LIGHTWEIGHT STEEL FRAMING MEMBER SECTION TABLES

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Prepared for: Canadian Sheet Steel Building Institute

Prepared by: Prof. R.M. Schuster, P.Eng. Distinguished Professor Emeritus, University of Waterloo

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CSSBI is Canada's foremost authority on sheet steel, its products, and its many applications. They are an industry association responsible for the development and dissemination of industry standards. A source for technical information and resources, they provide expert guidance to the general public and sheet steel manufacturers alike.

Canadian Sheet Steel Building Institute • www.cssbi.ca • info@cssbi.ca • (519) 650-1285

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GENERAL NOTES

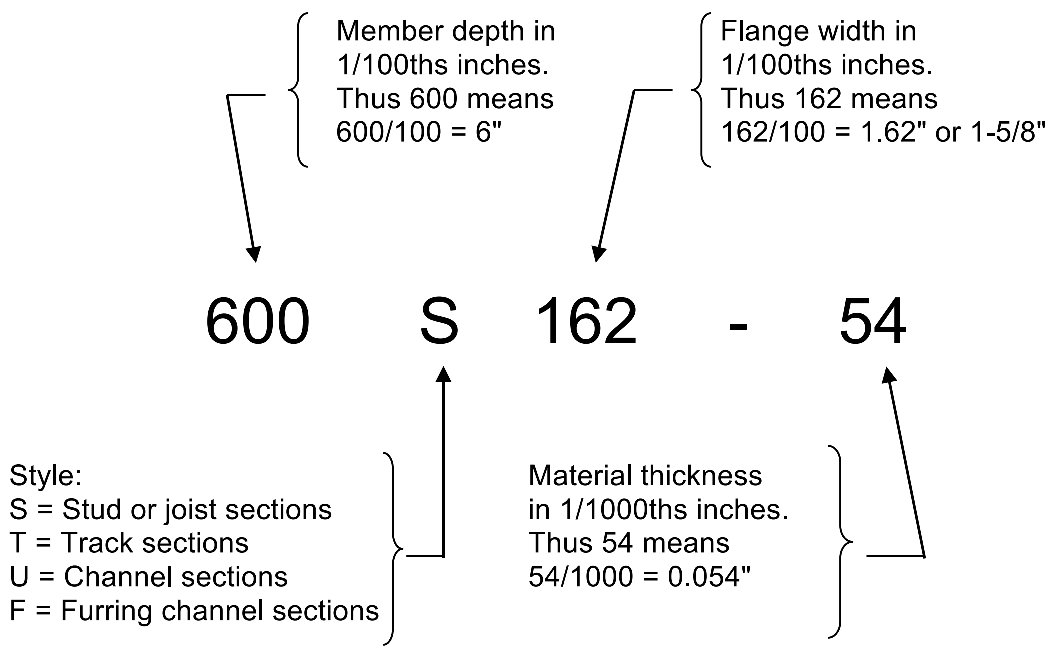
1. INTRODUCTION

The technical data in this publication is intended as an aid to the design professional and should not be used to replace the judgement of a qualified Engineer or Architect.

2. PRODUCT DESIGNATOR

Lightweight steel framing manufacturers in Canada use a common designator method for identifying their products. The designator is a four-part code that identifies depth, flange width, member type and material thickness. This designator (based on Imperial units) is used for both SI metric and Imperial units.

Example: 600S162-54



3. MANUFACTURER CERTIFICATION AND PRODUCT MARKING

3.1 **Lightweight steel framing manufacturers who are members of the CSSBI and adhere to the *CSSBI Manufacturer Certification Requirements for Cold Formed Steel Framing Members* are the only companies that have authorization from the CSSBI to utilize these tables.**

Under the *CSSBI Manufacturer Certification Program*, a participating manufacturer certifies that the designated structural and non-structural cold formed steel (CFS) framing members it produces meet or exceed the relevant ASTM International (ASTM), Canadian Standards Association (CSA) and American Iron and Steel Institute (AISI) standard requirements. The manufacturer's products are validated through an independent 3rd party review of the products and production practices, by appropriate testing and inspection.

3.2 **Marking:**

Individual products shall have a legible label, stencil, or embossment on the member with the following minimum information:

(a) Initials “CSSBI”;
(b) Manufacturer’s identification (2 or 3 letters);
(c) Designation steel thickness (in mils) exclusive of protective coatings; and,
(d) A reference number identifying the source coil.

Example: “CSSBI-XYZ-33 ABCD” would be a 33 mil thick product manufactured by XYZ company who is a CSSBI Manufacturer Member from a coil that can be traced through the reference number “ABCD”.

Additional information may also be included at the discretion of the manufacturer.

4. SECTION GEOMETRIES

4.1 Section geometries are identified by the product designator method described in Section 2.

4.2 Stud, joist, track and U-channel members shall be cold formed to shape from sheet steel with a minimum base steel thickness and inside bend radius as follows:

Designation Thickness (mil)	Minimum Base Steel Thickness (in.)	Base Steel Design Thickness (in.)	Inside Bend Radius (in.)
18	0.0179	0.0188	0.0843
33	0.0329	0.0346	0.0764
43	0.0428	0.0451	0.0712
54	0.0538	0.0566	0.0849
68	0.0677	0.0713	0.1069
97	0.0966	0.1017	0.1525

4.3 Stud and joist lip lengths based on the flange width are as follows:

Section	Flange Width (in.)	Lip Length (in.)
S125	1.250	0.1875
S162	1.625	0.500
S200	2.000	0.625
S250	2.500	0.625
S300	3.000	0.625

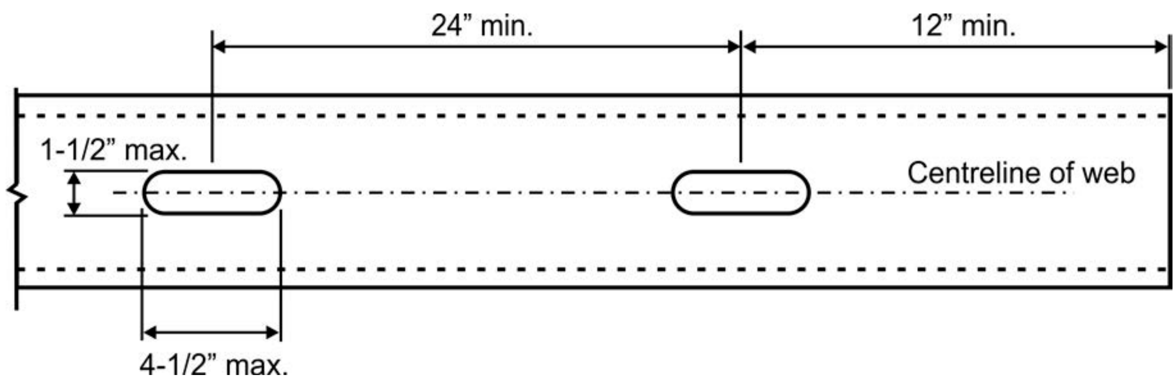
5. SECTION PROPERTIES

5.1 Structural properties are based on Limit States Design (LSD) of the CSA Standard S136-16, *North American Specification for the Design of Cold-Formed Steel Structural Members*, 2016 edition (S136-16).

5.2 Steel shall conform to the requirements of S136-16, AISI S220-15 *North American Standard for Cold-Formed Steel Framing - Nonstructural Members* and AISI S240-15 *North American Standard for Cold-Formed Steel Structural Framing.* Products with a design thicknesses less than or equal to 0.0451" shall have a minimum yield strength of 33 ksi and products with a design thicknesses equal to or greater than 0.0566" shall have a minimum yield strength of 50 ksi.

5.3 Section properties are computed for the base steel design thicknesses (exclusive of coating) shown in the tables.

5.4 When provided, factory punchouts shall be located along the centreline of the webs of the members and shall have a minimum centre-to-centre spacing of 24". Punchouts for members greater than 2.5" deep are a maximum of 1.5" wide by 4.5" in length. Any configuration or combination of holes that fit within the punchout width and length limitations stated above shall be permitted; other punchout configurations and locations not in compliance with the stated limitations must be approved by a design professional.



5.5 Increase in yield strength from cold work of forming has been included whenever applicable.

5.6 The effective moment of inertia for deflection, I_{xd}, is based on local buckling at an assumed specified live load stress of $0.6F_y$. This moment of inertia is only appropriate for checking serviceability limit states.

6. SYMBOLS

Gross Properties

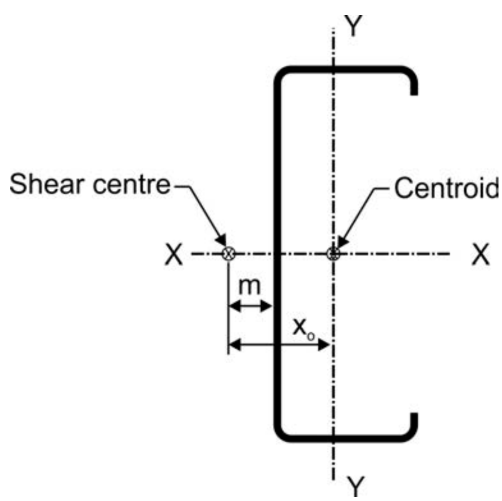
I_x Moment of inertia about x-axis
I_y Moment of inertia about y-axis
r_x Radius of gyration about x-axis
r_y Radius of gyration about y-axis
V_{rg} Factored shear resistance along y-axis of unperforated section

Effective Properties

I_{xd} Moment of inertia about x-axis for deflection calculations
M_{rx} Factored moment resistance for track, U-channel and furring channel sections based on local buckling
M_{rxDB} Factored moment resistance about x-axis based on distortional buckling, assuming $K_\phi = 0$
M_{rxLB} Factored moment resistance about x-axis based on local buckling
M_{ryDB} Factored moment resistance about y-axis based on distortional buckling with lip in compression
M_{ryLB} Factored moment resistance about y-axis based on local buckling with web/lip in compression
S_{xe} Effective section modulus about x-axis
V_{rn} Factored shear resistance along y-axis of perforated section

Torsional and other Properties

β $1 - (x_o/r_o)^2$
C_w Torsional warping constant
J Saint-Venant torsion constant. The values shown in the tables have been multiplied by 1,000. To obtain the actual values, divide table values by 1,000
L_u Limiting unbraced length below which lateral-torsional buckling is not considered
m Distance from shear centre to mid-plane of web
r_o Polar radius of gyration about shear centre
x_o Distance from shear centre to centroid along principle x-axis



Web Depth to Thickness Ratio (h/t)

Designation Thickness (mil)	**18**		**33**		**43**		**54**		**68**		**97**	
Design Thickness (in.)	**0.0188**		**0.0346**		**0.0451**		**0.0566**		**0.0713**		**0.1017**	
Section Depth (in.)	h(in.)	h/t	h(in.)	h/t	h(in.)	h/t	h(in.)	h/t	h(in.)	h/t	h(in.)	h/t
1.625	1.42	75.5										
2.50	2.29	122										
3.625	3.42	182	3.40	98.3	3.39	75.2	3.34	59.0	3.27	45.8	3.12	30.6
4	3.79	202[1]	3.78	109	3.77	83.5	3.72	65.7	3.64	51.1	3.49	34.3
6	5.79	*	5.78	167	5.77	128	5.72	101	5.64	79.2	5.49	54.0
8			7.78	225 [1]	7.77	172	7.72	136	7.64	107	7.49	73.7
10			9.78	*	9.77	217 [1]	9.72	172	9.64	135	9.49	93.3
12			11.8	*	11.8	*	11.7	207 [1]	11.6	163	11.5	113
14			13.8	*	13.8	*	13.7	242 [1]	13.6	191	13.5	133

[1] h/t exceeds 200; * h/t exceeds 260

7. DESIGN EXAMPLES

7.1 LOAD BEARING WALL STUDS – Concentric load only

Given:

Specified (unfactored) Loads: Axial live load (L) = 4.8 kips/stud
Axial dead load (D) = 2.0 kips/stud

Stud height = 14’-0”
Stud spacing = 16” o.c.
Assume studs are braced by bridging only
Select a stud section

Solution:

Factored load combination = 1.25D + 1.5L
C_f = 1.25(2.0) + 1.5(4.8) = *9.70 kips/stud*

Try 600S162-68 studs at 16” o.c.

From Combined Axial and Lateral Load table, the limiting factored compressive resistance for 0 psf factored lateral load
C_r = *10.4 kips/stud*
Since C_r = *10.4 kips/stud* > C_f = *9.70 kips/stud* ∴ **OK**

Conclusion:

Use ***600S162-68*** section spaced at 16” o.c. with 3 bridging lines arranged so that the maximum spacing does not exceed 48” o.c.

7.2 LOAD BEARING WALL STUDS – Combined loading

Given:

Specified (unfactored) Loads: Axial live load (L) = 3.6 kips/stud
Axial dead load (D) = 1.8 kips/stud
Wind load (W) = 25 psf

Stud height = 10'-0"
Stud spacing = 16" o.c.
Deflection limit = L/600
Assume studs are braced by bridging only
Select a stud section

Solution:

Try 600S162-54 studs at 16" o.c.

1) Dead load only

Factored load combination = 1.4D
C_f (factored axial load) = 1.4D = 1.4(1.8) = *2.52 kips/stud*
From Combined Axial and Lateral Load table, the limiting factored compressive resistance for 0 psf factored lateral load
C_r = *8.24 kips/stud*
Since C_r = 8.24 kips/stud > C_f = *2.52 kips/stud* ∴ **OK**

2) Dead + Wind + Live Load

a) Factored load combination # 1 = 1.25D + 1.5L + 0.4W
W_f (factored wind load) = 0.4W
= 0.4(25) = *10.0 psf*
C_f (factored axial load) = 1.25D + 1.5L
= 1.25(1.8) + 1.5(3.6)
= *7.65 kips/stud*

From Combined Axial and Lateral Load table, the limiting factored compressive resistance for 10 psf factored lateral load

C_r = *7.67 kips/stud*
Since C_r = *7.67 kips/stud* > C_f = *7.65 kips/stud* ∴ **OK**

b) Factored load combination # 2 = 1.25D + 0.5L + 1.4W
W_f (factored wind load) = 1.4W
= 1.4(25) = *35.0 psf*
C_f (factored axial load) = 1.25D + 0.5L
= 1.25(1.8) + 0.5(3.6)
= *4.05 kips/stud*

From Combined Axial and Lateral Load table, the limiting factored compressive resistance for 30 and 40 psf factored lateral load
C_r = *6.57 kips/stud* (for 30 psf)
C_r = *6.04 kips/stud* (for 40 psf)

By interpolation for 35 psf, C_r = *6.31* kips/stud > *4.05* kips/stud ∴ **OK**

3) Web crippling check

From Single Span Curtain Wall Limiting Heights table for a 25 psf specified wind load, web crippling does not control.

4) Deflection check (L/600)

From Single Span Curtain Wall Limiting Heights table, the limiting stud height for a specified wind load of 25 psf and a deflection limit of L/600 is 14'-4".

Since 14'-4" > 10'-0" ∴**OK**

Conclusion:

Use ***600S162-54*** section spaced at 16" o.c. with 2 bridging lines arranged so that the maximum spacing does not exceed 48" o.c.

7.3 FLOOR JOIST – Single span

Given:

Specified (unfactored) Loads:	Live load (L)	= 40 psf
	Dead load (D)	= 15 psf

Single span length = 16'-0"
Joist spacing = 16" o.c.
Deflection limit = L/360
Select a joist section

Solution:

Strength

Factored load combination = 1.25D + 1.5L
P_f = 1.25(15) + 1.5(40) = 78.8 psf

Try 800S162-54 joists at 16" o.c.

From Floor Joist Load table, the factored uniformly distributed single span
Strength Resistance = 91 psf
Since 91 psf > 78.8 psf ∴**OK**

Deflection

From Floor Joist Load table, the specified uniformly distributed single span L/360 deflection load is 44 psf
Since 44 psf > 40 psf ∴**OK**

Conclusion:

Use ***800S162-54*** section spaced at 16" o.c. Web stiffeners are not required based on an end bearing length of 3.5". If end bearing length is less than 3.5", web crippling must be checked.

7.4 CURTAIN WALL – Single span

Given:

Specified (unfactored) wind load = 30 psf
Stud height = 12'-0"
Stud spacing = 24" o.c.
Deflection limit = L/360
Select a stud section

Solution:

Try 600S162-43 studs at 24" o.c.

From Single Span Curtain Wall Limiting Heights table under 30 psf specified wind load, the limiting stud height is 12'-4"
Since 12'-4" > 12'-0" ∴ **OK**

Conclusion:
Use ***600S162-43*** section spaced at 24" o.c. Web stiffeners are not required.

7.5 CURTAIN WALL – Double span

Given:
Specified (unfactored) wind load = 50 psf
Stud height = 10'-0"
Stud spacing = 24" o.c.
Deflection limit = L/360
Select a stud section

Solution:
Try 800S162-43 studs at 24" o.c.

From Double Span Curtain Wall Limiting Heights table under 50 psf specified wind load, the limiting stud height is 10'-3"a
Since 10'-3" > 10'-0" ∴ **OK**

Conclusion:
Use ***800S162-43*** section spaced at 24" o.c. Web stiffeners are required at end and interior supports.

7.6 USE OF WEB CRIPPLING DATA TABLE – Single Web Member

Given:
Single web C-section
Depth = 8 in.
Designation thickness = 54 mil; Base Design Thickness, t = 0.0566 in.
Bearing length, N = 3 in.
Determine the factored end-one-flange (EOF) web crippling resistance.

Solution:
From the Factored Web Crippling Data table for Single Web Members

P_{eo1} = 305 lb; P_{eo2} = 107 lb

$$P_{rEOF} = P_{eo1} + P_{eo2}\sqrt{\frac{N}{t}} = 305 + 107\sqrt{\frac{3}{0.0566}} = \underline{1{,}084\,\text{lb}}$$

Conclusion:
The factored end-one-flange (EOF) web crippling resistance, P_{rEOF} = ***1,084 lb***.