LIGHTWEIGHT STEEL FRAMING
MEMBER SECTION TABLES

58-2018 June 2018

Prepared for: Canadian Sheet Steel Building Institute

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

Preface:

The material here in presented has been prepared for the general information of the reader. While the material is believed to be technically correct and in accordance with recognized good practice at the time of publication it should not be used without first securing competent advice with respect to its suitability for any specific application. Neither Bailey Metal Products Limited, the ***Canadian Sheet Steel Building Institute***, nor Prof. Schuster warrant or assume any liability for the suitability of the material for any general or particular application.

Founded in 1950, Bailey Metal Products Limited is a family owned and operated Canadian company. The Bailey Group of Companies is recognized as the industry leader, offering building solutions to both the commercial and residential construction markets. Our products include Structural Lightweight Steel Framing (LSF), Non-Loadbearing Steel Framing, Steel Framing Accessories, Connectors & Clips, COMSLAB Steel Composite Concrete Floor, Drywall Trims and Accessories.

Our team stands ready to provide products and technical support that meet your building team's needs. We would love to collaborate with you to satisfy your sound, structural or other performance requirements.

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

TABLE OF CONTENTS

GENERAL NOTES

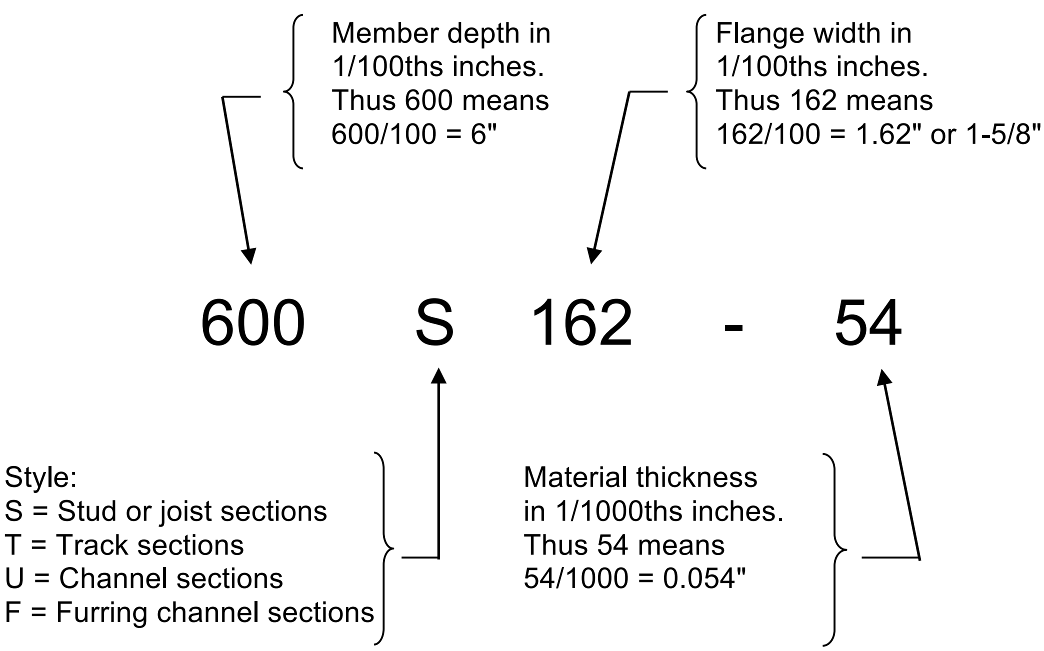
1. INTRODUCTION

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 require-ments. The manufacturer's products are validated through an independent 3rd party re-view 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 bridging 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 (mm)	Base Steel Design Thickness (mm)	Inside Bend Radius (mm)
18	0.455	0.478	2.141
33	0.836	0.879	1.941
43	1.087	1.146	1.808
54	1.367	1.438	2.156
68	1.720	1.811	2.715
97	2.454	2.583	3.874

4.3 Stud and joist lip lengths are as follows:

Section	Flange Width (mm)	Lip Length (mm)
S125	31.8	4.76
S162	41.3	12.7
S200	50.8	15.9
S250	63.5	15.9
S300	76.2	15.9

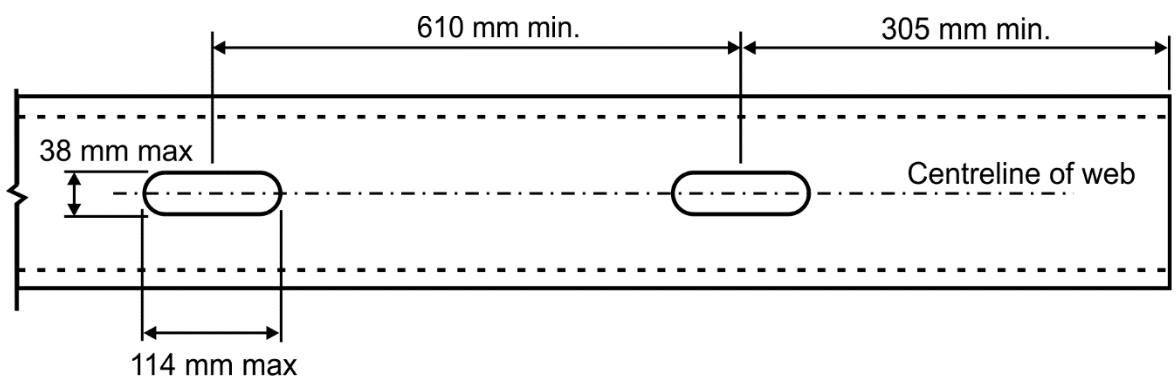
5. SECTION PROPERTIES

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 1.146 mm shall have a minimum yield strength of 230 MPa and products with a design thicknesses equal to or greater than 1.438 mm shall have a minimum yield strength of 345 MPa.

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 610 mm. Punchouts for members greater than 64 mm deep are a maximum of 38 mm wide by 114 mm 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

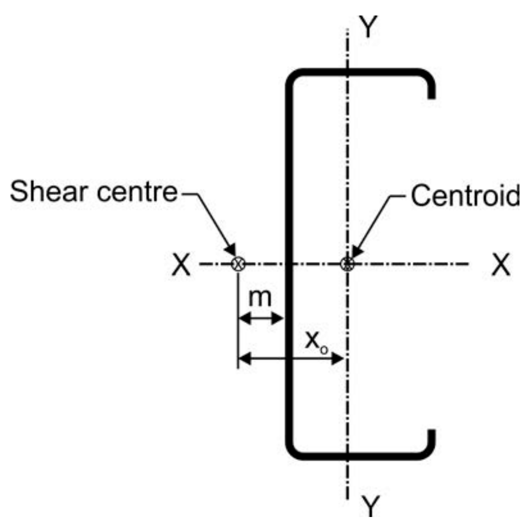
J Saint-Venant torsion constant.

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	
Base Design Thickness (mm)	0.478		0.879		1.146		1.438		1.811		2.583	
Section Depth (mm)	h(mm)	h/t	h(mm)	h/t	h(mm)	h/t	h(mm)	h/t	h(mm)	h/t	h(mm)	h/t
41.3	36.1	75.5										
63.5	58.2	122										
92.1	86.9	182	86.4	98.3	86.1	75.2	84.8	59.0	83.1	45.8	79.2	30.6
102	96.3	202[1]	96.0	109	95.8	83.5	94.5	65.7	92.5	51.1	88.6	34.3
152	147	*	147	167	147	128	145	101	143	79.2	139	54.0
203			198	225[1]	197	172	196	136	194	107	190	73.7
254			248	*	248	217[1]	247	172	245	135	241	93.3
305			299	*	299	*	298	207[1]	296	163	292	113
356			350	*	350	*	348	242[1]	346	191	343	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) = 20.5 kN/stud
Axial dead load (D) = 9.0 kN/stud

Stud height = 4.4 m
Stud spacing = 406 mm 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(9.0) + 1.5(20.5) = *42.0 kN/stud*

Try 600S162-68 studs at 406 mm o.c.

From Combined Axial and Lateral Load table, the limiting factored compressive resistance for 0 kPa factored lateral load
C_r = *45.5 kN/stud*
Since C_r = *45.5 kN/stud* > C_f = *42.0 kN/stud* ∴ **OK**

Conclusion:

Use ***600S162-68*** section spaced at 406 mm o.c. with 3 bridging lines arranged so that the maximum spacing does not exceed 1.22 m o.c.

7.2 LOAD BEARING WALL STUDS – Combined loading

Given:

Specified (unfactored) Loads: Axial live load (L) = 15.0 kN/stud
Axial dead load (D) = 8.0 kN/stud
Wind load (W) = 1.25 kPa

Stud height = 3.2 m
Stud spacing = 406 mm o.c.
Deflection limit = L/600
Assume studs are braced by bridging only
Select a stud section

Solution:

Try 600S162-54 studs at 406 mm o.c.

1) Dead load only

Factored load combination = 1.4D
C_f (factored axial load) = 1.4D = 1.4(8.0) = *11.2 kN/stud*
From Combined Axial and Lateral Load table, the limiting factored compressive resistance for 0 kPa factored lateral load
C_r = *36.6 kN/stud*
Since C_r = *36.6 kN/stud* > C_f = *11.2 kN/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(1.25) = *0.5 kPa*
C_f (factored axial load) = 1.25D + 1.5L
= 1.25(8.0) + 1.5(15.0)
= *32.5 kN/stud*

From Combined Axial and Lateral Load table, the limiting factored compressive resistance for 0.50 kPa factored lateral load
C_r = *33.7 kN/stud*
Since C_r = *33.7 kN/stud* > C_f = *32.5 kN/stud* ∴ **OK**

b) Factored load combination # 2 = 1.25D + 0.5L + 1.4W
W_f (factored wind load) = 1.4W
= 1.4(1.25) = *1.75 kPa*
C_f (factored axial load) = 1.25D + 0.5L
= 1.25(8.0) + 0.5(15.0)
= *17.5 kN/stud*

From Combined Axial and Lateral Load table, the limiting factored compressive resistance for 1.5 kPa and 2.0 kPa factored lateral load
C_r = *28.0 kN/stud* (for 1.5 kPa)
C_r = *25.3 kN/stud* (for 2.0 kPa)

By interpolation for 1.75 kPa, C_r = *26.7 kN/stud* > *17.5 kN/stud* ∴ **OK**

3) Web crippling check

From Single Span Curtain Wall Limiting Heights table for a 1.25 kPa 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 1.25 kPa and a deflection limit of L/600 is 4.3 m.
Since 4.3 m > 3.2 m ∴ **OK**

Conclusion:

Use ***600S162-54*** section spaced at 406 mm o.c. with 2 bridging lines arranged so that the maximum spacing does not exceed 1.22 m o.c.

7.3 FLOOR JOIST – Single span

Given:

Specified (unfactored) Loads: Live load (L) = 2.0 kPa
Dead load (D) = 0.70 kPa

Single span length = 4.8 m
Joist spacing = 406 mm o.c.
Deflection limit = L/360
Select a joist section

Solution:

Strength

Factored load combination = 1.25D + 1.5L
P_f = 1.25(0.70) + 1.5(2.0) = 3.88 kPa

Try 800S162-54 joists at 406 mm o.c.

From Floor Joist Load table, the factored uniformly distributed single span Strength Resistance = 4.5 kPa
Since *4.5 kPa* > *3.88 kPa* ∴ **OK**

Deflection

From Floor Joist Load table, the specified uniformly distributed single span L/360 deflection load is 2.2 kPa
Since *2.2 kPa* > *2.0 kPa* ∴ **OK**

Conclusion:

Use ***800S162-54*** section spaced at 406 mm o.c.
Web stiffeners are not required based on an end bearing length of 89 mm. If end bearing length is less than 89 mm, web crippling must be checked.

7.4 CURTAIN WALL – Single span

Given:

Specified (unfactored) wind load = 1.5 kPa
Stud height = 3.5 m
Stud spacing = 610 mm o.c.
Deflection limit = L/360
Select a stud section

Solution:

Try 600S162-43 studs at 610 mm o.c.

From Single Span Curtain Wall Limiting Heights table under 1.5 kPa specified wind load, the limiting stud height is 3.7 m

Since *3.7 m* > *3.5 m* $\therefore$ **OK**

Conclusion:

Use ***600S162-43*** section spaced at 610 mm o.c. Web stiffeners are not required.

7.5 CURTAIN WALL – Double span

Given:

Specified (unfactored) wind load = 2.5 kPa
Stud height = 3 m
Stud spacing = 610 mm o.c.
Deflection limit = L/360
Select a stud section

Solution:

Try 800S162-43 studs at 610 mm o.c.

From Double Span Curtain Wall Limiting Heights table under 2.5 kPa specified wind load, the limiting stud height is 3.1a m

Since *3.1 m* > *3 m* $\therefore$ **OK**

Conclusion:

Use ***800S162-43*** section spaced at 610 mm 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 = 203 mm
Designation thickness = 54 mil; Base Design Thickness, t = 1.438 mm
Bearing length, N = 75 mm
Determine the factored end-one-flange (EOF) web crippling resistance.

Solution:

From the Factored Web Crippling Data table for Single Web Members

P_{eo1} = 1.36 kN; P_{eo2} = 0.48 kN

$$P_{rEOF} = P_{eo1} + P_{eo2}\sqrt{\frac{N}{t}} = 1.36 + 0.48\sqrt{\frac{75}{1.438}} = \underline{4.83\text{kN}}$$

Conclusion:

The factored end-one-flange (EOF) web crippling resistance, P_{rEOF} = ***4.83 kN***