

# ASTM A240 / A240M — Stainless Steel Plate, Sheet & Strip

A customer-facing guide to chromium and chromium-nickel stainless steels for pressure vessels and general applications

Plate · Sheet · Strip

Pressure Vessels & General Service

ASME SA-240 Equivalent

Inch-Pound & SI Units

## 1 Scope & Product Form

ASTM A240 covers chromium, chromium-nickel, and chromium-manganese-nickel stainless steel plate, sheet, and strip. It is the material specification most commonly cited alongside ASME BPVC Section II Part A (SA-240) and general fabrication standards such as A480/A480M.

### COVERED PRODUCTS

#### Plate, Sheet & Strip

Hot-rolled and cold-rolled flat products supplied in annealed or heat-treated condition.

### ALLOY FAMILIES

#### Austenitic · Duplex · Ferritic · Martensitic · PH

Includes the full range of corrosion-resistant and heat-resistant stainless grades.

### APPLICATIONS

#### Pressure Vessels & General Use

Used in tanks, pressure equipment, heat exchangers, cladding, architectural panels, and process industry.

### UNITS

#### Dual Unit Standard

A240 (inch-pound) and A240M (SI). Unless "M" is specified on the order, inch-pound units apply.

#### HIGH TEMP

### H Grades for Creep Service

Austenitic H grades control chemistry and grain size for ASME Code service above 1000 °F (540 °C).

#### GENERAL REQUIREMENTS

### Reference A480 / A480M

Dimensions, tolerances, finish, marking, packaging and inspection defaults follow A480/A480M unless otherwise specified.

## 2 Grade Overview

A240 contains a very large grade list. The cards below highlight the grades most frequently ordered by customers, grouped by metallurgical family.

#### MOST POPULAR

### 304 / 304L / 304H

UNS S30400 / S30403 / S30409. The workhorse 18/8 austenitic grades. 304H adds carbon for creep resistance above 1000 °F.

#### CORROSION RESISTANT

### 316 / 316L / 316H / 317L

UNS S31600 / S31603 / S31609 / S31703. Mo-bearing grades for chlorides, acids, and marine exposure. 317L ups Mo to 3–4 %.

#### HIGH TEMPERATURE

### 309S / 310S / 321H / 347H

UNS S30908 / S31008 / S32109 / S34709. High Cr/Ni or stabilized grades for furnace parts and high-temperature pressure vessels.

#### STABILIZED

### 321 / 347 / 348

UNS S32100 / S34700 / S34800. Ti or Nb stabilized to resist sensitization during welding and service between 800–1500 °F.

#### PREMIUM

### 904L / 254 SMO® / 654 SMO®

UNS N08904 / S31254 / S32654. High-alloy austenitic grades for aggressive acids, seawater, and chloride-rich process streams.

#### DUPLEX

### 2205 / 2304 / 2507

UNS S32205 / S32304 / S32750. Lean, standard, and super duplex. Roughly double the yield strength of 316L plus excellent SCC resistance.

#### FERRITIC

### **409 / 430 / 439 / 444**

UNS S40920 / S43000 / S43932 / S44400.

Low-cost, magnetic grades for exhaust, cladding, and mildly corrosive service.

#### MARTENSITIC

### **410 / 410S / 420 / 440C**

UNS S41000 / S41008 / S42000 / S44004.

Hardenable grades for cutlery, tooling, wear parts, and turbine blades.

#### HIGH STRENGTH

### **17-4 PH / 15-5 PH**

UNS S17400 / S15500. Precipitation-hardening grades offering very high strength with moderate corrosion resistance.

## **3 Chemical Composition — Customer Favorites**

Composition limits for selected grades from Table 1 (values in weight %). For full grade list, refer to the ASTM A240 / A240M standard.

| Grade       | UNS    | C<br>max      | Mn<br>max | P<br>max | S<br>max | Si<br>max | Cr            | Ni            | Mo          | N             | Notes                                 |
|-------------|--------|---------------|-----------|----------|----------|-----------|---------------|---------------|-------------|---------------|---------------------------------------|
| <b>304</b>  | S30400 | 0.07          | 2.00      | 0.045    | 0.030    | 0.75      | 18.0–<br>20.0 | 8.0–<br>10.5  | —           | 0.10          | Most<br>common<br>grade               |
| 304L        | S30403 | 0.030         | 2.00      | 0.045    | 0.030    | 0.75      | 18.0–<br>20.0 | 8.0–<br>12.0  | —           | 0.10          | Low<br>carbon<br>for<br>welding       |
| 304H        | S30409 | 0.04–<br>0.10 | 2.00      | 0.045    | 0.030    | 0.75      | 18.0–<br>20.0 | 8.0–<br>10.5  | —           | —             | High-<br>temp<br>service              |
| <b>316</b>  | S31600 | 0.08          | 2.00      | 0.045    | 0.030    | 0.75      | 16.0–<br>18.0 | 10.0–<br>14.0 | 2.0–<br>3.0 | 0.10          | Standard<br>moly<br>grade             |
| 316L        | S31603 | 0.030         | 2.00      | 0.045    | 0.030    | 0.75      | 16.0–<br>18.0 | 10.0–<br>14.0 | 2.0–<br>3.0 | 0.10          | Weldable<br>moly<br>grade             |
| 316H        | S31609 | 0.04–<br>0.10 | 2.00      | 0.045    | 0.030    | 0.75      | 16.0–<br>18.0 | 10.0–<br>14.0 | 2.0–<br>3.0 | —             | High-<br>temp<br>service              |
| 317L        | S31703 | 0.030         | 2.00      | 0.045    | 0.030    | 0.75      | 18.0–<br>20.0 | 11.0–<br>15.0 | 3.0–<br>4.0 | 0.10          | Higher<br>Mo<br>pitting<br>resistance |
| 321         | S32100 | 0.08          | 2.00      | 0.045    | 0.030    | 0.75      | 17.0–<br>19.0 | 9.0–<br>12.0  | —           | 0.10          | Ti ≥ 5×C                              |
| 347         | S34700 | 0.08          | 2.00      | 0.045    | 0.030    | 0.75      | 17.0–<br>19.0 | 9.0–<br>13.0  | —           | —             | Cb+Ta ≥<br>10×C                       |
| <b>2205</b> | S32205 | 0.030         | 2.00      | 0.030    | 0.020    | 1.00      | 22.0–<br>23.0 | 4.5–<br>6.5   | 3.0–<br>3.5 | 0.14–<br>0.20 | Standard<br>duplex                    |
| 2507        | S32750 | 0.030         | 1.20      | 0.035    | 0.020    | 0.80      | 24.0–<br>26.0 | 6.0–<br>8.0   | 3.0–<br>5.0 | 0.24–<br>0.32 | Super<br>duplex                       |
| 904L        | N08904 | 0.020         | 2.00      | 0.045    | 0.035    | 1.00      | 19.0–<br>23.0 | 23.0–<br>28.0 | 4.0–<br>5.0 | 0.10          | Cu 1.0–2.0                            |

| Grade       | UNS    | C<br>max | Mn<br>max | P<br>max | S<br>max | Si<br>max | Cr            | Ni            | Mo          | N             | Notes                                |
|-------------|--------|----------|-----------|----------|----------|-----------|---------------|---------------|-------------|---------------|--------------------------------------|
| 254<br>SMO® | S31254 | 0.020    | 1.00      | 0.030    | 0.010    | 0.80      | 19.5–<br>20.5 | 17.5–<br>18.5 | 6.0–<br>6.5 | 0.18–<br>0.25 | 6 % Mo<br>super-<br>austenitic       |
| 410         | S41000 | 0.15     | 1.00      | 0.040    | 0.030    | 1.00      | 11.5–<br>13.5 | 0.75          | —           | —             | Quenched<br>&<br>tempered            |
| 430         | S43000 | 0.12     | 1.00      | 0.040    | 0.030    | 1.00      | 16.0–<br>18.0 | 0.75          | —           | —             | General-<br>purpose<br>ferritic      |
| 17-4<br>PH  | S17400 | 0.07     | 1.00      | 0.040    | 0.030    | 1.00      | 15.0–<br>17.5 | 3.0–<br>5.0   | —           | —             | Cu 3.0–<br>5.0,<br>Nb+Ta<br>0.15–0.4 |

**Important:** Carbon analysis shall be reported to the nearest 0.01 %, except for N08904 and S31254 where it is reported to 0.001 %. Total of Cr, Ni, Mo and Cu for ferritic/martensitic grades generally governs acceptance.

## 4 Mechanical Properties

Mechanical test requirements from Table 2. Plate values depend on product form (plate vs. sheet/strip) and thickness; the table below uses common annealed values for sheet/strip. For full detail and thickness-specific values, see ASTM A240 / A240M.

| Grade             | UNS                | Tensile Strength<br>ksi / MPa | Yield Strength<br>ksi / MPa | Elongation<br>% min | Hardness<br>max<br>Brinell /<br>Rockwell B | Cold Bend    |
|-------------------|--------------------|-------------------------------|-----------------------------|---------------------|--------------------------------------------|--------------|
| <b>304</b>        | S30400             | 75 / 515                      | 30 / 205                    | 40                  | 217 / 95                                   | not required |
| 304L              | S30403             | 70 / 485                      | 25 / 170                    | 40                  | 201 / 92                                   | not required |
| 304H              | S30409             | 75 / 515                      | 30 / 205                    | 40                  | 201 / 92                                   | not required |
| <b>316 / 316L</b> | S31600 /<br>S31603 | 75 / 515<br>70 / 485          | 30 / 205<br>25 / 170        | 40                  | 217 / 95                                   | not required |
| 316H              | S31609             | 75 / 515                      | 30 / 205                    | 40                  | 217 / 95                                   | not required |
| 321 / 347         | S32100 /<br>S34700 | 75 / 515                      | 30 / 205                    | 40                  | 217 / 95                                   | not required |
| 309S              | S30908             | 75 / 515                      | 30 / 205                    | 40                  | 217 / 95                                   | not required |
| 310S              | S31008             | 75 / 515                      | 30 / 205                    | 40                  | 217 / 95                                   | not required |
| 317L              | S31703             | 75 / 515                      | 30 / 205                    | 40                  | 217 / 95                                   | not required |
| 904L              | N08904             | 71 / 490                      | 31 / 220                    | 35                  | —                                          | not required |
| <b>2205</b>       | S32205             | 95 / 655                      | 65 / 450                    | 25                  | 293 / 31 HRC                               | not required |
| 2507              | S32750             | 116 / 800                     | 80 / 550                    | 15                  | 310 / 32 HRC                               | not required |
| 410               | S41000             | 65 / 450                      | 30 / 205                    | 20                  | 217 / 96                                   | required     |
| 410S              | S41008             | 60 / 415                      | 30 / 205                    | 22                  | 183 / 89                                   | required     |
| 430               | S43000             | 65 / 450                      | 30 / 205                    | 22                  | 183 / 89                                   | required     |
|                   |                    |                               |                             |                     |                                            |              |

| Grade   | UNS    | Tensile Strength<br>ksi / MPa                                                     | Yield Strength<br>ksi / MPa | Elongation<br>% min | Hardness<br>max<br>Brinell /<br>Rockwell B | Cold Bend |
|---------|--------|-----------------------------------------------------------------------------------|-----------------------------|---------------------|--------------------------------------------|-----------|
| 17-4 PH | S17400 | Condition-dependent; refer to A693 or A705 for precipitation-hardened properties. |                             |                     |                                            |           |

**Note:** Hardness values shown are representative maximums for annealed sheet/strip. Some grades and product forms have thickness-specific limits. Cold bend is required only for certain ferritic/martensitic grades per Table 2.

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## Heat Treatment

Proper heat treatment secures corrosion resistance, mechanical properties, and microstructural balance. Requirements vary by alloy family.

|                                                                                                                                                                                            |                                                                                                                                                                                             |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <div>AUSTENITIC</div> <div><b>Solution Anneal</b></div> <div>Heated to minimum temperatures (e.g., 1900 °F / 1040 °C for 304/316) and rapidly cooled to retain carbides in solution.</div> | <div>DUPLEX</div> <div><b>Solution Anneal + Rapid Cool</b></div> <div>Typically 1920–2050 °F (1050–1120 °C) followed by water quench. Slow cooling risks sigma/nitride precipitation.</div> |
| <div>FERRITIC</div> <div><b>Anneal</b></div> <div>Annealed at 1400–1700 °F (760–925 °C) depending on grade. Rapid cooling is generally specified to avoid embrittlement.</div>             | <div>MARTENSITIC</div> <div><b>Harden + Temper</b></div> <div>Austenitized around 1700–1850 °F, air/oil quenched, then tempered to desired hardness and toughness.</div>                    |

#### PH GRADES

### Austenitize + Age

Solution treated, then aged (e.g., 17-4 PH at 900–1150 °F) to precipitate strengthening phases.

#### H GRADES

### Controlled Anneal for Grain Size

Austenitic H grades must show ASTM No. 7 or coarser grain size (E112) for ASME high-temperature service.

## 6 Testing & Inspection

Tests required under A240 are straightforward. Additional tests must be specified in the purchase order; they are not performed automatically.

### Required Tests

- **Tensile test** — one per heat/condition lot (A370).
- **Hardness test** — Brinell or Rockwell as listed in Table 2.
- **Cold bend** — required only for grades so specified in Table 2.
- **Chemical analysis** — heat analysis; product analysis when specified.
- **Grain size** — required for austenitic H grades per E112.

### Supplementary Requirements

- **S1** — Charpy V-notch impact testing of plate (A370).
- **S2** — High-temperature service: grain size control for non-H austenitic grades above 1000 °F.
- **Other S-requirements** — refer to A480/A480M for additional supplementary options.

**Customer tip:** If your plate is heading into an ASME Code pressure vessel above 540 °C, specify an H grade (e.g., 304H, 316H) or invoke Supplementary Requirement S2. This avoids costly rejection during third-party inspection.

## 7 Dimensions & Tolerances

ASTM A240 defers dimensional tolerances, finish, and marking to A480/A480M. Common terms and thickness ranges are listed below for quick quoting.

#### PLATE

##### Thickness $\geq 3/16$ in (4.76 mm)

Hot-rolled flat product, usually supplied annealed/pickled or blast-cleaned. Width and length tolerances per A480/A480M.

#### SHEET

##### Thickness $< 3/16$ in (4.76 mm)

Flat-rolled product with width  $\geq 24$  in (610 mm). Available hot-rolled or cold-rolled, annealed and pickled or 2B/BA finish.

#### STRIP

##### Thickness $< 3/16$ in, Width $< 24$ in

Cold-rolled flat product supplied in coils or cut lengths. Tighter width and thickness tolerances than sheet.

#### FINISH CODES

##### No. 1 · 2B · 2D · BA · No. 4

Hot-rolled annealed/pickled (No. 1) and cold-rolled bright annealed/polished finishes are most common.

**Remember:** A240 is the material specification; A480/A480M is the dimensional/general-requirements specification. Always reference both when ordering plate, sheet, or strip.

## 8 Ordering Information

A complete order helps the mill quote accurately and prevents delays. Specify quantity, form, dimensions, grade, finish, and any special tests.

### Required Information

- Quantity (weight or number of pieces)
- Product form: plate, sheet, or strip
- ASTM designation: A240 or A240M (SI)
- Grade (type) and UNS number
- Finish designation
- Dimensions: thickness  $\times$  width  $\times$  length
- Edge condition (for sheet/strip)
- Applicable A480/A480M requirements

### Options to Consider

- Heat or product chemical analysis
- Special tests (S1 impact, S2 high-temp grain size)
- Non-destructive examination
- Restricted chemistry or tighter tolerances
- Certification / MTC requirements
- Marking, packaging, and loading method
- ASME / PED / other code compliance

**Example order line:** "5,000 kg ASTM A240 Type 316L (UNS S31603) stainless steel plate, No. 1 finish, 6 mm × 1500 mm × 6000 mm, annealed and pickled, with mill test certificate per EN 10204 3.1."

## 9 Key Takeaways

#1

### **A240 = Material, A480 = Dimensions**

A240 defines chemistry and mechanical properties; A480/A480M covers tolerances, finish, and general requirements.

#2

### **H Grades for High Temperature**

For ASME service above 1000 °F (540 °C), choose H grades (304H, 316H, 321H, 347H) or invoke S2 for grain size control.

#3

### **L Grades Resist Sensitization**

304L and 316L limit carbon to  $\leq 0.030\%$ , making them the safe choice for welded fabrications.

#4

### **Duplex = Strength + SCC Resistance**

2205 offers roughly twice the yield strength of 316L plus superior chloride stress-corrosion cracking resistance.

#5

### **Specify Supplementary Tests**

Charpy impact (S1) and high-temperature grain size (S2) are optional — state them on the order.

#6

### **Mind the Finish**

No. 1 (hot-rolled pickled) is standard for industrial plate; 2B/BA/No. 4 are common for sheet/strip in architectural or food applications.

**Disclaimer:** This guide is a simplified summary for customer convenience. For procurement, inspection, and code compliance, always refer to the latest official ASTM A240 / A240M standard and any applicable project or regulatory specifications.

ASTM A240 / A240M Customer Guide · Simplified summary based on ASTM A240/A240M-11

**For official requirements, consult the current ASTM standard and your project specifications.**