively:

1. 12-1/2 percent movement in both extension and compression for a total of 25 percent.

2.3 ELASTOMERIC JOINT SEALANTS

A. **Elastomeric Sealant Standard**: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant in the Elastomeric Joint-Sealant Schedule at the end of Part 3, including those referencing ASTM C 920 classifications for type, grade, class, and uses.

B. **Additional Movement Capability**: Where additional movement capability is specified in the Elastomeric Joint-Sealant Schedule, provide products with the capability, when tested for adhesion and cohesion under maximum cyclic movement per ASTM C 719, to withstand the specified percentage change in the joint width existing at the time of installation and remain in compliance with other requirements of ASTM C 920 for uses indicated.

C. **Stain-Test-Response Characteristics**: Where elastomeric sealants are specified in the Elastomeric Joint-Sealant Schedule to be non-staining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

D. **Suitability for Contact with Food**: Where elastomeric sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.

E. **Suitability for Immersion in Liquids**. Where elastomeric sealants are indicated for Use I for joints that will be continuously immersed in liquids, provide products that have undergone testing according to ASTM C 1247 and qualify for the length of exposure indicated by reference to ASTM C 920 for Class 1 or 2. Liquid used for testing sealants is deionized water, unless otherwise indicated.

2.4 ACOUSTICAL JOINT SEALANTS

A. **Acoustical Sealant for Exposed and Concealed Joints**: For each product of this description indicated in the Acoustical Joint-Sealant Schedule at the end of Part 3,

provide manufacturer's standard non-sag, paintable, non-staining latex sealant complying with ASTM C 834 and the following:

1. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

2.5 LATEX JOINT SEALANTS

A. **Latex Sealant Standard**: Comply with ASTM C 834

2.6 JOINT-SEALANT BACKING

A. **General**: Provide sealant backings of material and type that are non-staining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. **Cylindrical Sealant Backings**: ASTM C 1330, of type indicated below and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:

1. Proprietary, reticulated, closed-cell polymeric foam, nonoutgassing, with a density of 40 kg/cu. m and tensile strength of 241 kPa in accordance with ASTM D 1623, and with water absorption less than 0.02 g/cc in accordance with ASTM C 1083.

C. **Bond-Breaker Tape**: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

D. **Elastomeric Tubing Joint Backings**: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D 1056, nonabsorbent to water and gas, capable of remaining resilient at temperatures down to -32 deg C. Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and otherwise contribute to optimum sealant performance.

2.7 MISCELLANEOUS MATERIALS

A. **Primer**: Material recommended by joint sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. **Cleaners for Nonporous Surfaces**: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants with joint substrates.

C. **Masking Tape**: Non-staining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. **Surface Cleaning of Joints**: Clean out joints immediately before installing joint sealants to comply with joint sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.

2. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air. Porous joint surfaces include the following:

    a. Concrete.

    b. Masonry.

    c. Unglazed surfaces of ceramic tile.

3. Remove laitance and form-release agents from concrete.

4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.

    a. Metal.

    b. Glass.

    c. Porcelain enamel.

d. Glazed surfaces of ceramic tile.

B. **Joint Priming**: Prime joint substrates where recommended in writing by joint sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. **Masking Tape**: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. **General**: Comply with joint sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. **Sealant Installation Standard**: Comply with recommendations of ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. **Acoustical Sealant Application Standard**: Comply with recommendations of ASTM C 919 for use of joint sealants in acoustical applications as applicable to materials, applications, and conditions indicated.

D. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.

2. Do not stretch, twist, puncture, or tear sealant backings.

3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

E. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and back of joints.

F. Install sealants by proven techniques to comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.

2. Completely fill recesses provided for each joint configuration.

3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

G. **Tooling of Non-sag Sealants**: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealants from surfaces adjacent to joint.

2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.

3. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.

4. Provide flush joint configuration, per Figure 5B in ASTM C 1193, where indicated.

5. Provide recessed joint configuration, per Figure 5C in ASTM C 1193, of recess depth and at locations indicated.

   a. Use masking tape to protect adjacent surfaces of recessed tooled joints.

3.4 FIELD QUALITY CONTROL

A. Field-Adhesion Testing: Field-test joint-sealant adhesion to joint substrates as follows:

1. Extent of Testing: Test completed elastomeric sealant joints as follows:

   a. Perform 10 tests for the first 300 m of joint length for each type of elastomeric sealant and joint substrate.

   b. Perform one test for each 300 m of joint length thereafter or one test per each floor per elevation.

2. **Test Method**: Test joint sealants by hand-pull method described below:

   a. Make knife cuts from one side of joint to the other, followed by two cuts approximately 50 mm long at sides of joint and meeting cross cut at one end. Place a mark 25 mm from cross-cut end of 50-mm piece.

   b. Use fingers to grasp 50-mm piece of sealant between cross-cut end and 25-mm mark; pull firmly at a 90-degree angle or more in direction of side cuts while holding a ruler along side of sealant. Pull sealant out of joint to the distance recommended by sealant manufacturer for testing adhesive capability, but not less than that equaling specified maximum movement capability in extension; hold this position for 10 seconds.

c. For joints with dissimilar substrates, check adhesion to each substrate separately. Do this by extending cut along one side, checking adhesion to opposite side, and then repeating this procedure for opposite side.

3. Inspect joints for complete fill, for absence of voids, and for joint configuration complying with specified requirements. Record results in a field adhesion test log.

4. Inspect tested joints and report on the following:

a. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate. Compare these results to determine if adhesion passes sealant manufacturer's field- adhesion hand-pull test criteria.

b. Whether sealants filled joint cavities and are free from voids.

c. Whether sealant dimensions and configurations comply with specified requirements.

5. Record test results in a field adhesion test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.

6. Repair sealants pulled from test area by applying new sealants following same procedures used to originally seal joints. Ensure that original sealant surfaces are clean and new sealant contacts original sealant.

B. **Evaluation of Field-Test Results**: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements, will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.5 SEALANT INSTALLATION SCHEDULE

A. **General**: Unless otherwise indicated, install sealants at the following locations. For locations and applications not specified, install sealants of types recommended by the joint sealant manufacturer.

B. **Exterior Joints**:

1. Non-Traffic Joints: One-part non-sag urethane sealant.

2. Joints Subject to Traffic: Multi-part pourable urethane sealant.

C. Interior Joints:

1. Joints Subject to Traffic: Multi-part pourable urethane sealant.

2. Non-Traffic Joints:

   a. Joints Subject to Movement of 10 to 25 Percent: One-part non-sag urethane sealant.

   b. Joints Subject to Movement Under 10 Percent: Acrylic sealant.

3. Tiled Areas and Areas Subject to Attack by Mildew: One-part mildew-resistant silicone sealant.

4. Acoustical Rated Assemblies: Use acoustical sealant for sealing joints through and around acoustical rated assemblies.

5. Paintable Wall Joints: Acrylic sealant.

6. Sealants Subject to Contact with Food: Comply with requirements in Clause 2.3/D of this Section.

7. Sealants Subject to Water Immersion: Comply with requirements in Clause 2.3/E of this Section.

3.6 CLEANING

A. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.7 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from the original work.

END OF DOCUMENT

SECTION 30 – CUSTOM STEEL DOOR AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Related Drawing and Detail.

1.2 SUMMARY

A. This Section includes the following:

1. Steel doors.
2. Steel door frames.
3. Fire-rated door and frame assemblies.
4. Fire-rated window assemblies.
5. Louvers in doors. Steel louvered door.

B. Related Sections include the following:

1. Division 4 Section "Unit Masonry Assemblies" for building anchors into and grouting frames in masonry construction.
2. Division 8 Section "Door Hardware" for door hardware and weather stripping.
3. Division 8 Section "Glazing" for glass in doors.

1.3 PERFORMANCE REQUIREMENTS

A. **Fire-Rated Door Assemblies**: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to the Consultant, for fire ratings indicated, based on testing according to NFPA 252.

1. Test Pressure: Test at atmospheric pressure.
2. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies provide certification by a testing agency acceptable to authorities having jurisdiction that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
3. Temperature-Rise Rating: If indicated, provide doors that have a temperature-rise rating of 250 deg C maximum in 30 minutes of fire exposure.

B. **Fire Resisting Door Components**: All components of fire resisting doors and assemblies, including but not limited to: door leaves, frames, ironmongery, hardware and glazing, shall carry identifying labels of an approved independent testing and inspection agency or laboratory, confirming their individual fire resistance rating. The rating of all door components shall be equal to the rating of the door assembly.

C. **Fire Resisting Door Closers**: All fire resisting doors shall be fitted with door closers that automatically close and positively latch the door. In case of double-leaf doors, the closing system shall ensure that the inactive door leaf (door leaf with strike) closes first prior to active door leaf (door leaf with lock).

D. Fire rated door assemblies that are tested and certified according to British Standard Specifications (BS) shall also be accepted.

E. Weather Stripping: provide weather seals to all external doors.

F. Smoke-Control Door Assemblies: Comply with NFPA 105.

1.4 SUBMITTALS

A. **Product Data**: Include construction details, material descriptions, core descriptions, label compliance, sound and fire-resistance ratings, and finishes for each type of door and frame specified.

B. **Shop Drawings**: Show fabrication and installation of doors and frames. Include details of each frame type, elevations of door design types, conditions at openings, details of construction, dimensions of profiles and hardware preparation, location and installation requirements of door and frame hardware and reinforcements, and details of joints and connections. Show anchorage and accessories.

C. **Door Schedule**: Submit schedule of doors and frames using same reference numbers for details and openings as those on Drawings.

1. Coordinate glazing frames and stops with glass and glazing requirements.

D. **Samples for Initial Selection**: Manufacturer's color charts showing the full range of finishes or colors available for units with factory-applied color finishes.

E. **Samples for Verification**: For each type of exposed finish required, prepared on Samples not less than 75 by 125 mm and of same thickness and material indicated for the Work. If finishes involve normal color and texture variations, include sample sets showing the full range of variations expected.

F. **Construction Samples**: Approximately 300 by 300 mm, representing the required construction of doors and frames for Project.

1. Doors: Show vertical-edge, top, and bottom construction; insulation; face stiffeners; and hinge and other applied hardware reinforcement. Include louver section and glazing stops if applicable.

2. Frames: Show profile, welded corner joint, welded hinge reinforcement, dust-cover boxes, floor and wall anchors, stops, and silencers. Include panel and louver sections and glazing stops if applicable.

G. **Product Certificates**: Signed by manufacturers of doors certifying that products furnished comply with or exceed the acceptance criteria of ANSI A250.4 for Level A doors.

H. **Oversize Construction Certification**: For door assemblies required to be fire rated and exceeding limitations of labeled assemblies, submit certification of a testing agency acceptable to authorities having jurisdiction that each door and frame assembly has been constructed to comply with design, materials, and construction equivalent to requirements for labeled construction.

1.5 QUALITY ASSURANCE

A. **Quality System**: Comply with ISO 9001/9002 Quality System as a minimum. Incorporate all the standard procedures supplied by the Consultant and the Employer.

B. **Manufacturer Qualifications**: A firm experienced in manufacturing custom steel doors and frames similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

C. **Mockups**: Before installing custom steel doors and frames, build mockups to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for the completed Work:

1. Build mockups in the location indicated or, if not indicated, as directed by Consultant.

2. Build mockups for each custom steel doors and frames, and anchorage system components.

3. Notify Consultant seven days in advance of dates and times when mockups will be constructed.

4. Obtain Consultant’s approval of mockups before fabricating custom steel doors and frames.

5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.

6. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 WARRANTY

A. **Door Manufacturer's Warranty**: Provide written Warranty, signed by manufacturer, Installer, and Contractor, agreeing to repair or replace defective doors that do not fulfill quality and performance requirements or do not comply with tolerances in referenced quality standard such as, but not limited to:

1. Structural failures.

2. Faulty operation of movable parts and hardware.

3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

B. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.

1. Warranty Period: Three years from date of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver doors and frames palleted, wrapped, or crated to provide protection during transit and Project site storage. Do not use nonvented plastic.

B. Inspect doors and frames, on delivery, for damage. Minor damage may be repaired provided refinished items match new work and are approved by Consultant; otherwise, remove and replace damaged items as directed.

C. Store doors and frames under cover at building site. Place units on minimum 100-mm- high wood blocking. Avoid using nonvented plastic or canvas shelters that could create a humidity chamber. If wrappers on doors become wet, remove cartons immediately. Provide minimum 6-mm spaces between stacked doors to permit air circulation.

PART 2 - PRODUCTS

2.1 MATERIALS

A. **Metallic-Coated Steel Sheets**: ASTM A 653/A 653M, CS (commercial steel), Type B; with Z180 zinc (galvanized) or ZF180 zinc-iron-alloy (galvannealed) coating.

B. **Inserts, Bolts, and Fasteners**: Manufacturer's standard units. Where items are to be built into exterior walls, zinc coat according to ASTM A 153/A 153M, Class C or D as applicable.

2.2 DOORS

A. **General**: Provide flush-design doors, minimum 44 mm thick, of seamless construction, unless otherwise indicated. Construct doors with smooth, flush surfaces without visible joints or seams on exposed faces or stile edges.

1. Visible joints or seams around glazed or louvered panel inserts are permitted.

2. For single-acting swing doors, bevel both vertical edges 3 mm in 50 mm.

3. For double-acting swing doors, round vertical edges with 54-mm radius.

B. **Metallic Core Construction**: Provide the following core construction welded to both door faces:

1. Steel-Stiffened Core: Galvanized steel vertical stiffeners extending full-door height, spaced not more than 150 mm apart and spot welded to face sheets a maximum of 150 mm o.c. Fill spaces between stiffeners with rockwool insulation of minimum 96.00 kg/cu. m density applied to inside surfaces of face sheets.

2. Use for all doors internal and external.

3. Thickness of vertical stiffeners shall be equal to or more than thickness of door skins

C. **Fire Door Cores**: As required to provide fire-protection and temperature-rise ratings indicated.

D. **Astragals**: As required by NFPA 80 to provide fire ratings indicated. Comply with requirements specified in Division 8, section "Hardware"

E. **Top and Bottom Channels**: Spot weld metal channel not less than thickness of face sheet to face sheets not more than 150 mm o.c.

1. Reinforce tops and bottoms of doors with inverted horizontal channels of same material as face sheet so flanges of channels are even with bottom and top edges of face sheets.

2. For exterior doors, close bottom edge with metallic-coated steel closing channel and top edge with filler channel of same material, so webs of channels are flush with bottom and top door edges.

F. **Hardware Reinforcement**: Fabricate reinforcing plates from the same material as door to comply with the following:

1. Hinges and Pivots: 4.2 mm thick by 38 mm wide by 150 mm longer than hinge, secured by not less than 6 spot welds.

2. Lock Face, Flush Bolts, Closers, and Concealed Holders: 2.3 mm thick.

3. All Other Surface-Mounted Hardware: 1.3 mm thick.

G. **Interior Doors**: Fabricate face sheets of doors from two 1.30-mm- thick metallic-coated, cold-rolled, stretcher-leveled steel sheets and other metal components from hot- or cold-rolled steel sheets.

H. Thickness of face sheets for fire rated interior doors shall be as recommended by manufacturer to obtain fire rating indicated, but not less than 1.30 mm.

I. Thickness of face sheets for interior steel doors to receive armor plates shall be 1.60 mm.

J. **Exterior Steel Doors**: Fabricate face sheets of doors from two 1.6-mm- thick, stretcher-leveled, metallic-coated steel sheets. Provide weep-hole openings in bottom of doors to permit entrapped moisture to escape. Seal joints in top edges of doors against water penetration.

2.3 FRAMES

A. Fabricate frames of full-welded unit construction, with corners mitered, reinforced, and continuously welded full depth and width of frame. Knockdown frames are not acceptable.

1. For exterior use, form frames from 2.00-mm- thick, metallic-coated cold-rolled steel sheets.

2. For interior use, form frames from metallic-coated cold-rolled steel sheet of the following thicknesses:

a. Openings up to and Including 1200 mm Wide: 1.60 mm.

b. Openings More Than 1200 mm Wide: 1.7 mm.

B. **Hardware Reinforcement**: Fabricate from same material as frame. Minimum thickness of steel reinforcing plates for the following hardware:

1. Hinges and Pivots: 4.2 mm thick by 38 mm wide by 150 mm longer than hinge, secured by not less than 6 spot welds.

2. Strikes, Flush Bolts, and Closers: 2.3 mm.

3. Surface-Mounted Hold-Open Arms and Panic Devices: 2.3 mm.

C. **Mullions and Transom Bars**: Provide closed or tubular mullions and transom bars where indicated. Fasten mullions and transom bars at crossings and to jambs by butt welding. Reinforce joints between frame members with concealed clip angles or sleeves of same metal and thickness as frame.

1. Provide false head member to receive lower ceiling where frames extend to finish ceilings of different heights.

D. **Head Reinforcement**: Where installed in masonry, leave vertical mullions in frames open at top for grouting.

E. **Jamb Anchors**: Weld jamb anchors to frames near hinges and directly opposite on strike jamb as required to secure frames to adjacent construction.

1. In-Place Concrete or Masonry: Anchor frame jambs with minimum 9-mm-diameter concealed bolts into expansion shields or inserts 150 mm from top and bottom and 650 mm o.c., unless otherwise indicated. Reinforce frames at anchor locations. Except for fire-rated openings, apply removable stop to cover anchor bolts, unless otherwise indicated.

F. **Floor Anchors**: Provide floor anchors for each jamb and mullion that extends to floor, formed of same material as frame, 1.7 mm thick, as follows:

1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners, welded to bottom of jambs and mullions.

2. Cement-Based Screeds: Adjustable type with extension clips, allowing not less than 50-mm height adjustment. Terminate bottom of frames at finish floor surface.

G. **Head Anchors**: Provide 2 head anchors for frames more than 1066 mm wide and mounted in steel-stud walls.

H. **Head Strut Supports**: Provide 9-by-50-mm vertical steel struts extending from top of frame at each jamb to supporting construction above, unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction above. Provide adjustable wedged or bolted anchorage to frame jamb members.

I. **Structural Reinforcing Members**: Provide as part of frame assembly, where indicated at mullions, transoms, or other locations to be built into frame.

J. **Head Reinforcement**: For frames more than 1200 mm wide in masonry wall openings, provide continuous steel channel or angle stiffener, 2.3 mm thick for full width of opening, welded to back of frame at head.

K. **Spreader Bars**: Provide removable spreader bar across bottom of frames, tack welded to jambs and mullions.

L. **Rubber Door Silencers**: Except on weather-stripped doors, drill stop in strike jamb to receive three silencers on single-door frames and drill head jamb stop to receive two silencers on double-door frames. Install plastic plugs to keep holes clear during construction. Silencers shall be neoprene, UL-rated for fire doors.

M. **Plaster Guards**: Provide 0.4-mm- thick plaster guards or dust-cover boxes of same material as frame, welded to frame at back of hardware cutouts to close off interior of openings and prevent mortar or other materials from obstructing hardware operation.

N. External frames shall have continuous grooves along perimeter to house weather stripping.

2.4 LOUVERS

A. **Door Louvers**: Fabricate louvers and mount flush into doors without overlapping moldings on surface of door face sheets. Provide internal support as recommended by louver manufacturer. Prime paint steel louvers after fabrication.

1. Interior Louvers: Sightproof, stationary type, constructed of inverted Y-shaped blades formed of same material as door.

    a. Steel: 1.00 mm thick.

B. **Fire-Rated Automatic Louvers**: Sight proof louver inserts fabricated from 1.3-mm-thick steel, spring operated, and released by 57 deg C fusible links listed and labeled for use in fire-rated door assemblies of type and fire-resistance rating indicated by the same testing and inspecting agency that established fire-resistance rating of door assembly.

2.5 STOPS AND MOLDINGS

A. Provide stops and moldings around solid, glazed, and louvered panels where indicated.

B. Form fixed stops and moldings integral with frame, unless otherwise indicated.

C. Provide removable stops and moldings where indicated or required, formed of 0.8-mm- thick steel sheets matching steel frames. Secure with countersunk flat or oval head machine screws spaced uniformly not more than 300 mm o.c. Form corners with butted hairline joints.

D. Coordinate rabbet width between fixed and removable stops with type of glass or panel and type of installation indicated.

2.6 FABRICATION

A. Fabricate doors and frames rigid, neat in appearance, and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles. Weld exposed joints continuously; grind, fill, dress, and make smooth, flush, and invisible. Where practical, fit and assemble units in manufacturer's plant. Clearly identify work that cannot be permanently factory assembled before shipment, to assure proper assembly at Project site.

1. Fabricate doors to comply with acceptance criteria of ANSI A250.4 for a Level A door.

B. For doors with metallic core construction, weld cores to both door face sheets.

C. For doors with nonmetallic core construction, laminate core material to both door face sheets with waterproof adhesive.

D. **Exposed Fasteners**: Provide countersunk flat or oval heads for exposed screws and bolts, unless otherwise indicated.

E. **Thermal-Rated (Insulating) Assemblies**: At exterior locations and elsewhere as shown or scheduled, provide doors and frames fabricated as thermal-insulating assemblies and tested according to ASTM C 236 or ASTM C 976.

1. Provide thermal-rated assemblies with U-factor matching that of the assembly involving door.

F. **Hardware Preparation**: Prepare doors and frames to receive hardware, including cutouts, reinforcement, mortising, drilling, and tapping, according to final hardware schedule and templates provided by hardware supplier. Comply with applicable

requirements of ANSI A115 Series specifications for door and frame preparation for hardware.

1. Reinforce doors and frames to receive surface-applied hardware. Drilling and tapping for surface-applied hardware may be done at Project site.

2. Locate hardware as indicated or, if not indicated, according to HMMA 831, "Recommended Hardware Locations for Custom Hollow Metal Doors and Frames."

G. **Electrical Closets Doors**: Are to comply with the following requirements:

1. Doors are to be proprietary, labeled as one (1) hour fire resistance rated and complying with requirements specified in this Section.

2. Frames are to be integral with sill to be anchored to underlying sill construction.

2.7 STEEL LOUVERED DOOR:

A. General: Are to heavy-duty construction, stile-and-rail door leaves with prefabricated framed steel louver panels mechanically fixed flush with stiles and rail of the door leaves.

1. Stiles and rails are to of tubular construction with sound deadening core material. Stiles and top rail are to be 75 mm wide, bottom rail 250 mm high, unless otherwise indicated on Drawings.

2. Stiles and rails are to be from galvanized sheet steel as specified, 1.30 mm thick minimum. Reinforcement for hinge installation is to be minimum 4.00 thick galvanized steel plates. Drilling and tapping for surface applied ironmongery may be done on Project Site.

3. Louver panels are to be pre-fabricated panels from galvanized steel sheets as specified in this Section comprising tubular frame and fixed Z-shaped, blades, 1.60 mm thick minimum, in welded construction. Free area shall not be less than 43%.

4. Furnish doors with louver panels pre-assembled and finished with factory applied baked enamel system including corrosion inhibiting protective coating and baked-on polyester topcoat of minimum dry film thickness of 60 microns. Color is to be selected by the Consultant.

5. Louver panel fasteners are to be galvanized steel of matching finish.

2.8 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for cleaning, treating, priming, and when specified, finishing.

B. Finish products specified in this Section after fabrication.

2.9 METALLIC-COATED STEEL FINISHES

A. **Surface Preparation**: Clean surfaces with non-petroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas, and apply galvanizing repair paint specified below to comply with ASTM A 780.

1. Galvanizing Repair Paint: High-zinc-dust-content paint for re-galvanizing welds in steel, complying with SSPC-Paint 20.

B. **Factory-Applied Finish**: Immediately after cleaning and pre-treating, apply manufacturer's standard two-coat, air-dried-enamel, baked-enamel, or polyester finish consisting of prime coat and topcoat that complies with ANSI A250.3 acceptance criteria. Comply with paint manufacturer's instructions for applying and baking to achieve a minimum dry film thickness of 0.03 mm for topcoat.

1. Color and Gloss: As selected by Consultant from manufacturer's full range.

PART 3 - EXECUTION

3.1 INSTALLATION

A. **General**: Install doors and frames according to DHI A115.IG and manufacturer's written instructions.

B. **Frames**: Install steel frames for doors, transoms, sidelights, borrowed lights, and other openings, of size and profile indicated.

1. Where frames are fabricated in sections due to shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.

2. Install frames with removable glazing stops located on secure side of opening.

3. Install door silencers in frames before grouting.

4. Remove temporary braces necessary for installation only after frames have been properly set and secured.

5. Check plumb, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.

6. Apply bituminous coating to backs of frames that are filled with mortar, grout, and plaster containing anti-freezing agents.

7. Set masonry anchorage devices where required for securing frames to in-place concrete or masonry construction.

a. Set anchorage devices opposite each anchor location according to details on Shop Drawings and anchorage device manufacturer's written instructions. Leave drilled holes rough, not reamed, and free of dust and debris.

8. Floor anchors may be set with powder-actuated fasteners instead of masonry anchorage devices and machine screws, if so indicated on Shop Drawings.

9. Placing Frames: Set frames accurately in position; plumb; align, and brace securely until permanent anchors are set. After wall construction is complete, remove temporary braces and spreaders, leaving surfaces smooth and undamaged.

    a. At existing concrete or masonry construction, set frames and secure in place with machine screws and masonry anchorage devices.

    b. At fire-rated openings, install frames according to NFPA 80.

    c. Field splice only at approved locations. Weld, grind, and finish as required to conceal evidence of splicing on exposed faces.

    d. Remove spreader bars from each frame only after frame is properly set and secured.

10. Hollow core of frames shall be fully filled with cement sand grout.

11. Metal-Stud Partitions: Solidly pack mineral-fiber insulation behind frames.

12. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with mortar as specified in Division 4 Section "Unit Masonry Assemblies."

13. Concrete Walls: Solidly fill space between frames and concrete with grout. Install grout in lifts and take precautions, including bracing frames, to ensure that frames are not deformed or damaged by grout forces.

14. In-Place Concrete or Masonry Construction: Secure frames in place with post installed expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.

15. In-Place Gypsum Board Partitions: Secure frames in place with post installed expansion anchors through floor anchors at each jamb. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.

16. Ceiling Struts: Extend struts vertically from top of frame at each jamb to supporting construction above, unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction above. Provide adjustable wedged or bolted anchorage to frame jamb members.

C. **Doors**: Fit non-fire-rated doors accurately in their respective frames, with the following clearances:

1. Jambs and Head: 2 mm.

2. Meeting Edges, Pairs of Doors: 3 mm.

3. Bottom: 9 mm, if no threshold or carpet.

4. Bottom: 3 mm, at threshold or carpet.

D. **Fire-Rated Doors**: Install with clearances as specified in NFPA 80.

E. **Smoke Control Doors**: Install according to NFPA 105.

3.2 ADJUSTING AND CLEANING

A. **Final Adjustments**: Check and readjust operating hardware items just before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including doors or frames that are warped, bowed, or otherwise unacceptable.

B. **Factory-Finish Touchup**: Immediately after erection, sand to feather-edge minor scratched, chipped, or damaged areas and apply touchup of compatible air-drying paint. Minor finish imperfections may be repaired provided finish matches new work finish and is approved by Consultant; otherwise, remove and replace.

END OF DOCUMENT

SECTION 31 – WOODEN DOORS

PART 1 - GENERAL SECTION

1.1 RELATED DOCUMENTS

A. Related Drawing and Detail.

1.2 SUMMARY

A. This Section includes the following:

1. Non-fire-rated flush wood doors of semi-solid core.
2. Shop priming flush wood doors.
3. Factory fitting flush wood doors to frames and factory machining for hardware.
4. Louvers for flush wood doors.

B. Related Sections include the following:

1. Division 8 Section “Steel Doors and Frames” for steel frames to receive flush wood doors.
2. Division 8 Section "Door Hardware" hardware for flush wood doors.
3. Division 8 Section "Glazing" for glass view panels in flush wood doors.
4. Division 9 Section "Painting".

1.3 SUBMITTALS

A. Product Data: For each type of door. Include details of core and edge construction, trim for openings, and louvers.

1. Include factory-finishing specifications.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.

1. Indicate dimensions and locations of mortises and holes for hardware.
2. Indicate dimensions and locations of cutouts.

3. Indicate doors to be factory finished and finish requirements.

C. Samples for Initial Selection: Color charts consisting of actual materials in small sections for the following:

1. Faces of factory-finished doors with opaque finish. Show the full range of colors available.

D. Samples for Verification: As follows:

1. Corner sections of doors approximately 200 by 250 mm with door faces and edgings representing the typical range of color and grain for each species of veneer and solid lumber required. Finish sample with same materials proposed for factory-finished doors.

2. Louver blade and frame sections, 150 mm long, for each material and finish specified.

3. Frames for light openings, 150 mm long, for each material, type, and finish required.

1.4 QUALITY ASSURANCE

A. Quality System: Comply with ISO 9001/9002 Quality System as a minimum. Incorporate all the standard procedures supplied by the Consultant and the Employer.

B. Source Limitations: Obtain flush wood doors through one source from a single manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect doors during transit, storage, and handling to prevent damage, soiling, and deterioration. Comply with requirements of referenced standard and manufacturer's written instructions.

1. Individually package doors in plastic bags or cardboard cartons.

2. Individually package doors in cardboard cartons and wrap bundles of doors in plastic sheeting.

B. Mark each door with individual opening numbers used on Shop Drawings. Use removable tags or concealed markings.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until building is enclosed, wet-work is complete, and HVAC system is operating and will maintain temperature

and relative humidity at occupancy levels during the remainder of the construction period.

B. Environmental Limitations: Do not deliver or install doors until conditions for temperature and relative humidity have been stabilized and will be maintained in storage and installation areas during the remainder of the construction period to comply with requirements of the referenced quality standard for Project's geographical location.

1.7 WARRANTY

A. Door Manufacturer's Warranty: Provide written Warranty, signed by manufacturer, Installer, and Contractor, agreeing to repair or replace defective doors that have warped (bow, cup, or twist) more than 6.5 mm in a 1100-by-2100-mm section or that show telegraphing of core construction in face veneers exceeding 0.25 mm in a 75-mm span, or do not comply with tolerances in referenced quality standard.

1. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.

2. Warranty shall be in effect during the following period of time after the date of Substantial Completion:

a. Semi-solid-core Interior Doors: Two years.

PART 2 - PRODUCTS

2.1 WOODS, GENERAL

A. Woods shall be marked-on as Class-1 stocks which shall be properly treated, adequately seasoned and free from roy or insect attack, splits, shakes or checks, warping, twisting, chipping, loose knots and waming. Provide woods of wane-free edges. Woods shall conform to the requirements of BS EN No. 942; plywood to BS EN No. 636.

B. **Preservative Treatment**: All woods and plywood used shall be preservative treated. Application is to be carried out after cutting and machining, but before assembly, by a processor licensed by the treatment solution manufacturer. Solution strengths and treatment by pressure, vacuum or immersion process are to be selected to achieve service life and to suit wood treatability. Moisture content of wood at time of treatment is to be as specified for use in the work. After treatment, allow wood to dry before use. For each batch of wood, provide certificate of assurance that treatment has been carried out as specified.

C. Softwoods

1. Douglas Fir: Yellowish Brown wood of average intensity not less than 570 kg/m3 at 12% moisture content.

2. Whitewood: White/pale Yellowish Brown wood of average intensity of 470 kg/m3.

3. Or as directed by the Architect.

D. Hardwoods

1. White Oak Wood: Yellowish Brown, fine-grained wood of strong, compact, homogenous fibers and uniform texture. Average intensity shall not be less than 720 kg/m3 at 12% moisture content. Or as directed by the Architect.

E. Plywood

1. General: Shall be highest grade to BS EN 636, designated as veneer, with minimal imperfections as peeled. Moisture content shall not exceed 12%. Thickness shall be as specified. Employ plywood glued with INT glues to BS 1203.

2. Softwood Plywood: All layers shall be of softwood.

3. Hardwood Plywood: White Oak plywood; White-Oak veneer 0.90 mm thick minimum shall be factory hot-applied at exposed face of door, cut and match of veneer shall be selected by the Consultant.

2.2 ACCESSORY MATERIALS

A. Preservative treatment: Type listed in BS 1282 (except coal tar creosote) obtained from approved manufacturer to provide protection against termites and other destroying organisms.

B. Adhesives: Close contact type to BS EN 301 or BS EN 302, suitable for the purpose and compatible with preservative treatment.

2.3 NON-FIRE RATED SEMI-SOLID-CORE FLUSH WOOD DOORS

A. **General**: Non-fire-rated flush wood doors shall be swinging-type side-hinged to jambs of frames with hand of doors as indicated on Drawings, fabricated to the general tolerances of BS No. 4787 and shall consist of a frame (door leaf frame) consisting of stiles and rails constructed of Douglas fir and a core constructed of a lower-density softwood (Whitewood). Core strips shall cover, at least, 67% of door leaf area (Semi-solid core).

B. **Door Leaf Frame**: Stiles and rails shall be of dimensions as indicated on Drawings but in no case shall the width be less than 140 mm for mortise stile or less than 100 mm for other stile and rails, before lipping. Door-leaf-frame components shall be continuously lipped at outer edges with 20 mm thick lipping constructed of White Oak wood. Oak lipping shall be fixed to stiles and rails in continuous glued tongue-and-groove joints. Stiles, rails and lipping of door leaf frame shall be constructed in

one piece, no jointing or splicing shall be permissible. Joints between stiles and rails shall be glued mortise-and-tenon.

C. **Semi-Solid Cores**: Shall be horizontal rails of White wood, of uniform width. Ratio of solid to vacant shall be 2:1. Horizontal core rails shall be in one pieces. Throughout door leaf height, at least, two horizontal core rails shall be mortise-and-tenon jointed and glued to stiles.

D. **Facing**: Facing material shall be 6 mm thick plywood glued with waterproof glue under pressure to both sides of core. Facing material shall extend flush and uniform, in both directions, between inner edges of lipping. Extend facing in one piece; no jointing or splicing shall be permissible. Type of facing material shall be as follows:

1. Doors of Opaque Finish: Softwood plywood

E. **Thickness of Doors**: Unless otherwise indicated on Drawings, finish thickness of flush non-fire-rated wood doors shall be 45 mm; thickness of stiles, rails and core strips shall be 33 mm and 45 mm wood lipping.

2.4 LOUVERS AND LIGHT FRAMES

A. Metal Louvers: As follows:

1. Blade Type: Vision proof, inverted V.

2. Metal and Finish: Extruded aluminum with clear anodic finish, 25micron thick minimum.

2.5 HARDWARE

A. Hardware shall be as indicated in Hardware Sets and Door Schedule and as specified in Division 8, Section "Door Hardware".

2.6 FABRICATION, GENERALLY

A. Flush wood doors shall be fabricated in accordance with details shown on Drawings, requirements of this Section, general tolerances of BS No. 4787 and other in-contradicting requirements of BS No. 1186: Part 2.

B. Carefully plan and layout the work to erect wood doors and to accommodate the work of other trades.

C. Finish wood shall be smoothly dressed and sanded prior to assembly of door inner frames and shall be free from open joints, hammer and machine marks and other defects or surface blemishes.

D. Re-treat all treated wood which is sawn along the length, ploughed, thickness, planed or otherwise extensively processed. Treat wood surfaces exposed by minor

cutting and drilling with two flood coats of solution recommended for the purpose by the treatment solution manufacturer.

E. Finish and cut wood at exact dimensions as required. Stile and rails shall be connected only in glued mortise-and tenon joints with horizontal core strips assembled and jointed at their locations between rails, along stiles. The resulting frame shall be robust, firm and square.

F. Facing material shall be glued to core and frame. No nail-fixing exposed or concealed, for facing material shall be permissible. The assembly shall be glued under pressure with waterproof casein glue and be thoroughly dried and seasoned.

G. Join lipping at outer perimeter of frame in continuous tongue-and-groove joints with glue.

H. Factory machine doors for hardware that is not surface applied. Locate hardware as indicated on approved shop drawings. Comply with final hardware schedules, door frame shop drawings, and hardware templates.

1. Coordinate measurements of hardware mortises in metal frames to verify dimensions and alignment before factory machining.

I. Openings: Cut and trim openings through doors to comply with applicable requirements of referenced standards for kind(s) of door(s) required.

1. Light Openings: Trim openings with moldings of material and profile indicated.

2. Louvers: Factory install louvers in prepared openings.

2.7 SHOP PRIMING

A. Doors for Opaque Finish: Shop seal faces and edge of doors including cutouts with one coat of wood primer specified in Division 9 Section "Painting."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine installed door frames before hanging doors.

1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with plumb jambs and level heads.

2. Reject doors/ frames with defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Hardware: For installation, see Division 8 Section "Door Hardware."

B. Manufacturer's Written Instructions: Install wood doors to comply with manufacturer's written instructions, referenced quality standard, and as indicated.

C. Job-Fit Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer. Machine doors for hardware. Seal cut surfaces after fitting and machining.

1. Clearances: Provide 3.2 mm at heads, jambs, and between pairs of doors. Provide 3.2 mm from bottom of door to top of decorative floor finish or covering. Where threshold is shown or scheduled, provide 6.4 mm from bottom of door to top of threshold.

2. Bevel non-fire-rated doors 3-1/2 degrees at lock and hinge edges.

D. Field-Finished Doors: Refer to the following for finishing requirements:

1. Division 9 Section "Painting."

3.3 ADJUSTING AND PROTECTING

A. Operation: Re-hang or replace doors that do not swing or operate freely.

B. Protect doors as recommended by door manufacturer to ensure that wood doors are without damage or deterioration at the time of Substantial Completion by the Employer.

END OF DOCUMENT

SECTION 32 – ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Related Drawing and Detail.

1.2 SUMMARY

A. This Section includes the following:

1. Wall access doors and frames.
2. Recessed panels for ceramic tiles.
3. Access panels for suspended gypsum board ceilings.
4. Wood shaft access doors.

B. Related Sections include the following:

1. Division 4 Section "Unit Masonry Assemblies" for anchoring and grouting access door frames set in masonry construction.
2. Division 6, Section "Rough Carpentry" for materials and workmanship requirements for wooden shaft access doors.
3. Division 9 Section "Gypsum Board Assemblies" for access panels to be installed in suspended gypsum board ceilings.
4. Division 9 Section "Ceramic Tiles" for ceramic tiles and adhesives.
5. Division 9 Section "Painting".
6. Division 15 Section "Duct Accessories" for heating and air-conditioning duct access doors.

1.3 SUBMITTALS

A. **Product Data**: For each type of door and frame indicated. Include construction details relative to materials, individual components and profiles, finishes, and fire ratings (if required) for access doors and frames.

B. **Shop Drawings**: Show fabrication and installation details of doors and frames. Include plans, elevations, sections, details, and attachments to other Work.

C. **Samples**: For each door face material, at least 75 by 125 mm in size, in specified finish.

1.4 QUALITY ASSURANCE

A. **Source Limitations**: Obtain each type of doors and frames through one source from a single manufacturer.

B. **Fire-Rated Access Doors and Frames**: Units complying with NFPA 80 that are identical to access door and frame assemblies tested for fire-test-response characteristics per the following test method and that are labeled and listed by UL, ITS, or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. NFPA 252 for vertical access doors.

C. **Size Variations**: Obtain Engineer's acceptance of manufacturer's standard-size units, which may vary slightly from sizes indicated.

1.5 COORDINATION

A. **Verification**: Determine specific locations and sizes for access doors needed to gain access to concealed equipment, and indicate on schedule specified in "Submittals" Article.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B, with ZF180 zinc-iron-alloy (galvannealed) coating or Z180 mill-phosphatized zinc coating; stretcher-leveled standard of flatness; with minimum thickness indicated representing specified thickness according to ASTM A 924/A 924M.

C. **Plaster Bead**: Casing bead formed from 0.75-mm zinc-coated steel sheet with flange formed out of expanded metal lath and in size to suit thickness of plaster.

2.2 PAINT

A. **Shop Primers**: Provide primers that comply with Division 9 Section "Painting."

B. **Shop Primer for Metallic-Coated Steel**: Organic zinc-rich primer complying with SSPC-Paint 20 and compatible with topcoat.

C. **Galvanizing Repair Paint**: High-zinc-dust-content paint for re-galvanizing welds in steel, complying with SSPC-Paint 20.

2.3 ACCESS DOORS AND FRAMES

A. Flush, Insulated, Fire-Rated Access Doors and Trimless Frames: Fabricated from metallic-coated steel sheet.

1. Locations: wall surfaces.

2. Fire-Resistance Rating: As indicated on Drawings.

3. Temperature Rise Rating: 139 deg C at the end of 30 minutes.

4. Door: Flush panel with a core of mineral-fiber insulation enclosed in sheet metal with a minimum thickness of 1.5 mm.

5. Frame: Minimum 1.5-mm thick sheet metal with plaster bead.

6. Hinges: Concealed pin type.

7. Lock: Key-operated cylinder lock, specified in Division 8 Section “Door Hardware”.

B. **Recessed Panels for Ceramic tiles**: Units consisting of frame with expansion casing bead, door, hardware and complying with the following requirements:

1. Frame: Zinc-coated steel sections and shapes.

2. Plaster casing Bead: 0.76 mm zinc coated steel casing bead with flange formed out of expanded metal lath.

3. Panel: 2 mm zinc coated steel sheet.

4. Finish: Ceramic wall tiles matching adjacent walls adhered with water cleanable epoxy-based adhesive.

5. Hardware: Nickel-plated steel hinges, exposed type and self-latching bolt operated with knurled knob.

C. **Heavy Duty Gypsum Board Ceiling Panels**: Heavy duty ceiling flush access panel with fully concealed steel frame and gypsum board inlay fastened to door.

1. Material: Removable spring-loaded door, integrated safety catches, patented concealed nylon hinge mechanism, rounded or square corners as directed, formed galvanized frames, stainless steel springs, zinc-plated fasteners, self-adhesive rubber gasket and accessories. Frame shall be two-part type fixed to opening edges and recessed door gypsum board inlay.

2. Latch: Tamper-resistant cam latch.

3. Sizes: As indicated on Drawings.

4. Models: Suitable for flush installation in ceiling constructed from 12.5, 12.7, 15.00 or 15.9 mm.

2.4 SHAFT ACCESS DOOR

A. **Doors**: Solid core from approved softwood. 3 mm thick plywood facing and hardwood lipping.

B. **Frame**: Fabricate from preservative treated hardwood. Joints between stile and rail shall be single dove tail joints. Protect frame surfaces in contact with masonry with approved bitumen-based cold-applied protection coating.

C. **Anchors**: Type suitable for fixing into concrete or hollow concrete masonry with metal components fabricated from corrosion-resistant material. Use minimum two anchors per each frame jamb or sill.

D. **General**: Comply with requirements of Sections “Rough Carpentry” and “Flush Wood Doors” for preservative treatment and general workmanship requirements

E. **Finishing**: Field-applied approved paint type of color selected by Engineer.

2.5 FABRICATION

A. **General**: Provide access door assemblies manufactured as integral units ready for installation.

B. **Metal Surfaces**: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

C. **Steel Doors and Frames**: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.

1. For trimless frames with plaster bead for full-bed plaster applications, provide zinc-coated expanded metal lath and exposed casing bead welded to perimeter of frames.

D. **Latching Mechanisms**: Furnish number required to hold doors in flush, smooth plane when closed.

1. For cylinder lock, furnish two keys per lock and key all locks alike.

2. For recessed panel doors, provide access sleeves for each locking device. Furnish plastic grommets and install in holes cut through finish.

2.6 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

2.7 METALLIC-COATED STEEL FINISHES

A. **Galvanizing of Steel Shapes and Plates**: Hot-dip galvanize items indicated to comply with applicable standard listed below:

1. ASTM A 123/A 123M, for galvanizing steel and iron products.

2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.

B. **Surface Preparation**: Clean surfaces with non-petroleum solvent so surfaces are free of oil and other contaminants. For galvanized surfaces, apply, after cleaning, a conversion coating suited to the organic coating to be applied over it. For metallic-coated surfaces, clean welds, mechanical connections, and abraded areas, and apply galvanizing repair paint specified below to comply with ASTM A 780.

1. **Galvanizing Repair Paint**: High-zinc-dust-content paint for re-galvanizing welds in steel, complying with SSPC-Paint 20.

C. Factory Priming for Field-Painted Finish: Apply shop primer immediately after cleaning and pre-treating.

PART 3 - EXECUTION

3.1 PREPARATION

A. Advise installers of other work about specific requirements relating to access door and floor door installation, including sizes of openings to receive access door and frame, as well as locations of supports, inserts, and anchoring devices.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

B. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.

C. Install access doors with trimless frames flush with adjacent finish surfaces or recessed to receive finish material.

D. Installation of fire-rated access doors and panels shall maintain same applicable requirements of Standards referenced for installation of fire-rated steel frames in Division 8, Section "Custom Steel Doors and Frames".

3.3 ADJUSTING AND CLEANING

A. Adjust doors and hardware after installation for proper operation.

B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF DOCUMENT

PART 1 - GENERAL

SECTION 33 – ALUMINIUM WINDOWS

1.1 RELATED DOCUMENTS

A. Related Drawing and Detail.

1.2 SUMMARY

A. This Section includes aluminum-framed windows

B. Related Sections include the following:

1. Division 8 Section "Aluminum Framed Entrances and Storefronts."

2. Division 8 Section "Glazing" for glazing requirements for aluminum windows, including those specified to be factory glazed.

1.3 DEFINITIONS

A. Structural test pressure, for uniform load structural test, is equivalent to 150 percent of design pressure.

1.4 PERFORMANCE REQUIREMENTS

A. **General**: Provide aluminum windows capable of complying with performance requirements indicated, based on testing manufacturer's windows that are representative of those specified and that are of test size indicated below:

1. Size indicated on Drawings.

B. **Structural Performance**: Provide aluminum windows capable of withstanding the following, including wind loads based on passing AAMA/NWWDA 101/I.S.2, Uniform Load Structural Test, at basic wind speed indicated:

1. Deflection: Design glass framing system to limit lateral deflections of glass edges to less than 1/175 of glass-edge length 19 mm, whichever is less, at design pressure based on structural computations.

2. Basic Wind Speed: As indicated in meters per second at 10 m above grade. Determine wind loads and resulting design pressures applicable to Project according to the following, based on mean roof heights above grade as indicated on Drawings:

a. Uniform Building Code, 1997 Edition, Exposure C, Basic Wind Speed 130 km/hr

C. **Air Infiltration**: Maximum rate not more than indicated when tested according to AAMA/NWWDA 101/I.S.2, Air Infiltration Test.

1. Maximum Rate: 2 cu. m/h x sq. m of area at an inward test pressure of 300 Pa.

D. **Water Resistance**: No water leakage as defined in AAMA/NWWDA referenced test methods at a water test pressure equaling that indicated, when tested according to AAMA/NWWDA 101/I.S.2, Water Resistance Test.

1. Test Pressure: 20 percent of positive design pressure, but not more than 580 Pa.

E. **Thermal Transmittance**: Provide aluminum windows with a whole-window U-value maximum indicated at 15-mph (24-km/h) exterior wind velocity and winter condition temperatures when tested according to AAMA 1503 and ASTM E 1423.

1. U-Value: shall not exceed U-value specified for glass insulating units specified in Division 8, Section "Glazing".

F. **Sound Transmission Class**: Provide glazed windows rated for not less than 26 STC when tested for laboratory sound transmission loss according to ASTM E 90 and determined by ASTM E 413.

G. **Thermal Movements**: Provide aluminum windows, including anchorage, that accommodate thermal movements of units resulting from the following maximum change (range) in ambient and surface temperatures without buckling, distortion, opening of joints, failure of joint sealants, damaging loads and stresses on glazing and connections, and other detrimental effects. Base Consultanting calculation on actual surface temperatures of materials due to solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 35 deg C, ambient; 65 deg C material surfaces.

H. **Life-Cycle Testing**: Test according to AAMA 910 and comply with AAMA/ WDMA 101/I.S.2.

1.5 SUBMITTALS

A. **Product Data**: Include construction details, material descriptions, fabrication methods, dimensions of individual components and profiles, hardware, finishes, and operating instructions for each type of aluminum window indicated.

B. **Shop Drawings**: Include plans, elevations, sections, details, hardware, attachments to other Work, operational clearances, and the following:

1. Mullion details, including reinforcement and stiffeners.

2. Joinery details.

3. Expansion provisions.

4. Flashing and drainage details.

5. Weather-stripping details.

6. Thermal-break details.

7. Glazing details.

8. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional Consultant responsible for their preparation and used to determine the following:

   a. Structural test pressures and design pressures from basic wind speeds indicated.

   b. Deflection limitations of glass framing systems.

C. **Samples for Initial Selection**: For units with factory-applied color finishes.

D. **Samples for Verification**: For aluminum window components required, prepared on Samples of size indicated below.

1. Main Framing Member: 300-mm- long, full-size sections of extrusions with factory-applied color finish.

2. Hardware: Full-size units with factory-applied finish.

3. Weather Stripping: 300-mm- long sections.

4. Consultant reserves the right to require additional samples that show fabrication techniques, workmanship, and design of hardware and accessories.

E. **Qualification Data**: For manufacturer, Installer, and testing agency.

1. Installer Experience: List of five projects (minimum) of a similar nature carried out successfully by the installer with the same product endorsed by the manufacturer's representative.

F. Field Quality-Control Test Reports: From a qualified testing and inspecting agency engaged by Contractor.

G. **Product Test Reports**: Based on evaluation of comprehensive tests performed within the last four years by a qualified testing agency, for each type, grade, and

size of aluminum window. Test results based on use of down-sized test units will not be accepted.

H. **Maintenance Data**: For operable window sash, operating hardware, weather stripping and finishes to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. **Quality System**: Comply with ISO 9001/9002 Quality System as a minimum. Incorporate all the standard procedures supplied by the Consultant and the Employer.

B. **Manufacturer Qualifications**: A firm experienced in manufacturing items specified in this section similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to manufacture required units.

C. **Installer Qualifications**: An installer acceptable to aluminum window manufacturer for installation of units required for this Project.

1. A qualified firm specializing in performing the work of this Section with minimum three years documented experience and that is approved, authorized, or licensed by the product manufacturer to install his product and that is eligible to receive manufacturer's warranty. Include project names and addresses, names and addresses of Consultants and Employers, and other information specified

D. **Testing Agency Qualifications**: An independent testing agency, acceptable to Consultant, with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.

E. **Source Limitations**: Obtain aluminum windows through one source from a single manufacturer.

F. **Fenestration Standard**: Comply with AAMA/WDMA 101/I.S.2, "Voluntary Specifications for Aluminum, Vinyl (PVC) and Wood Windows and Glass Doors," for minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.

G. **Mockups**: Build mockups to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution.

1. Build mockup in building envelope wall in locations selected by Consultant.

2. Build one mockup of each type of windows indicated on Drawings.

3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion as judged solely by the Consultant, otherwise dismantle mockups, remove site and install permanent works.

H. **Pre-installation Conference**: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.7 PROJECT CONDITIONS

A. **Field Measurements**: Verify aluminum window openings by field measurements before fabrication and indicate measurements on Shop Drawings.

1.8 WARRANTY

A. **Special Warranty**: Provide written warranty signed by Manufacturer and Contractor in which manufacturer agrees to repair or replace aluminum windows that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, the following:

1. Failure to meet performance requirements.

2. Structural failures including excessive deflection.

3. Water leakage, air infiltration, or condensation.

4. Faulty operation of movable sash and hardware.

5. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

6. Insulting glass failure.

B. Warranty Period: 5 years from date of Substantial Completion.

C. Warranty Period for Metal Finishes: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. **Aluminum Extrusions**: Alloy and temper recommended by aluminum window manufacturer for strength, corrosion resistance, and application of required finish, but not less than 150-MPa ultimate tensile strength, not less than 110-MPa minimum yield strength, and not less than 2.00 mm thickness at any location for the main frame and sash members.

B. **Fasteners**: Aluminum, nonmagnetic stainless steel, epoxy adhesive, or other materials warranted by manufacturer to be non-corrosive and compatible with aluminum window members, trim, hardware, anchors, and other components

1. Reinforcement: Where fasteners screw-anchor into aluminum less than 3.2 mm thick, reinforce interior with aluminum or nonmagnetic stainless steel to receive screw threads, or provide standard, non-corrosive, pressed-in, splined grommet nuts.

2. Exposed Fasteners: Unless unavoidable for applying hardware, do not use exposed fasteners. For application of hardware, use fasteners that match finish of member or hardware being fastened, as appropriate.

C. **Anchors, Clips, and Accessories**: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.

D. **Reinforcing Members**: Aluminum or nonmagnetic stainless steel, complying with ASTM B 456 for Type SC 3 severe service conditions, provide sufficient strength to withstand design pressure indicated.

E. **Sliding-Type Weather Stripping**: Provide woven-pile weather stripping of wool, polypropylene, or nylon pile and resin-impregnated backing fabric. Comply with AAMA 701/702.

1. Sliding Weather Stripping: Wool, polypropylene, or nylon woven pile with nylon--fabric or aluminum-strip backing complying with AAMA 701/702 requirements.

F. **Compression-Type Weather Stripping**: Provide compressible weather stripping designed for permanently resilient sealing under bumper or wiper action, and completely concealed when aluminum window is closed.

1. Weather-Stripping Material: Dense elastomeric gaskets complying with ASTM C 864 fabricated from EPDM.

G. **Replaceable Weather Seals**: Comply with AAMA 701/702.

H. **Sealant**: For sealants required within fabricated windows, provide window manufacturer's standard, permanently elastic, non-shrinking, and non-migrating type recommended by sealant manufacturer for joint size and movement.

2.2 GLAZING

A. **Glass and Glazing Materials**: Refer to Division 8 Section "Glazing" for glass units and glazing requirements applicable to glazed aluminum window units.

B. **Glazing System**: Manufacturer's standard factory-glazing system that produces weather tight seal or as indicated in Division 8 Section "Glazing".

2.3 HARDWARE

A. **General**: Provide manufacturer's standard hardware fabricated from aluminum, designed to smoothly operate, tightly close, and securely lock aluminum windows and sized to accommodate sash or ventilator weight and dimensions. Cadmium-plated hardware is not permitted. Do not use aluminum in frictional contact with other metals. Where exposed, provide extruded, cast, or wrought aluminum with clear anodized satin finish.

B. **Hardware, General**: Comply with AAMA 902.

C. **Sill Cap/Track**: Extruded-aluminum with finish matching that of window track of thickness, dimensions, and profile indicated; designed to comply with performance requirements indicated and to drain to the exterior.

D. **Locks and Latches**: Designed to allow unobstructed movement of the sash across adjacent sash in direction indicated and operated from the inside only.

E. **Roller Assemblies**: Low-friction design.

F. **Four- or Six-Bar Friction Hinges**: Comply with AAMA 904.

1. Locking mechanism and handles for manual operation.

2. Friction Shoes: Provide friction shoes of nylon or other nonabrasive, non-staining, non-corrosive, durable material.

G. **Limit Devices**: Provide limit devices designed to restrict sash or ventilator opening.

1. Safety Devices: Limit clear opening to 150 mm for ventilation; with custodial key release.

H. **Horizontal-Sliding Windows**: Provide the following operating hardware:

1. Sash Rollers: Stainless-steel, lubricated ball-bearing rollers with nylon tires.

2. Sash Lock: Spring-loaded, snap-type lock at jambs; two per sash.

I. **Projected Windows**: Provide the following operating hardware:

1. Hinge: Five-knuckle butt hinge.

2. Lock: Combination lever handle and cam-action lock with concealed pawl and keeper.

3. Limit Device: Concealed friction adjustor, adjustable stay bar limit device; located on jamb of each ventilator.

2.4 FABRICATION

A. **General**: Fabricate aluminum windows, in sizes indicated, that comply with AAMA/WDMA 101/I.S.2 for performance class and performance grade indicated. Include a complete system for assembling components and anchoring windows.

B. Fabricate aluminum windows that are reglazable without dismantling sash or ventilator framing.

C. Thermally Improved Construction: Fabricate aluminum windows with an integral, concealed, low-conductance thermal barrier; located between exterior materials and window members exposed on interior side; in a manner that eliminates direct metal-to-metal contact.

1. Provide thermal-break construction that has been in use for not less than three years and has been tested to demonstrate resistance to thermal conductance and condensation and to show adequate strength and security of glass retention.

2. Provide thermal barriers tested according to AAMA 505; determine the allowable design shear flow per the appendix in AAMA 505.

3. Provide hardware with low conductivity for hardware bridging thermal breaks at frame or vent sash.

D. **Weather Stripping**: Provide full-perimeter weather stripping for each operable sash and ventilator.

E. **Weep Holes**: Provide weep holes and internal passages to conduct infiltrating water to exterior.

F. **Mullions**: Provide mullions and cover plates as shown, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections, as indicated. Provide mullions and cover plates capable of withstanding design loads of window units.

G. **Sub-frames**: Provide sub-frames with anchors for window units as shown, of profile and dimensions indicated but not less than 1.6-mm- thick extruded aluminum. Miter or cope corners, and weld and dress smooth with concealed mechanical joint fasteners. Finish to match window units. Provide subframes capable of withstanding design loads of window units.

H. **Factory-Glazed Fabrication**: Glaze aluminum windows in the factory where practical and possible for applications indicated. Comply with requirements in Division 8 Section "Glazing" and with AAMA/WDMA 101/I.S.2.

I. **Glazing Stops**: Provide snap-on glazing stops coordinated with Division 8 Section "Glazing" and glazing system indicated. Provide glazing stops to match sash and ventilator frames.

2.5 FINISHES

A. **General**: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

C. **High-Performance Organic Finish (3-Coat Fluoropolymer)**: AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coating; Organic Coating: manufacturer's standard 3-coat, thermocured system consisting of specially formulated inhibitive primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2605 and with coating and resin manufacturers' written instructions.

1. Color and Gloss: As selected by Consultant from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances; rough opening dimensions; levelness of sill plate; coordination with wall flashings, vapor retarders, and other built-in components; operational clearances and other conditions affecting performance of work.

1. Masonry and Concrete Surfaces: Visibly dry and free of excess mortar, sand, and other construction debris.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. **General**: Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components; Drawings; and Shop Drawings.

B. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.

C. Set sill members in bed of sealant or with gaskets, as indicated, for weathertight construction.

D. Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to the exterior.

E. Metal Protection: Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials by complying with requirements specified in "Dissimilar Materials" Paragraph in Appendix B in AAMA/WDMA 101/I.S.2.

3.3 ADJUSTING

A. Adjust operating sashes and ventilators, screens, hardware, and accessories for a tight fit at contact points and weather stripping for smooth operation and weather-tight closure. Lubricate hardware and moving parts.

3.4 PROTECTION AND CLEANING

A. Protect window surfaces from contact with contaminating substances resulting from construction operations. In addition, monitor window surfaces adjacent to and below exterior concrete and masonry surfaces during construction for presence of dirt, scum, alkaline deposits, stains, or other contaminants. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written recommendations.

B. Clean aluminum surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.

C. Clean factory-glazed glass immediately after installing windows. Comply with manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels and clean surfaces.

D. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

END OF DOCUMENTS

SECTION 34 – DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Related Drawing and Detail.

1.2 SUMMARY

A. This Section includes the following:

1. Commercial door hardware for the following steel and wood doors:

a. Swinging doors.

2. Cylinders for doors specified in other Sections.

3. Electrified door hardware.

B. Related Sections include the following:

1. Division 8 Section "Custom Steel Doors and Frames" for astragals provided as part of a fire-rated labeled assembly and for door silencers provided as part of the time.

2. Division 8 Section "Flush Wood Doors" for astragals provided as part of a fire-rated labeled assembly.

3. Division 8 Section "Access Doors and Frames".

4. Division 8 Section "Overhead Coiling Doors".

5. Division 8 Section "Aluminum Framed Entrances And Storefronts".

6. Division 8 Section "Sliding Automatic Entrance Doors" for entrance door hardware, except cylinders.

7. Division 16 Electrical Specification Systems for coordination of electrical hardware and security hardware.

C. Products furnished, but not installed, under this Section include the following. Coordinating, purchasing, delivering, and scheduling remain requirements of this Section.

1. Cylinders for locks on aluminum and glass entrance doors.

1.3 SUBMITTALS

A. **Product Data**: Include installation details, material descriptions, dimensions of individual components and profiles, and finishes.

B. **Shop Drawings**: Details of electrified door hardware, indicating the following:

1. Wiring Diagrams: Detail wiring for power, signal, and control systems and differentiate between manufacturer-installed and field-installed wiring. Include the following:

a. System schematic.

b. Point-to-point wiring diagram.

c. Riser diagram.

d. Elevation of each door.

2. Detail interface between electrified door hardware and fire other building systems.

C. **Samples for Initial Selection**: Manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available for each type of door hardware indicated.

D. **Samples**: For exposed door hardware of each type indicated below, in specified finish, full size. Tag with full description for coordination with the Door Hardware Schedule. Submit samples before, or concurrent with, submission of the final Door Hardware Schedule.

1. Door Hardware: Each piece of hardware indicated in hardware schedule or on Drawings.

2. Samples will be returned to Contractor. Units that are acceptable and remain undamaged through submittal, review, and field comparison process may, after final check of operation, be incorporated into the Work, within limitations of keying requirements.

E. **Door Hardware Schedule**: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."

2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening.

    a. Organize door hardware sets in same order as in the Door Hardware Schedule at the end of Part 3.

3. Content: Include the following information:

    a. Type, style, function, size, label, hand, and finish of each door hardware item.

    b. Manufacturer of each item.

    c. Fastenings and other pertinent information.

    d. Location of each door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.

    e. Explanation of abbreviations, symbols, and codes contained in schedule.

    f. Mounting locations for door hardware.

    g. Door and frame sizes and materials.

    h. Description of each electrified door hardware function, including location, sequence of operation, and interface with other building control systems.

        1) Sequence of Operation: Include description of component functions that occur in the following situations: authorized person wants to enter; authorized person wants to exit; unauthorized person wants to enter; unauthorized person wants to exit.

4. **Submittal Sequence**:

    a. Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

    b. Submit initial draft of final schedule along with essential Product Data to facilitate the fabrication of other work that is critical in the Project construction schedule. Submit the final Door Hardware Schedule after

Samples, Product Data, coordination with Shop Drawings of other work, delivery schedules, and similar information has been completed and accepted.

F. **Keying Schedule**: Prepared by or under the supervision of supplier, detailing Employer's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations.

G. **Product Certificates**: Signed by manufacturers of electrified door hardware certifying that products furnished comply with requirements.

1. Certify that door hardware approved for use on types and sizes of labeled fire doors complies with listed fire door assemblies.

H. **Qualification Data**: For firms and persons specified in "Quality Assurance" Article.

1. Include lists of completed projects with project names and addresses of architects/Consultants and owners, and other information specified.

I. **Product Test Reports**: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, indicating current products comply with requirements.

J. **Maintenance Data**: For each type of door hardware to include in maintenance manuals specified in Division 1.

K. **Warranties**: Special warranties specified in this Section.

1.4 QUALITY ASSURANCE

A. **Quality System**: Comply with ISO 9001/9002 Quality System as a minimum. Incorporate all the standard procedures supplied by the Consultant and the Employer.

B. **Installer Qualifications**: A qualified firm specializing in performing the work of this Section and who has completed door hardware similar in material, design, and extent to that indicated for this Project with minimum three years documented experience and that is approved, authorized, or licensed by the product manufacturer to install his product and that is eligible to receive manufacturer's warranty. Include project names and addresses, names and addresses of Consultants and Employers, and other information specified

C. **Supplier Qualifications**: A recognized architectural door hardware supplier, with warehousing facilities in the Project's vicinity, that has a record of successful in-service performance for supplying conventional and security door hardware similar in quantity, type, and quality to that indicated for this Project and that employs an experienced architectural hardware consultant (AHC) who is available to Employer, Consultant, and Contractor, at reasonable times during the course of the Work, for

consultation. The supplier shall have access to adequate inventory of all hardware items to meet Project construction schedules and shall have the ability to submit samples, hardware data, templates, and hardware schedules in accordance with Project construction schedules.

1. Require supplier to meet with Employer to finalize keying

2. Electrified Door Hardware Supplier Qualifications: An experienced door hardware supplier who has completed projects with electrified door hardware similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance, and who is acceptable to manufacturer of primary materials.

    a. Consultanting Responsibility: Prepare data for electrified door hardware, including Shop Drawings, based on testing and Consultanting analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

3. Scheduling Responsibility: Preparation of door hardware and keying schedules.

C. **Architectural Hardware Consultant Qualifications**: A person who is currently certified by the Door and Hardware Institute as an Architectural Hardware Consultant and who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project.

1. Electrified Door Hardware Qualifications: Experienced in providing consulting services for electrified door hardware installations.

D. **Source Limitations**: Obtain each type and variety of door hardware from a single manufacturer, unless otherwise indicated.

1. Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated. Manufacturers that are listed to perform electrical modifications, by a testing and inspecting agency acceptable to authorities having jurisdiction, are acceptable.

E. **Regulatory Requirements**: Comply with provisions of the following:

1. NFPA 101: Comply with the following for means of egress doors:

    a. Latches, Locks, and Exit Devices: Not more than 67 N to release the latch. Locks shall not require the use of a key, tool, or special knowledge for operation.

b. Delayed-Egress Locks: Lock releases within 15 seconds after applying a force not more than 67 N for not more than 3 seconds.

c. Door Closers: Not more than 133 N to set door in motion and not more than 67 N to open door to minimum required width.

d. Thresholds: Not more than 13 mm high.

2. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

F. **Fire-Rated Door Assemblies**: Provide door hardware for assemblies complying with NFPA 80, or any approved equal international standard, that are listed and labeled by a testing and inspecting agency acceptable to Consultant, for fire ratings indicated, based on testing according to NFPA 252.

1. Test Pressure: Test at atmospheric pressure.

G. **Labels**: All hardware components of fire resisting doors assemblies including, but not limited hinges, locks, bolts, door closers shall carry the identifying labels of an approved independent testing and inspection agency or laboratory, confirming their fire resistance rating. The rating of all door components shall be equal to the rating of the door assembly.

H. **Door Closers on Fire Rated Doors**: Comply with requirements with specified in Clause 2.10 of this Section.

I. **Keying Conference**: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings." Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including, but not limited to, the following:

1. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.

2. Preliminary key system schematic diagram.

3. Requirements for key control system.

4. Address for delivery of keys.

J. **Pre-installation Conference**: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings." Review methods and procedures related to electrified door hardware including, but not limited to, the following:

1. Inspect and discuss electrical roughing-in and other preparatory work performed by other trades.

2. Review sequence of operation for each type of electrified door hardware.

3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

4. Review required testing, inspecting, and certifying procedures.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.

B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver keys to manufacturer of key control system.

D. Deliver keys to Employer by registered mail or overnight package service.

1.6 COORDINATION

A. Coordinate layout and installation of recessed pivots and closers with floor construction. Cast anchoring inserts into concrete. Concrete, reinforcement, and formwork requirements are specified in Division 3 Section "Cast-in-Place Concrete."

B. **Templates**: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing door hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

C. **Electrical System Roughing-in**: Coordinate layout and installation of electrified door hardware with connections to power supplies and fire alarm system and detection devices and any other building system as indicated on Drawings.

1.7 WARRANTY

A. **General Warranty**: Special warranties specified in this Article shall not deprive Employer of other rights Employer may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. **Special Warranty**: Written warranty, executed by manufacturer agreeing to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, the following:

1. Structural failures including excessive deflection, cracking, or breakage.

2. Faulty operation of operators and door hardware.

3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

C. **Warranty Period**: Three years from date of Substantial Completion, unless otherwise indicated.

D. **Warranty Period for Electromagnetic and delayed-Egress Locks**: Five years from date of Substantial Completion.

E. **Warranty Period for Manual Closers**: 10 years from date of Substantial Completion.

F. **Warranty Period for Concealed Floor Closers**: Five years from date of Substantial Completion.

1.8 MAINTENANCE SERVICE

A. **Maintenance Tools and Instructions**: Furnish a complete set of specialized tools and maintenance instructions as needed for Employer's continued adjustment, maintenance, and removal and replacement of door hardware.

B. **Maintenance Service**: Beginning at Substantial Completion, provide six months' full maintenance by skilled employees of door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door hardware operation. Provide parts and supplies as used in the manufacture and installation of original products.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. **General**: Provide door hardware for each door to comply with requirements in this Section, and the Door and Hardware sets Schedule annexed at the end of Part 3.

1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and products complying with BHMA standard referenced.

2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.

B. **Designations**: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in the Door and Hardware sets Schedule at the end of Part 3. Products are identified by using door hardware designations, as follows:

1. International hardware manufactures have to establish their compliance with these specifications and with international fire codes for fire rated hardware.

2. References to BHMA Standards: Provide products complying with these standards and requirements for description, quality, and function.

2.2 HINGES AND PIVOTS

A. **Standards**: Comply with the following:

1. Butts and Hinges: BHMA A156.1.

2. Template Hinge Dimensions: BHMA A156.7.

3. Self-Closing Hinges and Pivots: BHMA A156.17.

4. Pivots: BHMA A156.4.

B. **Size**: Provide the following minimum sizes, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:

		Metal Thickness (mm)	
Maximum Door Size (mm)	Hinge Height (mm)	Standard Weight	Heavy Weight
800 by 2125 by 35	88	3.1	-
900 by 2125 by 35	100	3.3	-
900 by 2285 by 38	113	3.4	4.6
1050 by 2285 by 38	113	3.4	4.6

Maximum Door Size (mm)	Hinge Height (mm)	Metal Thickness (mm)	
		Standard Weight	Heavy Weight
1200 by 3050 by 38	125	3.7	4.8

C. **Template Requirements**: Except for hinges and pivots to be installed entirely (both leaves) into wood doors and frames, provide only template-produced units.

D. **Hinge Weight**: Unless otherwise indicated, provide the following:

1. Entrance Doors: Heavy-weight hinges.
2. Doors with Closers: Antifriction-bearing hinges.
3. Interior Doors: Standard-weight hinges.

E. **Hinge Base Metal**: Unless otherwise indicated, provide the following:

1. Exterior Hinges: Stainless steel alloy 316, with stainless-steel pin
2. Interior Hinges: Stainless steel alloy 304, with stainless-steel pin.
3. Hinges for Fire-Rated Assemblies: Stainless steel alloy 304, with stainless-steel pin.

F. **Hinge Options**: Comply with the following where indicated in the Door Hardware Schedule or on Drawings:

1. Maximum Security Pin: Fix pin in hinge barrel after it is inserted.
2. Non-removable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the following applications:
    a. Out-swinging exterior doors.
3. Corners: 4-mm radius.

G. **Hinges, General**: Shall be full mortise, template, of concealed ball bearing, 5 knuckles, suitable for high frequency applications and of life time warranty.

2.3 LOCKS AND LATCHES

A. **Standards**: Comply with the following:

1. Mortise Locks and Latches: BHMA A156.13.
2. Interconnected Locks and Latches: BHMA A156.12.
3. Auxiliary Locks: BHMA A156.5.
4. Push-Button Combination Locks: BHMA A156.2.
5. Electromagnetic Locks: BHMA A156.23.
6. Delayed-Egress Locks: BHMA A156.24.
7. Exit Locks: BHMA A156.5.

B. **Mortise Locks**: Stamped steel case with stainless steel parts; BHMA Grade 1; Series 1000. Provide mortise locks for exterior doors, throughout the job, except for toilets. All lock shall be ADA compliant Marine grade mortise locks shall be provided in the exterior and in non air conditioned areas. Provide ten years product warranty for performance and finish.

C. **Mortise Lock**: Shall be types produced for extra-heavy-duty applications. Lock lever shall be of anti-vandalism design.

D. Where threaded bars are used to assemble the two pieces of lock spindle, minimum inner diameter of threading bar shall be 6 mm.

E. **Interconnected Locks**: BHMA Grade 1; Series 5000.

F. **Auxiliary Locks**: BHMA Grade 1.

G. **Push-Button Combination Locks**: BHMA Grade 1 for cylindrical locks and Grade 2 for mortise locks.

H. **Certified Products**: Provide door hardware listed in the following BHMA directories:

1. Mechanical Locks and Latches: BHMA's "Directory of Certified Locks & Latches."

I. **Lock Trim**: Comply with the following: All trims to have returns. Trims shall be ADA compliant. Trim shall be stainless steel BHMA-630

1. Lever: Wrought, forged, or cast.

2. Escutcheon (Rose): Wrought, forged, or cast.

3. Dummy Trim: Match lock trim and escutcheons.

4. Lockset Designs: Provide the lockset design designated below or, if sets are provided by another manufacturer, provide designs that match those designated:

J. **Lock Functions**: Function numbers and descriptions indicated in the Door Hardware Schedule comply with the following:

1. Mortise Locks: BHMA A156.13.

2. Interconnected Locks: BHMA A156.12.

K. **Lock Features**: Comply with testing requirements for length of bolts to comply with labeled fire door requirements, and as follows:

1. Mortise Locks: Minimum 19-mm latchbolt throw.

2. Deadbolts: Minimum 25-mm bolt throw.

3. Pairs of Doors: 16-mm minimum throw of latch.

4. Fire-Rated Doors: Comply with UL requirements for throw of bolts and latches on rated fire openings.

5. Heavy duty anti friction tongue.

6. Non handed auxiliary guard latch.

7. Adjustable stainless steel armor front.

8. Seven pin interchangeable core cylinder.

9. Corrosion protected steel case.

L. **Rabbeted Doors**: Provide special rabbeted front and strike on locksets for rabbeted meeting stiles.

M. **Backset**: 70 mm, unless otherwise indicated.

N. **Lock Function**: Provide lock functions as described below, but not limited to

1. F-04 Office lock, with faceplate button depressed function.

2. Classroom function for stores

3. F-13 Corridor lock.

4. Provide classroom dead bolts for main doors of toilets and janitors rooms

Additional lock function will be required as per function of various rooms.

O. Locks shall have double buttons in face plate. For Office Locks the handle will rotate only when bottom button is depressed or turning key for outside cylinder. For other locks, the bottom button in face plate shall also retract the latch.

P. These requirements for mortise locks shall remain applicable in all respects for wood doors, steel doors and minimum doors.

2.4 DOOR BOLTS

A. **Standards**: Comply with the following:

1. Surface Bolts: BHMA A156.16.

2. Manual Flush Bolts: BHMA A156.16.

B. **Surface Bolts**: BHMA Grade 1.

1. Flush Bolt Heads: Minimum of 13-mm- diameter rods of brass, bronze, or stainless steel with minimum 300-mm- long rod for doors up to 2100 mm in height. Provide longer rods as necessary for doors exceeding 2100 mm.

C. **Flush Bolts**: BHMA Grade 1, designed for mortising into door edge.

D. **Bolt Throw**: Comply with testing requirements for length of bolts to comply with labeled fire door requirements, and as follows:

1. Half-Round Surface Bolts: Minimum 22-mm throw.

2. Interlocking Surface Bolts: Minimum 24-mm throw.

3. Fire-Rated Surface Bolts: Minimum 25-mm throw; listed and labeled for fire-rated doors.

4. Dutch-Door Bolts: Minimum 19-mm throw.

5. Mortise Flush Bolts: Minimum 19-mm throw.

2.5 EXIT DEVICES

A. **Standard**: BHMA A156.3.

1. BHMA Grade: Grade 1.

B. **Certified Products**: Provide exit devices listed in BHMA's "Directory of Certified Exit Devices."

C. **Panic Exit Devices**: Listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305.

D. **Panic Exit Devices**: For non-fire rated doors are to be as specified in Sub-Clause but with facility to hold latchbolts in retracted position so that the doors may be used as push/pull. Dogging is to be accomplished by a hex key cylinder installed on the body of touch bar devices or a hexagonal key in the hinge and lock cases of cross bar devices

E. **Fire Exit Devices**: Complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire and panic protection, based on testing according to UL 305 and NFPA 252.

F. **Dummy Push Bar**: Nonfunctioning push bar matching functional push bar.

1. Operation: Rigid.

G. **Outside Trim**: Lever with cylinder or Pull with cylinder; unless otherwise indicated material and finish to match locksets, unless otherwise indicated.

1. Match design for locksets and latchsets, unless otherwise indicated.

H. **Through Bolts**: For exit devices and trim on metal doors and non-fire-rated wood doors.

I. Fire and panic exit devices shall be of concealed latches. No exposed latches shall be accepted.

2.6 CYLINDERS AND KEYING

A. **Standards**: Comply with the following:

1. Cylinders: BHMA A156.5.

2. Key Control System: BHMA A156.5.

B. **Cylinder Grade**: BHMA Grade 1 or Grade 1A.

C. **Cylinders**: Manufacturer's standard tumbler type, constructed from brass or bronze, stainless steel, or nickel silver, and complying with the following:

1. Number of Pins: Seven.

2. Mortise Type: Threaded cylinders with rings and straight- or clover-type cam.

3. Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.

D. **Permanent Cores**: Manufacturer's standard; finish face to match lockset; complying with the following:

1. Interchangeable Cores: Core insert, removable by use of a special key, and usable with other manufacturers' cylinders.

2. Removable Cores: Core insert, removable by use of a special key, and for use with only the core manufacturer's cylinder and door hardware.

E. **Construction Keying**: Comply with the following:

1. Construction Master Keys: Provide cylinders with feature that permits voiding of construction keys without cylinder removal. Provide 10 construction master keys.

2. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 4 constructions master keys for Employer/Consultant use.

a. Replace construction cores with permanent cores, as directed by Employer.

b. Furnish permanent cores to Employer for installation.

F. **Keying System**: Unless otherwise indicated, provide a factory-registered keying system complying with the following requirements:

1. Master Key System: Cylinders are operated by a change key and a master key.

G. **Keys**: Provide stainless steel keys complying with the following:

1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:

a. Notation: Information to be furnished by Employer.

2. Quantity: In addition to one extra blank key for each lock, provide the following:

a. Cylinder Change Keys: Three.

b. Master Keys: Five.

H. **Key Control System**: BHMA Grade 1 system, including key-holding hooks, labels, two sets of key tags with self-locking key holders, key-gathering envelopes, and temporary and permanent markers. Contain system in metal cabinet with baked-enamel finish.

1. Wall-Mounted Cabinet: Cabinet with hinged-panel door equipped with key-holding panels and pin-tumbler cylinder door lock.

2. Capacity: Able to hold keys for 150 percent of the number of locks.

3. Cross-Index System: Set up by key control manufacturer, complying with the following:

a. Card Index: Furnish four sets of index cards for recording key information. Include three receipt forms for each key-holding hook.

2.7 STRIKES

A. **Standards**: Comply with the following:

1. Strikes for Mortise Locks and Latches: BHMA A156.13.

2. Strikes for Interconnected Locks and Latches: BHMA A156.12.

3. Strikes for Auxiliary Deadlocks: BHMA A156.5.

4. Dustproof Strikes: BHMA A156.16.

B. **Strikes**: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:

1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.

2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.

3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.

4. Provide recess type top strikes for bolts locking into head frames, unless otherwise indicated.

5. Provide dust-proof strikes for foot bolts, except where special threshold construction provides non recessed strike for bolt.

C. **Dustproof Strikes**: BHMA Grade 1.

2.8 CARD READER

A. Proximity Reader with Keypad:

1. Technology: Wiengand proximity system compatible with building security system.

2. Housing: Weather resistant ABS plastic housing. Color as selected by Consultant from manufacturer's full line.

3. Key Pad: 12 button key pad for entry of Personal Identification Number (PIN) in addition to proximity card.

4. Display Status: 3 LED status display and controllable beeper to indicate reader operation and status.

5. Tamper Detection: Mechanical tamper switch to send signal to security room if reader is completely removed from wall in addition to detecting when reader has been separated from its back plate.

6. Provide all mounting plates, cables, programs and other items required to make card reader work with building security system.

2.9 OPERATING TRIM

A. **Standard**: Comply with BHMA A156.6.

B. Door handles shall have returns in direction of door, straight handles shall not be accepted.

C. Handles shall be with round (rose) cover plates.

D. **Materials**: Fabricate from stainless steel, unless otherwise indicated.

E. **Push-Pull Design**: As indicated on Drawings.

2.10 ACCESSORIES FOR PAIRS OF DOORS

A. **Standards**: Comply with the following:

1. Coordinators: BHMA A156.3.

B. **Carry-Open Bars**: Provide carry-open bars for inactive leaves of pairs of doors, unless automatic or self-latching bolts are used.

C. Do not use security astragals. Use split adjustable astragals or concealed side mounted

2.11 CLOSERS

A. Closers, General-unless otherwise indicated, provide closers on all fire-rated doors, exterior doors, toilet and locker room doors, sound-retardant doors, corridor doors, doors between heated/cooled and unheated / uncooled areas, elevator equipment room doors, and other door as required. Closer shall be tested for 10 million cycles and will withstand 57 degree ambient temperature and will be provided with all weather hydraulic fluid. Closer will be equipped with the function of variable back check and delayed action. Closer will be provided with ten years warranty and warranty against leaks. Closer will be non banded. Closer will be provided with adjustable with speed and hold open facility. Concealed door closer will be completely and components will minimize tempering and vandalism.

1. Size of Units: Unless otherwise indicated, comply with the manufacturer's recommendation for size of door control unit depending on size of door, exposure to weather and drafts, and anticipated frequency of use.

2. Arms: Provide parallel arms for all overhead closers, unless otherwise indicated. Provide closer unit one size larger than recommended for use with standard arms.

3. Closing Cycle: Comply with requirements of authorities having jurisdiction or the Americans with Disabilities Act (ADA), "Accessibility Guidelines for Buildings and Facilities (ADAAG)", whichever are most stringent

    a. Opening Force: Comply with the following maximum opening-force requirements for locations indicated:

        1) Exterior Doors: 67 N.

        2) Interior Doors: 22.2N.

4. Construction: Provide marine-grade construction for closers in non-air conditioned areas and in door swimming pool areas, consisting of nonferrous and stainless steel components.

B. **Aluminum Entrance Doors**: Provide concealed door closer. Standards: Comply with the following:

1. Closers: BHMA A156.4.

2. Closer Holder Release Devices: BHMA A156.15.

C. **Surface Closers**: BHMA Grade 1.

D. **Concealed Closers**: BHMA Grade 1.

E. **Certified Products**: Provide door closers listed in BHMA's "Directory of Certified Door Closers".

F. **Door Closers on Fire Rated Doors**: Shall be type that closes the door and positively latch the door.

G. **Hold-Open Closers/Detectors**: Coordinate and interface integral smoke detector and closer device with fire alarm system. Fire rated doors with closers of hold open facility shall release automatically in case of fire based on signal from the fire alarm system (electric release door closer). System of release device for double leaf fire rated doors shall be adjustable so as the inactive leaf shall close prior to the active leaf and that active leave shall positively latch to the inactive leaf at final closing position (electric release door closers and door coordinator).

H. **Flush Floor Plates**: Provide finish cover plates for floor closers unless thresholds are indicated. Match door hardware finish, unless otherwise indicated.

I. **Recessed Floor Plates**: Provide recessed floor plates with insert of floor finish material for floor closers, unless thresholds are indicated. Provide extended closer spindle to accommodate thickness of floor finish.

J. Weather Comply with manufacturer's written recommendation of exposure to weather. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

K. **Grade**: Door closers shall be from types tested for 10 millions cycles of operation and sized for door leafs of minimum weight of 200 kilogram per leaf for both steel doors and external doors.

2.12 PROTECTIVE TRIM UNITS

A. **Standard**: Comply with BHMA A156.6.

B. **Materials**: Fabricate protection plates from the following to match requirement indicate:

1. Stainless Steel: beveled top and 2 sides.

C. **Protection Plates, General**:

1. Fabricate edge trim of stainless steel to fit door thickness in standard lengths or to match height of protection plates.

D. **Kick Plates**: beveled top and two side edges (B3E). Provide two kick plates for toilet doors. Kick plate will ensure that the door bottom is protected.

   a. Metal Plates: Stainless steel, 3.00 mm thick

E. **Armor Plates**: 3 mm thick, 914 mm high by full width of door less clearance for stops on door frame.

F. **Fasteners**: Provide manufacturer's standard exposed fasteners for door trim units consisting of either machine or self-tapping screws.

G. Furnish protection plates sized 38 mm less than door width on push side and 13 mm less than door width on pull side, by height specified in Door Hardware Schedule.

2.13 STOPS AND HOLDERS

A. **Standards**: Comply with the following:

1. Stops and Bumpers: BHMA A156.16.

2. Mechanical Door Holders: BHMA A156.16.

3. Electromagnetic Door Holders: BHMA A156.15.

4. Combination Overhead Holders and Stops: BHMA A156.8.

5. Door Silencers: BHMA A156.16.

B. **Stops and Bumpers**: BHMA Grade 1.

C. **Mechanical Door Holders**: BHMA Grade 1.

D. **Combination Floor and Wall Stops and Holders**: BHMA Grade 1.

E. **Combination Overhead Stops and Holders**: BHMA Grade 1.

F. **Electromagnetic Door Holders for Labeled Fire Door Assemblies**: Coordinate with fire detectors and interface with fire alarm system.

G. **Floor Stops**: For doors, unless wall or other type stops are scheduled or indicated. Do not mount floor stops where they will impede traffic.

1. Where floor or wall stops are not appropriate, provide overhead holders.

H. **Silencers for Wood Door Frames**: BHMA Grade 1; neoprene or rubber, minimum 16 by 19 mm; fabricated for drilled-in application to frame.

I. **Silencers for Metal Door Frames**: BHMA Grade 1; neoprene or rubber, minimum diameter 13 mm; fabricated for drilled-in application to frame.

2.14 DOOR GASKETING

A. **Standard**: Comply with BHMA A156.22.

B. **General**: Provide continuous weather-strip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated or scheduled. Provide non-corrosive fasteners for exterior applications and elsewhere as indicated.

1. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

2. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

3. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

C. **Air Leakage**: Not to exceed 0.000774 cu. m/s per m of crack length for gasketing other than for smoke control, as tested according to ASTM E 283.

D. **Smoke-Labeled Gasketing**: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke-control ratings indicated, based on testing according to UL 1784.

1. Provide smoke-labeled gasketing on 20-minute-rated doors and on smoke-labeled doors.

E. **Fire-Labeled Gasketing**: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL 10B or NFPA 252.

F. **Sound-Rated Gasketing**: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated, based on testing according to ASTM E 1408.

G. **Replaceable Seal Strips**: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

H. **Gasketing Materials**: Comply with ASTM D 2000 and AAMA 701/702.

I. **Weather-stripping and Seal Types**: Unless otherwise indicated, provide the following, or approved equal:

1. Door Shoes: Extruded aluminum, with vinyl seal and integral rain drip.

2. Rain Drips: Extruded aluminum. Unless noted otherwise, provide rain drips for all exterior doors.

3. Automatic Door Bottoms: Extruded aluminum with neoprene insert for doors to achieve STC of 47 or better, as indicated in the hardware schedule.

4. Meeting Stile Seals (Astragal Seals): Extruded anodized aluminum, with silicon seal.

5. Weather-stripping, Smoke Seals, and Sound Retarding Gaskets: Compression-type self-adhesive silicone gasket applied to door stops, white color.

6. Security Astragals: Cam operated, automatic security astragal.

2.15 THRESHOLDS

A. **General**: Unless otherwise indicated, provide standard metal threshold units of type, size, and profile as shown or scheduled. Comply with ANSI/BHMA A156.21.

1. Material: Extruded aluminum, non-slip finish, except as otherwise specified.

2. Exterior Hinged Doors: Provide units not less than 100 mm wide, and not more than 12-mm-high, with beveled edges providing a floor level change with a slope of not more than 1:2, formed to accommodate change in floor elevation where indicated, fabricated to accommodate door hardware and to fit door frames, and as follows:

a. For in-swinging doors provide units with interlocking lip and interior drain channel; include hook on bottom edge of door and drain pan.

b. For out-swinging doors provide rabbeted type units with replaceable weather-strip insert in stop. Provide threshold with thermal break when mentioned in the hardware schedule

B. **Exterior Thresholds**: ANSI/BHMA A156.21, extruded aluminum. Provide flat saddle type or interlocking type with resilient insert as shown.

C. **Threshold for Aluminum Entrance Doors**: Manufacturer's standard threshold with cutouts coordinated for operating hardware, with anchors and jamb clips, and

not more than 12-mm-high, with beveled edges providing a floor level change with a slope of not more than 1:2, formed to accommodate change in floor elevation where indicated.

D. **Threshold for Doors with Exit Devices**: Extruded aluminum latching type, with replaceable vinyl inserts.

E. **Interior Thresholds**: Extruded aluminum flat saddle type with smooth surface.

2.16 MISCELLANEOUS DOOR HARDWARE

A. **Standard**: Comply with the following:

1. Auxiliary Hardware: BHMA A156.16.

2. Exit Alarms: BHMA A156.5.

B. **Auxiliary Hardware**: BHMA Grade 1, unless otherwise indicated.

C. **Boxed Power Supplies**: Modular unit in NEMA ICS 6, Type 4 enclosure; filtered and regulated; voltage rating and type matching requirements of door hardware served; and listed and labeled for use with fire alarm systems.

2.17 FABRICATION

A. Manufacturer's Nameplate: Do not provide manufacturers' products that have manufacturer's name or trade name displayed in a visible location (omit removable nameplates) except in conjunction with required fire-rated labels and as otherwise approved by Consultant.

1. Manufacturer's identification will be permitted on rim of lock cylinders only.

B. **Base Metals**: Produce door hardware units of base metal specified, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18 for finishes. Do not furnish manufacturer's standard materials or forming methods if different from specified standard.

C. **Fasteners**: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to commercially recognized industry standards for application intended. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.

1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not

use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.

2. Steel Machine or Wood Screws: For the following fire-rated applications:

   a. Mortise hinges to doors.

   b. Strike plates to frames.

   c. Closers to doors and frames.

3. Steel Through Bolts: For the following fire-rated applications, unless door blocking is provided:

   a. Surface hinges to doors.

   b. Closers to doors and frames.

   c. Surface-mounted exit devices.

4. Spacers: For through bolting of hollow metal doors.

5. Fasteners for Wood Doors: Comply with requirements of DHI WDHS.2, "Recommended Fasteners for Wood Doors."

2.18 BASE METAL

A. Base Metal for hardware and door furniture shall be as follows:

   1- Exterior Units: Stainless Steel alloy 316

   2- Interior Units: Stainless Steel alloy 304

2.19 FINISHES

A. **Standard**: Comply with BHMA A156.18.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. **Appearance of Finished Work**: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. **BHMA Designations**: Comply with base material and finish requirements indicated by the following:

1. BHMA 630: Satin stainless steel, over stainless-steel base metal.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. **Steel Doors and Frames**: Comply with DHI A115 series.

1. Surface-Applied Door Hardware: Drill and tap doors and frames according to SDI 107.

B. **Wood Doors**: Comply with DHI A115-W series.

3.3 INSTALLATION

A. **Mounting Heights**: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:

1. Custom Steel Doors and Frames: DHI's "Recommended Locations for Builders' Hardware for Custom Steel Doors and Frames."

2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."

B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.

2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

C. **Key Control System**: Place keys on markers and hooks in key control system cabinet, as determined by final keying schedule.

D. **Thresholds**: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

3.4 ADJUSTING

A. **Initial Adjustment**: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

1. Door Closers: Adjust sweep period so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 75 mm from the latch, measured to the leading edge of the door.

B. **Six-Month Adjustment**: Approximately six months after date of Substantial Completion, Installer shall perform the following:

1. Examine and readjust each item of door hardware as necessary to ensure function of doors, door hardware, and electrified door hardware.

2. Consult with and instruct Employer’s personnel on recommended maintenance procedures.

3. Replace door hardware items that have deteriorated or failed due to faulty design, materials, or installation of door hardware units.

3.5 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Employer's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes.

END OF DOCUMENT

SECTION 35 - GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Related Drawing and Detail.

1.2 SUMMARY

A. This Section includes glazing for the following products, including those specified in other Sections where glazing requirements are specified by reference to this Section:

1. Aluiminum entrances.
2. Sliding automatic entrances doors.
3. Aluminum windows
4. Structure-Sealant-Glazed curtain walls..
5. Glass visions in doors.

B. **Related Sections**: The following sections contain requirements that relate to this Section.

Division 5 Section "Metal Fabrications".

1. Division 8 Section "Custom Steel Doors and Frames".
2. Division 8 Section "Aluminum-Framed Entrances and Storefornts".
3. Division 8 Section "Sliding Automatic Entrance Doors".
4. Division 8 Section "Aluminum Windows".
5. Division 8 Section "Mirrored Glass".
6. Division 8 Section "Structure-Sealant-Glazed Curtain Walls".

1.3 DEFINITIONS

A. **Manufacturer**: Manufacturer is used in this Section to refer to a firm that produces primary glass or fabricated glass as defined in the referenced glazing standard.

B. **Deterioration of Laminated Glass**: Defects developed from normal use that are attributed to the manufacturing process and not to glass breakage and practices for maintaining and cleaning laminated glass contrary to manufacturer's directions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated glass standard.

C. **Deterioration of Insulating Glass**: Failure of the hermetic seal under normal use due to causes other than glass breakage and improper practices for maintaining, and cleaning insulating glass. Evidence of failure is the obstruction of vision by dust, moisture, or film on the interior surfaces of glass. Improper practices for maintaining and cleaning glass do not comply with the manufacturer's directions.

1.4 PERFORMANCE REQUIREMENTS

A. **General**: Provide glazing systems that are produced, fabricated, and installed to withstand normal thermal movement, wind loading, and impact loading (where applicable), without failure including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; and other defects in construction.

B. **Glass Design**: Glass thicknesses indicated on Drawings shall be considered as the minimum only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites for the various size openings in the thicknesses and strengths (annealed or heat-treated) to meet or exceed the following criteria:

1. Minimum glass thickness, nominally, of lites shall be 6.0 mm.

2. Tinted and heat-absorbing glass thicknesses for each tint indicated shall be the same throughout Project.

3. Minimum glass thicknesses of lites, whether composed of annealed or heat-treated glass, shall be selected so the worst-case probability of failure does not exceed the following:

   a. Eight lites per 1000 for lites set vertically or not over 15 degrees off vertical and under wind action. Determine minimum thickness of monolithic annealed glass according to ASTM E 1300. For other than monolithic annealed glass, determine thickness per glass manufacturer's standard method of analysis including applying adjustment factors to ASTM E 1300 based on type of glass.

b. One lite per 1000 for lites set over 15 degrees off vertical and under action of wind and rain.

C. **Thermal Movement**: Allow for normal thermal movement resulting from the following maximum change (range) in ambient and surface temperatures acting on glass-framing members and glazing components. Base Consultanting calculation on materials' actual surface temperatures due to both solar heat gain and nighttime sky heat loss.

1. Temperature Change (Range): 35 deg C ambient; 65 deg C material surfaces.

D. **Deflection**: Center deflection of loaded glass lites shall not exceed L/10t where L is the short span of the lite in mm and t is the thickness of the monolithic or laminated lite in mm.

E. **Loads on Glass**:

1. Glass shall be of appropriate thickness to withstand the greater of the following pressures, or combinations thereof, acting normal to the surface without center point deflections in excess of those specified. Load combinations shall be per the specific requirements of the 1997 Uniform Building Code:

a. Wind Load: Positive and negative wind load shall be based on the UBC for a basic wind speed of 80 mph (130 km/h), Importance Factor 1.15, and Exposure Category "C".

b. Human Impact Loads: Comply with CPSC 16 CFR 1201 Category II in those locations designated as hazardous locations by UBC Section 2406.4.

2. Calculate glass thickness based upon the following minimum safety factors.

a. Vertical Glazing:

1) Fully Tempered Glass (Type FT): 1.4.

1.5 SUBMITTALS

A. **Product Data**: For each glass product and glazing material indicated.

B. **Samples**: Samples for verification purposes of 300-mm-square samples of each type of glass indicated except for clear monolithic glass products, and 300-mm-long samples of each color required for each type of sealant or gasket exposed to view. Install sealant or gasket sample between two strips of material representative in color of the adjoining framing system.

C. **Test Reports**:

1. Compatibility and adhesion test reports from sealant manufacturer indicating that glazing materials were tested for compatibility and adhesion with glazing sealants. Include sealant manufacturer's interpretation of test results relative to sealant performance and recommendations for primers and substrate preparation needed for adhesion.

2. Compatibility test report from manufacturer of insulating glass edge sealant indicating that glass edge sealants were tested for compatibility with other glazing materials including sealants, glazing tape, gaskets, setting blocks, and edge blocks.

3. Product test reports for each type of glazing sealant and gasket indicated, evidencing compliance with requirements specified.

D. **Certificates**: Product certificates signed by glazing materials manufacturers certifying that their products comply with specified requirements.

1. Separate certifications are not required for glazing materials bearing manufacturer's permanent labels designating type and thickness of glass, provided labels represent a quality control program of a recognized certification agency or independent testing agency acceptable to authorities having jurisdiction.

E. **Maintenance Data**: For glass and other glazing materials to include in Operating and Maintenance Manual.

F. **Consultanting Calculations**:

1. Submit Consultanting calculations including glass fabricator/manufacturer's calculations for wind pressure analysis and thermal stress analysis.

2. Consultanting calculations shall be submitted concurrently with the corresponding shop drawings.

3. All calculations shall bear the stamp of a professional Consultant legally authorized to practice in the jurisdiction where Project is located and experienced in providing Consultanting services of the kind indicated.

1.6 QUALITY ASSURANCE

A. **Glazing Publications**: Comply with published recommendations of glass product manufacturers and organizations below, except where more stringent requirements

are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. AAMA TIR-A7 "Sloped Glazing Guidelines" and "Glass Design for Sloped Glazing".

2. FGMA "Glazing Manual".

3. LSGA "Design Guide".

4. SIGMA TM-3000 "Vertical Glazing Guidelines" and TB-3001 "Sloped Glazing Guidelines".

B. **Safety Glass**: Products complying with ANSI Z97.1 and testing requirements of 16 CFR Part 1201 for Category II materials.

1. Subject to compliance with requirements, provide safety glass permanently marked with certification label of Safety Glazing Certification Council (SGCC) or other certification agency acceptable to authorities having jurisdiction.

C. **Insulating Glass Certification Program**: Provide insulating glass units permanently marked either on spacers or at least one component lite of units with appropriate certification label of Insulating Glass Certification Council (IGCC).

D. **Glazier Qualifications**: Engage an experienced glazier who has completed glazing similar in material, design, and extent to that indicated for Project with a record of successful in-service performance.

E. **Single-Source Responsibility for Glass**: Obtain glass from one source for each product indicated below:

1. Primary glass of each (ASTM C 1036) type and class indicated.

2. Heat-treated glass of each (ASTM C 1048) condition indicated.

3. Laminated glass of each (ASTM C 1172) kind indicated.

4. Insulating glass of each construction indicated.

F. **Single-Source Responsibility for Glazing Accessories**: Obtain glazing accessories from one source for each product and installation method indicated.

G. **Preconstruction Compatibility and Adhesion Testing**: Submit to sealant manufacturers samples of each glass, gasket, glazing accessory, and glass-framing member that will contact or affect glazing sealants for compatibility and adhesion testing as indicated below:

1. Use test methods standard with sealant manufacturer to determine if priming and other specific preparation techniques are required for rapid, optimum glazing sealants adhesion to glass and glazing channel substrates.

    a. Perform tests under normal environmental conditions during installation.

    b. Submit not less than 4 pieces of each type and finish of glass-framing members and each type, class, kind, condition, and form of glass (monolithic, laminated, insulating units) for adhesion testing, as well as one sample of each glazing accessory (gaskets, setting, blocks and spacers) for compatibility testing.

    c. Schedule sufficient time to test and analyze results to prevent delay in the progress of the Work.

    d. Investigate materials failing compatibility or adhesion tests and obtain sealant manufacturer's written recommendations for corrective measures, including using special primers.

2. Testing is not required when glazing sealant manufacturer can submit required preparation data that is acceptable to Consultant and is based on previous testing of current sealant products for adhesion to and compatibility with submitted glazing materials.

H. **Pre-Installation Conference**: Conduct conference at Project site.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect glass and glazing materials to comply with manufacturer's directions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, and other causes.

1. Where insulating glass units will be exposed to substantial altitude changes, comply with insulating glass fabricator's recommendations for venting and sealing to avoid hermetic seal ruptures.

1.8 PROJECT CONDITIONS

A. **Environmental Conditions**: Do not proceed with glazing when ambient and substrate temperature conditions are outside the limits permitted by glazing materials manufacturer or when glazing channel substrates are wet from rain, condensation, or other causes.

1. Install liquid sealants at ambient and substrate temperatures above 4 deg C.

1.9 WARRANTY

General: Warranties specified in this Article shall not deprive the Employer of other rights the Employer may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under requirements of the Contract Documents.

A. **Manufacturer's Warranty on Laminated Glass**: Submit written warranty signed by laminated glass manufacturer agreeing to furnish replacements for laminated glass units that deteriorate as defined in Article 1.2, "Definitions", f.o.b. point of manufacture, freight allowed Project site, within specified warranty period indicated below. Warranty covers only deterioration due to normal conditions of use and not to handling, installing, and cleaning practices contrary to glass manufacturer's published instructions.

1. Warranty Period: Manufacturer's standard, but not less than 5 years after date of Substantial Completion.

B. **Manufacturer's Warranty on Insulating Glass**: Submit written warranty signed by manufacturer of insulating glass agreeing to furnish replacements for insulating glass units that deteriorate as defined in Article 1.2, "Definitions", f.o.b. point of manufacture, freight allowed Project site, within specified warranty period indicated below. Warranty covers only deterioration due to normal conditions of use and not to handling, installing, protecting, and maintaining practices contrary to glass manufacturer's published instructions.

1. Warranty Period: Manufacturer's standard, but not less than 10 years after date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PRIMARY FLOAT GLASS PRODUCTS

A. **Float Glass**: ASTM C 1036, Type I (transparent glass, flat), Class as indicated below, and Quality q3 (glazing select).

1. Class 1 (clear), for interior glass unless otherwise indicated.

2. Class 2 (tinted, heat-absorbing, and light-reducing), Arctic-Blue body-tinted.

B. **Translucent Glass**: Glass that transmits light with varying degrees of diffusion produced by sandblasting of surface of clear float as specified in Sub-Clause A of this Clause so that vision is not clear and light transmittance is lower than clear Glass. Requirements of translucent glass are to be similar to that of ASTM 1036-85, Type 2, Class 1.

2.2 HEAT-TREATED FLOAT GLASS

A. **Fabrication Process**: By horizontal (roller-hearth) process.

B. **Clear, Heat-Treated Float Glass**: ASTM C 1048, Condition A (uncoated surfaces), Type I (transparent glass, flat), Class 1 (clear), Quality q3 (glazing select), kind as indicated below.

1. Kind FT (fully tempered).

2. Fully Tempered: Kind FT (fully tempered, having a minimum surface compression of 110,000 kPa (16,000 psi.).

3. "Roller distortion" and/or "ripples" shall run in the same direction for the entire Project. Glass shall be heat-treated through the use of a horizontal tempering furnace.

C. **Tinted, Heat-Treated Float Glass**: ASTM C 1048, Condition A (uncoated surfaces), Type I (transparent glass, flat), Class 2 (tinted heat-absorbing and light-reducing), Quality q3 (glazing select), with tint color and performance characteristics for 6.0-mm-thick glass matching those indicated for annealed primary tinted float glass; kind as indicated below:

1. Kind FT (fully tempered) as indicated on Drawings and for the following applications:

a. Exterior lites of exterior double insulating glass units.

b. For low glazing (800mm and below) applications including lites of double insulating glass units. .

2.1 COATED FLOAT GLASS

A. **General**: Provide coated glass complying with requirements indicated in this Article.

B. Provide Kind FT (fully tempered) where safety glass is indicated.

C. **Low-e Coated Float Glass**: Float glass with solar-reflective metallic-oxide coating applied on surface #2 or surface #3 of the double insulating unit. Low-e coating shall be neutral color.

2.3 LAMINATED GLASS

Laminated Glass: Comply with ASTM C 1172, Kind LT (two lites of fully tempered Type 1 glass) and other requirements specified. Refer to primary and heat-treated

glass requirements relating to properties of glass products comprising laminated glass products. Unless otherwise indicated, provide the following types of glass:

1. Laminated Glass 8.76 mm Thick Tinted/Clear:

    a. Outer Lite: Fully tempered, minimum 4.0 mm thick. Provide Arctic-Blue color tinted as selected by Consultant from manufacturer's standard colors to match existing.

    b. 2x0.38 mm PVB interlayer

    c. Inner Lite: Clear, fully tempered, minimum 4.0 mm thick.

2. Laminated Glass 13.50 mm Thick Clear/Clear:

    a. Outer Lite: Fully tempered, minimum 6.0 mm thick.

    b. 4x0.38 mm PVB interlayer

    c. Inner Lite: Clear, fully tempered, minimum 6.0 mm thick.

3. Laminated Glass 6.67 mm Thick Clear/Clear:

    a. Outer Lite: Fully tempered, clear glass minimum 3.0 mm thick.

    b. 2x0.38 mm PVB interlayer

    c. Inner Lite: Clear, fully tempered, minimum 3.0 mm thick.

B. **Interlayer**: Interlayer material as indicated below, and of thickness indicated with a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after laminating glass lites and installation.

1. Interlayer Material: Polyvinyl Butyral (PVB) sheets, clear, minimum thickness as indicated before.

C. **Laminating Process**: Fabricate laminated glass to produce glass free of foreign substances and air or glass pockets as follows:

1. Laminate lites with polyvinyl butyral interlayer in autoclave with heat plus pressure.

2.4 INSULATING GLASS PRODUCTS

A. **Sealed Insulating Glass Units**: Preassembled units consisting of organically sealed lites of glass separated by dehydrated air spaces complying with ASTM E 774 and with other requirements indicated. Provide dual-seal sealing system,

spacer material, dessicant, and corner construction as recommended by manufacturer, if not specified here after:

1. For properties of individual glass lites making up units, refer to requirements specified elsewhere in this Section applicable to types, classes, kinds, and conditions of glass products comprising lites of insulating glass units.

2. Construction of double insulating glass units Types G1 shall be as follows, unless otherwise indicated as Drawings.

   a. Outerboard lite: 8.76 mm thick laminated glass of Arctic-Blue tinted\clear construction as specified.

   b. Air space: 19 mm thick. Provide stainless steel spacers and silica gel granules.

   c. Innerboard lite: 6.00 mm clear tempered glass. Interior lite shall be fully tempered safety glass for locations designated as hazardons locations in UBC section 2604.4 and for sill glazing (below 800 mm and below from adjoining flor level).

3. Performance Characteristics of Insulating Units shall be as follows:

   a. Transmittance, Visible Light: 20 percent.

   b. U-Value, Summer Daytime: 1.4 W/sq. m x Deg. C., maximum

   c. Shading Coefficient: 0.21, maximum

   d. STC: 42 db.

B. Double Insulating Units Type GL2:

1. Panel Make-Up:

   a. Outer Lite: 6.00 mm thick fully tempered of Arcatic-blue glass.

   b. Inter Space: 12.00 or 13.00 mm dehydrated air space.

   c. Inner Lite: 6.00 mm clear float glass. Interior lite shall be fully tempered safety glass for locations designated as hazardous locations in UBC section 2604.4 and for sill glazing (below 900 mm and below from adjoining floor level).

   d. Low-e Coating: Neutral low-e coating as specified on surface #2 or #3.

e. Spacer:

- Material: Stainless steel.
- Desiccant: Molecular sieve or silica gel, or blend of both.
- Corner Construction: Manufacturer's standard corner construction.
- Seals: Two-layer manufacturer's standard seal system.

2. Thermal Performance:

Shading Coefficient: 0.23 maximum.

a. U-Value (Summer): 1.90 W/m2.k, maximum

b. Relative Heat Gain: 160 W/m^2, maximum

3. Visible Light Performance

a. Light Transmittance: 21%, minimum.

b. Light Reflection (External): 19%, maximum.

c. Light Reflectance (Internal): 9%, maximum

4. Acoustical Performance:

a. STC: 35

2.5 FIRE-RATED GLAZING PRODUCTS

A. **Laminated Glass with Intumescent Interlayers**: Proprietary product in the form of multiple lites of Condition A (uncoated surfaces), Type I (transparent glass, flat), Class 1 (clear), annealed float glass laminated with intumescent interlayers; and as follows:

1. Fire-Protection Rating: As indicated for the assembly in which the glazing material is installed, and permanently labeled by a testing and inspecting agency acceptable to the Consultant.

2.6 FRAMELESS GLASS (ALL-GLASS) PARTITIONS

A. **Glass**: 12 mm thick fully tempered safety glass lites.

B. **Dimensions**: Comply with details indicated on Drawings.

C. **Edge Treatment**: Polished.

D. **Assembly Angles**: Stainless steel

E. **Fixation Systems**: Manufacturer's standard that comply with details indicated on Drawings and general requirements specified in Division 5, Section "Metal Fabrication" for materials and workmanship

F. **Base Covers**: Stainless steel base covers as specified in Division 5, Section "Formed Metal Fabrications"

G. **Fasteners and Anchors**: Stainless steel matching finish where exposed to view, zinc-plated steel where concealed

H. **Miscellaneous Materials**: Furnish complete with all necessary materials for fixing in place.

I. **Stainless Steel Components**: Alloy 304, satin finish.

2.7 ELASTOMERIC GLAZING SEALANTS

A. **General**: Provide products of type indicated, complying with the following requirements:

1. Compatibility: Select glazing sealants and tapes of proven compatibility with other materials they will contact, including glass products, seals of insulating glass units, and glazing channel substrates, under conditions of installation and service, as demonstrated by testing and field experience.

2. Suitability: Comply with sealant and glass manufacturer's recommendations for selecting glazing sealants and tapes that are suitable for applications indicated and conditions existing at time of installation.

3. Colors: Provide colors of exposed joint sealants as selected by Consultant from manufacturer's full range of standard colors for products of type indicated.

B. **Elastomeric Glazing Sealant Standard**: Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer indicated that comply with ASTM C 920 requirements for Type, Grade, Class and Uses.

2.8 GLAZING TAPES

A. **Back-Bedding Mastic Glazing Tape**: Preformed, butyl-based elastomeric tape with a solids content of 100 percent, nonstaining and nonmigrating in contact with

nonporous surfaces, with or without spacer rod as recommended by tape and glass manufacturers for application indicated, packaged on rolls with a release paper backing, and complying with AAMA 800 for products indicated below:

1. AAMA 804.1.

2. AAMA 806.1.

3. AAMA 807.1.

B. **Expanded Cellular Glazing Tape**: Closed-cell, polyvinyl chloride foam tape, factory coated with adhesive on both surfaces, packaged on rolls with release liner protecting adhesive, and complying with AAMA 800 for Product 810.5.

2.9 GLAZING GASKETS

A. **Dense Compression Gaskets**: Molded or extruded gaskets of material indicated below, complying with standards referenced with name of elastomer indicated below, and of profile and hardness required to maintain watertight seal:

1. EPDM, ASTM C 864.

B. **Soft Compression Gaskets**: Extruded or molded closed-cell, integral-skinned gaskets of material indicated below, complying with ASTM C 509, Type II, black, and of profile and hardness required to maintain watertight seal:

1. EPDM.

2.10 MISCELLANEOUS GLAZING MATERIALS

A. **General**: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials involved for glazing application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. **Cleaners, Primers and Sealers**: Type recommended by sealant or gasket manufacturer.

C. **Setting Blocks**: Elastomeric material with a Shore A durometer hardness of 85, plus or minus 5.

D. **Spacers**: Elastomeric blocks or continuous extrusions with a Shore A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. **Edge Blocks**: Elastomeric material of hardness needed to limit glass lateral movement (side-walking).

F. **Plastic Foam Joint Fillers**: Preformed, compressible, resilient, nonstaining, nonextruding, nonoutgassing, strips of closed-cell plastic foam of density, size, and shape to control sealant depth and otherwise contribute to produce optimum sealant performance.

G. **Perimeter Insulation for Fire-Resistive Glazing**: Identical to product used in test assembly to obtain fire-resistive rating.

2.11 FABRICATION OF GLASS AND OTHER GLAZING PRODUCTS

A. Fabricate glass and other glazing products in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with recommendations of product manufacturer and referenced glazing standards as required to comply with specified performance requirements.

B. Glass Edges:

1. Exposed edges shall be ground and polished.

2. Butt glass edges shall be ground and polished.

3. All other edges shall have a high-quality factory-cut edge.

2.12 SPANDREL PANEL

A. **Spandrel Panels**: Are to comply with the following requirements and details indicated on Drawings

1. Box encasement: aluminum sheets of mill finish, 2.00 mm thick minimum.

2. Insulation: Foil-faced mineral fiber insulation as specified in Division 7, Section "Building Insulation".

3. Glass: To match outer lite of adjoining double insulating glass units as indicated on Drawings and specified with opicifier film on surface #2.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine glass framing, with glazier present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, offsets at corners.

2. Presence and functioning of weep system.

3. Minimum required face or edge clearances.

4. Effective sealing between joints of glass-framing members.

B. Do not proceed with glazing until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings that are not firmly bonded to substrates.

3.3 GLAZING, GENERAL

A. Comply with combined recommendations of manufacturers of glass, sealants, gaskets, and other glazing materials, except where more stringent requirements are indicated, including those in referenced glazing publications.

B. Glazing channel dimensions where indicated on Drawings provide minimum necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by referenced standards and Project conditions during installation.

C. Protect glass from edge damage during handling and installation as follows:

1. Use a rolling block in rotating glass units to prevent damage to glass corners. Do not impact glass with metal framing. Use suction cups to shift glass units within openings; do not raise or drift glass with a pry bar. Rotate glass lites with flares or bevels on bottom horizontal edges so edges are located at top of opening, unless otherwise indicated by manufacturer's label.

2. Remove damaged glass from Project site and legally dispose of off site. Damaged glass is glass with surface or edge damage or other imperfections that, when installed, weaken glass and impair performance and appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.

E. Install elastomeric setting blocks in sill rabbets, sized and located to comply with referenced glazing standard, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass sizes larger than 1270 united mm (length plus height) as follows:

1. Locate spacers inside, outside, and directly opposite each other. Install correct size and spacing to preserve required face clearances, except where gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and comply with specified performance requirements.

2. Provide 3-mm minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

H. Provide edge blocking to comply with requirements of referenced glazing publications, unless otherwise required by glass manufacturer.

I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

K. Square cut wedge-shaped gaskets at corners and install gaskets in manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

L. Any glass lites installed within 900 mm from adjoining finish floor level (sill glazing) shall be marked as safety in compliance with standard referenced in this Section.

3.4 TAPE GLAZING

A. Position tapes on fixed stops so that when compressed by glass their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously but not in one continuous length. Do not stretch tapes to make them fit opening.

C. Where framing joints are vertical, cover these joints by applying tapes to heads and sills first and then to jambs. Where framing joints are horizontal, cover these joints by applying tapes to jambs and then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until just before each lite is installed.

F. Where required, apply heel bead of elastomeric sealant.

G. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

H. Where required, apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

A. Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with stretch allowance during installation.

B. Secure compression gaskets in place with joints located at corners to compress gaskets producing a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

C. Install gaskets so they protrude from face of glazing stops.

3.6 SEALANT GLAZING (WET)

A. Install continuous spacers between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel weep systems until sealants cure. Secure spacers in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass. Install pressurized gaskets to protrude slightly out of channel to eliminate dirt and moisture pockets.

3.7 GLASS PARTITIONS

A. Fix partitions firm in place indicated on Drawings at lines indicated, perfectly plumb without deviations from horizontal or vertical lines. Provide firm connections between glass lites of partitions and glass fins. All bolts and anchors shall be tightly screwed without overstressing glass. Use concealed EPDM washers and shims as required and comply with manufacturer's instructions.

3.8 PROTECTION AND CLEANING

A. Protect exterior glass from breakage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove them immediately as recommended by glass manufacturer.

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for build-up of dirt, scum, alkali deposits, or stains, and remove as recommended by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, abraded, or damaged in any way, including natural causes, accidents and vandalism, during construction period.

E. Wash glass on both faces in each area of Project not more than 4 days prior to date scheduled for inspections that establish date of Substantial Completion. Wash glass using materials and methods recommended by glass manufacturer.

END OF DOCUMENTS

SECTION 36 – PORTLAND CEMENT PLASTER

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Related Drawing and Detail.

1.1 SUMMARY

A. This Section includes the following:

1. Portland cement plaster.

2. Metal Lath suspended ceiling.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 6 Section "Rough Carpentry".

2. Division 9 Section "Ceramic Tiles" for plaster base coat to be applied to receive ceramic wall tiles.

1.1 SUBMITTALS

A. **Product Data**: For each product specified.

B. **Samples for Initial Selection**: manufacturer's color charts consisting of actual units or sections of units at least 300 mm square showing the full range of colors, textures, and patterns available for each type of finish indicated.

1. Where finish involves normal color and texture variations, include Sample sets composed of 2 or more units showing the full range of variations expected.

2. Include similar Samples of material for joints and accessories involving color selection.

C. **Shop Drawings**: Submit shop drawings for suspended metal lath ceilings including layout and details of ceilings installation

D. **Material Certificates**: certificate signed by manufacturer for each kind of plaster aggregate certifying that materials comply with requirements.

1.1 QUALITY ASSURANCE

A. **Quality System**: Comply with ISO 9001/9002 Quality System as a minimum. Incorporate all the standard procedures supplied by the Consultant and the Employer.

B. **Mockups**: Prior to installing plaster work, construct panels for each type of finish and application required to verify selections made under Sample submittals and to demonstrate aesthetic effects as well as qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for final unit of Work.

1. Locate mockups on-site in the location and of the size indicated or, if not indicated, as directed by Consultant.

2. Erect mockups 1200 by 1200 mm by full thickness in presence of Consultant using materials, including lath, support system, and control joints, indicated for final Work.

3. Notify Consultant 7 days in advance of the dates and times when mockups will be constructed.

4. Demonstrate the proposed range of aesthetic effects and workmanship.

5. Obtain Consultant's approval of mockups before start of plaster Work.

6. Retain and maintain mockups during construction in an undisturbed condition as a standard for judging the completed Portland cement plaster Work.

7. When directed demolish mockups, remove rubbles from site and replace with permanent works.

1.1 DELIVERY, STORAGE, AND HANDLING

A. Deliver cementitious materials to Project site in original packages, containers, or bundles, labeled with manufacturer's name, product brand name, and lot number.

B. Store materials indoor, under cover, and dry, protected from weather, direct sunlight, surface contamination, aging, corrosion, and damage from construction traffic and other causes.

1.1 PROJECT CONDITIONS

A. **Environmental Requirements, General**: Comply with requirements of referenced plaster application standards and recommendations of plaster manufacturer for environmental conditions before, during, and after plaster application.

B. **Warm-Weather Requirements**: Protect plaster against uneven and excessive evaporation and from strong flows of dry air, both natural and artificial. Apply and cure plaster as required by climatic and job conditions to prevent dry out during cure period. Provide suitable coverings, moist curing, barriers to deflect sunlight and wind, or combinations of these, as required.

C. **Exterior Plaster Work**: Do not apply plaster when ambient temperature is below 4 deg C.

D. **Interior Plaster Work**: Maintain at least 10 deg C temperature in areas to be plastered for at least 48 hours before, during, and after application.

E. **Ventilation**: Provide natural or mechanical means of ventilation to properly dry interior spaces after Portland cement plaster has cured.

F. Protect contiguous work from soiling and moisture deterioration caused by plastering. Provide temporary covering and other provisions necessary to minimize harmful spattering of plaster on other work.

PART 2 - PRODUCTS

2.1 METAL SUPPORTS FOR SUSPENDED CEILINGS

A. **General**: Size metal ceiling supports to comply with ASTM C 1063, unless otherwise indicated.

B. **Postinstalled Anchors in Concrete**: Anchors of type indicated below, fabricated from corrosion-resistant materials, with holes or loops for attaching hanger wires; and with capability to sustain, without failure, a load equal to 5 times that imposed by ceiling construction, as determined by testing according to ASTM E 488 conducted by a qualified independent testing agency.

1. Chemical anchor.

C. **Wire for Hangers and Ties**: ASTM A 641M, Class 1 zinc coating, soft temper.

D. **Rod Hangers**: Mild steel, zinc coated.

E. **Flat Hangers**: Mild steel, zinc coated or protected with rust-inhibitive paint.

F. **Channels**: Cold-rolled steel, minimum 1.5-mm- thick base (uncoated) metal and 11.1-mm- wide flanges, and as follows:

1. Carrying Channels: Based on design calculations but not less than 38 mm deep, 0.7 kg/m.

G. **Finish**: ASTM A 653M, Z180 hot-dip galvanized coating for framing where indicated.

2.1 LATH

A. **Expanded-Metal Lath**: Comply with ASTM C 847 for material, type, configuration, and other characteristics indicated below.

1. Material: Fabricate expanded-metal lath from sheet metal conforming to the following:

   a. Galvanized Steel: Structural-quality, zinc-coated (galvanized) steel sheet complying with ASTM A 653M, Z275 minimum coating designation, unless otherwise indicated.

   b. Form: Coil.

   c. Special Pieces: For internal corners.

2. Diamond-Mesh Lath for Plaster Background: Comply with the following requirements:

   a. Configuration: Flat.

      1) i. Weight: 1.1 kg/sq. m.

3. Rib Lath for Suspended Ceilings: Comply with the following requirements:

   a. Configuration: Flat, rib depth of not over 3 mm.

      1) Weight: 1.8 kg/sq. m.

2.1 ACCESSORIES

A. **General**: Comply with material provisions of ASTM C 1063 and the requirements indicated below; coordinate depth of accessories with thicknesses and number of plaster coats required.

1. Galvanized Steel Components (for internal plaster): Fabricated from zinc-coated (galvanized) steel sheet complying with ASTM A 653M, Z90 minimum coating designation.

B. **Metal Corner Reinforcement**: Expanded, large-mesh, diamond-metal lath fabricated from zinc-alloy or welded-wire mesh fabricated from 1.2-mm- diameter, zinc-coated (galvanized) wire and specially formed to reinforce external corners of

Portland cement plaster on exterior exposures while allowing full plaster encasement.

C. **Cornerbeads**: Small nose cornerbeads fabricated from the following metal, with expanded flanges of large-mesh diamond-metal lath allowing full plaster encasement.

D. **Casing Beads**: Square-edged style, with expanded flanges.

E. **Curved Casing Beads**: Square-edged style, fabricated from aluminum coated with clear plastic, preformed into curve of radius indicated.

F. **Control Joints**: Prefabricated, of material and type indicated below:

1. One-Piece Type: Folded pair of nonperforated screeds in M-shaped configuration, with expanded or perforated flanges.

2. Two-Piece Type: Pair of casing beads with back flanges formed to provide slip-joint action, adjustable for joint widths from 3 to 16 mm.

a. Provide removable protective tape on plaster face of control joints.

G. **Foundation Sill (Weep) Screed**: Manufacturer's standard profile designed for use at sill plate line to form plaster stop and prevent plaster from contacting damp earth, fabricated from zinc-coated (galvanized) steel sheet.

H. **Lath Attachment Devices**: Material and type required by ASTM C 1063 for installations indicated.

2.1 PLASTER MATERIALS

A. **Base-Coat Cements**: Type as indicated below:

1. Portland cement, ASTM C 150, Type I.

B. Job-Mixed Finish-Coat Cement: Material and color as indicated below:

1. Portland cement: sand aerated mix

C. **Cement Color**: Gray.

D. Lime: do not use lime.

E. **Plasticiser**: ASTM C260.

F. **Sand Aggregate for Base Coats**: ASTM C 897.

G. **Aggregate for Finish Coats**: ASTM C 897 system and as indicated below:

1. Manufactured or natural sand, White in color.

2.1 MISCELLANEOUS MATERIALS

A. **Fiber for Base Coat**: Alkaline-resistant glass or polypropylene fibers, 13 mm long, free of contaminates, manufactured for use in Portland cement plaster.

B. **Water for Mixing and Finishing Plaster**: Potable.

C. **Acid-Etching Solution**: Muriatic acid (10 percent solution of commercial hydrochloric acid) mixed 1 part to not less than 6 nor more than 10 parts water.

D. **Dash-Coat Material**: 2 parts Portland cement to 3 parts fine sand, mixed with water to a mushy-paste consistency.

2.1 PLASTER MIXES AND COMPOSITIONS

A. **General**: Comply with ASTM C 926 for base- and finish-coat mixes as applicable to plaster bases, materials, and other requirements indicated. Do not use lime in plaster mixes.

B. **Base-Coat Mixes and Compositions**: Proportion materials for respective base coats in parts by volume per sum of cementitious materials for aggregates to comply with the following requirements for each method of application and plaster base indicated. Adjust mix proportions below within limits specified to attain workability.

C. **Fiber Content**: Add fiber to following mixes after ingredients have mixed at least 2 minutes. Comply with fiber manufacturer's written instructions but do not exceed 16 kg/cu. m of cementitious materials. Reduce aggregate quantities accordingly to maintain workability.

D. **Three-Coat Work over Metal Lath**: Base-coat proportions as indicated below:

1. Scratch Coat: 1 part Portland cement, 2-1/2 to 4 parts aggregate.

2. Brown Coat: 1 part Portland cement, 3 to 5 parts aggregate.

3. Admixtures and workability aids, as per manufacturer's printed instructions

E. **Two-Coat Work over Concrete and Concrete Unit Masonry**: Base-coat proportions as indicated below:

1. Base Coat: 1 part Portland cement, 5 parts aggregate, aerating plasticiser as per manufacturer's recommendation.

F. **Job-Mixed Finish Coats**: Proportion materials for finish coats in parts by volume for cementitious materials and parts by volume per sum of cementitious materials to comply with the following requirements:

1. Proportions using sand aggregates as indicated below:

   a. 1 part Portland cement, 4 parts aggregate, aerating plasticiser as per manufacturer's recommendation.

2.1 MIXING

A. Mechanically mix cementitious and aggregate materials for plasters to comply with applicable referenced application standard and with recommendations of plaster manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION OF CEILING SUSPENSION SYSTEMS

A. **Preparation and Coordination**: Coordinate installation of ceiling suspension system with installation of overhead structural systems to ensure inserts and other structural anchorage provisions have been installed to receive ceiling hangers in a manner that will develop their full strength and at spacings required to support ceiling.

B. **Hanger Installation**: Attach hangers to structure above ceiling to comply with ML/SFA 920, "Guide Specifications for Metal Lathing and Furring," and with referenced standards.

C. Install ceiling suspension system components of sizes and spacings indicated, but not in smaller sizes or greater spacings than those required by referenced lathing and furring installation standards.

1. Wire Hangers: Space 4-mm- diameter wire hangers not over 1200 mm o.c., parallel with and not over 900 mm perpendicular to direction of carrying channels, unless otherwise indicated, and within 150 mm of carrying channel ends.

2. Carrying Channels: Space carrying channels not over 900 mm o.c. with 1200-mm o.c. hanger spacing.

3. Furring Channels to Receive Metal Lath: Space furring channels not over 500 mm o.c. for 1.8-kg/sq. m flat rib lath.

3.1 PREPARATIONS FOR PLASTERING

A. Clean plaster bases and substrates for direct application of plaster, removing loose material and substances that may impair the Work.

B. Etch concrete and concrete unit masonry surfaces indicated for direct plaster application. Scrub with acid-etching solution on previously wetted surface and rinse thoroughly with clean water. Repeat application, if necessary, to obtain adequate suction and mechanical bond of plaster (where dash coat, bonding agent, or additive is not used).

C. **Dissimilar Backgrounds**: where rendering is to be continued without break across joints between dissimilar solid backgrounds which are in the same plane and rigidly bonded or tied together, cover joints with 150mm wide strip of building paper overlaid with 300mm wide galvanized steel lathing fixed with corrosion resistant fasteners at not more than 600mm centers along both edges.

D. Apply dash coat on concrete and concrete masonry surfaces indicated for direct plaster application. Moist-cure dash coat for at least 24 hours after application and before plastering.

E. Install temporary grounds and screeds to ensure accurate rodding of plaster to true surfaces; coordinate with scratch-coat work.

F. Refer to Division 6 Sections for installing permanent wood grounds, if any.

G. **Surface Conditioning**: Immediately before plastering, dampen concrete and concrete unit masonry surfaces that are indicated for direct plaster application. Determine and apply amount of moisture and degree of saturation that will result in optimum suction for plastering.

3.1 LATHING

A. Install metal lath for the following applications where plaster base coats are required. Provide appropriate type, configuration, and weight of metal lath selected from materials indicated that comply with referenced ML/SFA specifications and ASTM lathing installation standards.

1. Dissimilar Backgrounds: where rendering is to be continued without break across joints between dissimilar solid backgrounds which are in the same plane and rigidly bonded or tied together, cover joints with 150 mm wide strip of building paper overlaid with 300 mm wide galvanized steel lathing fixed at not more than 600 mm centers along both edges.

3.1 INSTALLATION OF PLASTERING ACCESSORIES

A. **General**: Comply with referenced lathing and furring installation standards for provision and location of plaster accessories of type indicated. Miter or cope accessories at corners; install with tight joints and in alignment. Attach accessories securely to plaster bases to hold accessories in place and in alignment during plastering. Install accessories of type indicated at following locations:

1. External Corners: Install corner reinforcement at external corners.

2. Terminations of Plaster: Install casing beads, unless otherwise indicated.

3. Control Joints: Install at locations indicated or, if not indicated, at locations complying with the following criteria and approved by Consultant:

   a. Where an expansion or contraction joint occurs in surface of construction directly behind plaster membrane.

   b. Distance between Control Joints: Not to exceed 5.5 m in either direction or a length-to-width ratio of 2-1/2 to 1.

   c. Wall Areas: Not more than 13 sq. m.

   d. Horizontal Surfaces: Not more than 9 sq. m in area.

   e. Where plaster panel sizes or dimensions change, extend joints full width or height of plaster membrane.

3.1 PLASTER APPLICATION

A. **Plaster Application Standard**: Apply plaster materials, composition, and mixes to comply with ASTM C 926.

B. Do not use materials that are frozen, caked, lumpy, dirty, or contaminated by foreign materials.

C. Do not use excessive water in mixing and applying plaster materials.

D. **Flat Surface Tolerances**: Do not deviate more than plus or minus 3 mm in 3 m from a true plane in finished plaster surfaces, as measured by a 3-m straightedge placed at any location on surface.

E. Grout hollow-metal frames, bases, and similar work occurring in plastered areas, with base-coat plaster material, and before lathing where necessary. Except where full grouting is indicated or required for fire-resistance rating, grout at least 150 mm at each jamb anchor.

F. Sequence plaster application with installation and protection of other work so that neither will be damaged by installation of other.

G. Plaster flush with metal frames and other built-in metal items or accessories that act as a plaster ground, unless otherwise indicated. Where interior plaster is not terminated at metal frame by casing beads, cut base coat free from metal frame before plaster sets and groove finish coat at junctures with metal.

H. **Corners**: Make internal corners and angles square; finish external corners flush with corner beads on interior work, square and true with plaster faces on exterior work.

I. **Finish Coats**: Apply finish coats to comply with the following requirements:

1. Float Finish: Apply finish coat to a minimum thickness of 3 mm to completely cover base coat, uniformly floated to a true even plane with fine-textured finish matching samples approved by the Consultant.

J. **Number of Coats and Thickness**: Excluding dash coats and dubbing out coats apply plaster of composition indicated, to comply with the following requirements:

1. Two Coats: Base and finish coats over the following plaster bases:

a. Concrete unit masonry.

b. Concrete, cast-in-place or precast when surface condition complies with ASTM C 926 for plaster bonded to solid base.

2. Three Coats: Scratch, base and finish coats over metal lath backgrounds and installations.

3. Overall thickness is to be 15.00 mm for internal plaster and 20.00 mm for external plaster.

4. One plaster base coat (15 mm thick) for walls to be finished with ceramic tiles set with thin bed adhesive.

5. One coat work (15 mm thick) for plaster on concrete structural slabs uniformly floated to a true even plane

K. Moist-cure plaster base and finish coats to comply with ASTM C 926, including written instructions for time between coats and curing in "Annex A2 Design Considerations."

3.1 CUTTING AND PATCHING

A. Cut, patch, replace, repair, and point up plaster as necessary to accommodate other work. Repair cracks and indented surfaces. Point-up finish plaster surfaces around items that are built into or penetrate plaster surfaces. Repair or replace work to eliminate blisters, buckles, check cracking, dry outs, efflorescence, excessive pinholes, and similar defects. Repair or replace work as necessary to comply with required visual effects.

3.1 CLEANING AND PROTECTING

A. Remove temporary covering and other provisions made to minimize spattering of plaster on other work. Promptly remove plaster from doorframes, windows, and other surfaces not to be plastered. Repair surfaces stained, marred or otherwise damaged during plastering work. When plastering work is completed, remove unused materials, containers, equipment, and plaster debris.

B. Provide final protection and maintain conditions, in a manner acceptable to Consultant, that ensure plaster work is without damage or deterioration at the time of Substantial Completion.

END OF DOCUMENTS

SECTION 37 - CERAMIC TILE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Related Drawing and Detail.

1.2 SUMMARY

A. This Section includes the following:

1. PorcelinTiles.

B. Related Sections include the following:

1. Division 3 Section "Cement Based Screeds" for floor screeds to receive ceramic tiles.

2. Division 5 Section "Architectural Joint Systems" for movement joints in ceramic flooring.

3. Division 7 Section "Cold Fluid-Applied Waterproofing" for waterproofing under thickset mortar beds.

4. Division 7 Section "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.

5. Division 9 Section "Portland Cement Plaster" for Portland cement scratch coat over metal lath on wall surfaces.

1.3 DEFINITIONS

A. **Module Size**: Actual tile size (minor facial dimension as measured per ASTM C 499) plus joint width indicated.

B. **Facial Dimension**: Actual tile size (minor facial dimension as measured per ASTM C 499).

C. **Facial Dimension**: Nominal tile size as defined in ANSI A137.1.

1.4 PERFORMANCE REQUIREMENTS

A. **Static Coefficient of Friction**: For tile installed on walkway surfaces, provide products with the following values as determined by testing identical products per ASTM C 1028:

1. Level Surfaces: Minimum 0.6.

B. **Load-Bearing Performance**: Provide installations rated for the following load-bearing performance level based on testing assemblies according to ASTM C 627 that are representative of those indicated for this Project:

1. Heavy: Passes cycles 1 through 12. Use where indicated in Finishing Schedules.

2. Moderate: Passes cycles 1 through 10. Use for other applications indicated on Schedule where heavy duty is not indicated.

1.5 SUBMITTALS

A. **Product Data**: For each type of tile, mortar, grout, and other products specified.

B. **Shop Drawings**: For the following:

1. Tile patterns and locations.

2. Widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.

3. Locate precisely each joint and crack in tile substrates, record measurements on shop drawings, and coordinate them with tile joint locations, as approved by Consultant.

C. **Tile Samples for Initial Selection**: Manufacturer's color charts consisting of actual tiles or sections of tiles showing the full range of colors, textures, and patterns available for each type and composition of tile indicated. Include Samples of accessories involving color selection.

D. **Grout Samples for Initial Selection**: Manufacturer's color charts consisting of actual sections of grout showing the full range of colors available for each type of grout indicated.

E. **Samples for Verification**: Of each item listed below, prepared on Samples of size and construction indicated. Where products involve normal color and texture variations, include Sample sets showing the full range of variations expected.

1. Each type and composition of tile and for each color and texture required, at least 400 mm square, mounted on braced cementitious backer units, and with grouted joints using product complying with specified requirements and approved for completed work in color or colors selected by Consultant.

2. Full-size units of each type of trim and accessory for each color required.

3. Stone thresholds in 150-mm lengths.

F. **Master Grade Certificates**: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.

G. **Product Certificates**: Signed by manufacturers certifying that the products furnished comply with requirements.

H. **Installer Experience**: List of five projects (minimum) of a similar nature carried out successfully by the installer with the same product.

I. **Installer Experience**: List of five projects (minimum) of a similar nature carried out successfully by the installer with the same product Qualification Data: For firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names of Consultants and Employers, and other any information required by Consultant.

J. **Test Reports**: Material test reports from qualified independent testing laboratory indicating and interpreting test results relative to compliance of tile and tile setting and grouting products with requirements indicated.

K. **Setting Material Test Reports**: Indicate and interpret test results for compliance of tile-setting and -grouting products with specified requirements.

1.6 QUALITY ASSURANCE

A. **Quality System**: Comply with ISO 9001/9002 Quality System as a minimum. Incorporate all the standard procedures supplied by the Consultant and the Employer.

B. **Installer Qualifications**: Engage an experienced installer who has completed tile installations similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

C. **Source Limitations for Tile**: Obtain each color, grade, finish, type, composition, and variety of tile from one source with resources to provide products from the same production run for each contiguous area of consistent quality in appearance and physical properties without delaying the Work.

D. **Source Limitations for Setting and Grouting Materials**: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from a single manufacturer and each aggregate from one source or producer.

E. **Source Limitations for Other Products**: Obtain each of the following products specified in this Section from one source and by a single manufacturer for each product:

1. Stone thresholds.

2. Cementitious backer units.

3. Joint sealants.

4. Waterproofing.

F. **Mockups**: Before installing tile, construct mockups for each form of construction and finish required to verify selections made under Sample submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for completed Work.

1. Locate mockups in the location and of the size indicated or, if not indicated, as directed by Consultant.

2. Notify Consultant 7 days in advance of the dates and times when mockups will be constructed.

3. Demonstrate the proposed range of aesthetic effects and workmanship.

4. Obtain Consultant's approval of mockups before proceeding with final unit of Work.

5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.

a. Approved mockups in an undisturbed condition as judged solely by the Consultant at the time of Substantial Completion may become part of the completed Work, otherwise demolish mockups, remove rubbles from site and install permanent works.

G. **Pre-installation Conference**: Conduct conference at Project site to comply with requirements of Division 1 Section "Project Management and Coordination."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirement of ANSI A137.1 for labeling sealed tile packages.

B. Prevent damage or contamination to materials by water, freezing, foreign matter, and other causes.

C. Handle tile with temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.8 PROJECT CONDITIONS

A. **Environmental Limitations**: Do not install tile until construction in spaces is completed and ambient temperature and humidity conditions are being maintained to comply with referenced standards and manufacturer's written instructions.

1.9 EXTRA MATERIALS

A. Deliver extra materials to Employer. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.

1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed, for each type, composition, color, pattern, and size indicated.

PART 2 - PRODUCTS

2.1 PRODUCTS, GENERAL

1. Provide tile complying with Standard Grade requirements, unless otherwise indicated.

2. Retain below with appropriate definitions in referenced part 1 article.

3. For facial dimensions of tile, comply with requirements relating to tile sizes specified in Part 1 "Definitions" Article.

4. Tiles are to be highest grade of production in manufacturer's quality grading system.

B. **ANSI Standards for Tile Installation Materials**: Provide materials complying with ANSI standards referenced in "Setting Materials" and "Grouting Materials" articles.

C. **Colors, Textures, and Patterns**: Where manufacturer's standard products are indicated for tile, grout, and other products requiring selection of colors, surface textures, patterns, and other appearance characteristics, provide specific products or materials complying with the following requirements:

1. Provide Consultant's selections from manufacturer's full range of colors, textures, and patterns for products of type indicated.

D. **Factory Blending**: For tile exhibiting color variations within the ranges selected during Sample submittals, blend tile in the factory and package so tile units taken from one package show the same range in colors as those taken from other packages and match approved Samples.

E. **Mounting**: Where factory-mounted tile is required, provide back- or edge-mounted tile assemblies as standard with manufacturer, unless another mounting method is indicated.

F. **Factory-Applied Temporary Protective Coating**: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by precoating them with a continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.

2.2 TILE PRODUCTS

A. **General Characteristics**: Tiles are to comply with the following general requirements:

1. Floor Tiles:

   a. Abrasive Hardness: Minimum Index 253 to ASTM C 501 (unglazed tiles), unless otherwise specified.

   b. Bending Strength: Minimum 35 Kg/cm^2 to ASTM C 648

   c. Water Absorption: As specified.

   d. Chemical Resistance: Unaffected with moderate acids.

   e. Tile Rating: For heavy duty floor by a rating system acceptable to the Consultant.

2. Wall Tiles:

   a. Water Absorption: Maximum 6% to ASTM C 373.

B. **Unglazed Paver Tile:** Provide flat tile complying With the following requirements:

1. Composition: Porcelain mix.

2. Constrition: Color-through.

3. Water Absorption: Less than 0.5% to ASTM C 373.

4. Surface Finish: Matt or Polished as indicated on Drawings.

5. Facial Dimensions: As indicated on Drawings.

6. Thickness: minimum 9.0 mm for tiles and 8.50 mm for fittings.

7. Face: Plain with Square or cushion edges.

B. **Wall Tile**: Provide flat tile complying with the following requirements:

1. Module Size: As indicated on Drawings.
2. Water Absorption: Less than 6% to ASTM C373.
3. Thickness: minimum 20 mm.
4. Face: Plain with modified square edges or cushion edges.

C. **Trim Units**: Provide tile trim units to match characteristics of adjoining flat tile and to comply with the following requirements:

1. Size: As indicated, coordinated with sizes and coursing of adjoining flat tile where applicable.
2. Shapes: As follows, selected from manufacturer's standard shapes:
   a. Base for Portland Cement Mortar Installations: Coved.
   b. Wainscot Cap for Thin-Set Mortar Installations: Surface bullnose.
   c. External Corners for Thin-Set Mortar Installations: Surface bullnose.
   d. Internal Corners: Field-butted square corners, except with coved base and cap angle pieces designed to member with stretcher shapes.

D. **TilesThickness of Tiles**: Specified thickness of tiles exclude thickness of keying patterns on back.

Background/Base: 15mm thick 1:4 cement/sand render on concrete or concrete blockworks

Bedding: Thin cement based adhesive to be approved

Grouting material: Epoxy grout Nitotile 489 as supplied by Fosroc or equal approved to be used in accordance with manufacturer recommendations. Colour to architects approval.

Movement joints: All internal corners; Width: 6mrn

Accessories: all exposed edges and corners to have preformed rounded edges.

2.3 PORCELIN WALL TILING

Background/Base: 15mrn thick 1:4 cement/sand render on concrete or concrete blockworks.

Bedding: Thin bed cement based adhesive. Adhesive: to be approved

Grouting material: Epoxy grout Nitotile 489 as supplied by Fosroc or equal approved to be used in accordance with manufacturer recommendations. Colour to architects approval.

Joint width: 3mm. Movement joints: Location: All internal corners; Width: 6mm

Accessories: all exposed edges and corners to have preformed rounded edges In toilets, no tiles behind low level ducts or full height ducts. Complete tiling should be done behind mirrors. In pantry, tiles are to be fixed behind base and wall units but not behind service duct panels. Plaster only where no tiles.

2.02 FLOOR TILING

Background/Base: screed 1 in-situ concrete

Screed: 11.5:3 cement/sand/aggregate semi-dry screed laid to falls and towards floor

drain outlets, overall thickness of flooring to be 75mm

Bedding: Waterproof adhesive on cement 1 sand bed

Adhesive: to be approved

Waterproofing: 2 coats Fosroc Nitoproof 10, or equal, to B.S. Standard. laid to

manufacturer’s recommendations, with necessary accessories

Grouting material: Epoxy grout Nitotile 489 as supplied by Fosroc or equal approved to be used in accordance with manufacturer recommendations. Colour to architects approval

Joint width: 2.5mm.

Movement joints: location: At all perimeters including door thresholds; Width: 6mm

- Accessories:

Skirting: Coved skirting tiles, 100mm high to match ceramic floor tiles, set flush with render, to be fixed on plastered walls, grouted with epoxy grout Nitotile 489 as supplied by Fosroc or equal approved, applied in accordance with manufacturer's recommendations.

2.03 CETAMIC FLOOR TILING TO HALL AREA

Type/Size: Vitritied matt finish floor files 400mmx400mm as manufactured by GRANITS or equivalent. Tiles to be beige colour as per approved sample and to Carrefour standard requirements. Tile size tolerance to be not greater than + or – 0.25mm in any side.

Background/Base: screed on in-situ concrete.

Screed: Quick furing proprietary wet mix sand/cement screed, such as *Isocrete Heavy Duty KScreed' laid in panels (maximum area 90m2) and as per manufacturer's recommendations. **Note:** semi-dry screed will not be permitted in these areas.

Adhesive and grout: Adhesive shall be Laticrete 325 or equivalent. Application strictly in accordance with manufacturer's instruction. Grout shall be epoxy Laticrete or equivalent. Colour to Architect approval.

Joint width: 3mm

2.04 GROUTING MATERIALS

A. **Sand-Portland Cement Grout**: ANSI A108.10, composed of white or gray cement and white or colored aggregate as required to produce color indicated.

B. **Chemical-Resistant Epoxy Grout**: ANSI A 118.3, color as indicated.

1. Provide product capable of resisting continuous and intermittent exposure to temperatures of up to 60 deg C and 100 deg C, respectively, as certified by mortar manufacturer for intended use.

C. **Grout Colors**: Provide colors as selected by the Consultant from manufacturer's full range of standard and custom colors. Finish shall be smooth, unless otherwise specified or directed by the Consultant.

2.05 ELASTOMERIC SEALANTS

A. **General**: Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer and characteristics indicated that comply with applicable requirements of Division 7 Section "Joint Sealants."

B. **Colors**: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints, unless otherwise indicated.

2.06 MISCELLANEOUS MATERIALS

A. **Trowelable Underlayments and Patching Compounds**: Latex-modified, Portland-cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

B. **Temporary Protective Coating**: Provide product indicated below that is formulated to protect exposed surfaces of tile against adherence of mortar and grout; is compatible with tile, mortar, and grout products; and is easily removable after grouting is completed without damaging grout or tile.

1. Petroleum paraffin wax, fully refined and odorless, containing at least 0.5 percent oil with a melting point of 49 to 60 deg C per ASTM D 87.

C. **Tile Cleaner**: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

2.07 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.

1. Verify that substrates for setting tile are firm; dry; clean; free from oil, waxy films, and curing compounds; and within flatness tolerances required by referenced ANSI A108 series of tile installation standards for installations indicated.

END OF DOCUMENTS

SECTION 38 - MARBLE AND GRANITE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Related Drawing and Detail.

1.2 SUMMARY

A. This Section includes the following:

1. PorcelinTiles.

B. Related Sections include the following:

1. Division 3 Section "Cement Based Screeds" for floor screeds to receive ceramic tiles.

2. Division 5 Section "Architectural Joint Systems" for movement joints in ceramic flooring.

3. Division 7 Section "Cold Fluid-Applied Waterproofing" for waterproofing under thickset mortar beds.

4. Division 7 Section "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.

5. Division 9 Section "Portland Cement Plaster" for Portland cement scratch coat over metal lath on wall surfaces.

1.3 DEFINITIONS

A. **Module Size**: Actual tile size (minor facial dimension as measured per ASTM C 499) plus joint width indicated.

B. **Facial Dimension**: Actual tile size (minor facial dimension as measured per ASTM C 499).

C. **Facial Dimension**: Nominal tile size as defined in ANSI A137.1.

1.4 PERFORMANCE REQUIREMENTS

A. **Static Coefficient of Friction**: For tile installed on walkway surfaces, provide products with the following values as determined by testing identical products per ASTM C 1028:

1. Level Surfaces: Minimum 0.6.

B. **Load-Bearing Performance**: Provide installations rated for the following load-bearing performance level based on testing assemblies according to ASTM C 627 that are representative of those indicated for this Project:

1. Heavy: Passes cycles 1 through 12. Use where indicated in Finishing Schedules.

2. Moderate: Passes cycles 1 through 10. Use for other applications indicated on Schedule where heavy duty is not indicated.

1.5 SUBMITTALS

A. **Product Data**: For each type of tile, mortar, grout, and other products specified.

B. **Shop Drawings**: For the following:

1. Tile patterns and locations.

2. Widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.

3. Locate precisely each joint and crack in tile substrates, record measurements on shop drawings, and coordinate them with tile joint locations, as approved by Consultant.

C. **Tile Samples for Initial Selection**: Manufacturer's color charts consisting of actual tiles or sections of tiles showing the full range of colors, textures, and patterns available for each type and composition of tile indicated. Include Samples of accessories involving color selection.

D. **Grout Samples for Initial Selection**: Manufacturer's color charts consisting of actual sections of grout showing the full range of colors available for each type of grout indicated.

E. **Samples for Verification**: Of each item listed below, prepared on Samples of size and construction indicated. Where products involve normal color and texture variations, include Sample sets showing the full range of variations expected.

1. Each type and composition of tile and for each color and texture required, at least 400 mm square, mounted on braced cementitious backer units, and with grouted joints using product complying with specified requirements and approved for completed work in color or colors selected by Consultant.

2. Full-size units of each type of trim and accessory for each color required.

3. Stone thresholds in 150-mm lengths.

F. **Master Grade Certificates**: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.

G. **Product Certificates**: Signed by manufacturers certifying that the products furnished comply with requirements.

H. **Installer Experience**: List of five projects (minimum) of a similar nature carried out successfully by the installer with the same product.

I. **Installer Experience**: List of five projects (minimum) of a similar nature carried out successfully by the installer with the same product Qualification Data: For firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names of Consultants and Employers, and other any information required by Consultant.

J. **Test Reports**: Material test reports from qualified independent testing laboratory indicating and interpreting test results relative to compliance of tile and tile setting and grouting products with requirements indicated.

K. **Setting Material Test Reports**: Indicate and interpret test results for compliance of tile-setting and -grouting products with specified requirements.

1.6 QUALITY ASSURANCE

A. **Quality System**: Comply with ISO 9001/9002 Quality System as a minimum. Incorporate all the standard procedures supplied by the Consultant and the Employer.

B. **Installer Qualifications**: Engage an experienced installer who has completed tile installations similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

C. **Source Limitations for Tile**: Obtain each color, grade, finish, type, composition, and variety of tile from one source with resources to provide products from the same production run for each contiguous area of consistent quality in appearance and physical properties without delaying the Work.

D. **Source Limitations for Setting and Grouting Materials**: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from a single manufacturer and each aggregate from one source or producer.

E. **Source Limitations for Other Products**: Obtain each of the following products specified in this Section from one source and by a single manufacturer for each product:

1. Stone thresholds.

2. Cementitious backer units.
3. Joint sealants.
4. Waterproofing.

F. **Mockups**: Before installing tile, construct mockups for each form of construction and finish required to verify selections made under Sample submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for completed Work.

1. Locate mockups in the location and of the size indicated or, if not indicated, as directed by Consultant.

2. Notify Consultant 7 days in advance of the dates and times when mockups will be constructed.

3. Demonstrate the proposed range of aesthetic effects and workmanship.

4. Obtain Consultant's approval of mockups before proceeding with final unit of Work.

5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.

   a. Approved mockups in an undisturbed condition as judged solely by the Consultant at the time of Substantial Completion may become part of the completed Work, otherwise demolish mockups, remove rubbles from site and install permanent works.

G. **Pre-installation Conference**: Conduct conference at Project site to comply with requirements of Division 1 Section "Project Management and Coordination."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirement of ANSI A137.1 for labeling sealed tile packages.

B. Prevent damage or contamination to materials by water, freezing, foreign matter, and other causes.

C. Handle tile with temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.8 PROJECT CONDITIONS

A. **Environmental Limitations**: Do not install tile until construction in spaces is completed and ambient temperature and humidity conditions are being maintained to comply with referenced standards and manufacturer's written instructions.

1.9 EXTRA MATERIALS

A. Deliver extra materials to Employer. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.

1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed, for each type, composition, color, pattern, and size indicated.

PART 2 - PRODUCTS

2.1 PRODUCTS, GENERAL

1. Provide tile complying with Standard Grade requirements, unless otherwise indicated.

2. Retain below with appropriate definitions in referenced part 1 article.

3. For facial dimensions of tile, comply with requirements relating to tile sizes specified in Part 1 "Definitions" Article.

4. Tiles are to be highest grade of production in manufacturer’s quality grading system.

B. **ANSI Standards for Tile Installation Materials**: Provide materials complying with ANSI standards referenced in "Setting Materials" and "Grouting Materials" articles.

C. **Colors, Textures, and Patterns**: Where manufacturer’s standard products are indicated for tile, grout, and other products requiring selection of colors, surface textures, patterns, and other appearance characteristics, provide specific products or materials complying with the following requirements:

1. Provide Consultant’s selections from manufacturer’s full range of colors, textures, and patterns for products of type indicated.

D. **Factory Blending**: For tile exhibiting color variations within the ranges selected during Sample submittals, blend tile in the factory and package so tile units taken from one package show the same range in colors as those taken from other packages and match approved Samples.

E. **Mounting**: Where factory-mounted tile is required, provide back- or edge-mounted tile assemblies as standard with manufacturer, unless another mounting method is indicated.

F. **Factory-Applied Temporary Protective Coating**: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by pre-coating them with a continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.

2.2 TILE PRODUCTS

A. **General Characteristics**: Tiles are to comply with the following general requirements:

1. Floor Tiles:

   a. Abrasive Hardness: Minimum Index 253 to ASTM C 501 (unglazed tiles), unless otherwise specified.

   b. Bending Strength: Minimum 35 Kg/cm^2 to ASTM C 648

   c. Water Absorption: As specified.

   d. Chemical Resistance: Unaffected with moderate acids.

   e. Tile Rating: For heavy duty floor by a rating system acceptable to the Consultant.

2. Wall Tiles:

   a. Water Absorption: Maximum 6% to ASTM C 373.

B. **Unglazed Paver Tile:** Provide flat tile complying with the following requirements:

1. Composition: Porcelain mix.

2. Constrition: Color-through.

3. Water Absorption: Less than 0.5% to ASTM C 373.

4. Surface Finish: Matt or Polished as indicated on Drawings.

5. Facial Dimensions: As indicated on Drawings.

6. Thickness: minimum 9.0 mm for tiles and 8.50 mm for fittings.

7. Face: Plain with Square or cushion edges.

B. **Wall Tile**: Provide flat tile complying with the following requirements:

1. Module Size: As indicated on Drawings.

2. Water Absorption: Less than 6% to ASTM C373.

3. Thickness: minimum 20 mm.

4. Face: Plain with modified square edges or cushion edges.

C. **Trim Units**: Provide tile trim units to match characteristics of adjoining flat tile and to comply with the following requirements:

1. Size: As indicated, coordinated with sizes and coursing of adjoining flat tile where applicable.

2. Shapes: As follows, selected from manufacturer's standard shapes:

a. Base for Portland Cement Mortar Installations: Coved.

b. Wainscot Cap for Thin-Set Mortar Installations: Surface bull-nose.

c. External Corners for Thin-Set Mortar Installations: Surface bull-nose.

d. Internal Corners: Field-butted square corners, except with coved base and cap angle pieces designed to member with stretcher shapes.

D. **Tiles Thickness of Tiles**: Specified thickness of tiles exclude thickness of keying patterns on back.

Background/Base: 15mm thick 1:4 cement/sand render on concrete or concrete block works

Bedding: Thin cement based adhesive to be approved

Grouting material: Epoxy grout Nitotile 489 as supplied by Fosroc or equal approved to be used in accordance with manufacturer recommendations. Colour to architects approval.

Movement joints: All internal corners; Width: 6mrn

Accessories: all exposed edges and corners to have preformed rounded edges

2.3 PORCELIN WALL TILING

Background/Base: 15mrn thick 1:4 cement/sand render on concrete or concrete block works.

Bedding: Thin bed cement based adhesive. Adhesive: to be approved

Grouting material: Epoxy grout Nitotile 489 as supplied by Fosroc or equal approved to be used in accordance with manufacturer recommendations. Colour to architects approval.

Joint width: 3mm. Movement joints: Location: All internal corners; Width: 6mm

Accessories: all exposed edges and corners to have preformed rounded edges In toilets, no tiles behind low level ducts or full height ducts. Complete tiling should be done behind mirrors. In pantry, tiles are to be fixed behind base and wall units but not behind service duct panels. Plaster only where no tiles.

2.02 FLOOR TILING

Background/Base: screed 1 in-situ concrete

Screed: 11.5:3 cement/sand/aggregate semi-dry screed laid to falls and towards floor

drain outlets, overall thickness of flooring to be 75mm

Bedding: Waterproof adhesive on cement 1 sand bed

Adhesive: to be approved

Waterproofing: 2 coats Fosroc Nitoproof 10, or equal, to B.S. Standard. laid to

manufacturer's recommendations, with necessary accessories

Grouting material: Epoxy grout Nitotile 489 as supplied by Fosroc or equal approved to be used in accordance with manufacturer recommendations. Colour to architects approval

Joint width: 2.5mm.

Movement joints: location: At all perimeters including door thresholds; Width: 6mm

- Accessories:

Skirting: Coved skirting tiles, 100mm high to match ceramic floor tiles, set flush with render, to be fixed on plastered walls, grouted with epoxy grout Nitotile 489 as supplied by Fosroc or equal approved, applied in accordance with manufacturer's recommendations.

2.03 CETAMIC FLOOR TILING TO HALL AREA

Type/Size: Vitritied matt finish floor files 400mmx400mm as manufactured by GRANITS or equivalent. Tiles to be beige colour as per approved sample and to

Carrefour standard requirements. Tile size tolerance to be not greater than + or – 0.25mm in any side.

Background/Base: screed on in-situ concrete.

Screed: Quick furing proprietary wet mix sand/cement screed, such as *Isocrete Heavy Duty KScreed' laid in panels (maximum area 90m2) and as per manufacturer's recommendations. **Note:** semi-dry screed will not be permitted in these areas.

Adhesive and grout: Adhesive shall be Laticrete 325 or equivalent. Application strictly in accordance with manufacturer's instruction. Grout shall be epoxy Laticrete or equivalent. Colour to Architect approval.

Joint width: 3mm

2.04 GROUTING MATERIALS

A. **Sand-Portland Cement Grout**: ANSI A108.10, composed of white or gray cement and white or colored aggregate as required to produce color indicated.

B. **Chemical-Resistant Epoxy Grout**: ANSI A 118.3, color as indicated.

1. Provide product capable of resisting continuous and intermittent exposure to temperatures of up to 60 deg C and 100 deg C, respectively, as certified by mortar manufacturer for intended use.

C. **Grout Colors**: Provide colors as selected by the Consultant from manufacturer's full range of standard and custom colors. Finish shall be smooth, unless otherwise specified or directed by the Consultant.

2.05 ELASTOMERIC SEALANTS

A. **General**: Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer and characteristics indicated that comply with applicable requirements of Division 7 Section "Joint Sealants."

B. **Colors**: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints, unless otherwise indicated.

2.06 MISCELLANEOUS MATERIALS

A. **Trowelable Underlayments and Patching Compounds**: Latex-modified, Portland-cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

B. **Temporary Protective Coating**: Provide product indicated below that is formulated to protect exposed surfaces of tile against adherence of mortar and grout; is compatible with tile, mortar, and grout products; and is easily removable after grouting is completed without damaging grout or tile.

1. Petroleum paraffin wax, fully refined and odorless, containing at least 0.5 percent oil with a melting point of 49 to 60 deg C per ASTM D 87.

C. **Tile Cleaner**: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

2.07 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.

1. Verify that substrates for setting tile are firm; dry; clean; free from oil, waxy films, and curing compounds; and within flatness tolerances required by referenced ANSI A108 series of tile installation standards for installations indicated.

END OF DOCUMENTS

SECTION 39 - PORCELIN TILES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Related Drawing and Detail.

1.2 SUMMARY

A. This Section includes the following:

1. PorcelinTiles.

B. Related Sections include the following:

1. Division 3 Section "Cement Based Screeds" for floor screeds to receive ceramic tiles.

2. Division 5 Section "Architectural Joint Systems" for movement joints in ceramic flooring.

3. Division 7 Section "Cold Fluid-Applied Waterproofing" for waterproofing under thickset mortar beds.

4. Division 7 Section "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.

5. Division 9 Section "Portland Cement Plaster" for Portland cement scratch coat over metal lath on wall surfaces.

1.3 DEFINITIONS

A. **Module Size**: Actual tile size (minor facial dimension as measured per ASTM C 499) plus joint width indicated.

B. **Facial Dimension**: Actual tile size (minor facial dimension as measured per ASTM C 499).

C. **Facial Dimension**: Nominal tile size as defined in ANSI A137.1.

1.4 PERFORMANCE REQUIREMENTS

A. **Static Coefficient of Friction**: For tile installed on walkway surfaces, provide products with the following values as determined by testing identical products per ASTM C 1028:

1. Level Surfaces: Minimum 0.6.

B. **Load-Bearing Performance**: Provide installations rated for the following load-bearing performance level based on testing assemblies according to ASTM C 627 that are representative of those indicated for this Project:

1. Heavy: Passes cycles 1 through 12. Use where indicated in Finishing Schedules.

2. Moderate: Passes cycles 1 through 10. Use for other applications indicated on Schedule where heavy duty is not indicated.

1.5 SUBMITTALS

A. **Product Data**: For each type of tile, mortar, grout, and other products specified.

B. **Shop Drawings**: For the following:

1. Tile patterns and locations.

2. Widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.

3. Locate precisely each joint and crack in tile substrates, record measurements on shop drawings, and coordinate them with tile joint locations, as approved by Consultant.

C. **Tile Samples for Initial Selection**: Manufacturer's color charts consisting of actual tiles or sections of tiles showing the full range of colors, textures, and patterns available for each type and composition of tile indicated. Include Samples of accessories involving color selection.

D. **Grout Samples for Initial Selection**: Manufacturer's color charts consisting of actual sections of grout showing the full range of colors available for each type of grout indicated.

E. **Samples for Verification**: Of each item listed below, prepared on Samples of size and construction indicated. Where products involve normal color and texture variations, include Sample sets showing the full range of variations expected.

1. Each type and composition of tile and for each color and texture required, at least 400 mm square, mounted on braced cementitious backer units, and with grouted joints using product complying with specified requirements and approved for completed work in color or colors selected by Consultant.

2. Full-size units of each type of trim and accessory for each color required.

3. Stone thresholds in 150-mm lengths.

F. **Master Grade Certificates**: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.

G. **Product Certificates**: Signed by manufacturers certifying that the products furnished comply with requirements.

H. **Installer Experience**: List of five projects (minimum) of a similar nature carried out successfully by the installer with the same product.

I. **Installer Experience**: List of five projects (minimum) of a similar nature carried out successfully by the installer with the same product Qualification Data: For firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names of Consultants and Employers, and other any information required by Consultant.

J. **Test Reports**: Material test reports from qualified independent testing laboratory indicating and interpreting test results relative to compliance of tile and tile setting and grouting products with requirements indicated.

K. **Setting Material Test Reports**: Indicate and interpret test results for compliance of tile-setting and -grouting products with specified requirements.

1.6 QUALITY ASSURANCE

A. **Quality System**: Comply with ISO 9001/9002 Quality System as a minimum. Incorporate all the standard procedures supplied by the Consultant and the Employer.

B. **Installer Qualifications**: Engage an experienced installer who has completed tile installations similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

C. **Source Limitations for Tile**: Obtain each color, grade, finish, type, composition, and variety of tile from one source with resources to provide products from the same production run for each contiguous area of consistent quality in appearance and physical properties without delaying the Work.

D. **Source Limitations for Setting and Grouting Materials**: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from a single manufacturer and each aggregate from one source or producer.

E. **Source Limitations for Other Products**: Obtain each of the following products specified in this Section from one source and by a single manufacturer for each product:

1. Stone thresholds.

2. Cementitious backer units.

3. Joint sealants.

4. Waterproofing.

F. **Mockups**: Before installing tile, construct mockups for each form of construction and finish required to verify selections made under Sample submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for completed Work.

1. Locate mockups in the location and of the size indicated or, if not indicated, as directed by Consultant.

2. Notify Consultant 7 days in advance of the dates and times when mockups will be constructed.

3. Demonstrate the proposed range of aesthetic effects and workmanship.

4. Obtain Consultant's approval of mockups before proceeding with final unit of Work.

5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.

a. Approved mockups in an undisturbed condition as judged solely by the Consultant at the time of Substantial Completion may become part of the completed Work, otherwise demolish mockups, remove rubbles from site and install permanent works.

G. **Pre-installation Conference**: Conduct conference at Project site to comply with requirements of Division 1 Section "Project Management and Coordination."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirement of ANSI A137.1 for labeling sealed tile packages.

B. Prevent damage or contamination to materials by water, freezing, foreign matter, and other causes.

C. Handle tile with temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.8 PROJECT CONDITIONS

A. **Environmental Limitations**: Do not install tile until construction in spaces is completed and ambient temperature and humidity conditions are being maintained to comply with referenced standards and manufacturer's written instructions.

1.9 EXTRA MATERIALS

A. Deliver extra materials to Employer. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.

1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed, for each type, composition, color, pattern, and size indicated.

PART 2 - PRODUCTS

2.1 PRODUCTS, GENERAL

1. Provide tile complying with Standard Grade requirements, unless otherwise indicated.

2. Retain below with appropriate definitions in referenced part 1 article.

3. For facial dimensions of tile, comply with requirements relating to tile sizes specified in Part 1 "Definitions" Article.

4. Tiles are to be highest grade of production in manufacturer's quality grading system.

B. **ANSI Standards for Tile Installation Materials**: Provide materials complying with ANSI standards referenced in "Setting Materials" and "Grouting Materials" articles.

C. **Colors, Textures, and Patterns**: Where manufacturer's standard products are indicated for tile, grout, and other products requiring selection of colors, surface textures, patterns, and other appearance characteristics, provide specific products or materials complying with the following requirements:

1. Provide Consultant's selections from manufacturer's full range of colors, textures, and patterns for products of type indicated.

D. **Factory Blending**: For tile exhibiting color variations within the ranges selected during Sample submittals, blend tile in the factory and package so tile units taken from one package show the same range in colors as those taken from other packages and match approved Samples.

E. **Mounting**: Where factory-mounted tile is required, provide back- or edge-mounted tile assemblies as standard with manufacturer, unless another mounting method is indicated.

F. **Factory-Applied Temporary Protective Coating**: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by pre-coating them with a continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.

2.2 TILE PRODUCTS

A. **General Characteristics**: Tiles are to comply with the following general requirements:

1. Floor Tiles:

   a. Abrasive Hardness: Minimum Index 253 to ASTM C 501 (unglazed tiles), unless otherwise specified.

   b. Bending Strength: Minimum 35 Kg/cm^2 to ASTM C 648

   c. Water Absorption: As specified.

   d. Chemical Resistance: Unaffected with moderate acids.

   e. Tile Rating: For heavy duty floor by a rating system acceptable to the Consultant.

2. Wall Tiles:

   a. Water Absorption: Maximum 6% to ASTM C 373.

B. **Unglazed Paver Tile:** Provide flat tile complying With the following requirements:

1. Composition: Porcelain mix.

2. Constrition: Color-through.

3. Water Absorption: Less than 0.5% to ASTM C 373.

4. Surface Finish: Matt or Polished as indicated on Drawings.

5. Facial Dimensions: As indicated on Drawings.

6. Thickness: minimum 9.0 mm for tiles and 8.50 mm for fittings.

7. Face: Plain with Square or cushion edges.

B. **Wall Tile**: Provide flat tile complying with the following requirements:

1. Module Size: As indicated on Drawings.
2. Water Absorption: Less than 6% to ASTM C373.
3. Thickness: minimum 8.0 mm.
4. Face: Plain with modified square edges or cushion edges.

C. **Trim Units**: Provide tile trim units to match characteristics of adjoining flat tile and to comply with the following requirements:

1. Size: As indicated, coordinated with sizes and coursing of adjoining flat tile where applicable.
2. Shapes: As follows, selected from manufacturer's standard shapes:
   a. Base for Portland Cement Mortar Installations: Coved.
   b. Wainscot Cap for Thin-Set Mortar Installations: Surface bull nose.
   c. External Corners for Thin-Set Mortar Installations: Surface bull nose.
   d. Internal Corners: Field-butted square corners, except with coved base and cap angle pieces designed to member with stretcher shapes.

D. **Thickness of Tiles**: Specified thickness of tiles exclude thickness of keying patterns on back.

Background/Base: 15mm thick 1:4 cement/sand render on concrete or concrete block works

Bedding: Thin cement based adhesive to be approved

Grouting material: Epoxy grout Nitotile 489 as supplied by Fosroc or equal approved to be used in accordance with manufacturer recommendations. Colour to architects approval.

Movement joints: All internal corners; Width: 6mrn

Accessories: all exposed edges and corners to have preformed rounded edges

2.3 PORCELIN WALL TILING

Background/Base: 15mrn thick 1:4 cement/sand render on concrete or concrete blockworks.

Bedding: Thin bed cement based adhesive. Adhesive: to be approved.

Grouting material: Epoxy grout Nitotile 489 as supplied by Fosroc or equal approved to be used in accordance with manufacturer recommendations. Colour to architects approval.

Joint width: 3mm. Movement joints: Location: All internal corners; Width: 6mm

Accessories: all exposed edges and corners to have preformed rounded edges In toilets, no tiles behind low level ducts or full height ducts. Complete tiling should be done behind mirrors. In pantry, tiles are to be fixed behind base and wall units but not behind service duct panels. Plaster only where no tiles.

2.02 FLOOR TILING

Background/Base: screed 1 in-situ concrete

Screed: 11.5:3 cement/sand/aggregate semi-dry screed laid to falls and towards floor

drain outlets, overall thickness of flooring to be 75mm

Bedding: Waterproof adhesive on cement 1 sand bed

Adhesive: to be approved

Waterproofing: 2 coats Fosroc Nitoproof 10, or equal, to B.S. Standard. laid to

manufacturer's recommendations, with necessary accessories

Grouting material: Epoxy grout Nitotile 489 as supplied by Fosroc or equal approved to be used in accordance with manufacturer recommendations. Colour to architects approval

Joint width: 2.5mm.

Movement joints: location: At all perimeters including door thresholds; Width: 6mm- Accessories:

Skirting: Coved skirting tiles, 100mm high to match ceramic floor tiles, set flush with render, to be fixed on plastered walls, grouted with epoxy grout Nitotile 489 as supplied by Fosroc or equal approved, applied in accordance with manufacturer's recommendations.

2.03 CERAMIC FLOOR TILING TO HALL AREA

Type/Size: Vitritied matt finish floor files 400mmx400mm as manufactured by GRANITO or equivalent. Tiles to be beige colour as per approved sample and to

Carrefour standard requirements. Tile size tolerance to be not greater than + or – 0.25mm in any side.

Background/Base: screed on in-situ concrete.

Screed: Quick furing proprietary wet mix sand/cement screed, such as *Isocrete Heavy Duty KScreed' laid in panels (maximum area 90m2) and as per manufacturer's recommendations. **Note:** semi-dry screed will not be permitted in these areas.

Adhesive and grout: Adhesive shall be Laticrete 325 or equivalent. Application strictly in accordance with manufacturer's instruction. Grout shall be epoxy Laticrete or equivalent. Colour to Architect approval.

Joint width: 3mm

2.04 GROUTING MATERIALS

A. **Sand-Portland Cement Grout**: ANSI A108.10, composed of white or gray cement and white or colored aggregate as required to produce color indicated.

B. **Chemical-Resistant Epoxy Grout**: ANSI A 118.3, color as indicated.

1. Provide product capable of resisting continuous and intermittent exposure to temperatures of up to 60 deg C and 100 deg C, respectively, as certified by mortar manufacturer for intended use.

C. **Grout Colors**: Provide colors as selected by the Consultant from manufacturer's full range of standard and custom colors. Finish shall be smooth, unless otherwise specified or directed by the Consultant.

2.05 ELASTOMERIC SEALANTS

A. **General**: Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer and characteristics indicated that comply with applicable requirements of Division 7 Section "Joint Sealants."

B. **Colors**: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints, unless otherwise indicated.

2.06 MISCELLANEOUS MATERIALS

A. **Trowelable Underlayments and Patching Compounds**: Latex-modified, Portland-cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

B. **Temporary Protective Coating**: Provide product indicated below that is formulated to protect exposed surfaces of tile against adherence of mortar and

grout; is compatible with tile, mortar, and grout products; and is easily removable after grouting is completed without damaging grout or tile.

1. Petroleum paraffin wax, fully refined and odorless, containing at least 0.5 percent oil with a melting point of 49 to 60 deg C per ASTM D 87.

C. **Tile Cleaner**: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

2.07 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.

1. Verify that substrates for setting tile are firm; dry; clean; free from oil, waxy films, and curing compounds; and within flatness tolerances required by referenced ANSI A108 series of tile installation standards for installations indicated.

END OF DOCUMENTS

SECTION 40 - PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Related Drawing and Detail.

1.2 SUMMARY

A. This Section includes surface preparation and field painting of the following:

1. Exposed exterior items and surfaces.

2. Exposed interior items and surfaces.

3. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.

B. Paint exposed surfaces, except where the paint schedules indicate that a surface or material is not to be painted or is to remain natural. If the paint schedules do not specifically mention an item or a surface, paint the item or surface the same as similar adjacent materials or surfaces whether or not schedules indicate colors. If the schedules do not indicate color or finish, the Consultant will select from standard colors and finishes available.

C. Do not paint pre-finished items, concealed surfaces, finished metal surfaces, operating parts, and labels.

1. Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:

2. Operating parts include moving parts of operating equipment and the following:

3. Labels: Do not paint over Underwriters Laboratories (UL), Factory Mutual (FM), or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

D. Related Sections include the following:

1. Division 5 Section "Metal Fabrications" for shop priming ferrous metal.

2. Division 8 Section "Flush Wood Doors" for shop priming wood doors.

3. Divisions 15 and 16: Painting of mechanical and electrical work is specified in Divisions 15 and 16, respectively.

1.3 DEFINITIONS

A. **General**: the following coating terms apply to this Section.

1. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85-degree meter.

2. Eggshell refers to low-sheen finish with a gloss range between 5 and 20 when measured at a 60-degree meter.

3. Satin refers to low-sheen finish with a gloss range between 15 and 35 when measured at a 60-degree meter.

4. Semigloss refers to medium-sheen finish with a gloss range between 30 and 65 when measured at a 60-degree meter.

5. Full gloss refers to high-sheen finish with a gloss range more than 65 when measured at a 60-degree meter.

1.4 SUBMITTALS

A. **Product Data**: For each paint system specified. Include block fillers and primers.

1. Material List: Provide an inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.

2. Manufacturer's Information: Provide manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material proposed for use.

B. **Samples for Initial Selection**: Manufacturer's color charts showing the full range of colors available for each type of finish-coat material indicated.

1. After color selection, the Consultant will furnish color chips for surfaces to be coated.

C. **Samples for Verification**: Of each color and material to be applied, with texture to simulate actual conditions, on representative Samples of the actual substrate.

1. Provide stepped Samples, defining each separate coat, including block fillers and primers. Use representative colors when preparing Samples for review. Resubmit until required sheen, color, and texture are achieved.

2. Provide a list of materials and applications for each coat of each sample. Label each sample for location and application.

3. Submit Samples on the following substrates for the Consultant's review of color and texture only:

   a. Concrete: Provide two 100-mm- square samples for each color and finish.

   b. Ferrous Metal: Provide two 100-mm- square samples of flat metal and two 200-mm- long samples of solid metal for each color and finish.

D. **Qualification Data**: For firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of Consultants and owners, and other information specified.

1.5 QUALITY ASSURANCE

A. **Quality System**: Comply with ISO 9001/9002 Quality System as a minimum. Incorporate all the standard procedures supplied by the Consultant and the Employer.

B. **Applicator Qualifications**: Engage an experienced applicator who has completed painting system applications similar in material and extent to that indicated for this Project with a record of successful in-service performance.

C. **Source Limitations**: Obtain fillers, primers, and undercoat materials for each coating system from the same manufacturer as the finish coats.

D. **Benchmark Samples (Mockups)**: Provide a full-coat benchmark finish sample of each type of coating and substrate required on the Project.

1. The Consultant will select one room or surface to represent surfaces and conditions for each type of coating and substrate to be painted.

   a. Wall Surfaces: Provide samples on at least 9 sq. m of wall surface.

   b. Small Areas and Items: The Consultant will designate an item or area as required.

2. After permanent lighting and other environmental services have been activated, apply coatings in this room or to each surface according to the Schedule or as specified. Provide required sheen, color, and texture on each surface.

a. After finishes are accepted, the Consultant will use the room or surface to evaluate coating systems of a similar nature.

3. Final approval of colors will be from job-applied samples.

E. **Manufacturers Qualifications**: Paint materials shall be the products of paint and coating manufacturers whose qualifications are as follows:

1. Manufacturers shall be reputable of multi-national scale in production and distribution with capabilities to deliver paint materials quantities necessary for the project on due time.

2. Manufacturers shall have evidence from scientific bodies that demonstrate their participation and share in the development of paint industry generally and production of new painting materials kinds.

3. Manufacturers shall have their own proprietary brand names that are well known worldwide.

4. Manufacturers shall have minimum 25 years of successful experience in producing painting materials for use in prestigious projects worldwide of same standard of quality as that intended for the Project.

5. Manufacturers shall be registered in the associations, councils, boards, federations or other similar bodies of paint manufacturers in countries of origin and practice.

F. **Performance of Paints**: Paints shall be fit for purpose and manufactured specifically for the applications indicated and uses intended, taking into account the type, nature, location, and aesthetic and utility requirements of the Project.

1. Opacity: Paint shall cover or hide the substrate to the Consultant's satisfaction.

2. Cleanability: Paint shall not absorb dirt and shall be capable of being washed or scrubbed periodically, to the Consultant's satisfaction, without adverse effect on its attributes or appearance.

3. Scrub resistance wet and dry: paint shall resist abrasion caused by scrubbing in accordance with ASTM D 2486.

4. Adhesion: Paint shall adhere firmly to the substrate without peeling.

5. Exposure resistance: Paint shall resist yellowing and weathering caused by UV rays and ozone.

G. **Standards**: Paints shall be manufactured to relevant US standards, or any other international standard approved by Authorities having jurisdiction.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the Project Site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label, and the following information:

1. Product name or title of material.
2. Product description (generic classification or binder type).
3. Manufacturer's stock number and date of manufacture.
4. Contents by volume, for pigment and vehicle constituents.
5. Thinning instructions.
6. Application instructions.
7. Color name and number.
8. VOC content.

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 7 deg C. Maintain containers used in storage in a clean condition, free of foreign materials and residue.

1. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

1.7 PROJECT CONDITIONS

A. Apply water-based paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 10 and 32 deg C.

B. Apply solvent-thinned paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 7.2 and 35 deg C.

C. Do not apply paint in snow, rain, fog, or mist; or when the relative humidity exceeds 85 percent; or at temperatures less than 3 deg C above the dew point; or to damp or wet surfaces.

1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

1.8 EXTRA MATERIALS

A. Furnish extra paint materials from the same production run as the materials applied and in the quantities described below. Package with protective covering for storage and identify with labels describing contents. Deliver extra materials to the Employer.

1. Quantity: Furnish the Employer with an additional 5 percent, but not less than 3.8 L or 1 case, as appropriate, of each material and color applied.

PART 2 - PRODUCTS

2.1 PAINT MATERIALS, GENERAL

A. **General**: Employed paints and painting materials shall be the highest grade and top quality in manufacturer's range of products for the generic kind of paint or paint material.

B. **General**: Materials for paint works shall comply with requirements of BS 6150, as applicable.

C. **Material Compatibility**: Provide block fillers, primers, undercoats, and finish-coat materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

D. **Material Quality**: Provide manufacturer's best-quality paint material of the various coating types specified. Paint-material containers not displaying manufacturer's product identification will not be acceptable.

E. **Colors**: Provide color selections made by the Consultant or by reference to manufacturer's color designations.

2.2 ANTI-CARBONATION PAINT MATERIALS, GENERAL

A. Paint for application on internal and external is to be anti-carbonation paint that is easy to clean, applicable on new or existing concrete, Portland cement plaster or masonry, water-based and non toxic, allows substrate to breath, Protects substrates form Carbonation, of elastic nature with crack bridging properties.

B. Anti-carbonation paint is to be self-cleaning by application of just sprayed water, highly durable, copolymer based coating which cures to form a tightly adherent, decorative weatherproof membrane guaranteed for up to 15 years. The formed

coating membrane shall tolerate thermal movement in the substrate without splitting or cracking and will retain its elastomeric properties even after prolonged exposure to ultra-violet light. Coating shall have the advantage of being reinforced using glass fiber matting or tapes and shall be capable of bridging cracks or joints between different substrates. The finished surface shall be chemical and pollution-resistant surface that has been specially manufactured to shed dirt, ensuring that it retains a bright, attractive appearance throughout its life. Coating shall be vapor permeable and allows entrapped substrate moisture to escape without causing blistering or delamination and shall produce an effective barrier to carbon dioxide diffusion and provide reinforced concrete substrates with an excellent defense against the harmful effects of carbonation. Color and sheen shall be selected by the Consultant from manufacturer's full range of products.

C. Anti carbonation paint shall also comply with following properties;

1. Carbon Dioxide Diffusion Resistance, Taywood Method

   a. Equivalent Thickness of Air: More than 175 mm.

   b. Equivalent Thickness of 30N Concrete: More than 500 mm;

2. Chloride Ion Diffusion Coefficient: No chloride ion diffusion after 60 days; Taywood Method

3. Static Crack Spanning Capability for 200-micron Dry Film Thickness at 23 ºC: Minimum 2.00 mm to ASTM C836.

4. Tear Resistance: 15 N/mm to ASTM D1004.

5. Tensile Strength: 5.00 N/mm2 to ASTM D412.

6. Reduction in Water absorption: Not less than 82% to ASTM C642.

7. Reduction in Chloride Ions Penetration: Not less than 92% to AASHTO M259.

8. Adhesion: Not less than 1.00 N/mm2, BS 1881.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with the Applicator present, under which painting will be performed for compliance with paint application requirements.

1. Do not begin to apply paint until unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.

2. Start of painting will be construed as the Applicator's acceptance of surfaces and conditions within a particular area.

B. **Coordination of Work**: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.

1. Notify the Consultant about anticipated problems using the materials specified over substrates primed by others.

3.2 PREPARATION

A. **General**: Preparation of surfaces to receive paints is to be according with requirements of BS 6150 and recommendations of paints manufacturer.

B. **General**: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of the size or weight of the item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.

C. **Cleaning**: Before applying paint or other surface treatments, clean the substrates of substances that could impair the bond of the various coatings. Remove oil and grease before cleaning.

1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

D. **Surface Preparation**: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.

1. Provide barrier coats over incompatible primers or remove and reprime.

2. Cementitious Materials: Prepare concrete, concrete masonry block, cement plaster, and mineral-fiber-reinforced cement panel surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.

a. Use abrasive blast-cleaning methods if recommended by paint manufacturer.

b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not paint surfaces where moisture content exceeds that permitted in manufacturer's written instructions.

c. Clean concrete floors to be painted with a 5 percent solution of muriatic acid or other etching cleaner. Flush the floor with clean water to remove acid, neutralize with ammonia, rinse, allow to dry, and vacuum before painting.

3. Ferrous Metals: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with recommendations of referenced standards.

a. Blast steel surfaces clean as recommended by paint system manufacturer and according to requirements of referenced standards.

b. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.

c. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up with the same primer as the shop coat.

4. Galvanized Surfaces: Clean galvanized surfaces with nonpetroleum-based solvents so surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.

E. **Materials Preparation**: Mix and prepare paint materials according to manufacturer's written instructions.

1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.

2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.

3. Use only thinners approved by paint manufacturer and only within recommended limits.

F. **Tinting**: Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of the same material are applied. Tint undercoats to match the

color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

3.3 APPLICATION

A. **General**: Apply paint according to recommendations of BS 6150 and manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.

1. Paint colors, surface treatments, and finishes are indicated in the schedules.

2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.

3. Provide finish coats that are compatible with primers used.

4. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, convector covers, covers for finned-tube radiation, grilles, and similar components are in place. Extend coatings in these areas, as required, to maintain the system integrity and provide desired protection.

5. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before the final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.

6. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.

7. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.

8. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.

9. Finish interior of wall and base cabinets and similar field-finished casework to match exterior.

10. Sand lightly between each succeeding enamel or varnish coat.

B. **Scheduling Painting**: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.

1. The number of coats and the film thickness required are the same regardless of application method. Do not apply succeeding coats until the previous coat has cured as recommended by the manufacturer. If sanding is required to

produce a smooth, even surface according to manufacturer's written instructions, sand between applications.

2. Omit primer on metal surfaces that have been shop primed and touchup painted.

3. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.

4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and where application of another coat of paint does not cause the undercoat to lift or lose adhesion.

C. **Application Procedures**: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.

1. Brushes: Use brushes best suited for the type of material applied. Use brush of appropriate size for the surface or item being painted.

2. Rollers: Use rollers of carpet, velvet back, or high-pile sheep's wool as recommended by the manufacturer for the material and texture required.

3. Spray Equipment: Use airless spray equipment with orifice size as recommended by the manufacturer for the material and texture required.

D. **Minimum Coating Thickness**: Apply paint materials no thinner than manufacturer's recommended spreading rate. Provide the total dry film thickness of the entire system as recommended by the manufacturer.

E. **Mechanical and Electrical Work**: Painting of mechanical and electrical work is limited to items exposed in equipment rooms and in occupied spaces.

F. **Prime Coats**: Before applying finish coats, apply a prime coat of material, as recommended by the manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn through or other defects due to insufficient sealing.

G. **Pigmented (Opaque) Finishes**: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.

H. **Transparent (Clear) Finishes**: Use multiple coats to produce a glass-smooth surface film of even luster. Provide a finish free of laps, runs, cloudiness, color irregularity, brush marks, orange peel, nail holes, or other surface imperfections.

1. Provide satin finish for final coats.

I. **Stipple Enamel Finish**: Roll and redistribute paint to an even and fine texture. Leave no evidence of rolling, such as laps, irregularity in texture, skid marks, or other surface imperfections.

J. **Completed Work**: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

3.4 FIELD QUALITY CONTROL

A. The Employer reserves the right to invoke the following test procedure at any time and as often as the Employer deems necessary during the period when paint is being applied:

1. The Employer will engage the services of an independent testing agency to sample the paint material being used. Samples of material delivered to the Project will be taken, identified, sealed, and certified in the presence of the Contractor.

2. The testing agency will perform appropriate tests for the following characteristics as required by the Employer:

a. Quantitative material analysis.

b. Abrasion resistance.

c. Apparent reflectivity.

d. Flexibility.

e. Washability.

f. Absorption.

g. Accelerated weathering.

h. Dry opacity.

i. Accelerated yellowness.

j. Recoating.

k. Skinning.

l. Color retention.

m. Alkali and mildew resistance.

3. The Employer may direct the Contractor to stop painting if test results show material being used does not comply with specified requirements. The Contractor shall remove noncomplying paint from the site, pay for testing, and repaint surfaces previously coated with the rejected paint. If necessary, the Contractor may be required to remove rejected paint from previously painted surfaces if, on repainting with specified paint, the 2 coatings are incompatible.

3.5 CLEANING

A. **Cleanup**: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from the site.

1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping. Be careful not to scratch or damage adjacent finished surfaces.

3.6 PROTECTION

A. Protect work of other trades, whether being painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Consultant.

B. Provide "Wet Paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.

1. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.7 EXTERIOR PAINT SCHEDULE

A. Coordinate the following paint coats with surface preparation steps as specified.

B. Concrete and Cement Sand Portland Plaster: Provide the following finish system over exterior concrete and Portland Cement Plaster.

1. Light Textured Emulsion Paint

a. 100% pure acrylic-based paint specially formulated for external application. The paint is to dry by evaporation of water and will produce a durable, flexible, excellent water and alkali resistant and is to provide long lasting protection for coated surfaces. The paint is to be UV-resistant, of high bond strength to substrates and distinguished color retention, and is to provide anti-carbonation shield for the substrate while allowing moisture of substrate to escape to the outside.

b. Finished surface is to be of light texture.

C. **Ferrous Metal**: Provide the following finish system over exterior ferrous metal.

1. Full-Gloss, Epoxy-Based Enamel: Two finish coat over primer.

a. Primer: High-molcular-weight, epoxy-resin primer at spreading rate recommended by manufacturer.

b. Finish Coat: High-molcular-weight, epoxy-resin topcoat at spreading rate recommended by the manufacturer.

c. Protection Coating: Two Coats of clear polyurethane-based, UV resistant protection coating.

3.8 INTERIOR PAINT SCHEDULE

A. Coordinate the following paint coats with surface preparation steps as specified.

B. **Concrete**: Provide the following paint systems over interior concrete and masonry surfaces:

1. Flat Acrylic Finish: 2 finish coats over a primer.

a. Primer: Alkali-resistant, acrylic-latex, interior primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 0.025 mm.

2. First and Second Coats: Flat, acrylic latex-based, interior paint applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 0.060 mm per coat.

C. **Plaster**: Provide the following finish systems over new, interior Portland cement plaster surfaces:

1. Flat Acrylic Finish: 2 finish coats over a primer.

a. Primer: Alkali-resistant, acrylic-latex, interior primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 0.036 mm.

b. Undercoat: same material for finish coats specified hereafter diluted to the manufacturer's recommendations.

c. First and Second Finish Coats: Flat, acrylic-latex, interior paint applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 0.064 mm per coat.

2. Semigloss, Alkyd-Enamel Finish: One finish coat over an undercoat and a primer.

a. Primer: Alkali-resistant, alkyd- or latex-based, interior primer, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils (0.031 mm).

b. First and Second Coats: Semigloss, alkyd, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 0.066 mm.

D. **Woodwork and Hardboard**: Provide the following paint finish systems over new, interior wood surfaces:

1. Semigloss, Acrylic-Enamel Finish: 2 finish coats over a wood undercoater.

a. Undercoat: Alkyd- or acrylic-latex-based, interior wood undercoater, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 0.031 mm.

b. First and Second Coats: Semigloss, acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 0.066 mm.

2. Full-Gloss, Alkyd-Enamel Finish: 2 finish coats over a wood undercoater.

a. Undercoat: Alkyd, interior enamel undercoater applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 0.031 mm.

b. First and Second Coats: Full-gloss, alkyd, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 0.061 mm.

E. **Stained Woodwork**: Provide the following stained finishes over new, interior woodwork:

1. Alkyd-Based, Satin-Varnish Finish: 2 finish coats of an alkyd-based, clear-satin varnish over a sealer coat and an alkyd-based, interior wood stain. Wipe wood filler before applying stain.

   a. Filler Coat: Paste-wood filler applied at spreading rate recommended by the manufacturer.

   b. Stain Coat: Alkyd-based, interior wood stain applied at spreading rate recommended by the manufacturer.

   c. Sealer Coat: Clear sanding sealer applied at spreading rate recommended by the manufacturer.

   d. First and Second Finish Coats: Alkyd-based or polyurethane varnish, as recommended by the manufacturer, applied at spreading rate recommended by the manufacturer.

F. **Zinc-Coated Metal**: Provide the following finish systems over zinc-coated metal:

1. Full-Gloss, Alkyd-Enamel Finish: One finish coat over an enamel undercoat and a primer.

   a. Primer: Galvanized metal primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 0.031 mm.

   b. Undercoat: Alkyd, interior enamel undercoat or semigloss, interior, alkyd-enamel finish coat, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 0.031 mm.

   c. Finish Coat: Full-gloss, alkyd, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 0.031 mm.

G. **Ferrous Metal**: Provide the following finish systems over ferrous metal:

1. Full-Gloss, Alkyd-Enamel Finish: two finish coat over a primer.

   a. Primer: Interior ferrous-metal primer at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 0.031 mm.

b. Finish Coat: Full-gloss, alkyd, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 0.031 mm percoat.

H. **Ferrous Metal**: Provide the following finish systems over ferrous metal:

1. Full-Gloss, Epoxy-Based Enamel: Two finish coat over primer.

a. Primer: High-molcular-weight, epoxy-resin primer at spreading rate recommended by manufacturer.

b. Finish Coat: High-molcular-weight, epoxy-resin topcoat at spreading rate recommended by the manufacturer.

END OF DOCUMENT

SECTION 41 – TOILET AND BATH ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Related Drawing and Detail.

1.2 SUMMARY

A. This Section includes the following:

1. Toilet and bath accessories.
2. Warm-air dryers.

B. Related Sections include the following:

1. Division 8 Section "Mirrored Glass" for mirrors.
2. Division 9 Section "Ceramic Tile" for ceramic toilet and bath accessories.
3. Division 16 Sections for the characteristics of electrical power in the project for hand dryers.

1.3 SUBMITTALS

A. **Product Data**: Include construction details, material descriptions and thicknesses, dimensions, profiles, fastening and mounting methods, specified options, and finishes for each type of accessory specified.

B. **Samples**: For each accessory item to verify design, operation, and finish requirements.

1. Approved full-size Samples will be returned and may be used in the Work.

C. **Setting Drawings**: For cutouts required in other work; include templates, substrate preparation instructions, and directions for preparing cutouts and installing anchoring devices.

D. **Product Schedule**: Indicating types, quantities, sizes, and installation locations by room of each accessory required. Use designations indicated in the Toilet and Bath Accessory Schedule and room designations indicated on Drawings in product schedule.

E. **Maintenance Data**: For accessories to include in maintenance manuals specified in Division 1. Provide lists of replacement parts and service recommendations.

1.4 QUALITY ASSURANCE

A. **Product Options**: Accessory requirements, including those for materials, finishes, dimensions, capacities, and performance, are established by specific products indicated in the Toilet and Bath Accessory Schedule.

1. Products of other manufacturers listed in Part 2 with equal characteristics, as judged solely by Consultant, may be provided.

2. Other manufacturers' products with equal characteristics may be considered. See Division 1 Section "Substitutions."

3. Do not modify aesthetic effects, as judged solely by Consultant, except with Consultant's approval. Where modifications are proposed, submit comprehensive explanatory data to Consultant for review.

1.5 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by disabled persons, proper installation, adjustment, operation, cleaning, and servicing of accessories.

F. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.6 WARRANTY

A. **General Warranty**: Special warranty specified in this Article shall not deprive Employer of other rights Employer may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. **Manufacturer's Mirror Warranty**: Written warranty, executed by mirror manufacturer agreeing to replace mirrors that develop visible silver spoilage defects within minimum warranty period indicated.

1. Minimum Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

A. **Stainless Steel**: ASTM A 666, Type 304, with No. 4 finish (satin), in 0.8-mm minimum nominal thickness, unless otherwise indicated.

B. **Brass**: ASTM B 19, leaded and unleaded flat products; ASTM B 16M, rods, shapes, forgings, and flat products with finished edges; ASTM B 30, castings.

C. **Sheet Steel**: ASTM A 366/A 366M, cold rolled, commercial quality, 0.9-mm minimum nominal thickness; surface preparation and metal pretreatment as required for applied finish.

D. **Galvanized Steel Sheet**: ASTM A 653/A 653M, Z180.

E. **Chromium Plating**: ASTM B 456, Service Condition Number SC 2 (moderate service), nickel plus chromium electrodeposited on base metal.

F. **Baked-Enamel Finish**: Factory-applied, gloss-white, baked-acrylic-enamel coating.

G. **Mirror Glass**: as per requirements of Division 8, section “Mirrored Glass”.

H. **Galvanized Steel Mounting Devices**: ASTM A 153/A 153M, hot-dip galvanized after fabrication.

I. **Fasteners**: Screws, bolts, and other devices of same material as accessory unit, tamper and theft resistant when exposed, and of galvanized steel when concealed.

2.2 FABRICATION

A. **General**: Names or labels are not permitted on exposed faces of accessories. On interior surface not exposed to view or on back surface of each accessory, provide printed, waterproof label or stamped nameplate indicating manufacturer’s name and product model number.

B. **Surface-Mounted Toilet Accessories**: Unless otherwise indicated, fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with continuous stainless-steel hinge. Provide concealed anchorage where possible.

C. **Recessed Toilet Accessories**: Unless otherwise indicated, fabricate units of all-welded construction, without mitered corners. Hang doors and access panels with full-length, stainless-steel hinge. Provide anchorage that is fully concealed when unit is closed.

D. **Mirror-Unit Hangers**: Provide mirror-unit mounting system that permits rigid, tamper- and theft-resistant installation, as follows:

1. One-piece, galvanized steel, wall-hanger device with spring-action locking mechanism to hold mirror unit in position with no exposed screws or bolts.

2. Heavy-duty wall brackets of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.

E. **Keys**: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Employer's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

B. Secure mirrors to walls in concealed, tamper-resistant manner with special hangers, toggle bolts, or screws. Set units level, plumb, and square at locations indicated, according to manufacturer's written instructions for substrate indicated.

3.2 ADJUSTING AND CLEANING

A. Remove temporary labels and protective coatings.

B. Clean and polish exposed surfaces according to manufacturer's written recommendations.

3.3 TOILET AND BATH ACCESSORY SCHEDULE

A. **Toilet Tissue Dispenser (Toilet Paper Holder)**: Provide toilet tissue dispenser complying with the following:

1. Type Single-roll dispenser.

2. Mounting: Surface mounted with concealed anchorage.

3. Material: Stainless steel

4. Operation: Noncontrol delivery with mfr's standard spindle.

5. Capacity: Designed for standard diameter-core tissue rolls up to 140 mm diameter (800 sheets)

C. **Soap Dish**: Stainless steel size and shape as selected by the Consultant from manufacturer's standard range.

D. **Soap Dispenser**: Provide soap dispensers complying with the following:

1. Liquid Soap Dispenser, Vertical-Tank Type: Wall mounted type, minimum 1182.9 ml capacity tank with stainless steel piston, springs, and internal parts designed to dispenses soap in measured quantity by pump action, and stainless-steel cover with unbreakable window-type refill indicator.

a. Mounting: Designed for wall mounting.

b. Soap Valve: Designed for dispensing soap in liquid form.

E. **Paper Towel Dispenser**: 800 multi-hold towels capcity, stainless steel, surface mounted.

F. Robe Hook

1. Stainless steel.

2. Double-prong with rectangular wall bracket and back plate for concealed mounting.

G. Grab Bar

1. Surface mounting, exposed.

2. Stainless steel.

3. 38 mm outside diameter and 1.20 mm minimum wall thickness and 38 mm distance from inside of bar and face of wall.

4. Furnish complete with two end flanges, 3 mm thick minimum and 76 mm diameter, each of three countersunk screw holes for attachment to walls.

5. Use of flanges with snap covers is acceptable.

E. **Warm-Air Dryer**: Provide warm-air dryer complying with the following:

1. Touch-Button-Activated Hand Dryer: Surface-mounted, warm-air hand dryer activated by touch button and with manufacturers' standard, white-painted metal cover and 30-second-timed power cut-off switch.

END OF DOCUMENT

SECTION 42 – UPVC DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Related Drawing and Detail.

1.2 SUMMARY

A. This Section includes the following:

1. Internal openable Doors.

B. Related Sections include the following:

1. Division 7 Section "Joint Sealants" for installation of joint sealants installed with aluminum-framed systems and for sealants to the extent not specified in this Section.

2. Division 8 Section "Sliding Automatic Entrances Doors".

3. Division 8 Section "Door Hardware" for lock cylinders and closers.

1.3 PERFORMANCE REQUIREMENTS

A. **General**: Provide UPVC Doors systems, including anchorage, capable of withstanding, without failure, the effects of the following:

1. Structural loads.

2. Thermal movements.

3. Movements of supporting structure indicated on Drawings including, but not limited to, story drift and deflection from uniformly distributed and concentrated live loads.

4. Dimensional tolerances of building frame and other adjacent construction.

5. Failure includes the following:

a. Deflection exceeding specified limits.

b. Thermal stresses transferred to building structure.

c. Framing members transferring stresses, including those caused by thermal and structural movements, to glazing.

d. Noise or vibration created by wind and thermal and structural movements.

e. Loosening or weakening of fasteners, attachments, and other components.

f. Sealant failure.

g. Failure of operating units to function properly.

B. Structural Loads:

1. Wind Loads: Uniform Building Code (UBC) 1997 Edition, Exposure C, Basic.

2. Seismic Loads: Provide UPVC systems, including anchorage, capable of withstanding the effects of earthquake motions calculated according to requirements of Uniform Building Code (UBC), 1997 Edition, Zone 2A.

C. Deflection of Framing Members:

1. **Deflection Normal to Wall Plane**: Limited to 1/175 of clear span for spans up to 4.1 m and to 1/240 of clear span plus 6.35 mm for spans greater than 4.1 m.

2. **Deflection Parallel to Glazing Plane**: Limited to amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components directly below to less than 3.2 mm and clearance between members and operable units directly below to less than 1.5 mm.

D. **Structural-Test Performance**: Provide systems tested according to ASTM E 330 as follows:

1. When tested at positive and negative wind-load design pressures, systems do not evidence deflection exceeding specified limits.

2. When tested at 150 percent of positive and negative wind-load design pressures, systems, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.

3. Test Durations: As required by design wind velocity but not less than 10 seconds.

4. **Temperature Change (Range)**: 35 deg C, ambient; 65 deg C, material surfaces.

5. **Test Performance**: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested according to AAMA 501.5.

    a. Test Ambient Temperature Range: plus 15 to 55 deg. C.

E. **Water Penetration Under Static Pressure**: Provide UPVC systems that do not evidence water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure difference of 20 percent of positive wind-load design pressure, but not less than 300 Pa.

F. **Sound Transmission**: Provide UPVC systems with fixed glazing and framing areas having minimum STC 30 according to ASTM E 413 and an OITC 26 according to ASTM E 1332, as determined by testing according to ASTM E 90.

1.4 SUBMITTALS

A. **Product Data**: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of product indicated.

B. **Shop Drawings**: For UPVC systems. Include plans, elevations, sections, details, and attachments to other work.

1. Include structural analysis data signed and sealed by the qualified professional Consultant responsible for their preparation.

2. Include details of provisions for system expansion and contraction and for draining moisture occurring within the system to the exterior.

3. For entrances, include hardware schedule and indicate operating hardware types, functions, quantities, and locations.

C. **Samples for Initial Selection**: For units with factory-applied color finishes.

D. **Samples for Verification**: For each type of exposed finish required, in manufacturer's standard sizes.

E. **Fabrication Sample**: Of each vertical-to-horizontal intersection of systems, made from 300-mm lengths of full-size components and showing details of the following:

1. Joinery.

2. Anchorage.

3. Expansion provisions.

4. Glazing.

5. Flashing and drainage.

F. Welding certificates.

G. **Qualification Data**: For Installer and testing agency.

H. **Preconstruction Sealant Test Reports**: For structural-sealant-glazed systems, compatibility and adhesion test reports from sealant manufacturer indicating that materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with sealants. Include sealant manufacturer's interpretation of test results for sealant performance and recommendations for primers and substrate preparation needed to obtain adhesion.

I. **Product Test Reports**: Based on evaluation of comprehensive tests performed by a qualified testing agency, for aluminum-framed systems.

J. Field quality-control test and inspection reports.

K. **Maintenance Data**: For aluminum-framed systems to include in maintenance manuals.

L. **Warranties**: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. **Quality System**: Comply with ISO 9001/9002 Quality System as a minimum. Incorporate all the standard procedures supplied by the Consultant and the Employer.

B. **Installer Qualifications**: Capable of assuming Consultanting responsibility and performing work of this Section and who is acceptable to manufacturer.

1. Consultanting Responsibility: Preparation of data for aluminum-framed systems including Shop Drawings based on testing and Consultanting analysis of manufacturer's standard units in assemblies similar to those indicated for this Project and submission of reports of tests performed on manufacturer's standard assemblies.

C. **Testing Agency Qualifications**: An independent agency qualified according to ASTM E 699 for testing indicated.

D. **Product Options**: Information on Drawings and in Specifications establishes requirements for systems' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.

1. Do not modify intended aesthetic effects, as judged solely by Consultant, except with Consultant's approval. If modifications are proposed, submit comprehensive explanatory data to Consultant for review.

E. **Welding**: Qualify procedures and personnel according to AWS D1.2, "Structural Welding Code-Aluminum."

F. **Mockups**: Prior to installing aluminum entrances, construct one mockup for an exterior aluminum entrances to verify selections made under sample submittals and to demonstrate aesthetic effects as well as qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for Work. Include class, glazing materials and spandrel panels.

1. Locate mockups on-site in the location and of the size indicated on Drawings.

2. Notify Consultant 7 days in advance of the dates and times when mockups will be constructed.

3. Demonstrate the proposed range of aesthetic effects and workmanship.

4. Obtain Consultant's approval of mockups before start of Work.

5. Retain and maintain mockups during construction in an undisturbed conditions as a standard for judging the completed Work.

a. Approved mockups in an undisturbed condition at the time of Substantial Completion as judged solely by the Consultant may become part of the completed Work, otherwise dismantle mockup and install permanent works.

1.6 PROJECT CONDITIONS

A. **Field Measurements**: Verify actual locations of structural supports for aluminum-framed systems by field measurements before fabrication and indicate measurements on Shop Drawings.

1.7 WARRANTY

A. **Special Assembly Warranty**: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum-framed systems that do not comply with requirements or that deteriorate as defined in this Section within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including, but not limited to, excessive deflection.

b. Noise or vibration caused by thermal movements.

c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

d. Water leakage through fixed glazing and framing areas.

e. Failure of operating components to function properly.

2. Warranty Period: Five years from date of Substantial Completion.

B. **Special Finish Warranty**: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes fail within specified warranty period. Warranty does not include normal weathering.

1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 FRAMING SYSTEMS

A. **Framing Members**: Manufacturer's standard extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.

B. **Brackets and Reinforcements**: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

C. **Fasteners and Accessories**: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

1. Where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration, use self-locking devices.

2. Reinforce members as required to receive fastener threads.

3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system.

2.2 DOORS

A. **Doors**: Manufacturer's standard glazed doors, for manual swing operation.

1. Door Construction: 44-mm overall thickness unless otherwise indicated on Drawings, with minimum 5-mm, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deep penetration and fillet welded or that incorporate concealed tie rods.

2. Door Design: Wide stile; 127-mm nominal width.

2.3 HARDWARE

A. **General**: Provide heavy-duty hardware units indicated in sizes, number, and type recommended by manufacturer for swing doors indicated and fabricated from cast, wrought or extruded aluminum. Finish exposed parts to match door finish, unless otherwise indicated.

B. **Closers, General**: Comply with requirements of Division 8, Section "Door Hardware" and manufacturer's recommendations for closer size, depending on door size, exposure to weather, and anticipated frequency of use.

1. Closing Cycle: Comply with requirements of authorities having jurisdiction.

2. Opening Force: Comply with the following maximum opening-force requirements for locations indicated:

a. Exterior Doors: 15 lbf (67 N).

C. **Hardware for Swing Doors**:

1. Hinges: As specified.

2. Door Pulls: Provide manufacturer's standard aluminum pull grips.

3 Door Stops: Floor-or-wall-mounted door stop as appropriate, with integral rubber bumper complying with ANSI A 156.16, Grade 1.

4. Keyed Cylinders: Mortise-type, 5-pin tumbler, stainless steel, inside cylinder units with cast aluminum face complying with ANSI A 156.5, Grade 1. Furnish 4 keys for each cylinder. Include cylinders in the master keying system

5. Locks: Roller type, for installation in aluminum styles of width indicated, aluminum casing.

6. Closers: As specified in this Section and in division 8, Section "Door Hardware".

2.4 ACCESSORY MATERIALS

A. **Joint Sealants**: For installation at perimeter of aluminum-framed systems, as specified in Division 7 Section "Joint Sealants."

2.5 FABRICATION

A. **General**: Fabricate components that, when assembled, will have accurately fitted joints with ends coped or mitered to produce hairline joints free of burrs and distortion. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

B. Form aluminum shapes before finishing.

C. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

D. **Framing Members, General**: Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.

2. Accurately fitted joints with ends coped or mitered.

3. Means to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.

4. Physical and thermal isolation of glazing from framing members.

5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.

6. Provisions for field replacement of glazing from exterior or interior.

7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

8. At interior doors, provide silencers at stops to prevent metal-to-metal contact. Install three silencers on strike jamb of single-door frames and two silencers on head of frames for pairs of doors.

E. **Doors**: Reinforce doors as required for installing hardware.

1. At pairs of exterior doors, provide sliding weather stripping retained in adjustable strip mortised into door edge.

2. At exterior doors, provide weather sweeps applied to door bottoms.

F. **Hardware Installation**: Factory install hardware to the greatest extent possible. Cut, drill, and tap for factory-installed hardware before applying finishes.

G. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

H. **Forming**: Form shapes with sharp profiles, straight and free of defects or deformations, before finishing.

I. Prepare components to receive concealed fasteners and anchor and connection devices.

J. Fabricate components to drain water passing joints and condensation and moisture occurring or migrating within the system to the exterior.

K. **Welding**: Weld components to comply with referenced AWS standard. Weld before finishing components to greatest extent possible. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

L. **Entrances**: Fabricate door framing in profiles indicated. Reinforce as required to support imposed loads. Factory assemble door and frame units and factory install hardware to greatest extent possible. Reinforce door and frame units as required for installing hardware indicated. Cut, drill, and tap for factory-installed hardware before finishing components.

1. **Exterior Doors**: Provide compression weather stripping at fixed stops. At other locations, provide sliding weather stripping retained in adjustable strip mortised into door edge.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install aluminum swing doors in accordance with manufacturer's recommendations and approved shop drawings.

B. Install units plumb, level, square, true to line or curvature as required, in alignment with work of other trades, free from waves, buckles, sags or other defects. Provide secure anchorage for all parts of work. Coordinate with related trades to ensure proper mating and connecting of the work.

C. Isolate aluminum from contact with dissimilar metals and materials by applying on contact surfaces a heavy coat of approved alkali-resistant bituminous paint; or by separating surfaces with a non-absorptive tape or gasket.

D. Install work in prepared openings. Conform with applicable requirements for assuring use of proper materials and procedures to prevent electrolytic deterioration.

E. Comply with manufacturer's instructions and recommendations for installation of work. Shim and allow for movement resulting from changes in thermal conditions.

F. Set frames level, plumb and in true alignment in accordance with approved shop drawings. Construct completely tight and waterproof assemblies. Provide proper support and anchor securely in place.

G. Provide sealing as necessary to make work watertight and properly finished including joints between frames and adjoining construction.

H. **Hardware**: Install hardware to hardware manufacturer's instructions and installation templates.

3.3 FIELD QUALITY CONTROL

A. **Testing Agency**: Engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

3.4 ADJUSTING

A. Adjust operating swing doors and hardware to provide a tight fit at contact points and weather-stripping for smooth operation and weathertight closure.

3.5 CLEANING

A. Clean aluminum surfaces promptly after installing units. Avoid damaging protective coatings and finishes. Remove excess glazing and sealing compounds, dirt and other substances.

B. Lubricate hardware and the moving parts. Clean glass of pre-glazed units promptly after installing sliding glass door units.

C. Wash and polish glass on both faces not more than 4 days prior to the date scheduled for final inspection. Comply with manufacturer's recommendations for final cleaning and maintenance.

D. Remove and replace glass that is broken, chipped, cracked, abraded, or damaged in other ways during the construction period, including by natural causes, accidents and vandalism at no additional cost to the Employer.

3.6 PROTECTION

A. Institute and maintain protective and other precautions required through remainder of construction period to ensure that except for normal weathering aluminum.

B. Aluminum swing doors units will be clean, neat and without damage or deterioration at time of Substantial Completion.

END OF DOCUMENT