

T6 Heat Treatment to Aluminum Castings

Heat Treatment is the process whereby controlled heating and cooling is used to alter the physical and mechanical properties of metals without affecting any change in the shape of the objects. Heat treatment process is used to increase material strength and also to improve machining, formability and restore ductility. Heat treatment process allows for the improvement in product performance through improvement in material characteristics.

Aluminum and its alloys are used in a variety of cast wrought forms and conditions of heat treatment. Forging, extrusions, sections etc. are examples of wrought products, while sand, gravity and pressure die castings are generally adopted casting methods.



Solution heat treatment involves heating of aluminum alloy to a particular temperature for sufficient time so that the alloying elements go into solid solution and form a single phase. The factors which affect the final properties of the alloy are soaking temperature, soaking time and cooling rate.

The soaking temperature depends on various phases which are present in alloys. Each phase will dissolve in solid solution at different rates. The soaking time is based on the rate of dissolution of alloying elements into solid solution. It also depends on the conditions under which the alloy is cast. Sand cast parts have coarser structure than permanent mould casting. Hence aluminium sand castings take time for dissolution of phases necessitating longer soaking time.

Here is an example commonly applied for a session of T6 heat treatment process, giving rise to a hardness between 80-100 BHN.

- Solutionising: keep materials in furnace at 525 ° Cel. for 8 hours;
- Quenching: sudden quenching in water at 30 ° Cel;
- Natural Ageing: up to 5 hours;
- Precipitation: keep in furnace at 165 ° Cel. for 8 hours.

For highly stressed castings it is usually necessary to use heat-treatable alloy. Full heat treatment involves rapid quenching of castings from high temperature solution treatment. The designer must recognize that this process imposes limitations on the size and complexity of castings and that some precautionary measures, such as the use of cast tie bars, may be necessary to minimize distortion of large or intricate castings. Alternatively, for some castings the use of a less strong alloy not requiring full heat treatment is preferred, the deficiency in strength being overcome by increased scantlings in the casting.