

# GUIDE SPECIFICATION

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## SECTION 05120

### CASTELLATED or CELLULAR STRUCTURAL STEEL BEAMS

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*This guide specification has been prepared by C-Beams, in printed and electronic media, as an aid to specifiers in preparing written construction documents for the C-Beam product (castellated or cellular structural steel beams). Castellated or Cellular Beams are high strength steel "WF" beam sections that have been cut longitudinally along the neutral axis in an angular or circular pattern to completely separate the top and bottom chords, then shifted to create hexagonal or round voids along the neutral axis, and re-attached via automatic welding machines to create a light weight steel beam.*

*Edit entire master to suit project requirements. Modify or add items as necessary. Delete items which are not applicable. Words and sentences within brackets [\_\_\_\_\_] reflect a choice to be made regarding inclusion or exclusion of a particular item or statement. This section may include performance, proprietary and descriptive type specifications. Edit to avoid conflicting requirements. Editor notes to guide the specifier are included between lines of asterisks to assist in choices to be made. Remove these notes before final printing of specification.*

*This guide specification is written around the Construction Specifications Institute (CSI), Section Format standards references to section names and numbers are based on MasterFormat 95.*

*For specification assistance on specific product applications, please contact our offices above or any of our local product representatives throughout the country.*

*C-Beams reserves the right to modify these guide specifications at any time. Updates to this guide specification will be posted to the manufacturer's web site and/or in printed matter as they occur. Manufacturer makes no expressed or implied warranties regarding content, errors, or omissions in the information presented.*

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## PART 1 GENERAL

### 1.1 SUMMARY

- A. Related Documents: General and Supplementary Conditions of the Contract, Division 1 - General Requirements, and Drawings are applicable to this Section.

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*Edit the Section Includes paragraph to briefly describe the content of this section. After editing section, refer back to this paragraph to verify no conflicts occur.*

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B. Section Includes:

1. Labor, materials, services, and equipment required in conjunction with or incidental to the furnishing, fabrication, delivery, and erection of castellated structural steel beams complete, including, but not limited to, the following
  - a. Qualification of welders.
  - b. Shop prime coat of paint.
  - c. Temporary construction bracing.
2. The extent of structural steel work is shown on the drawings, including schedules, notes and details to show sizes and locations of members, typical connections and types of steel required.
3. Include supplementary parts and members necessary to complete the structural steel work, regardless of whether such parts are definitely shown or specified, and furnish such bolts, gussets, plates, and other fasteners and accessories as may be required for proper assembly of items.

1.2 QUALITY ASSURANCE

A. Testing and Laboratory Services

1. Testing laboratory services for quality control: Refer to Division 1.

B. Codes and Standards: Comply with provisions of following, except as otherwise indicated

1. AISC "Code of Standard Practice for Steel Buildings and Bridges".
2. AISC "Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings," including the "Commentary" and Supplements thereto as issued.
3. AISC "Specifications for Structural Joints using ASTM A 325 or A 490 Bolts" approved by the Research Council on Riveted and Bolted Structural Joints of the Engineering Foundation.
4. Industrial Fasteners Institute "Handbook on Bolt, Nut, and Rivet Standards".
5. Steel Structure Painting Council
  - a. Painting Manual, Volume 1, Good Painting Practice.
  - b. Painting Manual, Volume 2, Systems Specifications.
6. Research Council on Riveted and Bolted Structural Joints: "Specifications for Structural Joints using ASTM A325 or A490 Bolts".
7. The Design of Welded Structures by Omar W. Blodgett.

C. Design

1. All Castellated or Cellular Beams are to be designed in accordance with the *AISC Manual of Steel Construction, Allowable Stress Design or Load and Resistance Factor Design*, Thirteenth Ed. and per the design procedures outlined in "*The Design of Welded Structures*" by Omar W. Blodgett.
2. Connections:
  - a. Design connections under direct supervision of a registered Professional Engineer to resist forces shown on structural drawings.
  - b. Use design values for high strength bearing type bolts with thread allowed across shear plane.
  - c. Connections for the C-Beam shall be based on the load indicated on contract documents.
3. Substitutions:
  - a. Submit substitutions of sections or modifications of details, or both, and reasons with shop drawings for approval.
  - b. Clearly identify and note substitutions as such.

- c. Coordinate approved substitutions, modifications, and necessary changes in related portions of work by fabricator.

### 1.3 SUBMITTALS

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*Include submittal requirements below which are consistent with the scope of the project and extent of work of this section. Only request submittals which are necessary for review of design intent.*

*Do not request submittals if drawings sufficiently describe the products of this section or if proprietary specifying techniques are used. The review of submittals increases the possibility of unintended variations to drawings.*

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- A. Product Data: Submit producer's or manufacturer's Specifications and installation instructions for following products. Include laboratory test reports and other data to show compliance with Specifications, including specified standards.
  - 1. Structural steel beams.
  - 2. High strength bolts, each type, including nuts and washers.
  - 3. Structural steel primer paint.
- B. Shop Drawings
  - 1. Submit Shop Drawings including complete details and schedules for fabrication and shop assembly of members, and details, schedules, procedures, and diagrams showing sequence of erection.
  - 2. Submit 1 sepia transparency and blue line prints as required by Division 1 of each detailed Shop and Installation Drawing.
  - 3. Include details of cuts, connections, camber, holes, and other pertinent data. Indicate welds by standard AWS symbols, and show size, length, and type of each weld.
  - 4. Provide setting drawings, templates, and directions for installation of anchor bolts and other anchorages to be installed by other trades.

### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store materials in accordance with requirements of Division 1.
- B. Store materials to permit easy access for inspection and identification. Keep steel members off ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration.
- C. 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.

### 1.5 JOB CONDITIONS

- A. Coordinate erection of structural steel with work of other trades.

## PART 2 PRODUCTS

### 2.1 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with requirements indicated herein, provide products of the following manufacturers:
  - 1. C-Beams, Charlotte, NC, phone (704) 970-1027.

## 2.2 MATERIALS

- A. Metal Surfaces, General: For fabrication of work which will be exposed to view, use only materials which are smooth and free of surface blemishes including pitting and roughness. Remove blemishes by grinding, or by welding and grinding, prior to cleaning, treating and application of surface finishes.
- B. Steel
  - 1. Structural Steel Shapes: High strength, low alloy Columbium-Vanadium steel of structural quality, ASTM A572/A572M, A529 or A992 Gr. 50.
- C. Bolts and Washers
  - 1. Anchor Bolts and Erection Bolts: Conform to ASTM A 307 and to requirements for regular hexagon bolts and nuts of ANSI Standards B18.2.1 and B18.2.2.
  - 2. High Strength Bolts for Connections: Conform to ASTM A 325 or A490.
    - a. Dimensions of Bolt Heads or Nuts: Conform to requirements for heavy hexagon nuts of ANSI Standard B18.2.2.
  - 3. Standard Washers: Flat and smooth, conforming to requirements of Type A in ANSI Standard B23.1.
    - a. Beveled Washers for `S' Shapes and Channels: Square or rectangular, taper in thickness, and be smooth.
    - b. Provide hardened steel washers for use with high strength bolts.
  - 4. At Contractor option, direct tension indicating washers for high strength bolts may be used on connections except anchor and erection bolts.
  - 5. At the Contractor's option, tension control bolts may, be used in lieu of standard high strength bolts and load indicating washers.
- D. Welding Electrodes: Conform to Specifications of the American Welding Society. For high-strength, low alloy steel, use electrodes, and filler metals equal in strength and compatible in appearance to parent metals being joined.
- E. Primer Paint: FS TT-P-31, red oxide, minimum 1 mils DFT.
- F. Zinc-Coating: Provide on items exposed to elements, conforming to ASTM Specification A 123.
- G. Cold Galvanizing Compound (touch-up):
  - 1. Acceptable Product: ZRC Cold Galvanizing Compound by ZRC Chemical Products, Quincy, MA.

## 2.3 FABRICATION

- A. Shop Fabrication and Assembly
  - 1. Fabricate and assemble structural assemblies in shop to greatest extent possible. Fabricate items of structural steel in accordance with AISC Specifications and as indicated on final Shop Drawings. Provide camber in structural members where indicated.
  - 2. Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence which will expedite erection and minimize field handling of materials.
  - 3. Where finishing is required, complete assembly, including welding of units, before start of finishing operations. Provide finish surfaces of members exposed in final structure free of markings, burrs, and other defects.
  - 4. Splicing of structural steel members is prohibited without prior approval of Architect/Engineer. Any member having a splice not shown and detailed on approved Shop Drawings shall be rejected.
  - 5. Members in Compression Joints which Depend on Contact Bearing: Mill bearing surfaces to a common plane. Completely assemble members to be milled before milling.
  - 6. Plates: Free of gross internal discontinuities such as ruptures and delaminations.

- B. Connections: Weld or bolt shop connections, as indicated.
  1. Bolt field connections, except where welded connections or other connections are indicated. Provide specified threaded fasteners for principle bolted connections. Drill or punch holes for bolted constructions at right angles to member. The slope of surfaces under the bolt head and nut shall not exceed 1:20. Provide beveled washers where slopes exceed 1:20. Bolt holes shall have a diameter not greater than one-sixteenth (1/16) inch larger than the nominal bolt diameter. Do not flame cut holes or enlarge by burning.
  2. High strength bolted connections: Install in accordance with AISC "Specifications for Structural Joints using ASTM A325 or A490 Bolts" (RCRBSJ).
  3. Welded Construction: Comply with AWS Code for procedures, appearance and quality of welds, and methods used in correcting welding work. Assemble and weld built-up sections by methods which will produce true alignment of axis without warp. Welds not specified shall be continuous fillet welds, using minimum fillet designed to develop the full strength of the membrane. No combination of bolts and welds shall be used for stress transmission at the same face of any connections.
  4. Clean areas to which studs are to be attached of rust, oil, grease, and paint. When the mill scale is sufficiently thick to cause difficulty in obtaining proper welds, remove by grinding or sand-blasting.
  5. For high-strength, low-alloy steels, follow welding procedures as recommended by steel producer for exposed and concealed connections.

2.4 FINISH

- A. General: Shop paint with one coat of specified primer structural steel, except those members or portions of members described below.
- B. Paint embedded steel which is partially exposed on exposed portions and initial 2 inches of embedded areas only.
- C. Do not paint members exposed to the elements. These are to be hot-dipped galvanized as specified herein.
- D. Do not paint surfaces which are to be field welded.
- E. Do not paint surfaces which are to receive sprayed on fireproofing, or are encased in concrete.
- F. Surface Preparation: After inspection and before shipping, clean steel-work to be painted. Remove loose rust, loose mill scale, and spatter, slag or flux deposits. Clean steel in accordance with Steel Structures Painting Council (SSPC) as follows:
 

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*Select one of the following options depending on exposure of steel and project budget.*

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  1. SP-1 "Solvent Cleaning."
  2. SP-2 "Hand Tool Cleaning."
  3. SP-3 "Power Tool Cleaning."
  4. SP-7 "Brush-off Blast Cleaning."
- G. Painting: Immediately after surface preparation, apply structural steel primer paint in accordance with manufacturer's instructions and at a rate to provide a uniform dry film thickness of a minimum of 1 mils. Use painting methods which result in full coverage of joints, corners, edges, and exposed surfaces.
 

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*ASTM A123 includes a specific zinc coating thickness based on the thickness of the component; heavier coating thicknesses can be specified. This reference standard does not apply to wire, pipe, or tube.*

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- H. Galvanize structural steel members to ASTM A123. [Galvanize all members which will be exposed to the elements, and elsewhere as detailed].

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.
- B. Beginning of installation means erector accepts existing conditions.

### 3.2 PREPARATION

- A. Examine areas and conditions under which structural steel work is to be installed, and notify Architect/Engineer of conditions detrimental to proper and timely completion of work.
- B. Check elevations of concrete and masonry bearing surfaces and locations of anchor bolts and similar devices before erection proceeds.

### 3.3 ERECTION

- A. General: Comply with AISC Specifications and Code of Standard Practice, and as herein specified.
- B. Erection:
  - 1. All bracing for erection and handling shall be in accordance with the manufacturer's recommendations.
  - 2. All bracing shown on plan as x-bracing shall be installed prior to releasing the hoisting cables. All bracing shown as horizontal may be applied after beams are erected.
  - 3. C-Beams assumes no responsibility for the erection of the items furnished.
- C. Temporary Shoring and Bracing:
  - 1. Provide adequate shoring and bracing to safely withstand all loads to which the structure may be subjected during the construction process, including wind loads, dead loads, construction, material, and equipment loads. Such bracing shall remain in place as long as required for safety.
  - 2. As the erection progresses, make permanent welded or bolted connections sufficiently to withstand erection stresses and maintain stability.
  - 3. The design of temporary shoring and bracing shall be the responsibility of the Contractor.
- D. Temporary Planking: Provide temporary planking and working platforms as necessary to effectively complete the work.
- E. Anchor Bolts: Furnish anchor bolts and other connectors required for securing structural steel to foundations and other in-place work.
- F. Erection Bolts: On exposed welded construction, remove erection bolts, fill holes with plug welds and grind smooth at exposed surfaces. On non-exposed welded construction, tighten erection bolts securely and leave in place.
- G. Bolted Connections
  - 1. High strength bolts shall be installed in conformance with the "Specification for Structural Joints using ASTM A325 or A 490 Bolts".
  - 2. When using slip-critical connections bolts shall be tightened to provide at least the minimum tension shown in Table 4 of the "Specification for Structural Joints using ASTM A325 and A 490 Bolts". Verification of tightening shall be done by direct tension indicators, or by properly calibrated wrenches. Do not re-use bolts where positive cinching of nut has been reversed at any time.
  - 3. Bolted parts shall fit solidly together when assembled. Joint surfaces shall be free of burrs, dirt and other foreign material that would prevent solid seating of the parts.
  - 4. Bolts tightened by calibrated wrench or by torque control shall have a hardened washer under the element (nut or bolt head) turned in tightening.
  - 5. Hardened washers shall be placed over slotted holes in an outer ply. Hardened beveled washers shall be used where the outer face of the bolted parts has a slope greater than 1:20 with respect to the bolt axis.

- H. Comply with AISC recommendations for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
  - I. Do not enlarge holes in members by burning or by use of drift pins, except in secondary bracing members. Ream holes that must be enlarged to admit bolts.
  - J. Gas Cutting: Do not use gas cutting torches in field for correcting fabrication errors in structural framing. Cutting will be permitted only on secondary members which are not under stress, as acceptable to Architect/Engineer. Finish gas-cut sections equal to a sheared appearance when permitted.
  - K. Touch-up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint. Apply paint to exposed areas with same materials as used for shop painting. Apply by brush or spray to provide a minimum dry film of thickness of 1 mils.
- 3.4 PROTECTION
- A. Protect installed work as required to insure original integrity is not altered.
- 3.5 CLEAN-UP
- A. Clean steel as work progresses to remove foreign matter.

**END OF SECTION**