### AISI-SAE

**CLASSIFICATIONS OF STEELS**

Base Metals Code Designations and Filler Metal Classifications as per AISI, SAE, ASME and CSA

| AISI | American Iron and Steel Institute |
| SAE | Society of Automotive Engineers |
| ASME | American Society of Mechanical Engineers |
| CSA | Canadian Standards Association |

#### AISI-SAE

Classification of Steels

<table>
<thead>
<tr>
<th>Classifications</th>
<th>Specifications</th>
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</thead>
<tbody>
<tr>
<td>Carbon steels</td>
<td>10XX</td>
</tr>
<tr>
<td>Carbon steels, resulfurized</td>
<td>11XX</td>
</tr>
<tr>
<td>Carbon steels, resulfurized and rephosphorized</td>
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</tr>
<tr>
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<td>13XX</td>
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<tr>
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<td>2XXX</td>
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<tr>
<td>Nickel steels 5.0% Ni</td>
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<td>Nickel chromium steels</td>
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<td>Ni-Cr steels 0.7% Ni, 0.7% Cr</td>
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<tr>
<td>Ni-Cr steels 1.25% Ni, 0.6% Cr</td>
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<tr>
<td>Ni-Cr steels 1.75% Ni, 1.0% Cr</td>
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<tr>
<td>Chromium-nickel-molybdenum steels</td>
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<tr>
<td>Nickel-moly steels 1.65% Ni, 0.25% Mo</td>
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<tr>
<td>Nickel-moly steels 3.25% Ni, 0.25% Mo</td>
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</tr>
<tr>
<td>Low chromium steels</td>
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<tr>
<td>Chromium-vandium steels</td>
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<td>Low Ni-Cr-Moly steels, 0.25% Mo</td>
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<tr>
<td>Silicon-Manganese Spring steels</td>
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<tr>
<td>Silicon-Manganese-Cr Spring steels</td>
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**Note:** First figure indicates the major class of steel. Second figure indicates a sub-division of the major class and the percentage of the major alloying elements. This is true of many of the alloy steels. The third and fourth figures are most important for welding because they indicate carbon in hundredths of a percent.

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## AISI-SAE
### Standard carbon steels

#### Free-Machining Grades

<table>
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<th>AISI No.</th>
<th>Composition *, %</th>
<th>SAE No.</th>
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<td>1.35 to 1.65</td>
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<table>
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</tr>
<tr>
<td>1215</td>
</tr>
<tr>
<td>12L14++</td>
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</table>

- Copper can be added to a standard steel.

‡ 0.15 to 0.35%Pb. When lead is required as an added element to a standard steel, a range of 0.15 to 0.35%, inclusive, is generally used. Such a steel is identified by inserting the letter "L" between the second and third numeral of the AISI number.

**AISI-SAE Standard Carbon Steels**

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<tr>
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<th>SAE No.</th>
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</tr>
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</tr>
<tr>
<td>1050</td>
<td>0.48 to 0.55</td>
<td>1050</td>
</tr>
</tbody>
</table>

* Copper can be added to a standard steel.
++ 0.15 to 0.35% Pb. When lead is required as an added element to a standard steel a range of 0.15 to 0.35%, inclusive, is generally used. Such a steel is identified by inserting the letter "L" between the second and third numeral of the AISI number.

Sources: American Iron & Steel Institute, New York; SAE Standard J403f

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### SAE Alloy Steel Compositions

<table>
<thead>
<tr>
<th>SAE No.</th>
<th>Composition * %</th>
<th>Corresponding AISI No.</th>
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</table>

* Small quantities of certain elements are present which are not specified or required.

Considered as incidental, they are acceptable to the following amounts: 0.35 Cu, 0.25 Ni, 0.20 Cr and 0.06 Mo.

**++ Electric furnace steel.**

Source: NORME SAE J404g
### CSA Standard G40.21-M Structural Quality Steels

#### Chemical Composition – Heat Analysis

**Plates, Bars, Spapes and Sheet Piling**

<table>
<thead>
<tr>
<th>Grade</th>
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<th>Mn</th>
<th>P</th>
<th>S</th>
<th>Si (a) (b)</th>
<th>Cr</th>
<th>Ni</th>
<th>Cu (d)</th>
<th>Usual Deoxidation</th>
<th>Grain Size</th>
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<td>-</td>
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<td>(g)</td>
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<td>-</td>
<td>Semi-killed</td>
<td>(g)</td>
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<td>300W</td>
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<td>0.05 max</td>
<td>0.40 max</td>
<td>0.10 max</td>
<td>-</td>
<td>-</td>
<td>Semi-killed</td>
<td>(g)</td>
</tr>
<tr>
<td>350W</td>
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<td>0.50-1.50</td>
<td>0.04 max</td>
<td>0.05 max</td>
<td>0.40 max</td>
<td>0.10 max</td>
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<td>-</td>
<td>Semi-killed</td>
<td>(g)</td>
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<td>-</td>
<td>Semi-killed</td>
<td>(g)</td>
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<td>400W</td>
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<td>(g)</td>
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<td>480Wt</td>
<td>0.26 max</td>
<td>0.80-1.50</td>
<td>0.03 max</td>
<td>0.04 max</td>
<td>0.15-0.40</td>
<td>0.10 max</td>
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<td></td>
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<tr>
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<td>0.75 max</td>
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<td>0.75-1.35</td>
<td>0.03 max</td>
<td>0.04 max</td>
<td>0.15-0.40</td>
<td>0.10 max</td>
<td>0.70 max</td>
<td>0.20-0.60</td>
<td>Killed Fine Grain Practice</td>
<td></td>
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<tr>
<td>400A</td>
<td>0.20 max</td>
<td>0.75-1.35</td>
<td>0.03 max</td>
<td>0.04 max</td>
<td>0.15-0.40</td>
<td>0.10 max</td>
<td>0.70 max</td>
<td>0.20-0.60</td>
<td>Killed Fine Grain Practice</td>
<td></td>
</tr>
<tr>
<td>480A</td>
<td>0.20 max</td>
<td>1.00-1.60</td>
<td>0.025 max</td>
<td>0.035 max</td>
<td>0.15-0.40</td>
<td>0.12 max</td>
<td>0.70 max</td>
<td>0.20-0.60</td>
<td>Killed Fine Grain Practice</td>
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</tr>
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<td>350AT</td>
<td>0.20 max</td>
<td>0.75-1.35</td>
<td>0.03 max</td>
<td>0.04 max</td>
<td>0.15-0.40</td>
<td>0.10 max</td>
<td>0.70 max</td>
<td>0.20-0.60</td>
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</tr>
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<td>0.20 max</td>
<td>0.75-1.35</td>
<td>0.03 max</td>
<td>0.04 max</td>
<td>0.15-0.40</td>
<td>0.10 max</td>
<td>0.70 max</td>
<td>0.20-0.60</td>
<td>Killed Fine Grain Practice</td>
<td></td>
</tr>
<tr>
<td>480AT</td>
<td>0.20 max</td>
<td>1.00-1.60</td>
<td>0.025 max</td>
<td>0.035 max</td>
<td>0.15-0.40</td>
<td>0.12 max</td>
<td>0.70 max</td>
<td>0.20-0.60</td>
<td>Killed Fine Grain Practice</td>
<td></td>
</tr>
<tr>
<td>700Q</td>
<td>0.20 max</td>
<td>1.50 max</td>
<td>0.03 max</td>
<td>0.04 max</td>
<td>0.15-0.35</td>
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<td>Boron 0.0005-0.005</td>
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<td>0.15-0.35</td>
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<td>Boron 0.0005-0.005</td>
<td>-</td>
<td>Killed Fine Grain</td>
<td></td>
</tr>
</tbody>
</table>

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Structural Quality Steels Notes

a. Silicon content of 0.15-0.40% is required for Type W steel over 40 mm (1-6 in) in thickness, or bar diameter, except as modified by footnote lb).

b. At the purchaser’s request or at the producer’s option, the steel may be made with no minimum silicon content provided that the steel contains a minimum of 0.02% total aluminum content.

c. The elements columbium and vanadium may be used singly or in combination with total percentage indicated, except that, if columbium is used singly or in combination with vanadium in plates thicker than 14 mm (0.56 in) or shapes heavier than Group 1, the a content shall be 0.15 minimum. Aluminum may be used as a grain refining element without prior approval by the purchaser, and when so used, shall not be included in the sum of grain refining elements included in CSA Standard G40.21-M, Table 4.

d. Copper content of 0.20% minimum may be specified by the purchaser on all grades.

e. At the producer’s option, material having a manganese content of 1.50% maximum be supplied.

f. For thicknesses over 20 mm (0.8 in), carbon maximum may be 0.32%.

g. See clauses 3.3 and 3.4 in CSA Standard G40.21-M.

h. With the prior agreement of the purchaser, the manganese content may be increased provided the sum of the carbon content Plus 1/6 of the manganese content does not a 0.40% for grade 350 WT or 0.42% for grade 400 VIT or 480 WT.

i. A nitrogen content of 0.01-0.02% may be used if the nitrogen content does not exceed the vanadium content.

j. The combined content of chromium, nickel and copper shall be not less than 1.00%.

k. The combined total of chromium and nickel contents shall be not less than 0.40%.

Note: In order to meet the required mechanical properties, the producer may use additional alloying elements with the prior approval of the purchaser.
# Mechanical properties of plates, Floor Plates, Bars, and Welded Shapes

<table>
<thead>
<tr>
<th>Grade</th>
<th>Usual Nominal Maximum Thickness mm</th>
<th>Tensile Strength MPa</th>
<th>Yield point, Mpa, minimum</th>
<th>Elongation, % minimum†</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Up to 65 mm</td>
<td>65mm 100mm 150mm 200mm</td>
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<tr>
<td>230G</td>
<td>300</td>
<td>380-500</td>
<td>230 230 230 230</td>
<td>21 24 19 19</td>
<td></td>
</tr>
<tr>
<td>350G</td>
<td>30</td>
<td>480-690</td>
<td>350 - - -</td>
<td>17 19 15 17</td>
<td></td>
</tr>
<tr>
<td>400G</td>
<td>30</td>
<td>550-720</td>
<td>400 - - -</td>
<td>16 19 13 17</td>
<td></td>
</tr>
<tr>
<td>300W*</td>
<td>200</td>
<td>450-620</td>
<td>300 280 280 280</td>
<td>20 23 18 18</td>
<td>Not available in plate. Bar-size shapes only.</td>
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<tr>
<td>350W*</td>
<td>150</td>
<td>450-620</td>
<td>350 320 320 - -</td>
<td>19 22 17 20</td>
<td></td>
</tr>
<tr>
<td>380W*</td>
<td>20</td>
<td>480-650</td>
<td>380 - - -</td>
<td>18 21 - -</td>
<td>Available in angles and bars only</td>
</tr>
<tr>
<td>400W</td>
<td>20</td>
<td>520-690</td>
<td>400 - - -</td>
<td>16 18 15 15</td>
<td></td>
</tr>
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<td>480W</td>
<td>20</td>
<td>590-790</td>
<td>480 - - -</td>
<td>15 17 14 14</td>
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</tr>
<tr>
<td>260WIT</td>
<td>150</td>
<td>410-590</td>
<td>260 250 250 - -</td>
<td>20 23 18 18</td>
<td></td>
</tr>
<tr>
<td>300WIT</td>
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<td>450-620</td>
<td>300 280 280 - -</td>
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</tr>
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<td>150</td>
<td>480-650</td>
<td>350 320 320 - -</td>
<td>19 22 17 20</td>
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<tr>
<td>400WT</td>
<td>20</td>
<td>520-690</td>
<td>400 - - -</td>
<td>18 20 15 17</td>
<td></td>
</tr>
<tr>
<td>480WT</td>
<td>20</td>
<td>590-790</td>
<td>480 - - -</td>
<td>15 17 12 14</td>
<td></td>
</tr>
<tr>
<td>350R</td>
<td>14</td>
<td>480-650</td>
<td>350 - - -</td>
<td>19 21 16 18</td>
<td></td>
</tr>
<tr>
<td>350A</td>
<td>100</td>
<td>480-650</td>
<td>350 350 - -</td>
<td>19 21 17 19</td>
<td></td>
</tr>
<tr>
<td>400A</td>
<td>40</td>
<td>520-690</td>
<td>400 - - -</td>
<td>18 21 15 18</td>
<td></td>
</tr>
<tr>
<td>480A</td>
<td>20</td>
<td>590-790</td>
<td>480 - - -</td>
<td>15 17 12 14</td>
<td></td>
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<td>480-650</td>
<td>350 350 - -</td>
<td>19 21 17 19</td>
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<tr>
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<td>18 21 15 18</td>
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</tr>
<tr>
<td>480AT</td>
<td>20</td>
<td>590-790</td>
<td>480 - - -</td>
<td>15 17 12 14</td>
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<td>800-950</td>
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<td>18 - - -</td>
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<td>700 - - -</td>
<td>18 - - -</td>
<td>BHN-235-293</td>
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</tbody>
</table>
Mechanical properties of plates,
Floor Plates, Bars, and Welded Shapes Notes

* Plates for API applications shall have an upper limit of tensile strength 140 MPa above the specified minimum.

†Per cent elongation is not specified or required for rolled floor plates.

‡Transverse values apply to plates wider than 600 mm only.

Notes:

(1) In the absence of yield point, the yield strength value can be measured by 0.5% extension under-load or 0.2% offset method. The value obtained shall meet the specified minimum yield point for the grade.

(2) For material having a thickness under 8 mm (5/16 in), refer to Clause 8.4.1 of CSA Standard CAN/CSA-G40.20-M.

(3) 1 MPa = 1 N/mm².
## Mechanical Properties - Rolled Shapes and Sheet Piling

<table>
<thead>
<tr>
<th>Grade</th>
<th>Usual Maximum</th>
<th>Tensile Strength</th>
<th>Yield Point</th>
<th>Elongation Per Cent</th>
<th>In 200 mm²</th>
<th>In 50 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Maximum Size</td>
<td>Group</td>
<td>Mpa Minimum</td>
<td>Minimum</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Group</td>
<td></td>
<td>Groups 1 and 2</td>
<td>Groups 3 and 4</td>
<td>Group 5</td>
<td></td>
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<td></td>
<td>Group</td>
<td></td>
<td>Mpa</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Group</td>
<td></td>
<td>In 200 mm²</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Group</td>
<td></td>
<td>In 50 mm</td>
<td></td>
<td></td>
<td></td>
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<tr>
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<td>14</td>
</tr>
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<td>350G</td>
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<td>480-690</td>
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<td>350</td>
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<tr>
<td>400G</td>
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<td>550-720</td>
<td>400</td>
<td>400</td>
<td></td>
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<td>260W</td>
<td>4</td>
<td>410-590</td>
<td>260</td>
<td>260</td>
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</tr>
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<td>3</td>
<td>450-620</td>
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<td>350</td>
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<td>380W</td>
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<td>480-650</td>
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<td>480</td>
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<tr>
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<td>260</td>
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<td>480WT</td>
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<td>480</td>
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<td>15</td>
</tr>
<tr>
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</tr>
<tr>
<td>350AT</td>
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<td>480-650</td>
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<td>320</td>
<td></td>
<td>19</td>
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<td>400AT</td>
<td>2</td>
<td>520-690</td>
<td>400</td>
<td></td>
<td></td>
<td>18</td>
</tr>
</tbody>
</table>

Notes:

1. In the absence of yield point, the yield strength value can be measured by 0.5% extension-under-load or 0.2% offset method. The value obtained shall meet the specified minimum yield point for the grade.

2. For material having a thickness under 8mm, refer to Clause 8.3 of CSA Standard CAN3-G40.20-M. “General Requirements for Rolled or Welded Structural Quality Steel.”

3. Mpa = 1 N/mm²
Mechanical properties – Hollow Sections

<table>
<thead>
<tr>
<th>Grade</th>
<th>Usual Nominal Thickness</th>
<th>Tensile Strength MPa</th>
<th>Yield Point Minimum MPa</th>
<th>Percent Elongation In 50 mm Minimum</th>
</tr>
</thead>
<tbody>
<tr>
<td>300W</td>
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<td>410-590</td>
<td>300</td>
<td>23</td>
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<tr>
<td>350W</td>
<td>16 mm</td>
<td>450-620</td>
<td>350</td>
<td>22</td>
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<tr>
<td>380W*</td>
<td>16 mm</td>
<td>480-650</td>
<td>380</td>
<td>21</td>
</tr>
<tr>
<td>350WT</td>
<td>16 mm</td>
<td>480-650</td>
<td>350</td>
<td>22</td>
</tr>
<tr>
<td>380WT*</td>
<td>16 mm</td>
<td>480-650</td>
<td>380</td>
<td>21</td>
</tr>
<tr>
<td>350A</td>
<td>16 mm</td>
<td>480-650</td>
<td>350</td>
<td>21</td>
</tr>
<tr>
<td>350AT</td>
<td>16 mm</td>
<td>480-650</td>
<td>350</td>
<td>21</td>
</tr>
</tbody>
</table>

Applicable also to angles

Notes:
1. 1 MPa = 1 N/mm²
2. For material having a thickness under 8mm, refer to clause 8.3 of CSA Standard CAN3-G40.20M General Requirements for Rolled or Welded Quality Steel.

Standard Impact Test * Temperature for Specified Category

<table>
<thead>
<tr>
<th>Category</th>
<th>Standard Test Temperature, °C</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>-20</td>
</tr>
<tr>
<td>3</td>
<td>-30</td>
</tr>
<tr>
<td>4</td>
<td>-45</td>
</tr>
<tr>
<td>5</td>
<td>To be specified by the purchaser †</td>
</tr>
</tbody>
</table>

*Charpy V-Notch, longitudinal specimens
†Before specifying, availability of product should be verified.
Note: Absorbed energy values obtained from Charpy V-Notch tests conducted at a particular testing temperature cannot be used to determine expected values at any other temperature. Values other than those shown may be available upon consultation between the purchaser and the producer, and shall be ordered as Category 5 material.

Standard Charpy Impact Energy * for Specified Grade †

<table>
<thead>
<tr>
<th>Grade</th>
<th>Minimum Average Absorbed Energy –J</th>
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<tbody>
<tr>
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<td>Categories 1-4</td>
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<td>400AT</td>
<td>27</td>
</tr>
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<td>480AT</td>
<td>27</td>
</tr>
<tr>
<td>700QT</td>
<td>34</td>
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</tbody>
</table>

*Charpy V-Notch, longitudinal specimens.
†Before specifying, availability of product should be verified.
Note: Absorbed energy values obtained from Charpy V-Notch tests conducted at a particular testing temperature cannot be used to determine expected values at any other temperature. Values other than those shown may be available upon consultation between the purchaser and the producer, and shall be ordered as Category 5 material.
P Numbers

**ASME QW-422 P Numbers**

<table>
<thead>
<tr>
<th>P No.</th>
<th>Group No.</th>
<th>Type of base metal</th>
</tr>
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<td>1</td>
<td>Carbon Steel Plate</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>C-Mn-Si Steel Pipe</td>
</tr>
<tr>
<td>1</td>
<td>3</td>
<td>Carbon Steel Casting</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>Cr-Mo Pipe (½ Cr –½ Mo)</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>Cr-Mo Pipe (1 Cr -½Mo)</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>Cr-Mo Pipe (2¼ Cr-1Mo)</td>
</tr>
<tr>
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<td>3</td>
<td>Mn-Mo Steel Plate</td>
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<tr>
<td>5</td>
<td>2</td>
<td>Cr-Mo Pipe (5 Cr-½ Mo)</td>
</tr>
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<td>Alloy Pipe Flangers (13 Cr)</td>
</tr>
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<td>2</td>
<td>Alloy Steel Plate (15 Cr)</td>
</tr>
<tr>
<td>6</td>
<td>3</td>
<td>Alloy Steel Forgings (13 Cr)</td>
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<td>Alloy Steel Plates (17 Cr-Ti)</td>
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<td>3</td>
<td>St. Steel Bars (Type XM-30 Ann.)</td>
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<td>Alloy Pipe Flanges (18 Cr-8Ni)</td>
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<td>2</td>
<td>Alloy Pipe Flanges (25Cr-20 Ni)</td>
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9A, 9B, 10A, 10B, on, up to and including p No. 61.