

Metals Activity Report – Detailed Product Category Definitions

Carbon & Alloy Bar Category Definitions

This entire category includes bars of the following shape and dimensions (where specified): round, square, hexagonal, flat, tees, angles (less than 80 mm – 3.2 inches) channels (less than 80 mm) and H or I sections (less than 80 mm). This category is not to include concrete reinforcing bars.

Cold Finished Carbon & Alloy Bars

Standard quality cold-finished carbon and alloy bars produced to ASTM A-108 and or ASTM A-311, available in grades AISI 10XX, 11XX and 12XX. Standard quality cold-finished carbon or alloy bars that have been drawn, turned, turned and polished or ground and polished, cold finished carbon steel bars, cold-drawn, stress-relieved carbon steel bars subject to mechanical property requirements.

Hot Rolled SBQ Bars

Special quality carbon and alloy steel bars produced to ASTM A-576 or ASTM A-675. SBQ bars can be grades AISI 10XX, 11XX, 12XX and 15XX and are marketed as special quality due to more stringent end use requirements. These bars have minimal surface imperfections and controlled chemistry.

Hot Rolled Carbon Bars

Low carbon general purpose carbon and alloy steel bars that offer excellent formability and weld-ability. These bars are produced to ASTM A-36, A-529, A-575, A-663 or A-572. These bars are used in structural and miscellaneous applications: carbon structural steel, high-strength carbon-manganese steel of structural quality, merchant quality, M-Grades, high-strength low-alloy columbium-vanadium structural steel bars.

Hot Rolled Alloy Bars

Hot rolled alloy steel bars that meet specifications of ASTM A-193 Grade B7, A-322, A-370 and A-434 Class BB through BD. These bars can be produced to grades AISI 41XX, 43XX, 51XX and 86XX. These bars provide good surface hardness and can be heat treated for better machine-ability: alloy steel bolting materials for high-temperature applications, standard grade alloy steel bars, hot-wrought alloy steel bars, quenched and tempered alloy steel bars.

Metals Activity Report – Detailed Product Category Definitions

Carbon Flat Rolled Category Definitions

Hot Rolled Sheet, SMP, & Coil	Flat hot rolled products with widths 74 inches or less and thickness less than 0.505 inches.
Cold Rolled Sheet & Coil	Cold rolled sheets: cold rolled flat products with widths of 24 inches (600 mm) or more and thickness of 0.0142 inches (0.361 mm) or more. Cold rolled strip of thickness less than 0.187 inches (4.75 mm) and width over ½ inches but less than 24 inches (600 mm)
Coated Sheet & Coil	Galvanized sheet and strip and all other metallic coated hot rolled and cold rolled sheets and strip

Carbon & Alloy Plate Category Definitions

Discrete and Cut-To-Length Plate from Wide Coils

Discrete mill plate 8 inches and wider of thickness 0.187 inches (4.75 mm) or greater, and wide coiled strip mill plate greater than 74 inches in width. Includes circles, flame cut plates, floor plates, sketch plates, universal plates, strip mill plates, rolled armor plates and plates for AWWA-Mill type of pipe

Hot rolled coils of thicknesses $\leq .505$ in widths up to 74" are typically produced on similar hot strip mill equipment. While traditional carbon nomenclature allows for a "strip mill plate" designation, it is more accurate to reserve plate category reporting to wide (>74") coiled strip mill plate based on the production equipment and the further processing (cut-to-length) of wide coils creating cut-to-length plate.

Discrete plate $\leq .505$ and cut-to-length plate from wide coils are exact substitutes. As such, collecting data in separate categories will not be accurate. Wide coil information collected today is reported as hot rolled sheet or plate depending on the workings of the reporting member's business system. Despite the definitions in place $\leq .505$ and ≤ 74 " is mostly reported as hot rolled sheet. Wide coil reporting will vary considerably

Carbon Structural Category Definitions

Wide Flange Beams	H Shapes only of size 80 millimeters (3.2 inches) and up.
Other Structural	Angles, beams or channels of any shape other than H shapes that are of size 80 millimeters (3.2 inches) and greater.

Metals Activity Report – Detailed Product Category Definitions

Carbon and Alloy Pipe & Tube Category Definitions

DOM	ASTM A512 & ASTM A513, Type 5 and Type 6 (All Sizes) A512-96 Cold-Drawn Buttweld Carbon Steel Mechanical Tubing A513-00 Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing
Structural Tubing	ASTM A500 (All sizes - rounds and shapes) ASTM A501 (All sizes - rounds and shapes) CSA G40.21-50W (All sizes – rounds and shapes) ROPS (Rollover Protection Steel) A500-01a Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes A501-01 Hot-Formed Welded and Seamless Carbon Steel Structural Tubing
Pressure Tubing	ASTM A106 (1-1/2 inch Nom. and smaller) ASTM A179, ASTM A-214, J-524, J-525 ASTM A333 ASTM A-335 A106-02a Seamless Carbon Steel Pipe for High-Temperature Service A1006/A1006M-00 Steel Line Pipe, Black, Plain End, Laser Beam Welded A179/A179M-90a Seamless Cold-Drawn Low-Carbon Steel Heat-Exchanger and Condenser Tubes A333/A333M-99 Seamless and Welded Steel Pipe for Low-Temperature Service A335/A335M-02 Seamless Ferritic Alloy-Steel Pipe for High-Temperature Service
Standard Pipe	ASTM A53 (All sizes) ASTM A106 (2 inch Nom. & larger) ASTM A134, ASTM A-135, ASTM A-211 A53/A53M-02 Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless A134-96 Pipe, Steel, Electric-Fusion (Arc)-Welded (Sizes NPS 16 and Over)
Other Welded	ASTM A-513 Type 1 & 2 (All sizes, rounds and shapes) A513-00 Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing
Seamless Mechanical	ASTM A519 (All sizes – Carbon & Alloy) A519 Seamless Carbon and Alloy Steel Mechanical Tubing

Metals Activity Report – Detailed Product Category Definitions

Stainless Category Definitions

Sheet, Coil & Strip	Cold rolled coil and sheet under 3/16 inches in thickness
Rod, Bar, Shapes	Includes all long products with the exception of pipe and tube (rounds, squares, hexes, extrusions, angle)
Plate	Includes plate mill plate, discrete plate, and coil mill plate with dimensions 3/16 and over in thickness.
Pipe & Tube	All seamless and welded stainless pipe & tube: all sizes of seamless and welded austenitic stainless steel pipes, seamless austenitic steel pipe for high-temperature central-station service, seamless and welded austenitic stainless steel tubing for general service use, seamless ferritic and austenitic alloy-steel boiler, superheater, and heat-exchanger tubes, electric-fusion-welded austenitic chromium-nickel alloy steel pipe for high-temperature service, all sizes of welded ornamental/structural grade pipe and tubing, welded austenitic steel boiler, superheater, heat-exchanger, and condenser tubes, and welded stainless steel mechanical tubing.

Aluminum Category Definitions

Sheet & Coil, Heat Treated	Heat treated hot rolled or cold rolled sheet in any width from 0.006 to 0.249 inches in thickness in the following categories: <div style="margin-left: 40px;">Series 2XXX, 6XXX and 7XXX</div>
Sheet & Coil, All Other	Non-Heat Treated hot rolled or cold rolled sheet in any width from 0.006 to 0.249 inches in thickness in the following categories: <div style="margin-left: 40px;">Bare Series 1XXX, 3XXX and 5XXX</div> <div style="margin-left: 40px;">Painted Painted or anodized Series 1XXX, 3XXX and 5XXX</div>
Plate	Hot rolled, cold rolled, or cast plate in any width that is 0.250 inches and above in thickness in the following categories: <div style="margin-left: 40px;">Heat Treated Series 2XXX, 6XXX and 7XXX</div> <div style="margin-left: 40px;">Non-Heat Treated Series 1XXX, 3XXX and 5XXX</div> <div style="margin-left: 40px;">Cast</div>

Metals Activity Report – Detailed Product Category Definitions

Rod, Bar, Wire
(Rolled or Extruded)

Round, hex, rectangular, and square rod, bar and wire. Other shapes should be reported in extruded shapes category. Extruded plate should be reported as bar.

Pipe & Tubing

Hollow bar, square and rectangular tubing.

Extruded Shapes, (Rolled or Structural)

The aluminum extrusion process begins with the design process, for it is the design of the product--based on its intended use--that determines many of the ultimate production parameters. Questions regarding machine-ability, finishing, and environment of use will lead to the choice of alloy to be extruded. The function of the profile will determine the design of its form and, hence, the design of the die that shapes it. Once the design questions have been answered, the actual extrusion process begins with billet, the aluminum material from which profiles are extruded. The billet must be softened by heat prior to extrusion. The heated billet is placed into the extrusion press, a powerful hydraulic device wherein a ram pushes a dummy block that forces the softened metal through a precision opening, known as a die, to produce the desired shape. The extrusion process has been likened to squeezing toothpaste out of a tube. When pressure is applied at the closed end, the paste is forced to flow through the open end, accepting the round shape of the opening as it emerges. If the opening is flattened, the paste will emerge as a flat ribbon. Complex shapes can be produced by complex openings.

Metals Activity Report – Detailed Product Category Definitions

Acronym Key

DOM	Drawn Over Mandrel – a method of making steel tubing from coils
SBQ	Special Bar Quality: a marketing term applied to bars made of higher-grade alloy steel.
ASTM	American Society for Testing Material
SMP	Silicon Modified Polyester – refers to specialized coatings for sheet steel.
AWWA-Mill Type (Pipe)	American Water Works Association – refers to water pipe
Rollover Protection Steel	Steel tubing used in vehicles to prevent injury in the case of vehicle rollover.

Designations of Carbon and Low-Alloy Steels

Abstract:

A designation is the specific identification of each grade, type, or class of steel by a number, letter, symbol, name, or suitable combination. Unique to a particular steel grade, type and class are terms used to classify steel products. Within the steel industry, they have very specific uses: grade is used to denote chemical composition; type is used to indicate deoxidation practice; and class is used to describe some other attribute, such as strength level or surface smoothness. This article describes basics of SAE, AISI, UNS, AMS, European and Japanese designation systems.

A designation is the specific identification of each grade, type, or class of steel by a number, letter, symbol, name, or suitable combination. Unique to a particular steel grade, type and class are terms used to classify steel products. Within the steel industry, they have very specific uses: grade is used to denote chemical composition; type is used to indicate deoxidation practice; and class is used to describe some other attribute, such as strength level or surface smoothness.

In ASTM specifications, however, these terms are used somewhat interchangeably. In ASTM A 533, for example, type denotes chemical composition, while class indicates strength level. In ASTM A 515, grade identifies strength level; the maximum carbon content permitted by this specification depends on both plate thickness and strength level. In ASTM A 302 grade denotes requirements for both chemical composition and mechanical properties. ASTM A 514 and A 5117 are specifications for high-strength quenched and tempered plate for structural and pressure vessel applications, respectively, each contains several compositions that can provide the required mechanical properties. However, A 514 type A has the identical composition limits as A 517 grade.

Metals Activity Report – Detailed Product Category Definitions

Chemical composition is by far the most widely used basis for classification and/or designation of steels. The most commonly used system of designation in the United States is that of the Society of Automotive Engineers (SAE) and the American Iron and Steel Institute (AISI). The Unified Numbering System (UNS) is also being used with increasing frequency.

SAE-AISI Designations

As stated above, the most widely used system for designating carbon and alloy steels is the SAE-AISI system. As a point of technicality, there are two separate systems, but they are nearly identical and have been carefully coordinated by the two groups. It should be noted, however, that AISI has discontinued the practice of designating steels.

The SAE-AISI system is applied to semi-finished forgings, hot-rolled and cold-finished bars, wire rod and seamless tubular goods, structural shapes, plates, sheet, strip, and welded tubing.

Carbon steels contain less than 1.65% Mn, 0.60% Si, and 0.60% Cu; they comprise the lxxx groups in the SAE-AISI system and are subdivided into four distinct series as a result of the difference in certain fundamental properties among them.

Designations for merchant quality steels include the prefix M. A carbon steel designation with the letter B inserted between the second and third digits indicates the steel contains 0.0005 to 0.003% B. Likewise, the letter L inserted between the second and third digits indicates that the steel contains 0.15 to 0.35% Pb for enhanced machinability. Resulfurized carbon steels of the 11xx group and resulfurized and rephosphorized carbon steels of the 12xx group are produced for applications requiring good machinability. Steels that having nominal manganese contents of between 0.9 and 1.5% but no other alloying additions now have 15xx designations in place of the 10xx designations formerly used.

Alloy steels contain manganese, silicon, or copper in quantities greater than those listed for the carbon steels, or they have specified ranges or minimums for one or more of the other alloying elements. In the AISI-SAE system of designations, the major alloying elements are indicated by the first two digits of the designation. The amount of carbon, in hundredths of a percent, is indicated by the last two (or three) digits.

For alloy steels that have specific hardenability requirements, the suffix H is used to distinguish these steels from corresponding grades that have no hardenability requirement. As with carbon steels, the letter B inserted between the second and third digits indicates that the steel contains boron. The prefix E signifies that the steel was produced by the electric furnace process.

Metals Activity Report – Detailed Product Category Definitions

Aluminum - The Most Common Grades

1100 This grade is commercially pure aluminum. It is soft and ductile and has excellent workability. It is ideal for applications involving intricate forming because it work hardens more slowly than other alloys. It is the most weldable of aluminum alloys, by any method. It is non heat-treatable. It has excellent resistance to corrosion and is widely used in the chemical and food processing industries. It responds well to decorative finishes which make it suitable for giftware.

2011 This is the most free-machining of the common aluminum alloys. It also has excellent mechanical properties. Thus, it is widely used for automatic screw machine products in parts requiring extensive machining.

2014 & 2017 The 2017 alloy combines excellent machinability and high strength with the result that it is one of the most widely used alloys for automatic screw machine work. It is a tough, ductile alloy suitable for heavy-duty structural parts. Its strength is slightly less than that of 2014.

2024 This is one of the best known of the high strength aluminum alloys. With its high strength and excellent fatigue resistance, it is used to advantage on structures and parts where good strength-to-weight ratio is desired. It is readily machined to a high finish. It is readily formed in the annealed condition and may be subsequently . Arc or gas welding is generally not recommended, although this alloy may be spot, seam or flash welded. Since corrosion resistance is relatively low, 2024 is commonly used with an anodized finish or in clad form ("Alclad") with a thin surface layer of high purity aluminum. Applications: aircraft structural components, aircraft fittings, hardware, truck wheels and parts for the transportation industry.

3003 This is the most widely used of all aluminum alloys. It is essentially commercially pure aluminum with the addition of manganese which increases the strength some 20% over the 1100 grade. Thus, it has all the excellent characteristics of 1100 with higher strength. It has excellent corrosion resistance. It has excellent workability and it may be deep drawn or spun, welded or brazed. It is non-heat treatable. Applications: cooking utensils, decorative trim, awnings, siding, storage tanks, chemical equipment.

5005 This alloy is generally considered to be an improved version of 3003. It has the same general mechanical properties as 3003 but appears to stand up better in actual service. It is readily workable. It can be deep drawn or spun, welded or brazed. It has excellent corrosion resistance. It is non heat-treatable. It is well suited for anodizing and has fewer tendencies to streak or discolor. Applications same as 3003.

5052 This is the highest strength alloy of the more common non heat-treatable grades. Fatigue strength is higher than most aluminum alloys. In addition, this grade has particularly good resistance to marine atmosphere and salt-water corrosion. It has excellent workability. It may be drawn or formed into intricate shapes and its slightly greater strength in the annealed condition minimizes tearing that occurs in 1100 and 3003. Applications: Used in a wide variety of applications from aircraft components to home appliances, marine and transportation industry parts, heavy duty cooking utensils and equipment for bulk processing of food.

5083 & 5086 For many years there has been a need for aluminum sheet and plate alloys that would offer, for high strength welded applications,

Metals Activity Report – Detailed Product Category Definitions

several distinct benefits over such alloys as 5052 and 6061. Some of the benefits fabricators have been seeking are greater design efficiency, better welding characteristics, good forming properties, excellent resistance to corrosion and the same economy as in other non heat-treatable alloys. Metallurgical research has developed 5083 and 5086 as superior weldable alloys, which fill these needs. Both alloys have virtually the same characteristics with 5083 having slightly higher mechanical properties due to the increased manganese content over 5086. Applications: unfired pressure vessels, missile containers, heavy-duty truck and trailer assemblies, boat hulls and superstructures.

6061 This is the least expensive and most versatile of the heat-treatable aluminum alloys. It has most of the good qualities of aluminum. It offers a range of good mechanical properties and good corrosion resistance. It can be fabricated by most of the commonly used techniques. In the annealed condition it has good workability. In the T4 condition fairly severe forming operations may be accomplished. The full T6 properties may be obtained by artificial aging. It is welded by all methods and can be furnace brazed. It is available in the clad form ("Alclad") with a thin surface layer of high purity aluminum to improve both appearance and corrosion resistance. Applications: This grade is used for a wide variety of products and applications from truck bodies and frames to screw machine parts and structural components. 6061 is used where appearance and better corrosion resistance with good strength are required.

6063 This grade is commonly referred to as the architectural alloy. It was developed as an extrusion alloy with relatively high tensile properties, excellent finishing characteristics and a high degree of resistance to corrosion. This alloy is most often found in various interior and exterior architectural applications, such as windows, doors, store fronts and assorted trim items. It is the alloy best suited for anodizing applications - either plain or in a variety of colors.

7075 This is one of the highest strength aluminum alloys available, and its strength-to weight ratio is excellent and it is ideally used for highly stressed parts. It may be formed in the annealed condition and subsequently heat-treated. Spot or flash welding can be used, although arc and gas welding are not recommended. It is available in the clad ("Alclad") form to improve the corrosion resistance with the over-all high strength being only moderately affected. Applications: Used where highest strength is needed.

ALUMINUM ALLOY DESIGNATIONS

The aluminum industry uses a four-digit index system for the designation of its wrought aluminum alloys. As outlined below, the first digit indicates the alloy group according to the major alloying elements.

1xxx Series

In this group - minimum aluminum content is 99% and there is no major alloying element. The second digit indicates modifications in impurity limits. If the second digit is zero, there is no special control on individual impurities. Digits 1 through 9, which are assigned consecutively as needed, indicate special control of one or more individual impurities. The last two digits indicate specific minimum aluminum content. Although the absolute minimum aluminum content in this group is 99%, the minimum for certain grades is higher than 99%, and the last two digits represent the hundredths of a percent over 99. Thus, 1030 would indicate 99.30% minimum aluminum without special control on individual impurities. The designations 1130, 1230, 1330, etc. indicate the same purity with special control on one or more impurities. Likewise, 1100 indicates minimum

Metals Activity Report – Detailed Product Category Definitions

aluminum content of 99.00% with individual impurity control.

2xxx through 9xxx Series

The major alloying elements are indicated by the first digit, as follows:

- 2xxx** Copper
- 3xxx** Manganese
- 4xxx** Silicon
- 5xxx** Magnesium
- 6xxx** Magnesium and silicon
- 7xxx** Zinc
- 8xxx** Other element
- 9xxx** Unused series

The second digit indicates alloy modification. If the second digit is zero, it indicates the original alloy; digits 1 through 9, which are assigned consecutively, indicate alloy modifications. The last two digits have no special significance, serving only to identify the different alloys in the group.

Experimental Alloys

Experimental alloys are designated according to the four-digit system, but they are prefixed by the letter X. The prefix is dropped when the alloy becomes standard. During development, and before they are designated as experimental, new alloys are identified by serial numbers assigned by their originators. Use of the serial number is discontinued when the X number is assigned.

ALUMINUM TEMPER DESIGNATIONS

Temper designations of wrought aluminum alloys consist of suffixes to the numeric alloy designations. For example, in 3003-H14, 3003 denotes the alloy and "H1 4" denotes the temper, or degree of hardness. The temper designation also reveals the method by which the hardness was obtained. Temper designations differ between non heat-treatable alloys and heat-treatable alloys, and their meanings are given below:

Non Heat-Treatable Alloys

The letter "H" is always followed by 2 or 3 digits. The first digit indicates the particular method used to obtain the temper, as follows:

- **H1** means strain hardened only.
- **H2** means strain hardened, then partially annealed.
- **H3** means strain hardened, then stabilized.

The temper is indicated by the second digit as follows:

Metals Activity Report – Detailed Product Category Definitions

- 2 1/4 hard
- 4 1/2 hard
- 6 3/4 hard
- 8 full hard
- 9 extra hard

Added digits indicate modification of standard practice.

Heat-Treatable Alloys

- F As fabricated
- O Annealed
- T Heat treated

The letter "T" is always followed by one or more digits. These digits indicate the method used to produce the stable tempers, as follows:

- T3 Solution heat treated, then cold worked.
- T351 Solution heat treated, stress-relieved stretched, then cold worked.
- T36 Solution heat treated, then cold worked (controlled).
- T4 Solution heat treated, then naturally aged.
- T451 Solution heat treated, then stress relieved stretched.
- T5 Artificially aged only,
- T6 Solution heat treated, then artificially aged.
- T61 Solution heat treated (boiling water quench), then artificially aged.
- T651 Solution heat treated, stress-relieved stretched, then artificially aged (precipitation heat treatment).
- T652 Solution heat treated, stress relieved by compression. then artificially aged.
- T7 Solution heat treated, then stabilized.
- T8 Solution heat treated, cold worked, then artificially aged.
- T81 Solution heat treated, cold worked (controlled), then artificially aged.
- T851 Solution heat treated, cold worked, stress-relieved stretched, then artificially aged.
- T9 Solution heat treated, artificially aged, then cold worked.
- T10 Artificially aged, then cold worked.

Added digits indicate modification of standard practice.