

**Flat Bar**

Description: Stiffener Material <= 4" width <= 3/4" thick

Material Grade: **ASTM A-36 / A 36M - 08**

Strength Requirements  
Minimum

| Yield Strength |     | Tensile Strength |     |
|----------------|-----|------------------|-----|
| psi            | ksi | psi              | ksi |
| 36,000         | 36  | 58,000           | 58  |

Chemical Requirements  
(Maximum percentage)

| Carbon | Manganese | Phosphorus | Sulfur | Silicon |
|--------|-----------|------------|--------|---------|
| C      | Mn        | P          | S      | Si      |
| 0.26   | nr        | 0.04       | 0.05   | 0.4     |

Description: Flange Material >= 5" width

Material Grade: **ASTM A 529 / A 529M - 05 Grade 55**

Strength Requirements  
Minimum

| Yield Strength |     | Tensile Strength |     |
|----------------|-----|------------------|-----|
| psi            | ksi | psi              | ksi |
| 55,000         | 55  | 70,000           | 70  |

Chemical Requirements  
(Maximum percentage)

| Carbon | Manganese | Phosphorus | Sulfur | Silicon |
|--------|-----------|------------|--------|---------|
| C      | Mn        | P          | S      | Si      |
| 0.27   | 1.35 *    | 0.04       | 0.05   | 0.4 **  |

| Chart 1 |           |
|---------|-----------|
| Carbon  | Manganese |
| C       | Mn        |
| 0.26    | 1.4       |
| 0.25    | 1.45      |
| 0.24    | 1.5       |

Table 1: Note 1

\* if C is not max at 0.27, then Mn can be up to max = 1.50 - see chart 1  
\*\* 0.1 minimum

Description: Flange Material >= 5" width

Material Grade: **ASTM A 572 / A 572M - 07 Grade 55**

Strength Requirements  
Minimum

| Yield Strength |     | Tensile Strength |     |
|----------------|-----|------------------|-----|
| psi            | ksi | psi              | ksi |
| 55,000         | 55  | 70,000           | 70  |

Chemical Requirements  
(Maximum percentage)

| Carbon | Manganese  | Phosphorus | Sulfur | Silicon |
|--------|------------|------------|--------|---------|
| C      | Mn         | P          | S      | Si      |
| 0.25   | 1.35 *, ** | 0.04       | 0.05   | 0.4     |

| Chart 2 |           |
|---------|-----------|
| Carbon  | Manganese |
| C       | Mn        |
| 0.24    | 1.41      |
| 0.23    | 1.47      |
| 0.22    | 1.53      |
| 0.21    | 1.59      |

Table 2: Note D

\* if C is not max at 0.25, then Mn can be up to max = 1.60 - see chart 2  
\*\*minimum Mn = 0.5 for thickness < 0.375"; 0.8 for thickness >0.375"

**Steel Sheet**

Description:

Web Material

Material Grade:

**ASTM A 572 / A 572M - 07 Grade 50**

Strength Requirements  
Minimum

| Yield Strength |     | Tensile Strength |     |
|----------------|-----|------------------|-----|
| psi            | ksi | psi              | ksi |
| 50,000         | 50  | 65,000           | 65  |

Chemical Requirements  
(Maximum percentage)

| Carbon | Manganese  | Phosphorus | Sulfur   | Silicon |
|--------|------------|------------|----------|---------|
| C      | Mn         | P          | S        | Si      |
| 0.23   | 1.35 *, ** | 0.04 ***   | 0.05 *** | 0.4     |

| Chart 3 |           |
|---------|-----------|
| Carbon  | Manganese |
| C       | Mn        |
| 0.22    | 1.41      |
| 0.21    | 1.47      |
| 0.20    | 1.53      |
| 0.19    | 1.59      |

\* if C is not max at 0.23, then Mn can be up to max = 1.60 - see chart 3  
 \*\*minimum Mn = 0.5 for thickness <= 0.375"; 0.8 for thickness >0.375"  
 \*\*\* up to widths = 15", for width > 15", Pmax = 0.03 and Smax = 0.03

Description:

Web Material

Material Grade:

**ASTM A 1011 / A 1011M - 10 Grade SS 50 [NON HSLA]**

Strength Requirements  
Minimum

| Yield Strength |     | Tensile Strength |     |
|----------------|-----|------------------|-----|
| psi            | ksi | psi              | ksi |
| 50,000         | 50  | 65,000           | 65  |

Chemical Requirements  
(Maximum percentage)

| Carbon | Manganese | Phosphorus | Sulfur | Silicon | Chromium | Nickel | Copper |
|--------|-----------|------------|--------|---------|----------|--------|--------|
| C      | Mn        | P          | S      | Si      | Cr       | Ni     | Cu     |
| 0.25   | 1.35 *    | 0.035      | 0.04   | nr      | 0.15     | 0.2    | 0.2    |

\* if C is not max at 0.25, then Mn can be up to max = 1.50 - see chart 4

| Chart 4 |           |
|---------|-----------|
| Carbon  | Manganese |
| C       | Mn        |
| 0.24    | 1.41      |
| 0.23    | 1.47      |
| 0.225   | 1.50      |

**Hot Rolled**

Description: I-Beam  
 Material Grade: **ASTM A 572 / A 572M - 07 Grade 50**

| Strength Requirements | Yield Strength |     | Tensile Strength |     |
|-----------------------|----------------|-----|------------------|-----|
|                       | psi            | ksi | psi              | ksi |
| Minimum               | 50,000         | 50  | 65,000           | 65  |

| Chemical Requirements<br>(Maximum percentage) | Carbon<br>C | Manganese<br>Mn | Phosphorus<br>P | Sulfur<br>S | Silicon<br>Si |
|---|-------------|-----------------|-----------------|-------------|---------------|
|   | 0.23        | 1.35 *, **      | 0.04            | 0.05        | 0.4           |

| Carbon<br>C | Manganese<br>Mn |
|-------------|-----------------|
| 0.22        | 1.41            |
| 0.21        | 1.47            |
| 0.20        | 1.53            |
| 0.19        | 1.59            |

\* if C is not max at 0.23, then Mn can be up to max = 1.60 - see chart 3  
 \*\*minimum Mn = 0.5 for all shapes

Description: I-Beam or Channel  
 Material Grade: **ASTM A 992 / A 992M - 06a**

| Strength Requirements | Yield Strength |     | Tensile Strength |     |
|-----------------------|----------------|-----|------------------|-----|
|                       | psi            | ksi | psi              | ksi |
| Minimum               | 50,000         | 50  | 65,000           | 65  |

| Chemical Requirements<br>(Maximum percentage) | Carbon<br>C | Manganese<br>Mn | Phosphorus<br>P | Sulfur<br>S | Silicon<br>Si | Chromium<br>Cr | Nickel<br>Ni | Copper<br>Cu |
|---|-------------|-----------------|-----------------|-------------|---------------|----------------|--------------|--------------|
|   | 0.23        | 0.5 (*min) -1.6 | 0.035           | 0.045       | 0.4           | 0.35           | 0.45         | 0.6          |

\*min = 0.30 if flange or leg thickness <= 1" and Mn / S > 20

Description: Hot Rolled Channels  
 Material Grade: **ASTM A 572 / A 572M - 07 Grade 50**

| Strength Requirements | Yield Strength |     | Tensile Strength |     |
|-----------------------|----------------|-----|------------------|-----|
|                       | psi            | ksi | psi              | ksi |
| Minimum               | 50,000         | 50  | 65,000           | 65  |

| Chemical Requirements<br>(Maximum percentage) | Carbon<br>C | Manganese<br>Mn | Phosphorus<br>P | Sulfur<br>S | Silicon<br>Si |
|---|-------------|-----------------|-----------------|-------------|---------------|
|   | 0.23        | 1.35 *, **      | 0.04            | 0.05        | 0.4           |

\* if C is not max at 0.23, then Mn can be up to max = 1.60 - see chart 3  
 \*\*minimum Mn = 0.5 for all shapes

**Hot Rolled**

Description: Hot Rolled Channels  
 Material Grade: **ASTM A 588 / A 588M - 10 Grade 50 (Composition Grade A)**

| Strength Requirements | Yield Strength |     | Tensile Strength |     |
|-----------------------|----------------|-----|------------------|-----|
|                       | psi            | ksi | psi              | ksi |
| Minimum               | 50,000         | 50  | 70,000           | 70  |

| Chemical Requirements<br>(Maximum percentage) | Carbon<br>C | Manganese<br>Mn | Phosphorus<br>P | Sulfur<br>S | Silicon<br>Si | Chromium<br>Cr | Nickel<br>Ni | Copper<br>Cu |
|---|-------------|-----------------|-----------------|-------------|---------------|----------------|--------------|--------------|
|   | 0.19        | 0.8 -1.25 *     | 0.04            | 0.05        | 0.65          | 0.65           | 0.4          | 0.4          |

\* if C is not max at 0.19, then Mn can be up to max = 1.50 - see chart 5

Description: Hot Rolled Angle  
 Material Grade: **ASTM A-36 / A 36M - 08**

| Strength Requirements | Yield Strength |     | Tensile Strength |     |
|-----------------------|----------------|-----|------------------|-----|
|                       | psi            | ksi | psi              | ksi |
| Minimum               | 36,000         | 36  | 58,000           | 58  |

| Chemical Requirements<br>(Maximum percentage) | Carbon<br>C | Manganese<br>Mn | Phosphorus<br>P | Sulfur<br>S | Silicon<br>Si |
|---|-------------|-----------------|-----------------|-------------|---------------|
|   | 0.26        | nr              | 0.04            | 0.05        | 0.4           |

| Chart 5     |                 |
|-------------|-----------------|
| Carbon<br>C | Manganese<br>Mn |
| 0.18        | 1.31            |
| 0.17        | 1.37            |
| 0.16        | 1.43            |
| 0.15        | 1.49            |

Description: Pipe or Tube  
 Material Grade: **ASTM A 500 / A 500M-10 Grade B**

| Strength Requirements | Yield Strength |     | Tensile Strength |     |
|-----------------------|----------------|-----|------------------|-----|
|                       | psi            | ksi | psi              | ksi |
| Minimum               | 42,000         | 42  | 58,000           | 58  |

| Chemical Requirements<br>(Maximum percentage) | Carbon<br>C | Manganese<br>Mn | Phosphorus<br>P | Sulfur<br>S | Silicon<br>Si |
|---|-------------|-----------------|-----------------|-------------|---------------|
|   | 0.26        | 1.35 *          | 0.035           | 0.035       | nr            |

\* if C is not max at 0.26, then Mn can be up to max = 1.50 - see chart 6

| Chart 6     |                 |
|-------------|-----------------|
| Carbon<br>C | Manganese<br>Mn |
| 0.25        | 1.41            |
| 0.24        | 1.47            |
| 0.235       | 1.50            |

**Cold-Formed**

| Description:          | Cold-Formed Members  |           |                  |        | GA = 16, 15, 14, 13, 12   |          |        |        |         |  |        |           |   |    |      |      |      |      |       |      |
|-----------------------|--|-----------|------------------|--------|---|----------|--------|--------|---------|--|--------|-----------|---|----|------|------|------|------|-------|------|
|                       | Material Grade: <b>ASTM A 1011 / A1011M - 10 Grade SS 55</b> |           |                  |        | <b>[NON HSLA]</b>   |          |        |        |         |  |        |           |   |    |      |      |      |      |       |      |
| Strength Requirements | Yield Strength   |           | Tensile Strength |        | <table border="1"> <tr> <th colspan="2">Chart 4</th> </tr> <tr> <th>Carbon</th> <th>Manganese</th> </tr> <tr> <th>C</th> <th>Mn</th> </tr> <tr> <td>0.24</td> <td>1.41</td> </tr> <tr> <td>0.23</td> <td>1.47</td> </tr> <tr> <td>0.225</td> <td>1.50</td> </tr> </table> |          |        |        | Chart 4 |  | Carbon | Manganese | C | Mn | 0.24 | 1.41 | 0.23 | 1.47 | 0.225 | 1.50 |
|                       | Chart 4  |           |                  |        |   |          |        |        |         |  |        |           |   |    |      |      |      |      |       |      |
| Carbon                | Manganese  |           |                  |        |   |          |        |        |         |  |        |           |   |    |      |      |      |      |       |      |
| C                     | Mn   |           |                  |        |   |          |        |        |         |  |        |           |   |    |      |      |      |      |       |      |
| 0.24                  | 1.41   |           |                  |        |   |          |        |        |         |  |        |           |   |    |      |      |      |      |       |      |
| 0.23                  | 1.47   |           |                  |        |   |          |        |        |         |  |        |           |   |    |      |      |      |      |       |      |
| 0.225                 | 1.50   |           |                  |        |   |          |        |        |         |  |        |           |   |    |      |      |      |      |       |      |
| Minimum               | psi  | ksi       | psi              | ksi    |   |          |        |        |         |  |        |           |   |    |      |      |      |      |       |      |
| Chemical Requirements | Carbon   | Manganese | Phosphorus       | Sulfur | Silicon   | Chromium | Nickel | Copper |         |  |        |           |   |    |      |      |      |      |       |      |
| (Maximum percentage)  | C  | Mn        | P                | S      | Si  | Cr       | Ni     | Cu     |         |  |        |           |   |    |      |      |      |      |       |      |
|                       | 0.25   | 1.35 *    | 0.035            | 0.04   | nr  | 0.15     | 0.2    | 0.2    |         |  |        |           |   |    |      |      |      |      |       |      |

\* if C is not max at 0.25, then Mn can be up to max = 1.50 - see chart 4

| Description:          | Cold Formed Members  |           |                  |        |   |          |        |        |         |           |            |        |         |          |        |        |   |    |   |   |    |    |    |    |      |        |       |      |    |      |     |      |  |  |  |  |  |      |     |      |
|-----------------------|--|-----------|------------------|--------|---|----------|--------|--------|---------|-----------|------------|--------|---------|----------|--------|--------|---|----|---|---|----|----|----|----|------|--------|-------|------|----|------|-----|------|--|--|--|--|--|------|-----|------|
|                       | Material Grade: <b>ASTM A 1039 / A 1039M - 10 Grade SS 55 (GA = 16 Only)</b> |           |                  |        |   |          |        |        |         |           |            |        |         |          |        |        |   |    |   |   |    |    |    |    |      |        |       |      |    |      |     |      |  |  |  |  |  |      |     |      |
| Strength Requirements | Yield Strength   |           | Tensile Strength |        | <table border="1"> <tr> <th>Carbon</th> <th>Manganese</th> <th>Phosphorus</th> <th>Sulfur</th> <th>Silicon</th> <th>Chromium</th> <th>Nickel</th> <th>Copper</th> </tr> <tr> <th>C</th> <th>Mn</th> <th>P</th> <th>S</th> <th>Si</th> <th>Cr</th> <th>Ni</th> <th>Cu</th> </tr> <tr> <td>0.25</td> <td>1.35 *</td> <td>0.035</td> <td>0.04</td> <td>nr</td> <td>0.30</td> <td>0.3</td> <td>0.50</td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> <td>0.15</td> <td>0.2</td> <td>0.35</td> </tr> </table> |          |        |        | Carbon  | Manganese | Phosphorus | Sulfur | Silicon | Chromium | Nickel | Copper | C | Mn | P | S | Si | Cr | Ni | Cu | 0.25 | 1.35 * | 0.035 | 0.04 | nr | 0.30 | 0.3 | 0.50 |  |  |  |  |  | 0.15 | 0.2 | 0.35 |
|                       | Carbon   | Manganese | Phosphorus       | Sulfur |   |          |        |        | Silicon | Chromium  | Nickel     | Copper |         |          |        |        |   |    |   |   |    |    |    |    |      |        |       |      |    |      |     |      |  |  |  |  |  |      |     |      |
| C                     | Mn   | P         | S                | Si     | Cr  | Ni       | Cu     |        |         |           |            |        |         |          |        |        |   |    |   |   |    |    |    |    |      |        |       |      |    |      |     |      |  |  |  |  |  |      |     |      |
| 0.25                  | 1.35 *   | 0.035     | 0.04             | nr     | 0.30  | 0.3      | 0.50   |        |         |           |            |        |         |          |        |        |   |    |   |   |    |    |    |    |      |        |       |      |    |      |     |      |  |  |  |  |  |      |     |      |
|                       |  |           |                  |        | 0.15  | 0.2      | 0.35   |        |         |           |            |        |         |          |        |        |   |    |   |   |    |    |    |    |      |        |       |      |    |      |     |      |  |  |  |  |  |      |     |      |
| Minimum               | psi  | ksi       | psi              | ksi    |   |          |        |        |         |           |            |        |         |          |        |        |   |    |   |   |    |    |    |    |      |        |       |      |    |      |     |      |  |  |  |  |  |      |     |      |
| Chemical Requirements | Carbon   | Manganese | Phosphorus       | Sulfur | Silicon   | Chromium | Nickel | Copper |         |           |            |        |         |          |        |        |   |    |   |   |    |    |    |    |      |        |       |      |    |      |     |      |  |  |  |  |  |      |     |      |
| (Maximum percentage)  | C  | Mn        | P                | S      | Si  | Cr       | Ni     | Cu     |         |           |            |        |         |          |        |        |   |    |   |   |    |    |    |    |      |        |       |      |    |      |     |      |  |  |  |  |  |      |     |      |
|                       | 0.25   | 1.35 *    | 0.035            | 0.04   | nr  | 0.30     | 0.3    | 0.50   |         |           |            |        |         |          |        |        |   |    |   |   |    |    |    |    |      |        |       |      |    |      |     |      |  |  |  |  |  |      |     |      |
|                       |  |           |                  |        |   | 0.15     | 0.2    | 0.35   |         |           |            |        |         |          |        |        |   |    |   |   |    |    |    |    |      |        |       |      |    |      |     |      |  |  |  |  |  |      |     |      |

Limit H  
Limit L

\* if C is not max at 0.25, then Mn can be up to max = 1.50 - see chart 4

| Description:          | Cold Formed Members   |           |                  |        |  |          |        |        |         |           |            |        |         |          |        |        |   |    |   |   |    |    |    |    |      |      |      |      |    |      |     |      |
|-----------------------|---|-----------|------------------|--------|--|----------|--------|--------|---------|-----------|------------|--------|---------|----------|--------|--------|---|----|---|---|----|----|----|----|------|------|------|------|----|------|-----|------|
|                       | Material Grade: <b>Galvanized - Grade SS 55) = Ga. 16, 15, 14, 13 and 12 (ASTM A653/A653M-11)</b> |           |                  |        |  |          |        |        |         |           |            |        |         |          |        |        |   |    |   |   |    |    |    |    |      |      |      |      |    |      |     |      |
| Strength Requirements | Yield Strength  |           | Tensile Strength |        | <table border="1"> <tr> <th>Carbon</th> <th>Manganese</th> <th>Phosphorus</th> <th>Sulfur</th> <th>Silicon</th> <th>Chromium</th> <th>Nickel</th> <th>Copper</th> </tr> <tr> <th>C</th> <th>Mn</th> <th>P</th> <th>S</th> <th>Si</th> <th>Cr</th> <th>Ni</th> <th>Cu</th> </tr> <tr> <td>0.25</td> <td>1.35</td> <td>0.04</td> <td>0.04</td> <td>nr</td> <td>0.15</td> <td>0.2</td> <td>0.25</td> </tr> </table> |          |        |        | Carbon  | Manganese | Phosphorus | Sulfur | Silicon | Chromium | Nickel | Copper | C | Mn | P | S | Si | Cr | Ni | Cu | 0.25 | 1.35 | 0.04 | 0.04 | nr | 0.15 | 0.2 | 0.25 |
|                       | Carbon  | Manganese | Phosphorus       | Sulfur |  |          |        |        | Silicon | Chromium  | Nickel     | Copper |         |          |        |        |   |    |   |   |    |    |    |    |      |      |      |      |    |      |     |      |
| C                     | Mn  | P         | S                | Si     | Cr   | Ni       | Cu     |        |         |           |            |        |         |          |        |        |   |    |   |   |    |    |    |    |      |      |      |      |    |      |     |      |
| 0.25                  | 1.35  | 0.04      | 0.04             | nr     | 0.15   | 0.2      | 0.25   |        |         |           |            |        |         |          |        |        |   |    |   |   |    |    |    |    |      |      |      |      |    |      |     |      |
| Minimum               | psi   | ksi       | psi              | ksi    |  |          |        |        |         |           |            |        |         |          |        |        |   |    |   |   |    |    |    |    |      |      |      |      |    |      |     |      |
| Chemical Requirements | Carbon  | Manganese | Phosphorus       | Sulfur | Silicon  | Chromium | Nickel | Copper |         |           |            |        |         |          |        |        |   |    |   |   |    |    |    |    |      |      |      |      |    |      |     |      |
| (Maximum percentage)  | C   | Mn        | P                | S      | Si   | Cr       | Ni     | Cu     |         |           |            |        |         |          |        |        |   |    |   |   |    |    |    |    |      |      |      |      |    |      |     |      |
|                       | 0.25  | 1.35      | 0.04             | 0.04   | nr   | 0.15     | 0.2    | 0.25   |         |           |            |        |         |          |        |        |   |    |   |   |    |    |    |    |      |      |      |      |    |      |     |      |

Description: Sheeting Substrate  
 Material Grade: **ASTM A 792 / A792M - 10 Grade 80 Class 1**

| Strength Requirements<br>Minimum | Yield Strength |     | Tensile Strength |     |
|----------------------------------|----------------|-----|------------------|-----|
|                                  | psi            | ksi | psi              | ksi |
|                                  | 80,000         | 80  | 82,000           | 82  |

| Chemical Requirements<br>(Maximum percentage) | Carbon | Manganese | Phosphorus | Sulfur | Silicon | Chromium | Nickel | Copper |
|---|--------|-----------|------------|--------|---------|----------|--------|--------|
|   | C      | Mn        | P          | S      | Si      | Cr       | Ni     | Cu     |
|   | 0.20   | 1.35      | 0.04       | 0.04   | nr      | 0.15     | 0.2    | 0.25   |

Description: Sheeting Substrate  
 Material Grade: **ASTM A 792 / A 792M - 10 Grade 50 Class 1 or 2 (24GA)**

| Strength Requirements<br>Minimum | Yield Strength |     | Tensile Strength |     |
|----------------------------------|----------------|-----|------------------|-----|
|                                  | psi            | ksi | psi              | ksi |
|                                  | 50,000         | 50  | 65,000           | 65  |

| Chemical Requirements<br>(Maximum percentage) | Carbon | Manganese | Phosphorus | Sulfur | Silicon | Chromium | Nickel | Copper |
|---|--------|-----------|------------|--------|---------|----------|--------|--------|
|   | C      | Mn        | P          | S      | Si      | Cr       | Ni     | Cu     |
|   | 0.25   | 1.35      | 0.2        | 0.04   | nr      | 0.15     | 0.2    | 0.25   |

**Bolts**

FOR ALL BOLTS, PHYSICAL AND COMPOSITION PROPERTIES VARY COMMONLY BY DIAMETER

DESCRIPTION/USE: Anchor Bolts  
 DEFINING SPEC: **ASTM F1554 - 07a Grade 36**  
 DEFINING SPEC: **ASTM F1554 - 07a Grade 55**  
 DEFINING SPEC: **ASTM A307 - 10 Grade 36 [not unique to anchor bolts]**

DESCRIPTION/USE: Machine Bolts (non high-strength)  
 DEFINING SPEC: **ASTM A307 - 10**

DESCRIPTION/USE: High Strength Structural Bolts  
 DEFINING SPEC: **ASTM A325 - 10**

|   |            |
|---|------------|
| Rev 1: confirm A1011 not required to be HSLA (non HSLA)   | 01/26/11   |
| Rev 2: added A1039 material for 16ga coldform<br>added Cr, Ni, Cu levels to A1011 & A1039   | 02/15/11   |
| Rev 3: Reorganized for distribution to shop   | 2/28/2011  |
| Rev 4: Added 24GA gr 50 sheeting  | 10/28/2011 |
| Rev 5: Updated to current ASTM designations   | 4/9/2012   |
| Rev 6: Revised Pipe Grade Requirements  | 5/2/2012   |
| Rev 7: Revised Sheeting Substrate from<br>Added Galvanized ASTM A653 to Cold Formed Members<br>Changed Chemical Requirements for Cold Formed Members<br>Added Tube to the Pipe Description<br>Added Channel to the I-Beam Description | 4/22/2013  |
| Rev 8: Revised qualifications to Manganese when Carbon is less than<br>maximum for ASTM's A529, A572, A1011, A588, A500, A1039  | 10/12/2017 |

Rev 9: Revised 24Ga Sheet material to Class 1 & 2.

5/3/2018