SECTION 05 12 00
STRUCTURAL STEEL

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes structural steel.
   1. Structural steel framing for kitchen area of the building.

1.02 PERFORMANCE REQUIREMENTS

A. Structural Performance: Engineer structural steel connections required by the Contract Documents to be selected or completed by the fabricator to withstand design loadings indicated.

B. Engineering Responsibility: Engage a fabricator who utilizes a qualified professional engineer, registered in New Jersey, to prepare calculations, shop drawings and other structural data for structural steel connections.

1.03 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product Data for each type of product specified.

C. Shop Drawings signed and sealed by professional engineer detailing fabrication of structural steel components.
   1. Include details of cuts, connections, splices, camber, holes and other pertinent data.
   2. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length and type of each weld.
   3. Indicate type, size and length of bolts, distinguishing between shop and field bolts. Identify high-strength bolted slip-critical, direct-tension, or tensioned shear/bearing connections.

D. Mill test reports signed by manufacturers certifying that their products, including the following, comply with requirements.
   1. Structural steel, including chemical and physical properties.
   2. Bolts, nuts, and washers, including mechanical properties and chemical analysis
   .3. Direct-tension indicators.
   4. Twist-off tension control bolts.
   5. Shop primers.
   6. Nonshrink grout.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who has completed structural steel work similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

B. Fabricator Qualifications: Engage a firm experienced in fabricating structural steel similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to fabricate structural steel without delaying the Work.

C. Comply with applicable provisions of the following specifications and documents:
   1. AISC's "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design."
   2. AISC's "Specification for Allowable Stress Design of Single-Angle Members."
   3. AISC's "Seismic Provisions for Structural Steel Buildings."
   4. ASTM A 6 "Specification for General Requirements for Rolled Steel Plates, Shapes, Sheet Piling, and Bars for Structural Use."
   5. Research Council on Structural Connections' (RCSC) "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

D. Professional Engineer Qualifications: A professional engineer who is legally authorized to practice in the jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for projects with structural steel framing that are similar to that indicated for this Project in material, design and extent.

E. Welding Standards: Comply with applicable provisions of AWS D1.1 "Structural Welding Code-Steel."
   1. Present evidence that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver structural steel to Project site in such quantities and at such times to ensure continuity of installation.

B. Store materials to permit easy access for inspection and identification. Keep steel members off ground by using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration.
   1. Store fasteners in a protected place. Clean and re-lubricate bolts and nuts that become dry or rusty before use.
   2. Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. Repair or replace damaged materials or structures as directed.

1.06 INSPECTION AND TESTING

A. General: Owner will engage and pay for the services of an independent Testing Agency acceptable to the Engineer.

   1. Contractor shall be responsible for providing the Testing Agency and Engineer with proper notice of the initiation of each phase and portion of work requiring testing or inspection. Written notice of commencement date shall be provided at least 5 working days prior to the start of shop work and the start of fieldwork. Subsequently, Contractor shall give a minimum of 24 hours verbal notice of work, or completion of work as applicable, requiring inspection and/or testing.

   2. Contractor shall furnish Testing Agency with a complete set of Construction Documents and Specifications, along with one copy of each accepted shop drawing bearing the

Engineer's review stamp, mill test certificate and manufacturer's certification. Provide reasonable office space to Testing Agency at fabrication plants and at the site. Provide Testing Agency personnel with convenient and safe access to the work and all reasonable assistance necessary to permit effective inspection and testing work.

3. Testing Agency may inspect and test materials and work at the source before shipment, as well as at the site before, during or at any time after installation. Deficient or incomplete work or materials shall be corrected or replaced, as directed by the Engineer, without additional costs or delays to the Owner.

4. The Testing Agency shall report directly to the Owner and Engineer the results of all testing and inspection by means of daily written reports. When any test or inspection reveals deficient or non-conforming work, Testing Agency shall notify Owner and Engineer immediately by means of a written report specially and clearly marked and identified to show deficient areas of work. Furthermore, the Testing Agency shall provide a table of all known members, noting when each piece was shop inspected, field inspected, any deficiencies and when the deficiencies were corrected. This table is to be provided to the Owner and Engineer with the weekly submission of daily reports. The format of this table is to be submitted to the Owner and Engineer for approval before inspection is begun.

5. Performance or waiving of inspection, testing or surveillance by Testing Agency for a given portion of the work will not relieve Contractor from responsibility to conform strictly to the requirements of the Contract Documents.

6. Where additional tests are deemed necessary by Engineer due to failure to pass tests, the cost of additional testing will be deducted from payments to Contractor.

7. If, due to errors by the Contractor or failure to perform his work in accordance with the Contract Documents, the Engineer must perform additional design or drafting work or review proposed solutions, the Contractor shall, through the Owner, reimburse the Engineer in accordance with the Engineer's current fee schedule plus out of pocket expenses incurred.

B. Field Inspection and Testing: Work performed in the field shall be subject to inspection and testing as follows:

1. Testing Agency shall verify that all steel pieces and connections are installed completely and properly in the correct location and manner in accordance with accepted shop drawings.

2. Lot numbers on containers of all bolting materials shall be verified to match submitted manufacturer's certifications. Manufacturer and grade markings on all components of bolt assemblies shall be verified.

3. High strength bolts and bolting operations shall be tested and inspected in accordance with part 1.06 E of this Section.

4. Welds and welding operations shall be tested and inspected in accordance with part 1.06 D of this Section.

5. Steel exposed to the weather shall be inspected to verify that paint has been properly touched up at damaged or scratched areas.

C. Welding: Inspection and testing of welds and welding operations shall be performed in accordance with AWS D1.1 Section 6 by the Testing Agency using AWS Certified Welding Inspectors.

1. Testing Agency shall verify:

a. Welding materials and equipment conform to the Contract Documents and AWS requirements and are used in correct positions and procedures.

b. Size, length and location of all welds, and correct and appropriate processes are used.

c. Welds are only made by welders certified by AWS for applicable process and position.

d. At appropriate intervals, performance of individual welders and preparation and fit-up of joints.

2. All welds shall be visually inspected. Acceptance criteria shall be per AWS D1.1 Section 8.15.1 or 10.17.1 as applicable.

3. Fifty percent of all full and partial penetration welds, whether made in the shop or field, shall be ultrasonically tested, for 100% of their length, in accordance with AWS D1.1 Section 6 Part C and Section 8.15 or 10.17 as applicable.

a. If testing discloses a large ratio, in the opinion of the Engineer, of unacceptable welds, the required percentage shall be increased to 100% by the Engineer.

b. If, in the opinion of the Engineer, the testing consistently discloses acceptable welds, the percentage of tested welds may be reduced by the Engineer to a minimum of 25%.

4. Fifty percent of all fillet welds, for 100% of their length, shall be tested by dye penetrant (ASTM E165) or magnetic particle (ASTM E709) method. Acceptance criteria shall be per AWS D1.1 Section 8.15 or 10.17 as applicable.

a. If testing discloses a large ratio, in the opinion of the Engineer, of unacceptable welds, the required percentage shall be increased to 100% by the Engineer.

b. If, in the opinion of the Engineer, the testing consistently discloses acceptable welds, the percentage of tested welds may be reduced by the Engineer to a minimum of 25%.

5. Welds which are not satisfactory or which are found to be defective by the Testing Agency shall be cut out and replaced by a satisfactory weld at no additional cost or delay to the Owner.

6. High Strength Bolting: High strength bolts and bolting operations shall be tested and inspected as specified herein and in accordance with the RCSC Specification, Section 9.

7. Storage and Handling: The Testing Agency shall verify that bolting materials are properly stored and protected and at time of installation, are clean and free of rust and thread damage.

8. Assembly: The Testing Agency shall verify that the proper bolting assembly is installed by checking size and grade of bolt, type and grade of nut, location and number of flat washers, and location, orientation and type of direct tension indicator (if used).

9. Snugging: The Testing Agency shall verify that all bolts in a connection are properly snugged in accordance with RCSC Specification procedures and requirements of this Section before final tensioning of any bolt in a connection.

10. Calibration: The Contractor shall provide a tension-measuring device (Skidmore-Wilhelm or similar), with proper calibration certification, at the jobsite at all times when bolts are being tensioned. At the start of work, when requested by the Engineer, and whenever deemed appropriate by the Testing Agency, installation

procedures shall be confirmed by tensioning a representative sample of bolts in the tension measuring device. A representative sample shall consist of not less than three bolts of each size, grade, length and producer being used. Installation procedures shall achieve a tension not less than that given in Table 4 of the RCSC Specification within 10 seconds from a snug tight condition.

11. Twist-off Bolts: Twist-off type bolts shall be inspected by observing installation procedures and by verifying that the splined end of every bolt shank has been properly broken off by the wrench chuck.

12. Direct Tension Indicators: Bolts installed with direct tension indicators shall be inspected by observing installation procedures and by measuring the average residual gap of the DTI on every bolt in accordance with the manufacturer's recommendations.

13. Turn-of-nut Installation: Bolts installed by the turn-of-nut method shall be inspected by measuring torque with a calibrated wrench. At the beginning of work, when deemed appropriate by the Testing Agency, whenever conditions such as lubrication or surface dirt change, and when a new or different manufacturer's material is being used, an inspecting torque shall be established. This shall be done by tensioning 5 bolts of each grade, diameter and manufacturer in a Skidmore-Wilhelm device to a tension not less than 105% of the minimum required and measuring torque with a properly certified calibrated wrench. The high and low values shall be discarded and the middle three averaged to establish an inspecting torque for each grade, diameter and producer. A minimum of 10 percent of the bolts, but not less than 2, in every connection shall be inspected. The Contractor shall provide the Skidmore-Wilhelm device, a calibrated wrenches, scaffolding and laborers as needed to perform such procedures at times requested by the Testing Agency.

14. Verification Procedures: If the Testing Agency reasonably suspects that any bolts may not be properly tensioned, due to relaxation as a result of improper snugging or any other reason, the arbitration inspection method of the RCSC Specification, Section 9(b), shall be used, except that all bolts in the connection in question shall be checked. The Contractor shall provide a Skidmore-Wilhelm device, calibrated wrench, a laborer and scaffolding as required to safely and properly perform such verification.

15. Laboratory Testing: High strength bolting materials shall be randomly tested throughout the project at times and in quantities chosen by the Engineer.

    a. Tension tests of full-size bolts shall be performed to determine the proof load and ultimate tensile strength in accordance with ASTM F606 using Method 1, Length Measurement.

    b. Rockwell hardness of bolts shall be determined on the wrench flats after removal of surface material in accordance with ASTM F606. The reported hardness shall be the average of three hardness readings.

    c. Rockwell hardness of nuts shall be determined on the bearing face in accordance with ASTM F606.

    d. Surface hardness of hardened washers shall be determined in accordance with ASTM F606.

    e. In addition, the surface hardness, the core hardness of 5/16 inch thick washers shall also be determined in accordance with ASTM F606.

    f. Direct tension indicators shall be tested in accordance with ASTM F959.

g. If requested by the Engineer, chemical properties and dimensional tolerances of bolting materials may also be tested.

1.07 QUALITY ASSURANCE

A. General: Contractor shall examine all Contract Documents and note any discrepancies and special construction problems requiring close coordination and exact time schedules; assume the responsibility of same and administer action such that the proper solution will result.

1. Contractor's quality assurance procedures shall be effective and shall assure that all work fulfills the requirements of applicable provisions of the Contract Documents.

2. Contractor shall maintain, on staff, sufficient office, field engineering, and field supervision staff to assure that all data and layout drawings for work of other Sections is transmitted to detailers to allow proper detailing of holes, penetrations, chases, and the like and to assure proper execution of the work in the field.

3. Perform quality control functions required to achieve and to document that work conforms to the Contract Documents. Provide access to Contractor's quality control documents and reports upon request of Owner, Architect, Engineer or Testing Agency. Provide reasonable numbers of photocopies of specific quality control reports on request.

4. Contractor and Construction Manager shall coordinate and schedule the work of this Section with the work of other Sections of this Specification in order to optimize quality and to avoid delay in overall job progress.

5. Prior to starting applicable phases of the work of this Section, Contractor shall cooperate and coordinate with each trade affected by the work of this Section, including areas where work of other Specification Sections joins or relates to work of this Section. Contractor shall report unsatisfactory or nonconforming conditions to Engineer in writing prior to the start of work.

B. Fabrication: The fabricator shall be certified by and use the AISC Quality Certification Program in establishing and administering a quality control program. Such program shall ensure that the work is performed in accordance with the Contract Documents.

C. Erection: The erector shall maintain a quality control program to the extent necessary to ensure that all of the work is performed in accordance with the Contract Documents. The erector shall provide the equipment, personnel and management for the scope, magnitude and specified quality of the work.

D. Qualifications: Throughout the progress of the work of this Section, provide at least one person who shall be thoroughly familiar with the specified requirements, completely trained and experienced in the necessary skills, and who shall be present at the site and shall direct all work performed under this Section.

1. The structural steel detailing firm shall be subject to acceptance by the Engineer. To ensure continuity, there shall be a single structural steel detailing firm. As a minimum requirement for acceptance, the structural detailing firm shall demonstrate experience in detailing of not less than five buildings of the type of this work and shall demonstrate in-house quality control procedures to the satisfaction of the Engineer.

2. Fabricator shall have experience in the fabrication of structural steel for at least five buildings of the type of this work and shall possess all capabilities and qualifications required for AISC Type II Certification.

3. Erector shall have experience in the erection of structural steel of at least five buildings of the type of this work.

4. Welders and welding operators performing work under this Section shall be qualified in accordance with the building code and with applicable AWS requirements for each specific welding procedure and process which the welder will use in this work. When requested by the Engineer, Contractor shall require welders to be retested.

5. Each welding procedure shall be described fully in the shop drawings and shall be designated prequalified under AWS D1.1 or shall be qualified in accordance with provisions of AWS D1.1 prior to use in the work. Each weld shall be visually inspected by the welder performing the work.

    a. Contractor shall comply with AWS D1.1 Section 6.6.

E. Contractor's Responsibilities: The Contractor shall be solely responsible for the items listed below. While the following list is not intended to be a complete listing of all responsibilities, it is provided to bring these items to the specific attention of the Contractor. Engineer's review of shop drawings or other submittals, or performance or waiving of inspection or testing, does not relieve Contractor from these responsibilities.

1. Safety and stability of the work. Construction sequences, whether stated or implied, are intended only to assist the Contractor in coordinating the work of the project.

2. Fabrication procedures and the means, methods, techniques, sequences and procedures of construction.

3. Correctness of dimensions and quantities, for the fitting to other or existing elements, for conditions to be confirmed and correlated at the site, and for the verification of the physical interrelationships of elements of the work.

4. The amount, method of distributing, and proposed supplemental support of loads during construction. Construction loads shall not exceed the superimposed load which the member, with necessary supplemental support, is capable of carrying safely without damage.

5. Obtain all field measurements required for proper fabrication and installation of work covered by this Section. Precise measurements are the responsibility of Contractor.

6. Report unsatisfactory or non-conforming conditions to the Engineer in writing prior to the start of work.

1.08 MEASUREMENTS AND TOLERANCES

A. Measurements: Lay out each part of the work in strict accordance with the Contract Documents. Precise measurements and layout are the sole responsibility of the Contractor.

1. Obtain all field measurements required for proper detailing, fabrication and installation of the work. Field verify all dimensions and locations of existing conditions shown on the Contract Documents. Where discrepancies exist, notify Engineer in writing, and by sketch when applicable, of discrepancies and proposed solutions to correct discrepancies.

2. Lay out the work from at least 2 pre-established benchmarks and axis lines, individually correct for length and bearing.

B. Tolerances: Structural steel shall be fabricated and erected within the tolerances specified in the AISC Specification and Code, except that more restrictive tolerances, when specifically shown or noted in the Drawings or provided under this Specification, shall take

precedence and shall apply to the work.

1. In lieu of the criteria given in Section M.4.4 of the AISC Specification, fit of finished compression splices shall be as follows: at least 65 percent of the contact area shall be in uniform bearing about the centroid of the bearing surface, with no separation greater than 1/32 inch. This requirement also applies to both shop and field connected base plates and bearing plates.
2. Trusses shall be erected and aligned to provide chords within 1/2 inch of theoretical locations with respect to the plane of the truss.
3. Slide bearing joints shall be assembled and erected to have uniform contact over 75 percent of the joint with no separation greater than 0.02 inch.

1.09 DELIVERIES, STORAGE AND HANDLING

A. Anchor bolts, embedded plates, anchorage devices, and other items required to be embedded in cast-in-place concrete shall be delivered to the project site at times coordinated by Contractor to allow convenient installation and orderly cast-in-place concrete operations.

B. Include setting drawings, templates, and directions for installation with all anchor bolts and with all other items or devices furnished and delivered to the project site for installation under other sections of this Specification.

C. Structural steel members which are stored on or off the project site shall be supported above ground on platforms, skids or other supports so as to protect steel members from overstress, permanent deformation, corrosion and other damage.

D. Materials shall be delivered to the site in the manufacturer's original and unopened containers and packaging, bearing labels as to type of material, brand name, and manufacturer's name. Delivered materials which are damaged or otherwise not suitable for installation, shall be removed from the jobsite and replaced with acceptable materials.

E. Handling, shipping and erecting of shop painted steel pieces shall not be performed until the paint has dried thoroughly. Protect the paint from damage and keep individual members free from contact with the ground and with each other.

1. Contractor shall furnish members in-place, fully painted, including all touch-up painting required as specified herein, at all locations where painting is required in the drawings by provisions of this Specification, and by the CT.

1.10 DEFICIENT WORK

F. Deficient work or any work failing to strictly conform to the Contract Documents shall be removed and replaced, or repaired if accepted by Engineer, at no cost to the Owner, Architect or Engineer.

1. Contractor shall prepare appropriate details and procedures to bring such work into conformance with the Contract Documents and submit to Engineer for review and acceptance. Contractor shall, through the Owner, reimburse the Engineer for time and expense incurred reviewing proposal procedures and details in accordance with the Engineer's current fee schedule.
2. Nonconforming work may be rejected by Owner, Architect or Engineer at any time, regardless of prior acceptance in shop drawings, prior inspection, inclusion in inspection or test reports, or inclusions in certificates of payments.

G. Deficient work shall include, but not be limited to:

1. Bent, twisted or warped pieces.
2. Unauthorized cutting or reaming.
3. Cracking, interior or surface defects.
4. Painted or unpainted surfaces not sufficiently clean to receive spray fireproofing or finish coat.
5. Tops of flanges not sufficiently clean to receive field-applied stud shear connectors or deck welding.
6. Workmanship not in accordance with the Drawings, with this Specification, with accepted samples, or with referenced codes or standards.
7. Exceedance of tolerances.

PART 2 PRODUCTS

2.01 MATERIALS

A. Structural Steel Shapes, Plates and Bars: As follows:
   1. Carbon Steel: ASTM A 992 Grade 50 for all steel shapes, ASTM A36 for angles, channels, plates and bars except as noted on the Drawings.

B. Steel Pipe: ASTM A 53, Type E Grade B.
   1. Weight Class: Standard, except where indicated on drawings.
   2. Finish: Black, except where indicated to be galvanized.

C. Anchor Rods, Bolts, Nuts and Washers: As follows:
   1. Unheaded Rods: ASTM A 529 as noted on the Drawings.
   2. Washers: ASTM A 36.

D. High-Strength Bolts, Nuts and Washers: F3125/F3125M, Type 1, heavy hex steel structural bolts, heavy hex carbon-steel nuts, and hardened carbon-steel washers.
   1. Finish: Plain, uncoated.

E. Welding Electrodes: Comply with AWS requirements.

2.02 PRIMER AND FINISH COATS FOR STEEL EXPOSED TO WEATHER

A. Shop Primer: High build inorganic zinc primer designed for fast dry and extended recoatability, applied at spreading rate to achieve not less than 2.0 mil total dry film thickness (DFT) or as recommended by manufacturer.
   1. Acceptable manufacturers and products:
      a. Tnemec: Tneme Series 90-96
      b. Carboline: Carbo Zinc 11HS
      c. PPG: Metalhide Series
      d. Sherwin-Williams (S-W): Zinc Clad II

B. Field Finish Coat Systems: Applied at spreading rate to achieve a total dry film thickness (DFT) as recommended by manufacturer for each coat

1. Primer: Touch-up primer for damaged surfaces shall be compatible with shop primer and finish coats specified.

2. Finish Coats: Hi-Gloss, multi-components aliphatic acrylic polyurethane: Two finish coats over specified shop primed steel.

   a. Intermediate Coat: One coat applied at spreading rate to achieve not less than 3.0 mil total dry film thickness (DFT) or as recommended by manufacturer.

      1) Tnemec: Hi-Build Epoxoline Series 66 or 69.

      2) Carboline: #893

      3) PPG: Pitt-Thane Acrylic Aliphatic Urethane Series 97-840.

      4) Sherwin-Williams (S-W): Hi-Solids Polyurethane (B65-300 Series).

   b. Finish Coat: Hi-gloss, two components, low VOC, acrylic polyurethane resin coating, designed for exterior exposure and gloss and color retention, applied at spreading rate to achieve not less than 3.0 mil total dry film thickness(DFT) of not less than 3.0-4.0 mils per coat.

      1) Tnemec: Endura Shield Series 74 or 75.

      2) Carboline: #834 or 134 HS

      3) PPG: Pitt-Thane Acrylic Aliphatic Urethane Series 97-840.

      4) Sherwin-Williams (S-W): Hi-Solids Polyurethane (B65-300 Series).

2.03 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: Premixed, nonmetallic, noncorrosive, non-staining grout containing selected silica sands, Portland cement, shrinkage compensating agents, plasticizing and water-reducing agents, complying with ASTM C 1107, of consistency suitable for application, and a 30-minute working time.

2.04 FABRICATION

A. Fabricate and assemble structural steel in shop to greatest extent possible. Fabricate structural steel according to AISC specifications referenced in this Section and in Shop Drawings.
   1. Mark and match-mark materials for field assembly.

   2. Fabricate for delivery a sequence that will expedite erection and minimize field handling of structural steel.

   3. Complete structural steel assemblies, including welding of units, before starting shop-priming operations.

   4. Comply with fabrication tolerance limits of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for structural steel.

B. Finishing: Accurately mill ends of columns and other members transmitting loads in bearing.

2.05 SHOP CONNECTIONS

A. Shop install and tighten high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM F3125 or A 490 Bolts."

B. Weld Connections: Comply with AWS D1.1 for procedures, appearance and quality of welds, and methods used in correcting welding work.
   1. Assemble and weld built-up sections by methods that will maintain true alignment of axes without warp.

2.06 SHOP PRIMING

A. Shop prime steel surfaces, except the following:
   1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
   2. Surfaces to be field welded.
   3. Surfaces to be high-strength bolted with slip-critical connections.
   4. Surfaces to receive sprayed on fireproofing.
   5. Galvanized surfaces.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust, loose mill scale, and spatter, slag, or flux deposits. Prepare surfaces according to SSPC specifications as follows:
   1. SSPC-SP 2 "Hand Tool Cleaning."
   2. SSPC-SP 3 "Power Tool Cleaning."

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's instructions and at rate recommended by SSPC to provide a dry film thickness of not less than 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
   1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
   2. Apply 2 coats of shop paint to inaccessible surfaces after assembly or erection. Change color of second coat to distinguish it from first.

2.07 SOURCE QUALITY CONTROL

A. Owner will engage an independent testing and inspecting agency to perform shop inspections and tests and to prepare test reports.
   1. Testing agency will conduct and interpret tests and state in each report whether test specimens comply with or deviate from requirements.
   2. Provide testing agency with access to places where structural steel Work is being fabricated or produced so required inspection and testing can be accomplished.

B. Correct deficiencies in or remove and replace structural steel that inspections and test reports indicate do not comply with specified requirements.

C. Additional testing, at Contractor's expense, will be performed to determine compliance of corrected Work with specified requirements.

D. Shop-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM F 3125 or A 490 Bolts."
   1. Direct-tension indicator gaps will be verified to comply with ASTM F 959, Table 2.

E. In addition to visual inspection, shop-welded connections will be inspected and tested according to AWS D1.1 and the inspection procedures listed below, at testing agency's option.
   1. Liquid Penetrant Inspection: ASTM E 165.

   2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.

   3. Radiographic Inspection: ASTM E 94 and ASTM E 142; minimum quality level "2-2T."

   4. Ultrasonic Inspection: ASTM E 164.

PART 3 EXECUTION

3.01 EXAMINATION

A. Before erection proceeds, and with the steel erector present, verify elevations of concrete and masonry bearing surfaces and locations of anchorages for compliance with requirements.

B. Do not proceed with erection until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place, unless otherwise indicated.

3.03 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC specifications referenced in this Section.

B. Base and Bearing Plates: Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen surfaces prior to setting base and bearing plates. Clean bottom surface of base and bearing plates.
   1. Set base and bearing plates for structural members on wedges, shims, or setting nuts as required.

   2. Tighten anchor bolts after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of base or bearing plate prior to packing with grout.

   3. Pack grout solidly between bearing surfaces and plates so no voids remain. Finish exposed surfaces, protect installed materials, and allow to cure.

      a. Comply with manufacturer's instructions for proprietary grout materials.

C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

D. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
1. Level and plumb individual members of structure.

E. Splice members only where indicated.

F. Do not use thermal cutting during erection.

G. Do not enlarge unfair holes in members by burning or by using drift pins. Ream holes that must be enlarged to admit bolts.

3.04 FIELD CONNECTIONS

A. Install and tighten high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM F 3125 or A 490 Bolts."

B. Weld Connections: Comply with AWS D1.1 for procedures, appearance and quality of welds, and methods used in correcting welding work.
1. Comply with AISC specifications referenced in this Section for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.

2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without warp.

3.05 FIELD QUALITY CONTROL

A. Owner will engage an independent testing and inspecting agency to perform field inspections and tests and to prepare test reports.
1. Testing agency will conduct and interpret tests and state in each report whether tested Work complies with or deviates from requirements.

B. Correct deficiencies in or remove and replace structural steel that inspections and test reports indicate do not comply with specified requirements.

C. Additional testing, at Contractor's expense, will be performed to determine compliance of corrected Work with specified requirements.

D. Field-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM F 3125 or A 490 Bolts."
1. Direct-tension indicator gaps will be verified to comply with ASTM F 959, Table 2.

E. In addition to visual inspection, field-welded connections will be inspected and tested according to AWS D1.1 and the inspection procedures listed below, at testing agency's option.
1. Liquid Penetrant Inspection: ASTM E 165.

2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.

3. Radiographic Inspection: ASTM E 94 and ASTM E 142; minimum quality level "2-2T."

4. Ultrasonic Inspection: ASTM E 164.

3.06 CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint. Apply paint to exposed areas using same material as used for shop painting.
   1. Apply by brush or spray to provide a minimum dry film thickness of 1.5 mils.

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

** END OF SECTION **

SECTION 05 52 00
GLASS GUARD ASSEMBLIES

PART 1GENERAL

1.01 SECTION INCLUDES

A. Through Glass Point Supported Tempered Glass Guard Assemblies.

1.02 RELATED SECTIONS

A. Section 03 30 00 – Cast In Place Concrete.

1.03 REFERENCES

A. ASTM C 1048 – Standard Specification for Heat Treated Flat Glass – Kind HS, Kind FT Coated and Uncoated Glass

B. NAAMM Metal Finishes Manual; national Association of Architectural Metal Manufacturers

C. AAMA CW-12-84 Structural Properties of Glass

D. ASTM E 2358-04 Standard specification for the Performance of Glass in Permanent Glass Railing Systems, Guards and Balustrades.

1.04 SYSTEM DESCRIPTION

A. Performance Requirements for Guard Assembly:
   1. Support distributed load of 50 pounds per linear foot (0.73kN/M), applied horizontally at right angles in any direction to the top/grab rail.
   2. Support concentrated horizontal load of 200 pounds (0.89kN), applied in any direction at any point along top/grab rail.
   3. 50 lbs (0.22kN) on 1 sf (0.093m^2) perpendicular to guard at any location
   4. Wind loads 25 psf or as otherwise specified.
   5. These loads need not to be assumed to act concurrently.
   6. Maximum deflection at top of glass is height/24.

1.05 SUBMITTALS

A. Submit under provisions of Section 01 30 00.

B. Product Data: Submit Manufacturer's technical product data for railing components and accessories.

C. Shop Drawings: Dimensioned drawings of railing assemblies indicating the following:
   1. Elevations; include joint locations, transitions, and terminations.
   2. Glass light fabrication plans with dimensions, holes and finishes.
   3. Point support layout, details and attachment to support structure.
   4. Manufacturer's installation and maintenance instructions.

D. Engineering Design Report: Calculations showing point support reactions and glass stresses. Calculations shall have the original seal and signature of the New York registered professional Structural Engineer.

E. Samples of manufacturer's finishes (As selected by the Architect.)

1.06 QUALITY ASSURANCE

A. Components and installation are to be in accordance with state and local building codes.

B. All components and fittings are furnished by the same manufacturer.

C. All glass to be fabricated by an approved temperer to a tolerance of 1/32" for the light size and hole locations.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials properly protected against damage to finished surfaces during transit.

B. Inspect materials upon delivery for damage. Unless minor defects can be made to meet the Architect's specifications and satisfaction, damaged parts shall be removed and replaced.

C. Store materials at building site under cover in a dry location.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturer: C.R. Laurence Co., Inc. (CRL) Tel: (800) 421-6144 Fax: (800) 587-7501 Email: railings@crlaurence.com www.crlaurence.com or equal.

B. Manufacturers of equivalent products will be considered for substitution in accordance with provisions of Section 01630 - Product Substitution Procedures.

2.02 MATERIALS

A. Aluminum Components: Conforming to ASTM B 221/ASTM B221M, Alloy 6063- T52.

B. Stainless Steel Components: Conforming to ASTM A 666, Type 304.

C. Brass Components: Conforming to ASTM B 248, No. 260, Yellow Brass

2.03 COMPONENTS

A. Glazing: Fully tempered ASTM C 1048 Kind FT, Quality q3.
   1. Thickness: 3/4 inch (19mm).
   2. Color: Clear.
   3. No exposed glass edges.

B. Internal Handrail Cap Connection Sleeves: Metal tube, material compatible with handrail cap material.

C. CRL Standoff fittings.

D. Cap Railing:
   1. Profile: Part # GRL10BS, rectangular 1 15/16 inches (25.4-33.3mm).
   2. Material: Stainless Steel.
   3. Finish: Brushed Stainless.

E. Through Glass Handrail Brackets:
   1. Material: Stainless Steel
   2. Finish: Match handrail cap finish

F. Handrail Tubing:
   1. Profile: Part # PR15BS10, round 1.9 inches (48 mm) outside diameter.
   2. Material: Stainless Steel.
   3. Finish: Brushed Stainless.

G. Fasteners: Types and sizes indicated in shop drawings and engineering report.

2.04 FABRICATION

A. Fabricate handrail assembly components to lengths and configurations complying with shop drawings.

B. Machine joint edges smooth and plane to produce hairline seams when site assembled; supply concealed sleeve connectors for joints.

C. Isolate dissimilar metals to prevent electrolytic action by applying primer to concealed surfaces of metal components.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install handrails in accordance with manufacturer's recommended installation instructions and approved shop drawings. Standoffs shall be located to a tolerance of 1/32". All bushings, spacers, bearing pads and other components shown in the shop drawings must be properly installed.

3.02 CLEANING

A. Clean glazing surfaces after installation, complying with requirements contained in the manufacturer's instructions. Remove excess glazing sealant compounds, dirt or other substances.

B. Remove protective films from metal surfaces.

C. Clean railing surfaces with clean water and mild detergent. Do not use abrasive chemicals, detergents, or other implements that may mar or gouge the material.

3.03 PROTECTION

A. Institute protective measures required throughout the remainder of the construction period to ensure that all the materials do not incur any damage or deterioration.

B. Repair components damaged by subsequent construction activities in accordance with manufacturer's recommendations; replace damaged components that cannot be repaired to Architect's acceptance.

** END OF SECTION **

SECTION 05 73 13
GLAZED DECORATIVE METAL RAILINGS

PART1GENERAL

1.01 DOCUMENTS

A. Read, interpret and coordinate the General Conditions, Supplementary Conditions and Division 01 and all other parts as they apply to this section.

1.02 SUMMARY

A. Provide Decorative Stair, Hand and Guard Rail Systems.

B. Provide glazed and non-glazed decorative handrails and guards at interior [exterior] locations as indicated.

1.03 RELATED SECTIONS

A. Section 03 30 00 - Cast-in-Place Concrete

B. Section 07 92 00 Sealers

1.04 REFERENCES

A. ASTM B209, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate

B. ASTM B221 M Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

C. ASTM B241/B241M, Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube

D. ASTM B483/B483M-03 Standard Specification for Aluminum and Aluminum-Alloy Drawn Tubes for General Purpose Applications.

E. ASTM E894 Anchorage of Permanent Metal Railing Systems and Rails for Buildings.

F. ASTM E2353 Evaluation Performance of Glazing in Permanent Glass Railing System, Guards and Balustrades.

G. ASTM E935-00e1 Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings.

H. ASTM E985-00e1 Standard Specification for Permanent Metal Railing Systems and Rails for Buildings.

I. International Code Council, International Building Code, 2015.

J. National Association of Architectural Metal Manufacturers (NAAMM)

1.05 DESIGN REQUIREMENTS

A. Design, fabrication and installation of guardrails as detailed on drawings.

B. Design guardrails and connections to withstand lateral forces in accordance with local and International Building Codes, and local by-law requirements for guardrails. Test in accordance with ASTM A935.

C. Meet code requirements for height, size of openings and restrictions of climb-ability.

D. Glass and Glazing: Drawings.

1.06 SUBMITTALS

A. Provide information requested and specified in accordance with Section 01 33 00.

B. Shop Drawings:
1. Prepare, seal and sign Shop Drawings and perform field reviews. Retain a Professional, structural engineer experienced in design of guardrail system and licensed in the place of the work. Shop Drawings will show design and installation requirements.
2. Show layout, spacing, sizes, thicknesses and types of cold formed metal framing, fastening and anchorage details, including mechanical fasteners. Show reinforcing channels, opening framing, supplemental framing, strapping, blocking, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.
3. Indicate design loads, design thickness exclusive of coatings, coating specifications, connection and bracing details, screw sizes and spacing, anchors and maximum sizes of cut-outs.
4. Indicate locations, dimensions, openings and requirements of related work.

C. Submit samples of aluminium profile, glass sample, joining and finishes to the Consultant for approval.

D. Submit data covering the care, cleaning and maintenance of finishes for incorporation in the maintenance manuals.

1.07 QUALITY ASSURANCE

A. Manufacturer: Company specializing in the manufacture of guardrail systems for a minimum of five (5) years. Work of this section to be performed by a contractor experienced in the fabrication and working of steel, including cutting, bending, forming, and finishing.

B. Installer: Company specializing in the installation of guardrails with five (5) years proven experience for projects of similar size, materials and complexity. Provide written proof of qualifications when requested.

C. Appearance of Finished Installation: Information on drawings and in specifications establishes requirements for system's aesthetic effects and performance characteristics:
1. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, one another, and adjoining construction.
2. Performance characteristics are indicated by criteria subject to verification by one or more methods including structural analysis, preconstruction testing, field testing, and in-service performance.
3. Do not modify intended aesthetic effects, as judged by Consultant, except as directed and accepted by Consultant.
    a. Submit comprehensive explanatory data to Consultant for review where modifications are proposed to meet performance characteristics.
4. Source Limitation: all components and fittings to be from same manufacturer.

5. Safety Glazing Labelling: Permanently mark glass with certification label acceptable to authorities having jurisdiction. Label will indicate manufacturer's name, type of glass, thickness and safety glazing standard glass complies with.

1.08 DELIVERY, STORAGE, HANDLING AND PROTECTION

A. Exercise care in storing, handling and erecting material. Support materials properly at all times so that no piece will be bent, twisted, or damaged structurally or visually.

B. Fabricate large assemblies so they can be safely and easily transported and handled to their place of installation.

C. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer. Inspect delivery. Keep materials in original, unopened containers and packaging until installation.

D. Store materials in clean, dry area indoors in accordance with manufacturer's written instructions and away from uncured concrete or masonry; cover with waterproof paper, tarpaulin or polyethylene sheeting in a manner that permits air circulation inside of covering. Do not store materials directly on floor.

E. Correct damaged material and where damage is deemed irreparable by the Owner; replace the affected item at no additional expense to the Owner.

F. Apply protective covering to face of exposed finished metalwork before it leaves shop, covering to remain until item installed and ready for final finishing.

G. Protect materials and finish during handling and installation to prevent damage.

H. Protect glass infill panels from edge damage.

1.09 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated on Drawings.

1.10 SITE CONDITIONS

A. Coordinate this work with the remainder of the work and exercise the necessary scheduling to ensure that all work is carried out and all items incorporated during the appropriate construction phase.

B. Provide items to be built in to those trades affected, along with dimensioned setting drawings, in time to be installed in the work.

C. Protect other work from damage by the work of this section.

PART2 PRODUCTS

2.01 MANUFACTURER

A. Acceptable Manufacturer: Q-railing USA,14321 Franklin Ave., Suite A, Tustin, CA 92780 USA Tel: 1-714-259-1372 Email: sales.us@q-railing.com or equal.

2.02 MATERIALS

A. Aluminum: conforming to ASTM B221, B221M, Alloy 6063-T52.

B. Miscellaneous Steel shapes and plates: conforming to CAN/CSA-G40.21-M87, type 300W. Guardrail members and connections as indicated.

C. Steel/Stainless steel:
1. Type 304 for interior work and Type 316 for exterior work,
2. Finish: unless otherwise indicated, polished directional satin finish.

3. Material: Group 1 alloy 304 or 316 stainless-steel bolts and nuts complying with ASTM F593 and ASTM F594.
4. Refer to Section 05 50 00 for fabrication and finishes of Stainless Steel.

D. Screws, anchors, and inserts: corrosion resistant cadmium plated stainless steel, sized to suit application, to hold glass in place and prevent chipping or breakage at fastener location.

2.03 FABRICATION

A. Fabricate railing assembly to design dimensions, details, and specified requirements for compliance and structural performance. Fabricate members and fittings to provide flush, smooth, rigid hairline joints.

B. Exposed Mechanical Fastenings: concealed fasteners and fitting where possible and locate exposed fasteners unobtrusively; consistent with design of component, except where specifically noted otherwise.

C. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

D. Accurately form components, to each other and to building structure. Contractor to verify dimensions on site prior to fabrication.

E. Rails fabricated in the longest practical lengths to minimize installer joints.

F. Fabricated work to be complete with components required for installation and anchoring.

G. Cut, drill and punch metals cleanly and accurately. Machine edges smooth.

H. Close exposed ends of hollow railing members with prefabricated end fittings.

I. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated.

2.04 ISOLATION COATING

A. Isolate incompatible components by means of isolation coating as required.
1. Dissimilar metals
2. Concrete, mortar and masonry
3. Wood

2.05 COMPONENTS

A. *Upon choosing system*, Consultant to specify the following:
1. Glazing: ¾" clear glass with standard edge, Refer to Drawings.
2. Base Shoe: 8420.
3. Cap Railings: 6960.
4. Handrail brackets: Model 0117.
5. Handrail Tube: 0900.

PART3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and ready to receive work.

B. Supply items required to be cast into concrete, embedded in masonry, and/or placed in partitions with setting templates and written instructions, to appropriate trades.

C. Beginning of installation means installer accepts existing conditions.

D. Examine areas to receive decorative metal railings and note conditions that adversely affect installation or subsequent use of decorative railing system; coordinate with Contractor for correction of unacceptable site conditions. Commencement of work by this section will signify acceptance of surface and conditions.

3.02 PREPARATION

A. Perform cutting, drilling, and fitting required for installing metal railings.

B. Field check and verify that structural framing, enclosures, weld plates, blocking, and that size and location of pockets are placed in accordance with reviewed shop drawings.

C. Report discrepancies to Contractor and Consultant, and recommend corrective action by responsible parties.

3.03 INSTALLATION

A. Install in accordance with Reviewed shop drawings and manufacturer's instructions.

B. Install components plumb and level, with fitted hairline joints, free from distortion or defects detrimental to appearance and performance.

C. Provide fasteners and anchors required for connecting railings to structure. Anchor railing to structure.

D. Secure wall brackets to wall at 4'-0" (1219mm) O.C. maximum with through-bolts and plate where these can be concealed, otherwise use bolts and expansion shields to achieve maximum rigidity of rail. Wood plugs for fixing to walls will not be permitted. Use metal anchoring devices.

E. Grout bases of posts, balusters or newels occurring in concrete using non-shrink grout in accordance with manufacturer's instructions. Finish smooth, level and flush with surrounding finished surface.

F. Isolate where necessary to prevent electrolysis due to dissimilar metal-to-metal contact or metal-to-masonry and concrete. Use 2 coats of bituminous paint, butyl tape, or building paper.

G. Fasten top rail sleeves and top rail to posts. Insert glass panels into bottom and top rail in accordance with the shop drawings and written instructions.

H. Conceal bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.

I. Grind off surplus welding materials and provide sharp profiles and arises.

J. Touch up with matching primer, or zinc rich paint for galvanized components, field welds, damaged and abraded surfaces, and surfaces not previously primed. Leave ready for finish painting by Section 09 90 00.

3.04 ERECTION TOLERANCES

A. Maximum Offset From True Alignment: in accordance with Structural Consultant and 6 mm (1/4").

3.05 FIELD QUALITY CONTROL

A. The design engineer responsible for the preparation of shop drawings will perform regular field reviews during installation and submit reports to the Consultant.

3.06 CLEANING

A. Clean installations and assemblies progressively and, at completion of work.

B. Remove protective coverings and clean metal work using cleaning solutions and methods to suit the metal and its finish at completion of work.

C. Protect adjacent materials and finishes from damage or discoloring during cleaning.

D. Wash railing using clean water and soap, rinse with water. Do not use acid solutions, steel wool, or other abrasives that may mar or gouge material.

E. Remove excess sealant by method acceptable to sealant manufacturer.

F. Clean glass panels by: removing dust and grit with generous application of water and, remove grease and film deposits with mild solution of soap and water and, rinse thoroughly.

G. At completion, remove equipment, tools, surplus materials and debris from job site.

3.07 PROTECTION OF FINISHED WORK

A. Protect finishes of railing from damage during construction with temporary protective coverings to ensure all materials do not incur any damage or deterioration.

B. Restore finishes damaged during installation and construction so no evidence remains of corrected work. Replace damaged components that are irreparable to Consultant's acceptance.

C. Field repair or refinishing of damaged, marred or discoloured finishes will not be accepted.

** END OF SECTION **