

# Felt Tips

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## Steel Stud Stumper

Have you used steel stud framing recently? How did you note it on the Drawings? Do something like "25 ga 2-1/2" studs @ 24" OC"? If you did this you may not be getting what you really want. Did you know that steel studs from different manufacturers for a particular size and sheet metal thickness have different structural properties? We'll avoid the deprecated "gage" word for referring to sheet metal thickness [especially for the metricated projects]. If you said, "No", then you've been caught unaware of a change in the steel stud industry. This is a subtle, yet significant, change which many people didn't realize was happening.

If you recall the June 1994 *Felt-Tip*, you may remember the ending. If you look in the product literature of many steel studs producers you'll notice that the nominal thickness of a "25 gage" steel stud is 0.0179 inches, yet the thickness for 25 gage sheet steel is 0.0209 inches. Sheet steel manufacturers used Manufacturers Standard Gage, but they recently decided to discontinue the usage of gage numbers to represent the material's thickness. 0.0179 inches goes with 26 gage sheet steel. Some manufacturers call this their base (uncoated) steel thickness or design thickness. Tolerance allowances sometimes allow particular thicknesses of sheet metal to be labelled with more than one sheet metal gage number.

Steel studs are being "engineered" by their manufacturer's for maximum structural performance for the amount of sheet metal being used and resulting cost. When you specify a "25 ga 2-1/2" stud" you will get varying span and load carrying capabilities depending upon who manufactures the studs. Each manufacturer has produced studs with different structural performance properties, yet be made from the same thickness of sheet steel and have the same web depth.

By varying the flange width, depth of the flange return lips, and embossing deformations in the stud's flange, manufacturers can adjust the two structural section properties of importance: Section Modulus (S) and Moment of Inertia (I). In the following chart, notice differences among section properties, lip dimensions, and limiting height.

2-1/2 Inch Steel Studs 0.0179 Sheet Metal Nominal Thickness (Minimum)							
Manufacturer	Designation	Section Modulus ( $S_{xx}$ ), Inches <sup>3</sup>	Moment of Inertia ( $I_{xx}$ ), Inches <sup>4</sup>	Cross Sectional Area, Inches <sup>2</sup>	Flange Width, Inches	Flange Return Lip Length, Inches	Limiting Height, feet
Amico	ADWS-25	0.074	0.091	0.067	1.25	*	8.6
Clark	DWS 2-1/2x25	0.063	0.095	0.054	1.3125	0.25	9.75
Dale/Incor	-	0.063	0.091	0.102	1.25	0.3125	9.61
Dietrich	2-1/2 STN-25	0.075	0.093	0.069	1.25	*	10.1

\* Information not available from published literature.  
Note: National Gypsum (Gold Bond) and Unimast/United States Gypsum steel studs were not included in this comparison since they list their limiting heights based upon studs being sheathed with at least one layer of gypsum board. The manufacturers listed above do not include the effect of sheathing panels in limiting heights. Limiting height is based upon studs spaced at 16 inch centers, 5 pound per square foot lateral load, and maximum deflection of span divided by 240.

None of the four manufacturers listed in the table above have matching structural performance values, yet they meet the same basic criteria of a 2-1/2 inch stud using 0.0179 inch thick sheet metal.

Another way of evaluating steel stud performance is through the "limiting height criteria". Limiting height criteria establishes the maximum vertical distance (such as from top of slab to underside of structure above) that the studs are capable of spanning. This span is based upon stud spacing, load (lateral for non-load-bearing studs; lateral and vertical loads for load-bearing studs), and bracing action from sheathing (such as gypsum board or plywood panels). Steel stud section properties should have a direct relationship on limiting height, yet the limiting height values listed in the table above yield no obvious relationship to the section properties. Some studs have their limiting heights affected by deflection (using moment of inertia) or bending stresses (section modulus).

Section properties of studs of the same dimension and thickness can be increased by increasing the flange width. Review the information from the following table. Notice how the increased flange width affects the section properties, without changing the sheet metal thickness or web depth.

Section Properties for 2-1/2 inch wide, 20 gage sheet metal thickness Steel Studs Manufactured by Dale/Incor					
Designation	Flange Width, inches	Flange Return Width, Inches	Section Modulus ( $S_{xx}$ ), Inches <sup>3</sup>	Moment of Inertia ( $I_{xx}$ ), Inches <sup>4</sup>	Cross Sectional Area, Inches <sup>2</sup>
CN	1-3/8	5/16	0.1336	0.1975	0.1913
CEE	1-5/8	7/16	0.1556	0.2288	0.2163
JW	2	9/16	0.1862	0.2730	0.2508
JWE	2-1/2	5/8	0.2015	0.3273	0.2896

Shaftwall framing members (C-H, C-T, E, and I-shaped studs, with J-shaped runner track) have similar structural property differences, as C-shaped steel studs, between manufacturers.

How to specify steel studs? There are several methods; three are shown below. Another aspect to address is the use of the word "gage". You may want to not use the word since the steel stud industry no longer uses gage numbers. The examples below use the word "Type" in place of the word "Gage."

#### Possible Specifying Options

- Specify the minimum acceptable structural performance properties of each stud flange size and sheet metal thickness combination. Although this may be considered the most obvious and logical response, it can produce a very long segment of text within a specification section. This text can get flustering for users if dual metric and inch-pound measurements are used in the specifications. Consider the following example showing section properties organized in tabular form:

<i>Stud Minimum Section Properties</i>						
		<i>Stud Size</i>				
		<i>41 mm (1-5/8")</i>	<i>63 mm (2-1/2")</i>	<i>92 mm (3-5/8")</i>	<i>102 mm (4")</i>	<i>152 mm (6")</i>
<i>Type 25</i>						
<i>I<sub>xx</sub></i>	<i>mm<sup>4</sup> (inches<sup>4</sup>)</i>	<i>1.42×10<sup>4</sup> (0.034)</i>	<i>3.79×10<sup>4</sup> (0.091)</i>	<i>8.99×10<sup>4</sup> (0.216)</i>	<i>1.14×10<sup>5</sup> (0.273)</i>	<i>2.98×10<sup>5</sup> (0.716)</i>
<i>S<sub>xx</sub></i>	<i>mm<sup>3</sup> (inches<sup>3</sup>)</i>	<i>5.74×10<sup>2</sup> (0.035)</i>	<i>1.03×10<sup>3</sup> (0.063)</i>	<i>1.72×10<sup>3</sup> (0.105)</i>	<i>1.9×10<sup>3</sup> (0.116)</i>	<i>3.06×10<sup>3</sup> (0.187)</i>
<i>Type 22</i>						
<i>I<sub>xx</sub></i>	<i>mm<sup>4</sup> (inches<sup>4</sup>)</i>	<i>2.25×10<sup>4</sup> (0.054)</i>	<i>5.99×10<sup>4</sup> (0.144)</i>	<i>1.42×10<sup>5</sup> (0.342)</i>	<i>1.79×10<sup>5</sup> (0.431)</i>	<i>4.75×10<sup>5</sup> (1.141)</i>
<i>S<sub>xx</sub></i>	<i>mm<sup>3</sup> (inches<sup>3</sup>)</i>	<i>9.67×10<sup>2</sup> (0.059)</i>	<i>1.69×10<sup>3</sup> (0.103)</i>	<i>2.8×10<sup>3</sup> (0.171)</i>	<i>3.21×10<sup>3</sup> (0.196)</i>	<i>5.57×10<sup>3</sup> (0.340)</i>
<i>Type 20</i>						
<i>I<sub>xx</sub></i>	<i>mm<sup>4</sup> (inches<sup>4</sup>)</i>	<i>2.71×10<sup>4</sup> (0.065)</i>	<i>7.28×10<sup>4</sup> (0.175)</i>	<i>1.72×10<sup>5</sup> (0.414)</i>	<i>2.18×10<sup>5</sup> (0.523)</i>	<i>5.76×10<sup>5</sup> (1.385)</i>
<i>S<sub>xx</sub></i>	<i>mm<sup>3</sup> (inches<sup>3</sup>)</i>	<i>1.25×10<sup>3</sup> (0.076)</i>	<i>2.02×10<sup>3</sup> (0.123)</i>	<i>3.49×10<sup>3</sup> (0.213)</i>	<i>4.03×10<sup>3</sup> (0.246)</i>	<i>7.16×10<sup>3</sup> (0.437)</i>

- Specify the minimum acceptable dimensions of the flange width and flange lips. Since these two items affect structural performance capabilities within a single size/thickness combination, this may be a simpler way of achieving the effect of specifying section properties. From a construction contract administration viewpoint, this may be difficult, since many manufacturers do not list the return flange dimension in their product literature; this would require contractors to verify that the information is provided from the manufacturer and designers to call manufacturers to verify the information.

## Example:

- A. *Wall studs:*
1. *Type 25:*
    - a. *Return flange lip minimum dimension: 5 mm (3/16 inches).*
    - b. *Flange width minimum dimension: 32 mm (1-1/4 inches).*
    - c. *Uncoated sheet steel thickness: 0.45 mm (0.0179 inches).*
  2. *Type 22:*
    - a. *Return flange lip minimum dimension: 5 mm (3/16 inches).*
    - b. *Flange width minimum dimension: 32 mm (1-1/4 inches).*
    - c. *Uncoated sheet steel thickness: 0.68 mm (0.0270 inches).*
  3. *Type 20:*
    - a. *Return flange lip minimum dimension: 5 mm (3/16 inches).*
    - b. *Flange width minimum dimension: 32 mm (1-1/4 inches).*
    - c. *Uncoated sheet steel thickness: 0.84 mm (0.0329 inches).*

- Specify minimum limiting height of the studs. Ensure that the many variables which affect limiting heights are included so that contractors and suppliers can provide the products which meet the design criteria used to select the studs. Example:

- A. *Stud Framing Minimum Span Height:*
1. *Structural requirements:*
    - a. *0.24 kPa (5 psf) load.*
    - b. *L/240 deflection criteria.*
    - c. *One layer of gypsum board each side of studs.*
    - d. *Span height determined using composite action of studs and gypsum board.*
  2. *Minimum span height for studs spaced at 600 mm (24 inches) on centers:*
    - a. *Type 25:*
      - (1) *41 mm (1-5/8 inch): 2145 mm (7 feet).*
      - (2) *63 mm (2-1/2 inch): 2200 mm (9 feet).*
      - (3) *92 mm (3-5/8 inch): 3700 mm (11 feet).*
      - (4) *102 mm (4 inch): 3800 mm (12 feet).*
      - (5) *152 mm (6 inch): 4000 mm (13 feet).*
    - b. *Type 22:*
      - (1) *41 mm (1-5/8 inch): 2400 mm (8 feet).*
      - (2) *63 mm (2-1/2 inch): 3300 mm (10 feet).*
      - (3) *92 mm (3-5/8 inch): 4200 mm (12 feet).*
      - (4) *102 mm (4 inch): 4300 mm (13 feet).*
      - (5) *152 mm (6 inch): 5500 mm (16 feet).*
    - c. *Type 20:*
      - (1) *41 mm (1-5/8 inch): 3000 mm (10 feet).*
      - (2) *63 mm (2-1/2 inch): 3500 mm (11 feet).*
      - (3) *92 mm (3-5/8 inch): 4500 mm (15 feet).*
      - (4) *102 mm (4 inch): 4700 mm (15 feet).*
      - (5) *152 mm (6 inch): 6000 mm (19 feet).*

None of these solutions is as simple as stating thickness, web depth, and spacing, but they will provide greater assurance of getting what you really want. Specifying method will depend on personal preferences.

## Sources; Manufacturer Catalogs from:

AMICO; Birmingham, Alabama.  
Clark Steel Products; Cincinnati, Ohio.  
Dale/Incor; Baltimore, Maryland.

Dietrich; Pittsburgh, Pennsylvania.  
National Gypsum Company; Charlotte, North Carolina  
Unimast; Chicago, Illinois.

Contributed by: Scott Sider, CCS