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ESR-4062

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This report is subject to renewal 02/2019.

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., d/b/a MARINO\WARE

400 METUCHEN ROAD
SOUTH PLAINFIELD, NEW JERSEY 07080

EVALUATION SUBJECT:

COLD-FORMED STEEL FRAMING

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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., d/b/a MARINO\WARE
400 METUCHEN ROAD
SOUTH PLAINFIELD, NEW JERSEY 07080
(908) 757-9000
www.marinoware.com

EVALUATION SUBJECT:

COLD-FORMED STEEL FRAMING

1.0 EVALUATION SCOPE

Compliance with the following codes:

- 2015, 2012 and 2009 *International Building Code*® (IBC)
- 2015, 2012 and 2009 *International Residential Code*® (IRC)

Property evaluated:

Structural

2.0 USES

The steel framing described in this report is used for framing of nonload-bearing interior walls, curtain walls and load-bearing walls, floor joists, ceiling joists and furring.

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. The values in each of the tables for C-shapes are for C-shapes with punch-outs. See Table 10 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 Studs and Tracks: Studs 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:

4.1.1 IBC Method: The section properties indicated in Tables 4, 5, 7 and 8 have been determined in accordance with the applicable edition of the North American Specification for Design of Cold-formed Steel Structural Members (AISI). 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 the applicable edition of AISI. Allowable concentrated loads and reactions based on web crippling are shown in Table 6, for related web crippling loading conditions. The design of flexural members used for framing of nonload-bearing interior walls, curtain walls, load-bearing walls, floors or ceilings must address combined bending and web crippling, and combined bending and shear.

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4.1.2 IRC Method: The steel framing members identified in Table 9 comply with the structural framing requirements of IRC Sections R505.2, R603.2 and R804.2, and qualify for use with the prescriptive requirements of the IRC. When steel framing members are used to construct buildings that do not conform to the applicable requirements of IRC Section R505.1.1, R603.1.1 or R804.1.1; and for steel framing members not identified in Table 3, the structural analysis and design must be in accordance with the IBC, as described in Section 4.1.1 of this report.

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.

6.0 EVIDENCE SUBMITTED

Data in accordance with the ICC-ES Acceptance Criteria for Cold-formed Steel Framing Members (AC46), dated June 2012 (editorially revised April 2015).

7.0 IDENTIFICATION

At a spacing not exceeding 96 inches (2440 mm) on center, each framing member is stamped with the name of the manufacturer (Marino\WARE) or initials (MW); the member designation as provided in Tables 1, 2, 7 and 8; the evaluation report number (ESR-4062); the minimum uncoated steel thickness in decimal inches; the steel designation and minimum specified yield strength; and the coating designation for framing members if other than G40 galvanization coating.

TABLE 1—C-SHAPES

MEMBER	WEB[2] (in)	FLANGE (in)	LIP (in)	THICKNESS DESIGNATION[3] (mils)	AREA (in^2)	WEIGHT (lb/ft)
250S137-33	2.500	1.375	0.375	33	0.197	0.67
250S137-43	2.500	1.375	0.375	43	0.255	0.87
250S137-54	2.500	1.375	0.375	54	0.316	1.07
250S137-68	2.500	1.375	0.375	68	0.390	1.33
250S137-97	2.500	1.375	0.375	97	0.533	1.81
250S162-33	2.500	1.625	0.500	33	0.223	0.76
250S162-43	2.500	1.625	0.500	43	0.289	0.98
250S162-54	2.500	1.625	0.500	54	0.358	1.22
250S162-68	2.500	1.625	0.500	68	0.443	1.51
250S162-97	2.500	1.625	0.500	97	0.610	2.07
350S137-33	3.500	1.375	0.375	33	0.232	0.79
350S137-43	3.500	1.375	0.375	43	0.300	1.02
350S137-54	3.500	1.375	0.375	54	0.372	1.27
350S137-68	3.500	1.375	0.375	68	0.461	1.57
350S137-97	3.500	1.375	0.375	97	0.635	2.16
350S162-33	3.500	1.625	0.500	33	0.258	0.88
350S162-43	3.500	1.625	0.500	43	0.334	1.14
350S162-54	3.500	1.625	0.500	54	0.415	1.41
350S162-68	3.500	1.625	0.500	68	0.515	1.75
350S162-97	3.500	1.625	0.500	97	0.711	2.42
362S137-33	3.625	1.375	0.375	33	0.236	0.80
362S137-43	3.625	1.375	0.375	43	0.306	1.04
362S137-54	3.625	1.375	0.375	54	0.379	1.29
362S137-68	3.625	1.375	0.375	68	0.470	1.60
362S137-97	3.625	1.375	0.375	97	0.648	2.20
362S162-33	3.625	1.625	0.500	33	0.262	0.89
362S162-43	3.625	1.625	0.500	43	0.340	1.16
362S162-54	3.625	1.625	0.500	54	0.422	1.44
362S162-68	3.625	1.625	0.500	68	0.524	1.78
362S162-97	3.625	1.625	0.500	97	0.724	2.46
362S200-33	3.625	2.000	0.625	33	0.297	1.01
362S200-43	3.625	2.000	0.625	43	0.385	1.31
362S200-54	3.625	2.000	0.625	54	0.479	1.63
362S200-68	3.625	2.000	0.625	68	0.595	2.02
362S200-97	3.625	2.000	0.625	97	0.826	2.81
362S250-43	3.625	2.500	0.625	43	0.430	1.46
362S250-54	3.625	2.500	0.625	54	0.535	1.82
362S250-68	3.625	2.500	0.625	68	0.666	2.27
362S250-97	3.625	2.500	0.625	97	0.927	3.16
362S300-54	3.625	3.000	0.625	54	0.620	2.11
362S300-68	3.625	3.000	0.625	68	0.773	2.63
362S300-97	3.625	3.000	0.625	97	1.080	3.67
400S137-33	4.000	1.375	0.375	33	0.249	0.85
400S137-43	4.000	1.375	0.375	43	0.323	1.10
400S137-54	4.000	1.375	0.375	54	0.401	1.36
400S137-68	4.000	1.375	0.375	68	0.497	1.69
400S137-97	4.000	1.375	0.375	97	0.686	2.33
400S162-33	4.000	1.625	0.500	33	0.275	0.94
400S162-43	4.000	1.625	0.500	43	0.357	1.21
400S162-54	4.000	1.625	0.0566	54	0.443	1.51
400S162-68	4.000	1.625	0.0713	68	0.550	1.87
400S162-97	4.000	1.625	0.1017	97	0.762	2.59
400S200-33	4.000	2.000	0.625	33	0.310	1.05
400S200-43	4.000	2.000	0.625	43	0.402	1.37
400S200-54	4.000	2.000	0.625	54	0.500	1.70
400S200-68	4.000	2.000	0.625	68	0.622	2.12
400S200-97	4.000	2.000	0.625	97	0.864	2.94
400S250-43	4.000	2.500	0.625	43	0.447	1.52
400S250-54	4.000	2.500	0.625	54	0.556	1.89
400S250-68	4.000	2.500	0.625	68	0.693	2.36
400S250-97	4.000	2.500	0.625	97	0.966	3.29
400S300-54	4.000	3.000	0.625	54	0.641	2.18
400S300-68	4.000	3.000	0.625	68	0.800	2.72
400S300-97	4.000	3.000	0.625	97	1.118	3.80
550S137-33	5.500	1.375	0.375	33	0.301	1.02
550S137-43	5.500	1.375	0.375	43	0.391	1.33
550S137-54	5.500	1.375	0.375	54	0.486	1.65
550S137-68	5.500	1.375	0.375	68	0.604	2.05
550S137-97	5.500	1.375	0.375	97	0.838	2.85
550S162-33	5.500	1.625	0.500	33	0.327	1.11
550S162-43	5.500	1.625	0.500	43	0.424	1.44
550S162-54	5.500	1.625	0.500	54	0.528	1.80
550S162-68	5.500	1.625	0.500	68	0.657	2.24
550S162-97	5.500	1.625	0.500	97	0.915	3.11
600S137-33	6.000	1.375	0.375	33	0.318	1.08
600S137-43	6.000	1.375	0.375	43	0.413	1.41
600S137-54	6.000	1.375	0.375	54	0.514	1.75
600S137-68	6.000	1.375	0.375	68	0.640	2.18
600S137-97	6.000	1.375	0.375	97	0.889	3.03
600S162-33	6.000	1.625	0.500	33	0.344	1.17
600S162-43	6.000	1.625	0.500	43	0.447	1.52
600S162-54	6.000	1.625	0.500	54	0.556	1.89
600S162-68	6.000	1.625	0.500	68	0.693	2.36
600S162-97	6.000	1.625	0.500	97	0.966	3.29
600S200-33	6.000	2.000	0.625	33	0.379	1.29
600S200-43	6.000	2.000	0.625	43	0.492	1.67
600S200-54	6.000	2.000	0.625	54	0.613	2.09
600S200-68	6.000	2.000	0.625	68	0.764	2.60
600S200-97	6.000	2.000	0.625	97	1.067	3.63
600S250-43	6.000	2.500	0.625	43	0.537	1.83
600S250-54	6.000	2.500	0.625	54	0.670	2.28
600S250-68	6.000	2.500	0.625	68	0.836	2.84
600S250-97	6.000	2.500	0.625	97	1.169	3.98
600S300-54	6.000	3.000	0.625	54	0.754	2.57
600S300-68	6.000	3.000	0.625	68	0.943	3.21
600S300-97	6.000	3.000	0.625	97	1.321	4.50

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

TABLE 1—C-SHAPES (Continued)

MEMBER	WEB[2] (in)	FLANGE (in)	LIP (in)	THICKNESS DESIGNATION[3] (mils)	AREA (in^2)	WEIGHT (lb/ft)
800S137-33[1]	8.000	1.375	0.375	33	0.388	1.32
800S137-43	8.000	1.375	0.375	43	0.503	1.71
800S137-54	8.000	1.375	0.375	54	0.627	2.13
800S137-68	8.000	1.375	0.375	68	0.782	2.66
800S137-97	8.000	1.375	0.375	97	1.093	3.72
800S162-33[1]	8.000	1.625	0.500	33	0.413	1.41
800S162-43	8.000	1.625	0.500	43	0.537	1.83
800S162-54	8.000	1.625	0.500	54	0.670	2.28
800S162-68	8.000	1.625	0.500	68	0.836	2.84
800S162-97	8.000	1.625	0.500	97	1.169	3.98
800S200-33[1]	8.000	2.000	0.625	33	0.448	1.52
800S200-43	8.000	2.000	0.625	43	0.582	1.98
800S200-54	8.000	2.000	0.625	54	0.726	2.47
800S200-68	8.000	2.000	0.625	68	0.907	3.09
800S200-97	8.000	2.000	0.625	97	1.271	4.32
800S250-43	8.000	2.500	0.625	43	0.627	2.13
800S250-54	8.000	2.500	0.625	54	0.783	2.66
800S250-68	8.000	2.500	0.625	68	0.978	3.33
800S250-97	8.000	2.500	0.625	97	1.372	4.67
800S300-54	8.000	3.000	0.625	54	0.868	2.95
800S300-68	8.000	3.000	0.625	68	1.085	3.69
800S300-97	8.000	3.000	0.625	97	1.525	5.19
1000S162-43[1]	10.000	1.625	0.500	43	0.627	2.13
1000S162-54	10.000	1.625	0.500	54	0.783	2.66
1000S162-68	10.000	1.625	0.500	68	0.978	3.33
1000S162-97	10.000	1.625	0.500	97	1.372	4.67
1000S200-43[1]	10.000	2.000	0.625	43	0.672	2.29
1000S200-54	10.000	2.000	0.625	54	0.839	2.86
1000S200-68	10.000	2.000	0.625	68	1.050	3.57
1000S200-97	10.000	2.000	0.625	97	1.474	5.02
1000S250-43[1]	10.000	2.000	0.625	43	0.717	2.44
1000S250-54	10.000	2.500	0.625	54	0.896	3.05
1000S250-68	10.000	2.500	0.625	68	1.121	3.81
1000S250-97	10.000	2.500	0.625	97	1.576	5.36
1000S300-54	10.000	3.000	0.625	54	0.981	3.34
1000S300-68	10.000	3.000	0.625	68	1.228	4.18
1000S300-97	10.000	3.000	0.625	97	1.728	5.88
1200S162-54[1]	12.000	1.625	0.500	54	0.896	3.05
1200S162-68	12.000	1.625	0.500	68	1.121	3.81
1200S162-97	12.000	1.625	0.500	97	1.576	5.36
1200S200-54[1]	12.000	2.000	0.625	54	0.953	3.24
1200S200-68	12.000	2.000	0.625	68	1.192	4.06
1200S200-97	12.000	2.000	0.625	97	1.677	5.71
1200S250-54[1]	12.000	2.500	0.625	54	1.009	3.43
1200S250-68	12.000	2.500	0.625	68	1.263	4.30
1200S250-97	12.000	2.500	0.625	97	1.779	6.05
1200S300-54[1]	12.000	3.000	0.625	54	1.094	3.72
1200S300-68	12.000	3.000	0.625	68	1.370	4.66
1200S300-97	12.000	3.000	0.625	97	1.932	6.57

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

[1] Web-height to thickness ratio exceeds 200. Web stiffeners 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)	AREA (in^2)	WEIGHT (lb/ft)	MEMBER	WEB[2] (in)	FLANGE (in)	THICKNESS DESIGNATION[3] (mils)	AREA (in^2)	WEIGHT (lb/ft)
250T125-33	2.500	1.250	33	0.173	0.59	362T200-33	3.625	2.000	33	0.264	0.90
250T125-43	2.500	1.250	43	0.225	0.77	362T200-43	3.625	2.000	43	0.343	1.17
250T125-54	2.500	1.250	54	0.282	0.96	362T200-54	3.625	2.000	54	0.431	1.47
250T125-68	2.500	1.250	68	0.355	1.21	362T200-68	3.625	2.000	68	0.543	1.85
250T125-97	2.500	1.250	97	0.506	1.72	362T200-97	3.625	2.000	97	0.773	2.63
250T150-33	2.500	1.500	33	0.190	0.65	362T250-43	3.625	2.500	43	0.389	1.32
250T150-43	2.500	1.500	43	0.248	0.84	362T250-54	3.625	2.500	54	0.487	1.66
250T150-54	2.500	1.500	54	0.311	1.06	362T250-68	3.625	2.500	68	0.614	2.09
250T150-68	2.500	1.500	68	0.391	1.33	362T250-97	3.625	2.500	97	0.875	2.98
250T150-97	2.500	1.500	97	0.557	1.90						
250T200-33	2.500	2.000	33	0.225	0.76	400T125-33	4.000	1.250	33	0.225	0.76
250T200-43	2.500	2.000	43	0.293	1.00	400T125-43	4.000	1.250	43	0.293	1.00
250T200-54	2.500	2.000	54	0.367	1.25	400T125-54	4.000	1.250	54	0.367	1.25
250T200-68	2.500	2.000	68	0.462	1.57	400T125-68	4.000	1.250	68	0.462	1.57
250T200-97	2.500	2.000	97	0.659	2.24	400T125-97	4.000	1.250	97	0.659	2.24
250T250-43	2.500	2.500	43	0.338	1.15	400T150-33	4.000	1.500	33	0.242	0.82
250T250-54	2.500	2.500	54	0.424	1.44	400T150-43	4.000	1.500	43	0.315	1.07
250T250-68	2.500	2.500	68	0.534	1.82	400T150-54	4.000	1.500	54	0.396	1.35
250T250-97	2.500	2.500	97	0.761	2.59	400T150-68	4.000	1.500	68	0.498	1.69
						400T150-97	4.000	1.500	97	0.710	2.41
350T125-33	3.500	1.250	33	0.207	0.71	400T200-33	4.000	2.000	33	0.277	0.94
350T125-43	3.500	1.250	43	0.270	0.92	400T200-43	4.000	2.000	43	0.360	1.23
350T125-54	3.500	1.250	54	0.339	1.15	400T200-54	4.000	2.000	54	0.452	1.54
350T125-68	3.500	1.250	68	0.427	1.45	400T200-68	4.000	2.000	68	0.569	1.94
350T125-97	3.500	1.250	97	0.608	2.07	400T200-97	4.000	2.000	97	0.811	2.76
350T150-33	3.500	1.500	33	0.225	0.76	400T250-43	4.000	2.500	43	0.405	1.38
350T150-43	3.500	1.500	43	0.293	1.00	400T250-54	4.000	2.500	54	0.509	1.73
350T150-54	3.500	1.500	54	0.367	1.25	400T250-68	4.000	2.500	68	0.641	2.18
350T150-68	3.500	1.500	68	0.462	1.57	400T250-97	4.000	2.500	97	0.913	3.11
350T150-97	3.500	1.500	97	0.659	2.24						
350T200-33	3.500	2.000	33	0.259	0.88	550T125-33	5.500	1.250	33	0.277	0.94
350T200-43	3.500	2.000	43	0.338	1.15	550T125-43	5.500	1.250	43	0.360	1.23
350T200-54	3.500	2.000	54	0.424	1.44	550T125-54	5.500	1.250	54	0.452	1.54
350T200-68	3.500	2.000	68	0.534	1.82	550T125-68	5.500	1.250	68	0.569	1.94
350T200-97	3.500	2.000	97	0.761	2.59	550T125-97	5.500	1.250	97	0.811	2.76
350T250-43	3.500	2.500	43	0.383	1.30	550T150-33	5.500	1.500	33	0.294	1.00
350T250-54	3.500	2.500	54	0.480	1.63	550T150-43	5.500	1.500	43	0.383	1.30
350T250-68	3.500	2.500	68	0.605	2.06	550T150-54	5.500	1.500	54	0.480	1.63
350T250-97	3.500	2.500	97	0.862	2.93	550T150-68	5.500	1.500	68	0.605	2.06
						550T150-97	5.500	1.500	97	0.862	2.93
362T125-33	3.625	1.250	33	0.212	0.72	550T200-33	5.500	2.000	33	0.329	1.12
362T125-43	3.625	1.250	43	0.276	0.94	550T200-43	5.500	2.000	43	0.428	1.46
362T125-54	3.625	1.250	54	0.346	1.18	550T200-54	5.500	2.000	54	0.537	1.83
362T125-68	3.625	1.250	68	0.436	1.48	550T200-68	5.500	2.000	68	0.676	2.30
362T125-97	3.625	1.250	97	0.621	2.11	550T200-97	5.500	2.000	97	0.964	3.28
362T150-33	3.625	1.500	33	0.229	0.78	550T250-43	5.500	2.500	43	0.473	1.61
362T150-43	3.625	1.500	43	0.298	1.02	550T250-54	5.500	2.500	54	0.594	2.02
362T150-54	3.625	1.500	54	0.374	1.27	550T250-68	5.500	2.500	68	0.748	2.54
362T150-68	3.625	1.500	68	0.471	1.60	550T250-97	5.500	2.500	97	1.066	3.63
362T150-97	3.625	1.500	97	0.672	2.29						

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

TABLE 2—TRACKS (Continued)

MEMBER	WEB[2] (in)	FLANGE (in)	THICKNESS DESIGNATION[3] (mils)	AREA (in^2)	WEIGHT (lb/ft)	MEMBER	WEB[2] (in)	FLANGE (in)	THICKNESS DESIGNATION[3] (mils)	AREA (in^2)	WEIGHT (lb/ft)
600T125-33	6.000	1.250	33	0.294	1.00	800T250-43	8.000	2.500	43	0.586	1.99
600T125-43	6.000	1.250	43	0.383	1.30	800T250-54	8.000	2.500	54	0.735	2.50
600T125-54	6.000	1.250	54	0.480	1.63	800T250-68	8.000	2.500	68	0.926	3.15
600T125-68	6.000	1.250	68	0.605	2.06	800T250-97	8.000	2.500	97	1.320	4.49
600T125-97	6.000	1.250	97	0.862	2.93						
600T150-33	6.000	1.500	33	0.311	1.06	1000T125-43[1]	10.000	1.250	43	0.563	1.92
600T150-43	6.000	1.500	43	0.405	1.38	1000T125-54	10.000	1.250	54	0.707	2.41
600T150-54	6.000	1.500	54	0.509	1.73	1000T125-68	10.000	1.250	68	0.890	3.03
600T150-68	6.000	1.500	68	0.641	2.18	1000T125-97	10.000	1.250	97	1.269	4.32
600T150-97	6.000	1.500	97	0.913	3.11	1000T150-43[1]	10.000	1.500	43	0.586	1.99
600T200-33	6.000	2.000	33	0.346	1.18	1000T150-54	10.000	1.500	54	0.735	2.50
600T200-43	6.000	2.000	43	0.451	1.53	1000T150-68	10.000	1.500	68	0.926	3.15
600T200-54	6.000	2.000	54	0.565	1.92	1000T150-97	10.000	1.500	97	1.320	4.49
600T200-68	6.000	2.000	68	0.712	2.42	1000T200-43[1]	10.000	2.000	43	0.631	2.15
600T200-97	6.000	2.000	97	1.015	3.45	1000T200-54	10.000	2.000	54	0.792	2.69
600T250-43	6.000	2.500	43	0.496	1.69	1000T200-68	10.000	2.000	68	0.997	3.39
600T250-54	6.000	2.500	54	0.622	2.12	1000T200-97	10.000	2.000	97	1.422	4.84
600T250-68	6.000	2.500	68	0.783	2.67	1000T250-43[1]	10.000	2.500	43	0.676	2.30
600T250-97	6.000	2.500	97	1.116	3.80	1000T250-54	10.000	2.500	54	0.848	2.89
						1000T250-68	10.000	2.500	68	1.068	3.64
800T125-33[1]	8.000	1.250	33	0.363	1.24	1000T250-97	10.000	2.500	97	1.523	5.18
800T125-43	8.000	1.250	43	0.473	1.61						
800T125-54	8.000	1.250	54	0.594	2.02	1200T125-54[1]	12.000	1.250	54	0.820	2.79
800T125-68	8.000	1.250	68	0.748	2.54	1200T125-68	12.000	1.250	68	1.033	3.51
800T125-97	8.000	1.250	97	1.066	3.63	1200T125-97	12.000	1.250	97	1.472	5.01
800T150-33[1]	8.000	1.500	33	0.380	1.29	1200T150-54[1]	12.000	1.500	54	0.848	2.89
800T150-43	8.000	1.500	43	0.496	1.69	1200T150-68	12.000	1.500	68	1.068	3.64
800T150-54	8.000	1.500	54	0.622	2.12	1200T150-97	12.000	1.500	97	1.523	5.18
800T150-68	8.000	1.500	68	0.783	2.67	1200T200-54[1]	12.000	2.000	54	0.905	3.08
800T150-97	8.000	1.500	97	1.116	3.80	1200T200-68	12.000	2.000	68	1.140	3.88
800T200-33[1]	8.000	2.000	33	0.415	1.41	1200T200-97	12.000	2.000	97	1.625	5.53
800T200-43	8.000	2.000	43	0.541	1.84	1200T250-54[1]	12.000	2.500	54	0.962	3.27
800T200-54	8.000	2.000	54	0.679	2.31	1200T250-68	12.000	2.500	68	1.211	4.12
800T200-68	8.000	2.000	68	0.854	2.91	1200T250-97	12.000	2.500	97	1.727	5.88
800T200-97	8.000	2.000	97	1.218	4.15						

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

[1] Web-height to thickness ratio exceeds 200. Web stiffeners 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.

[1]Minimum 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]

MEMBER	GROSS[3]					EFFECTIVE PROPERTIES[2] (F_y = 33 ksi)							EFFECTIVE PROPERTIES[2] (F_y = 50 ksi)							TORSIONAL PROPERTIES					
	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_a (in-k)	V_{ag} (lb)	V_{anet} (lb)	L_u (in)	M_{ad} (in-k)	I_x (in^4)	S_x (in^3)	M_a (in-k)	V_{ag} (lb)	V_{anet} (lb)	L_u (in)	M_{ad} (in-k)	Jx1000 (in^4)	C_w (in^6)	X_o (in)	m (in)	R_o (in)	β
250S137-33	0.203	0.163	1.015	0.052	0.515	0.203	0.158	3.11	975	399	35.5	3.10	---	---	---	---	---	---	---	0.079	0.076	-1.141	0.677	1.612	0.499
250S137-43	0.261	0.208	1.010	0.067	0.511	0.261	0.205	4.53	1265	394	33.7	4.60	---	---	---	---	---	---	---	0.173	0.096	-1.129	0.670	1.599	0.501
250S137-54	0.318	0.255	1.004	0.080	0.504	---	---	---	---	---	---	---	0.318	0.244	8.22	2353	565	27.1	8.36	0.337	0.115	-1.115	0.663	1.583	0.504
250S137-68	0.386	0.309	0.994	0.095	0.495	---	---	---	---	---	---	---	0.386	0.308	10.65	2866	519	26.8	10.68	0.661	0.138	-1.096	0.653	1.561	0.507
250S137-97	0.506	0.405	0.975	0.120	0.475	---	---	---	---	---	---	---	0.506	0.405	14.75	3798	429	26.5	14.74	1.839	0.176	-1.057	0.633	1.514	0.513
250S162-33	0.235	0.188	1.027	0.087	0.624	0.235	0.180	3.55	975	399	44.1	3.56	---	---	---	---	---	---	---	0.089	0.146	-1.470	0.859	1.898	0.401
250S162-43	0.302	0.242	1.022	0.111	0.620	0.302	0.240	5.22	1265	394	42	5.26	---	---	---	---	---	---	---	0.196	0.184	-1.457	0.852	1.885	0.402
250S162-54	0.370	0.296	1.016	0.135	0.613	---	---	---	---	---	---	---	0.370	0.284	9.42	2353	565	33.9	9.48	0.383	0.223	-1.443	0.845	1.868	0.403
250S162-68	0.450	0.360	1.007	0.162	0.605	---	---	---	---	---	---	---	0.450	0.357	12.11	2866	519	33.7	12.21	0.752	0.268	-1.424	0.835	1.846	0.405
250S162-97	0.596	0.477	0.989	0.209	0.586	---	---	---	---	---	---	---	0.596	0.477	16.93	3798	429	33.5	16.91	2.102	0.346	-1.386	0.815	1.801	0.408
350S137-33	0.441	0.252	1.380	0.059	0.503	0.441	0.223	4.41	1024	487	34.8	4.54	---	---	---	---	---	---	---	0.093	0.153	-1.016	0.621	1.786	0.676
350S137-43	0.568	0.324	1.375	0.075	0.498	0.568	0.307	6.07	1739	631	34.7	6.38	---	---	---	---	---	---	---	0.204	0.193	-1.005	0.615	1.774	0.679
350S137-54	0.696	0.398	1.367	0.090	0.492	---	---	---	---	---	---	---	0.696	0.366	10.95	3372	947	28	11.43	0.398	0.233	-0.991	0.607	1.759	0.683
350S137-68	0.849	0.485	1.357	0.107	0.482	---	---	---	---	---	---	---	0.849	0.472	14.12	4202	897	27.9	14.52	0.782	0.280	-0.973	0.598	1.738	0.687
350S137-97	1.130	0.646	1.334	0.136	0.462	---	---	---	---	---	---	---	1.130	0.629	22.9	5704	775	27.9	19.34	2.189	0.361	-0.935	0.579	1.693	0.695
350S162-33	0.508	0.290	1.404	0.098	0.617	0.508	0.257	5.08	1024	487	42.8	5.21	---	---	---	---	---	---	---	0.103	0.277	-1.324	0.796	2.026	0.573
350S162-43	0.654	0.374	1.400	0.125	0.612	0.654	0.357	7.05	1739	631	42.6	7.31	---	---	---	---	---	---	---	0.227	0.350	-1.312	0.789	2.014	0.575
350S162-54	0.804	0.460	1.392	0.152	0.606	---	---	---	---	---	---	---	0.804	0.426	12.74	3372	947	34.5	13.06	0.443	0.426	-1.298	0.782	1.998	0.578
350S162-68	0.985	0.563	1.383	0.184	0.597	---	---	---	---	---	---	---	0.985	0.549	16.44	4202	897	34.5	16.86	0.872	0.514	-1.280	0.772	1.977	0.581
350S162-97	1.320	0.754	1.362	0.238	0.578	---	---	---	---	---	---	---	1.320	0.738	26.18	5704	775	34.7	22.57	2.452	0.672	-1.242	0.752	1.932	0.587
362S137-33	0.479	0.264	1.424	0.059	0.501	0.479	0.232	4.59	1024	521	34.7	4.72	---	---	---	---	---	---	---	0.094	0.165	-1.003	0.615	1.813	0.694
362S137-43	0.616	0.340	1.419	0.075	0.497	0.616	0.320	6.32	1739	676	34.6	6.65	---	---	---	---	---	---	---	0.207	0.208	-0.991	0.608	1.801	0.697
362S137-54	0.756	0.417	1.411	0.091	0.490	---	---	---	---	---	---	---	0.756	0.381	11.42	3372	1016	27.9	11.91	0.405	0.251	-0.978	0.601	1.785	0.700
362S137-68	0.922	0.509	1.401	0.109	0.480	---	---	---	---	---	---	---	0.922	0.493	14.77	4370	1004	27.8	15.24	0.797	0.302	-0.959	0.592	1.764	0.704
362S137-97	1.229	0.678	1.377	0.137	0.460	---	---	---	---	---	---	---	1.229	0.662	24.1	5943	875	27.8	20.30	2.233	0.390	-0.922	0.573	1.720	0.713
362S162-33	0.551	0.304	1.450	0.099	0.616	0.551	0.268	5.29	1024	521	42.6	5.43	---	---	---	---	---	---	---	0.105	0.297	-1.308	0.789	2.048	0.592
362S162-43	0.710	0.392	1.445	0.127	0.611	0.710	0.372	7.34	1739	676	42.5	7.63	---	---	---	---	---	---	---	0.230	0.376	-1.297	0.782	2.036	0.594
362S162-54	0.873	0.481	1.438	0.154	0.604	---	---	---	---	---	---	---	0.873	0.444	13.28	3372	1016	34.4	13.58	0.451	0.457	-1.283	0.774	2.020	0.597
362S162-68	1.069	0.590	1.429	0.186	0.596	---	---	---	---	---	---	---	1.069	0.574	17.18	4370	1004	34.3	17.66	0.887	0.552	-1.264	0.765	1.998	0.600
362S162-97	1.435	0.792	1.408	0.241	0.577	---	---	---	---	---	---	---	1.435	0.776	27.52	5943	875	34.5	23.71	2.496	0.723	-1.226	0.745	1.954	0.606

For SI: 1 inch = 25.4 mm; 1 $inch^3$ = 1.64x10^4 mm^3; 1 $inch^4$ = 4.15x10^5 mm^4; 1 $inch^6$ = 2.69x10^8 mm^6; 1 kip-in = 112.99 N-m; 1 lb = 4.45 N.

TABLE 4—C-SHAPE PROPERTIES[4] (Continued)

MEMBER	GROSS[3]					EFFECTIVE PROPERTIES[2] (F_y = 33 ksi)							EFFECTIVE PROPERTIES[2] (F_y = 50 ksi)							TORSIONAL PROPERTIES					
	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_a (in-k)	V_{ag} (lb)	V_{anet} (lb)	L_u (in)	M_{ad} (in-k)	I_x (in^4)	S_x (in^3)	M_a (in-k)	V_{ag} (lb)	V_{anet} (lb)	L_u (in)	M_{ad} (in-k)	Jx1000 (in^4)	C_w (in^6)	X_o (in)	m (in)	R_o (in)	β
362S200-33	0.648	0.358	1.478	0.177	0.772	0.647	0.294	5.81	1024	521	53.5	6.19	---	---	---	---	---	---	---	0.118	0.577	-1.741	1.030	2.411	0.478
362S200-43	0.836	0.461	1.474	0.227	0.767	0.836	0.427	8.43	1739	676	53.5	8.70	---	---	---	---	---	---	---	0.261	0.734	-1.729	1.024	2.398	0.480
362S200-54	1.030	0.568	1.467	0.277	0.761	---	---	---	---	---	---	---	1.030	0.49	14.66	3372	1016	43.3	15.46	0.511	0.896	-1.715	1.016	2.382	0.482
362S200-68	1.265	0.698	1.458	0.337	0.753	---	---	---	---	---	---	---	1.265	0.666	19.95	4370	1004	43.4	20.51	1.008	1.089	-1.696	1.006	2.360	0.484
362S200-97	1.711	0.944	1.440	0.446	0.735	---	---	---	---	---	---	---	1.711	0.928	32.03	5943	875	43.7	28.26	2.847	1.441	-1.658	0.986	2.315	0.487
362S250-43	0.980	0.541	1.510	0.385	0.946	0.980	0.449	8.88	1739	676	64.1	9.36	---	---	---	---	---	---	---	0.292	1.230	-2.199	1.277	2.830	0.396
362S250-54	1.210	0.668	1.504	0.473	0.940	---	---	---	---	---	---	---	1.205	0.514	15.4	3372	1016	52	16.55	0.571	1.506	-2.184	1.269	2.813	0.397
362S250-68	1.490	0.822	1.496	0.578	0.931	---	---	---	---	---	---	---	1.490	0.689	20.63	4370	1004	52	22.16	1.129	1.837	-2.165	1.259	2.791	0.398
362S250-97	2.027	1.118	1.478	0.772	0.912	---	---	---	---	---	---	---	2.027	1.046	35.17	5943	875	52.5	33.47	3.197	2.452	-2.126	1.239	2.746	0.400
362S300-54	1.422	0.785	1.515	0.822	1.151	---	---	---	---	---	---	---	1.386	0.628	18.81	3372	1016	66.6	19.02	0.662	3.237	-2.860	1.640	3.435	0.307
362S300-68	1.756	0.969	1.507	1.010	1.143	---	---	---	---	---	---	---	1.756	0.812	24.31	4370	1004	66.7	25.48	1.310	3.965	-2.841	1.630	3.413	0.307
362S300-97	2.400	1.324	1.491	1.368	1.126	---	---	---	---	---	---	---	2.400	1.259	37.68	5943	875	67.3	38.69	3.723	5.337	-2.803	1.610	3.369	0.307
400S137-33	0.603	0.301	1.556	0.061	0.496	0.603	0.259	5.12	976	595	34.5	5.28	---	---	---	---	---	---	---	0.099	0.204	-0.965	0.597	1.897	0.741
400S137-43	0.776	0.388	1.551	0.078	0.491	0.776	0.359	7.09	1739	810	34.4	7.47	---	---	---	---	---	---	---	0.219	0.257	-0.954	0.591	1.885	0.744
400S137-54	0.953	0.477	1.542	0.094	0.484	---	---	---	---	---	---	---	0.953	0.428	12.82	3372	1223	27.7	13.39	0.428	0.311	-0.940	0.583	1.870	0.747
400S137-68	1.165	0.582	1.531	0.112	0.475	---	---	---	---	---	---	---	1.165	0.558	16.7	4871	1356	27.6	17.43	0.842	0.375	-0.922	0.574	1.849	0.751
400S137-97	1.557	0.779	1.507	0.142	0.454	---	---	---	---	---	---	---	1.557	0.764	27.81	6658	1207	27.5	23.32	2.365	0.486	-0.885	0.555	1.806	0.760
400S162-33	0.692	0.346	1.586	0.103	0.611	0.692	0.299	5.91	976	595	42.3	6.06	---	---	---	---	---	---	---	0.110	0.363	-1.263	0.768	2.118	0.644
400S162-43	0.892	0.446	1.581	0.131	0.606	0.892	0.417	8.23	1739	810	42.2	8.54	---	---	---	---	---	---	---	0.242	0.460	-1.252	0.761	2.106	0.647
400S162-54	1.098	0.549	1.574	0.159	0.600	---	---	---	---	---	---	---	1.098	0.498	14.9	3372	1223	34.1	15.25	0.473	0.560	-1.238	0.754	2.090	0.649
400S162-68	1.346	0.673	1.564	0.192	0.591	---	---	---	---	---	---	---	1.346	0.648	19.41	4871	1356	34	20.15	0.933	0.677	-1.220	0.745	2.069	0.653
400S162-97	1.812	0.906	1.542	0.249	0.572	---	---	---	---	---	---	---	1.812	0.892	31.64	6658	1207	34	27.13	2.628	0.889	-1.182	0.725	2.025	0.659
400S200-33	0.812	0.406	1.619	0.183	0.769	0.812	0.328	6.49	976	595	53.1	6.90	---	---	---	---	---	---	---	0.124	0.697	-1.688	1.007	2.462	0.530
400S200-43	1.047	0.524	1.615	0.235	0.764	1.047	0.478	9.45	1739	810	53	9.74	---	---	---	---	---	---	---	0.272	0.886	-1.676	1.000	2.449	0.532
400S200-54	1.292	0.646	1.608	0.287	0.758	---	---	---	---	---	---	---	1.292	0.549	16.43	3372	1223	42.9	17.31	0.534	1.083	-1.662	0.993	2.433	0.534
400S200-68	1.589	0.795	1.599	0.349	0.750	---	---	---	---	---	---	---	1.589	0.751	22.48	4871	1356	42.9	23.05	1.054	1.318	-1.643	0.983	2.412	0.536
400S200-97	2.155	1.077	1.579	0.462	0.731	---	---	---	---	---	---	---	2.155	1.063	36.68	6658	1207	43	32.25	2.978	1.749	-1.605	0.963	2.368	0.540
400S250-43	1.224	0.612	1.655	0.399	0.945	1.224	0.503	9.93	1739	810	63.7	10.42	---	---	---	---	---	---	---	0.303	1.486	-2.139	1.252	2.864	0.443
400S250-54	1.512	0.756	1.649	0.490	0.938	---	---	---	---	---	---	---	1.506	0.576	17.24	3372	1223	51.6	18.42	0.594	1.821	-2.124	1.244	2.848	0.444
400S250-68	1.864	0.932	1.640	0.599	0.929	---	---	---	---	---	---	---	1.864	0.775	23.19	4871	1356	51.6	24.76	1.174	2.225	-2.105	1.235	2.826	0.445
400S250-97	2.541	1.271	1.622	0.801	0.911	---	---	---	---	---	---	---	2.541	1.191	40.06	6658	1207	51.9	38.05	3.329	2.978	-2.066	1.214	2.780	0.448
400S300-54	1.776	0.888	1.664	0.852	1.153	---	---	---	---	---	---	---	1.734	0.705	21.11	3372	1223	65.7	21.12	0.685	3.819	-2.792	1.613	3.449	0.345
400S300-68	2.195	1.098	1.657	1.048	1.145	---	---	---	---	---	---	---	2.195	0.913	27.33	4871	1356	65.8	28.36	1.356	4.683	-2.774	1.603	3.428	0.345
400S300-97	3.007	1.504	1.640	1.420	1.127	---	---	---	---	---	---	---	3.007	1.43	42.81	6658	1207	66.2	44.72	3.855	6.317	-2.735	1.583	3.383	0.346

For SI: 1 inch = 25.4 mm; 1 $inch^3$ = 1.64x10^4 mm^3; 1 $inch^4$ = 4.15x10^5 mm^4; 1 $inch^6$ = 2.69x10^8 mm^6; 1 kip-in = 112.99 N-m; 1 lb = 4.45 N.

TABLE 4—C-SHAPE PROPERTIES[4] (Continued)

MEMBER	GROSS[3]					EFFECTIVE PROPERTIES[2] (F_y = 33 ksi)							EFFECTIVE PROPERTIES[2] (F_y = 50 ksi)							TORSIONAL PROPERTIES					
	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_a (in-k)	V_{ag} (lb)	V_{anet} (lb)	L_u (in)	M_{ad} (in-k)	I_x (in^4)	S_x (in^3)	M_a (in-k)	V_{ag} (lb)	V_{anet} (lb)	L_u (in)	M_{ad} (in-k)	Jx1000 (in^4)	C_w (in^6)	X_o (in)	m (in)	R_o (in)	β
550S137-33	1.283	0.467	2.064	0.067	0.472	1.283	0.453	8.95	699	699	33.7	7.49	---	---	---	---	---	---	---	0.120	0.411	-0.841	0.536	2.278	0.864
550S137-43	1.655	0.602	2.059	0.085	0.467	1.655	0.592	13.08	1550	1199	31.7	11.61	---	---	---	---	---	---	---	0.265	0.520	-0.830	0.530	2.268	0.866
550S137-54	2.039	0.741	2.049	0.103	0.460	---	---	---	---	---	---	---	2.039	0.714	24.03	3093	1881	25.5	20.86	0.519	0.632	-0.817	0.523	2.254	0.868
550S137-68	2.503	0.910	2.036	0.123	0.451	---	---	---	---	---	---	---	2.503	0.909	31.42	5350	2532	24.9	28.87	1.023	0.764	-0.801	0.514	2.234	0.871
550S137-97	3.380	1.229	2.008	0.155	0.430	---	---	---	---	---	---	---	3.380	1.229	44.72	9518	3026	23.8	46.64	2.891	0.997	-0.766	0.497	2.192	0.878
550S162-33	1.458	0.530	2.112	0.113	0.589	1.458	0.512	10.11	699	699	41.4	8.62	---	---	---	---	---	---	---	0.130	0.713	-1.114	0.697	2.459	0.795
550S162-43	1.883	0.685	2.107	0.145	0.584	1.883	0.681	14.79	1550	1199	39.2	13.14	---	---	---	---	---	---	---	0.288	0.905	-1.103	0.691	2.448	0.797
550S162-54	2.324	0.845	2.098	0.176	0.577	---	---	---	---	---	---	---	2.324	0.811	26.86	3093	1881	31.6	23.51	0.564	1.105	-1.090	0.684	2.434	0.800
550S162-68	2.861	1.040	2.086	0.212	0.568	---	---	---	---	---	---	---	2.861	1.031	34.94	5350	2532	31.1	32.26	1.114	1.342	-1.072	0.675	2.414	0.803
550S162-97	3.886	1.413	2.061	0.276	0.549	---	---	---	---	---	---	---	3.886	1.413	50.13	9518	3026	30	51.55	3.154	1.775	-1.037	0.656	2.372	0.809
600S137-33	1.582	0.527	2.229	0.069	0.464	1.548	0.455	8.98	638	638	33.5	8.72	---	---	---	---	---	---	---	0.127	0.500	-0.807	0.519	2.416	0.889
600S137-43	2.042	0.681	2.223	0.087	0.459	2.041	0.645	12.74	1416	1240	33.2	11.83	---	---	---	---	---	---	---	0.280	0.633	-0.796	0.513	2.406	0.890
600S137-54	2.518	0.839	2.213	0.105	0.452	---	---	---	---	---	---	---	2.518	0.777	23.26	2823	1947	26.8	21.24	0.549	0.769	-0.784	0.506	2.391	0.893
600S137-68	3.094	1.031	2.200	0.125	0.443	---	---	---	---	---	---	---	3.094	1.03	30.84	5350	2879	26.5	28.87	1.084	0.930	-0.768	0.497	2.371	0.895
600S137-97	4.188	1.396	2.170	0.159	0.422	---	---	---	---	---	---	---	4.188	1.396	50.8	10472	3805	23.6	50.82	3.066	1.216	-0.734	0.480	2.330	0.901
600S162-33	1.793	0.598	2.282	0.116	0.581	1.793	0.577	11.41	638	638	41.1	9.48	---	---	---	---	---	---	---	0.137	0.861	-1.072	0.677	2.587	0.828
600S162-43	2.316	0.772	2.276	0.148	0.576	2.316	0.767	16.68	1416	1240	39	14.47	---	---	---	---	---	---	---	0.303	1.095	-1.062	0.670	2.577	0.830
600S162-54	2.860	0.953	2.267	0.180	0.570	---	---	---	---	---	---	---	2.860	0.916	30.33	2823	1947	31.4	25.90	0.594	1.337	-1.049	0.663	2.562	0.832
600S162-68	3.525	1.175	2.255	0.218	0.560	---	---	---	---	---	---	---	3.525	1.164	39.47	5350	2879	30.8	35.69	1.174	1.626	-1.032	0.655	2.543	0.835
600S162-97	4.797	1.599	2.229	0.283	0.541	---	---	---	---	---	---	---	4.797	1.599	56.73	10472	3805	29.8	56.68	3.329	2.153	-0.997	0.636	2.501	0.841
600S200-33	2.075	0.692	2.340	0.209	0.743	2.058	0.621	12.28	638	638	51.6	10.76	---	---	---	---	---	---	---	0.151	1.593	-1.457	0.901	2.855	0.740
600S200-43	2.683	0.894	2.335	0.268	0.739	2.683	0.873	17.24	1416	1240	51.5	15.38	---	---	---	---	---	---	---	0.334	2.033	-1.446	0.894	2.844	0.742
600S200-54	3.319	1.106	2.327	0.328	0.732	---	---	---	---	---	---	---	3.319	1.015	30.4	2823	1947	41.6	27.37	0.655	2.493	-1.432	0.887	2.829	0.744
600S200-68	4.101	1.367	2.316	0.400	0.723	---	---	---	---	---	---	---	4.101	1.317	43.71	5350	2879	39.3	39.69	1.295	3.047	-1.415	0.878	2.809	0.746
600S200-97	5.612	1.871	2.293	0.530	0.705	---	---	---	---	---	---	---	5.612	1.871	64.53	10472	3805	38.3	63.66	3.679	4.080	-1.378	0.859	2.767	0.752
600S250-43	3.082	1.027	2.396	0.458	0.923	3.082	0.918	18.14	1416	1240	62.4	16.21	---	---	---	---	---	---	---	0.364	3.411	-1.874	1.136	3.179	0.652
600S250-54	3.819	1.273	2.388	0.562	0.917	---	---	---	---	---	---	---	3.766	1.069	32	2823	1947	50.5	28.72	0.715	4.194	-1.860	1.129	3.163	0.654
600S250-68	4.727	1.576	2.378	0.688	0.908	---	---	---	---	---	---	---	4.723	1.386	41.49	5350	2879	50.4	39.08	1.416	5.145	-1.842	1.119	3.142	0.656
600S250-97	6.496	2.165	2.357	0.923	0.889	---	---	---	---	---	---	---	6.496	2.063	69.38	10472	3805	47.3	66.82	4.030	6.947	-1.803	1.100	3.098	0.661
600S300-54	4.462	1.487	2.432	0.986	1.143	---	---	---	---	---	---	---	4.332	1.277	38.23	2823	1947	59.1	29.62	0.806	8.115	-2.483	1.481	3.659	0.539
600S300-68	5.534	1.845	2.423	1.214	1.135	---	---	---	---	---	---	---	5.534	1.61	48.2	5350	2879	59	40.53	1.597	9.992	-2.465	1.471	3.638	0.541
600S300-97	7.639	2.546	2.404	1.649	1.117	---	---	---	---	---	---	---	7.639	2.442	73.11	10472	3805	58.8	64.67	4.556	13.587	-2.427	1.451	3.594	0.544
800S137-33[1]	3.198	0.799	2.873	0.073	0.435	2.998	0.622	12.30	474	474	32.5	10.71	---	---	---	---	---	---	---	0.155	0.957	-0.696	0.460	2.987	0.946
800S137-43	4.134	1.033	2.866	0.093	0.430	4.001	0.896	17.70	1051	1051	32.2	15.76	---	---	---	---	---	---	---	0.341	1.214	-0.687	0.454	2.978	0.947
800S137-54	5.110	1.277	2.855	0.112	0.423	---	---	---	---	---	---	---	4.974	1.083	32.42	2091	2091	25.9	28.46	0.670	1.478	-0.676	0.448	2.964	0.948
800S137-68	6.303	1.576	2.839	0.134	0.414	---	---	---	---	---	---	---	6.285	1.468	43.96	4221	3367	25.6	39.61	1.325	1.789	-0.661	0.440	2.944	0.950
800S137-97	8.597	2.149	2.805	0.169	0.394	---	---	---	---	---	---	---	8.597	2.149	64.35	10885	5938	25	63.90	3.767	2.349	-0.630	0.423	2.902	0.953

For SI: 1 inch = 25.4 mm; 1 $inch^3$ = 1.64x10^4 mm^3; 1 $inch^4$ = 4.15x10^5 mm^4; 1 $inch^6$ = 2.69x10^8 mm^6; 1 kip-in = 112.99 N-m; 1 lb = 4.45 N.

TABLE 4—C-SHAPE PROPERTIES[4] (Continued)

MEMBER	GROSS[3]					EFFECTIVE PROPERTIES[2] (F_y = 33 ksi)							EFFECTIVE PROPERTIES[2] (F_y = 50 ksi)							TORSIONAL PROPERTIES					
	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_a (in-k)	V_{ag} (lb)	V_{anet} (lb)	L_u (in)	M_{ad} (in-k)	I_x (in^4)	S_x (in^3)	M_a (in-k)	V_{ag} (lb)	V_{anet} (lb)	L_u (in)	M_{ad} (in-k)	Jx1000 (in^4)	C_w (in^6)	X_o (in)	m (in)	R_o (in)	β
800S162-33[1]	3.582	0.896	2.943	0.125	0.550	3.384	0.710	14.03	474	474	40.1	12.61	---	---	---	---	---	---	---	0.165	1.630	-0.936	0.607	3.137	0.911
800S162-43	4.633	1.158	2.937	0.160	0.546	4.500	1.019	20.14	1051	1051	39.9	18.33	---	---	---	---	---	---	---	0.364	2.076	-0.926	0.601	3.128	0.912
800S162-54	5.736	1.434	2.927	0.194	0.539	---	---	---	---	---	---	---	5.600	1.229	36.79	2091	2091	32.1	32.81	0.715	2.539	-0.914	0.594	3.113	0.914
800S162-68	7.089	1.772	2.913	0.235	0.530	---	---	---	---	---	---	---	7.070	1.663	49.8	4221	3367	31.9	45.09	1.416	3.093	-0.899	0.586	3.094	0.916
800S162-97	9.713	2.428	2.883	0.305	0.510	---	---	---	---	---	---	---	9.713	2.428	72.7	10885	5938	31.4	71.91	4.030	4.114	-0.866	0.568	3.053	0.919
800S200-33[1]	4.096	1.024	3.023	0.227	0.712	4.096	0.816	16.12	474	474	50.5	14.52	---	---	---	---	---	---	---	0.179	2.971	-1.288	0.817	3.363	0.853
800S200-43	5.302	1.325	3.018	0.292	0.708	5.302	1.293	25.54	1051	1051	50.4	20.98	---	---	---	---	---	---	---	0.395	3.797	-1.277	0.811	3.353	0.855
800S200-54	6.573	1.643	3.009	0.357	0.701	---	---	---	---	---	---	---	6.573	1.499	44.87	2091	2091	40.7	37.39	0.775	4.663	-1.265	0.804	3.338	0.856
800S200-68	8.140	2.035	2.996	0.435	0.692	---	---	---	---	---	---	---	8.140	1.964	65.21	4221	3367	38.4	54.62	1.537	5.712	-1.248	0.796	3.319	0.859
800S200-97	11.203	2.801	2.969	0.576	0.673	---	---	---	---	---	---	---	11.203	2.801	96.63	10885	5938	37.2	89.69	4.381	7.684	-1.214	0.777	3.278	0.863
800S250-43	6.015	1.504	3.097	0.500	0.893	6.015	1.313	25.95	1051	1051	61.5	22.08	---	---	---	---	---	---	---	0.425	6.374	-1.675	1.043	3.632	0.787
800S250-54	7.465	1.866	3.088	0.614	0.886	---	---	---	---	---	---	---	7.378	1.525	45.66	2091	2091	49.8	39.10	0.836	7.850	-1.661	1.036	3.617	0.789
800S250-68	9.261	2.315	3.077	0.752	0.877	---	---	---	---	---	---	---	9.240	2.059	61.65	4221	3367	49.6	53.69	1.658	9.652	-1.644	1.027	3.597	0.791
800S250-97	12.789	3.197	3.053	1.009	0.857	---	---	---	---	---	---	---	12.789	3.054	102.7	10885	5938	46.4	93.51	4.731	13.091	-1.607	1.008	3.555	0.796
800S300-54	8.657	2.164	3.159	1.085	1.118	---	---	---	---	---	---	---	8.443	1.826	54.66	2091	2091	58.6	40.22	0.927	14.642	-2.244	1.372	4.033	0.690
800S300-68	10.758	2.690	3.149	1.336	1.110	---	---	---	---	---	---	---	10.758	2.371	70.98	4221	3367	58.4	55.46	1.839	18.066	-2.226	1.363	4.012	0.692
800S300-97	14.913	3.728	3.127	1.817	1.092	---	---	---	---	---	---	---	14.913	3.576	107.05	10885	5938	58.1	89.89	5.257	24.677	-2.188	1.343	3.970	0.696
1000S162-43[1]	8.025	1.605	3.577	0.168	0.518	7.523	1.302	25.74	836	836	38.8	22.47	---	---	---	---	---	---	---	0.425	3.430	-0.823	0.545	3.707	0.951
1000S162-54	9.950	1.990	3.565	0.204	0.511	---	---	---	---	---	---	---	9.391	1.572	47.07	1661	1661	31.3	40.37	0.836	4.198	-0.812	0.538	3.692	0.952
1000S162-68	12.325	2.465	3.550	0.246	0.502	---	---	---	---	---	---	---	11.978	2.154	64.51	3345	3345	31	56.37	1.658	5.121	-0.798	0.531	3.673	0.953
1000S162-97	16.967	3.393	3.516	0.320	0.483	---	---	---	---	---	---	---	16.967	3.269	97.89	9864	7177	30.4	92.57	4.731	6.827	-0.768	0.514	3.631	0.955
1000S200-43[1]	9.085	1.817	3.676	0.309	0.677	8.602	1.470	29.05	836	836	49.3	26.15	---	---	---	---	---	---	---	0.456	6.236	-1.147	0.743	3.910	0.914
1000S200-54	11.278	2.256	3.666	0.378	0.671	---	---	---	---	---	---	---	10.769	1.705	51.05	1661	1661	39.8	46.64	0.896	7.665	-1.135	0.737	3.896	0.915
1000S200-68	13.994	2.799	3.652	0.460	0.662	---	---	---	---	---	---	---	13.665	2.42	72.46	3345	3345	39.6	64.50	1.779	9.401	-1.120	0.729	3.876	0.917
1000S200-97	19.336	3.867	3.622	0.609	0.643	---	---	---	---	---	---	---	19.336	3.741	112	9864	7177	39	104.74	5.082	12.679	-1.088	0.711	3.836	0.920
1000S250-43[1]	10.203	2.041	3.771	0.531	0.860	10.203	1.617	31.95	836	836	60.7	27.68	---	---	---	---	---	---	---	0.486	10.481	-1.518	0.965	4.155	0.867
1000S250-54	12.677	2.535	3.762	0.653	0.854	---	---	---	---	---	---	---	12.660	1.879	56.26	1661	1661	49.1	49.20	0.957	12.922	-1.505	0.958	4.140	0.868
1000S250-68	15.751	3.150	3.749	0.799	0.844	---	---	---	---	---	---	---	15.741	2.768	82.89	3345	3345	48.8	68.09	1.899	15.909	-1.488	0.950	4.121	0.870
1000S250-97	21.827	4.365	3.722	1.072	0.825	---	---	---	---	---	---	---	21.827	4.181	140.63	9864	7177	45.6	120.08	5.433	21.632	-1.454	0.932	4.080	0.873
1000S300-54	14.587	2.917	3.856	1.161	1.088	---	---	---	---	---	---	---	14.360	2.262	67.74	1661	1661	58.1	50.69	1.047	23.644	-2.051	1.280	4.502	0.792
1000S300-68	18.153	3.631	3.845	1.430	1.079	---	---	---	---	---	---	---	18.153	3.153	94.41	3345	3345	57.8	70.10	2.081	29.210	-2.034	1.271	4.482	0.794
1000S300-97	25.237	5.047	3.821	1.945	1.061	---	---	---	---	---	---	---	25.237	4.847	145.13	9864	7177	57.4	115.62	5.959	40.007	-1.998	1.253	4.441	0.798

For SI: 1 inch = 25.4 mm; 1 inch^3 = 1.64x10^4 mm^3; 1 inch^4 = 4.15x10^5 mm^4; 1 inch^6 = 2.69x10^8 mm^6; 1 kip-in = 112.99 N-m; 1 lb = 4.45 N.

TABLE 4—C-SHAPE PROPERTIES[4,5] (Continued)

MEMBER	GROSS[3]					EFFECTIVE PROPERTIES[2] (F_y = 33 ksi)							EFFECTIVE PROPERTIES[2] (F_y = 50 ksi)							TORSIONAL PROPERTIES					
	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_a (in-k)	V_{ag} (lb)	V_{anet} (lb)	L_u (in)	M_{ad} (in-k)	I_x (in^4)	S_x (in^3)	M_a (in-k)	V_{ag} (lb)	V_{anet} (lb)	L_u (in)	M_{ad} (in-k)	Jx1000 (in^4)	C_w (in^6)	X_o (in)	m (in)	R_o (in)	β
1200S162-54[1]	15.730	2.622	4.190	0.212	0.486	---	---	---	---	---	---	---	14.298	1.914	57.31	1377	1377	30.5	46.77	0.957	6.340	-0.732	0.493	4.281	0.971
1200S162-68	19.518	3.253	4.173	0.255	0.477	---	---	---	---	---	---	---	18.390	2.645	79.19	2771	2771	30.2	66.08	1.899	7.739	-0.719	0.485	4.261	0.972
1200S162-97	26.966	4.494	4.137	0.331	0.459	---	---	---	---	---	---	---	26.735	4.091	122.49	8147	7411	29.5	111.39	5.433	10.331	-0.691	0.470	4.219	0.973
1200S200-54[1]	17.662	2.944	4.306	0.393	0.643	---	---	---	---	---	---	---	16.334	2.073	62.07	1377	1377	39	54.76	1.017	11.550	-1.032	0.681	4.474	0.947
1200S200-68	21.947	3.658	4.291	0.479	0.634	---	---	---	---	---	---	---	20.864	2.963	88.71	2771	2771	38.7	76.57	2.020	14.176	-1.017	0.673	4.455	0.948
1200S200-97	30.417	5.069	4.258	0.635	0.615	---	---	---	---	---	---	---	30.175	4.66	139.51	8147	7411	38.1	126.88	5.783	19.150	-0.987	0.656	4.414	0.950
1200S250-54[1]	19.681	3.280	4.416	0.683	0.823	---	---	---	---	---	---	---	18.433	2.149	64.34	1377	1377	48.3	58.41	1.078	19.505	-1.378	0.892	4.699	0.914
1200S250-68	24.484	4.081	4.402	0.836	0.813	---	---	---	---	---	---	---	23.575	3.007	90.04	2771	2771	48.1	81.58	2.141	24.034	-1.362	0.884	4.679	0.915
1200S250-97	34.016	5.669	4.373	1.121	0.794	---	---	---	---	---	---	---	33.835	5.037	150.82	8147	7411	47.5	135.18	6.134	32.734	-1.329	0.867	4.639	0.918
1200S300-54[1]	22.479	3.747	4.533	1.221	1.057	---	---	---	---	---	---	---	22.278	2.702	80.9	1377	1377	57.4	60.65	1.168	35.310	-1.893	1.201	5.025	0.858
1200S300-68	28.003	4.667	4.520	1.504	1.048	---	---	---	---	---	---	---	28.003	3.734	111.79	2771	2771	57.2	84.79	2.322	43.658	-1.876	1.193	5.005	0.860
1200S300-97	39.017	6.503	4.494	2.046	1.029	---	---	---	---	---	---	---	39.017	6.256	187.31	8147	7411	56.7	141.05	6.660	59.901	-1.842	1.175	4.965	0.862

For SI: 1 inch = 25.4 mm; 1 $inch^3$ = 1.64x10^4 mm^3; 1 $inch^4$ = 4.15x10^5 mm^4; 1 $inch^6$ = 2.69x10^8 mm^6; 1 kip-in = 112.99 N-m; 1 lb = 4.45 N.

[1]Web-height to thickness ratio, h/t, exceeds 200. Web stiffeners designed in accordance with AISI are required at support points and concentrated Loads. Holes/punch-outs in the web are outside the scope of this report.
[2]The values are for members with punch-outs.
[3]Gross properties are based on the full, unreduced cross-section, away from web punch-outs.
[4]Use the effective moment of inertia for deflection calculation.
[5]Allowable moment is lesser of M_a and M_{ad}. Distortional buckling is based on an assumed KΦ = 0.

SYMBOLS

I_x = Strong axis moment of inertia
S_x = Strong axis section modulus
R_x = Strong axis radius of gyration
I_y = Weak axis moment of inertia
R_y = Weak axis radius of gyration
M_a = Strong axis allowable bending moment
V_{ag} = Allowable shear of unpunched web section
V_{anet} = Allowable shear of punched web section
L_u = Unbraced length
M_{ad} = Allowable moment based on distortional buckling
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 = Torsional radii of gyration
β = Torsional flexural constant

TABLE 5—TRACK PROPERTIES[3]

MEMBER	GROSS[2]					EFFECTIVE PROPERTIES (F_y = 33 ksi)				EFFECTIVE PROPERTIES (F_y = 50 ksi)				TORSIONAL PROPERTIES					
	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_a (in-k)	V_{ag} (lb)	I_x (in^4)	S_x (in^3)	M_a (in-k)	V_{ag} (lb)	Jx1000 (in^4)	C_w (in^6)	X_o (in)	m (in)	R_o (in)	β
250T125-33	0.192	0.145	1.054	0.027	0.397	0.166	0.103	2.03	1024	---	---	---	---	0.069	0.033	-0.760	0.456	1.358	0.687
250T125-43	0.250	0.188	1.055	0.035	0.395	0.231	0.147	2.91	1356	---	---	---	---	0.153	0.042	-0.755	0.453	1.356	0.690
250T125-54	0.318	0.236	1.062	0.043	0.392	---	---	---	---	0.297	0.188	5.64	2563	0.301	0.054	-0.749	0.449	1.357	0.696
250T125-68	0.408	0.297	1.072	0.054	0.389	---	---	---	---	0.402	0.262	7.85	3199	0.602	0.069	-0.740	0.444	1.360	0.704
250T125-97	0.604	0.423	1.092	0.074	0.383	---	---	---	---	0.604	0.423	12.67	4476	1.745	0.101	-0.724	0.434	1.365	0.719
250T150-33	0.221	0.167	1.079	0.045	0.485	0.179	0.107	2.11	1024	---	---	---	---	0.076	0.054	-0.973	0.573	1.532	0.596
250T150-43	0.289	0.217	1.080	0.058	0.483	0.252	0.154	3.03	1356	---	---	---	---	0.168	0.070	-0.968	0.570	1.529	0.599
250T150-54	0.368	0.273	1.088	0.072	0.481	---	---	---	---	0.325	0.197	5.89	2563	0.332	0.089	-0.961	0.566	1.529	0.605
250T150-68	0.472	0.344	1.099	0.089	0.478	---	---	---	---	0.445	0.276	8.27	3199	0.663	0.114	-0.953	0.561	1.531	0.613
250T150-97	0.701	0.491	1.121	0.124	0.471	---	---	---	---	0.701	0.463	13.86	4476	1.921	0.168	-0.935	0.550	1.534	0.629
250T200-33	0.280	0.212	1.117	0.097	0.658	0.203	0.112	2.22	1024	---	---	---	---	0.090	0.118	-1.418	0.813	1.921	0.455
250T200-43	0.366	0.275	1.118	0.126	0.657	0.288	0.163	3.21	1356	---	---	---	---	0.198	0.153	-1.413	0.810	1.918	0.457
250T200-54	0.466	0.346	1.127	0.157	0.654	---	---	---	---	0.371	0.209	6.25	2563	0.392	0.195	-1.405	0.806	1.917	0.462
250T200-68	0.600	0.437	1.139	0.196	0.652	---	---	---	---	0.517	0.296	8.86	3199	0.783	0.251	-1.396	0.800	1.916	0.469
250T200-97	0.893	0.626	1.165	0.275	0.646	---	---	---	---	0.856	0.510	15.27	4476	2.271	0.374	-1.376	0.789	1.915	0.484
250T250-43	0.443	0.333	1.146	0.230	0.826	0.318	0.169	3.34	1356	---	---	---	---	0.229	0.283	-1.873	1.053	2.346	0.362
250T250-54	0.565	0.419	1.155	0.287	0.824	---	---	---	---	0.410	0.217	6.50	2563	0.453	0.361	-1.865	1.049	2.343	0.366
250T250-68	0.728	0.530	1.168	0.360	0.821	---	---	---	---	0.576	0.310	9.27	3199	0.904	0.466	-1.855	1.043	2.341	0.372
250T250-97	1.086	0.761	1.195	0.506	0.815	---	---	---	---	0.972	0.541	16.20	4476	2.622	0.696	-1.834	1.031	2.336	0.384
350T125-33	0.405	0.222	1.397	0.030	0.379	0.354	0.165	3.27	1024	---	---	---	---	0.083	0.070	-0.668	0.414	1.594	0.824
350T125-43	0.528	0.288	1.397	0.038	0.377	0.490	0.233	4.61	1739	---	---	---	---	0.183	0.090	-0.663	0.412	1.592	0.826
350T125-54	0.668	0.361	1.404	0.048	0.375	---	---	---	---	0.626	0.297	8.89	3372	0.362	0.114	-0.658	0.408	1.595	0.830
350T125-68	0.851	0.454	1.412	0.059	0.372	---	---	---	---	0.839	0.407	12.18	4536	0.723	0.144	-0.650	0.403	1.599	0.835
350T125-97	1.243	0.645	1.430	0.081	0.366	---	---	---	---	1.243	0.645	19.30	6383	2.096	0.209	-0.636	0.394	1.607	0.844
350T150-33	0.461	0.253	1.432	0.049	0.469	0.382	0.171	3.39	1024	---	---	---	---	0.090	0.114	-0.866	0.527	1.738	0.752
350T150-43	0.601	0.328	1.433	0.064	0.467	0.531	0.243	4.80	1739	---	---	---	---	0.198	0.148	-0.861	0.525	1.736	0.754
350T150-54	0.761	0.412	1.440	0.079	0.465	---	---	---	---	0.679	0.310	9.28	3372	0.392	0.187	-0.855	0.521	1.738	0.758
350T150-68	0.972	0.518	1.450	0.099	0.462	---	---	---	---	0.919	0.428	12.81	4536	0.783	0.238	-0.847	0.516	1.741	0.763
350T150-97	1.422	0.738	1.469	0.136	0.455	---	---	---	---	1.422	0.701	20.98	6383	2.271	0.346	-0.831	0.506	1.748	0.774
350T200-33	0.574	0.315	1.487	0.108	0.647	0.428	0.181	3.57	1024	---	---	---	---	0.103	0.249	-1.285	0.761	2.069	0.614
350T200-43	0.749	0.409	1.489	0.140	0.645	0.600	0.257	5.09	1739	---	---	---	---	0.229	0.323	-1.280	0.758	2.066	0.616
350T200-54	0.949	0.513	1.496	0.175	0.642	---	---	---	---	0.770	0.329	9.85	3372	0.453	0.409	-1.273	0.754	2.067	0.621
350T200-68	1.213	0.647	1.508	0.218	0.639	---	---	---	---	1.054	0.458	13.71	4536	0.904	0.522	-1.264	0.749	2.069	0.626
350T200-97	1.780	0.923	1.530	0.305	0.633	---	---	---	---	1.708	0.769	23.01	6383	2.622	0.765	-1.247	0.738	2.073	0.638
350T250-43	0.896	0.490	1.530	0.257	0.819	0.659	0.268	5.29	1739	---	---	---	---	0.260	0.593	-1.719	0.996	2.443	0.505
350T250-54	1.137	0.615	1.538	0.321	0.817	---	---	---	---	0.846	0.343	10.26	3372	0.513	0.752	-1.712	0.992	2.442	0.509
350T250-68	1.454	0.776	1.550	0.401	0.814	---	---	---	---	1.168	0.479	14.35	4536	1.025	0.961	-1.703	0.987	2.443	0.514
350T250-97	2.139	1.109	1.575	0.563	0.808	---	---	---	---	1.924	0.815	24.39	6383	2.973	1.413	-1.684	0.975	2.443	0.525

For SI: 1 inch = 25.4 mm; 1 $inch^3$ = 1.64x10^4 mm^3; 1 $inch^4$ = 4.15x10^5 mm^4; 1 $inch^6$ = 2.69x10^8 mm^6; 1 kip-in = 112.99 N-m; 1 lb = 4.45 N.

TABLE 5—TRACK PROPERTIES[3] (Continued)

MEMBER	GROSS[2]					EFFECTIVE PROPERTIES (F_y = 33 ksi)				EFFECTIVE PROPERTIES (F_y = 50 ksi)				TORSIONAL PROPERTIES					
	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_a (in-k)	V_{ag} (lb)	I_x (in^4)	S_x (in^3)	M_a (in-k)	V_{ag} (lb)	Jx1000 (in^4)	C_w (in^6)	X_o (in)	m (in)	R_o (in)	β
362T125-33	0.438	0.232	1.438	0.030	0.377	0.384	0.174	3.44	1024	---	---	---	---	0.085	0.076	-0.658	0.409	1.626	0.836
362T125-43	0.571	0.302	1.439	0.039	0.375	0.531	0.245	4.84	1739	---	---	---	---	0.187	0.098	-0.654	0.407	1.625	0.838
362T125-54	0.723	0.378	1.445	0.048	0.373	---	---	---	---	0.678	0.312	9.34	3372	0.369	0.123	-0.648	0.404	1.627	0.841
362T125-68	0.921	0.475	1.454	0.060	0.370	---	---	---	---	0.907	0.427	12.78	4703	0.738	0.156	-0.641	0.399	1.631	0.846
362T125-97	1.343	0.675	1.471	0.082	0.363	---	---	---	---	1.343	0.675	20.20	6622	2.140	0.226	-0.626	0.390	1.639	0.854
362T150-33	0.499	0.264	1.475	0.050	0.467	0.414	0.180	3.56	1024	---	---	---	---	0.091	0.124	-0.854	0.522	1.767	0.766
362T150-43	0.650	0.343	1.476	0.064	0.465	0.574	0.255	5.04	1739	---	---	---	---	0.202	0.160	-0.850	0.519	1.766	0.768
362T150-54	0.823	0.431	1.483	0.080	0.462	---	---	---	---	0.735	0.325	9.74	3372	0.400	0.202	-0.844	0.516	1.768	0.772
362T150-68	1.050	0.542	1.492	0.099	0.459	---	---	---	---	0.993	0.449	13.43	4703	0.799	0.257	-0.836	0.511	1.771	0.777
362T150-97	1.534	0.771	1.512	0.138	0.453	---	---	---	---	1.534	0.733	21.94	6622	2.315	0.374	-0.820	0.501	1.778	0.787
362T200-33	0.619	0.328	1.532	0.110	0.645	0.464	0.190	3.76	1024	---	---	---	---	0.105	0.269	-1.270	0.754	2.092	0.631
362T200-43	0.808	0.427	1.534	0.142	0.643	0.649	0.270	5.34	1739	---	---	---	---	0.233	0.350	-1.265	0.752	2.090	0.633
362T200-54	1.024	0.536	1.541	0.177	0.640	---	---	---	---	0.832	0.345	10.34	3372	0.460	0.442	-1.259	0.748	2.091	0.637
362T200-68	1.307	0.675	1.552	0.221	0.638	---	---	---	---	1.138	0.480	14.37	4703	0.919	0.564	-1.250	0.743	2.093	0.643
362T200-97	1.917	0.963	1.575	0.308	0.631	---	---	---	---	1.839	0.803	24.06	6622	2.666	0.825	-1.232	0.732	2.097	0.655
362T250-43	0.966	0.510	1.577	0.260	0.818	0.713	0.281	5.56	1739	---	---	---	---	0.263	0.641	-1.702	0.990	2.460	0.521
362T250-54	1.224	0.641	1.585	0.324	0.816	---	---	---	---	0.914	0.360	10.77	3372	0.521	0.812	-1.695	0.986	2.460	0.525
362T250-68	1.565	0.808	1.597	0.406	0.813	---	---	---	---	1.259	0.502	15.04	4703	1.040	1.038	-1.686	0.980	2.460	0.530
362T250-97	2.300	1.155	1.621	0.570	0.807	---	---	---	---	2.069	0.851	25.49	6622	3.016	1.524	-1.667	0.969	2.461	0.541
400T125-33	0.549	0.265	1.563	0.031	0.371	0.484	0.201	3.97	940	---	---	---	---	0.090	0.095	-0.630	0.396	1.725	0.867
400T125-43	0.716	0.344	1.563	0.040	0.369	0.666	0.282	5.57	1739	---	---	---	---	0.198	0.122	-0.626	0.394	1.724	0.868
400T125-54	0.904	0.431	1.569	0.049	0.366	---	---	---	---	0.849	0.359	10.74	3372	0.392	0.154	-0.621	0.390	1.727	0.871
400T125-68	1.150	0.541	1.577	0.061	0.363	---	---	---	---	1.134	0.488	14.62	5205	0.783	0.194	-0.614	0.386	1.731	0.874
400T125-97	1.673	0.768	1.594	0.084	0.357	---	---	---	---	1.673	0.768	23.00	7337	2.271	0.280	-0.600	0.377	1.740	0.881
400T150-33	0.622	0.300	1.603	0.051	0.460	0.519	0.208	4.12	940	---	---	---	---	0.097	0.155	-0.821	0.507	1.859	0.805
400T150-43	0.811	0.390	1.604	0.066	0.458	0.719	0.293	5.80	1739	---	---	---	---	0.214	0.200	-0.817	0.504	1.857	0.807
400T150-54	1.025	0.489	1.610	0.082	0.456	---	---	---	---	0.918	0.374	11.19	3372	0.422	0.252	-0.811	0.501	1.860	0.810
400T150-68	1.306	0.615	1.619	0.102	0.453	---	---	---	---	1.237	0.513	15.35	5205	0.844	0.320	-0.804	0.496	1.864	0.814
400T150-97	1.903	0.874	1.638	0.141	0.447	---	---	---	---	1.903	0.832	24.92	7337	2.447	0.463	-0.788	0.487	1.872	0.823
400T200-33	0.768	0.371	1.666	0.113	0.639	0.581	0.220	4.34	940	---	---	---	---	0.110	0.336	-1.229	0.737	2.166	0.678
400T200-43	1.002	0.482	1.668	0.146	0.637	0.811	0.311	6.14	1739	---	---	---	---	0.244	0.436	-1.224	0.734	2.164	0.680
400T200-54	1.268	0.604	1.675	0.182	0.635	---	---	---	---	1.037	0.397	11.88	3372	0.483	0.551	-1.217	0.730	2.165	0.684
400T200-68	1.617	0.761	1.685	0.227	0.632	---	---	---	---	1.412	0.549	16.42	5205	0.965	0.702	-1.209	0.725	2.168	0.689
400T200-97	2.363	1.085	1.707	0.317	0.625	---	---	---	---	2.268	0.911	27.28	7337	2.797	1.022	-1.192	0.715	2.173	0.699
400T250-43	1.193	0.573	1.715	0.268	0.813	0.888	0.324	6.40	1739	---	---	---	---	0.275	0.799	-1.653	0.970	2.517	0.569
400T250-54	1.511	0.720	1.723	0.335	0.811	---	---	---	---	1.137	0.413	12.38	3372	0.543	1.011	-1.646	0.966	2.517	0.572
400T250-68	1.928	0.907	1.735	0.418	0.808	---	---	---	---	1.559	0.574	17.19	5205	1.086	1.289	-1.637	0.961	2.518	0.578
400T250-97	2.823	1.296	1.758	0.587	0.802	---	---	---	---	2.546	0.965	28.89	7337	3.148	1.886	-1.618	0.950	2.521	0.588

For SI: 1 inch = 25.4 mm; 1 $inch^3$ = 1.64x10^4 mm^3; 1 $inch^4$ = 4.15x10^5 mm^4; 1 $inch^6$ = 2.69x10^8 mm^6; 1 kip-in = 112.99 N-m; 1 lb = 4.45 N.

TABLE 5—TRACK PROPERTIES[3] (Continued)

MEMBER	GROSS[2]					EFFECTIVE PROPERTIES (F_y = 33 ksi)				EFFECTIVE PROPERTIES (F_y = 50 ksi)				TORSIONAL PROPERTIES					
	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_a (in-k)	V_{ag} (lb)	I_x (in^4)	S_x (in^3)	M_a (in-k)	V_{ag} (lb)	Jx1000 (in^4)	C_w (in^6)	X_o (in)	m (in)	R_o (in)	β
550T125-33	1.159	0.410	2.046	0.033	0.346	1.029	0.270	5.33	680	---	---	---	---	0.110	0.195	-0.541	0.350	2.145	0.936
550T125-43	1.510	0.533	2.047	0.043	0.344	1.428	0.416	8.23	1504	---	---	---	---	0.244	0.252	-0.537	0.348	2.144	0.937
550T125-54	1.903	0.668	2.052	0.053	0.342	---	---	---	---	1.811	0.535	16.01	2980	0.483	0.315	-0.532	0.345	2.147	0.939
550T125-68	2.412	0.839	2.058	0.066	0.339	---	---	---	---	2.379	0.769	23.02	5350	0.965	0.397	-0.526	0.341	2.152	0.940
550T125-97	3.483	1.190	2.072	0.090	0.333	---	---	---	---	3.483	1.190	35.62	10197	2.797	0.564	-0.514	0.333	2.161	0.943
550T150-33	1.295	0.459	2.099	0.055	0.434	1.115	0.310	6.12	680	---	---	---	---	0.117	0.320	-0.714	0.455	2.259	0.900
550T150-43	1.688	0.596	2.099	0.072	0.432	1.516	0.468	9.25	1504	---	---	---	---	0.260	0.414	-0.709	0.452	2.258	0.901
550T150-54	2.128	0.747	2.105	0.089	0.430	---	---	---	---	1.928	0.595	17.81	2980	0.513	0.519	-0.704	0.449	2.261	0.903
550T150-68	2.699	0.939	2.112	0.110	0.427	---	---	---	---	2.569	0.804	24.07	5350	1.025	0.655	-0.698	0.445	2.265	0.905
550T150-97	3.904	1.333	2.128	0.153	0.421	---	---	---	---	3.904	1.278	38.27	10197	2.973	0.937	-0.684	0.436	2.275	0.909
550T200-33	1.567	0.555	2.184	0.123	0.613	1.246	0.307	6.06	680	---	---	---	---	0.131	0.694	-1.088	0.674	2.516	0.813
550T200-43	2.043	0.722	2.185	0.160	0.611	1.690	0.495	9.79	1504	---	---	---	---	0.290	0.900	-1.083	0.671	2.514	0.814
550T200-54	2.578	0.905	2.191	0.199	0.609	---	---	---	---	2.153	0.630	18.86	2980	0.573	1.133	-1.077	0.668	2.517	0.817
550T200-68	3.274	1.139	2.200	0.248	0.606	---	---	---	---	2.894	0.857	25.67	5350	1.146	1.434	-1.070	0.663	2.521	0.820
550T200-97	4.746	1.621	2.219	0.347	0.600	---	---	---	---	4.566	1.391	41.64	10197	3.323	2.067	-1.055	0.653	2.529	0.826
550T250-43	2.399	0.848	2.252	0.295	0.790	1.841	0.516	10.20	1504	---	---	---	---	0.321	1.643	-1.484	0.899	2.810	0.721
550T250-54	3.029	1.063	2.259	0.368	0.788	---	---	---	---	2.405	0.657	19.66	2980	0.634	2.070	-1.478	0.895	2.812	0.724
550T250-68	3.849	1.339	2.269	0.460	0.785	---	---	---	---	3.201	0.897	26.86	5350	1.267	2.627	-1.470	0.890	2.815	0.727
550T250-97	5.588	1.908	2.290	0.646	0.779	---	---	---	---	5.073	1.470	44.01	10197	3.674	3.801	-1.453	0.880	2.822	0.735
600T125-33	1.428	0.465	2.204	0.034	0.339	1.258	0.297	5.87	622	---	---	---	---	0.117	0.238	-0.516	0.337	2.289	0.949
600T125-43	1.861	0.604	2.205	0.044	0.337	1.768	0.461	9.11	1377	---	---	---	---	0.260	0.307	-0.513	0.335	2.288	0.950
600T125-54	2.344	0.756	2.209	0.054	0.335	---	---	---	---	2.241	0.592	17.73	2728	0.513	0.384	-0.508	0.332	2.291	0.951
600T125-68	2.969	0.950	2.215	0.067	0.332	---	---	---	---	2.934	0.858	25.69	5350	1.025	0.483	-0.503	0.329	2.296	0.952
600T125-97	4.281	1.347	2.228	0.092	0.326	---	---	---	---	4.281	1.347	40.33	10885	2.973	0.685	-0.491	0.321	2.305	0.955
600T150-33	1.590	0.517	2.260	0.057	0.426	1.334	0.303	5.99	622	---	---	---	---	0.124	0.390	-0.684	0.439	2.399	0.919
600T150-43	2.072	0.673	2.261	0.073	0.424	1.890	0.474	9.36	1377	---	---	---	---	0.275	0.504	-0.680	0.437	2.398	0.920
600T150-54	2.611	0.843	2.266	0.091	0.422	---	---	---	---	2.400	0.609	18.24	2728	0.543	0.632	-0.675	0.434	2.401	0.921
600T150-68	3.309	1.059	2.273	0.113	0.419	---	---	---	---	3.162	0.891	26.68	5350	1.086	0.797	-0.669	0.430	2.406	0.923
600T150-97	4.778	1.504	2.288	0.156	0.413	---	---	---	---	4.778	1.444	43.23	10885	3.148	1.138	-0.656	0.421	2.415	0.926
600T200-33	1.913	0.622	2.352	0.126	0.604	1.542	0.333	6.59	622	---	---	---	---	0.138	0.847	-1.048	0.655	2.645	0.843
600T200-43	2.494	0.809	2.353	0.163	0.602	2.076	0.565	11.16	1377	---	---	---	---	0.305	1.098	-1.044	0.652	2.643	0.844
600T200-54	3.145	1.015	2.359	0.203	0.600	---	---	---	---	2.641	0.717	21.48	2728	0.604	1.381	-1.038	0.649	2.646	0.846
600T200-68	3.990	1.277	2.367	0.254	0.597	---	---	---	---	3.540	0.973	29.12	5350	1.206	1.746	-1.031	0.644	2.650	0.849
600T200-97	5.773	1.816	2.385	0.354	0.591	---	---	---	---	5.558	1.568	46.94	10885	3.499	2.510	-1.016	0.635	2.659	0.854
600T250-43	2.916	0.946	2.425	0.303	0.781	2.322	0.563	11.13	1377	---	---	---	---	0.336	2.004	-1.436	0.878	2.925	0.759
600T250-54	3.678	1.187	2.432	0.377	0.779	---	---	---	---	2.953	0.732	21.92	2728	0.664	2.523	-1.430	0.874	2.927	0.761
600T250-68	4.670	1.495	2.442	0.472	0.776	---	---	---	---	3.918	1.017	30.46	5350	1.327	3.198	-1.422	0.869	2.930	0.764
600T250-97	6.767	2.129	2.462	0.662	0.770	---	---	---	---	6.157	1.656	49.58	10885	3.849	4.616	-1.406	0.859	2.938	0.771

For SI: 1 inch = 25.4 mm; 1 $inch^3$ = 1.64x10^4 mm^3; 1 $inch^4$ = 4.15x10^5 mm^4; 1 $inch^6$ = 2.69x10^8 mm^6; 1 kip-in = 112.99 N-m; 1 lb = 4.45 N.

TABLE 5—TRACK PROPERTIES[3] (Continued)

MEMBER	GROSS[2]					EFFECTIVE PROPERTIES (F_y = 33 ksi)				EFFECTIVE PROPERTIES (F_y = 50 ksi)				TORSIONAL PROPERTIES					
	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_a (in-k)	V_{ag} (lb)	I_x (in^4)	S_x (in^3)	M_a (in-k)	V_{ag} (lb)	Jx1000 (in^4)	C_w (in^6)	X_o (in)	m (in)	R_o (in)	β
800T125-33[1]	2.895	0.711	2.824	0.036	0.313	2.441	0.407	8.03	465	---	---	---	---	0.145	0.456	-0.439	0.294	2.875	0.977
800T125-43	3.773	0.924	2.824	0.046	0.311	3.484	0.640	12.65	1030	---	---	---	---	0.321	0.589	-0.436	0.292	2.874	0.977
800T125-54	4.745	1.158	2.827	0.057	0.309	---	---	---	---	4.426	0.824	24.66	2039	0.634	0.735	-0.432	0.289	2.877	0.977
800T125-68	5.998	1.454	2.833	0.070	0.306	---	---	---	---	5.956	1.216	36.39	4087	1.267	0.920	-0.427	0.286	2.881	0.978
800T125-97	8.613	2.062	2.843	0.096	0.301	---	---	---	---	8.613	2.062	61.72	10885	3.674	1.296	-0.417	0.279	2.889	0.979
800T150-33[1]	3.180	0.781	2.891	0.060	0.397	2.569	0.414	8.18	465	---	---	---	---	0.152	0.751	-0.588	0.388	2.977	0.961
800T150-43	4.144	1.015	2.891	0.077	0.395	3.689	0.655	12.95	1030	---	---	---	---	0.336	0.972	-0.584	0.386	2.976	0.961
800T150-54	5.214	1.272	2.896	0.096	0.393	---	---	---	---	4.692	0.844	25.27	2039	0.664	1.215	-0.580	0.383	2.979	0.962
800T150-68	6.594	1.599	2.902	0.119	0.390	---	---	---	---	6.361	1.255	37.58	4087	1.327	1.526	-0.575	0.379	2.984	0.963
800T150-97	9.479	2.269	2.914	0.165	0.384	---	---	---	---	9.479	2.192	65.62	10885	3.849	2.162	-0.564	0.372	2.993	0.965
800T200-33[1]	3.749	0.921	3.005	0.135	0.571	2.788	0.424	8.37	465	---	---	---	---	0.166	1.638	-0.917	0.589	3.194	0.918
800T200-43	4.887	1.197	3.006	0.175	0.569	4.043	0.676	13.35	1030	---	---	---	---	0.367	2.124	-0.913	0.587	3.193	0.918
800T200-54	6.152	1.501	3.011	0.218	0.567	---	---	---	---	5.149	0.871	26.09	2039	0.725	2.664	-0.908	0.584	3.196	0.919
800T200-68	7.786	1.888	3.019	0.272	0.564	---	---	---	---	7.051	1.310	39.22	4087	1.448	3.357	-0.902	0.580	3.201	0.921
800T200-97	11.212	2.683	3.034	0.379	0.558	---	---	---	---	10.833	2.347	70.27	10885	4.200	4.792	-0.889	0.571	3.210	0.923
800T250-43	5.629	1.380	3.100	0.326	0.746	4.655	0.739	14.60	1030	---	---	---	---	0.397	3.877	-1.274	0.801	3.433	0.862
800T250-54	7.090	1.730	3.106	0.407	0.744	---	---	---	---	5.902	0.959	28.71	2039	0.785	4.870	-1.268	0.798	3.436	0.864
800T250-68	8.978	2.177	3.114	0.509	0.741	---	---	---	---	7.756	1.560	46.72	4087	1.569	6.151	-1.261	0.793	3.441	0.866
800T250-97	12.944	3.098	3.132	0.713	0.735	---	---	---	---	11.872	2.487	74.47	10885	4.550	8.818	-1.247	0.784	3.450	0.869
1000T125-43[1]	6.630	1.305	3.431	0.047	0.290	5.886	0.819	16.19	822	---	---	---	---	0.382	0.973	-0.379	0.259	3.464	0.988
1000T125-54	8.333	1.634	3.434	0.059	0.288	---	---	---	---	7.479	1.055	31.59	1628	0.755	1.212	-0.376	0.256	3.466	0.988
1000T125-68	10.522	2.053	3.438	0.073	0.286	---	---	---	---	10.155	1.575	47.15	3261	1.508	1.515	-0.372	0.253	3.470	0.989
1000T125-97	15.077	2.912	3.447	0.100	0.280	---	---	---	---	15.077	2.753	82.42	9507	4.375	2.123	-0.363	0.247	3.477	0.989
1000T150-43[1]	7.207	1.419	3.507	0.080	0.370	6.195	0.837	16.54	822	---	---	---	---	0.397	1.612	-0.513	0.345	3.564	0.979
1000T150-54	9.061	1.777	3.511	0.100	0.368	---	---	---	---	7.880	1.079	32.29	1628	0.785	2.013	-0.509	0.342	3.567	0.980
1000T150-68	11.445	2.233	3.516	0.124	0.366	---	---	---	---	10.774	1.621	48.53	3261	1.569	2.522	-0.505	0.339	3.571	0.980
1000T150-97	16.413	3.170	3.526	0.171	0.360	---	---	---	---	16.413	2.902	86.90	9507	4.550	3.557	-0.495	0.332	3.579	0.981
1000T200-43[1]	8.361	1.646	3.640	0.183	0.539	6.722	0.861	17.01	822	---	---	---	---	0.428	3.540	-0.813	0.534	3.769	0.953
1000T200-54	10.516	2.062	3.645	0.228	0.537	---	---	---	---	8.560	1.111	33.26	1628	0.845	4.434	-0.809	0.531	3.772	0.954
1000T200-68	13.292	2.594	3.651	0.284	0.534	---	---	---	---	11.820	1.684	50.42	3261	1.690	5.576	-0.803	0.527	3.776	0.955
1000T200-97	19.087	3.686	3.664	0.397	0.528	---	---	---	---	18.583	3.081	92.25	9507	4.901	7.924	-0.791	0.519	3.786	0.956
1000T250-43[1]	9.515	1.873	3.751	0.344	0.713	7.283	0.876	17.32	822	---	---	---	---	0.458	6.477	-1.147	0.737	3.987	0.917
1000T250-54	11.972	2.348	3.757	0.429	0.711	---	---	---	---	9.309	1.132	33.89	1628	0.906	8.125	-1.142	0.734	3.990	0.918
1000T250-68	15.138	2.954	3.764	0.536	0.708	---	---	---	---	12.867	1.726	51.68	3261	1.810	10.240	-1.135	0.730	3.995	0.919
1000T250-97	21.760	4.202	3.780	0.751	0.702	---	---	---	---	20.304	3.201	95.84	9507	5.252	14.617	-1.122	0.721	4.005	0.921

For SI: 1 inch = 25.4 mm; 1 $inch^3$ = 1.64x10^4 mm^3; 1 $inch^4$ = 4.15x10^5 mm^4; 1 $inch^6$ = 2.69x10^8 mm^6; 1 kip-in = 112.99 N-m; 1 lb = 4.45 N.

TABLE 5—TRACK PROPERTIES[3] (Continued)

MEMBER	GROSS[2]					EFFECTIVE PROPERTIES (F_y = 33 ksi)				EFFECTIVE PROPERTIES (F_y = 50 ksi)				TORSIONAL PROPERTIES					
	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_a (in-k)	V_{ag} (lb)	I_x (in^4)	S_x (in^3)	M_a (in-k)	V_{ag} (lb)	Jx1000 (in^4)	C_w (in^6)	X_o (in)	m (in)	R_o (in)	β
1200T125-54[1]	13.335	2.186	4.033	0.060	0.271	---	---	---	---	11.460	1.286	38.51	1354	0.876	1.820	-0.333	0.230	4.055	0.993
1200T125-68	16.826	2.747	4.036	0.074	0.268	---	---	---	---	15.686	1.934	57.90	2713	1.750	2.270	-0.329	0.227	4.059	0.993
1200T125-97	24.078	3.897	4.044	0.102	0.263	---	---	---	---	23.751	3.442	103.06	7902	5.076	3.171	-0.322	0.222	4.065	0.994
1200T150-54[1]	14.378	2.357	4.117	0.103	0.348	---	---	---	---	12.020	1.313	39.31	1354	0.906	3.033	-0.454	0.310	4.156	0.988
1200T150-68	18.148	2.963	4.121	0.127	0.345	---	---	---	---	16.566	1.987	59.48	2713	1.810	3.795	-0.450	0.307	4.160	0.988
1200T150-97	25.987	4.206	4.130	0.176	0.340	---	---	---	---	25.719	3.616	108.27	7902	5.252	5.335	-0.441	0.301	4.168	0.989
1200T200-54[1]	16.464	2.699	4.265	0.236	0.510	---	---	---	---	12.962	1.350	40.41	1354	0.966	6.714	-0.730	0.487	4.357	0.972
1200T200-68	20.791	3.395	4.271	0.294	0.508	---	---	---	---	18.026	2.058	61.62	2713	1.931	8.431	-0.725	0.483	4.362	0.972
1200T200-97	29.805	4.824	4.283	0.410	0.502	---	---	---	---	28.959	3.819	114.35	7902	5.602	11.945	-0.714	0.476	4.371	0.973
1200T250-54[1]	18.550	3.041	4.392	0.445	0.681	---	---	---	---	14.092	1.374	41.14	1354	1.027	12.339	-1.039	0.680	4.565	0.948
1200T250-68	23.435	3.826	4.399	0.556	0.678	---	---	---	---	19.608	2.106	63.04	2713	2.052	15.529	-1.033	0.676	4.569	0.949
1200T250-97	33.623	5.442	4.413	0.780	0.672	---	---	---	---	31.596	3.954	118.37	7902	5.953	22.101	-1.021	0.668	4.579	0.950

For SI: 1 inch = 25.4 mm; 1 $inch^3$ = 1.64x10^4 mm^3; 1 $inch^4$ = 4.15x10^5 mm^4; 1 $inch^6$ = 2.69x10^8 mm^6; 1 kip-in = 112.99 N-m; 1 lb = 4.45 N.

[1]Web-height to thickness ratio, h/t, exceeds 200. Web stiffeners designed in accordance with AISI are required at support points and concentrated Loads.
[2]Gross properties are based on the full, unreduced cross-section.
[3]Use the effective moment of inertia for deflection calculation.

SYMBOLS

I_x = Strong axis moment of inertia
S_x = Strong axis section modulus
R_x = Strong axis radius of gyration
I_y = Weak axis moment of inertia
R_y = Weak axis radius of gyration
M_a = Strong axis allowable bending moment
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 = Torsional radii of gyration
β = Torsional flexural constant

TABLE 6—ALLOWABLE CONCENTRATED LOADS AND END REACTIONS FOR C-SHAPES BASED ON WEB CRIPPLING[2] (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

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

[1] Bearing length to web height ration, N/h, exceeds 2. Web stiffeners are required.
[2] Values are for members fastened to supports.

TABLE 6— ALLOWABLE CONCENTRATED LOADS AND END REACTIONS FOR C-SHAPES BASED ON WEB CRIPPLING[2] (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—STRUCTURAL PROPERTIES OF FURRING CHANNELS[1,2]

SECTION	F_y (ksi)	DESIGN THICKNESS (in)	GROSS PROPERTIES						EFFECTIVE PROPERTIES		
			Area (in^2)	Weight (lb/ft)	Ix (in^4)	Rx (in)	Iy (in^4)	Ry (in)	Ix (in^4)	Sx (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 $inch^2$ = 645 mm^2; 1 $inch^3$ = 1.64x10^4; 1 $inch^4$ = 4.15x10^5 mm^4; 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 I_y = Weak axis moment of inertia S_x = Strong axis section modulus
R_x = Strong axis radius of gyration R_y = Weak axis radius of gyration M_a = Strong axis allowable bending moment

TABLE 8—STRUCTURAL PROPERTIES OF U-CHANNELS[1]

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 $inch^2$ = 645 mm^2; 1 $inch^3$ = 1.64x10^4; 1 $inch^4$ = 4.15x10^5 mm^4; 1 lb/lin ft = 14.5939 N/m; 1 kip-in = 112.99 N-m; 1 ksl = 6.89 Mpa; 1 lb = 4.45 N.

[1] For deflection calculations, use effective I_x.

SYMBOLS
I_x = Strong axis moment of inertia I_y = Weak axis moment of inertia S_x = Strong axis section modulus V_a = Allowable shear of web section
R_x = Strong axis radius of gyration R_y = Weak axis radius of gyration M_a = Strong axis allowable bending moment

TABLE 9—C-SECTIONS FOR USE WITH THE IRC[1,2]

IRC MEMBER DESIGNATION	EQUIVALENT MARINO\WARE MEMBER DESIGNATION				
	t = 33	t = 43	t = 54[1]	t = 68[1]	t=97[1]
350S162-t	350S162-33	350S162-43	350S162-54	350S162-68	----
	350S200-33	350S200-43	350S200-54	350S200-68	----
550S162-t	550S162-33	550S162-43	550S162-54	550S162-68	550S162-97
	550S200-33	550S200-43	550S200-54	550S200-68	550S200-97
800S162-t	800S162-33	800S162-43	800S162-54	800S162-68	800S162-97
	800S200-33	800S200-43	800S200-54	800S200-68	800S200-97
1000S162-t	---	1000S162-43	1000S162-54	1000S162-68	1000S162-97
	---	1000S200-43	1000S200-54	1000S200-68	1000S200-97
1200S162-t	---	---	1200S162-54	1200S162-68	1200S162-97
	---	---	1200S200-54	1200S200-68	1200S200-97

[1]These members are applicable to the 2015 IRC and 2012 IRC and are not applicable to the 2009 IRC.
[2]Framing members must have a minimum lip size of 0.5 inch (12.7 mm).

TABLE 10—MANUFACTURING LOCATIONS

Marino\WARE – South Plainfield South Plainfield, NJ 07080	Marino\WARE – East Chicago East Chicago, IN 46312
Marino\WARE – Griffin Griffin, GA 30223	Marino\WARE – Pasadena Pasadena, TX 77507

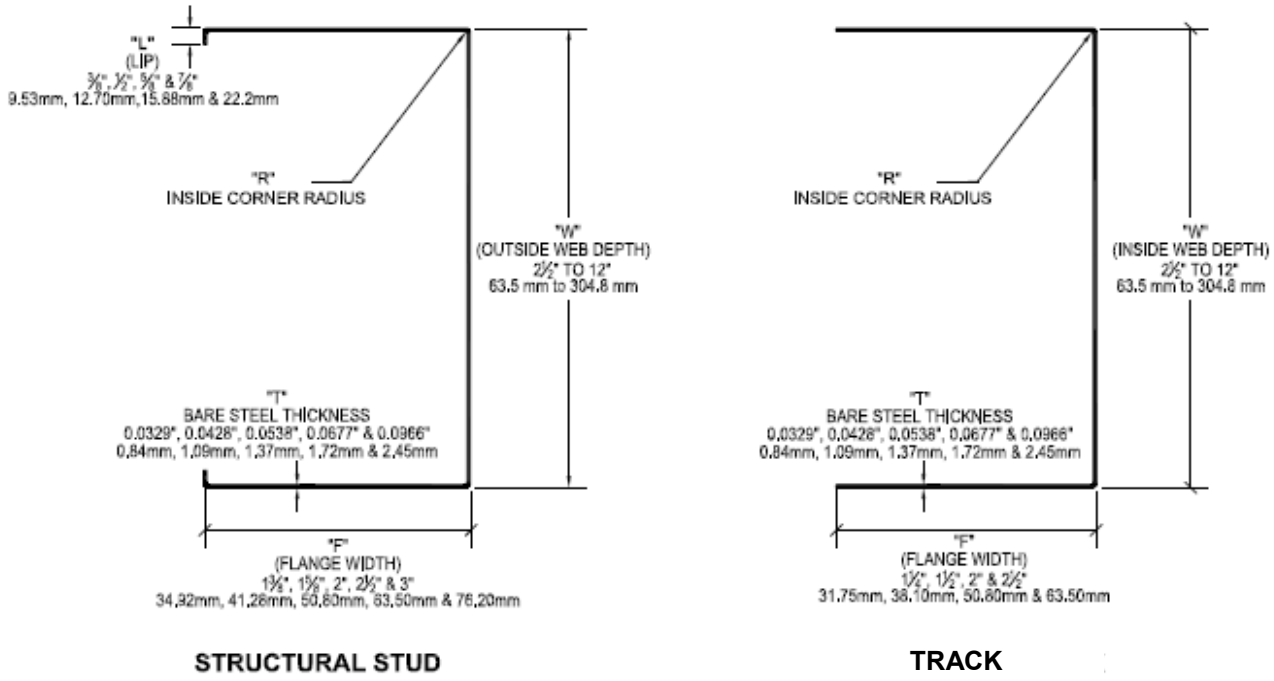


FIGURE 1—SECTION PROFILES

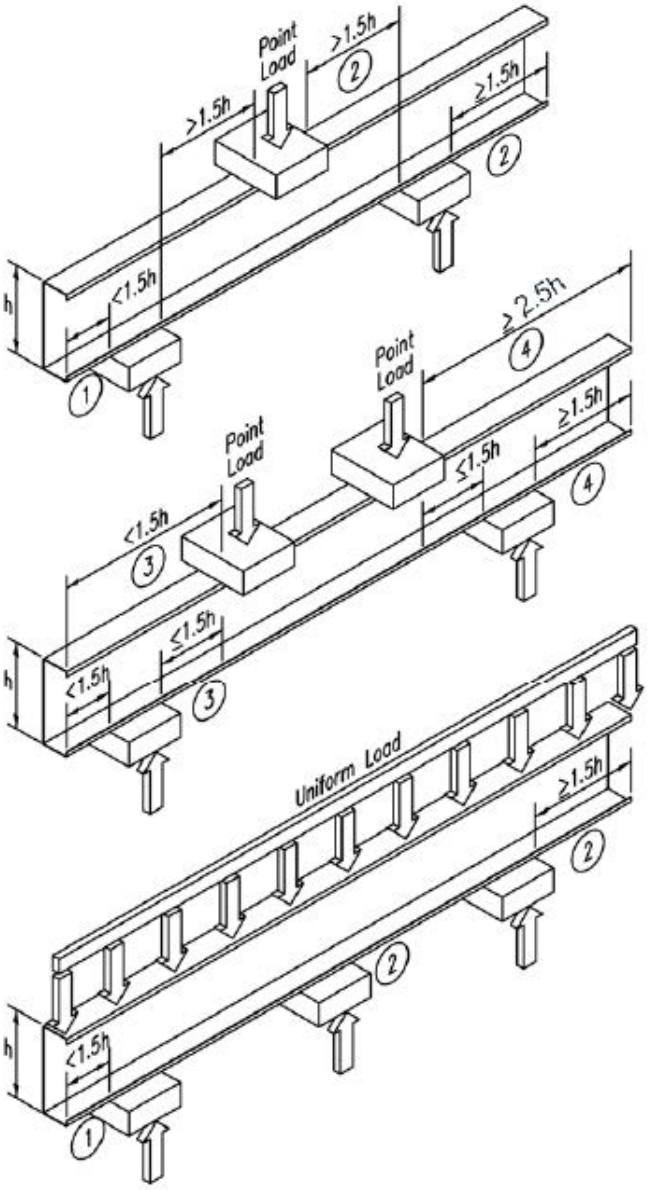

Point Load
>1.5h
>1.5h
≥1.5h
<1.5h
h
≥2.5h
Point Load
≥1.5h
≤1.5h
Point Load
<1.5h
≤1.5h
<1.5h
Uniform Load
≥1.5h
<1.5h
1
2
3
4

FIGURE 2

ICC-ES Evaluation Report

ESR-4062 CBC and CRC Supplement

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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., d/b/a MARINO\WARE
400 METUCHEN ROAD
SOUTH PLAINFIELD, NEW JERSEY 07080
(908) 757-9000
www.marinoware.com

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, recognized in ICC-ES master report ESR-4062, has also been evaluated for compliance with Chapters 22 and 22A of the CBC and Chapters 5, 6 and 8 of the CRC noted below.

Applicable code editions:

- 2016 *California Building Code* (CBC)
- 2016 *California Residential Code* (CRC)

2.0 CONCLUSIONS

2.1 CBC:

The MARINO\WARE Cold-Formed Steel Framing, described in Sections 2.0 through 7.0 of the master evaluation report ESR-4062, complies with CBC Chapters 22 and 22A, provided the design and installation are in accordance with the 2015 *International Building Code®* (IBC) provisions noted in the master report and the additional requirements of CBC Chapters 16, 16A, 17, 17A, 22, and 22A, as applicable.

2.2 CRC:

The MARINO\WARE Cold-Formed Steel Framing, described in Sections 2.0 through 7.0 of the master evaluation report ESR-4062, complies with CRC Chapters 5, 6 and 8, provided the design and installation are in accordance with the 2015 *International Residential Code®* (IRC) provisions noted in the master report.

This supplement expires concurrently with the master report, reissued February 2018.

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ICC-ES Evaluation Report

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Section: 09 22 13—Metal Furring
Section: 09 22 16.13—Non-Structural Metal Stud Framing

REPORT HOLDER:

WARE INDUSTRIES, INC., d/b/a MARINO\WARE
400 METUCHEN ROAD
SOUTH PLAINFIELD, NEW JERSEY 07080
(908) 757-9000
www.marinoware.com

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, recognized in ICC-ES master report ESR-4062, has also been evaluated for compliance with the codes noted below.

Applicable code editions:

- 2014 *Florida Building Code—Building*
- 2014 *Florida Building Code—Residential*

2.0 CONCLUSIONS

The MARINO\WARE Cold-Formed Steel Framing**,** described in Sections 2.0 through 7.0 of the master evaluation report ESR-4062, complies with the *Florida Building Code—Building* and the *Florida Building Code—Residential*, provided the design and installation are in accordance with the 2012 *International Building Code®* (IBC) provisions noted in the master report.

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* and the *Florida Building Code—Residential*.

For products falling under Florida Rule 9N-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).

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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., d/b/a MARINO\WARE
400 METUCHEN ROAD
SOUTH PLAINFIELD, NEW JERSEY 07080
(908) 757-9000
www.marinoware.com

EVALUATION SUBJECT:

COLD-FORMED STEEL FRAMING

1.0 REPORT PURPOSE AND SCOPE

The purpose of this evaluation report supplement is to indicate that MARINO\WARE cold-formed steel framing members, recognized in ICC-ES master report ESR-4062, are certified to be in compliance with the ICC-ES/CSSA Code Compliance Certification Program. Studs and tracks are periodically checked for mechanical properties, coatings, dimensions and labeling.

2.0 LABELING

Certified products bear the following label:



3.0 CERTIFIED MANUFACTURING FACILITIES

Marino\WARE – South Plainfield South Plainfield, New Jersey 07080	Marino\WARE – Griffin Griffin, Georgia 30223	Marino\WARE – East Chicago East Chicago, Indiana 46312	Marino\WARE – Pasadena Pasadena, Texas 77507

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