THE BENEFITS OF ALUMINUM

- Aluminum is a light metal, about the third of the density of steel, copper, and brass.
- Aluminum has good corrosion resistance to common atmospheric and marine atmospheres. Its corrosion resistance and scratch resistance can be enhanced by anodizing.
- Aluminum has high reflectivity and can be used for decorative applications.
- Some aluminum alloys can match or even exceed the strength of common construction steel.
- Aluminum retains its toughness at very low temperatures, without becoming brittle like carbon steels.
- **Aluminum is a good conductor of heat and electricity. When measured by equal cross-sectional area, electrical grade aluminum has conductivity which is approximately 62% of electrical grade annealed copper. However, when compared using equal weight, the conductivity of aluminum is 204% of copper.**
- Aluminum is readily worked and formed using a wide variety of forming processes including deep-drawing and roll forming.
- Aluminum is non-toxic and is commonly used in contact with foodstuffs.
- Aluminum can be readily recycled.

ALUMINUM ALLOY DESIGNATIONS

Alloy Designation System for Wrought Sheet Products

Aluminum alloys for sheet products are identified by a four-digit numerical system which is administered by the *Aluminum Association*. The alloys are conveniently divided into eight groups based on their principal alloying element. The first digit identifies the alloy group as follows:

ALLOY GROUP	PRINCIPAL ALLOYING ELEMENT	
1xxx	Unalloyed Aluminum	Purity of 99.0% or Greater
2xxx	Copper	Heat Treatable Alloys
3xxx	Manganese	
4xxx	Silicon	Low Melting Point Alloys
5xxx	Magnesium	
6xxx	Magnesium and Silicon	Heat Treatable Alloys
7xxx	Zinc	Heat Treatable Alloys
8xxx	Other Elements	

The last two digits in the 1xxx group correspond with the two digits after the decimal which indicate the minimum aluminum content. For example the aluminum content of 1060 is 99.60% minimum, 1100 is 99.00% minimum, 1350 is 99.50% minimum and so on.

The last two digits of the other groups are sequential numbers issued by the Aluminum Association to ensure each alloy is uniquely identified.

The second digit in all the groups indicates a minor modification of the basic alloy. For instance, 5252 is the second modification of 5052 alloy.

ALUMINUM TEMPER DESIGNATIONS

The temper designation follows the alloy code and is separated by a hyphen.

-F	**As Fabricated:** Applies to products of rolling or forming where there is no special control over the thermal or work-hardening conditions. Since mechanical properties may vary widely, no limits have been assigned. This temper usually applies to sheet products which are at intermediate stages of production.
-H	**Strain-Hardened:** Applies to wrought products which are strengthened by cold-rolling or cold-working.
-O	**Annealed:** Applies to wrought products which have been heated above the recrystallization temperature to produce the lowest tensile strength condition of the alloy.

DESIGNATIONS OF THE –H STRAIN HARDENED TEMPERS

The First Digit

There are three different methods used to achieve the final temper of strain hardened material.

-H1	**Strain Hardened Only:** Applies to products which are strain hardened to obtain the desired strength level without any subsequent thermal treatment.
-H2	**Strain Hardened And Partially Annealed:** Applies to products that are strain hardened to a higher strength level than desired, followed by a partial anneal (or "back anneal") which reduces the strength to the desired level.
-H3	**Strain Hardened And Stabilized:** This designation only applies to magnesium-containing alloys which gradually age-soften at room temperature after strain hardening. A low temperature anneal is applied which stabilizes the properties.

The Second Digit

The amount of strain hardening, and hence the strength level, is indicated by a second digit.

-Hx2	Quarter hard
-Hx4	Half hard
-Hx6	Three quarter
-Hx8	Full hard
-Hx9	Extra hard (the minimum tensile strength exceeds that of the Hx8 temper by 2 ksi or more)

Hx1, Hx3, Hx5 and Hx7 tempers are intermediate between those defined above.
The mechanical property limits that correspond to each temper designation can be found by referring to an appropriate aluminum standard such as the *Aluminum Association Standards and Data* or ASTM B 209.

The Third Digit

A third digit is sometimes used to indicate a variation of the basic two-digit temper.

HEAT TREATMENT TEMPERS

Alloys in the 2xxx, 6xxx and 7xxx groups can be strengthened by a heat treatment process. The aluminum is heat treated by carrying out a solution treatment process, in which the metal is heated to an elevated temperature followed by rapid cooling, then a precipitation hardening process (or "aging" process). The tempers are designated by –T followed by a digit. Some common –T tempers are as follows:

-T3	**Solution heat-treated, cold worked, and naturally aged:** Applies to products that are cold-worked to improve strength after solution heat-treatment, or which the effect of flattening or straightening is recognized in mechanical property limits.
-T4	**Solution heat-treated and naturally aged:** Applies to product that are allowed to age harden at room temperature following a solution treatment.
-T6	**Solution heat-treated and artificially aged:** Applies to products that are reheated to a low temperature following a solution treatment. This allows the metal to achieve its highest heat-treated strength level.