# CISC HANDBOOK OF STEEL CONSTRUCTION

## 11th Edition, 2nd Revised Printing 2016

## REVISIONS LIST NO. 1 - NOVEMBER 2016

The following revisions and updates have been incorporated into the 2nd Revised Printing of the 11th Edition of the CISC Handbook of Steel Construction. Minor editorial revisions are not shown.

| Page | Revisions |
|---|---|
| iv | In the Foreword, add the following (fifth) paragraph:<br>"Future revisions and errata to this Handbook can be obtained from the CISC publications webpage (*www.cisc-icca.ca/solutions-centre/publications*)." |
| 2-156 | Add Clause 30.1:<br>**30.1 General**<br>This clause is written expressly for third-party inspection performed on behalf of owners or their delegated consultants. It does not apply to internal quality control activities performed by the erector or fabricator, whether self-performed or contracted.<br>The CISC Accredited Steel Inspector for Buildings provides objective evidence that the inspector has a minimum competency in steel fabrication and erection inspection. This CISC accreditation is considered a complementary competency record, to be paired with CSA W178.2 (welding) if needed.<br><br>In Clause 30.5, add the following (third) paragraph:<br>"This clause and the requirement for W178.2 inspector qualification are not intended to apply to fabricators or erectors. Fabricators and erectors, within their certification to CSA W47.1, are to have company-specific processes and competent personnel to ensure conforming welds." |

3-42 Replace the factored shear resistances with the values highlighted in red in Table 3-23:

## FACTORED SHEAR RESISTANCE — Table 3-23

### On Effective Throat Per Millimetre of Weld Length (kN/mm)

| Rated Electrode Tensile Strength, $X_u$ (MPa) | Unit Shear Resist-ance (MPa) | Effective Throat Thickness (mm) | | | | | | | | | | | | (40 mm deleted) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 10 | 12 | 15 | 20 | 25 | 30 |
| 430 | 193 | 0.386 | 0.579 | 0.772 | 0.965 | 1.16 | 1.35 | 1.54 | 1.93 | 2.32 | 2.90 | 3.86 | 4.83 | 5.79 |
| 490 | 220 | 0.440 | 0.660 | 0.880 | 1.10 | 1.32 | 1.54 | 1.76 | 2.20 | 2.64 | 3.30 | 4.40 | 5.50 | 6.60 |
| 550 | 247 | 0.494 | 0.741 | 0.988 | 1.23 | 1.48 | 1.73 | 1.98 | 2.47 | 2.96 | 3.70 | 4.94 | 6.17 | 7.41 |
| 620 | 278 | 0.557 | 0.835 | 1.11 | 1.39 | 1.67 | 1.95 | 2.23 | 2.78 | 3.34 | 4.17 | 5.57 | 6.96 | 8.35 |

3-63 In the section on Encroachment by Framing Angles on Beam Fillets, add the following (second) paragraph:

"The minimum nominal depth of supported beam given in Tables 3-37 and 3-38 has been adjusted for the fillet radius indicated in mill catalogs, taking into account the encroachment onto the fillets."

3-66 Replace the last line:

"6 mm fillet welds provide a capacity of 814 kN with angle length L = 310 mm and W = 76 mm"

with the following:

"6 mm fillet welds provide a capacity of 846 kN with angle length L = 310 mm and W = 76 mm"

3-67 Replace the second line:

"= 9.1 × 450 / 814 = 5.0 mm < 10.2 mm OK"

with the following:

"= 9.1 × 450 / 846 = 4.8 mm < 10.2 mm OK"

3-68 Replace the minimum and maximum nominal depths of supported beam with the values highlighted in red in Table 3-37:

## BOLTED DOUBLE-ANGLE BEAM CONNECTIONS Table 3-37

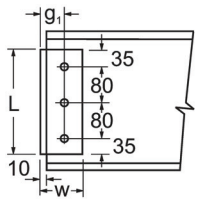
### A325 Bolts, F1852 [1] Assemblies

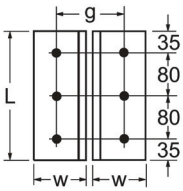
**CSA G40.21-300W Angles**

**ASTM A992, A572 Gr. 50, CSA G40.21-350W Beams and Supporting Members**

BOLT GROUP RESISTANCE - EITHER LEG WITH BOLTS

Web-Framing Legs




Outstanding Legs

| Angle Width and Gauge | | |
|---|---|---|
| W | g | $g_1$ |
| 102 | 140 | 65 |
| 89 | 130 | 60 |
| 76 | 100 | 45 |

| Nominal Depth of Supported Beam (mm) | | Conn. Angle Length L (mm) | Bolts per Vertical Line | BEARING-TYPE CONNECTIONS ULS Factored Load Resistance (kN) | | | | SLIP-CRITICAL CONNECTIONS [2] Specified Load Resistance (kN) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | **Threads Intercepted** | | Threads Excluded | | A325 Installed by Turn-of-Nut ($c_s$ = 1.0) | | A325 Installed with F959 [5], F1852 [1] ($c_s$ = 0.78) | |
| | | | | Bolt Size (in.) | | Bolt Size (in.) | | Bolt Size (in.) | | Bolt Size (in.) | |
| min. | max. | | | ¾ | ⅞ | ¾ | ⅞ | ¾ | ⅞ | ¾ | ⅞ |
| 200 | 310 | 150 | 2 | **316** | **430** | 451 | 615 | 150 | 204 | 117 | 159 |
| 310 | 460 | 230 | 3 | **474** | **645** | 677 | 922 | 224 | 305 | 175 | 238 |
| 410 | 610 | 310 | 4 | **632** | **860** | 903 | 1230 | 299 | 407 | 233 | 318 |
| 460 | 760 | 390 | 5 | **790** | **1080** | 1130 | 1540 | 374 | 509 | 292 | 397 |
| 610 | 920 | 470 | 6 | **948** | **1290** | 1350 | 1840 | 449 | 611 | 350 | 476 |
| 690 | 1100 | 550 | 7 | **1110** | **1510** | 1580 | 2150 | 523 | 712 | 408 | 556 |
| 760 | | 630 | 8 | **1260** | **1720** | 1810 | 2460 | 598 | 814 | 467 | 635 |
| 840 | | 710 | 9 | **1420** | **1940** | 2030 | 2770 | 673 | 916 | 525 | 714 |
| 920 | | 790 | 10 | **1580** | **2150** | 2260 | 3070 | 748 | 1020 | 583 | 794 |
| 1000 | | 870 | 11 | **1740** | **2370** | 2480 | 3380 | 823 | 1120 | 642 | 873 |
| 1100 | | 950 | 12 | **1900** | **2580** | 2710 | 3690 | 897 | 1220 | 700 | 953 |
| Welded beam | | 1030 | 13 | **2050** | **2800** | 2930 | 3990 | 972 | 1320 | 758 | 1030 |

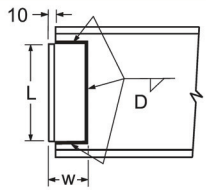
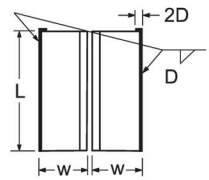
3-69 Replace the minimum and maximum nominal depths of supported beam, and the factored load resistances with the values highlighted in red in Table 3-38:

## WELDED DOUBLE-ANGLE BEAM CONNECTIONS Table 3-38

**Fillet Welds: $X_u$ = 490 MPa**

**CSA G40.21-300W Angles**

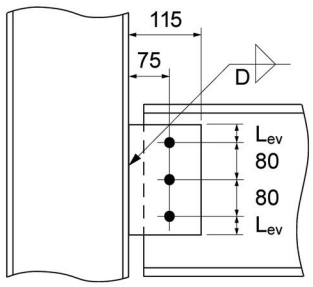
**ASTM A992, A572 Gr. 50, CSA G40.21-350W[1] Beams and Supporting Members**

| WELD GROUP RESISTANCE | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|   Web-Framing Legs with Welds | | | | | | | |   Outstanding Legs with Welds | | | | Conn. Angle Length L (mm) | Nominal Depth of Supported Beam (mm) | |
| **TWO C-SHAPE WELDS ULS Factored Load Resistance (kN)** | | | | | | | | **TWO VERTICAL WELDS ULS Fact. Load Resistance (kN)** | | | | | | |
| Angle Width, W | | | | | | | | Angle Width, W | | | | | | |
| 76 mm | | | | 64 mm | | | | 89 mm or 76 mm | | | | | | |
| Fillet Size D (mm) | | | | Fillet Size D (mm) | | | | Fillet Size D (mm) | | | | | | |
| 5 | 6 | 8 | 10 | 5 | 6 | 8 | 10 | 5 | 6 | 8 | 10 | | min. | max. |
| 368 | 442 | 590 | 737 | 354 | 425 | 567 | 709 | 115 | 139 | 185 | 231 | 150 | 200 | 310 |
| 532 | 639 | 852 | 1060 | 524 | 628 | 838 | 1050 | 250 | 300 | 400 | 500 | 230 | 310 | 460 |
| 705 | 846 | 1130 | 1410 | 660 | 792 | 1060 | 1320 | 400 | 480 | 640 | 800 | 310 | 410 | 610 |
| 823 | 987 | 1320 | 1650 | 768 | 922 | 1230 | 1540 | 545 | 654 | 872 | 1090 | 390 | 460 | 760 |
| 931 | 1120 | 1490 | 1860 | 874 | 1050 | 1400 | 1750 | 683 | 820 | 1090 | 1370 | 470 | 610 | 920 |
| 1030 | 1240 | 1650 | 2070 | 979 | 1170 | 1570 | 1960 | 816 | 980 | 1310 | 1630 | 550 | 690 | 1100 |
| 1140 | 1370 | 1820 | 2280 | 1080 | 1300 | 1730 | 2170 | 946 | 1140 | 1510 | 1890 | 630 | 760 | |
| 1250 | 1500 | 2000 | 2500 | 1190 | 1430 | 1910 | 2390 | 1070 | 1290 | 1720 | 2150 | 710 | 840 | |
| 1350 | 1620 | 2160 | 2700 | 1300 | 1550 | 2070 | 2590 | 1200 | 1440 | 1920 | 2400 | 790 | 920 | |
| 1460 | 1750 | 2340 | 2920 | 1400 | 1680 | 2240 | 2800 | 1330 | 1590 | 2120 | 2660 | 870 | 1000 | |
| 1570 | 1880 | 2510 | 3140 | 1510 | 1810 | 2420 | 3020 | 1450 | 1740 | 2330 | 2910 | 950 | 1100 | |
| 1670 | 2000 | 2670 | 3340 | 1620 | 1940 | 2590 | 3230 | 1580 | 1890 | 2530 | 3160 | 1030 | Welded beam | |

3-76 Add the following (last) paragraph before the References:

"The tabulated bolt resistances are based on a resistance factor, $\phi_b$ = 0.67, found in older editions of CSA S16 and corresponding approximately to the bolt resistance incorporated into the design method proposed by Astaneh et al."

3-77 Replace the factored load resistances with the values highlighted in red in Table 3-41:




## SHEAR TAB BEAM CONNECTIONS

### Table 3-41

**FACTORED LOAD RESISTANCE (KN)**
**Bearing-Type Connections**
**Bolt Threads Intercepted**

**A325 Bolts, F1852 Assemblies**
**G40.21-300W Plates**
**Fillet Welds $X_u$ = 490 MPa**

End distance:
$L_{ev}$ = 40 mm for 1-inch bolts, 35 mm for smaller bolts.

**RIGID SUPPORT**

| Number of Bolts | ¾-in. Bolts | | | | ⅞-in. Bolts | | | | 1-in. Bolts | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Plate Length (mm) | Resist-ance (kN) | Plate Thick-ness (mm) | Weld Size D (mm) | Plate Length (mm) | Resist-ance (kN) | Plate Thick-ness (mm) | Weld Size D (mm) | Plate Length (mm) | Resist-ance (kN) | Plate Thick-ness (mm) | Weld Size D (mm) |
| 2 | 150 | 82.5 | 6 | 5 | 150 | 112 | 6 | 5 | 160 | 147 | 8 | 6 |
| 3 | 230 | 184 | 6 | 5 | 230 | 251 | 10 | 8 | 240 | 328 | 12 | 10 |
| 4 | 310 | 265 | 8 | 6 | 310 | 360 | 10 | 8 | 320 | 471 | 12 | 10 |
| 5 | 390 | 322 | 8 | 6 | 390 | 438 | 10 | 8 | 400 | 572 | 12 | 10 |
| 6 | 470 | 370 | 6 | 5 | 470 | 503 | 10 | 8 | 480 | 657 | 12 | 10 |
| 7 | 550 | 413 | 6 | 5 | 550 | 563 | 8 | 6 | 560 | 735 | 12 | 10 |

6-30 Add the angle sections highlighted in red:

# ANGLES

| Canadian (SI) Section (mm x mm x mm) | Imperial Section (in. x in. x in.) |
|---|---|
| L254x 254x 32 | L10x 10x 1 1/4 |
| x 29 | x 1 1/8 |
| x 25 | x 1 |
| x 22 | x 7/8 |
| x 19 | x 3/4 |
| L203x 203x 29 | L8x 8x 1 1/8 |
| x 25 | x 1 |
| x 22 | x 7/8 |
| x 19 | x 3/4 |
| x 16 | x 5/8 |
| x 14 | x 9/16 |
| x 13 | x 1/2 |
| L203x 152x 25 | L8x 6x 1 |
| x 22 | x 7/8 |
| x 19 | x 3/4 |
| x 16 | x 5/8 |
| x 14 | x 9/16 |
| x 13 | x 1/2 |
| x 11 | x 7/16 |
| L203x 102x 25 | L8x 4x 1 |
| x 22 | x 7/8 |
| x 19 | x 3/4 |
| x 16 | x 5/8 |
| x 14 | x 9/16 |
| x 13 | x 1/2 |
| x 11 | x 7/16 |
| L178x 102x 19 | L7x 4x 3/4 |
| x 16 | x 5/8 |
| x 13 | x 1/2 |
| x 11 | x 7/16 |
| x 9.5 | x 3/8 |
| L152x 152x 25 | L6x 6x 1 |
| x 22 | x 7/8 |
| x 19 | x 3/4 |
| x 16 | x 5/8 |
| x 14 | x 9/16 |
| x 13 | x 1/2 |
| x 11 | x 7/16 |
| x 9.5 | x 3/8 |
| x 7.9 | x 5/16 |
| L152x 102x 22 | L6x 4x 7/8 |
| x 19 | x 3/4 |
| x 16 | x 5/8 |
| x 14 | x 9/16 |
| x 13 | x 1/2 |
| x 11 | x 7/16 |
| x 9.5 | x 3/8 |
| x 7.9 | x 5/16 |
| L152x 89x 13 | L6x 3 1/2 x 1/2 |
| x 9.5 | x 3/8 |
| x 7.9 | x 5/16 |

| Canadian (SI) Section (mm x mm x mm) | Imperial Section (in. x in. x in.) |
|---|---|
| L127x 127x 22 | L5x 5x 7/8 |
| x 19 | x 3/4 |
| x 16 | x 5/8 |
| x 13 | x 1/2 |
| x 11 | x 7/16 |
| x 9.5 | x 3/8 |
| x 7.9 | x 5/16 |
| L127x 89x 19 | L5x 3 1/2 x 3/4 |
| x 16 | x 5/8 |
| x 13 | x 1/2 |
| x 9.5 | x 3/8 |
| x 7.9 | x 5/16 |
| x 6.4 | x 1/4 |
| L127x 76x 13 | L5x 3x 1/2 |
| x 11 | x 7/16 |
| x 9.5 | x 3/8 |
| x 7.9 | x 5/16 |
| x 6.4 | x 1/4 |
| L102x 102x 19 | L4x 4x 3/4 |
| x 16 | x 5/8 |
| x 13 | x 1/2 |
| x 11 | x 7/16 |
| x 9.5 | x 3/8 |
| x 7.9 | x 5/16 |
| x 6.4 | x 1/4 |
| L102x 89x 13 | L4x 3 1/2 x 1/2 |
| x 9.5 | x 3/8 |
| x 7.9 | x 5/16 |
| x 6.4 | x 1/4 |
| L102x 76x 16 | L4x 3x 5/8 |
| x 13 | x 1/2 |
| x 9.5 | x 3/8 |
| x 7.9 | x 5/16 |
| x 6.4 | x 1/4 |
| L89x 89x 13 | L3 1/2 x 3 1/2 x 1/2 |
| x 11 | x 7/16 |
| x 9.5 | x 3/8 |
| x 7.9 | x 5/16 |
| x 6.4 | x 1/4 |
| L89x 76x 13 | L3 1/2 x 3x 1/2 |
| x 11 | x 7/16 |
| x 9.5 | x 3/8 |
| x 7.9 | x 5/16 |
| x 6.4 | x 1/4 |
| L89x 64x 13 | L3 1/2 x 2 1/2 x 1/2 |
| x 9.5 | x 3/8 |
| x 7.9 | x 5/16 |
| x 6.4 | x 1/4 |
| L76x 76x 13 | L3x 3x 1/2 |
| x 11 | x 7/16 |
| x 9.5 | x 3/8 |
| x 7.9 | x 5/16 |
| x 6.4 | x 1/4 |
| x 4.8 | x 3/16 |

| Canadian (SI) Section (mm x mm x mm) | Imperial Section (in. x in. x in.) |
|---|---|
| L76x 64x 13 | L3x 2 1/2 x 1/2 |
| x 11 | x 7/16 |
| x 9.5 | x 3/8 |
| x 7.9 | x 5/16 |
| x 6.4 | x 1/4 |
| x 4.8 | x 3/16 |
| L76x 51x 13 | L3x 2x 1/2 |
| x 9.5 | x 3/8 |
| x 7.9 | x 5/16 |
| x 6.4 | x 1/4 |
| x 4.8 | x 3/16 |
| L64x 64x 13 | L2 1/2 x 2 1/2 x 1/2 |
| x 9.5 | x 3/8 |
| x 7.9 | x 5/16 |
| x 6.4 | x 1/4 |
| x 4.8 | x 3/16 |
| L64x 51x 9.5 | L2 1/2 x 2x 3/8 |
| x 7.9 | x 5/16 |
| x 6.4 | x 1/4 |
| x 4.8 | x 3/16 |
| L64x 38x 6.4 | L2 1/2 x 1 1/2 x 1/4 |
| x 4.8 | x 3/16 |
| L51x 51x 9.5 | L2x 2x 3/8 |
| x 7.9 | x 5/16 |
| x 6.4 | x 1/4 |
| x 4.8 | x 3/16 |
| x 3.2 | x 1/8 |
| L51x 38x 6.4 | L2x 1 1/2 x 1/4 |
| x 4.8 | x 3/16 |
| x 3.2 | x 1/8 |
| L44x 44x 6.4 | L1 3/4 x 1 3/4 x 1/4 |
| x 4.8 | x 3/16 |
| x 3.2 | x 1/8 |
| L38x 38x 6.4 | L1 1/2 x 1 1/2 x 1/4 |
| x 4.8 | x 3/16 |
| x 4.0 | x 5/32 |
| x 3.2 | x 1/8 |
| L32x 32x 6.4 | L1 1/4 x 1 1/4 x 1/4 |
| x 4.8 | x 3/16 |
| x 3.2 | x 1/8 |
| L25x 25x 6.4 | L1x 1x 1/4 |
| x 4.8 | x 3/16 |
| x 3.2 | x 1/8 |
| L19x 19x 3.2 | L 3/4 x 3/4 x 1/8 |

6-186 Replace the first two paragraphs and accompanying table with the text highlighted in red:

**Minimum Size**

The minimum fillet size as measured should be as shown in the table, unless a larger size is required to meet the calculated resistance. This minimum size requirement need not apply when:

a) welding attachments to members without calculated stress or

b) welding procedures have been established to prevent cracking in accordance with W59-13.

| Material thickness $t$ (mm) | Minimum fillet size (mm) |
|---|---|
| $t \leq 6$ | 3* |
| $6 < t \leq 12$ | 5 |
| $12 < t \leq 20$ | 6 |
| $20 < t$ | 8 |

** For cyclically-loaded structures min. size = 5 mm*

For consumables with a hydrogen content conforming to the H8 requirement or lower, $t$ is the thickness of the thinner part joined. Otherwise, $t$ is the thickness of the thicker part joined; the weld size, however, need not exceed the thickness of the thinner part provided particular care is taken to provide sufficient heat input to ensure weld soundness.

The minimum effective length of a fillet weld should be 38 mm or 4 times the size of the fillet, whichever is larger. Where the geometry of the joint makes it impossible to deposit the minimum effective length, the effective fillet size shall be 0.25 times its effective length.