GENERAL ALUMINUM INFORMATION

1100

This grade is commercially pure aluminium. 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 aluminium 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 aluminium 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 aluminium 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 heat treated. 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 aluminium. Applications: aircraft structural components, aircraft fittings, hardware, truck wheels and parts for the transportation industry.

3003

This is the most widely used of all aluminium alloys. It is essentially commercially pure aluminium 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 less tendency to streak or discolour. 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 aluminium alloys. In addition, this grade has particularly good resistance to marine atmosphere and saltwater 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 aluminium sheet and plate alloys that would offer, for high strength welded applications, 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 aluminium alloys. It has most of the good qualities of aluminium. 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 aluminium 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 colours.

7075

This is one of the highest strength aluminium alloys available. 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 aluminium industry uses a four-digit index system for the designation of its wrought aluminium alloys.

As outlined below, the first digit indicates the alloy group according to the major alloying elements.

1xxx Series

In this group. Minimum aluminium 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 aluminium content. Although the absolute minimum aluminium 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 per cent over 99.

Thus, 1030 would indicate 99.30% minimum aluminium. 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 aluminium 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	6xxx Magnesium and silicon
3xxx Manganese	7xxx Zinc
4xxx Silicon	8xxx Other element
5xxx Magnesium	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.

ALUMINIUM TEMPERS DESIGNATIONS

Temper designations of wrought aluminium alloys consist of suffixes to the numeric alloy designations. For example, in 3003-H14, 3003 denotes the alloy and “H14” 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:

GENERAL INFORMATION ON ALUMININUM GRADES NUMBERS

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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:

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, and then cold worked.

Added digits indicate modification of standard practice.

COMPARISON OF MODERN & OLD SYSTEMS OF ALUMINUM ALLOY DESIGNATION

Although the old system of aluminium identification has been obsolete for many years, stock with the old markings is still occasionally found. The following comparison is presented as an aid in identifying such materials in terms of the modern system.

In the old system, alloy composition was indicated by a one- or two-digit number followed by the letter "S" to indicate that it was a wrought alloy, i.e., an alloy that could be shaped by rolling, drawing or forging. Any variation in the basic composition was indicated by a letter preceding the numerical alloy designation. For example, A17S was a modification of the basic alloy 17S. In modern terminology these two alloys are designated 2117S and 2017S, respectively. Temper was designated by a second letter: "O" for soft (annealed), "H" for strain hardness of non-heat-treatable alloys, and "T" for hardness of heat-treatable alloys. Degree of hardness of non-heat-treatable alloys was indicated by a fraction preceding the letter "H". For example, 3S1/4H would be quarter-hard 3S alloy.

The following Table gives examples of the old and modern designations of some common aluminium alloys.

Modern System	Old English System
1100	2S
3003	3S
3003-O	3SO
2014	14S
2017	17S
2117	A17S
2018	18S
2218	B18S
2024T	24ST
5052	52S
7075T6	75ST6

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