

**SECTION 05 40 00
COLD-FORMED METAL FRAMING**

PART 1 - GENERAL

1.1 DESCRIPTION:

A. This section specifies materials and services required for installation of cold-formed steel, including tracks and required accessories as shown and specified. This Section includes the following:

1. Exterior non-load-bearing steel stud curtain wall.

1.2 RELATED WORK:

- A. Structural steel framing: Section 05 12 00, STRUCTURAL STEEL FRAMING.
- B. Open web steel joists: Section 05 21 00, STEEL JOIST FRAMING.
- C. Non-load-bearing metal stud framing assemblies: Section 09 22 16, NON-STRUCTURAL METAL FRAMING.
- D. Gypsum board assemblies: Section 09 29 00, GYPSUM BOARD.

1.3 DESIGN REQUIREMENTS:

- A. Design steel in accordance with American Iron and Steel Institute Publication "Specification for the Design of Cold-Formed Steel Structural Members", except as otherwise shown or specified.
- C. Structural Performance: Engineer, fabricate, and erect cold-formed metal framing to withstand design loads within limits and under conditions required.
 1. Design Loads: As indicated.
 2. Design framing systems to withstand design loads without deflections greater than the following:
 - c. Exterior Non-load-Bearing Curtain wall: Lateral deflection of 1/600 of the wall height.
 3. Design framing systems to provide for movement of framing members without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change (range) of 67 degrees C (120 degrees F).

4. Design framing system to accommodate deflection of primary building structure and construction tolerances, and to maintain clearances at openings.
5. Design exterior non-load-bearing curtain wall framing to accommodate lateral deflection without regard to contribution of sheathing materials.
6. Engineering Responsibility: Engage a fabricator who assumes undivided responsibility for engineering cold-formed metal framing by employing a qualified professional engineer to prepare design calculations, shop drawings, and other structural data.
7. Exterior metal stud wall systems, including but not limited to preformed metal and brick faced with metal panel back-up, serving as the building envelope shall be supported by a structural resisting system for air blast loading that serves to protect occupants from both loads and flying projectile hazards. The supporting system shall span from floor slab to floor slab meeting the following design requirements.
 - a. Design exterior metal stud/metal panel wall assembly for airblast loading parameters of pressure, $P_r = 4$ psi and corresponding impulse, $I_r = 40$ psi-msec. The spatial distribution of overpressure shall be uniform unless otherwise specified or indicated.
 - b. System components shall be designed using an equivalent single degree of freedom or other approved dynamic analysis method in accordance with the following dynamic response limits:
 - (1) Metal Panels:
 - (a) Ductility $\mu \leq 10$
 - (b) Support Rotation: 8 degree
 - (c) Connections: Develop capacity of the metal panels

(2) Cold Formed Metal Deck:

(a) Ductility $\mu \leq 3$

(b) Support Rotation: 2 degree

(c) Connections: Develop capacity of the metal deck

(3) Cold Formed Metal Studs:

(a) Ductility $\mu \leq 2$

(b) Support Rotation: 3.8 degree

(c) Connections: Develop capacity of the metal studs

c. System components shall be designed using an equivalent single degree of freedom or other approved dynamic analysis method in accordance with the following dynamic response limits of a rotation of 3.8 degrees and ductility of 2.

d. Shear, welds, local buckling and web crippling of structural steel panels and supporting frame components shall be designed in accordance with AISC 325, the plastic design provisions of AISC 335 or by other approved methods.

e. Design of connections shall be in accordance with the Load Factor and Resistance Design method of the American Iron and Steel Institute (AISI) North American Specification for the Design of Cold-Formed Steel Structural Members, 2001 Edition.

f. Connections shall be designed for the flexural capacity of the member being connected or the maximum force that can be delivered, whichever is less. Connections shall not use

1.4 SUBMITTALS:

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Shop Drawings: Shop and erection drawings showing steel unit layout, connections to supporting members, and information necessary to complete installation as shown and specified.

- C. Manufacturer's Literature and Data: Showing steel component sections and specifying structural characteristics.
- D. For cold-formed metal framing indicated to comply with certain design loadings, include structural analysis data sealed and signed by the qualified professional engineer who was responsible for its preparation.
- E. Blast Calculations: Prior to performing engineering calculations submit a description of the technique(s) that will be employed to calculate the response of the system to the defined loading.
 - a. Calculation package is to include a summary sheet briefly outlining the following:
 - (1) Evaluation criteria
 - (2) Calculation assumptions
 - (3) Table of results by component
 - (4) Statement of Conformance with specification requirements
 - b. Calculation submittal is to be stamped and signed by a registered Professional Engineer whose qualifications meet or exceed Quality Assurance criteria.
 - c. Submit single degree of freedom (or better) dynamic analysis calculations for metal wall panel systems.
 - d. Anchorage. Analyze the strength of the embedded anchor assembly, as well as pull-out and reaction forces shared with the building structure. Include exact loadings to be transferred to the building structure in the analysis.
 - e. Mechanical Anchors. Mechanical anchor capacities shall be developed from dynamic testing. An International Code Council (ICC-ES) evaluation report showing testing for dynamic loading (i.e. seismic or blast) is to be submitted with calculations
- F. Certificates: Engineer's qualifications that meet or exceed Quality

Assurance criteria. At a minimum, qualifications must list each project in which the Engineer performed dynamic analysis of metal panel wall assemblies and/or similar systems, the effective start and end dates of performance of the analysis and a reference

- G. Quality Assurance: Engage an engineering professional to perform dynamic analysis of the Pre-formed Metal Wall Panel system. The Engineer shall have a minimum of 5 years experience performing dynamic analysis for blast resistant design and demonstrable experience designing blast resistant wall systems in the past 18 months.

1.5 APPLICABLE PUBLICATIONS:

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.

- B. American Iron and Steel Institute (AISI):

Specification and Commentary for the Design of Cold-Formed Steel Structural Members (1996)

- C. American Society of Testing and Materials (ASTM):

A36/A36M-08.....Standard Specifications for Carbon Structural Steel

A123/A123M-09.....Standard Specifications for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

A153/A153M-09.....Standard Specifications for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

A307-10.....Standard Specifications for Carbon Steel Bolts and Studs

A653/A653M-10.....Standard Specifications for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

C1107/C1107M-08.....Standard Specifications for Packaged Dry, Hydraulic-Cement Grout (Non-shrink)

E488-96(R2003).....Standard Test Methods for Strength of Anchors
in Concrete and Masonry Elements

E1190-95(R2007).....Standard Test Methods for Strength of Power-
Actuated Fasteners Installed in Structural
Members

D. American Welding Society (AWS):

D1.3/D1.3M-08.....Structural Welding Code-Sheet Steel

E. Military Specifications (Mil. Spec.):

MIL-P-21035B.....Paint, High Zinc Dust Content, Galvanizing
Repair

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Sheet Steel for joists, studs and accessories 16 gage and heavier: ASTM
A653, structural steel, zinc coated G90 with a yield of 340 MPa (50
ksi) minimum.

B. Sheet Steel for joists, studs and accessories 18 gage and lighter: ASTM
A653, structural steel, zinc coated G90, with a yield of 230 MPa (33
ksi) minimum.

C. Galvanizing Repair Paint: MIL-P-21035B.

D. Nonmetallic, Non-shrink Grout: Premixed, nonmetallic, noncorrosive,
nonstaining grout containing selected silica sands, Portland cement,
shrinkage-compensating agents, plasticizing and water-reducing agents,
complying with ASTM C1107, with fluid consistency and a 30 minute
working time.

E. Material Properties for blast analysis:

a. Yield strength of framing members may be increased to account for
dynamic strain rate effects in accordance with ARMY TM 5-1300 as
follows:

(1) Structural Steel: For $f_y = 36$ ksi, the yield strength may be
increased by a factor of 1.42. For $f_y = 46$ ksi, the yield
strength may be increased by a factor of 1.31. For $f_y = 50$ ksi,

the yield strength may be increased by a factor of 1.25.

(2) Structural Aluminum: For $f_y = 25\text{ksi}$, the yield strength may be increased by a factor of 1.02.

b. Section Modulus: The plastic section modulus may be used in dynamic design calculations

c. Built-Up Sections: Design built-up sections using ultimate stress and strain compatibility approaches as defined by industry standards. If built-up section is analyzed as one unit, full shear stress transfer along the line of contact between the individual sections for composite action must be illustrated.

2.2 WALL FRAMING:

A. Steel Studs: Manufacturer's standard C-shaped steel studs of web depth indicated, with lipped flanges, and complying with the following:

1. Design Uncoated-Steel Thickness:

1.52 mm (0.0598 inch)

2.66 mm (0.1046 inch)

2. Flange Width:

(1-5/8 inches)

3. Web: Punched

B. Steel Track: Manufacturer's standard U-shaped steel track, unpunched, of web depths indicated, with straight flanges, and complying with the following:

1. Design Uncoated-Steel Thickness: Matching steel studs.

2. Flange Width: Manufacturer's standard deep flange where indicated, standard flange elsewhere.

2.4 FRAMING ACCESSORIES:

A. Fabricate steel framing accessories of the same material and finish used for framing members, with a minimum yield strength of 230 MPa (33 ksi).

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:

1. Supplementary framing.
2. Bracing, bridging, and solid blocking.
3. Web stiffeners.
4. Gusset plates.
5. Deflection track and vertical slide clips.
6. Stud kickers and girts.
8. Reinforcement plates.

2.5 ANCHORS, CLIPS, AND FASTENERS:

- A. Steel Shapes and Clips: ASTM A36, zinc coated by the hot-dip process according to ASTM A123.
- B. Cast-in-Place Anchor Bolts and Studs: ASTM A307, Grade A, zinc coated by the hot-dip process according to ASTM A153.
- C. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times the design load, as determined by testing per ASTM E488 conducted by a qualified independent testing agency.
- D. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times the design load, as determined by testing per ASTM E1190 conducted by a qualified independent testing agency.
- E. Mechanical Fasteners: Corrosion-resistant coated, self-drilling, self-threading steel drill screws. Low-profile head beneath sheathing, manufacturer's standard elsewhere.

2.6 REQUIREMENTS:

- A. Welding in accordance with AWS D1.3
- B. Furnish members and accessories by one manufacturer only.

PART 3 - EXECUTION

3.1 FABRICATION:

- A. Framing components may be preassembled into panels. Panels shall be square with components attached.
- B. Cut framing components squarely or as required for attachment. Cut framing members by sawing or shearing; do not torch cut.
- C. Hold members in place until fastened.
- D. Fasten cold-formed metal framing members by welding or screw fastening, as standard with fabricator. Wire tying of framing members is not permitted.
 - 1. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - 2. Locate mechanical fasteners and install according to cold-formed metal framing manufacturer's instructions with screw penetrating joined members by not less than 3 exposed screw threads.
- E. Where required, provide specified insulation in double header members and double jamb studs which will not be accessible after erection.

3.2 ERECTION:

- A. Handle and lift prefabricated panels in a manner as to not distort any member.
- B. Securely anchor tracks to supports as shown.
- C. At butt joints, securely anchor two pieces of track to same supporting member or butt-weld or splice together.
- D. Plumb, align, and securely attach studs to flanges or webs of both upper and lower tracks.
- E. All axially loaded members shall be aligned vertically to allow for full transfer of the loads down to the foundation. Vertical alignment shall be maintained at floor/wall intersections.
- F. Install jack studs above and below openings and as required to furnish support. Securely attach jack studs to supporting members.
- G. Install headers in all openings that are larger than the stud spacing in that wall.

- H. Attach bridging for studs in a manner to prevent stud rotation. Space bridging rows as shown.
- I. Studs in one piece for their entire length, splices will not be permitted.
- J. Provide a load distribution member at top track where joist is not located directly over bearing stud.
- K. Provide joist bridging and web stiffeners at reaction points where shown.
- L. Provide end blocking where joist ends are not restrained from rotation.
- M. Provide an additional joist under parallel partitions, unless otherwise shown, when partition length exceeds one-half joist span and when floor and roof openings interrupt one or more spanning members.
- N. Provide temporary bracing and leave in place until framing is permanently stabilized.
- O. Do not bridge building expansion joints with cold-formed metal framing. Independently frame both sides of joints.
- P. Fasten reinforcement plate over web penetrations that exceed size of manufacturer's standard punched openings.

3.3 TOLERANCES:

- A. Vertical alignment (plumbness) of studs shall be within 1/960th of the span.
- B. Horizontal alignment (levelness) of walls shall be within 1/960th of their respective lengths.
- C. Spacing of studs shall not be more than 3 mm (1/8 inch) +/- from the designed spacing providing that the cumulative error does not exceed the requirements of the finishing materials.
- D. Prefabricated panels shall be not more than 3 mm (1/8 inch) +/- out of square within the length of that panel.

3.4 FIELD REPAIR:

Touch-up damaged galvanizing with galvanizing repair paint.

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