

*This document contains standards that are the minimum requirements for BCIT construction projects. The information in the document is organized using the MasterFormat® and SectionFormat® systems. It is not a specification; it is intended to supplement the Consultant's own documents. Do not use this information as a standalone specification.*

**SECTION 05 41 00  
STRUCTURAL METAL STUD FRAMING**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- .1 Provide engineered design of load bearing exterior steel stud framing.
- .2 Provide load bearing exterior steel stud framing, materials, installation, inspections and certifications as indicated with accessories for a complete installation.
- .3 Install building insulation and air barrier to locations that will become inaccessible after framing.
- .4 Drywall partition types are designated on the Drawings in accordance with wall types listed in the Assembly Schedule. For fire resistance rated walls and ceilings comply with installation requirements of testing agency for wall and ceiling systems as detailed on Drawings in addition to the requirements of these specifications.
- .5 Fire Resistance Rated Walls and Ceilings: Comply with installation requirements of testing agency for wall and ceiling systems detailed on Drawings. Do not vary from specified systems.
- .6 Refer to structural notes on structural Drawings.
- .7 Deflection channels are required at all partitions. Ensure they are installed prior to application of finishes.
- .8 Construct partitions so they extend from floor to underside of structure overhead unless indicated or listed otherwise.

**1.2 REFERENCES**

- .1 ANSI/AWS D1.3/D1.3M:2008 Structural Welding Code - Sheet Steel, Fifth Edition, with Errata
- .2 British Columbia Building Code, 2012 Edition (BCBC).
- .3 CSA S136-12 Package North American Specification for the Design of Cold Formed Steel Structural Members and S136.1-12 - Commentary on North American specification for the design of cold-formed steel structural members, Includes Update No. 1 (2014), Update No. 2. (2014), Update No. 3 (2015).
- .4 CSA W47.2-11(R2015) Certification of companies for fusion welding of steel, Includes Update No. 3 (2011), Update No. 5 (2012).
- .5 CSA W59-13 Welded Steel Construction (Metal Arc Welding).
- .6 International Steel Stud Manufacturer's 'Legacy Report' on required stud gages; International Code Council (ICC) Evaluation Service, Legacy Report on the 1997 Uniform Building Code J, the 2000 International Building Code, the BOCA National Building Code 1999 and the 1999 Standard Building Code. ER-4943P reissued September 1, 2001.
- .7 Specification for Design of Cold-Formed Steel Structural Members, Canadian Institute of Steel Construction (CISC).
- .8 Wall and Ceiling Specification Standards Manual, Association of Wall and Ceiling Contractors of B.C. (AWCC). Fifth Edition, 2012.

**1.3 DESIGN REQUIREMENTS**

- .1 Design of structural steel walls to be performed by a structural engineer registered in the Province of British Columbia with experience in design of cold-formed elements and systems.
- .2 Calculate structural properties in accordance with CSA S136.

- .3 Calculate wind and seismic loads in accordance with Part 4 of the British Columbia Building Code.
- .4 Limit maximum deflection under specified wind loads to  $L/720$  for walls with ceramic tile or masonry veneer finishes and  $L/360$  for other walls.
- .5 Space members not to exceed 400 mm (16 in.) on centre.
- .6 Required depth of steel studs is shown on Drawings. Do not use other sizes unless approved by Consultant.
- .7 Design components to accommodate specified erection tolerances of the structure.
- .8 Design wind bearing stud end connections to accommodate floor/roof deflections and to ensure that studs are not loaded axially.
  - .1 Wind Pressure:
    - .1 Load bearing steel stud systems shall be designed by the specialty structural engineer of the supplier for the wind pressures identified in the structural notes on the structural Drawings.
  - .2 Differential Movement For Cladding Design:
    - .1 Ensure deflection gaps are incorporated into the design and construction of the steel stud systems. Refer to structural notes:
      - .1 Vertical Movement Between 2 Floors.
      - .2 Horizontal Displacement between Floors.
- .9 Connect steel framing members by bolts, welding, or sheet metal screws.
- .10 Design steel studs to take into account the anchorage of other materials being supported including but not limited to finishes and the provision of lateral support at window heads and sills.
- .11 Design steel studs to support equipment where detailed. Obtain design loads from equipment supplier.
- .12 Partitions shall extend from floor to the underside of structure overhead unless indicated and/or listed otherwise.

#### 1.4 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 Submittal Procedures.
- .2 Product Data: Submit manufacturer's product data, information and installation instructions for each item of framing and accessories.
- .3 Shop Drawings:
  - .1 Shop Drawings shall be signed and sealed by a Structural Engineer licensed to practice in the Province of British Columbia. Engineer to provide Letters of Assurance indicating compliance with B.C. Building Code.
  - .2 Layout diagrams for setting anchor bolts.
  - .3 Shop details indicating sizes, cuts and connections of all members.
  - .4 Indicate locations for required cross bracing where specified in ULC wall rating types.
  - .5 Submit manufacturer's details that comply with ULC ratings and indicate where each detail will be installed. Do not vary from assemblies specified.
  - .6 Connections to concrete, steel and other structures abutting and supporting the steel stud work.
  - .7 Indicate minimum gauge of studs at the following locations:

- .1 Minimum gauge at walls higher than one storey.
- .2 Minimum gauge at walls with finish of cement board and or tile assembly.
- .3 Minimum gauge at walls with millwork or equipment mounted directly to stud framing.
- .4 Letters of Assurance: Engineer who seals Shop Drawings will submit Schedules S-B and S-C to the Certified Registered Professional (CRP):
  - .1 At initial Shop Drawing Submission:
    - .1 Submit Schedule S-B, "Assurance of Professional Design and Commitment for Field Review."
  - .2 After Completion of Field Reviews:
    - .1 Submit Schedule S-C, "Assurance of Professional Field Review and Compliance."
  - .3 Submit written inspection reports of field reviews to Consultant within five (5) working days after completion of each site inspection made to confirm compliance of steel stud work with reviewed Shop Drawings.
- .5 Samples: Submit samples of framing components and fasteners to Consultant if requested.
- .6 Reports: Submit two (2) certified copies of mill reports covering chemical and mechanical properties, and coating designation of steel used in this work.

## **1.5 QUALITY ASSURANCE**

- .1 Installer Qualifications: Company specializing in heavy gauge steel stud work with proven experience for projects of similar size and complexity.
- .2 Manufacturer Qualifications: Use products and materials from same source for entire project.
- .3 Companies Engaged in Welding: Certified by the Canadian Welding Bureau to CSA W47.1 and welders qualified for the base material and procedures to be executed.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- .1 General: Minimum gauges shall be in accordance with the design included in the sealed Shop Drawings.
- .2 Steel: Sheet steel to ASTM A924.
- .3 Zinc Coating: Studs, track, and components to be hot-dipped galvanized with a coating conforming to Z275.
- .4 Welding Materials: To CSA W59.
- .5 Screws: #8 or heavier, 11 mm dia. pan head, self-drilling, case hardened, self-tapping sheet metal screws, 0.008 mm coating of zinc or cadmium plating. Screw length equal to thickness of materials penetrated plus not less than 12 mm (1/2 in.) penetration of the stud. Use not less than 10 mm (3/8 in.) pan head self drilling, self tapping screws for fastening studs to track.
- .6 Anchors: Concrete expansion anchors or other suitable drilled type fasteners, as selected by the steel stud design engineer.
- .7 Bolts, Nuts, Washers: Hot dipped galvanized to CSA G164, 600 g/m<sup>2</sup> zinc coating.
- .8 Touch-up Primer: Zinc rich, to CGSB 1-GP-181M.
- .9 Insulation for Deflection Channel: Refer to Section 07 21 00 Building Insulation.
- .10 Steel Studs:
  - .1 To CSA S-136, fabricated from zinc coated steel, depth as indicated.

- .2 No stud shall be less than 1.092 mm base metal thickness (43 mil, 18 gauge), 1.150 mm design thickness unless indicated otherwise on sealed Shop Drawings. Thicker material may be required to satisfy structural requirements.
- .3 Studs carrying cement board or any tile assembly shall be minimum 1.372 mm base steel thickness (54 mil, 16 gauge), 1.444 mm design thickness unless indicated otherwise on sealed Shop Drawings.
- .4 Studs carrying attached millwork or other equipment loads shall be of minimum gauge specified for this purpose on sealed Shop Drawings.
- .11 Steel Stud Tracks: Fabricated from same material and finish as steel studs, depth to suit.
- .12 Bridging: Fabricated from same material and finish as studs, 38 x 12 mm, 1.22 mm minimum thickness (1-1/2 x 1/2 in., 0.047 in. minimum thickness.)
- .13 Angle clips: Fabricated from same material and finish as studs, 38 x 38 mm x depth of steel stud, 1.22 mm minimum thickness (1-1/2 x 1-1/2 in x depth of steel stud, 0.047 in minimum thickness).

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- .1 Examine work of other trades with Installer present. Correct unsatisfactory conditions. Verify that surfaces and conditions are ready to accept the work of this section. Start of installation means acceptance of existing conditions.

#### 3.2 PREPARATION

- .1 Review Shop Drawings and carefully note where rated separations are required.
- .2 Ensure cross bracing and other construction details required per specific ULC wall types, horizontal and vertical shafts, and double stud wall assemblies are noted and adhered to.
- .3 Deflection channels are required at all partitions. Ensure they are installed prior to application of finishes.

#### 3.3 ERECTION

- .1 Erect work in accordance with, AWCC standards, reviewed Shop Drawings, Code requirements and manufacturer's printed instructions. Where in conflict, follow more stringent requirements.
- .2 Fire Resistance Rated Walls: Construct fire rated assemblies exactly as indicated to comply with Code requirements. Place vertical joints over studs. Comply with requirements of testing agency for rated assemblies detailed on Drawings.
- .3 Box-in and gasket electrical, telephone and TV outlets in fire rated partitions with drywall, typical. Seal for Environmental Tobacco Smoke (ETS) control as specified in Section 07 84 00 Fire Stopping and Smoke Seals and Section 07 92 00 Joint Sealants.
- .4 Anchor tracks securely to the structure at 800 mm (32 in.) on centre max., unless lesser spacing prescribed on engineered Shop Drawings.
- .5 Erect studs plumb, aligned and securely attach with not less than one No. 8 screw or weld at each side of flange of top and bottom tracks.
- .6 Seat studs into top and bottom tracks.
- .7 Allow deflection spaces between drywall partitions and building structural framing components to allow for movement of framing components.
- .8 Deflection Head:
  - .1 Deflection channels are required at all partitions. Install 50 mm (2 in.) minimum deflection channel at top of walls where required to accommodate vertical deflection.

- .2 Nest top track into deflection channel a minimum of 25 mm (1 in.) and a maximum of 38 mm (1-1/2 in.), unless indicated otherwise on Drawings.
- .3 Do not fasten tracks together.
- .4 Install insulation in deflection channel.
- .9 Install studs at not more than 50 mm (2 in.) from abutting walls, openings, and each side of corners and terminations with dissimilar materials.
- .10 Bridging:
  - .1 Unless engineering design for steel stud wall assembly provides for lateral stiffening by means other than internal bridging, brace steel studs with horizontal internal bridging at 1500 mm (60 in.) on centre maximum. Fasten bridging to 1.52 mm (0.06 in.) steel clips fastened to steel studs with four (4) No. 8 screws or by welding. Touch-up welded areas with coat of galvanized paint.
  - .2 Provide cross bracing or bridging where specified in the ULC listings for rated assemblies including rated double stud wall assemblies.
- .11 Frame openings in stud walls to adequately carry loads by use of additional framing members and bracing as detailed on Shop Drawings.
- .12 Provide 1.22 mm (0.05 in.) sheet metal backing in walls for anchoring and mounting equipment, grab bars, or other items, not supplied with backing attachments. Fasten equipment, fittings and anchors to blocking or backing in partitions.
  - .1 Penetrate sheet metal screws a minimum of three (3) exposed threads beyond joined materials.
  - .2 Perform welding in accordance with CSA W59 and/or ANSI/AWS D1.3 as applicable.
  - .3 Touchup welds with coat of zinc rich primer.
- .13 Frame both sides of control and expansion joints independently and do not bridge joints with furring, framing, or accessories.

### 3.4 RATED ASSEMBLIES

- .1 Install rated assemblies in accordance with ULC listed assemblies. Do not vary from the design unless an alternate assembly is approved in writing by the Consultant.

### 3.5 ERECTION TOLERANCES

- .1 Plumb: Not to exceed 1/500th of the member length.
- .2 Camber: Not to exceed 1/1000th of the member length.
- .3 Spacing: Not more than 3 mm (1/8 in.) from design spacing.
- .4 Gap between End of Stud and Track Web: Not more than 3 mm (1/8 in.), except where required to accommodate deflection.

### 3.6 CUTOUTS

- .1 Limit unreinforced cut-outs for services to the following dimensions:

<b>Member Depth</b>	<b>Across Member Depth</b>	<b>Along Member Length</b>	<b>Spacing O.C.</b>
89 mm (3-1/2 in.)	38 mm (1-1/2 in.)	100 mm (4 in.)	600 mm (24 in.)
>150 mm (>6 in.)	64 mm (2-1/2 in.)	115 mm (4-1/2 in.)	600 mm (24 in.)

- .2 Limit distance from centerline of last unreinforced cutout to end of member to less than 305 mm (12 in.).

**END OF SECTION**

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**SECTION 05 50 00  
METAL FABRICATIONS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- .1 Provide stainless steel handrails, guardrails, railings, and accessories for a complete system.
- .2 Exterior handrails and guardrails shall be constructed of steel. Finish shall be either stainless steel or galvanized and then painted.

**1.2 RELATED SECTIONS**

- .1 Division 3 Concrete.

**1.3 REFERENCES**

- .1 ASTM A276/A276M-16a Standard Specification for Stainless Steel Bars and Shapes.
- .2 British Columbia Building Code, 2012 Edition (BCBC).
- .3 CAN/CGSB 1.108-M89 [Withdrawn] Bituminous Solvent Type Paint.
- .4 CAN/CSA S16-14 Design of Steel Structures.
- .5 CSA G40.20-13/G40.21-13 General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel, Includes Update No. 1 (2014).
- .6 CSA W47.1-09 (R2014) Certification of Companies for Fusion Welding of Steel.
- .7 CSA W48-14 Filler Metals and Allied Materials for Metal Arc Welding.
- .8 CSA W59-13 Welded Steel Construction (Metal Arc Welding), Includes Update No. 1 (2014), Update No. 3 (2015), Update No. 4 (2015).

**1.4 SYSTEM DESCRIPTION /PERFORMANCE REQUIREMENTS**

- .1 Structural Performance of Handrails and Railings: Provide handrails and railings complying with requirements of the BC Building Code, 2012 Edition.
- .2 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): 67 degrees of C (120 degrees of F), ambient; 100 degrees of C (180 degrees of F), material surfaces.
- .3 Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

**1.5 SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 Submittal Procedures.
- .2 Product Data: For each product used in handrails and railings, including finishing materials and methods.

- .3 Shop Drawings:
    - .1 Shop Drawings shall be signed and sealed by a Structural Engineer licensed to practice in the Province of British Columbia. Engineer to provide Letters of Assurance indicating compliance with B.C. Building Code.
    - .2 Submit Shop Drawings for review prior to fabrication of metal items.
    - .3 Include plans, elevations, sections, details of installation, and attachments to other work, handrails and guardrails. Include drawings for stairs, railings and connections, including connections to primary structure.
    - .4 Prepare Shop Drawings under direct supervision of a registered Professional Structural Engineer experienced in design of this work and licensed to practice in the Province of British Columbia.
    - .5 Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
    - .6 Indicate welded connections using standard welding symbols. Indicate net weld lengths.
    - .7 Letters of Assurance: Engineer who seals Shop Drawings shall submit to Consultant, with initial Shop Drawings submission, an Assurance of 'Structural Design' and Commitment for 'Field Review' on form acceptable to Consultant. Engineer who seals Shop Drawing shall provide a letter of personal assurance. Written inspection reports of field review shall be submitted to Consultant promptly as field reviews are made. On completion of installation, Engineer shall submit to Consultant an Assurance of Field Review on form acceptable to Consultant.
  - .4 Templates: For anchor bolts.
  - .5 Certificates: For welders that are to be employed on the work, submit welder's certificates indicating certification within the last 12 months for CSA W55.3 and for steel.
  - .6 Welding Certificates: Copies of certificates for welding procedures and personnel.
  - .7 Samples for Initial Selection: Manufacturer's colour charts showing the full range of colours and other finish characteristics available for products with factory applied finishes.
  - .8 Samples for Verification: For each profile and pattern of metal fabrication and for each type of finish required, prepared on metal of same thickness and alloy indicated for the Work. If finishes involve normal color and texture variations, include sample sets, consisting of two or more units, showing the full range of variations expected.
    - .1 Include 150 mm (6 in.) long samples of linear shapes.
    - .2 Include 150 mm (6 in.) square samples of plates.
    - .3 Include full-size samples of castings and forgings.
  - .9 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 Consultants and owners, and other information specified.
- 1.6 QUALITY ASSURANCE**
- .1 Fabricator Qualifications: A firm experienced in producing metal handrails and railings similar to that indicated for the Work with a record of successful in-service performance, and sufficient production capacity to produce required units.
  - .2 Installer Qualifications: Installation shall be by the fabricator.



- .3 Testing Agency Qualifications: An independent testing agency with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.
- .4 Preconstruction Testing Service: Engage a qualified independent testing agency to test handrails and railings for compliance with specified requirements for performance and test methods. Conduct tests using specimens and assemblies representative of proposed materials and construction.
  - .1 Fabricate and install test assemblies using personnel who will perform the same tasks for Project.
  - .2 Select sizes and configurations of assemblies to adequately demonstrate capability of handrails and railings to comply with performance requirements.
  - .3 Notify Consultant seven days in advance of dates and times when assemblies will be constructed.
  - .4 When testing is complete, remove assemblies; do not reuse materials on Project.
- .5 Welding Standards: Qualify procedures and personnel according to the following:
  - .1 AWS D1.1 "Structural Welding Code-Steel."

## 1.7 PROJECT CONDITIONS

- .1 Field Measurements: Where handrails and railings are 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.

## 1.8 COORDINATION

- .1 Coordinate installation of anchorages for handrails, guardrails, and railing items. 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 METALS

- .1 General: Provide metals free from surface blemishes where exposed to view in finished unit. Exposed-to-view surfaces exhibiting pitting, seam marks, roller marks, stains, discolorations, or other imperfections on finished units are not acceptable.
- .2 Steel:
  - .1 Steel Tubing: ASTM A500/A500M, Grade B.
  - .2 Steel Pipe: ASTM A53/A53M, Grade B Schedule 40.
  - .3 Stainless Steel Tubing: ASTM A269, Grade TP 304 welded with No. 4 finish.
  - .4 Fittings: Elbows, T-shapes, wall brackets, escutcheons; cast steel.
  - .5 Mounting: Adjustable brackets and flanges, with inserts for casting in concrete, brackets for embedding in masonry. Prepare backing plate for mounting in wall construction as indicated.
  - .6 Exposed Fasteners: Exposed fasteners are not permitted.
  - .7 Galvanizing: ASTM A123/A123M, provide minimum 2.0 oz/sq ft (360 g/sq m) galvanized coating for exterior items. Galvanize after fabrication.
  - .8 Shop and Touch-Up Primer: as recommended by Fabricator.
  - .9 Touch-Up Primer for Galvanized Surfaces: CAN/CGSB-1.181 zinc rich.

- .10 Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails, unless otherwise indicated.
  - .1 Provide cast brackets with flange tapped for concealed anchorage to threaded hanger bolt.
  - .2 Provide formed or cast brackets with predrilled hole for exposed bolt anchorage.
  - .3 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.
  - .4 Provide brackets with interlocking pieces that conceal anchorage.

## 2.2 STAINLESS STEEL HANDRAILS AND GUARDRAILS

- .1 Stainless-Steel Bars and Shapes: ASTM A 276, Type 304 [Type 316L].
- .2 Plate and Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304 [Type 316L].
- .3 Rolled-Stainless-Steel Floor Plate: ASTM A 793.

## 2.3 ACCESSORIES

- .1 Bituminous Paint: Cold-applied asphalt mastic complying with SSPC-Paint 12, except containing no asbestos fibers.
- .2 Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, conforming to ASTM F 593; with hex nuts to ASTM F 594 and, where indicated, flat washers; Alloy Group 1 (A1).
- .3 Cast-in-Place 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.
  - .1 Cast-in-place anchors.
  - .2 Chemical anchors.
  - .3 Expansion anchors.
- .4 Expanded Metal: ASTM F 1267, [Type I (expanded)] [Type II (expanded and flattened)], Class 3 (corrosion-resistant steel), made from stainless-steel sheet, ASTM A 240/A 240M or ASTM A 666, Type 304 [Type 316].
- .5 Perforated Metal: Stainless-steel sheet, ASTM A 240/A 240M or ASTM A 666, [Type 304] [Type 316L], [0.062 inch (1.59 mm)] thick, [with 1/4-inch (6.4-mm) holes 3/8 inch (9.5 mm) o.c. in staggered rows].
- .6 Woven-Wire Mesh: Intermediate-crimp, [diamond] [square] pattern, 2-inch (50-mm) woven-wire mesh, made from 0.141-inch- (3.57-mm-) diameter wire complying with ASTM A580/A580M, [Type 304] [Type 316].
- .7 Fasteners: Use fasteners of same basic metal as fastened metal, unless otherwise indicated. Do not use metals that are corrosive or incompatible with materials joined. Provide Robertson screws for exposed fasteners, unless otherwise indicated.
- .8 Grout: Non-shrink type as recommended by fabricator.
- .9 Touch Up Paint for Steel: Zinc rich paint conforming to CGSB 1-GP-181 M.
- .10 Welding Electrodes and Filler Metal: Type and alloy of filler metal and electrodes as recommended by producer of metal to be welded, complying with applicable AWS specifications, and as required for color match, strength, and compatibility in fabricated items.

**2.4 FABRICATION**

- .1 Fabricate in accordance with reviewed Shop Drawings and Code requirements.
- .2 Form handrails, guardrails, and railings to required shapes and sizes, with true curves, lines, and angles. Provide components in sizes and profiles indicated, but not less than that needed to comply with requirements indicated for structural performance.
- .3 Provide necessary rebates, lugs, and brackets to assemble units and to attach to other work. Drill and tap for required fasteners, unless otherwise indicated. Use concealed fasteners where possible.
- .4 Comply with AWS for recommended practices in shop welding and brazing. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed joints of all flux, and dress all exposed and contact surfaces.
- .5 Fabricate items with uniform hairline joints tightly fitted and secured. Cope or miter corner joints. Form joints exposed to weather to exclude water penetration.
- .6 Finish exposed surfaces to smooth, sharp, well-defined lines and arris.
- .7 Assemble items 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.
- .8 Welded Connections: Fabricate handrails and railings to interconnect members with concealed internal welds that eliminate surface grinding, using fittings designed and fabricated for this purpose.
- .9 Form changes in direction of railing members as detailed.
- .10 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, or otherwise deforming exposed surfaces of handrail and railing components.
- .11 Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated; close ends of returns. Close exposed ends of handrail and railing members with manufacturer's standard prefabricated end fittings.
- .12 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. Furnish 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.

**2.5 FABRICATION TOLERANCES**

- .1 Squareness: 3 mm (1/8 in.) maximum difference in diagonal measurements.
- .2 Maximum Offset Between Faces: 1.5 mm (1/16 in.).
- .3 Maximum Misalignment of Adjacent Members: 1.5 mm (1/16 in.).
- .4 Maximum Bow: 3 mm in 1.2 m (1/8 in. in 48 in.).
- .5 Maximum Deviation From Plane: 1.5 mm in 1.2 m (1/16 in. in 48 in.).

**2.6 FINISHES**

- .1 Remove tool and die marks and stretch lines, or blend into finish. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
- .2 Stainless Steel Tubing Finishes:

- .1 180-Grit Polished Finish: Uniform, directionally textured finish.
- .2 320-Grit Polished Finish: Oil-ground, uniform, fine, directionally textured finish.
- .3 Polished and Buffed Finish: Match Consultant's sample.
- .3 Stainless Steel Sheet and Plate Finishes:
  - .1 Directional Satin Finish: ASTM A 489/A 480, No. 4.
  - .2 High Luster Finish: ASTM A 480/A 480M, No. 7.
  - .3 Mirror Finish: ASTM A 480/A 480M, No. 8.
- .4 Finishing Galvanized Items: Finish to MPI EXT 5.3B.
  - .1 Primer: Cementitious.
  - .2 Finish Coat: Alkyd.
  - .3 Gloss: As specified by Consultant.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- .1 Examine areas to receive metal fabrications with Installer present. Correct unsatisfactory conditions.
- .2 Verify existing conditions before starting work.
- .3 Verify that field conditions are acceptable and are ready to receive work.
- .4 Verify dimensions, tolerances, and method of attachment with other work.

#### **3.2 PREPARATION**

- .1 Clean and strip primed steel items to bare metal where site welding is required.
- .2 Supply steel items required to be cast into concrete, embedded in masonry, or similar construction with setting templates to appropriate trades.

#### **3.3 INSTALLATION**

- .1 Install items plumb and level, accurately fitted, free from distortion or defects.
- .2 Provide for erection loads, and for sufficient temporary bracing or anchors in formwork to maintain true alignment until completion of erection and installation of permanent attachments.
  - .1 Fit exposed connections accurately together. Weld connections, unless otherwise indicated. Do not weld, cut, or abrade galvanized surfaces.
- .3 Set bearing and leveling plates on cleaned surfaces using wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts and pack with nonshrink, nonmetallic grout.
- .4 Touch up surfaces and finishes after erection.
  - .1 Painted Surfaces: Clean field welds, bolted connections, and abraded areas and touch up paint with the same material as used for shop painting.
  - .2 Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780.
- .5 Field weld components as indicated or as required.
- .6 Perform field welding to CSA requirements.
- .7 Obtain approval prior to site cutting or making adjustments not scheduled.

- .8 After erection, prime welds, abrasions, and un-shop primed surfaces, except surfaces to be in contact with concrete.

### 3.4 ERECTION TOLERANCES

- .1 Maximum Variation From Plumb: 6 mm (1/4 in.) per story, non-cumulative.
- .2 Maximum Offset From True Alignment: 6 mm (1/4 in.).
- .3 Maximum Out-of-Position: 6 mm (1/4 in.).

### 3.5 CLEANING AND PROTECTION

- .1 Clean metal fabrications by washing thoroughly with clean water and soap and rinsing with clean water.

### 3.6 PROTECTION

- .1 Restore finishes damaged during installation and construction period so 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 SECTION**