



Preface

After a great deal of hard work by CFSC members, a draft Quality Control framework has been created for the manufacture of steel trusses and related components. Given the proprietary and specialized engineering nature of steel truss and component manufacturing, there are gaps in this framework that will need to be filled by users of this guide.

Since this remains a work in progress, CFSC would appreciate any feedback/improvements that anyone is willing to provide to improve/complete the content of this document. Thank you for supporting CFSC and contributing to the advancement of the steel truss and component manufacturing industry

Quality Standard for Steel Truss and Component Manufacturing

1.0 Assessing incoming steel:

1.1 Randomly check one piece for each 1000 lineal feet delivered for:

1.1.1 Steel thickness per General Provisions table A5.1.1 (Excerpted from STANDARD FOR COLD-FORMED STEEL FRAMING –GENERAL PROVISIONS, AISI 1101 17th Street, NW Suite 1300 Washington, DC 20036-4700)

Table A5.1-1

Minimum Base Metal Thickness of Cold-Formed Steel Members

Designation (thickness in mils)	Minimum Base Metal Thickness Inches (mm)	Old Reference Gauge Number ¹
27	0.0269 (0.683)	22
33	0.0329 (0.836)	20 – Structural ²
43	0.0428 (1.09)	18
54	0.0538 (1.37)	16
68	0.0677 (1.72)	14
97	0.0966 (2.45)	12
118	0.1180 (3.00)	10

¹ Gauge thickness is an obsolete method of specifying sheet and strip steel thickness. Gauge numbers are only a very rough approximation of steel thickness and shall not be used to order, design or specify any sheet or strip steel product.

² Historically, 20-gauge material has been furnished in two different thicknesses for structural and drywall (non-structural) applications.

1.1.1.1 Or, verify that there is identification on the steel per General Provisions section A5.4 as follows (Excerpted from STANDARD FOR COLD-FORMED STEEL FRAMING –GENERAL PROVISIONS, AISI 1101 17th Street, NW Suite 1300 Washington, DC 20036-4700):

A5.4 Product Identification

Framing members used in steel construction shall be identified with a legible sticker, stamp, stencil, or embossment, spaced a maximum of 4 feet (1.22 m) on center and located on the web of the framing member, in accordance with one of the following standards:

ASTM C645 (Non-structural framing members only)

ASTM C955 (Structural framing members only)

ASTM A1003/A1003M (Framing members not described in ASTM C645 or C955)

ASTM A1003/A1003M-00

Section 13.2: Except for the products described in Specifications C645 and C955 all cold-formed products manufactured from material purchased or certified to this specification shall be marked legibly to indicate conformance with the following: minimum steel sheet thickness, metallic-coating designation, nonmetallic-coating thickness, nonmetallic-coating type, minimum yield strength, product designation, and name of manufacturer.

1.1.2 Check for defects in the steel as delivered:

1.1.2.1 Improperly Shaped Chord and Web Members

Chord and web members that do not conform to the manufacturers or the applicable ASTM geometric specifications and tolerance requirements shall not be used.

1.1.2.2 Rips and Punctures:

Any member that has a rip or puncture of the nature depicted below should not be used. This type of damage must be removed or repaired. Damaged sections can be cut off and the remaining sound section used normally.

1.1.2.1.1 During the truss manufacturing process the damaged portion of the member may be removed and the remaining portion of the member used if adequate length remains in the member and there is no other damage.

1.1.2.3 Cracks:

Members with visible cracks of the nature depicted below must be replaced. Members with visible cracks shall be discarded and not repaired.

1.1.2.1.1 Other members from the same production run should be carefully evaluated, and approved by the Truss Designer, who is designing the trusses, prior to use in a truss.

1.1.2.4 Holes:

1.1.2.3.1 Holes with a diameter of ¼” or less are acceptable when spaced a minimum of 3 times the hole diameter from each other.

1.1.2.3.2 The 3 times the hole diameter minimum requirement also applies to a screw hole to member edge and end distances.

1.1.2.3.3 Holes remaining after the removal of temporary shipping attachments, shipping bracing, or other attachments are acceptable if the diameter and spacing guidelines above are followed.

1.1.2.3.4 Single drilled holes in webs with a diameter greater than ¼” but not greater than ½” are acceptable when spaced a minimum of 12 times the hole diameter from each other.

1.1.2.3.5 Web holes should be located near the mid-height of the web.

1.1.2.3.6 Holes in flanges should be reviewed and approved by the Truss Designer, who is designing the trusses, prior to use in a truss.

1.1.2.5 Members with Dents and Dings or are Kinked, Bent or Twisted

1.1.2.4.1 Dents and dings that create any type of depression, kink, bend or twist in a radius bend of a steel member shall not be allowed in any location.

1.1.2.4.2 Dents and dings meeting the requirements for diameter and spacing, as described for holes in section 1.1.2.3, are allowed in flat areas of members.

1.1.2.4.3 If the dent or ding distorts any portion of the member, resulting in a depression that causes the member to be kinked, bent, or twisted in any manner, can have the damaged area removed or repaired as directed, reviewed and approved by the Truss Designer, who is designing the trusses, prior to use in a truss.

1.1.2.4.4 Members with a depression, kink, or bend in a radius bend or are twisted can have the damaged area removed or repaired as directed, reviewed and approved by the Truss Designer, who is designing the trusses, prior to use in a truss.

1.1.2.6 Damage to Coatings — Scratches and Abrasions

1.1.2.5.1 Scratches and surface abrasions that significantly damage or remove the surface galvanizing but do not penetrate into the steel are acceptable, if repaired.

1.1.2.5.2 Repair shall consist of preparing the surface and applying a zinc rich coating as recommended in the latest version of ASTM A 780 section or by the coating manufacturer.

1.1.3 Check for rust:

1.1.3.1 Red Rust

1.1.3.1.1 Red rust at the cut end of members is acceptable

1.1.3.1.2 Rust resulting from screw shavings is acceptable.

1.1.3.1.3 Red rust in other areas shall be repaired. Repair shall consist of preparing the surface and applying a zinc rich coating as recommended in section 1.1.4.2 or by the coating manufacturer.

1.1.3.1.4 Members with rust covering 5% or more of the surface should not be used and cannot be repaired.

1.1.3.2 White Rust

1.1.3.2.1 White rust is acceptable.

2.0 Manufacturing Tolerances

2.1 All incoming material shall conform to the following tolerances (Excerpted from STANDARD FOR COLD-FORMED STEEL FRAMING –GENERAL PROVISIONS, AISI 1101 17th Street, NW Suite 1300 Washington, DC 20036-4700):

Table A2.1

ASTM C 955-00 Manufacturing Tolerances for Structural Members

(see Figure A2.1)

Dimension ¹	Item Checked	Chords and Webs, in. (mm)
A	Length	+3/32 (2.38)
		-3/32 (2.38)
B ²	Web Width	+1/32 (0.79)
		-1/32 (0.79)
C	Flare	+1/16 (1.59)
	Overbend	-1/16 (1.59)
D	Hole Center	+1/16 (1.59)
	Width	-1/16 (1.59)
E	Hole Center Length	+1/4 (6.35)
		-1/4 (6.35)
F	Crown	+1/16 (1.59)
		-1/16 (1.59)
G	Camber	1/32 per ft (2.6 per m)
		1/2 max (12.7)
H	Bow	1/32 per ft (2.6 per m)
		1/2 max (12.7)
I	Twist	1/32 per ft (2.6 per m)
		1/2 max (12.7)

¹ All measurements shall be taken not less than 1 ft (305 mm) from the end.

² Outside dimension for chords and webs.

2.2 In-plant raw material handling and storage, check all members:

2.2.1 Prior to sawing, check for any handling damage following section 1.1.2.

2.2.2 Check for rust following section 1.1.3.

2.3 Sawing Members:

2.3.1 All members shall be cut to length in accordance with the Truss Design Drawing within a tolerance of plus or minus 3/8”.

2.3.2 Material handling and cut to length quality control checks in accordance with section 2.2 and 2.3.1 shall be made on a minimum of 3 truss set-ups per saw per week per shift and recorded for in-plant audits.

2.4 Truss Assembly Inspections:

2.4.1 Frequency of truss assembly inspections:

2.4.1.1 At a minimum, 3 trusses per week per set-up location per shift shall be inspected and recorded for in-plant audits.

2.4.2 Assembly:

2.4.2.1 Prior to assembly check for any member handling damage following section 1.1.2 and check for any rust following section 1.1.3.

2.4.2.3 If there is any handling damage or rust beyond the tolerances found in sections 1.1.2 and 1.1.3 contact the Truss Designer for evaluation and action to be taken.

2.4.2.4 Assessment of conformance with the Truss Design Drawing:

2.4.2.4.1 Check the label to ensure that the proper size and thickness of steel member for the chords.

2.4.2.4.2 Check the label to ensure that the proper size and thickness of steel member for the webs.

2.4.2.4.3 Each joint is constructed according to the manufacturers' requirements and in accordance with the truss design drawing

2.4.2.4.3.1 Web member to chord member attachment location tolerance is plus or minus 3/8” deviation from the Truss Design Drawing specification.

2.4.2.4.3.2 Web member to chord member to adjacent web member location attachment tolerance is plus or minus 3/8” deviation from the Truss Design Drawing specification.

2.4.2.4.3.3 Chord member to chord member attachment location tolerance is plus or minus 3/8” deviation from the Truss Design Drawing specification.

2.4.2.5 Joint gussets

2.4.2.5.1 All gussets should be marked legibly to indicate conformance with the following: minimum steel sheet thickness, metallic or non-metallic coating (i.e., coating designation or type and thickness), minimum yield strength, product designation, and name of manufacturer.

Exceptions:

2.4.2.5.1.1 Unmarked gussets shall be checked for conformance to the truss design drawing by checking the label on the box that the gussets were taken from.

2.4.2.5.2 Gussets shall be of the grade, thickness, coating, size, and shape specified by the truss design drawing.

2.4.2.5.3 Gusset plates that have dents or dings or are kinked, bent or twisted shall not be used.

2.4.2.5.4 The placement of gusset plates shall not interfere with other design aspects or function of the truss.

2.4.2.5.5 Gussets of a higher grade, thickness, or coating of the same size and shape shall not be prohibited from being substituted for the grade, thickness, or coating as specified.

2.4.2.6 Fasteners:

2.4.2.6.1 Corrosion Protection

2.4.2.6.1.1 Fasteners shall have a rust inhibiting coating suitable for the installation in which they are being used, or be manufactured from material not susceptible to corrosion.

2.4.2.6.1.2 Fasteners shall be checked for conformance by checking the label on the box that the fasteners were taken from.

2.4.2.6.2 Screw Connections

2.4.2.6.2.1 Self-drilling tapping screw fasteners for steel-to-steel connections shall be in compliance with the Truss Design Drawing.

2.4.2.6.2.1.1 Use of a larger than specified screw size shall be permitted, providing that the minimum spacing and edge distance requirements are met.

2.4.2.6.2.2 Screw fasteners shall extend through the steel connection a minimum of three (3) exposed threads. Screw fasteners shall penetrate individual members of connections without causing permanent separation between members.

2.4.2.6.2.3 Stripped screw fasteners shall be permitted to be considered effective provided the number of stripped screw fasteners considered effective does not exceed twenty-five percent (25%) of the total number of screw fasteners considered effective in the connection.

2.4.2.6.2.3.1 This applies to only shear connections.

2.4.2.6.2.4 Check that the proper fasteners are used per the Truss Design Drawing by checking the label on the box that the screws are being taken from.

2.4.2.7.2.5 Check that each screw is placed in accordance with the Truss Design Drawings:

2.4.2.6.2.5.1 Number of screws per joint is correct.

2.4.2.6.2.5.2 End distance is correct.

2.4.2.6.2.5.3 Edge distance is correct.

2.4.2.6.2.5.4 Screw to screw spacing is correct.

2.4.2.6.2.5 All screws are applied per the screw manufacturers requirements

2.4.2.6.2.5.1 Each screw is set properly per section 2.4.2.6.2.2 or per manufacturers requirements.

2.4.2.6.2.5.2 All screws are seated properly and the number stripped does not exceed the requirements of section 2.4.2.6.2.3.

2.4.2.6.2.5.2.1 Check with the Truss Designer, who is designing the trusses, on action to be taken for all joints that have more stripped screws exceed the requirements of section 2.4.2.6.2.3.

2.4.2.7.2.5.3 Screws with screw heads that are sheared off are considered to be ineffective and shall be replaced.

2.4.2.6.3 Rivets

2.4.2.6.3.1 Rivet Fasteners shall be installed in accordance with the requirements of the Truss Design Drawings and the fastener manufacturer..

2.4.2.6.4 Bolted Joints

2.4.2.6.4.1 Bolted joints shall be fabricated and installed in accordance with the requirements of the Truss Design Drawings, and the fastener manufacturer..

2.4.2.6.5 Clinch Joining

2.4.2.6.5.1 Clinch Joining shall be fabricated and installed in accordance with the requirements of the Truss Design Drawings, and the fastener manufacturer.

2.4.2.6.6 Welded Connections

2.4.2.6.6.1 Welds shall be made in accordance with the requirements of the Truss Design Drawings. At a minimum welded connections shall be in accordance with the Specification and AWS D1.3.

3.0 Finished product inspection:

3.1 Frequency of truss assembly inspection:

3.1.1 At a minimum, 3 trusses per week per set-up location per shift shall be inspected and recorded for in-plant audits.

3.2 Manufactured Truss Dimensions

3.2.1 Manufactured Truss dimensions which vary from the Truss Design Drawing shall not exceed the tolerances shown in Table E8. Inaccuracies exceeding these allowable tolerances shall be acceptable upon approval and follow-up documentation by the Truss Designer, who is designing the trusses. Any shop modifications or repairs shall be documented by the Truss Designer.

(Excerpted from STANDARD FOR COLD-FORMED STEEL FRAMING –TRUSS DESIGN, AISI 1101 17th Street, NW Suite 1300 Washington, DC 20036-4700)

Table E8

MANUFACTURING TOLERANCES FOR FINISHED TRUSS UNITS

Length ¹	Variance from Design Dimensions
Up to 30 ft.	½ inch
Over 30 ft.	¾ inch
Height ²	Variance from Design Dimensions
Up to 5 ft.	¼ inch
Over 5 ft.	½ inch

¹ Length, for manufacturing tolerance purposes, is the overall length of the truss unit, excluding overhangs, and extensions.

² Height, for manufacturing tolerances purpose, is the overall height of the truss unit measured from the top of the top chord to the bottom of the bottom chord at the highest point of the truss, excluding projections above the top chord and below the bottom chord, overhangs, and extensions.

3.3 After assembly check for any member damage per the requirements of section 1.1.2.

3.3.1 If any damage is found contact the Truss Designer, who is designing the trusses, for evaluation and action to be taken, prior to shipping the truss.

3.4 Truss camber, if any, shall be provided, as specified in the truss design.

3.4.1 If camber is different than specified contact the Truss Designer, who is designing the trusses, for evaluation and action to be taken, prior to shipping the truss.

3.5 Special Marking

3.5.1 Trusses shall be marked with tags or other legible markings to document the orientation of parallel chord trusses, locations of special bearing conditions and web member permanent bracing locations. Alternatively, it shall be acceptable for the Truss Designer to provide this information to the contractor by means of indications on the Truss Design Drawings and/or on separate detail drawings.

3.5.1.1 Parallel chord trusses shall have the top chord clearly marked, with tags or otherwise, to prevent up-side-down installation.

3.5.1.2 Trusses having bearing locations other than at the end of heel locations shall have bearing points clearly marked (with tags, on the truss design drawings or otherwise) in a manner that permits verification during and after installation.

3.5.1.3 Lateral Bracing All truss chord and web members which require permanent lateral bracing (such as but not limited to top chords of piggyback trusses, long compression webs, and bottom chords at cantilevers) to prevent lateral buckling as set forth in the Truss Design Drawing shall be clearly marked (with tags, on the truss design drawings or otherwise) to identify and in a manner that permits verification of the need for field bracing during and after installation.

3.5.1.4 The use of STCA tags shall meet all these identification requirements.

3.6 In-plant Truss Packaging and Storage

3.6.1 Trusses shall be packaged and stored at the manufacturing facility in a manner so they will not be damaged.

3.6.2 Truss damaged during the packaging and/or storage process at the manufacturing facility shall be replaced or repaired. Any needed repairs shall be undertaken by the Truss Designer, who is designing the trusses, prior to shipping the truss.

4.0 Truss Repair Performed at the Manufacturing Plant Prior to Shipping

4.1 Cutting, Notching and Patching of Truss Members

4.1.1 Cutting or notching of truss members, or the patching of those cuts shall not be permitted without an approved Truss Design Drawing detailing the condition and the design of the repair.

4.2 Splicing of Truss Members

4.2.1 Splicing truss members shall not be performed without an approved Truss Design Drawing detailing the condition and the design of the splice.

Appendix 1 -- Definitions (Selected Excerpts from STANDARD FOR COLD-FORMED STEEL FRAMING –GENERAL PROVISIONS, AISI 1101 17th Street, NW Suite 1300 Washington, DC 20036-4700 and ANSI/TPI/WTCA 4-2002)

Abrasion: A scraped or worn area.

Base Metal Thickness. The thickness of bare steel exclusive of all coatings.

Bent member: An out of straight member with no visible kinks.

Bracing. Structural elements that are installed to provide restraint or support (or both) to other framing members so that the complete assembly forms a stable structure.

Crack: A break or slit at any corner radius typically caused by the member manufacturing process.

Dent/Ding: A depression or hollow in a member, made by a blow or pressure.

Design Professional. An individual who is registered or licensed to practice their respective design profession as defined by the statutory requirements of the state in which the project is to be constructed.

Design Thickness. The steel thickness used in design which is equal to the minimum *base metal thickness* divided by 0.95.

Ding: Same as a dent.

Hole: An opening forced into or through a member. A penetration through a member.

Improperly shaped member: A member that does not conform to the manufacturer's geometric specifications and tolerances.

Kink: A fold, crease, tight twist, or curl at a corner radius. This causes the member to be out-of-straight.

Puncture: A member that has a hole, tear, split or other type of perforation.

Red rust: Oxidation of base metal with red appearance.

Rip: Same as puncture.

Scratch: A scrape, dig, tear or similar marking of the surface.

Truss. A coplanar system of *structural members* joined together at their ends usually to construct a series of triangles that form a stable beam-like framework.

Truss Designer: The individual or organization responsible for the design of Trusses in accordance with this Standard, the Truss Design Standard and all Legal Requirements. The Truss Designer is also referred to as a *Truss Design Engineer* when the Truss design calculations and/or Truss Design Drawings resulting from the design of the Trusses shall be sealed by an engineer.

Truss Design Drawing: The graphic depiction of an individual Truss.

Truss Manufacturer: An individual or organization regularly engaged in the manufacturing of Trusses and who manufactures Trusses and who may supply Structural Elements for the Building Structural System.

Twisted member: An out of square member that has changed shape due to torsion that has no visible kinks.

Yield Strength. A characteristic of the basic strength of the steel material defined as the highest unit stress that the material can endure before permanent deformation occurs as measured by a tensile test in accordance with specification ASTM A 370.

Web. That portion of a framing member that connects the flanges. (see Figure 1)

White rust: Galvanized surface oxidation with white powdery appearance. (Wet storage stain)

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