# Are You Properly Specifying Materials?

Part two in a three-part series: structural plates

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THE MATERIALS AND PRODUCTS USED IN BUILDING DESIGN AND CONSTRUCTION are almost universally designated by reference to an appropriate ASTM specification. This simplifies the design and construction process because all characteristics of the product specified are defined by simple reference to an approved standard. However, with dozens of ASTM specifications applicable in steel building construction alone and several new ones now available, it can be challenging to keep the standard designations in contract documents current.

This article (Part Two) is a summary of the common ASTM specifications used for structural plates, bars and other plate products in building design and construction.

Part One (see January 1999 *Modern Steel Construction*) covered structural members. Part Three will focus on fastening products.

The generally applicable ASTM specifications for structural plates are given in Table 1. Following is a discussion of the usual and other applicable ASTM specifications for structural plates and other plate-type products. The usual ASTM specifications are summarized by product in Table 2.

## Structural Plates

The usual material specification for structural plates is ASTM A36 ($F_y$ = 36 ksi; $F_u$ = 58 ksi). Note that the yield strength given is applicable when the plate thickness is equal to or less than 8". Above 8" thickness, $F_y$ = 32 ksi.

Structural plates with higher yield and tensile strength can be obtained by specifying ASTM A572 grade 42, 50, 60 or 65, ASTM A529 grade 42 or 50, ASTM A514 grade 90 or 100, or ASTM A852. Structural plates with atmospheric corrosion resistance (weathering) characteristics can be obtained by specifying ASTM A588 grade 42, 46, or 50. However, the availability and cost effectiveness of structural plates in grades other than ASTM A36 should be confirmed prior to their specification. Note also that the availability of grades other than ASTM A36 varies through the range of thickness.

Regardless of the material specification chosen, the production tolerances for structural plates are given in ASTM A6.

## Structural Bars

The foregoing comments for structural plates apply equally to structural bars, except that neither ASTM A514 and nor A852 is applicable. So again, the usual material specification for structural bars is ASTM A36 ($F_y$ = 36 ksi; $F_u$ = 58 ksi).

Actually, it should be highlighted that there is very little, if any, structural difference between flat bars and plates. Consequently, plate is becoming a universally applied term today and a PL ½ x 4½ x 1'-3", for example, might be fabricated from plate or bar stock.

From AISC's *A Guide to Engineering and Quality Criteria for Steel Structures—Common Questions Answered* (AISC Publication S323), the historical classification system for flat bars and plates would suggest that there is only a physical difference between them that centers on size (see Table 3) and production procedure. In raw form, flat stock has historically been classified as a bar if it is less than or equal to 8" wide and as a plate if it is greater than 8" wide. Flat bars are rolled between horizontal and vertical rolls and trimmed to length by shearing or flame cutting on the ends only. Plates are generally produced using one of three methods: (1) sheared plates are rolled between horizontal rolls and trimmed to width and length by shearing or flame cutting on the edges and ends; (2) universal mill (UM) plates are rolled between horizontal and vertical rolls and trimmed to length by shearing or flame cutting on the ends only; and, (3) stripped plates are sheared or flame cut from wider sheared plates.

**Table 1. ASTM specifications and their product-specific applicability**

| Product | Applicable ASTM specifications | Notes: |
|---|---|---|
| Structural plate | A36, A514, A529, A572, A588, A852 | 1 |
| Structural bar | A36, A529, A572, A588 | 1 |
| Raised-pattern floor plate | A786 | 2 |
| Sheet and strip | A570, A606, A607 | — |

**Notes:**
1. Availability varies through the range of thickness.
2. Ordered as "commercial grade" or to plate material specification, such as ASTM A36, A572 or A588. "Commercial grade," per ASTM A786 Section 5.1.2, means "the product will be supplied 0.33 percent carbon and without specified mechanical properties."

# *Specifying Plates for Detail Materials*

Plates for detail materials, such as shear plates, flange plates, gusset plates, transverse stiffeners and web doubler plates, are commonly designated with the letters “PL” followed by thickness x width x length. The thickness and width are specified as fractional inch dimensions and the length is specified in feet and inches. Thus, a ½”-thick flange plate with 8½” width and 16” length would be specified as PL ½ x 8½ x 1’-4”. Similarly, a ¾”-thick gusset plate with 18” width and 36” length would be specified as PL ¾ x 18 x 3’-0”.

While structural plates and bars can be produced in thickness increments far smaller, it is recommended that thicknesses be selected for detail materials in ⅛-in increments. That is, use thickness increments such as ⅜” and ½” rather than 5/16” and 7/16”, respectively. Fabricators will rarely stock plates in 1/16” thickness increments.

## Table 2. Plate products and their usual ASTM specifications

| Product | Usual ASTM Specification | Min. $F_y$ (ksi) | Min. $F_u$ (ksi) |
|---|---|---|---|
| Structural plate | A36 | 36 | 58 |
| Structural bar | A36 | 36 | 58 |
| Raised-pattern floor plate | A786 | see Note 2 | see Note 2 |
| Other plate products | varies with application | varies | varies |

**Notes:**

1. $F_y$ = 32 ksi for ASTM A36 material over 8" thick.
2. If ordered as "commercial grade", no minimum strength is applicable. If ordered to a plate material specification such as ASTM A36, A572 or A588, $F_y$ and $F_u$ are as specified therein. "Commercial grade," per ASTM A786 Section 5.1.2, means "the product will be supplied 0.33 percent carbon and without specified mechanical properties."

## Table 3. Classification of Plate Products

| Thickness (in.) | Width (in.) | | | | | |
|---|---|---|---|---|---|---|
| | to 3½ | over 3½ to 6 | over 6 to 8 | over 8 to 12 | over 12 to 48 | over 48 |
| 0.2300 and over | bar | bar | bar | plate | plate | plate |
| 0.2031 to 0.2299 | bar | bar | strip | strip | sheet | plate |
| 0.1800 to 0.2030 | strip | strip | strip | strip | sheet | plate |
| 0.0449 to 0.1799 | strip | strip | strip | strip | sheet | sheet |
| 0.0344 to 0.0448 | strip | strip | Hot-rolled sheet and strip not generally produced in these widths and thicknesses | | | |
| 0.0255 to 0.0343 | strip | | | | | |
| to 0.0254 | | | | | | |

## Raised-Pattern Floor Plates

ASTM A786 is the standard specification for rolled steel floor plates. As floorplate design is seldom controlled by strength considerations, ASTM A786 "commercial grade" is commonly specified. If so, per ASTM A786 Section 5.1.2, "the product will be supplied 0.33 percent maximum carbon and without specified mechanical properties." Alternatively, if a defined strength level is desired, ASTM A786 raised-pattern floor plate can be ordered to a defined plate specification, such as ASTM A36, A572, or A588; see ASTM A786 Sections 5.1.2 and 8 and Appendix Table X1.1.

## Other Plate Products

Sheet and strip products, which are generally thinner than structural plate and bar products (see Table 3), are produced to such ASTM specifications as A570, A606 or A607. Skelp is a general term for the plate products used in the production of hollow structural sections (HSS).

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