
USACE / NAVFAC / AFCEA / NASA UFGS-05 40 00 (April 2006)

Preparing Activity: NAVFAC Replacing without change
UFGS-05400 (October 2003)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated July 2009

SECTION TABLE OF CONTENTS

DIVISION 05 - METALS

SECTION 05 40 00

COLD-FORMED METAL FRAMING

04/06

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS
- 1.3 DELIVERY, STORAGE, AND HANDLING
- 1.4 LOAD-BEARING COLD-FORMED METAL FRAMING
- 1.5 MAXIMUM DEFLECTION
- 1.6 QUALITY ASSURANCE
 - 1.6.1 Drawing Requirements
 - 1.6.2 Design Data Required

PART 2 PRODUCTS

- 2.1 STEEL STUDS, JOISTS, TRACKS, BRACING, BRIDGING AND ACCESSORIES
 - 2.1.1 Studs and Joists of 1.5 mm 16 Gage (0.0598 Inch) and Heavier
 - 2.1.2 Studs and Joists of 1.2 mm 18 Gage (0.0478 Inch) and Lighter
 - 2.1.3 Sizes, Gages, Section Modulus, and Other Structural Properties
- 2.2 MARKINGS
- 2.3 CONNECTIONS
- 2.4 PAINT
- 2.5 PLASTIC GROMMETS

PART 3 EXECUTION

- 3.1 FASTENING
 - 3.1.1 Welds
 - 3.1.2 Screws
 - 3.1.3 Anchors
- 3.2 INSTALLATION
 - 3.2.1 Tracks
 - 3.2.2 Studs
 - 3.2.3 Joists and Trusses
 - 3.2.4 Erection Tolerances
 - 3.2.5 Special Inspection and Testing for Seismic-Resisting Systems

-- End of Section Table of Contents --

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SECTION 05 40 00

COLD-FORMED METAL FRAMING

04/06

NOTE: This guide specification covers the requirements for framing components and erection of load-bearing light gage steel.

Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable items(s) or insert appropriate information.

Remove information and requirements not required in respective project, whether or not brackets are present.

Comments and suggestions on this guide specification are welcome and should be directed to the technical proponent of the specification. A listing of technical proponents, including their organization designation and telephone number, is on the Internet.

Recommended changes to a UFGS should be submitted as a Criteria Change Request (CCR).

NOTE: The following information shall be shown on the project drawings:

1. The extent and location of all framing indicating gage, size, section modulus, and other structural properties required.
2. Connections and other installation details.
3. Indicate concentrated loads, e.g., pipe supports, that may overstress a flange or connection.

PART 1 GENERAL

1.1 REFERENCES

NOTE: This paragraph is used to list the publications cited in the text of the guide specification. The publications are referred to in the text by basic designation only and listed in this paragraph by organization, designation, date, and title.

Use the Reference Wizard's Check Reference feature when you add a RID outside of the Section's Reference Article to automatically place the reference in the Reference Article. Also use the Reference Wizard's Check Reference feature to update the issue dates.

References not used in the text will automatically be deleted from this section of the project specification when you choose to reconcile references in the publish print process.

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI SG02-1 (2001) North American Specification for the Design of Cold-Formed Steel Structural Members

AISI SG03-3 (2002) Cold-Formed Steel Design Manual Set

AMERICAN WELDING SOCIETY (AWS)

AWS D1.3/D1.3M (2008; Errata 2008) Structural Welding Code - Sheet Steel

ASTM INTERNATIONAL (ASTM)

ASTM A 1008/A 1008M (2009) Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardened

ASTM A 1011/A 1011M (2009a) Standard Specification for Steel, Sheet, and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability

ASTM A 123/A 123M (2009) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

| | |
|-------------------|--|
| ASTM A 153/A 153M | (2009) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware |
| ASTM A 370 | (2009a) Standard Test Methods and Definitions for Mechanical Testing of Steel Products |
| ASTM A 653/A 653M | (2009) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process |
| ASTM B 633 | (2007) Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel |
| ASTM C 955 | (2009) Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases |
| ASTM E 329 | (2008) Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction |

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

| | |
|---------|---|
| SAE J78 | (1998) Steel Self Drilling Tapping Screws |
|---------|---|

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

| | |
|---------------|---|
| SSPC Paint 25 | (1997; E 2004) Paint Specification No. 25Zinc Oxide, Alkyd, Linseed Oil Primer for Use Over Hand Cleaned Steel Type I and Type II |
|---------------|---|

1.2 SUBMITTALS

NOTE: Review submittal description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list to reflect only the submittals required for the project. Submittals should be kept to the minimum required for adequate quality control.

A "G" following a submittal item indicates that the submittal requires Government approval. Some submittals are already marked with a "G". Only delete an existing "G" if the submittal item is not complex and can be reviewed through the Contractor's Quality Control system. Only add a "G" if the submittal is sufficiently important or complex in context of the project.

For submittals requiring Government approval on Army projects, a code of up to three characters within

the submittal tags may be used following the "G" designation to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy, Air Force, and NASA projects.

Choose the first bracketed item for Navy, Air Force and NASA projects, or choose the second bracketed item for Army projects.

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are [for Contractor Quality Control approval.][for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Framing Components[; G][; G, [_____]]

- a. Cross sections, plans, and/or elevations showing component types and locations for each framing application; including shop coatings and material thicknesses for each framing component.
- b. Connection details showing fastener type, quantity, location, and other information to assure proper installation.
- c. Drawings depicting panel configuration, dimensions, components, locations, and construction sequence if the Contractor elects to install prefabricated/prefinished frames.

SD-03 Product Data

Steel studs, joists, tracks, bracing, bridging and accessories

[SD-05 Design Data

NOTE: Require calculations for items considered critical by the designer. Delete paragraph if calculations are not necessary.

Metal framing calculations[; G][; G, [_____]]

SD-07 Certificates

Load-bearing cold-formed metal framing

Mill certificates or test reports from independent testing agency, qualified in accordance with ASTM E 329, showing that the

steel sheet used in the manufacture of each cold-formed component complies with the minimum yield strengths and uncoated steel thickness specified. Test reports shall be based on the results of three coupon tests in accordance with **ASTM A 370**.

Welds

Certified copies of welder qualifications test records showing qualification in accordance with **AWS D1.3/D1.3M**.

1.3 DELIVERY, STORAGE, AND HANDLING

Deliver materials to job site and store in adequately ventilated, dry locations. Storage area shall permit easy access for inspection and handling. If necessary to store materials outside, stack off the ground, support on a level platform, and protect from the weather as approved. Handle materials to prevent damage. Finish of the framing members shall be maintained at all times, using an approved high zinc dust content, galvanizing repair paint whenever necessary to prevent the formation of rust. Replace damaged items with new, as directed by the Contracting Officer.

1.4 LOAD-BEARING COLD-FORMED METAL FRAMING

Include [top and bottom tracks,] bracing, fastenings, and other accessories necessary for complete installation. Framing members shall have the structural properties indicated. Where physical structural properties are not indicated, they shall be as necessary to withstand all imposed loads. Design framing in accordance with **AISI SG03-3**. [Non-load-bearing metal framing, furring, and ceiling suspension systems are specified in Section **09 22 00** SUPPORTS FOR PLASTER AND GYPSUM BOARD.] [Metal suspension systems for acoustical ceilings are specified in Section **09 51 00** ACOUSTICAL CEILINGS.]

1.5 MAXIMUM DEFLECTION

NOTE: Modify to suit project requirements. Use maximum deflection of L/360 unless special considerations require modification.

a. Exterior Studs:

| <u>Deflection Criteria</u> | <u>Exterior Finish</u> |
|----------------------------|---------------------------------|
| L/240 or L/360 | Synthetic Plaster, Metal Panels |
| L/360 | Cement Plaster, Wood Veneer |
| L/600 | Brick Veneer, Stone Panels |

Wall deflections shall be computed on the basis that studs withstand all lateral forces independent of any composite action from sheathing materials. Studs abutting windows or louvers shall also be designed not to exceed **6 mm** **1/4 inch** maximum deflection.

b. Floor Joists:

L/360 - Live load only
L/240 - Total load

c. Roof Rafters:

L/240 - Live load only

1.6 QUALITY ASSURANCE

1.6.1 Drawing Requirements

Submit **framing components** to show sizes, thicknesses, layout, material designations, methods of installation, and accessories.

[1.6.2 Design Data Required

Submit **metal framing calculations** to verify sizes, gages, and spacing of members and connections. Show methods and practices used in installation.

]PART 2 PRODUCTS

2.1 STEEL **STUDS, JOISTS**, TRACKS, BRACING, BRIDGING AND ACCESSORIES

Framing components shall comply with **ASTM C 955** and the following.

NOTE: It is assumed that members will be protected from the weather. If members will be exposed or subject to moisture directly, by water infiltration, or via vapor transmission and condensation or indirectly in a corrosive atmosphere, delete carbon steels (painted) and specify coating Class **Z275 G90** for such members. Specify G40 for brick ties and screw fasteners. See special option below for deflection limit on exterior wall brick construction. Grades specified are normally used for this type of framing. See manufacturer's current literature for other grades and section properties available.

2.1.1 Studs and Joists of **1.5 mm 16 Gage (0.0598 Inch)** and Heavier

Galvanized steel, **ASTM A 653/A 653M**, SS Grade 50, [**Z180**] [**Z275**] [**G60**] [**G90**] [**;** or carbon steel, **ASTM A 1011/A 1011M**, Grade 50, painted].

2.1.2 Studs and Joists of **1.2 mm 18 Gage (0.0478 Inch)** and Lighter

Studs and Joists of **1.2 mm 18 Gage (0.0478 Inch)** and Lighter, Track, and Accessories (All Gages): Galvanized steel, **ASTM A 653/A 653M**, SS, **Grade 345 230 MPa Grade 50 33,000 psi Z180 G60** [**;** or carbon steel, **ASTM A 1008/A 1008M**, Grade C, painted].

2.1.3 Sizes, Gages, Section Modulus, and Other Structural Properties

Size and gage as indicated. Steel stud deflection shall be limited to L/600 for exterior wall brick veneer construction.

2.2 MARKINGS

Studs and track shall have product markings stamped on the web of the

section. The markings shall be repeated throughout the length of the member at a maximum spacing of 1200 mm 4 feet on center and shall be legible and easily read. The product marking shall include the following:

- a. An ICBO number.
- b. Manufacturer's identification.
- c. Minimum delivered uncoated steel thickness.
- d. Protective coating designator.
- e. Minimum yield strength.

2.3 CONNECTIONS

Screws for steel-to-steel connections shall be self-drilling tapping in compliance with SAE J78 of the type, size, and location as shown on the drawings. Electroplated screws shall have a Type II coating in accordance with ASTM B 633. Screws, bolts, and anchors shall be hot-dipped galvanized in accordance with ASTM A 123/A 123M or ASTM A 153/A 153M as appropriate. Screws bolts, and anchors shall be hot dipped galvanized in accordance with ASTM A 123/A 123M or ASTM A 153/A 153M as appropriate.

[2.4 PAINT

Ungalvanized steel, if used, shall be thoroughly cleaned, phosphate treated, and coated with corrosion-inhibiting primer, SSPC Paint 25.

]2.5 PLASTIC GROMMETS

Supply plastic grommets, recommended by stud manufacturer, to protect electrical wires. Prevent metal to metal contact for plumbing pipes.

PART 3 EXECUTION

3.1 FASTENING

Fasten framing members together by welding or by using self-drilling or self-tapping screws. Electrodes and screw connections shall be as required and indicated in the design calculations.

3.1.1 Welds

NOTE: The welding of cold-formed steel should be performed by qualified workmen. The Contractor, Subcontractor, or Fabricator shall provide verification that welders are qualified in accordance with AWS D1.3/D1.3M.

TI 809-07 provides suggested design values for fillet and flare-bevel welds. Welding is not recommended on minimum metal thickness of less than 1.09 mm (0.0428 inch).

All welding shall be performed in accordance with AWS D1.3/D1.3M, as modified by AISI SG02-1. All welders, welding operations, and welding

procedures shall be qualified according to AWS D1.3/D1.3M. All welds shall be cleaned and coated with rust inhibitive galvanizing paint. Do not field weld materials lighter than 1.2 mm 18 gage.

3.1.2 Screws

NOTE: TI 809-07 provides suggested capacities of screw connections. Screws will not be used to resist pullout type loadings.

Minimum Screw Sizes for Steel-to-Steel Connections

| Point Size | Minimum Screw Size | Total Thickness of Steel (mm (in)) |
|------------|--------------------|------------------------------------|
| 2 | #8 | 2.540 mm (0.100 inches max) |
| 2 | #10 | 2.794 mm (0.110 inches max) |
| 2 | #12 | 3.556 mm (0.140 inches max) |
| 3 | #8 | 3.556 mm (0.140 inches max) |
| 3 | #10 | 4.445 mm (0.175 inches max) |
| 3 | #12 | 5.334 mm (0.210 inches max) |

Total thickness of steel is combined thickness of all connected steel members.

Screws shall be [of the] [self-drilling self-tapping] type, size, and location shown on the drawings. Screw penetration through joined materials shall not be less than three exposed threads. Minimum spacings and edge distances for screws shall be as specified in AISI SG02-1. Screws covered by sheathing materials shall have low profile heads.

3.1.3 Anchors

NOTE: TI 809-07 provides suggested capacities of expansion and power type anchors. Power driven anchors can be used to attach tracks to structural steel and concrete floors and foundations. Power driven anchors will not be used to anchor shear walls.

Anchors shall be of the type, size, and location shown on the drawings.

3.2 INSTALLATION

3.2.1 Tracks

Provide accurately aligned runners at top and bottom of partitions. Anchor tracks as indicated in design calculations. Butt weld joints in tracks or splice with stud inserts. Fasteners shall be at least 75 mm 3 inches from the edge of concrete slabs.

3.2.2 Studs

Cut studs square and set with firm bearing against webs of top and bottom tracks. Position studs vertically in tracks and space as indicated in

design. Do not splice studs. Provide at least two studs at jambs of doors and other openings 600 mm 2 feet wide or larger. Provide jack studs over openings, as necessary, to maintain indicated stud spacing. Provide tripled studs at corners, positioned to receive interior and exterior finishes. Fasten studs to top and bottom tracks by welding or screwing both flanges to the tracks. Framed wall openings shall include headers and supporting components as shown on the drawings. Headers shall be installed in all openings that are larger than the stud spacing in a wall. In curtain wall construction, provide for vertical movement where studs connect to the structural frame. Provide horizontal bracing in accordance with the design calculations and AISI SG03-3, consisting of, as a minimum, runner channel cut to fit between and welded to the studs or hot- or cold-rolled steel channels inserted through cutouts in web of each stud and secured to studs with welded clip angles. Bracing shall be not less than the following:

| <u>LOAD</u> | <u>HEIGHT</u> | <u>BRACING</u> |
|----------------|-------------------------------|--|
| Wind load only | Up to 3000 mm Over 3000 mm | One row at mid-height Rows 1500 mm o.c. maximum |
| Axial load | Up to 3000 mm Over 3000 mm | Two rows at 1/3 points Rows 900 mm o.c. maximum |

| <u>LOAD</u> | <u>HEIGHT</u> | <u>BRACING</u> |
|----------------|-------------------------------|---|
| Wind load only | Up to 10 feet Over 10 feet | One row at mid-height Rows 5'-0" o.c. maximum |
| Axial load | Up to 10 feet Over 10 feet | Two rows at 1/3 points Rows 3'-4" o.c. maximum |

3.2.3 Joists and Trusses

Locate each joist or truss directly above a stud. Provide doubled joists under parallel partitions wherever partition length exceeds 1/2 of joist span. Joists shall have at least 60 mm 2.50 inches of bearing on steel, 100 mm 4 inches on masonry, and shall be reinforced over bearings where required to prevent web crippling. Splice joists over bearings only. Lap and weld splices as indicated. Provide manufacturer's standard bridging which shall not be less than the following:

| <u>CLEAR SPAN</u> | <u>BRIDGING</u> |
|---------------------|--------------------------|
| Up to 4200 mm | One row near center |
| 4200 mm to 6000 mm | Two rows at 1/3 points |
| 6000 mm to 7800 mm | Three rows at 1/4 points |
| 7800 mm to 10600 mm | Four rows at 1/5 points |

| <u>CLEAR SPAN</u> | <u>BRIDGING</u> |
|-------------------|--------------------------|
| Up to 14 feet | One row near center |
| 14 to 20 feet | Two rows at 1/3 points |
| 20 to 26 feet | Three rows at 1/4 points |
| 26 to 32 feet | Four rows at 1/5 points |

Temporary bracing shall be provided and remain in place until work is permanently stabilized.

3.2.4 Erection Tolerances

- a. Framing members which will be covered by finishes such as wallboard, plaster, or ceramic tile set in a mortar setting bed, shall be within the following limits:
 - (1) Layout of walls and partitions: 6 mm 1/4 inch from intended position;
 - (2) Plates and runners: 6 mm in 2400 mm 1/4 inch in 8 feet from a straight line;
 - (3) Studs: 6 mm in 2400 mm 1/4 inch in 8 feet out of plumb, not cumulative; and
 - (4) Face of framing members: 6 mm in 2400 mm 1/4 inch in 8 feet from a true plane.
- b. Framing members which will be covered by ceramic tile set in dry-set mortar, latex-portland cement mortar, or organic adhesive shall be within the following limits:
 - (1) Layout of walls and partitions: 6 mm 1/4 inch from intended position;
 - (2) Plates and runners: 3 mm in 2400 mm 1/8 inch in 8 feet from a straight line;
 - (3) Studs: 3 mm in 2400 mm 1/8 inch in 8 feet out of plumb, not cumulative; and
 - (4) Face of framing members: 3 mm in 2400 mm 1/8 inch in 8 feet from a true plane.

3.2.5 Special Inspection and Testing for Seismic-Resisting Systems

NOTE: Include this paragraph only when special inspection and testing for seismic-resisting systems is required by paragraph 3.2 of FEMA 302, NEHRP RECOMMENDED PROVISIONS FOR SEISMIC REGULATIONS FOR NEW BUILDINGS AND OTHER STRUCTURES.

This paragraph will be applicable to both new buildings designed according to TI 809-04, SEISMIC DESIGN FOR BUILDINGS, and to existing building seismic rehabilitation designs done according to TI 809-05, SEISMIC EVALUATION AND REHABILITATION FOR BUILDINGS.

The designer must indicate on the drawings all locations and all features for which special inspection and testing is required in accordance with Chapter 3 of FEMA 302. This includes indicating the locations of all structural components and connections requiring inspection.

Add any additional requirements as necessary.

Special inspections and testing for seismic-resisting systems and components shall be done in accordance with Section 01 45 35 SPECIAL INSPECTION FOR SEISMIC-RESISTING SYSTEMS.

-- End of Section --