

**TOLERANCES**

Nickel, Nickel Alloy, and Cobalt Alloy Sheet, Strip, and Plate

1. **SCOPE:** This specification covers established inch/pound manufacturing tolerances applicable to sheet, strip, and plate of nickel, nickel alloys, and cobalt alloys ordered to inch/pound dimensions. These tolerances apply to all conditions, unless otherwise noted. The term "excl" is used to apply only to the higher figure of a specified range.
- 1.1 Where the terms "nickel", "nickel-copper", "nickel-chromium", "nickel-molybdenum", "nickel-molybdenum-chromium", and "cobalt" are used without qualification, they refer to both non-heat-treatable and heat treatable alloys as applicable, unless otherwise noted.
2. **THICKNESS:** Thickness for sheet and strip is measured at any place on widths less than 1 in., at any place 3/8 in. and over from an edge on widths 1 in. and over, and for plate at least 3/8 in. but not more than 3 in. from an edge.
- 2.1 **Sheet:**
  - 2.1.1 **Nickel, Nickel-Chromium, and Nickel-Copper Alloys:** For thickness 0.018 in. and under, tolerances apply only to widths of 36 in. and under in lengths 96 in. and under. Cold rolled tolerances do not apply to precipitation-hardenable nickel-chromium alloys over 44 in. width.

**TABLE I**

| Specified Thickness<br>Inch | Thickness Tolerance, Inch, Plus and Minus |                           |                      |                           |
|-----------------------------|-------------------------------------------|---------------------------|----------------------|---------------------------|
|                             | Cold Rolled                               |                           | Hot Rolled           |                           |
|                             | Width Ranges, Inches                      |                           | Width Ranges, Inches |                           |
|                             | 48<br>and<br>Under                        | Over 48<br>to<br>60, incl | 48<br>and<br>Under   | Over 48<br>to<br>60, incl |
| 0.010 to 0.018, incl        | 0.002                                     | --                        | --                   | --                        |
| Over 0.018 to 0.025, incl   | 0.002                                     | 0.003                     | 0.003                | 0.004                     |
| Over 0.025 to 0.034, incl   | 0.003                                     | 0.004                     | 0.004                | 0.005                     |
| Over 0.034 to 0.056, incl   | 0.004                                     | 0.005                     | 0.005                | 0.006                     |
| Over 0.056 to 0.070, incl   | 0.005                                     | 0.006                     | 0.006                | 0.007                     |
| Over 0.070 to 0.078, incl   | 0.006                                     | 0.007                     | 0.007                | 0.008                     |
| Over 0.078 to 0.093, incl   | 0.007                                     | 0.008                     | 0.008                | 0.009                     |
| Over 0.093 to 0.109, incl   | 0.007                                     | 0.009                     | 0.009                | 0.010                     |
| Over 0.109 to 0.125, incl   | 0.008                                     | 0.010                     | 0.010                | 0.012                     |
| Over 0.125 to 0.140, incl   | 0.008                                     | 0.010                     | 0.012                | 0.014                     |
| Over 0.140 to 0.171, incl   | 0.009                                     | 0.012                     | 0.014                | 0.016                     |
| Over 0.171 to 0.187, incl   | 0.010                                     | 0.013                     | 0.015                | 0.017                     |
| Over 0.187 to 0.218, incl   | 0.011                                     | 0.015                     | 0.017                | 0.019                     |
| Over 0.218 to 0.234, incl   | 0.012                                     | 0.016                     | 0.018                | 0.020                     |
| Over 0.234 to 0.250, incl   | 0.013                                     | 0.018                     | 0.020                | 0.022                     |

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- 2.1.2 Nickel-Molybdenum, Nickel-Molybdenum-Chromium, and Cobalt Alloys (Widths 48 In. and Under): For specified thicknesses over 0.187 in., plate tolerances of Table V apply.

TABLE II

| Specified Thickness<br>Inch | Thickness Tolerance, Inch |       |
|-----------------------------|---------------------------|-------|
|                             | Plus                      | Minus |
| 0.010 to 0.018, incl        | 0.002                     | 0.002 |
| Over 0.018 to 0.025, incl   | 0.003                     | 0.003 |
| Over 0.025 to 0.034, incl   | 0.004                     | 0.004 |
| Over 0.034 to 0.056, incl   | 0.005                     | 0.005 |
| Over 0.056 to 0.070, incl   | 0.006                     | 0.006 |
| Over 0.070 to 0.078, incl   | 0.007                     | 0.007 |
| Over 0.078 to 0.093, incl   | 0.008                     | 0.008 |
| Over 0.093 to 0.109, incl   | 0.009                     | 0.009 |
| Over 0.109 to 0.125, incl   | 0.010                     | 0.010 |
| Over 0.125 to 0.140, incl   | 0.013                     | 0.010 |
| Over 0.140 to 0.171, incl   | 0.016                     | 0.010 |
| Over 0.171 to 0.187, incl   | 0.018                     | 0.010 |

## 2.2 Cold-Rolled Strip:

- 2.2.1 Nickel, Nickel-Chromium, and Nickel-Copper Alloys: Table III does not apply to precipitation-hardenable nickel-chromium alloys for specified thicknesses over 0.025 in. or to any alloy in widths over 12 inches.

TABLE III

| Specified Thickness (T)<br>Inch | Thickness Tolerance, Inch, Plus and Minus |
|---------------------------------|-------------------------------------------|
|                                 | All Widths                                |
| Up to 0.006, excl               | 0.10T                                     |
| 0.006 to 0.015, incl            | 0.001                                     |
| Over 0.015 to 0.050, incl       | 0.0015                                    |
| Over 0.050 to 0.093, incl       | 0.0025                                    |
| Over 0.093 to 0.125, incl       | 0.004                                     |

- 2.2.2 Nickel-Molybdenum, Nickel-Molybdenum-Chromium, and Cobalt Alloys: Not produced.

- 2.3 Hot-Rolled Plate: Minus tolerance shall be 0.010 in. for all widths and all thicknesses in all alloys; plus tolerances shall be as shown in 2.3.1 and 2.3.2.

- 2.3.1 Nickel, Nickel-Chromium, and Nickel-Copper Alloys: Tolerances shown in Table IV are only approximate for precipitation-hardenable nickel-chromium alloys; failure to meet these tolerances shall not be cause for rejection of such alloy product.

TABLE IV

| Specified Thickness (T)<br>Inches | Thickness Tolerance, Inch, Plus Only<br>For Width Ranges Shown, Inches |                   |                   |                   |
|-----------------------------------|------------------------------------------------------------------------|-------------------|-------------------|-------------------|
|                                   | Up to<br>48, excl                                                      | 48 to 60,<br>excl | 60 to 72,<br>excl | 72 to 84,<br>excl |
| 0.1875 to 0.3125, excl            | 0.113T                                                                 | 0.132T            | 0.150T            | 0.169T            |
| 0.3125 to 0.375, excl             | 0.094T                                                                 | 0.113T            | 0.132T            | 0.150T            |
| 0.375 to 0.4375, excl             | 0.088T                                                                 | 0.094T            | 0.113T            | 0.132T            |
| 0.4375 to 0.500, excl             | 0.075T                                                                 | 0.088T            | 0.094T            | 0.113T            |
| 0.500 to 0.625, excl              | 0.063T                                                                 | 0.075T            | 0.088T            | 0.094T            |
| 0.625 to 0.750, excl              | 0.057T                                                                 | 0.069T            | 0.075T            | 0.088T            |
| 0.750 to 1.000, excl              | 0.050T                                                                 | 0.057T            | 0.069T            | 0.075T            |
| 1.000 and over                    | 0.050T                                                                 | 0.050T            | 0.057T            | 0.069T            |

2.3.2 Nickel-Molybdenum, Nickel-Molybdenum-Chromium, and Cobalt Alloys (Widths 48 In. and Under):

TABLE V

| Specified Thickness (T)<br>Inches | Thickness Tolerance, Inch, Plus Only |
|-----------------------------------|--------------------------------------|
| 0.1875 to 0.3125, excl            | 0.132T                               |
| 0.3125 to 0.375, excl             | 0.113T                               |
| 0.375 to 0.4375, excl             | 0.094T                               |
| 0.4375 to 0.500, excl             | 0.088T                               |
| 0.500 to 0.625, excl              | 0.075T                               |
| 0.625 to 0.750, excl              | 0.069T                               |
| 0.750 to 1.000, excl              | 0.057T                               |
| 1.000 and over                    | 0.050T                               |

### 3. WIDTH:

3.1 Sheet (All Alloys, Widths 60 In. and Under): Shall not vary in width more than +1/8 in., -0.

### 3.2 Cold-Rolled Strip:

3.2.1 Nickel, Nickel-Chromium, and Nickel-Copper Alloys:

TABLE VI

| Specified Thickness<br>Inch | Specified Width<br>Inches | Width Tolerance, Inch<br>Plus and Minus |
|-----------------------------|---------------------------|-----------------------------------------|
| Up to 0.009, incl           | 12 and under              | 0.005                                   |
| Over 0.009 to 0.024, incl   | 12 and under              | 0.007                                   |
| Over 0.024 to 0.075, incl   | 14 and under              | 0.007                                   |
| Over 0.075 to 0.100, incl   | 14 and under              | 0.009                                   |
| Over 0.100 to 0.125, incl   | 14 and under              | 0.012                                   |

3.2.2 Nickel-Molybdenum, Nickel-Molybdenum-Chromium, and Cobalt Alloys: Not produced.

### 3.3 Hot-Rolled Plate:

3.3.1 Nickel, Nickel-Chromium, Nickel-Copper, Nickel-Molybdenum, Nickel-Molybdenum-Chromium, and Cobalt Alloys:

- 3.3.1.1 Sheared Plate 240 In. and Under in Length: Minus tolerance shall be 0.125 in. for all widths and all thicknesses; plus tolerance shall be as shown in Table VII. The minimum available width of sheared plate is 24 inches.

TABLE VII

| Specified Thickness<br>Inches | Width Tolerance, Inch, Plus Only<br>Width Ranges, Inches |                        |                        |
|-------------------------------|----------------------------------------------------------|------------------------|------------------------|
|                               | Up to 30,<br>incl                                        | Over 30<br>to 72, incl | Over 72<br>to 84, incl |
| 0.1875 to 0.3125, excl        | 0.1875                                                   | 0.250                  | 0.375                  |
| 0.3125 to 0.500, excl         | 0.250                                                    | 0.375                  | 0.375                  |
| 0.500 to 0.750, excl          | 0.375                                                    | 0.375                  | 0.500                  |
| 0.750 to 1.000, excl          | 0.500                                                    | 0.500                  | 0.625                  |
| 1.000 to 1.250, excl          | 0.625                                                    | 0.625                  | 0.750                  |

- 3.3.1.2 Sheared Plate Over 240 In. in Length: Minus tolerance shall be 0.1875 in. for all widths and all thicknesses; plus tolerance shall be 0.0625 in. greater than those of Table VII.

- 3.3.1.3 Abrasive-Cut Plate: Plates over 1.250 in. in specified thickness are supplied only with abrasive-cut edges. Standard width tolerances for abrasive-cut plate shall be  $\pm 0.125$  in. for specified thicknesses 1.250 in. and under and  $\pm 0.1875$  in., -0.125 in. for specified thicknesses over 1.250 to 2.750 in., inclusive.

- 3.3.1.3.1 Minimum available width of abrasive-cut plate is 2 in. and increases to 4 in. for thick plate.

- 3.3.2 Tolerances for width of powder or inert-arc cut plate and for diameter of machined, powder, or inert-arc cut circular plate shall be as agreed upon by purchaser and vendor.

4. LENGTH:

- 4.1 Sheet and Strip: Definite lengths shall vary not more than  $+1/8$  in., -0 from the length ordered.

4.2 Hot-Rolled Plate:

- 4.2.1 Nickel, Nickel-Chromium, Nickel-Copper, Nickel-Molybdenum, Nickel-Molybdenum-Chromium, and Cobalt Alloys:

- 4.2.1.1 Sheared Plate: Minus tolerance shall be 0.125 in. for all lengths and all thicknesses; plus tolerances shall be as shown in Table VIII.

TABLE VIII

| Specified Thickness<br>Inches | Length Tolerance, Inch, Plus Only<br>For Length Ranges Shown, Inches |                        |                         |                          |
|-------------------------------|----------------------------------------------------------------------|------------------------|-------------------------|--------------------------|
|                               | 24 to<br>60, incl                                                    | Over 60 to<br>96, incl | Over 96 to<br>120, incl | Over 120 to<br>240, incl |
| 0.1875 to 0.3125, excl        | 3/16                                                                 | 1/4                    | 3/8                     | 1/2                      |
| 0.3125 to 0.500, excl         | 3/8                                                                  | 1/2                    | 1/2                     | 1/2                      |
| 0.500 to 0.750, excl          | 1/2                                                                  | 1/2                    | 5/8                     | 5/8                      |
| 0.750 to 1.000, excl          | 5/8                                                                  | 5/8                    | 5/8                     | 3/4                      |
| 1.000 to 1.250, incl          | 3/4                                                                  | 3/4                    | 3/4                     | 7/8                      |