Division 05
Metals

TABLE OF CONTENTS

SECTION 055000

METAL FABRICATIONS

SECTION 055000

METAL FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Furnish all labour, materials, tools and equipment, and perform all services and operations necessary to execute the work of this section to install all miscellaneous metal components and accessories, anchors and fastenings and perform all operations in connection with metal fabrication work.

B. This section establishes requirements for miscellaneous metal fabrication anchors and supports as required and not detailed elsewhere.

C. Metal fabrication work is defined as including any items shown on the Drawings and/or specified herein, fabricated from metal shapes, plates, bars, pipes, tubes, casting and roll-formed shaped which are not a part of an overall system specified in any other Section of these Specifications.

D. This Section includes all metal fabrications and supplementary items necessary for installation, not covered under other section; including, but not limited to the following:

1. Steel framing and anchor bolts, steel pipe sleeves, and wedge-type inserts indicated to be cast into concrete.
2. Drilled inserts.
3. Steel support systems for service equipment fixation.
4. Abrasive metal nosing
5. Rough hardware.
6. Edgings, loose bearing and levelling plates.
7. Metal fence for catwalk.
8. Metal railing for catwalk.
9. Steel grating for catwalk.
10. Trench drain grating and frames.
11. Steel framing and supports for countertops, miscellaneous trims, framing and supports.
12. Metal floor plates and supports.
13. Mop and broom rack.
14. Channel door frames.
15. Hanger brackets.

1.3 SUBMITTALS

A. Product Data: Manufacturer/fabricator’s technical literature for each product and system indicated. Include manufacturer/fabricator's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.

C. Samples representative of materials and finished products as may be requested by the Engineer.

D. Welding Certifications: Certificates for welding procedures and personnel.

E. Product Test Reports: Written reports based on evaluation of comprehensive tests performed by qualified testing agency indicating that each product complies with requirements.

F. Field Quality Control Reports: Written report of testing and inspection required by "Field Quality Control".

G. Manufacturer/Fabricator's Project Acceptance Document: Certification that products are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required.

H. Qualification Data: For manufacturer/fabricator and installer: 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 Engineer/Project Managers and Client, and other information specified.

I. Structural calculations.

1.4 QUALITY ASSURANCE

A. Testing: Field testing for the materials shall be carried out as specified herein and other related documents.

B. Manufacturer/Fabricator Qualifications: Manufacturer/fabricator with not less than 5 years experience with successful production of products and systems similar to scope of this Project, with a record of successful in-service performance and completion of projects for a period of not less than 5 years and with sufficient production capability, facilities and personnel, to produce required Work.

C. Installer Qualifications:

1. Experience: Installer with not less than 5 years' experience in performing specified Work similar to scope of this Project, with a record of successful in-service performance and completion of projects for a period of not less than 5 years, and with sufficient production capability, facilities and personnel, to produce required Work.
2. Supervision: Installer shall maintain a competent supervisor who is at Project during times specified Work is in progress, and, who is experienced in installing systems similar to type and scope required for Project.

D. Manufacturer/Fabricator's Technical Representative Qualification: Direct technical employee of manufacturer/ fabricator with at least 5 years' experience in providing recommendations, observations, evaluations, and problem diagnostics. Sales representatives are not acceptable.

E. Welding Qualifications: Qualify procedures and personnel according to following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel".
2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel".
3. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel".
4. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum".

1.5 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site to comply with requirements of applicable Division 01 Sections.

1.6 PROJECT CONDITIONS

A. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.7 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

B. Coordinate installation of anchorages for metal fabrications. 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.

1.8 WARRANTY

A. The manufacturer shall submit warranty certificate for all materials manufactured by him for a period of 5 years against manufacturing defects, workmanship and against rusting etc.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer/ fabricator. Provide secondary materials only as recommended by manufacturer/ fabricator of primary materials.

2.2 FERROUS METAL MATERIALS

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, blemishes, or other imperfections where exposed to view on finished units. Do not use steel sheet with variations in flatness exceeding those permitted by referenced standards for stretcher-leveled sheet.

1. Provide uncoated ferrous metal at interior exposures.
2. Provide galvanized metal where indicated on drawings or if not indicated, then at unconditioned spaces and at exterior exposures.

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

C. Steel Tubing: ASTM A 500, cold-formed steel tubing.

D. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40) unless another weight is indicated or required by structural loads.

E. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D

F. Stainless-Steel Sheet, Strip, and Plate: ASTM A 240/A 240M or ASTM A 666, Type 316L.

G. Stainless-Steel Bars and Shapes: ASTM A 276, Type 316L.

H. Rolled-Stainless-Steel Floor Plate: ASTM A 793.

I. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/ A 47M, unless otherwise indicated.

2.3 NON-FERROUS METAL MATERIALS

A. Aluminum Plate and Sheet: ASTM B 209/B 209M, Alloy 6063-T6.

B. Aluminum Extrusions: ASTM B 221/B 221M, Alloy 6063-T6.

C. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, Alloy 6061-T6.

D. Aluminum Castings: ASTM B 26/B 26M, Alloy 443.0-F.

E. Aluminum sheet cladding, if applicable: made of 4mm thick composite powder coated aluminum, factory finished, with following specifications:

1. Aluminum Composite Panels: 4mm thick aluminium composite panels composed of proprietary core sandwiched between two skins of 0.5mm thick aluminium sheet
   a. Weight: 5.5 kg/m²
   b. Thermal Expansion: 2.4mm/m/100^{o}K
   c. Fire Behaviour: Non-inflammable, with fire resistant core ASTM E84
   d. Sound transmission loss: 25dB to ASTM E 413.
   e. Tensile strength: 5 kg/mm²
   f. Finish: PVDF Kynar or PVF-3 Durasol finish. Color to Engineer's approval.

F. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), alloy shall be 6063-T6. All aluminum sheets to come from the same batch.

G. Color: as directed by the Engineer.

H. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads and as recommended by the panel manufacturer.

1. Use stainless-steel fasteners. Type 18-8 stainless, recommended by manufacturer for specific condition.
2. Provide exposed fasteners with heads matching color of panel by means of plastic caps or factory-applied coating.
3. Provide metal-backed neoprene washers under heads of exposed fasteners located on weather side of panels.

I. Accessories: Unless otherwise specified, provide components required for a complete assembly including trim, clips, covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match materials and finishes of panels.

1. Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release paper backing. Provide permanently elastic, non-sag, non-toxic, non-staining tape.

2. Joint Sealant: One-part elastomeric polyurethane, or silicone-rubber sealant as recommended by panel manufacturer.
3. Gaskets: Gaskets shall be dry seal santoprene pressure type.

2.4 FASTENERS

A. Fastener Type and Material: Select fasteners for type, grade, and class required to produce connections suitable for anchoring fabrications to other types of construction indicated.

B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307/F 568M, Grade A/ ASTM F 568M, Property Class 4.6; with hex nuts, ASTM A 563/A 563M; and, where indicated, flat washers.

C. Stainless Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, ASTM F 593/F 738M; with hex nuts, ASTM F 594/F 836M; and, where indicated, flat washers; Alloy Group 2 (A4) for Type 316.

D. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563/ A 563M; and, where indicated, flat washers. Hot-dip galvanizes or provides mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.

E. Plain Washers: Round carbon steel, ASME B18.22.1/ASME B18.22M.

F. Lock Washers: Helical, spring type carbon steel, ASME B18.21.1/ ASME B18.21.2M.

G. Eyebolts: ASTM A 489.

H. Machine Screws: ASME B18.6.3/B18.6.7M.

I. Lag Screws: ASME B18.2.1/B18.2.3.8M.

J. Wood Screws: ASME B18.6.1, flat head, carbon steel.

2.5 ANCHORS

A. General: Provide anchors capable of sustaining, without failure, a load equal to 6 times load imposed when installed in unit masonry and 4 times load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

B. Cast-in-Place Anchors in Concrete: Bolts, washers, and shims as needed, either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel; hot-dip galvanized according to ASTM F 2329.

C. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.

1. Material for Interior Locations: Carbon steel components zinc plated to comply with ASTM B 633 or ASTM F 1941/F 1941M, Class Fe/Zn 5, unless otherwise indicated.
2. Material for Exterior Locations: Alloy Group 2 (A4) for Type 316 stainless steel bolts, ASTM F 593/F 738M, and nuts, ASTM F 594/F 836M.
3. Post-Tensioned Concrete Locations: Anchors shall not exceed 1 in (25 mm) embedment. Obtain Structural Engineer's written approval for all proposed anchors in post-tensioned concrete prior to installation.

2.6 MANUFACTURED PRODUCTS

A. Anti-Slip Coating:
1. Description: Proprietary material and application process that forms permanent, uniform, slip resistant surface texture on metals.
2. Color: As selected from manufacturer/fabricators standard colors available.
3. Static Coefficient of Friction Characteristics: Not less than 0.6 according to ASTM D 2047.

2.7 PAINT MATERIALS

A. Shop Primer for Ferrous Metal: Fast-curing, lead and chromate free, universal modified-alkyd primer complying with performance requirements of FS TT-P-664, selected for good resistance to normal atmospheric corrosion, compatibility with finish paint systems indicated, and capability to provide a sound foundation for field-applied topcoats despite prolonged exposure.

B. Galvanizing Repair Paint: High-zinc-dust-content paint for re-galvanizing welds in galvanized steel, with dry film containing not less than 94 percent zinc dust by weight, and complying with DOD-P-21035 or SSPC-Paint 20.

C. Bituminous Paint: Cold-applied asphalt mastic complying with SSPC-Paint 12, except containing no asbestos fibers.

D. Separate dissimilar metals with bituminous paint or preformed dielectric separators, which will prevent galvanic action.

E. Bituminous Paint: ASTM D 1187, cold-applied asphalt emulsion.

2.8 ACCESSORY ITEMS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Concrete Materials and Properties: Comply with requirements in Division 3 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with minimum 28 day compressive strength of 3000 psi (210.92 k/cm), unless otherwise indicated.

C. Cap for Concrete-Filled Pipe Bollard: ASTM F 626, domed aluminum alloy post caps.

D. Non-shrink, Non-metallic Grout: Factory-packaged, non-staining, non-corrosive, non-gaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer/fabricator for interior and exterior applications.

2.9 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports that are not a part of structural framework as necessary to complete the Work.

B. Fabricate units from structural-steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.
1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors 32 mm wide by 6 mm thick by 200 mm long at 600 mm on center, unless otherwise indicated.

2.10 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from structural-steel shapes, plates, and bars of profiles shown with continuously welded joints, and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work. Provide anchors, welded to trim, for embedding in concrete or masonry construction, spaced not more than 150 mm apart and 150mm from each end.

2.11 ROUGH HARDWARE

A. Furnish bent or otherwise custom-fabricated, bolts, plates, anchors, hangers, dowels, and other miscellaneous steel and iron shapes as required for framing and supporting woodwork, and for anchoring or securing woodwork to concrete or other structures.

B. Fabricate items to sizes, shapes and dimensions required. Furnish malleable-iron washers for heads and nuts that bear on wood structural connections, and furnish steel washers elsewhere.

2.12 TRENCH COVERS

A. Fabricate chequered floor plates from rolled-steel floor plate complying with ASTM A786 of 8mm minimum thickness.

B. Include steel angle stiffeners and fixed and removable sections. Provide flush steel bar drop handles for lifting removable sections, one at each end of each section. Flooring plates and frames shall be galvanized after fabrication.

C. Refer electrical drawings for detailing.

2.13 METAL GRATINGS

A. Materials, General:
   1. Hot Rolled, Pickled and Oiled Steel: Commercial steel per ASTM A 1011, minimum yield of 227.5MPa
   2. Mill Galvanized Steel: Commercial steel per ASTM A 653 and ASTM A 924 with G-90 coating designation, minimum yield of 227.5MPa
   3. Hot-Dip Galvanized After Fabrication: Commercial steel per ASTM A 1011, minimum yield of 227.5MPa, hot-dip galvanized after fabrication per ASTM A 123.
   4. Aluminum: Alloy 5052, Temper H32 aluminum per ASTM B 209
   5. Stainless Steel: Type 304 (Type 316) stainless steel, 2B or 2D finish, per ASTM A 240.

B. Materials, Components
   1. Safety Grating: Shall meet or exceed the Federal Standard for Safety Grating, RR-G-1602D.
   2. Slip Resistant Grating: Shall be constructed from a single sheet with integrally formed side channels and surface textures.

2.14 ABRASIVE METAL NOSINGS

A. Carborundum: Shall be made from non-slip material, with an integral abrasive finish.
1. Fabricate units in sizes and configurations indicated and in lengths necessary to accurately fit openings or conditions.
2. Nosing: Cross-hatched units, 100mm wide with 6mm lip, for fixing into concrete steps.

B. Provide anchors for embedding units in concrete, either integral or applied to units, as standard with manufacturer.

C. Apply bituminous paint to concealed bottoms, sides, and edges of nosing units set into concrete.

2.15 LOOSE BEARING AND LEVELLING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction, made flat, free from warps or twists, and of the required thickness and bearing area. Drill plates to receive anchor bolts and for grouting as required. Galvanize after fabrication.

2.16 MOP AND BROOM RACK

A. Provide 175mm long x 12mm diameter cranked mild steel rods plug welded to 50 x 10mm mild steel flat bar in pairs. Space rods in each pair 40mm apart and space pairs 300mm apart.

B. Fabricated mop and broom rack to be hot dip galvanized.

C. Provide mop and broom racks in utility rooms as required.

2.17 CHANNEL DOOR FRAMES

A. Structural channel sections, selected for trueness of web and flange, with joints welded and ground smooth.

B. Supply bar stop and bent bar anchors for anchorage to masonry or concrete as required.

C. Fit frames with temporary spreaders to prevent frame from springing out of shape.

2.18 HANGER BRACKETS

A. Provide steel hanger brackets to support boxes for masks, glove and cap dispensers on Operating Theatres, and any additional areas as indicated.

B. Sizes of brackets to suit application.

C. Finish: Galvanized.

2.19 FABRICATION, GENERAL

A. General: Fabricate metal fabrications, including clips, brackets and other components necessary to support and anchor fabrications to supporting structure and to comply with requirements indicated for design, diameter, member sizes and spacing, details, finish and anchorage.

1. Join components by welding unless otherwise indicated.

B. Form metal fabrications from materials of size, thickness, and shapes indicated but not less than that needed to comply with performance requirements indicated.

C. Work to dimensions indicated or accepted on shop drawings, using proven details of fabrication and support. Use type of materials indicated or specified for various components of each metal fabrication.

D. Form exposed work true to line and level with accurate angles, surfaces and straight sharp edges.

E. Shop Assembly: Assemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces.

F. Fabrication Requirements:

1. Shear and punch metals cleanly and accurately. Remove burrs and ease exposed edges to a radius of approximately 0.8 mm unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
2. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
3. Form work true to line and level with accurate angles and surfaces and straight sharp edges.
4. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

G. Exterior Requirements:

1. Allow for thermal movement resulting from 49°C change (range) in ambient and 82°C surface temperatures by preventing buckling, opening up 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 night-time sky heat loss.
2. Fabricate hot-dip galvanized fabrications so that field assembly will be by bolted connections and not welding.
3. Fabricate joints exposed to weather in a manner to exclude water, or provide weep holes where water may accumulate.

H. Assembly Requirements:

1. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
2. Form exposed connections with hairline joints, flush, smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated. Locate joints where least conspicuous.
3. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 6mm by 6mm, with a minimum 150mm embedment and 50mm hook, not less than 200mm from ends and corners of units and 600mm on center, unless otherwise indicated.
4. Complete fabrication prior to shop painting or hot-dip galvanizing.

I. Shop-Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

Weld corners and seams continuously to develop full strength of member to comply with 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 welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

2.20 FINISHES, GENERAL

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

1. Finish metal fabrications after assembly.
2. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.21 STEEL AND IRON FINISHES

A. Exterior Fabrications:

1. Galvanized Finish: Hot-dip galvanize according to following. For surfaces to be painted, do not quench or apply post galvanizing treatments that might interfere with paint adhesion. 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.
   a. Steel and Iron Products: ASTM A 123.
   b. Steel and Iron Hardware: ASTM A 153.
2. Shop Priming: Coordinate with Division 09 Section “Painting”.
   a. Preparation of Uncoated Surfaces: Prepare uncoated surfaces to comply with requirements of coating product to be used, but not less than minimum requirements of SSPC-SP 6/NACE No. 3 surface preparation specifications and environmental exposure conditions of installed fabrications.
   b. Preparation of Galvanized Surfaces: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner.
   c. Application: SSPC-PA 1; apply shop primer to uncoated surfaces. Stripe paint corners, crevices, bolts, welds, and sharp edges.

B. Interior Fabrications:

1. Shop Priming for Concealed Interior Locations:
   a. Preparation of Uncoated Surfaces: Prepare uncoated surfaces to comply with requirements of coating product to be used, but not less than minimum requirements of SSPC-SP 6/NACE No. 3 surface preparation specifications and environmental exposure conditions of installed fabrications.

b. Application: SSPC-PA 1; apply shop primer to uncoated surfaces, except those with galvanized finishes and those to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Stripe paint corners, crevices, bolts, welds, and sharp edges.

2. Shop Priming for Exposed Interior Locations: Coordinate with Division 09 Section "Painting".
   a. Preparation of Uncoated Surfaces: Prepare uncoated surfaces to comply with requirements of coating product to be used, but not less than minimum requirements of SSPC-SP 6/NACE No. 3 surface preparation specifications and environmental exposure conditions of installed fabrications.
   b. Application: SSPC-PA 1; apply shop primer to uncoated surfaces. Stripe paint corners, crevices, bolts, welds, and sharp edges.

2.22 ALUMINUM FINISHES

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

B. As-Fabricated Finish: AA-M10 (Mechanical Finish: as fabricated, unspecified).

C. Finish: Powder coated with thick. of 80 micron.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive metal fabrications and associated Work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting Work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
1. Respective manufacturer/fabricator's written installation instructions.
2. Accepted submittals.
3. Contract Documents.

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

3.3 PREPARATION

A. General: Comply with manufacturer/fabricator's instructions, recommendations and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 INSTALLATION OF METAL FABRICATIONS

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where

necessary for securing metal fabrications to in-place construction. Include threaded fasteners for concrete and masonry inserts, through bolts, lag bolts, and other connectors.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

C. Connections: Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been coated or finished after fabrication and are intended for bolted or screwed field connections or other means without further cutting or fitting.

D. Field Welding: Weld connections continuously to develop full strength of member to comply with following requirements:

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 welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

E. Corrosion Protection: Coat concealed aluminum surfaces that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with heavy coat of bituminous paint.

3.5 SETTING LOOSE PLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of bearing plates.

B. Set loose leveling and bearing plates on wedges or other adjustable devices. After the bearing members have been positioned and plumbed, tighten the anchor bolts.

C. Do not remove wedges or shims, but if protruding, cut off flush with the edge of the bearing plate before packing with grout.

3.6 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

3.7 INSTALLATION OF MISCELLANEOUS ITEMS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturer/fabricators' written instructions and requirements indicated on Shop Drawings.

B. Stair Nosing: Install with anchorage system to comply with manufacturer/fabricator's written instructions. Center nosing on tread widths to within 75mm of ends. Align nosing flush with riser faces and level with tread surfaces.

3.8 FIELD QUALITY CONTROL

A. Manufacturer/Fabricator's Field Service: Manufacturer/fabricator's qualified technical representative shall inspect first day's Work and periodically inspect Work to ensure installation is proceeding in accordance with manufacturer/fabricator's designs, recommendations, instructions and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.

3.9 ADJUSTING AND CLEANING

A. Touch-Up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces. Apply by brush or spray to provide a minimum 2.0mil (0.05mm) dry film thickness.

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

END OF SECTION

SECTION 05 5213

PIPE & TUBE RAILINGS

SECTION 05 5213

PIPE & TUBE RAILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes: Pipe, tube railings, and supplementary items including anchors and support components, as necessary for installation.

1.3 PERFORMANCE REQUIREMENTS

A. Railing assembly shall be in accordance with the relevant BS or ASTM standards.

B. Structural Performance: Provide handrails and railings complying with ASTM E 985 for structural performance, based on testing performed as per ASTM E 894 (Test Method for Anchorage of Permanent Metal Railing Systems and Rails for Buildings) and ASTM E 935.

C. Thermal Movements: Provide handrails and railings that allow for thermal movements resulting from the maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

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 Literature for handrails.
2. Grout, anchoring cement and paint products.

B. Shop Drawings: Show fabrication and installation of handrails. Include plans, elevations, sections, component details, and attachments to other work. Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.

C. Samples: 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. 150mm long sections of each distinctly different linear railing member, including handrails, top rails and posts.
2. Fittings, brackets and connections. Submit samples of wall bracket, escutcheon, end stop and all accessories etc.

3. Assembled sample of railings, made from full-size components including top rail, post, handrail, and infill. Show method of finishing members at intersections.

D. Mock up shall be erected at site for each type of handrail for approval of Engineer.

1.5 WARRANTY

A. The manufacturer shall submit warranty certificate for all materials manufactured by him for a period of 10 years against manufacture defects, workmanship and against rusting etc.

1.6 STORAGE

A. Store handrails in a dry, well-ventilated, weather tight place in accordance with manufacturer's recommendations.

1.7 PROJECT CONDITIONS

A. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify 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 products and systems with interfacing and adjoining construction to provide a successful installation without failure.

B. Coordinate installation of anchorages for 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.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Single Source Responsibility: Furnish each type of product from single manufacturer/ fabricator. Provide secondary materials only as recommended by manufacturer/ fabricator.

B. Aluminum tube handrails and post with post mounted handrail system at the staircase 01,02 and 03 Block A, staircase 04,05 and 06 Block B, staircase 08,14 and logistic Block C, staircase 09,10,11,12,15 and MEP access staircase Block D, as indicated in the drawings:

1. Handrails and posts tubes: Diameter of top rail, posts and bottom tubes shall be as per drawings. Rails and posts shall be fabricated with joints as per manufacturer's standards.

2. Post mounted handrail with elbow mounting pipe: Diameter of rail shall be as per drawings, joints of rail and mounting pipes shall be fabricated as per manufacturer's standards.
3. Fittings:
   a. For main handrail: 100mm dia., floor aluminum brackets, shall be fixed to flooring using special bolts. Posts shall be fixed to square-shaped plates.
   b. For post mounted handrail: Ring-shapes, post mounted aluminum brackets with 6mm thick and 40mm dia. shall be fixed to post using special bolts. Elbows mounting pipe shall be fixed to ring-shaped bracket as per manufacturer's standards.
4. Exposed Fasteners: Flush countersunk aluminum screws or bolts: consistent with railing design.
5. Splice Connectors: Aluminum collars.
6. Finishing: Powder coated finish to all exposed surfaces, color as per selection of Engineer/Client.
7. All accessories and fixing shall be as per approval from Engineer.

C. Aluminum wall mounted handrail with elbow mounting pipe at staircases 01, 02 and 03 Block A, staircases 04, 05 and 06 Block B, staircases 08, 14 and logistic Block C, staircases 09, 10, 11, 12, 15 and MEP access staircase Block D, as indicated in the drawings:

1. Wall mounted handrail with elbow mounting pipe: Diameter of rail and mounting pipe shall be as per drawings, rail and mounting pipes shall be fabricated with joints as per manufacturer's standards.
2. Fittings: Ring-shapes, wall aluminum brackets with 6mm thick and 75mm dia.
3. Mounting: Ring-shaped plates shall be fixed to walls using special bolts. Elbows mounting pipe shall be fixed to ring-shaped plates as per manufacturer's standards.
4. Exposed Fasteners: Flush countersunk aluminum screws or bolts: consistent with railing design.
5. Splice Connectors: Aluminum collars.
6. Finishing: powder coated finish to all exposed surfaces, color as per selection of Engineer.
7. All accessories and fixing shall be as per approval from Engineer.

D. Stainless steel handrail shall consist of two top rails, post, bottom rail and glass balustrade connected to the post by stainless steel clamps at staircase 16 Block A Rehab Entrance as indicated in the drawings.

1. Rails and posts pipes: Diameter of pipe shall be per drawings.
2. Glass shall be 13.5mm thick, low iron Laminated glass (6mm fully tempered clear glass+1.5mm sentry glass plus interlayer + 6mm fully tempered clear glass).
3. Fittings: For fixing the stainless steel posts, 100mm dia., stainless steel floor brackets, shall be fixed to floor using special bolts. Posts shall be welded to square-shaped plates. For fixing the glass, stainless steel clamps 6mm thick, shall be fixed over laminated glass by stainless steel screws.

4. Exposed Fasteners: Flush countersunk stainless steel screws or bolts: consistent with railing design.
5. Splice Connectors: Stainless steel welding collars.
6. Finishing: Stainless steel grade 304 with polished finish unless selected otherwise by Engineer/Client.

E. Mild steel tubes handrails and post with post mounted handrail system at external Steel Access Stair Block A and Block C as indicated in the drawings:

1. Handrails and posts tubes: Diameter of top rail, posts and bottom tubes shall be as per drawings. Rails and posts shall be fabricated with welded joints.
2. Post mounted handrail with elbow mounting pipe: Diameter of rail shall be as per drawings, rail and mounting pipes shall be fabricated with welded joints.
3. Fittings:
   a. For main handrail: 100mm dia., mild steel floor brackets, shall be fixed to floor using galvanized steel bolts. Posts shall be welded to square-shaped plates.
   b. For post mounted handrail: Ring-shapes, post mounted mild steel brackets with 6mm thick and 40mm dia. shall be welded to post using special galvanized steel bolts. Elbows mounting pipe shall be welded to ring-shaped.
4. Mounting: M.S plates fixed to concrete floors using special bolts. Supports to be welded to the plates.
5. Finishing: Acrylic polyurethane topcoat @ 75 mic over epoxy intermediate and initial coats (Refer to section 099100 ‘’Painting”)
6. All accessories and fixing shall be as per approval by Engineer.

2.2 FASTENERS

A. Fasteners for anchoring railings to other construction: Aluminum/stainless steel and mild steel required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.

2.3 ANCHORS

A. General: Provide aluminum/stainless steel and mild steel anchors capable of sustaining, without failure, a load equal to 6 times load imposed when installed in unit masonry and 4 times load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

B. Cast-in-Place Anchors in Concrete: Bolts, washers, and shims as needed, either threaded type or wedge type unless otherwise indicated; Aluminum.

2.4 ACCESSORY ITEMS

A. Fittings, Brackets and Fasteners: Aluminum/stainless steel and mild steel.

B. Non-shrink, Non-metallic Grout: Factory-packaged, non-staining, non-corrosive, non-gaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer/fabricator for interior and exterior applications.

2.5 FABRICATION, GENERAL

A. General: Fabricate railings, including clips, brackets, and other components necessary to support and anchor railings to supporting structure, and 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.

1. Join components by welding unless otherwise indicated.

B. Shop Assembly: Assemble railings in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces.

C. Fabrication Requirements:

1. Cut, drill, and punch cleanly and accurately. Remove burrs and ease edges to a radius of approximately 0.8 mm unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
2. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
3. Form work true to line and level with accurate angles and surfaces.
4. Form changes in direction by bending or by inserting prefabricated elbow fittings.
5. Bend members in jigs to produce uniform curvature for each configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
6. Close exposed ends of railing members with prefabricated end fittings.
7. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns, unless clearance between end of rail and wall is 6 mm or less.

D. Exterior Requirements:

1. Form exposed connections with joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use flat-head (countersunk) screws or bolts unless otherwise indicated. Locate joints where least conspicuous.
2. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

E. Shop-Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

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

F. Brackets, Flanges, Fittings, and Anchors:
1. Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.
2. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.

G. Fixed Railing Posts: If not coring concrete for railing posts to be set in concrete, provide stainless steel sleeves not less than 150 mm long with inside dimensions not less than 12 mm greater than outside dimensions of post, with metal plate forming bottom closure.

H. Removable Railing Posts: Fabricate slip-fit sockets from stainless steel tube or pipe whose interior diameter is sized for a close fit with posts; limit movement of post without lateral load, measured at top, to not more than 1/40 of post height. Provide socket covers designed and fabricated to resist being dislodged.

2.6 FINISHES, GENERAL

A. General Finish Quality Standard: NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
1. Finish fabrications after assembly.
2. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.7 ALUMINUM FINISHES

A. Finish: Shall be powder coating.

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

2.8 STAINLESS-STEEL FINISHES

A. Finish: Shall be polished stainless steel grade 304.

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

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

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. Acceptance of Surfaces and Conditions: Examine substrates to receive products

and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

1. Examine plaster and concrete, 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. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
1. Respective manufacturer/fabricator's written installation instructions.
2. Accepted submittals.
3. Contract Documents.

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

3.3 PREPARATION

A. General: Comply with manufacturer/fabricator's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors, which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 INSTALLATION OF PIPE AND TUBE RAILINGS

A. Cutting, Fitting, and Placement:
1. Perform cutting, drilling, and fitting required for installing railings. Set accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; measured from established lines and levels and free of rack.
2. 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.

B. General Installation Requirements:
1. Fit exposed connections together to form tight, hairline joints.
2. Adjust railings before anchoring to ensure matching alignment at abutting joints.
3. Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.
4. Aluminum Railing Systems: Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of damp-proof paint.

C. Field Welding: Weld connections continuously to develop full strength of member to comply with 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 welding flux immediately.
4. Weld exposed corners and seams continuously unless otherwise indicated.
5. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Non-welded Connections for Aluminum Railing Systems: Use mechanical or adhesive joints for permanently connecting railing components. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of railings.

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

F. Anchoring Posts in Concrete:
1. Anchor posts according to one of following:
   a. Metal sleeves preset and anchored into concrete.
   b. Form or core-drill holes not less than 125mm deep and 19mm larger than outside diameter of post; clean holes of loose material.
2. Fill annular space between post and concrete or metal sleeves with non-shrink, non-metallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer/fabricator's written instructions.
3. Leave anchorage joint exposed with 3mm buildup, sloped away from post.

G. Anchoring Posts onto Concrete: Attach flange to concrete using post-installed anchors in pre-drill holes, welded or attached with set screws to post.

H. Anchoring Posts onto Steel:
1. Flanges: 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.
2. Aluminum Railings: Use fittings designed and engineered for this purpose.

I. Installing Removable Posts: Install in slip-fit metal sockets cast in concrete.

J. Attaching Railings to Walls: Except where end flanges are used, attach with wall brackets with 38mm clearance from inside face of handrail and finished wall surface. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads. Secure with following devices:
1. Concrete and Solid Masonry: Post-installed anchors.
2. Hollow Masonry: Toggle bolts.

K. Tolerances:
1. Posts: Set plumb within a tolerance of 1.5mm per 900mm.
2. Rails: Align so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 6mm per 3.6m.

3.5 FIELD QUALITY CONTROL

A. Manufacturer/Fabricator's Field Service: Manufacturer/fabricator's qualified technical representative shall periodically inspect work to ensure installation is in accordance with manufacturer/fabricator's designs, instructions and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions.

END OF SECTION