HEAT TREATMENT OF NONFERROUS METALS

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ALUMINIUM ALLOY

- Aluminum is a white, lustrous metal, light in weight and corrosion resistant in its pure state. It is ductile, malleable, and nonmagnetic. Aluminum combined with various percentages of other metals, generally copper, manganese, and magnesium, form the aluminum alloys that are used in aircraft construction. Aluminum alloys are lightweight and strong, but do not possess the corrosion resistance of pure aluminum and are generally treated to prevent deterioration. **"Alclad"** is an aluminum alloy with a protective coating of aluminum to make it almost equal to the pure metal in corrosion resistance.
- Several of the aluminum alloys respond readily to heat treatment. In general, this treatment consists of heating the alloy to a known temperature, holding this temperature for a definite time, then quenching the part to room temperature or below. During the heating process, a greater number of the constituents of the metal are put into solid solution. Rapid quenching retains this condition, which results in a considerable improvement in the strength characteristics.

- The heating of aluminum alloy should be done in an electric furnace or molten salt bath. The salt bath generally used is a mixture of equal parts of potassium nitrate and sodium nitrate. Parts heated by this method must be throughly washed in water after treatment. The salt bath method of heating should never be used for complicated parts and assemblies that cannot be easily washed free of the salt.
- **Heat Treating Procedures**
- There are two types of heat treatment applicable to aluminum alloys. They are known as solution and precipitation heat treatment. Certain alloys develop their full strength from the solution treatment, while others require both treatments for maximum strength. The NA 01-1A-9 lists the different temper designa-tions assigned to aluminum alloys and gives an example of

the alloys using these temper designations.

- **SOLUTION HEAT TREATMENT.—** The solution treatment consists of heating the metal to the temperature required to cause the constituents to go into a solid solution.

To complete the solution, often the metal is held at a high temperature for a sufficient time, and then quenched rapidly in cold water to retain this condition. It is necessary that solution heat treatment of aluminum alloys be accomplished within close limits in reference to temperature control and quenching. The temperature for heat-treating is usually chosen as high as possible without danger of exceeding the melting point of any element of the alloy. This is necessary to obtain the maximum improvement in mechanical properties. If the maximum specified temperature is exceeded, eutectic melting will occur. The consequence will be inferior physical properties, and usually a severely blistered surface. If the temperature of the heat treatment is low, maximum strength will not be obtained.

COPPER

- Copper tends to become hard and brittle, when hammered or cold worked. It can be softened by annealing. All plates, rods, tubes etc of copper are thoroughly annealed before use. Annealing is done by heating to a dull red colour (650°C), keeping the pieces at this temperature for a few minutes, and then quenching in water or allowing it to cool in the air. During the process of drawing into wire, copper must be annealed to avoid fracture.
- Copper should not be heated in a reducing atmosphere, such as coal gas or carbon monoxide produced on the brazing hearth with a slow fire. Prolonged heating at a high temperature will also produce brittleness due to very coarse crystallization.

BRASS

- Brass is hardened by cold working. It can be annealed by heating between 535°C to 670°C and cooled either in air or water. Normalizing is done by heating it up to 700°C and cooling either in air or water.

ZINC

- Zinc is bluish white metal. It is brittle at normal temperature, but is malleable and ductile between 100°C to 150°C. Small pieces of zinc can be annealed by dipping them in boiling water. The temperature should be such that a hand touch can bear. Large jobs may be annealed by heating with a blowlamp or torch to the same temperature, which the hand can bear.