

ICC-ES Evaluation Report

ESR-4062

Reissued February 2024

This report also contains:


- NYCBC Supplement

Subject to renewal February 2025

- FBC Supplement

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<p>DIVISION: 05 00 00—METALS</p> <p>Section: 05 40 00—Cold-Formed Metal Framing</p> <p>Section: 05 41 00—Structural Metal Stud Framing</p> <p>Section: 05 42 00—Cold-Formed Metal Joist Framing</p> <p>DIVISION: 09 00 00—FINISHES</p> <p>Section: 09 22 13—Metal Furring</p> <p>Section: 09 22 16.13—Non-Structural Metal Stud Framing</p>	<p>REPORT HOLDER: WARE INDUSTRIES, INC., dba MARINO\WARE</p>	<p>EVALUATION SUBJECT: COLD-FORMED STEEL FRAMING</p>	
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1.0 EVALUATION SCOPE

Compliance with the following codes:

2021, 2018, 2015 and 2012 [International Building Code® \(IBC\)](#)

Property evaluated:

Structural

2.0 USES

The c-shapes, tracks, and u-channels are used as structural members as defined by the North American Standard for Cold-Formed Steel Structural Framing (AISI S240) and the North American Standard for Cold-Formed Steel Framing – General Provisions (AISI S200), as applicable and may also be used as nonstructural members.

The furring channels are used as nonstructural members as defined by the North American Standard for Cold-Formed Steel Nonstructural Framing (AISI S220).

3.0 DESCRIPTION

3.1 General:

The steel framing described in this report, consisting of structural C-shapes (studs and joists), tracks, furring channels and U-channels, is cold-rolled fabricated from coils of steel. The C-shapes are manufactured with or without web punch-outs; all other framing members (tracks, U-channels and furring hat channels) are

manufactured without web punch-outs. When provided in the structural C-shapes, punch-outs measuring up to 0.75 inch by 2 inches (19 mm by 51 mm) for the 2.5-inch-deep members and either 1.5 inches by 3.25 inches (38 mm by 83 mm) or 1.5 inches by 4 inches (38 mm by 102 mm) for the other sized members are located along the centerline of the webs. The minimum distance between the end of the C-shape and the near edge of the web punch-out is 10 inches (254 mm). The minimum distance between centerlines of punch-outs is 24 inches (610 mm). See [Tables 1, 2, 7, 8](#) and [Figure 1](#) for recognized framing section names, profiles and dimensions. See [Table 9](#) for manufacturing locations.

3.2 Materials:

3.2.1 General: Steel framing members are available in design steel thicknesses ranging from 0.0188 inch to 0.1017 inch (0.478 mm to 2.58 mm), as shown in [Table 3](#), and in the sizes and configurations shown in [Tables 1, 2, 7, 8](#) and [Figure 1](#).

3.2.2 C-shapes and Tracks: C-shapes and tracks are cold-formed from galvanized steel coils conforming to ASTM A653, SS Grade 33 or Grade 50, Class 1; or ASTM A1003, Structural Grade 33, Type H, (ST33H) or Structural Grade 50, Type H (ST50H). The steel has a minimum metallic coating listed for Type H and Type L in Table 1 of ASTM A1003.

3.2.3 U-channels: U-channels are cold-formed from galvanized steel coils conforming to ASTM A653, SS Grade 33; or ASTM A1003, Structural Grade 33, Type H (ST33H), with a minimum metallic coating listed for Type H and Type L in Table 1 of ASTM A1003.

3.2.4 Furring Channels: Furring channels are cold-formed from galvanized steel coils conforming to ASTM A1003, Nonstructural Grade 33 (NS33), with a minimum metallic coating listed for Type NS in Table 1 of ASTM A1003.

4.0 DESIGN AND INSTALLATION

4.1 Design:

The section properties indicated in [Tables 4, 5, 7](#) and [8](#) have been determined in accordance with the North American Specification for the Design of Cold-formed Steel Structural Members (AISI S100). The allowable moments as indicated in [Tables 4, 5, 7](#) and [8](#) are for use with Allowable Strength Design (ASD), and are for flexural members installed with the compression flange continuously braced. For other conditions of compression flange bracing, the allowable moment must be determined in accordance with AISI S100. Allowable concentrated loads and reactions based on web crippling are shown in [Table 6](#). The design of flexural members must address combined bending and web crippling, and combined bending and shear.

4.2 Installation:

The framing members must be installed in accordance with the applicable code, the approved plans and this report. If there is a conflict between the plans submitted for approval and this report, this report governs. The approved plans must be available at the jobsite at all times.

5.0 CONDITIONS OF USE:

The Marino\WARE cold-formed steel framing described in this report complies with, or is a suitable alternative to what is specified in, those codes listed in Section 1.0 of this report, subject to the following conditions:

- 5.1 The framing members are installed in accordance with the applicable code, the approved construction documents and this report.
- 5.2 Minimum uncoated steel thickness of the framing members as delivered to the jobsite is at least 95 percent of the design steel thickness noted in [Table 3](#).
- 5.3 Complete construction documents and calculations verifying compliance with this report must be submitted to the code official for each project. The calculations and construction documents must be prepared and sealed by a registered design professional where required by the statutes of the jurisdiction in which the project is to be constructed.
- 5.4 The framing members are manufactured under a quality control program with inspections by ICC-ES.

6.0 EVIDENCE SUBMITTED

Data in accordance with the [ICC-ES Acceptance Criteria for Cold-formed Steel Framing Members \(AC46\)](#), approved October 2019 (editorially revised December 2020).

7.0 IDENTIFICATION

- 7.1 The ICC-ES mark of conformity, electronic labeling, or the evaluation report number (ICC-ES ESR-4062) along with the name, registered trademark, or registered logo of the report holder [and/or listee] must be included in the product label.
- 7.2 In addition, at a spacing not exceeding 96 inches (2440 mm) on center, each framing member (other than the furring channel) is labeled with the name of the manufacturer (Marino\WARE) or initials (MW); the member designation as provided in [Tables 1, 2 and 8](#); the evaluation report number (ICC-ES ESR-4062); the minimum uncoated steel thickness in decimal inches; the minimum specified yield strength; and the coating designation .

At a spacing not exceeding 96 inches (2440 mm) on center, each furring channel is labeled with the name of the manufacturer (Marino\WARE) or initials (MW); the member designation as provided in [Table 7](#); the evaluation report number (ICC-ES ESR-4062); the minimum uncoated steel thickness in decimal inches; the coating designation if other than G40; and the designation "NS".

- 7.3 The report holder's contact information is the following:

WARE INDUSTRIES, INC., dba MARINO\WARE
400 METUCHEN ROAD
SOUTH PLAINFIELD, NEW JERSEY 07080
(908) 757-9000

www.marinoware.com
sales@marinoware.com

TABLE 1—C-SHAPES

MEMBER	WEB ² (in)	FLANGE (in)	LIP (in)	THICKNESS DESIGNATION ³ (mils)	MEMBER	WEB ² (in)	FLANGE (in)	LIP (in)	THICKNESS DESIGNATION ³ (mils)
250S137-33	2 1/2	1 3/8	3/8	33	400S250-33	4	2 1/2	5/8	33
250S137-43	2 1/2	1 3/8	3/8	43	400S250-43	4	2 1/2	5/8	43
250S137-54	2 1/2	1 3/8	3/8	54	400S250-54	4	2 1/2	5/8	54
250S137-68	2 1/2	1 3/8	3/8	68	400S250-68	4	2 1/2	5/8	68
250S137-97	2 1/2	1 3/8	3/8	97	400S250-97	4	2 1/2	5/8	97
250S162-33	2 1/2	1 5/8	1/2	33	400S250-118	4	2 1/2	5/8	118
250S162-43	2 1/2	1 5/8	1/2	43					
250S162-54	2 1/2	1 5/8	1/2	54	600S137-33	6	1 3/8	3/8	33
250S162-68	2 1/2	1 5/8	1/2	68	600S137-43	6	1 3/8	3/8	43
250S162-97	2 1/2	1 5/8	1/2	97	600S137-54	6	1 3/8	3/8	54
250S200-33	2 1/2	2	5/8	33	600S137-68	6	1 3/8	3/8	68
250S200-43	2 1/2	2	5/8	43	600S137-97	6	1 3/8	3/8	97
250S200-54	2 1/2	2	5/8	54	600S162-33	6	1 5/8	1/2	33
250S200-68	2 1/2	2	5/8	68	600S162-43	6	1 5/8	1/2	43
250S200-97	2 1/2	2	5/8	97	600S162-54	6	1 5/8	1/2	54
250S250-33	2 1/2	2 1/2	5/8	33	600S162-68	6	1 5/8	1/2	68
250S250-43	2 1/2	2 1/2	5/8	43	600S162-97	6	1 5/8	1/2	97
250S250-54	2 1/2	2 1/2	5/8	54	600S162-118	6	1 5/8	1/2	118
250S250-68	2 1/2	2 1/2	5/8	68	600S200-33	6	2	5/8	33
250S250-97	2 1/2	2 1/2	5/8	97	600S200-43	6	2	5/8	43
					600S200-54	6	2	5/8	54
					600S200-68	6	2	5/8	68
362S137-33	3 5/8	1 3/8	3/8	33	600S200-97	6	2	5/8	97
362S137-43	3 5/8	1 3/8	3/8	43	600S200-118	6	2	5/8	118
362S137-54	3 5/8	1 3/8	3/8	54	600S250-43	6	2 1/2	5/8	43
362S137-68	3 5/8	1 3/8	3/8	68	600S250-54	6	2 1/2	5/8	54
362S137-97	3 5/8	1 3/8	3/8	97	600S250-68	6	2 1/2	5/8	68
362S162-33	3 5/8	1 5/8	1/2	33	600S250-97	6	2 1/2	5/8	97
362S162-43	3 5/8	1 5/8	1/2	43	600S250-118	6	2 1/2	5/8	118
362S162-54	3 5/8	1 5/8	1/2	54	600S300-54	6	3	5/8	54
362S162-68	3 5/8	1 5/8	1/2	68	600S300-68	6	3	5/8	68
362S162-97	3 5/8	1 5/8	1/2	97	600S300-97	6	3	5/8	97
362S162-118	3 5/8	1 5/8	1/2	118	600S300-118	6	3	5/8	118
362S200-33	3 5/8	2	5/8	33					
362S200-43	3 5/8	2	5/8	43	800S137-33 ¹	8	1 3/8	3/8	33
362S200-54	3 5/8	2	5/8	54	800S137-43	8	1 3/8	3/8	43
362S200-68	3 5/8	2	5/8	68	800S137-54	8	1 3/8	3/8	54
362S200-97	3 5/8	2	5/8	97	800S137-68	8	1 3/8	3/8	68
362S200-118	3 5/8	2	5/8	118	800S137-97	8	1 3/8	3/8	97
362S250-43	3 5/8	2 1/2	5/8	43	800S162-33 ¹	8	1 5/8	1/2	33
362S250-54	3 5/8	2 1/2	5/8	54	800S162-43	8	1 5/8	1/2	43
362S250-68	3 5/8	2 1/2	5/8	68	800S162-54	8	1 5/8	1/2	54
362S250-97	3 5/8	2 1/2	5/8	97	800S162-68	8	1 5/8	1/2	68
362S250-118	3 5/8	2 1/2	5/8	118	800S162-97	8	1 5/8	1/2	97
					800S162-118	8	1 5/8	1/2	118
400S137-33	4	1 3/8	3/8	33	800S200-33 ¹	8	2	5/8	33
400S137-43	4	1 3/8	3/8	43	800S200-43	8	2	5/8	43
400S137-54	4	1 3/8	3/8	54	800S200-54	8	2	5/8	54
400S137-68	4	1 3/8	3/8	68	800S200-68	8	2	5/8	68
400S162-33	4	1 5/8	1/2	33	800S200-97	8	2	5/8	97
400S162-43	4	1 5/8	1/2	43	800S200-118	8	2	5/8	118
400S162-54	4	1 5/8	1/2	54	800S250-43	8	2 1/2	5/8	43
400S162-68	4	1 5/8	1/2	68	800S250-54	8	2 1/2	5/8	54
400S162-97	4	1 5/8	1/2	97	800S250-68	8	2 1/2	5/8	68
400S162-118	4	1 5/8	1/2	118	800S250-97	8	2 1/2	5/8	97
400S200-33	4	2	5/8	33	800S250-118	8	2 1/2	5/8	118
400S200-43	4	2	5/8	43	800S300-54	8	3	5/8	54
400S200-54	4	2	5/8	54	800S300-68	8	3	5/8	68
400S200-68	4	2	5/8	68	800S300-97	8	3	5/8	97
400S200-97	4	2	5/8	97	800S300-118	8	3	5/8	118
400S200-118	4	2	5/8	118					

For SI: 1 inch = 25.4 mm

Table 1 continued on next page.

TABLE 1—C-SHAPES (Continued)

MEMBER	WEB ² (in)	FLANGE (in)	LIP (in)	THICKNESS DESIGNATION ³ (mils)	MEMBER	WEB ² (in)	FLANGE (in)	LIP (in)	THICKNESS DESIGNATION ³ (mils)
1000S162-43 ¹	10	1 ⁵ / ₈	1/2	43	1400S162-54 ¹	14	1 ⁵ / ₈	1/2	54
1000S162-54	10	1 ⁵ / ₈	1/2	54	1400S162-68	14	1 ⁵ / ₈	1/2	68
1000S162-68	10	1 ⁵ / ₈	1/2	68	1400S162-97	14	1 ⁵ / ₈	1/2	97
1000S162-97	10	1 ⁵ / ₈	1/2	97	1400S162-118	14	1 ⁵ / ₈	1/2	118
1000S162-118	10	1 ⁵ / ₈	1/2	118	1400S200-54 ¹	14	2	5/8	54
1000S200-43 ¹	10	2	5/8	43	1400S200-68	14	2	5/8	68
1000S200-54	10	2	5/8	54	1400S200-97	14	2	5/8	97
1000S200-68	10	2	5/8	68	1400S200-118	14	2	5/8	118
1000S200-97	10	2	5/8	97	1400S250-54 ¹	14	2 ¹ / ₂	5/8	54
1000S200-118	10	2	5/8	118	1400S250-68	14	2 ¹ / ₂	5/8	68
1000S250-43 ¹	10	2	5/8	43	1400S250-97	14	2 ¹ / ₂	5/8	97
1000S250-54	10	2	5/8	54	1400S250-118	14	2 ¹ / ₂	5/8	118
1000S250-68	10	2	5/8	68	1400S300-54 ¹	14	3	5/8	54
1000S250-97	10	2	5/8	97	1400S300-68	14	3	5/8	68
1000S250-118	10	2	5/8	118	1400S300-97	14	3	5/8	97
1000S300-54	10	3	5/8	54	1400S300-118	14	3	5/8	118
1000S300-68	10	3	5/8	68	1400S350-54 ¹	14	3 ¹ / ₂	1	54
1000S300-97	10	3	5/8	97	1400S350-68	14	3 ¹ / ₂	1	68
1000S300-118	10	3	5/8	118	1400S350-97	14	3 ¹ / ₂	1	97
1000S350-54	10	3 ¹ / ₂	1	54	1400S350-118	14	3 ¹ / ₂	1	118
1000S350-68	10	3 ¹ / ₂	1	68					
1000S350-97	10	3 ¹ / ₂	1	97	1600S162-68 ¹	16	1 ⁵ / ₈	1/2	68
1000S350-118	10	3 ¹ / ₂	1	118	1600S162-97	16	1 ⁵ / ₈	1/2	97
					1600S162-118	16	1 ⁵ / ₈	1/2	118
1200S162-43 ¹	12	1 ⁵ / ₈	1/2	43	1600S200-68 ¹	16	2	5/8	68
1200S162-54 ¹	12	1 ⁵ / ₈	1/2	54	1600S200-97	16	2	5/8	97
1200S162-68	12	1 ⁵ / ₈	1/2	68	1600S200-118	16	2	5/8	118
1200S162-97	12	1 ⁵ / ₈	1/2	97	1600S250-68 ¹	16	2 ¹ / ₂	5/8	68
1200S162-118	12	1 ⁵ / ₈	1/2	118	1600S250-97	16	2 ¹ / ₂	5/8	97
1200S200-54 ¹	12	2	5/8	54	1600S250-118	16	2 ¹ / ₂	5/8	118
1200S200-68	12	2	5/8	68	1600S300-68 ¹	16	3	5/8	68
1200S200-97	12	2	5/8	97	1600S300-97	16	3	5/8	97
1200S200-118	12	2	5/8	118	1600S300-118	16	3	5/8	118
1200S250-54 ¹	12	2 ¹ / ₂	5/8	54	1600S350-68 ¹	16	3 ¹ / ₂	1	68
1200S250-68	12	2 ¹ / ₂	5/8	68	1600S350-97	16	3 ¹ / ₂	1	97
1200S250-97	12	2 ¹ / ₂	5/8	97	1600S350-118	16	3 ¹ / ₂	1	118
1200S250-118	12	2 ¹ / ₂	5/8	118					
1200S300-54 ¹	12	3	5/8	54					
1200S300-68	12	3	5/8	68					
1200S300-97	12	3	5/8	97					
1200S300-118	12	3	5/8	118					
1200S350-54 ¹	12	3 ¹ / ₂	1	54					
1200S350-68	12	3 ¹ / ₂	1	68					
1200S350-97	12	3 ¹ / ₂	1	97					
1200S350-118	12	3 ¹ / ₂	1	118					

For SI: 1 inch = 25.4 mm

¹ Webslenderness ratio (h/t) exceeds 200. Web stiffeners designed in accordance with AISI S100 are required at all support points and concentrated loads. Punch-outs/holes in the web are outside the scope of this report.

² Web height measured from outside face to outside face of flanges.

³ See Table 3 for design thickness, minimum thickness, and inside bend radius

TABLE 2—TRACKS

MEMBER	WEB ² (in)	FLANGE (in)	THICKNESS DESIGNATION ³ (mils)	MEMBER	WEB ² (in)	FLANGE (in)	THICKNESS DESIGNATION ³ (mils)	MEMBER	WEB ² (in)	FLANGE (in)	THICKNESS DESIGNATION ³ (mils)
250T125-33	2½	1¼	33	400T300-33	4	3	33	1000T125-97	10	1¼	97
250T125-43	2½	1¼	43	400T300-43	4	3	43	1000T125-118	10	1¼	118
250T125-54	2½	1¼	54	400T300-54	4	3	54	1000T200-43 ¹	10	2	43
250T125-68	2½	1¼	68	400T300-68	4	3	68	1000T200-54	10	2	54
250T125-97	2½	1¼	97	400T300-97	4	3	97	1000T200-68	10	2	68
250T200-33	2½	2	33	400T300-118	4	3	118	1000T200-97	10	2	97
250T200-43	2½	2	43					1000T200-118	10	2	118
250T200-54	2½	2	54	600T125-33	6	1¼	33	1000T300-43 ¹	10	3	43
250T200-68	2½	2	68	600T125-43	6	1¼	43	1000T300-54	10	3	54
250T200-97	2½	2	97	600T125-54	6	1¼	54	1000T300-68	10	3	68
250T300-33	2½	3	33	600T125-68	6	1¼	68	1000T300-97	10	3	97
250T300-43	2½	3	43	600T125-97	6	1¼	97	1000T300-118	10	3	118
250T300-54	2½	3	54	600T125-118	6	1¼	118				
250T300-68	2½	3	68	600T200-33	6	2	33	1200T125-54 ¹	12	1¼	54
250T300-97	2½	3	97	600T200-43	6	2	43	1200T125-68	12	1¼	68
				600T200-54	6	2	54	1200T125-97	12	1¼	97
362T125-33	3⅝	1¼	33	600T200-68	6	2	68	1200T125-118	12	1¼	118
362T125-43	3⅝	1¼	43	600T200-97	6	2	97	1200T200-54 ¹	12	2	54
362T125-54	3⅝	1¼	54	600T200-118	6	2	118	1200T200-68	12	2	68
362T125-68	3⅝	1¼	68	600T300-33	6	3	33	1200T200-97	12	2	97
362T125-97	3⅝	1¼	97	600T300-43	6	3	43	1200T200-118	12	2	118
362T125-118	3⅝	1¼	118	600T300-54	6	3	54	1200T300-54 ¹	12	3	54
362T200-33	3⅝	2	33	600T300-68	6	3	68	1200T300-68	12	3	68
362T200-43	3⅝	2	43	600T300-97	6	3	97	1200T300-97	12	3	97
362T200-54	3⅝	2	54	600T300-118	6	3	118	1200T300-118	12	3	118
362T200-68	3⅝	2	68								
362T200-97	3⅝	2	97	800T125-33 ¹	8	1¼	33	1400T125-54 ¹	14	1¼	54
362T200-118	3⅝	2	118	800T125-43	8	1¼	43	1400T125-68	14	1¼	68
362T300-33	3⅝	3	33	800T125-54	8	1¼	54	1400T125-97	14	1¼	97
362T300-43	3⅝	3	43	800T125-68	8	1¼	68	1400T125-118	14	1¼	118
362T300-54	3⅝	3	54	800T125-97	8	1¼	97	1400T200-54 ¹	14	2	54
362T300-68	3⅝	3	68	800T125-118	8	1¼	118	1400T200-68	14	2	68
362T300-97	3⅝	3	97	800T200-33 ¹	8	2	33	1400T200-97	14	2	97
362T300-118	3⅝	3	118	800T200-43	8	2	43	1400T200-118	14	2	118
				800T200-54	8	2	54	1400T300-54 ¹	14	3	54
400T125-33	4	1¼	33	800T200-68	8	2	68	1400T300-68	14	3	68
400T125-43	4	1¼	43	800T200-97	8	2	97	1400T300-97	14	3	97
400T125-54	4	1¼	54	800T200-118	8	2	118	1400T300-118	14	3	118
400T125-68	4	1¼	68	800T300-33 ¹	8	3	33				
400T125-97	4	1¼	97	800T300-43	8	3	43	1600T125-68 ¹	16	1¼	68
400T125-118	4	1¼	118	800T300-54	8	3	54	1600T125-97	16	1¼	97
400T200-33	4	2	33	800T300-68	8	3	68	1600T125-118	16	1¼	118
400T200-43	4	2	43	800T300-97	8	3	97	1600T200-68 ¹	16	2	68
400T200-54	4	2	54	800T300-118	8	3	118	1600T200-97	16	2	97
400T200-68	4	2	68					1600T200-118	16	2	118
400T200-97	4	2	97	1000T125-43 ¹	10	1¼	43	1600T300-68 ¹	16	3	68
400T200-118	4	2	118	1000T125-54	10	1¼	54	1600T300-97	16	3	97
				1000T125-68	10	1¼	68	1600T300-118	16	3	118

For SI: 1 inch = 25.4 mm, 1 plf = 1.4882 kg/m

¹ Webslenderness ratio (h/t) exceeds 200. Web stiffeners designed in accordance with AISI S100 are required at all support points and concentrated loads.

² Web height measured from inside face to inside face of flanges.

³ See Table 3 for design thickness, minimum thickness, and inside bend radius.

TABLE 3—UNCOATED STEEL THICKNESS

THICKNESS DESIGNATION (mils)	DESIGN THICKNESS (in)	MINIMUM THICKNESS ¹ (in)	INSIDE BEND RADIUS (in)
18	0.0188	0.0179	0.0843
27	0.0283	0.0269	0.0796
33	0.0346	0.0329	0.0764
43	0.0451	0.0428	0.0712
54	0.0566	0.0538	0.0849
68	0.0713	0.0677	0.1069
97	0.1017	0.0966	0.1525

For SI: 1 inch = 25.4 mm.

¹Minimum thickness represents 95 percent of the design thickness and is the minimum acceptable thickness of the uncoated steel delivered to the jobsite

TABLE 4—C-SHAPE PROPERTIES^{4,5}

MEMBER	F _y (ksi)	GROSS PROPERTIES ³							EFFECTIVE PROPERTIES ²						TORSIONAL PROPERTIES ³						L _u (in.)
		Area (in ²)	Weight (lb/ft)	I _x (in ⁴)	S _x (in ³)	r _x (in.)	I _y (in ⁴)	r _y (in.)	I _x (in ⁴)	S _x (in ³)	M _{al} (in-k)	M _{ad} (in-k)	V _{ag} (lb)	V _{anet} (lb)	Jx1000 (in ⁴)	C _w (in ⁶)	x _o (in.)	m (in.)	r _o (in.)	β	
250S137-33	33	0.197	0.671	0.203	0.163	1.02	0.0524	0.515	0.203	0.158	3.11	2.90	975	399	0.0787	0.0764	-1.14	0.677	1.61	0.499	35.6
250S137-43 ⁶	33	0.255	0.868	0.261	0.208	1.01	0.0665	0.511	0.261	0.205	4.53 ⁶	4.02	1265	394	0.173	0.0959	-1.13	0.670	1.60	0.501	33.6
250S137-43	50	0.255	0.868	0.261	0.208	1.01	0.0665	0.511	0.261	0.197	5.89	5.37	1917	597	0.173	0.0959	-1.13	0.670	1.60	0.501	28.7
250S137-54 ⁶	50	0.316	1.07	0.318	0.255	1.00	0.0802	0.504	0.318	0.244	8.22 ⁶	7.06	2353	565	0.337	0.115	-1.12	0.663	1.58	0.504	27.1
250S137-68 ⁶	50	0.390	1.33	0.386	0.309	0.995	0.0956	0.495	0.386	0.308	10.7 ⁶	9.13	2866	519	0.661	0.138	-1.10	0.653	1.56	0.507	26.8
250S137-97 ⁶	50	0.533	1.82	0.507	0.406	0.975	0.121	0.476	0.507	0.406	14.8 ⁶	14.7	3798	429	1.84	0.176	-1.06	0.633	1.52	0.513	26.5
250S162-33	33	0.223	0.759	0.235	0.188	1.03	0.0870	0.624	0.235	0.180	3.55	3.39	975	399	0.0891	0.146	-1.47	0.859	1.90	0.401	44.1
250S162-43 ⁶	33	0.289	0.983	0.302	0.242	1.02	0.111	0.620	0.302	0.240	5.22 ⁶	4.70	1265	394	0.196	0.184	-1.46	0.852	1.89	0.402	42.1
250S162-43	50	0.289	0.983	0.302	0.242	1.02	0.111	0.620	0.302	0.217	6.50	6.30	1917	597	0.196	0.184	-1.46	0.852	1.89	0.402	35.7
250S162-54 ⁶	50	0.358	1.22	0.370	0.296	1.02	0.135	0.613	0.370	0.284	9.42 ⁶	8.28	2353	565	0.383	0.223	-1.44	0.845	1.87	0.404	33.9
250S162-68 ⁶	50	0.443	1.51	0.450	0.360	1.01	0.162	0.605	0.450	0.357	12.1 ⁶	10.7	2866	519	0.752	0.268	-1.42	0.835	1.85	0.405	33.7
250S162-97 ⁶	50	0.610	2.07	0.597	0.478	0.990	0.210	0.587	0.597	0.477	16.9 ⁶	16.8	3798	429	2.10	0.346	-1.39	0.815	1.80	0.408	36.9
250S200-33	33	0.258	0.877	0.279	0.223	1.04	0.154	0.773	0.273	0.197	3.90	3.94	975	399	0.103	0.302	-1.93	1.11	2.32	0.312	56.0
250S200-43	33	0.334	1.14	0.358	0.287	1.04	0.198	0.769	0.358	0.278	5.49	5.48	1265	394	0.227	0.382	-1.91	1.10	2.31	0.312	56.1
250S200-43	50	0.334	1.14	0.358	0.287	1.04	0.198	0.769	0.355	0.252	7.56	7.30	1917	597	0.227	0.382	-1.91	1.10	2.31	0.312	45.3
250S200-54	50	0.415	1.41	0.440	0.352	1.03	0.241	0.763	0.440	0.321	9.60	9.64	2353	565	0.443	0.464	-1.90	1.09	2.29	0.313	45.5
250S200-68 ⁶	50	0.515	1.75	0.538	0.430	1.02	0.293	0.755	0.537	0.417	13.8 ⁶	12.6	2866	519	0.872	0.561	-1.88	1.08	2.27	0.313	43.4
250S200-97 ⁶	50	0.711	2.42	0.719	0.575	1.01	0.386	0.737	0.719	0.575	19.8 ⁶	19.7	3798	429	2.45	0.735	-1.84	1.06	2.23	0.314	43.3

Table 4 continued on next page.

TABLE 4—C-SHAPE PROPERTIES^{4,5} (Continued)

MEMBER	F _y (ksi)	GROSS PROPERTIES ³							EFFECTIVE PROPERTIES ²						TORSIONAL PROPERTIES ³					L _u (in.)	
		Area (in ²)	Weight (lb/ft)	I _x (in ⁴)	S _x (in ³)	r _x (in.)	I _y (in ⁴)	r _y (in.)	I _x (in ⁴)	S _x (in ³)	M _{al} (in-k)	M _{ad} (in-k)	V _{ag} (lb)	V _{anet} (lb)	Jx1000 (in ⁴)	C _w (in ⁶)	x _o (in.)	m (in.)	r _o (in.)		β
250S250-33	33	0.292	0.995	0.331	0.265	1.07	0.262	0.946	0.310	0.214	4.22	4.28	975	399	0.117	0.503	-2.42	1.37	2.80	0.258	66.5
250S250-43	33	0.379	1.29	0.426	0.341	1.06	0.336	0.941	0.423	0.297	5.87	6.01	1265	394	0.257	0.638	-2.40	1.36	2.79	0.258	66.8
250S250-43	50	0.379	1.29	0.426	0.341	1.06	0.336	0.941	0.400	0.265	7.95	7.90	1917	597	0.257	0.638	-2.40	1.36	2.79	0.258	53.9
250S250-54	50	0.471	1.60	0.524	0.419	1.06	0.412	0.935	0.505	0.341	10.2	10.5	2353	565	0.503	0.778	-2.39	1.35	2.77	0.258	54.1
250S250-68	50	0.586	1.99	0.643	0.514	1.05	0.503	0.926	0.638	0.446	13.4	13.9	2866	519	0.993	0.944	-2.37	1.34	2.75	0.258	54.5
250S250-97 ⁶	50	0.813	2.77	0.865	0.692	1.03	0.670	0.908	0.865	0.664	22.3 ⁶	20.6	3798	429	2.80	1.25	-2.33	1.32	2.71	0.258	52.4
362S137-33	33	0.236	0.80	0.479	0.264	1.42	0.0594	0.501	0.479	0.232	4.59	4.45	1024	521	0.0942	0.165	-1.00	0.615	1.81	0.694	34.7
362S137-43	33	0.306	1.04	0.616	0.340	1.42	0.0755	0.497	0.616	0.320	6.32	6.25	1739	676	0.207	0.208	-0.991	0.608	1.80	0.697	34.6
362S137-43	50	0.306	1.04	0.616	0.340	1.42	0.0755	0.497	0.616	0.292	8.73	8.27	2141	832	0.207	0.208	-0.991	0.608	1.80	0.697	28.0
362S137-54	50	0.379	1.29	0.756	0.417	1.41	0.0911	0.490	0.756	0.381	11.4	11.0	3372	1016	0.405	0.251	-0.978	0.601	1.79	0.700	27.9
362S137-68	50	0.470	1.60	0.923	0.509	1.40	0.109	0.481	0.922	0.493	14.8	14.5	4370	1004	0.797	0.302	-0.959	0.592	1.77	0.704	27.8
362S137-97 ⁶	50	0.648	2.20	1.23	0.678	1.38	0.138	0.461	1.23	0.662	24.1 ⁶	24.1	5943	875	2.23	0.390	-0.922	0.573	1.72	0.713	25.1
362S162-33	33	0.262	0.89	0.551	0.304	1.45	0.0993	0.616	0.551	0.268	5.29	5.18	1024	521	0.105	0.297	-1.31	0.789	2.05	0.592	42.6
362S162-43	33	0.340	1.16	0.710	0.392	1.45	0.127	0.611	0.710	0.372	7.34	7.27	1739	676	0.230	0.376	-1.30	0.782	2.04	0.594	42.5
362S162-43	50	0.340	1.16	0.710	0.392	1.45	0.127	0.611	0.710	0.321	9.62	9.64	2141	832	0.230	0.376	-1.30	0.782	2.04	0.594	34.4
362S162-54	50	0.422	1.44	0.873	0.482	1.44	0.154	0.604	0.873	0.444	13.3	12.8	3372	1016	0.451	0.457	-1.28	0.774	2.02	0.597	34.4
362S162-68	50	0.524	1.78	1.070	0.590	1.43	0.186	0.596	1.07	0.574	17.2	16.9	4370	1004	0.887	0.552	-1.26	0.765	2.00	0.600	34.4
362S162-97 ⁶	50	0.724	2.46	1.440	0.792	1.41	0.241	0.577	1.44	0.776	27.5 ⁶	27.5	5943	875	2.50	0.723	-1.23	0.745	1.95	0.606	31.5
362S162-118 ⁶	50	0.863	2.94	1.670	0.923	1.39	0.274	0.563	1.67	0.904	33.1 ⁶	33.1	6996	784	4.44	0.828	-1.20	0.731	1.92	0.611	31.1
362S200-33	33	0.297	1.01	0.648	0.358	1.48	0.177	0.772	0.637	0.294	5.81	5.96	1024	521	0.118	0.577	-1.74	1.03	2.41	0.478	53.6
362S200-43	33	0.385	1.31	0.836	0.461	1.47	0.227	0.767	0.836	0.427	8.43	8.38	1739	676	0.261	0.734	-1.73	1.02	2.40	0.480	53.5
362S200-43	50	0.385	1.31	0.836	0.461	1.47	0.227	0.767	0.830	0.377	11.3	11.1	2141	832	0.261	0.734	-1.73	1.02	2.40	0.480	43.3
362S200-54	50	0.478	1.63	1.030	0.568	1.47	0.277	0.761	1.03	0.490	14.7	14.8	3372	1016	0.511	0.896	-1.72	1.02	2.38	0.482	43.3
362S200-68	50	0.595	2.03	1.270	0.698	1.46	0.337	0.753	1.27	0.666	20.0	19.6	4370	1004	1.01	1.09	-1.70	1.01	2.36	0.484	43.3
362S200-97 ⁶	50	0.826	2.81	1.710	0.944	1.44	0.446	0.735	1.71	0.929	32.0 ⁶	32.0	5943	875	2.85	1.44	-1.66	0.986	2.32	0.487	40.5
362S200-118 ⁶	50	0.988	3.36	2.010	1.110	1.43	0.514	0.721	2.01	1.09	38.6 ⁶	38.6	6996	784	5.08	1.66	-1.63	0.971	2.28	0.490	40.2
362S250-33	33	0.331	1.13	0.760	0.419	1.51	0.299	0.951	0.716	0.315	6.23	6.36	1024	521	0.132	0.965	-2.21	1.28	2.84	0.395	64.2
362S250-43	33	0.430	1.46	0.980	0.541	1.51	0.385	0.946	0.973	0.449	8.88	9.02	1739	676	0.292	1.23	-2.20	1.28	2.83	0.396	64.1
362S250-43	50	0.430	1.46	0.980	0.541	1.51	0.385	0.946	0.921	0.390	11.7	11.8	2141	832	0.292	1.23	-2.20	1.28	2.83	0.396	51.9
362S250-54	50	0.535	1.82	1.210	0.668	1.50	0.473	0.940	1.16	0.514	15.4	15.8	3372	1016	0.571	1.51	-2.18	1.27	2.81	0.397	52.0
362S250-68	50	0.666	2.27	1.490	0.822	1.50	0.578	0.931	1.48	0.689	20.6	21.2	4370	1004	1.13	1.84	-2.17	1.26	2.79	0.398	52.0
362S250-97 ⁶	50	0.927	3.16	2.030	1.120	1.48	0.773	0.913	2.03	1.05	35.2 ⁶	32.4	5943	875	3.20	2.45	-2.13	1.24	2.75	0.401	49.3
362S250-118 ⁶	50	1.110	3.78	2.390	1.320	1.47	0.898	0.899	2.39	1.26	43.3 ⁶	44.7	6996	784	5.72	2.85	-2.10	1.22	2.71	0.402	49.1

Table 4 continued on next page.

TABLE 4—C-SHAPE PROPERTIES^{4,5} (Continued)

MEMBER	F _y (ksi)	GROSS PROPERTIES ³							EFFECTIVE PROPERTIES ²						TORSIONAL PROPERTIES ³					L _u (in.)	
		Area (in ²)	Weight (lb/ft)	I _x (in ⁴)	S _x (in ³)	r _x (in.)	I _y (in ⁴)	r _y (in.)	I _x (in ⁴)	S _x (in ³)	M _{al} (in-k)	M _{ad} (in-k)	V _{ag} (lb)	V _{anet} (lb)	Jx1000 (in ⁴)	C _w (in ⁶)	x _o (in.)	m (in.)	r _o (in.)		β
400S137-33	33	0.249	0.85	0.603	0.302	1.556	0.061	0.496	0.603	0.259	5.12	4.97	976	595	0.099	0.204	-0.965	0.597	1.897	0.741	34.5
400S137-43	33	0.323	1.10	0.776	0.388	1.551	0.078	0.491	0.776	0.359	7.09	7.02	1739	810	0.219	0.257	-0.954	0.591	1.886	0.744	34.3
400S137-43	50	0.323	1.10	0.776	0.388	1.551	0.078	0.491	0.776	0.326	9.75	9.27	2141	997	0.219	0.257	-0.954	0.591	1.886	0.744	27.8
400S137-54	50	0.401	1.36	0.953	0.477	1.543	0.094	0.484	0.953	0.428	12.82	12.40	3372	1223	0.428	0.311	-0.940	0.583	1.870	0.747	27.7
400S137-68	50	0.497	1.69	1.165	0.583	1.531	0.112	0.475	1.165	0.558	16.70	16.50	4871	1356	0.842	0.375	-0.922	0.574	1.849	0.751	27.6
400S162-33	33	0.275	0.94	0.692	0.346	1.586	0.103	0.611	0.692	0.299	5.91	5.80	976	595	0.110	0.363	-1.263	0.768	2.118	0.644	42.3
400S162-43	33	0.357	1.21	0.892	0.446	1.581	0.131	0.606	0.892	0.417	8.23	8.16	1739	810	0.242	0.460	-1.252	0.761	2.106	0.647	42.2
400S162-43	50	0.357	1.21	0.892	0.446	1.581	0.131	0.606	0.892	0.359	10.75	10.80	2141	997	0.242	0.460	-1.252	0.761	2.106	0.647	34.2
400S162-54	50	0.443	1.51	1.098	0.549	1.574	0.159	0.600	1.098	0.497	14.89	14.40	3372	1223	0.473	0.560	-1.238	0.754	2.090	0.649	34.1
400S162-68	50	0.550	1.87	1.346	0.673	1.564	0.192	0.591	1.346	0.648	19.41	19.10	4871	1356	0.933	0.677	-1.220	0.745	2.069	0.653	34.0
400S162-97 ⁶	50	0.762	2.59	1.813	0.907	1.542	0.250	0.572	1.813	0.892	31.60 ⁶	31.60	6658	1207	2.627	0.889	-1.182	0.725	2.026	0.660	31.1
400S162-118 ⁶	50	0.910	3.10	2.119	1.059	1.526	0.283	0.558	2.118	1.042	38.10 ⁶	38.10	7869	1102	4.679	1.020	-1.154	0.711	1.993	0.665	30.7
400S200-33	33	0.310	1.05	0.812	0.406	1.619	0.183	0.769	0.798	0.329	6.49	6.65	976	595	0.124	0.697	-1.688	1.007	2.462	0.530	53.1
400S200-43	33	0.402	1.37	1.048	0.524	1.615	0.235	0.764	1.047	0.478	9.45	9.38	1739	810	0.272	0.886	-1.676	1.000	2.450	0.532	53.0
400S200-43	50	0.402	1.37	1.048	0.524	1.615	0.235	0.764	1.040	0.422	12.63	12.40	2141	997	0.272	0.886	-1.676	1.000	2.450	0.532	43.0
400S200-54	50	0.500	1.70	1.292	0.646	1.608	0.287	0.758	1.292	0.549	16.43	16.60	3372	1223	0.534	1.083	-1.662	0.993	2.433	0.534	42.9
400S200-68	50	0.622	2.12	1.590	0.795	1.599	0.349	0.750	1.589	0.751	22.47	22.00	4871	1356	1.054	1.318	-1.643	0.983	2.412	0.536	42.9
400S200-97 ⁶	50	0.864	2.94	2.155	1.078	1.580	0.463	0.732	2.155	1.063	36.70 ⁶	36.70	6658	1207	2.978	1.749	-1.605	0.963	2.368	0.541	40.0
400S200-118 ⁶	50	1.034	3.52	2.533	1.266	1.565	0.533	0.718	2.532	1.249	44.20 ⁶	44.30	7869	1102	5.317	2.024	-1.577	0.948	2.335	0.544	39.6
400S250-33	33	0.344	1.17	0.948	0.474	1.660	0.310	0.949	0.894	0.352	6.95	7.07	976	595	0.137	1.165	-2.151	1.259	2.878	0.441	63.7
400S250-43	33	0.447	1.52	1.224	0.612	1.655	0.399	0.945	1.215	0.503	9.93	10.00	1739	810	0.303	1.486	-2.139	1.252	2.865	0.443	63.7
400S250-43	50	0.447	1.52	1.224	0.612	1.655	0.399	0.945	1.151	0.436	13.06	13.10	2141	997	0.303	1.486	-2.139	1.252	2.865	0.443	51.6
400S250-54	50	0.556	1.89	1.512	0.756	1.649	0.490	0.938	1.450	0.576	17.24	17.60	3372	1223	0.594	1.821	-2.124	1.244	2.848	0.444	51.6
400S250-68	50	0.693	2.36	1.865	0.932	1.640	0.599	0.929	1.843	0.775	23.19	23.70	4871	1356	1.174	2.225	-2.105	1.235	2.826	0.445	51.6
400S250-97 ⁶	50	0.965	3.29	2.542	1.271	1.623	0.801	0.911	2.542	1.191	40.10 ⁶	36.40	6658	1207	3.329	2.978	-2.066	1.214	2.781	0.448	48.8
400S250-118 ⁶	50	1.158	3.94	2.999	1.500	1.609	0.932	0.897	2.999	1.436	49.40 ⁶	44.40	7869	1102	5.956	3.467	-2.037	1.199	2.746	0.450	48.5

Table 4 continued on next page.

TABLE 4—C-SHAPE PROPERTIES^{4,5} (Continued)

MEMBER	F _y (ksi)	GROSS PROPERTIES ³							EFFECTIVE PROPERTIES ²						TORSIONAL PROPERTIES ³					L _u (in.)	
		Area (in ²)	Weight (lb/ft)	I _x (in ⁴)	S _x (in ³)	r _x (in.)	I _y (in ⁴)	r _y (in.)	I _x (in ⁴)	S _x (in ³)	M _{al} (in-k)	M _{ad} (in-k)	V _{ag} (lb)	V _{anet} (lb)	Jx1000 (in ⁴)	C _w (in ⁶)	X _o (in.)	m (in.)	r _o (in.)		β
600S137-33	33	0.318	1.08	1.582	0.527	2.230	0.069	0.464	1.540	0.455	8.98	7.76	638	638	0.127	0.500	-0.807	0.519	2.416	0.889	33.5
600S137-43	33	0.413	1.41	2.042	0.681	2.224	0.087	0.459	2.036	0.645	12.74	11.20	1415	1240	0.280	0.633	-0.796	0.513	2.406	0.890	33.2
600S137-43	50	0.413	1.41	2.042	0.681	2.224	0.087	0.459	1.999	0.579	17.33	14.60	1415	1240	0.280	0.633	-0.796	0.513	2.406	0.890	27.0
600S137-54	50	0.514	1.75	2.518	0.839	2.214	0.105	0.452	2.517	0.777	23.26	19.90	2822	1947	0.549	0.769	-0.784	0.506	2.392	0.893	26.8
600S137-68	50	0.640	2.18	3.095	1.032	2.200	0.126	0.443	3.094	1.030	30.84	26.90	5350	2879	1.084	0.930	-0.768	0.497	2.372	0.895	26.5
600S137-97 ⁶	50	0.889	3.03	4.189	1.396	2.171	0.159	0.423	4.188	1.396	50.80 ⁶	41.40	10472	3805	3.066	1.216	-0.734	0.480	2.330	0.901	23.6
600S162-33	33	0.344	1.17	1.793	0.598	2.282	0.116	0.581	1.793	0.577	11.41	9.08	638	638	0.137	0.862	-1.072	0.677	2.588	0.828	41.1
600S162-43 ⁶	33	0.447	1.52	2.316	0.772	2.277	0.148	0.576	2.316	0.767	16.70 ⁶	13.00	1415	1240	0.303	1.095	-1.062	0.670	2.577	0.830	39.0
600S162-43	50	0.447	1.52	2.316	0.772	2.277	0.148	0.576	2.316	0.705	21.12	17.00	1415	1240	0.303	1.095	-1.062	0.670	2.577	0.830	33.2
600S162-54 ⁶	50	0.556	1.89	2.861	0.954	2.268	0.181	0.570	2.860	0.915	30.30 ⁶	23.00	2822	1947	0.594	1.337	-1.049	0.663	2.563	0.833	31.4
600S162-68 ⁶	50	0.693	2.36	3.525	1.175	2.255	0.218	0.561	3.525	1.164	39.50 ⁶	31.10	5350	2879	1.174	1.626	-1.032	0.655	2.543	0.835	30.8
600S162-97 ⁶	50	0.965	3.29	4.798	1.599	2.229	0.283	0.542	4.797	1.599	56.70 ⁶	47.50	10472	3805	3.329	2.153	-0.997	0.636	2.501	0.841	29.8
600S162-118 ⁶	50	1.158	3.94	5.654	1.885	2.209	0.322	0.527	5.653	1.884	68.90 ⁶	68.50	12526	3622	5.956	2.487	-0.971	0.623	2.470	0.846	29.1
600S200-33	33	0.379	1.29	2.075	0.692	2.340	0.209	0.743	2.043	0.621	12.28	10.40	638	638	0.151	1.593	-1.457	0.901	2.855	0.740	51.6
600S200-43	33	0.492	1.67	2.683	0.894	2.335	0.268	0.739	2.683	0.873	17.24	14.90	1415	1240	0.334	2.033	-1.446	0.894	2.844	0.742	51.4
600S200-43	50	0.492	1.67	2.683	0.894	2.335	0.268	0.739	2.666	0.807	24.17	19.40	1415	1240	0.334	2.033	-1.446	0.894	2.844	0.742	41.7
600S200-54	50	0.613	2.09	3.320	1.107	2.327	0.329	0.732	3.319	1.015	30.39	26.30	2822	1947	0.655	2.493	-1.432	0.887	2.829	0.744	41.6
600S200-68 ⁶	50	0.764	2.60	4.101	1.367	2.316	0.400	0.723	4.100	1.317	43.70 ⁶	35.40	5350	2879	1.295	3.047	-1.415	0.878	2.809	0.746	39.3
600S200-97 ⁶	50	1.067	3.63	5.613	1.871	2.293	0.530	0.705	5.612	1.871	64.50 ⁶	55.00	10472	3805	3.679	4.080	-1.378	0.859	2.767	0.752	38.3
600S200-118 ⁶	50	1.282	4.36	6.643	2.214	2.276	0.612	0.691	6.641	2.214	78.40 ⁶	78.00	12526	3622	6.594	4.753	-1.351	0.845	2.735	0.756	37.6
600S250-43	33	0.537	1.83	3.083	1.028	2.396	0.458	0.923	3.062	0.918	18.14	15.70	1415	1240	0.364	3.411	-1.874	1.136	3.179	0.652	62.4
600S250-43	50	0.537	1.83	3.083	1.028	2.396	0.458	0.923	2.912	0.818	24.51	20.30	1415	1240	0.364	3.411	-1.874	1.136	3.179	0.652	50.6
600S250-54	50	0.670	2.28	3.820	1.273	2.389	0.562	0.917	3.663	1.069	32.00	27.60	2822	1947	0.715	4.194	-1.860	1.129	3.163	0.654	50.5
600S250-68	50	0.836	2.84	4.728	1.576	2.379	0.688	0.908	4.667	1.386	41.49	37.50	5350	2879	1.416	5.146	-1.842	1.119	3.142	0.657	50.4
600S250-97 ⁶	50	1.169	3.98	6.497	2.166	2.358	0.923	0.889	6.496	2.063	69.40 ⁶	59.00	10472	3805	4.030	6.947	-1.803	1.100	3.099	0.661	47.3
600S250-118 ⁶	50	1.407	4.79	7.715	2.572	2.342	1.076	0.874	7.713	2.498	85.90 ⁶	75.20	12526	3622	7.233	8.142	-1.775	1.085	3.066	0.665	46.7
600S300-54	50	0.726	2.47	4.320	1.440	2.439	0.875	1.098	3.939	1.106	33.13	28.50	2822	1947	0.775	6.452	-2.299	1.372	3.527	0.575	59.1
600S300-68	50	0.907	3.09	5.354	1.785	2.430	1.075	1.089	5.064	1.446	43.30	38.90	5350	2879	1.537	7.937	-2.280	1.363	3.506	0.577	58.9
600S300-97	50	1.271	4.32	7.382	2.461	2.410	1.454	1.070	7.251	2.247	67.28	62.00	10472	3805	4.381	10.776	-2.241	1.343	3.461	0.581	58.8
600S300-118 ⁶	50	1.531	5.21	8.787	2.929	2.396	1.704	1.055	8.785	2.797	94.20 ⁶	79.70	12526	3622	7.872	12.684	-2.212	1.328	3.427	0.583	55.3

Table 4 continued on next page.

TABLE 4—C-SHAPE PROPERTIES^{4,5} (Continued)

MEMBER	F _y (ksi)	GROSS PROPERTIES ³							EFFECTIVE PROPERTIES ²						TORSIONAL PROPERTIES ³					L _u (in.)	
		Area (in ²)	Weight (lb/ft)	I _x (in ⁴)	S _x (in ³)	r _x (in.)	I _y (in ⁴)	r _y (in.)	I _x (in ⁴)	S _x (in ³)	M _{al} (in-k)	M _{ad} (in-k)	V _{ag} (lb)	V _{anet} (lb)	Jx1000 (in ⁴)	C _w (in ⁶)	x _o (in.)	m (in.)	r _o (in.)		β
800S137-33 ¹	33	0.388	1.32	3.199	0.800	2.873	0.073	0.435	2.972	0.622	12.29	10.20	474	474	0.155	0.957	-0.696	0.460	2.988	0.946	32.5
800S137-43	33	0.503	1.71	4.135	1.034	2.866	0.093	0.430	3.981	0.896	17.70	15.00	1051	1051	0.341	1.214	-0.687	0.454	2.979	0.947	32.2
800S137-43	50	0.503	1.71	4.135	1.034	2.866	0.093	0.430	3.872	0.795	23.80	19.30	1051	1051	0.341	1.214	-0.687	0.454	2.979	0.947	26.2
800S137-54	50	0.627	2.13	5.111	1.278	2.855	0.112	0.423	4.940	1.083	32.42	26.80	2091	2091	0.670	1.478	-0.676	0.448	2.964	0.948	25.9
800S137-68	50	0.782	2.66	6.305	1.576	2.839	0.134	0.414	6.265	1.468	43.96	37.10	4220	3367	1.325	1.789	-0.661	0.440	2.944	0.950	25.6
800S137-97	50	1.093	3.72	8.600	2.150	2.806	0.170	0.394	8.597	2.149	64.35	59.70	10885	5938	3.767	2.349	-0.630	0.423	2.902	0.953	25.0
800S162-33 ¹	33	0.413	1.41	3.583	0.896	2.944	0.125	0.550	3.361	0.710	14.03	12.20	474	474	0.165	1.630	-0.936	0.607	3.138	0.911	40.1
800S162-43	33	0.537	1.83	4.635	1.159	2.938	0.160	0.546	4.483	1.019	20.14	17.60	1051	1051	0.364	2.076	-0.926	0.601	3.128	0.912	39.8
800S162-43	50	0.537	1.83	4.635	1.159	2.938	0.160	0.546	4.377	0.866	25.93	22.80	1051	1051	0.364	2.076	-0.926	0.601	3.128	0.912	32.3
800S162-54	50	0.670	2.28	5.737	1.434	2.927	0.194	0.539	5.568	1.229	36.79	31.30	2091	2091	0.715	2.539	-0.914	0.594	3.114	0.914	32.1
800S162-68	50	0.836	2.84	7.091	1.773	2.913	0.235	0.530	7.052	1.663	49.80	42.90	4220	3367	1.416	3.093	-0.898	0.586	3.094	0.916	31.9
800S162-97	50	1.169	3.98	9.716	2.429	2.883	0.305	0.511	9.713	2.428	72.70	68.40	10885	5938	4.030	4.114	-0.866	0.568	3.053	0.920	31.4
800S162-118 ⁶	50	1.407	4.79	11.507	2.877	2.860	0.347	0.496	11.504	2.876	105.00 ⁶	105.00	16235	7115	7.233	4.766	-0.842	0.556	3.023	0.922	28.0
800S200-43	33	0.582	1.98	5.303	1.326	3.018	0.292	0.708	5.302	1.293	25.55	20.30	1051	1051	0.395	3.797	-1.277	0.811	3.353	0.855	50.3
800S200-43	50	0.582	1.98	5.303	1.326	3.018	0.292	0.708	5.272	1.066	31.91	26.30	1051	1051	0.395	3.797	-1.277	0.811	3.353	0.855	40.9
800S200-54	50	0.726	2.47	6.574	1.644	3.009	0.357	0.701	6.572	1.499	44.88	36.00	2091	2091	0.775	4.663	-1.265	0.804	3.338	0.856	40.7
800S200-68 ⁶	50	0.907	3.09	8.142	2.036	2.996	0.435	0.692	8.140	1.964	65.20 ⁶	49.10	4220	3367	1.537	5.712	-1.248	0.796	3.319	0.859	38.4
800S200-97 ⁶	50	1.271	4.32	11.206	2.801	2.970	0.576	0.674	11.203	2.801	96.60 ⁶	77.90	10885	5938	4.381	7.684	-1.214	0.777	3.278	0.863	37.2
800S200-118 ⁶	50	1.531	5.21	13.319	3.330	2.950	0.666	0.659	13.315	3.329	118.00 ⁶	99.30	16235	7115	7.872	8.981	-1.188	0.764	3.248	0.866	36.5
800S250-43	33	0.627	2.13	6.017	1.504	3.097	0.500	0.893	5.979	1.314	25.96	21.40	1051	1051	0.425	6.374	-1.675	1.043	3.632	0.787	61.5
800S250-43	50	0.627	2.13	6.017	1.504	3.097	0.500	0.893	5.693	1.080	32.32	27.50	1051	1051	0.425	6.374	-1.675	1.043	3.632	0.787	49.9
800S250-54	50	0.783	2.66	7.467	1.867	3.089	0.614	0.886	7.171	1.525	45.67	37.70	2091	2091	0.836	7.850	-1.661	1.036	3.617	0.789	49.8
800S250-68	50	0.978	3.33	9.263	2.316	3.077	0.752	0.877	9.141	2.059	61.65	51.70	4220	3367	1.658	9.653	-1.644	1.027	3.597	0.791	49.6
800S250-97 ⁶	50	1.372	4.67	12.792	3.198	3.053	1.009	0.857	12.789	3.053	103.00 ⁶	82.90	10885	5938	4.731	13.091	-1.607	1.008	3.555	0.796	46.4
800S250-118 ⁶	50	1.655	5.63	15.245	3.811	3.035	1.176	0.843	15.241	3.706	128.00 ⁶	107.00	16235	7115	8.510	15.395	-1.580	0.994	3.524	0.799	45.6
800S300-54	50	0.839	2.86	8.360	2.090	3.156	0.959	1.069	7.666	1.535	45.97	38.80	2091	2091	0.896	12.076	-2.073	1.271	3.924	0.721	58.6
800S300-68	50	1.050	3.57	10.383	2.596	3.145	1.179	1.060	9.842	2.145	64.21	53.40	4220	3367	1.778	14.888	-2.055	1.262	3.904	0.723	58.4
800S300-97	50	1.474	5.02	14.378	3.594	3.123	1.595	1.040	14.120	3.304	98.91	86.30	10885	5938	5.082	20.304	-2.017	1.243	3.861	0.727	58.1
800S300-118 ⁶	50	1.779	6.06	17.170	4.293	3.106	1.871	1.026	17.167	4.108	138.00 ⁶	112.00	16235	7115	9.149	23.979	-1.989	1.229	3.829	0.730	54.5

Table 4 continued on next page.

TABLE 4—C-SHAPE PROPERTIES^{4,5} (Continued)

MEMBER	F _y (ksi)	GROSS PROPERTIES ³							EFFECTIVE PROPERTIES ²						TORSIONAL PROPERTIES ³					L _u (in.)	
		Area (in ²)	Weight (lb/ft)	I _x (in ⁴)	S _x (in ³)	r _x (in.)	I _y (in ⁴)	r _y (in.)	I _x (in ⁴)	S _x (in ³)	M _{al} (in-k)	M _{ad} (in-k)	V _{ag} (lb)	V _{anet} (lb)	Jx1000 (in ⁴)	C _w (in ⁶)	x _o (in.)	m (in.)	r _o (in.)		β
1000S162-33 ¹	33	0.483	1.64	6.200	1.240	3.584	0.132	0.522	5.558	0.900	17.79	14.80	377	377	0.193	2.692	-0.832	0.550	3.716	0.950	39.1
1000S162-43 ¹	33	0.627	2.13	8.028	1.606	3.577	0.168	0.518	7.479	1.302	25.74	21.70	836	836	0.425	3.430	-0.823	0.545	3.707	0.951	38.8
1000S162-43 ¹	50	0.627	2.13	8.028	1.606	3.577	0.168	0.518	7.255	1.099	32.91	27.80	836	836	0.425	3.430	-0.823	0.545	3.707	0.951	31.5
1000S162-54	50	0.783	2.66	9.953	1.991	3.566	0.204	0.511	9.310	1.572	47.06	38.70	1660	1660	0.836	4.198	-0.812	0.538	3.693	0.952	31.3
1000S162-68	50	0.978	3.33	12.329	2.466	3.550	0.247	0.502	11.919	2.155	64.51	53.80	3345	3345	1.658	5.121	-0.798	0.531	3.673	0.953	31.0
1000S162-97	50	1.372	4.67	16.972	3.394	3.517	0.320	0.483	16.966	3.269	97.89	88.00	9862	7175	4.731	6.827	-0.768	0.514	3.632	0.955	30.4
1000S162-118	50	1.655	5.63	20.175	4.035	3.491	0.364	0.469	20.168	4.034	120.77	115.00	16235	9536	8.510	7.924	-0.746	0.502	3.601	0.957	30.0
1000S200-43 ¹	33	0.672	2.29	9.088	1.818	3.676	0.309	0.677	8.550	1.470	29.05	25.40	836	836	0.456	6.236	-1.147	0.743	3.910	0.914	49.3
1000S200-43 ¹	50	0.672	2.29	9.088	1.818	3.676	0.309	0.677	8.273	1.270	38.03	32.70	836	836	0.456	6.236	-1.147	0.743	3.910	0.914	40.0
1000S200-54	50	0.839	2.86	11.281	2.256	3.666	0.378	0.671	10.651	1.705	51.05	45.10	1660	1660	0.896	7.665	-1.135	0.737	3.896	0.915	39.8
1000S200-68	50	1.050	3.57	13.998	2.800	3.652	0.460	0.662	13.594	2.420	72.46	62.20	3345	3345	1.778	9.401	-1.120	0.729	3.877	0.917	39.6
1000S200-97	50	1.474	5.02	19.341	3.868	3.622	0.610	0.643	19.335	3.741	112.00	101.00	9862	7175	5.082	12.679	-1.087	0.711	3.836	0.920	39.0
1000S200-118	50	1.779	6.06	23.058	4.612	3.600	0.704	0.629	23.051	4.610	138.03	131.00	16235	9536	9.149	14.848	-1.064	0.699	3.806	0.922	38.7
1000S250-43 ¹	33	0.717	2.44	10.205	2.041	3.771	0.531	0.860	10.145	1.617	31.95	26.80	836	836	0.486	10.481	-1.518	0.965	4.155	0.867	60.7
1000S250-43 ¹	50	0.717	2.44	10.205	2.041	3.771	0.531	0.860	9.136	1.342	40.19	34.30	836	836	0.486	10.481	-1.518	0.965	4.155	0.867	49.3
1000S250-54	50	0.896	3.05	12.680	2.536	3.762	0.653	0.854	12.202	1.879	56.27	47.60	1660	1660	0.957	12.922	-1.505	0.958	4.141	0.868	49.1
1000S250-68	50	1.121	3.81	15.755	3.151	3.749	0.799	0.844	15.553	2.769	82.90	65.70	3345	3345	1.899	15.909	-1.488	0.950	4.121	0.870	48.8
1000S250-97 ⁶	50	1.576	5.36	21.832	4.366	3.722	1.073	0.825	21.826	4.181	141.00 ⁶	107.00	9862	7175	5.432	21.632	-1.454	0.932	4.080	0.873	45.6
1000S250-118 ⁶	50	1.903	6.48	26.086	5.217	3.702	1.250	0.810	26.079	5.082	175.00 ⁶	140.00	16235	9536	9.788	25.490	-1.428	0.918	4.050	0.876	44.8
1000S300-54	50	0.953	3.24	14.079	2.816	3.845	1.024	1.037	12.824	1.903	56.96	49.00	1660	1660	1.017	19.888	-1.892	1.185	4.409	0.816	58.0
1000S300-68	50	1.192	4.06	17.512	3.502	3.833	1.258	1.027	16.643	2.803	83.91	68.00	3345	3345	2.020	24.551	-1.874	1.176	4.389	0.818	57.8
1000S300-97	50	1.677	5.71	24.323	4.865	3.808	1.702	1.007	23.895	4.498	134.68	111.00	9862	7175	5.783	33.570	-1.838	1.158	4.347	0.821	57.4
1000S300-118 ⁶	50	2.028	6.90	29.114	5.823	3.789	1.997	0.992	29.108	5.586	188.00 ⁶	146.00	16235	9536	10.426	39.725	-1.811	1.144	4.316	0.824	53.8
1000S350-54	50	1.052	3.58	16.223	3.245	3.928	1.768	1.297	15.099	2.328	69.70	60.70	1660	1660	1.123	36.575	-2.546	1.566	4.857	0.725	72.2
1000S350-68	50	1.317	4.48	20.208	4.042	3.917	2.185	1.288	19.745	3.418	102.33	83.70	3345	3345	2.232	45.277	-2.529	1.557	4.837	0.727	72.0
1000S350-97	50	1.855	6.31	28.152	5.630	3.895	2.992	1.270	28.146	5.118	153.24	136.00	9862	7175	6.397	62.280	-2.492	1.538	4.795	0.730	71.6
1000S350-118 ⁶	50	2.245	7.64	33.777	6.755	3.879	3.543	1.256	33.770	6.426	213.00 ⁶	176.00	16235	9536	11.544	74.030	-2.465	1.524	4.764	0.732	67.8
1200S162-43 ¹	33	0.717	2.44	12.676	2.113	4.203	0.174	0.493	11.338	1.585	31.32	25.10	694	694	0.486	5.177	-0.742	0.499	4.297	0.970	37.8
1200S162-43 ¹	50	0.717	2.44	12.676	2.113	4.203	0.174	0.493	10.943	1.332	39.88	32.00	694	694	0.486	5.177	-0.742	0.499	4.297	0.970	30.7
1200S162-54 ¹	50	0.896	3.05	15.735	2.623	4.191	0.212	0.486	14.138	1.914	57.31	45.00	1377	1377	0.957	6.340	-0.732	0.493	4.282	0.971	30.5
1200S162-68	50	1.121	3.81	19.524	3.254	4.174	0.255	0.477	18.256	2.645	79.19	63.30	2770	2770	1.899	7.739	-0.719	0.485	4.262	0.972	30.2
1200S162-97	50	1.576	5.36	26.974	4.496	4.138	0.332	0.459	26.610	4.091	122.49	106.00	8145	7410	5.432	10.331	-0.691	0.470	4.220	0.973	29.5
1200S162-118	50	1.903	6.48	32.155	5.359	4.110	0.377	0.445	32.143	5.168	154.73	140.00	14982	11034	9.788	12.002	-0.670	0.459	4.188	0.974	29.0

Table 4 continued on next page.

TABLE 4—C-SHAPE PROPERTIES^{4,5} (Continued)

MEMBER	F _y (ksi)	GROSS PROPERTIES ³							EFFECTIVE PROPERTIES ²						TORSIONAL PROPERTIES ³					L _u (in.)	
		Area (in ²)	Weight (lb/ft)	I _x (in ⁴)	S _x (in ³)	r _x (in.)	I _y (in ⁴)	r _y (in.)	I _x (in ⁴)	S _x (in ³)	M _{al} (in-k)	M _{ad} (in-k)	V _{ag} (lb)	V _{anet} (lb)	Jx1000 (in ⁴)	C _w (in ⁶)	x _o (in.)	m (in.)	r _o (in.)		β
1200S200-54 ¹	50	0.953	3.24	17.668	2.945	4.307	0.394	0.643	16.104	2.073	62.06	53.10	1377	1377	1.017	11.550	-1.032	0.681	4.475	0.947	39.0
1200S200-68	50	1.192	4.06	21.954	3.659	4.291	0.479	0.634	20.708	2.963	88.71	74.00	2770	2770	2.020	14.176	-1.017	0.673	4.456	0.948	38.7
1200S200-97	50	1.677	5.71	30.425	5.071	4.259	0.635	0.615	30.066	4.660	139.51	122.00	8145	7410	5.783	19.150	-0.987	0.656	4.415	0.950	38.1
1200S200-118	50	2.028	6.90	36.357	6.060	4.234	0.733	0.601	36.345	5.865	175.59	160.00	14982	11034	10.426	22.451	-0.964	0.644	4.384	0.952	37.7
1200S250-54 ¹	50	1.009	3.43	19.686	3.281	4.417	0.683	0.823	17.261	2.149	64.34	56.60	1377	1377	1.078	19.505	-1.378	0.892	4.699	0.914	48.3
1200S250-68	50	1.263	4.30	24.490	4.082	4.403	0.836	0.813	22.905	3.007	90.04	79.00	2770	2770	2.141	24.034	-1.362	0.884	4.680	0.915	48.1
1200S250-97	50	1.779	6.05	34.025	5.671	4.373	1.122	0.794	33.668	5.037	150.82	131.00	8145	7410	6.134	32.734	-1.329	0.867	4.639	0.918	47.5
1200S250-118	50	2.152	7.32	40.736	6.789	4.351	1.307	0.779	40.724	6.540	195.82	172.00	14982	11034	11.065	38.619	-1.305	0.854	4.609	0.920	47.1
1200S300-54 ¹	50	1.066	3.63	21.704	3.617	4.513	1.074	1.004	18.842	2.273	68.04	58.70	1377	1377	1.138	30.051	-1.743	1.111	4.941	0.876	57.4
1200S300-68	50	1.335	4.54	27.026	4.504	4.500	1.320	0.994	25.752	3.318	99.33	82.10	2770	2770	2.262	37.127	-1.726	1.103	4.921	0.877	57.2
1200S300-97	50	1.881	6.40	37.624	6.271	4.473	1.786	0.975	36.984	5.830	174.56	136.00	8145	7410	6.484	50.853	-1.691	1.085	4.880	0.880	56.7
1200S300-118 ⁶	50	2.276	7.75	45.116	7.519	4.452	2.096	0.960	45.103	7.231	244.00 ⁶	180.00	14982	11034	11.703	60.251	-1.666	1.071	4.849	0.882	53.0
1200S350-54 ¹	50	1.165	3.96	24.866	4.144	4.620	1.866	1.266	22.233	2.788	83.47	73.30	1377	1377	1.244	54.279	-2.363	1.478	5.342	0.804	71.4
1200S350-68	50	1.459	4.97	31.002	5.167	4.609	2.306	1.257	30.331	4.062	121.61	101.00	2770	2770	2.473	67.251	-2.346	1.469	5.322	0.806	71.2
1200S350-97	50	2.059	7.01	43.277	7.213	4.585	3.159	1.239	43.267	6.590	197.30	166.00	8145	7410	7.098	92.673	-2.310	1.450	5.281	0.809	70.8
1200S350-118 ⁶	50	2.493	8.49	52.002	8.667	4.567	3.741	1.225	51.990	8.259	274.00 ⁶	217.00	14982	11034	12.821	110.302	-2.284	1.436	5.251	0.811	66.9
1400S162-54 ¹	50	1.009	3.43	23.311	3.330	4.806	0.218	0.464	20.091	2.256	67.53	50.20	1176	1176	1.078	8.980	-0.667	0.454	4.874	0.981	29.7
1400S162-68	50	1.263	4.30	28.963	4.138	4.788	0.262	0.456	26.125	3.135	93.85	71.50	2364	2364	2.141	10.966	-0.654	0.447	4.854	0.982	29.4
1400S162-97	50	1.779	6.05	40.130	5.733	4.749	0.341	0.438	38.613	4.914	147.14	122.00	6938	6938	6.134	14.651	-0.628	0.433	4.811	0.983	28.7
1400S162-118	50	2.152	7.32	47.944	6.849	4.720	0.387	0.424	47.537	6.282	188.07	162.00	12743	11285	11.065	17.032	-0.609	0.422	4.778	0.984	28.2
1400S200-54 ¹	50	1.066	3.63	25.960	3.709	4.936	0.406	0.617	22.812	2.440	73.05	59.90	1176	1176	1.138	16.355	-0.946	0.633	5.063	0.965	38.2
1400S200-68	50	1.335	4.54	32.295	4.614	4.919	0.494	0.608	29.512	3.504	104.92	84.40	2364	2364	2.262	20.083	-0.932	0.625	5.043	0.966	37.9
1400S200-97	50	1.881	6.40	44.867	6.410	4.884	0.655	0.590	43.369	5.580	167.06	142.00	6938	6938	6.484	27.156	-0.904	0.609	5.002	0.967	37.3
1400S200-118	50	2.276	7.75	53.715	7.674	4.858	0.756	0.576	53.310	7.096	212.47	188.00	12743	11285	11.703	31.861	-0.883	0.598	4.971	0.968	36.8
1400S250-54 ¹	50	1.122	3.82	28.711	4.102	5.058	0.707	0.794	24.330	2.527	75.65	64.70	1176	1176	1.199	27.675	-1.272	0.835	5.275	0.942	47.6
1400S250-68	50	1.406	4.78	35.753	5.108	5.043	0.865	0.784	32.488	3.550	106.29	91.00	2364	2364	2.383	34.118	-1.256	0.827	5.256	0.943	47.3
1400S250-97	50	1.982	6.75	49.778	7.111	5.011	1.161	0.765	48.297	6.010	179.94	153.00	6938	6938	6.835	46.520	-1.225	0.811	5.215	0.945	46.7
1400S250-118	50	2.400	8.17	59.693	8.528	4.987	1.353	0.751	59.291	7.880	235.92	203.00	12743	11285	12.342	54.927	-1.202	0.798	5.184	0.946	46.2

Table 4 continued on next page.

TABLE 4—C-SHAPE PROPERTIES^{4,5} (Continued)

MEMBER	F _y (ksi)	GROSS PROPERTIES ³							EFFECTIVE PROPERTIES ²						TORSIONAL PROPERTIES ³					L _u (in.)	
		Area (in ²)	Weight (lb/ft)	I _x (in ⁴)	S _x (in ³)	r _x (in.)	I _y (in ⁴)	r _y (in.)	I _x (in ⁴)	S _x (in ³)	M _{al} (in-k)	M _{ad} (in-k)	V _{ag} (lb)	V _{anet} (lb)	Jx1000 (in ⁴)	C _w (in ⁶)	x _o (in.)	m (in.)	r _o (in.)		β
1400S300-54 ¹	50	1.179	4.01	31.462	4.495	5.166	1.115	0.972	25.548	2.580	77.25	67.60	1176	1176	1.259	42.691	-1.617	1.046	5.500	0.914	56.8
1400S300-68	50	1.477	5.03	39.211	5.602	5.152	1.370	0.963	34.328	3.655	109.43	95.20	2364	2364	2.503	52.772	-1.601	1.038	5.480	0.915	56.5
1400S300-97	50	2.084	7.09	54.689	7.813	5.123	1.854	0.943	52.219	6.372	190.78	160.00	6938	6938	7.186	72.365	-1.568	1.020	5.440	0.917	55.9
1400S300-118	50	2.524	8.59	65.671	9.382	5.100	2.175	0.928	65.272	8.426	252.29	213.00	12743	11285	12.981	85.812	-1.544	1.008	5.409	0.919	55.5
1400S350-54 ¹	50	1.278	4.35	35.839	5.120	5.296	1.947	1.234	30.915	3.249	97.28	85.30	1176	1176	1.365	76.252	-2.207	1.400	5.868	0.859	70.7
1400S350-68	50	1.602	5.45	44.718	6.388	5.283	2.406	1.225	42.938	4.710	141.01	119.00	2364	2364	2.715	94.534	-2.190	1.391	5.849	0.860	70.4
1400S350-97	50	2.262	7.70	62.521	8.932	5.257	3.296	1.207	62.505	8.190	245.22	195.00	6938	6938	7.799	130.430	-2.155	1.373	5.809	0.862	69.9
1400S350-118 ⁶	50	2.742	9.33	75.217	10.745	5.238	3.903	1.193	75.197	10.259	340.00 ⁶	257.00	12743	11285	14.098	155.387	-2.130	1.360	5.779	0.864	66.1
1600S162-68 ¹	50	1.406	4.78	40.929	5.116	5.395	0.268	0.436	35.573	3.624	108.49	78.50	2062	2062	2.383	14.816	-0.601	0.415	5.446	0.988	28.6
1600S162-97	50	1.982	6.75	56.845	7.106	5.355	0.348	0.419	53.192	5.738	171.79	136.00	6042	6042	6.835	19.807	-0.577	0.401	5.402	0.989	27.9
1600S162-118	50	2.400	8.17	68.040	8.505	5.324	0.394	0.405	66.027	7.398	221.51	183.00	11086	11086	12.342	23.035	-0.559	0.391	5.369	0.989	27.4
1600S200-68 ¹	50	1.477	5.03	45.307	5.663	5.538	0.506	0.585	40.059	4.045	121.10	93.40	2062	2062	2.503	27.155	-0.862	0.584	5.635	0.977	37.1
1600S200-97	50	2.084	7.09	63.072	7.884	5.501	0.671	0.567	59.472	6.500	194.60	159.00	6042	6042	7.186	36.744	-0.835	0.569	5.593	0.978	36.4
1600S200-118	50	2.524	8.59	75.627	9.453	5.473	0.774	0.554	73.635	8.331	249.43	213.00	11086	11086	12.981	43.132	-0.815	0.558	5.561	0.979	35.9
1600S250-68 ¹	50	1.549	5.27	49.830	6.229	5.673	0.889	0.758	43.935	4.092	122.52	102.00	2062	2062	2.624	46.230	-1.167	0.778	5.841	0.960	46.5
1600S250-97	50	2.186	7.44	69.498	8.687	5.639	1.193	0.739	65.945	6.982	209.05	173.00	6042	6042	7.536	63.082	-1.138	0.762	5.799	0.962	45.9
1600S250-118	50	2.649	9.01	83.452	10.432	5.613	1.390	0.724	81.480	9.221	276.08	232.00	11086	11086	13.619	74.524	-1.116	0.750	5.769	0.963	45.4
1600S300-68 ¹	50	1.620	5.51	54.353	6.794	5.792	1.411	0.933	46.265	4.210	126.04	107.00	2062	2062	2.745	71.609	-1.494	0.981	6.055	0.939	55.8
1600S300-97	50	2.288	7.78	75.924	9.491	5.761	1.910	0.914	71.014	7.391	221.28	182.00	6042	6042	7.887	98.275	-1.463	0.964	6.014	0.941	55.1
1600S300-118	50	2.773	9.44	91.278	11.410	5.737	2.240	0.899	89.323	9.835	294.47	245.00	11086	11086	14.258	116.606	-1.439	0.951	5.983	0.942	54.7
1600S350-68 ¹	50	1.745	5.94	61.638	7.705	5.944	2.490	1.195	55.181	5.180	155.09	135.00	2062	2062	2.957	127.370	-2.055	1.322	6.402	0.897	69.7
1600S350-97	50	2.466	8.39	86.292	10.786	5.916	3.410	1.176	82.842	8.382	250.95	224.00	6042	6042	8.500	175.896	-2.022	1.304	6.362	0.899	69.1
1600S350-118	50	2.990	10.18	103.917	12.990	5.895	4.039	1.162	101.987	11.304	338.45	296.00	11086	11086	15.375	209.692	-1.998	1.291	6.332	0.900	68.8

For SI: 1 inch = 25.4 mm; 1 kip-in = 112.99 N-m; 1 lb = 4.45 N.

¹Web slenderness ratio (h/t) exceeds 200. Web stiffeners designed in accordance with AISI S100 are required at support points and concentrated Loads. Holes/punch-outs in the web are outside the scope of this report.

²Effective properties except for V_{ag} are based on members with punch-outs.

³Gross and torsional properties are based on the full, unreduced cross-section, away from web punch-outs.

⁴Use the effective moment of inertia for deflection calculation.

⁵Allowable moment is lesser of M_{al} and M_{ad}. Distortional buckling is based on an assumed KΦ = 0.

⁶Cold work of forming applied.

SYMBOLS

I_x = Moment of inertia about x-axis
 S_x = Section modulus about x-axis
 r_x = Radius of gyration about x-axis
 J = Moment of inertia about y-axis
 r_y = Radius of gyration about y-axis
 M_{al} = Allowable bending moment about x-axis based on local buckling

M_{ad} = Allowable moment about x-axis based on distortional buckling
 V_{ag} = Allowable shear of unpunched web section
 V_{anet} = Allowable shear of punched web section
 J = St. Venant torsion constant
 C_w = Torsional warping constant

x_o = Distance from shear center to the centroid along the principal X-axis
 m = Distance from shear center to mid-plane of web
 r_o = Polar radiud of gyration about shear center
 β = Torsional flexural constant
 L_u = Unbraced length below which lateral-torsional buckling is not considered

TABLE 5—TRACK PROPERTIES³

MEMBER	F _y (ksi)	GROSS PROPERTIES ²							EFFECTIVE PROPERTIES ²				TORSIONAL PROPERTIES ²					
		Area (in ²)	Weight (lb/ft)	I _x (in ⁴)	S _x (in ³)	r _x (in.)	I _y (in ⁴)	r _y (in.)	I _x (in ⁴)	S _x (in ³)	M _{al} (in-k)	V _{ag} (lb)	Jx1000 (in ⁴)	C _w (in ⁶)	x _o (in.)	m (in.)	r _o (in.)	β
250T125-33	33	0.173	0.59	0.192	0.145	1.05	0.027	0.397	0.167	0.103	2.03	1024	0.069	0.033	-0.760	0.456	1.36	0.687
250T125-43	33	0.225	0.77	0.250	0.188	1.06	0.035	0.395	0.233	0.147	2.91	1356	0.153	0.043	-0.755	0.453	1.36	0.690
250T125-43	50	0.225	0.77	0.250	0.188	1.06	0.035	0.395	0.221	0.137	4.09	2054	0.153	0.043	-0.755	0.453	1.36	0.690
250T125-54	50	0.282	0.96	0.318	0.236	1.06	0.044	0.392	0.299	0.188	5.64	2563	0.302	0.054	-0.749	0.449	1.36	0.696
250T125-68	50	0.355	1.21	0.408	0.297	1.07	0.054	0.389	0.405	0.262	7.85	3199	0.602	0.069	-0.740	0.444	1.36	0.704
250T125-97	50	0.506	1.72	0.604	0.423	1.09	0.074	0.383	0.604	0.423	12.67	4476	1.745	0.102	-0.724	0.434	1.37	0.719
250T200-33	33	0.225	0.77	0.280	0.212	1.12	0.097	0.658	0.204	0.112	2.22	1024	0.090	0.118	-1.418	0.813	1.92	0.455
250T200-43	33	0.293	1.00	0.366	0.275	1.12	0.126	0.657	0.290	0.163	3.21	1356	0.199	0.153	-1.413	0.810	1.92	0.457
250T200-43	50	0.293	1.00	0.366	0.275	1.12	0.126	0.657	0.272	0.150	4.48	2054	0.199	0.153	-1.413	0.810	1.92	0.457
250T200-54	50	0.367	1.25	0.466	0.346	1.13	0.157	0.654	0.374	0.209	6.25	2563	0.392	0.195	-1.405	0.806	1.92	0.462
250T200-68	50	0.462	1.57	0.600	0.437	1.14	0.196	0.652	0.519	0.296	8.87	3199	0.784	0.251	-1.396	0.800	1.92	0.469
250T200-97	50	0.659	2.24	0.894	0.626	1.17	0.275	0.646	0.861	0.510	15.28	4476	2.271	0.374	-1.376	0.789	1.92	0.484
250T300-33	33	0.294	1.00	0.398	0.301	1.16	0.290	0.993	0.240	0.119	2.36	1024	0.117	0.360	-2.349	1.301	2.80	0.298
250T300-43	33	0.383	1.30	0.521	0.391	1.17	0.376	0.991	0.344	0.174	3.43	1356	0.260	0.470	-2.343	1.299	2.80	0.299
250T300-43	50	0.383	1.30	0.521	0.391	1.17	0.376	0.991	0.320	0.159	4.77	2054	0.260	0.470	-2.343	1.299	2.80	0.299
250T300-54	50	0.480	1.64	0.664	0.492	1.18	0.470	0.989	0.445	0.223	6.69	2563	0.513	0.599	-2.335	1.294	2.79	0.302
250T300-68	50	0.605	2.06	0.856	0.623	1.19	0.589	0.987	0.627	0.319	9.56	3199	1.025	0.773	-2.324	1.288	2.79	0.307
250T300-97	50	0.862	2.93	1.279	0.896	1.22	0.831	0.981	1.074	0.563	16.86	4476	2.973	1.158	-2.303	1.276	2.78	0.316
362T125-33	33	0.212	0.72	0.438	0.232	1.44	0.030	0.377	0.384	0.174	3.44	1024	0.085	0.076	-0.658	0.409	1.63	0.836
362T125-43	33	0.276	0.94	0.571	0.302	1.44	0.039	0.375	0.530	0.245	4.84	1739	0.187	0.098	-0.654	0.407	1.62	0.838
362T125-43	50	0.276	0.94	0.571	0.302	1.44	0.039	0.375	0.508	0.230	6.89	2141	0.187	0.098	-0.654	0.407	1.62	0.838
362T125-54	50	0.346	1.18	0.723	0.378	1.45	0.048	0.373	0.677	0.312	9.34	3372	0.370	0.123	-0.648	0.404	1.63	0.841
362T125-68	50	0.436	1.48	0.921	0.475	1.45	0.060	0.370	0.907	0.427	12.78	4703	0.738	0.156	-0.641	0.399	1.63	0.846
362T125-97	50	0.621	2.11	1.343	0.675	1.47	0.082	0.364	1.343	0.675	20.21	6622	2.140	0.226	-0.626	0.390	1.64	0.854
362T125-118 ⁴	50	0.757	2.58	1.667	0.821	1.48	0.098	0.359	1.667	0.821	28.2 ⁴	8008	3.894	0.278	-0.615	0.383	1.65	0.860
362T200-33	33	0.264	0.90	0.619	0.328	1.53	0.110	0.645	0.463	0.190	3.76	1024	0.105	0.269	-1.270	0.754	2.09	0.631
362T200-43	33	0.343	1.17	0.808	0.427	1.53	0.142	0.643	0.647	0.270	5.34	1739	0.233	0.350	-1.265	0.752	2.09	0.633
362T200-43	50	0.343	1.17	0.808	0.427	1.53	0.142	0.643	0.613	0.252	7.56	2141	0.233	0.350	-1.265	0.752	2.09	0.633
362T200-54	50	0.431	1.47	1.024	0.536	1.54	0.177	0.641	0.829	0.345	10.34	3372	0.460	0.442	-1.259	0.748	2.09	0.638
362T200-68	50	0.543	1.85	1.307	0.675	1.55	0.221	0.638	1.133	0.480	14.38	4703	0.919	0.564	-1.250	0.743	2.09	0.643
362T200-97	50	0.773	2.63	1.917	0.963	1.58	0.308	0.632	1.834	0.804	24.06	6622	2.666	0.825	-1.232	0.732	2.10	0.655
362T200-118	50	0.944	3.21	2.388	1.176	1.59	0.371	0.627	2.388	1.072	32.10	8008	4.852	1.026	-1.219	0.724	2.10	0.663
362T300-33	33	0.333	1.13	0.861	0.457	1.61	0.327	0.992	0.541	0.197	3.89	1024	0.133	0.811	-2.159	1.234	2.87	0.434
362T300-43	33	0.434	1.48	1.124	0.594	1.61	0.425	0.990	0.763	0.290	5.73	1739	0.294	1.055	-2.153	1.231	2.86	0.435
362T300-43	50	0.434	1.48	1.124	0.594	1.61	0.425	0.990	0.718	0.270	8.08	2141	0.294	1.055	-2.153	1.231	2.86	0.435
362T300-54	50	0.544	1.85	1.425	0.746	1.62	0.531	0.988	0.979	0.371	11.11	3372	0.581	1.337	-2.146	1.227	2.86	0.439
362T300-68	50	0.685	2.33	1.823	0.941	1.63	0.665	0.985	1.354	0.519	15.55	4703	1.161	1.711	-2.136	1.221	2.86	0.443
362T300-97	50	0.977	3.32	2.682	1.348	1.66	0.937	0.979	2.248	0.887	26.55	6622	3.367	2.518	-2.116	1.209	2.86	0.453
362T300-118	50	1.192	4.06	3.350	1.650	1.68	1.134	0.975	2.998	1.206	36.09	8008	6.130	3.145	-2.101	1.201	2.86	0.460

Table 5 continued on next page.

TABLE 5—TRACK PROPERTIES³ (Continued)

MEMBER	F _y (ksi)	GROSS PROPERTIES ²							EFFECTIVE PROPERTIES ²				TORSIONAL PROPERTIES ²					
		Area (in ²)	Weight (lb/ft)	I _x (in ⁴)	S _x (in ³)	r _x (in.)	I _y (in ⁴)	r _y (in.)	I _x (in ⁴)	S _x (in ³)	M _{al} (in-k)	V _{ag} (lb)	Jx1000 (in ⁴)	C _w (in ⁶)	x _o (in.)	m (in.)	r _o (in.)	β
800T125-33 ¹	33	0.363	1.24	2.895	0.711	2.82	0.036	0.313	2.425	0.407	8.04	465	0.145	0.456	-0.439	0.294	2.87	0.977
800T125-43	33	0.473	1.61	3.773	0.924	2.82	0.046	0.311	3.489	0.640	12.65	1030	0.321	0.589	-0.436	0.292	2.87	0.977
800T125-43	50	0.473	1.61	3.773	0.924	2.82	0.046	0.311	3.236	0.552	16.54	1030	0.321	0.589	-0.436	0.292	2.87	0.977
800T125-54	50	0.594	2.02	4.745	1.158	2.83	0.057	0.309	4.440	0.824	24.67	2039	0.634	0.735	-0.432	0.289	2.88	0.977
800T125-68	50	0.748	2.54	5.998	1.454	2.83	0.070	0.307	5.991	1.216	36.40	4086	1.267	0.920	-0.427	0.286	2.88	0.978
800T125-97	50	1.066	3.63	8.613	2.062	2.84	0.097	0.301	8.613	2.062	61.73	10885	3.674	1.296	-0.417	0.279	2.89	0.979
800T125-118 ⁴	50	1.301	4.43	10.569	2.506	2.85	0.115	0.297	10.569	2.506	86.2 ⁴	16235	6.688	1.567	-0.410	0.274	2.90	0.980
800T200-33 ¹	33	0.415	1.41	3.749	0.921	3.01	0.135	0.571	2.733	0.424	8.37	465	0.166	1.638	-0.917	0.589	3.19	0.918
800T200-43	33	0.541	1.84	4.887	1.197	3.01	0.175	0.569	4.002	0.676	13.35	1030	0.367	2.124	-0.913	0.587	3.19	0.918
800T200-43	50	0.541	1.84	4.887	1.197	3.01	0.175	0.569	3.661	0.577	17.28	1030	0.367	2.124	-0.913	0.587	3.19	0.918
800T200-54	50	0.679	2.31	6.152	1.501	3.01	0.218	0.567	5.109	0.872	26.10	2039	0.725	2.664	-0.908	0.584	3.20	0.919
800T200-68	50	0.854	2.91	7.786	1.888	3.02	0.272	0.564	7.060	1.310	39.22	4086	1.448	3.357	-0.902	0.580	3.20	0.921
800T200-97	50	1.218	4.15	11.212	2.684	3.03	0.379	0.558	10.956	2.347	70.28	10885	4.200	4.792	-0.889	0.571	3.21	0.923
800T200-118	50	1.487	5.06	13.786	3.269	3.05	0.456	0.554	13.786	3.059	91.60	16235	7.646	5.854	-0.879	0.565	3.22	0.925
800T300-33 ¹	33	0.484	1.65	4.887	1.200	3.18	0.416	0.927	3.133	0.443	8.76	465	0.193	4.872	-1.662	1.026	3.70	0.799
800T300-43	33	0.631	2.15	6.372	1.562	3.18	0.540	0.925	4.835	0.737	14.57	1030	0.428	6.330	-1.657	1.024	3.70	0.800
800T300-43	50	0.631	2.15	6.372	1.562	3.18	0.540	0.925	4.248	0.608	18.21	1030	0.428	6.330	-1.657	1.024	3.70	0.800
800T300-54	50	0.792	2.69	8.028	1.958	3.18	0.675	0.923	6.140	0.956	28.62	2039	0.845	7.960	-1.652	1.020	3.70	0.801
800T300-68	50	0.997	3.39	10.171	2.466	3.19	0.844	0.920	8.202	1.549	46.38	4086	1.690	10.067	-1.644	1.015	3.71	0.803
800T300-97	50	1.422	4.84	14.676	3.513	3.21	1.188	0.914	12.915	2.586	77.44	10885	4.901	14.473	-1.628	1.006	3.72	0.808
800T300-118	50	1.735	5.91	18.075	4.286	3.23	1.436	0.910	16.710	3.395	101.63	16235	8.924	17.775	-1.617	0.998	3.72	0.811
1000T125-43 ¹	33	0.563	1.92	6.630	1.305	3.43	0.047	0.290	5.866	0.819	16.19	822	0.382	0.973	-0.379	0.259	3.46	0.988
1000T125-43 ¹	50	0.563	1.92	6.630	1.305	3.43	0.047	0.290	5.387	0.702	21.03	822	0.382	0.973	-0.379	0.259	3.46	0.988
1000T125-54	50	0.707	2.41	8.333	1.634	3.43	0.059	0.288	7.469	1.055	31.59	1627	0.755	1.213	-0.376	0.256	3.47	0.988
1000T125-68	50	0.890	3.03	10.522	2.053	3.44	0.073	0.286	10.216	1.575	47.15	3260	1.508	1.515	-0.372	0.253	3.47	0.989
1000T125-97	50	1.269	4.32	15.077	2.912	3.45	0.100	0.281	15.077	2.753	82.43	9505	4.375	2.123	-0.363	0.247	3.48	0.989
1000T125-118	50	1.549	5.27	18.471	3.540	3.45	0.119	0.277	18.471	3.536	105.86	16235	7.966	2.558	-0.357	0.243	3.48	0.990
1000T200-43 ¹	33	0.631	2.15	8.361	1.646	3.64	0.183	0.539	6.644	0.861	17.01	822	0.428	3.540	-0.813	0.534	3.77	0.953
1000T200-43 ¹	50	0.631	2.15	8.361	1.646	3.64	0.183	0.539	6.030	0.731	21.90	822	0.428	3.540	-0.813	0.534	3.77	0.953
1000T200-54	50	0.792	2.69	10.516	2.062	3.65	0.228	0.537	8.481	1.111	33.26	1627	0.845	4.434	-0.809	0.531	3.77	0.954
1000T200-68	50	0.997	3.39	13.292	2.594	3.65	0.284	0.534	11.819	1.684	50.43	3260	1.690	5.576	-0.803	0.527	3.78	0.955
1000T200-97	50	1.422	4.84	19.087	3.686	3.66	0.397	0.528	18.722	3.081	92.26	9505	4.901	7.924	-0.791	0.519	3.79	0.956
1000T200-118	50	1.735	5.91	23.423	4.489	3.67	0.477	0.524	23.423	4.208	126.00	16235	8.924	9.649	-0.783	0.514	3.79	0.957
1000T300-43 ¹	33	0.721	2.45	10.669	2.100	3.85	0.572	0.891	7.923	0.919	18.16	822	0.489	10.582	-1.505	0.950	4.23	0.873
1000T300-43 ¹	50	0.721	2.45	10.669	2.100	3.85	0.572	0.891	6.887	0.762	22.82	822	0.489	10.582	-1.505	0.950	4.23	0.873
1000T300-54	50	0.905	3.08	13.427	2.633	3.85	0.714	0.888	10.180	1.191	35.66	1627	0.966	13.289	-1.500	0.947	4.23	0.874
1000T300-68	50	1.140	3.88	16.985	3.314	3.86	0.894	0.885	14.062	1.905	57.03	3260	1.931	16.771	-1.493	0.943	4.23	0.876
1000T300-97	50	1.625	5.53	24.434	4.719	3.88	1.257	0.880	21.873	3.589	107.46	9505	5.602	24.009	-1.478	0.934	4.24	0.879
1000T300-118	50	1.984	6.75	30.024	5.755	3.89	1.519	0.875	28.102	4.668	139.77	16235	10.201	29.395	-1.468	0.927	4.25	0.881

Table 5 continued on next page.

TABLE 5—TRACK PROPERTIES³ (Continued)

MEMBER	F _y (ksi)	GROSS PROPERTIES ²							EFFECTIVE PROPERTIES ²				TORSIONAL PROPERTIES ²					
		Area (in ²)	Weight (lb/ft)	I _x (in ⁴)	S _x (in ³)	r _x (in.)	I _y (in ⁴)	r _y (in.)	I _x (in ⁴)	S _x (in ³)	M _{al} (in-k)	V _{ag} (lb)	Jx1000 (in ⁴)	C _w (in ⁶)	x _o (in.)	m (in.)	r _o (in.)	β
1200T125-54 ¹	50	0.820	2.79	13.335	2.186	4.03	0.060	0.271	11.351	1.286	38.51	1354	0.876	1.820	-0.333	0.230	4.06	0.993
1200T125-68	50	1.033	3.51	16.826	2.747	4.04	0.074	0.268	15.686	1.934	57.91	2712	1.750	2.270	-0.329	0.227	4.06	0.993
1200T125-97	50	1.472	5.01	24.078	3.897	4.04	0.102	0.264	23.961	3.443	103.07	7901	5.076	3.171	-0.322	0.222	4.07	0.994
1200T125-118	50	1.798	6.12	29.472	4.740	4.05	0.122	0.260	29.472	4.491	134.45	14431	9.243	3.812	-0.316	0.218	4.07	0.994
1200T200-54 ¹	50	0.905	3.08	16.464	2.699	4.27	0.236	0.510	12.780	1.350	40.42	1354	0.966	6.714	-0.730	0.487	4.36	0.972
1200T200-68	50	1.140	3.88	20.791	3.395	4.27	0.294	0.508	17.950	2.058	61.63	2712	1.931	8.431	-0.725	0.483	4.36	0.972
1200T200-97	50	1.625	5.53	29.805	4.824	4.28	0.410	0.502	29.167	3.820	114.36	7901	5.602	11.946	-0.714	0.476	4.37	0.973
1200T200-118	50	1.984	6.75	36.531	5.876	4.29	0.493	0.498	36.531	5.278	158.03	14431	10.201	14.513	-0.706	0.471	4.38	0.974
1200T300-54 ¹	50	1.018	3.46	20.636	3.383	4.50	0.745	0.855	14.142	1.391	41.66	1354	1.087	20.211	-1.375	0.884	4.78	0.917
1200T300-68	50	1.282	4.36	26.079	4.258	4.51	0.932	0.852	20.112	2.140	64.07	2712	2.173	25.471	-1.369	0.880	4.79	0.918
1200T300-97	50	1.828	6.22	37.441	6.060	4.53	1.311	0.847	33.474	4.052	121.31	7901	6.304	36.357	-1.355	0.871	4.80	0.920
1200T300-118	50	2.232	7.60	45.942	7.389	4.54	1.584	0.842	43.213	5.696	170.53	14431	11.478	44.420	-1.346	0.865	4.81	0.922
1400T125-54 ¹	50	0.933	3.18	19.977	2.814	4.63	0.061	0.256	16.041	1.517	45.43	1160	0.997	2.559	-0.299	0.209	4.64	0.996
1400T125-68	50	1.175	4.00	25.196	3.536	4.63	0.076	0.254	22.385	2.293	68.65	2322	1.992	3.189	-0.296	0.206	4.65	0.996
1400T125-97	50	1.676	5.70	36.025	5.019	4.64	0.104	0.249	34.790	4.134	123.77	6759	5.778	4.445	-0.289	0.201	4.65	0.996
1400T125-118	50	2.046	6.96	44.068	6.106	4.64	0.124	0.246	44.008	5.454	163.28	12342	10.520	5.334	-0.284	0.197	4.66	0.996
1400T200-54 ¹	50	1.018	3.46	24.221	3.412	4.88	0.242	0.487	17.783	1.589	47.57	1160	1.087	9.520	-0.665	0.449	4.95	0.982
1400T200-68	50	1.282	4.36	30.571	4.291	4.88	0.301	0.485	25.204	2.432	72.82	2322	2.173	11.942	-0.661	0.446	4.95	0.982
1400T200-97	50	1.828	6.22	43.774	6.098	4.89	0.420	0.479	41.581	4.559	136.50	6759	6.304	16.883	-0.651	0.439	4.96	0.983
1400T200-118	50	2.232	7.60	53.606	7.427	4.90	0.505	0.476	53.546	6.354	190.25	12342	11.478	20.479	-0.644	0.434	4.97	0.983
1400T300-54 ¹	50	1.131	3.85	29.881	4.209	5.14	0.769	0.825	19.487	1.636	48.97	1160	1.208	28.800	-1.271	0.829	5.36	0.944
1400T300-68	50	1.425	4.85	37.737	5.297	5.15	0.963	0.822	27.927	2.523	75.55	2322	2.415	36.258	-1.265	0.825	5.36	0.944
1400T300-97	50	2.032	6.91	54.105	7.538	5.16	1.354	0.816	47.088	4.816	144.19	6759	7.005	51.644	-1.252	0.817	5.37	0.946
1400T300-118	50	2.481	8.44	66.324	9.189	5.17	1.636	0.812	62.022	6.816	204.08	12342	12.755	62.998	-1.243	0.811	5.38	0.947
1600T125-68 ¹	50	1.318	4.49	35.916	4.421	5.22	0.077	0.241	30.575	2.651	79.38	2029	2.233	4.273	-0.268	0.189	5.23	0.997
1600T125-97	50	1.879	6.40	51.323	6.276	5.23	0.106	0.237	48.074	4.826	144.48	5906	6.479	5.945	-0.262	0.184	5.24	0.997
1600T125-118	50	2.294	7.81	62.756	7.637	5.23	0.125	0.234	61.272	6.420	192.23	10781	11.797	7.126	-0.257	0.181	5.24	0.998
1600T200-68 ¹	50	1.425	4.85	42.914	5.282	5.49	0.307	0.464	34.142	2.806	84.00	2029	2.415	16.123	-0.607	0.414	5.54	0.988
1600T200-97	50	2.032	6.91	61.398	7.508	5.50	0.428	0.459	56.883	5.299	158.64	5906	7.005	22.755	-0.598	0.408	5.55	0.988
1600T200-118	50	2.481	8.44	75.146	9.145	5.50	0.515	0.455	73.686	7.433	222.56	10781	12.755	27.568	-0.592	0.403	5.55	0.989
1600T300-68 ¹	50	1.567	5.33	52.245	6.430	5.77	0.988	0.794	37.541	2.906	87.02	2029	2.656	49.199	-1.176	0.776	5.95	0.961
1600T300-97	50	2.235	7.61	74.833	9.151	5.79	1.389	0.788	63.832	5.580	167.07	5906	7.706	69.964	-1.165	0.769	5.95	0.962
1600T300-118	50	2.729	9.29	91.667	11.155	5.80	1.678	0.784	84.496	7.939	237.69	10781	14.033	85.244	-1.156	0.763	5.96	0.962

For SI: 1 inch = 25.4 mm; 1 kip-in = 112.99 N-m; 1 lb = 4.45 N.

¹Web slenderness ratio (h/t) exceeds 200. Web stiffeners designed in accordance with AISI S100 are required at support points and concentrated loads.

²Gross, effective, and torsional properties are based on the full, unreduced cross-section.

³Use the effective moment of inertia for deflection calculation.

⁴Cold work of forming applied.

SYMBOLS

- I_x = Moment of inertia about x-axis
- S_x = Section modulus about x-axis
- r_x = Radius of gyration about x-axis
- I_y = Moment of inertia about y-axis
- r_y = Radius of gyration about y-axis
- M_{al} = Allowable bending moment about x-axis based on local buckling
- V_{ag} = Allowable shear of unpunched web section

- J = St. Venant torsion constant
- C_w = Torsional warping constant
- x_o = Distance from shear center to the centroid along the principal X-axis
- m = Distance from shear center to mid-plane of web
- r_o = Polar radius of gyration about shear center
- β = Torsional flexural constant
- L_u = Unbraced length below which lateral-torsional buckling is not considered

TABLE 6—ALLOWABLE CONCENTRATED LOADS AND END REACTIONS FOR C-SHAPES BASED ON WEB CRIPPLING² (pounds)

STUD DESIGNATION	F _y (ksi)	CONDITION 1 (E1F)				CONDITION 2 (I1F)				CONDITION 3 (E2F)				CONDITION 4 (I2F)			
		Bearing Length (in)				Bearing Length (in)				Bearing Length (in)				Bearing Length (in)			
		1	3.5	4	6	1	3.5	4	6	1	3.5	4	6	1	3.5	4	6
162S__-33	33	180	See Note 1	See Note 1	See Note 1	336	See Note 1	See Note 1	See Note 1	170	See Note 1	See Note 1	See Note 1	441	See Note 1	See Note 1	See Note 1
250 S__-33	33	173	271	285	See Note 1	330	453	472	See Note 1	150	201	209	See Note 1	411	519	535	See Note 1
250 S__-43	33	287	443	466	See Note 1	580	780	810	See Note 1	267	351	364	See Note 1	720	892	918	See Note 1
250 S__-54	50	656	996	1046	See Note 1	1350	1785	1850	See Note 1	652	842	870	See Note 1	1730	2109	2165	See Note 1
250 S__-68	50	990	1480	1552	See Note 1	2073	2693	2785	See Note 1	1049	1333	1375	See Note 1	2750	3302	3384	See Note 1
250 S__-97	50	1872	2726	See Note 1	See Note 1	4025	5095	See Note 1	See Note 1	2167	2683	See Note 1	See Note 1	5597	6575	See Note 1	See Note 1
350 S__-33	33	166	260	274	323	324	445	463	526	131	175	182	205	384	484	499	551
350 S__-43	33	278	428	451	528	571	768	798	900	240	315	326	365	680	842	866	949
350 S__-54	50	637	967	1016	1186	1331	1761	1825	2046	594	768	794	883	1645	2005	2059	2245
350 S__-68	50	965	1441	1512	1758	2047	2660	2751	3068	970	1232	1271	1406	2631	3159	3238	3510
350 S__-97	50	1831	2666	2790	See Note 1	3983	5041	5198	See Note 1	2035	2520	2592	See Note 1	5397	6339	6479	See Note 1
362 S__-33	33	165	259	273	322	323	444	462	525	129	173	179	202	381	480	495	547
362 S__-43	33	277	427	449	526	570	767	796	898	236	311	322	360	675	836	860	943
362 S__-54	50	634	963	1012	1182	1329	1758	1822	2043	588	760	785	874	1635	1994	2047	2232
362 S__-68	50	962	1437	1507	1752	2044	2657	2747	3064	961	1221	1259	1393	2618	3143	3221	3492
362 S__-97	50	1827	2659	2783	3212	3978	5035	5192	5738	2020	2501	2573	2821	5374	6313	6452	6936
400 S__-33	33	163	256	269	317	322	442	460	522	122	164	170	192	372	469	483	534
400 S__-43	33	274	422	444	520	567	763	792	893	227	299	309	346	662	819	843	924
400 S__-54	50	628	954	1002	1170	1323	1750	1813	2034	569	735	760	846	1607	1960	2012	2194
400 S__-68	50	953	1424	1494	1737	2036	2646	2736	3051	936	1188	1226	1356	2579	3096	3173	3440
400 S__-97	50	1814	2640	2762	3189	3965	5018	5174	5718	1978	2448	2518	2761	5309	6236	6374	6852
550 S__-33	33	155	243	256	302	315	432	450	511	100	134	139	157	339	428	441	487
550 S__-43	33	262	405	426	499	556	749	778	877	195	256	265	297	614	760	782	858
550 S__-54	50	606	920	966	1128	1302	1722	1784	2001	502	649	671	746	1508	1838	1887	2058
550 S__-68	50	923	1380	1447	1683	2007	2608	2697	3007	844	1071	1105	1223	2441	2931	3003	3256
550 S__-97	50	1766	2571	2691	3106	3917	4957	5111	5648	1826	2261	2325	2550	5078	5965	6097	6555

Table 6 continued on next page.

TABLE 6— ALLOWABLE CONCENTRATED LOADS AND END REACTIONS FOR C-SHAPES BASED ON WEB CRIPPLING² (pounds) (Continued)

STUD DESIGNATION	F _y (ksi)	CONDITION 1 ³ (E1F)				CONDITION 2 ³ (I1F)				CONDITION 3 ³ (E2F)				CONDITION 4 ³ (I2F)			
		Bearing Length (in)				Bearing Length (in)				Bearing Length (in)				Bearing Length (in)			
		1	3.5	4	6	1	3.5	4	6	1	3.5	4	6	1	3.5	4	6
600 S -33	33	153	240	253	297	313	430	447	507	93	125	130	146	329	416	429	473
600 S -43	33	259	400	420	493	553	745	773	872	185	243	252	282	600	743	764	838
600 S -54	50	599	909	956	1116	1295	1713	1775	1991	482	623	644	716	1478	1802	1850	2017
600 S -68	50	914	1366	1433	1666	1998	2596	2685	2994	816	1036	1069	1183	2399	2881	2952	3201
600 S -97	50	1752	2551	2669	3081	3902	4939	5093	5628	1781	2205	2268	2487	5010	5885	6014	6466
800 S -43	33	247	381	401	470	542	730	757	854	150	197	204	228	548	678	698	765
800 S -64	50	575	872	917	1070	1272	1682	1743	1955	409	529	547	608	1370	1670	1714	1869
800 S -68	50	882	1318	1382	1607	1966	2555	2642	2946	716	910	939	1038	2250	2701	2768	3001
800 S -97	50	1702	2477	2592	2992	3850	4873	5025	5553	1618	2003	2060	2259	4761	5593	5716	6145
1000 S -54	50	553	840	882	1031	1251	1655	1715	1923	346	447	462	514	1275	1554	1595	1740
1000 S -68	50	854	1275	1338	1555	1938	2518	2604	2904	629	799	824	912	2119	2544	2607	2826
1000 S -97	50	1657	2412	2525	2914	3805	4815	4965	5487	1476	1827	1879	2060	4545	5338	5456	5866
1200 S -68	50	828	1237	1298	1509	1913	2485	2570	2866	551	699	721	798	2001	2402	2462	2669
1200 S -97	50	1618	2355	2464	2844	3764	4764	4912	5428	1348	1668	1716	1882	4350	5109	5222	5614

For SI: 1 inch = 25.4 mm; 1 pound = 4.4482 N; 1 ksl = 6.89 Mpa.

¹ Bearing length to web height ratio, N/h, exceeds 2. Web stiffeners are required.

² Values are for members fastened to supports.

³ Allowable web conditions are as follows (See Figure 2 for illustration):

Condition 1 – End One Flange Loading (E1F)
Condition 2 – Interior One Flange Loading (I1F)

Condition 3 – End Two Flange Loading (E2F)
Condition 4 – Interior Two Flange Loading (I2F)

TABLE 7—FURRING CHANNELS PROPERTIES^{1,2}

SECTION	F _y (ksi)	DESIGN THICKNESS (in)	GROSS PROPERTIES						EFFECTIVE PROPERTIES		
			Area (in ²)	Weight (lb/ft)	I _x (in ⁴)	r _x (in)	I _y (in ⁴)	r _y (in)	I _x (in ⁴)	S _x (in ³)	M _a (ft-lb)
087F125-18	33	0.0188	0.070	0.239	0.009	0.356	0.0422	0.774	0.0086	0.0160	26.41
087F125-27	33	0.0283	0.105	0.357	0.013	0.353	0.0628	0.774	0.0131	0.0272	44.78
087F125-30	33	0.0312	0.115	0.392	0.014	0.352	0.0691	0.774	0.0143	0.0307	50.47
087F125-33	33	0.0346	0.127	0.433	0.016	0.351	0.0763	0.774	0.0157	0.0337	55.43

For SI: 1 inch = 25.4 mm; 1 inch² = 645 mm²; 1 inch³ = 1.64x10⁴; 1 inch⁴ = 4.15x10⁵ mm⁴; 1 lb/lin ft = 14.5939 N/m; 1 kip-in = 112.99 N-m; 1 ksl = 6.89 Mpa.

¹ For deflection calculations, use effective I_x.

² Effective properties are given as the minimum value for positive or negative bending.

SYMBOLS

I_x = Strong axis moment of inertia
r_x = Strong axis radius of gyration

I_y = Weak axis moment of inertia
r_y = Weak axis radius of gyration

S_x = Strong axis section modulus
M_a = Strong axis allowable bending moment

TABLE 8—U-CHANNEL PROPERTIES¹

SECTION	F _y (ksi)	DESIGN THICKNESS	GROSS						EFFECTIVE PROPERTIES			
			Area (in ²)	Weight (lb/ft)	I _x (in ⁴)	r _x (in)	I _y (in ⁴)	r _y (in)	I _x (in ⁴)	S _x (in ³)	M _a (in-k)	V _a (lb)
75U050-54	33	0.0566	0.087	0.30	0.007	0.288	0.002	0.155	0.007	0.019	0.45	315
150U050-54	33	0.0566	0.129	0.44	0.039	0.547	0.003	0.144	0.039	0.052	1.22	840
200U050-54	33	0.0566	0.157	0.54	0.079	0.709	0.003	0.136	0.079	0.079	1.87	1190

For SI: 1 inch = 25.4 mm; 1 inch² = 645 mm²; 1 inch³ = 1.64x10⁴; 1 inch⁴ = 4.15x10⁵ mm⁴; 1 lb/lin ft = 14.5939 N/m; 1 kip-in = 112.99 N-m; 1 ksi = 6.89 Mpa; 1 lb = 4.45 N.

¹ For deflection calculations, use effective I_x.

SYMBOLS

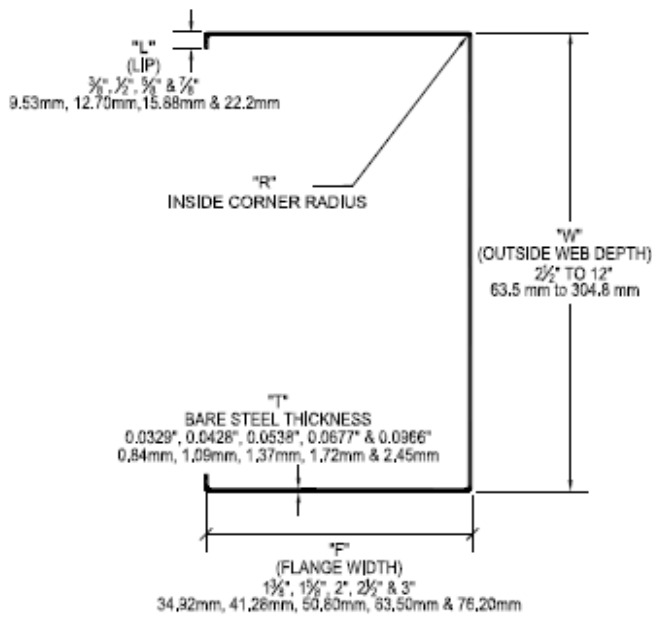
I_x = Strong axis moment of inertia
r_x = Strong axis radius of gyration

I_y = Weak axis moment of inertia
r_y = Weak axis radius of gyration

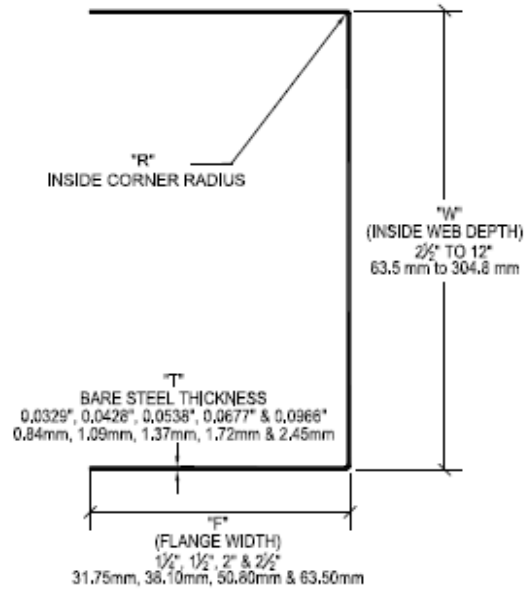
S_x = Strong axis section modulus
M_a = Strong axis allowable bending moment
V_a = Allowable shear of web section

TABLE 9—MANUFACTURING LOCATIONS

Marino\WARE – South Plainfield South Plainfield, NJ 07080	Marino\WARE – East Chicago East Chicago, IN 46312	Marino\WARE – Griffin Griffin, GA 30223
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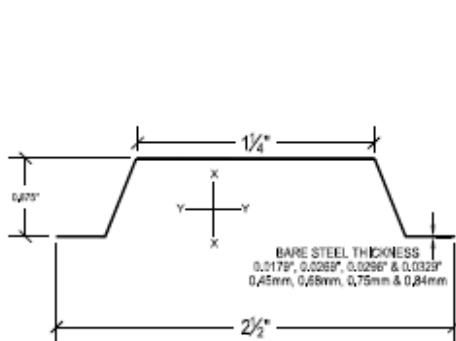
STRUCTURAL STUD



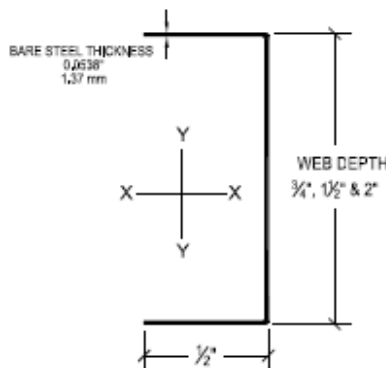
STRUCTURAL TRACK

C-SHAPE

TRACK



FURRING HAT CHANNEL



U-CHANNEL

FIGURE 1—SECTION PROFILES

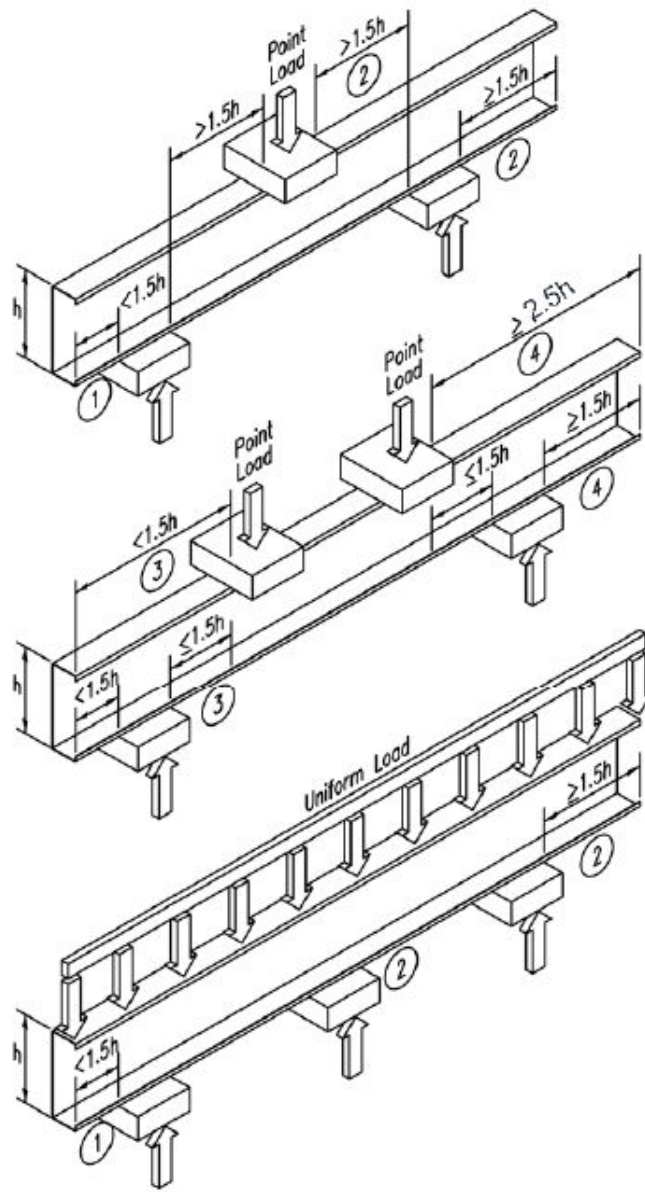


FIGURE 2

DIVISION: 05 00 00—METALS

Section: 05 40 00—Cold-Formed Metal Framing

Section: 05 41 00—Structural Metal Stud Framing

Section: 05 42 00—Cold-Formed Metal Joist Framing

DIVISION: 09 00 00—FINISHES

Section: 09 22 13—Metal Furring

Section: 09 22 16.13—Non-Structural Metal Stud Framing

REPORT HOLDER:

WARE INDUSTRIES, INC., dba MARINO\WARE

EVALUATION SUBJECT:

COLD-FORMED STEEL FRAMING

1.0 REPORT PURPOSE AND SCOPE**Purpose:**

The purpose of this evaluation report supplement is to indicate that MARINO\WARE Cold-Formed Steel Framing, described in ICC-ES evaluation report ESR-4062, has also been evaluated for compliance with the code noted below as adopted by the New York City Department of Building.

Applicable code edition:

- 2022 *New York City Building Code*

2.0 CONCLUSION

The MARINO\WARE Cold-Formed Steel Framing, described in Sections 2.0 through 7.0 of the evaluation report ESR-4062, complies with the New York City Building Code Chapter 22, and are subject to conditions of use described in this supplement.

3.0 CONDITION OF USE

The MARINO\WARE Cold-Formed Steel Framing, described in the evaluation report must comply with all the following conditions:

- All applicable sections in the evaluation report ESR-4062.
- The design, installation, conditions of use and identification of the MARINO\WARE Cold-Formed Steel Framing are in accordance with the 2015 *International Building Code*® (2015 IBC) provisions noted in the evaluation report ESR-4062.
- The design, installation, and inspection are in accordance with additional requirements of the 2022 *New York City Building Code* Chapters 16, 17 and 22, as applicable.

This supplement expires concurrently with the evaluation report, reissued February 2024.

DIVISION: 05 00 00—METALS

Section: 05 40 00—Cold-Formed Metal Framing

Section: 05 41 00—Structural Metal Stud Framing

Section: 05 42 00—Cold-Formed Metal Joist Framing

DIVISION: 09 00 00—FINISHES

Section: 09 22 13—Metal Furring

Section: 09 22 16.13—Non-Structural Metal Stud Framing

REPORT HOLDER:

WARE INDUSTRIES, INC., dba MARINO\WARE

EVALUATION SUBJECT:

COLD-FORMED STEEL FRAMING

1.0 REPORT PURPOSE AND SCOPE**Purpose:**

The purpose of this evaluation report supplement is to indicate that MARINO\WARE Cold-Formed Steel Framing, described in ICC-ES evaluation report ESR-4062, has also been evaluated for compliance with the code noted below.

Applicable code edition:2023 and 2020 *Florida Building Code—Building***2.0 CONCLUSIONS**

The MARINO\WARE Cold-Formed Steel Framing, described in Sections 2.0 through 7.0 of the evaluation report ESR-4062, complies with the *Florida Building Code—Building*. The design requirements must be in accordance with the *Florida Building Code—Building*. The installation requirements noted in ICC-ES evaluation report ESR-4062 for the 2021 and 2018 *International Building Code*® (IBC) meet the requirements of the *Florida Building Code—Building*.

Use of the MARINO\WARE Cold-formed Steel Framing has also been found to be in compliance with the High-Velocity Hurricane Zone provisions of the *Florida Building Code—Building*.

Exception 1: Members noted with footnote 6 in Table 4 and footnote 4 in Table 5 include cold work of forming in the allowable moment and have not been evaluated for compliance with the High-Velocity Hurricane Zone provisions of the *Florida Building Code—Building* (Section 2222.3).

Exception 2: Members with a thickness designation of 18 mils or 27 mils with a coating of less than G90 have not been evaluated for compliance with the High-Velocity Hurricane Zone provisions of the *Florida Building Code—Building*.

For products falling under Florida Rule 61G20-3, verification that the report holder's quality-assurance program is audited by a quality-assurance entity approved by the Florida Building Commission for the type of inspections being conducted is the responsibility of an approved validation entity (or the code official when the report holder does not possess an approval by the Commission).

This supplement expires concurrently with the evaluation report, reissued February 2024.