

## ALUMINIUM BRONZES ALLOYS

Aluminium bronzes are copper-base alloys with an addition of aluminium up to 14 per cent. They are noted for their exceptional strength and corrosion resistance. Aluminium bronzes have been available for more than seventy years and for the past half century the 'complex' alloys with additions of iron, nickel and manganese

have been produced. Today, commercial alloys normally contain aluminium within the limits of between 5 - 12 per cent, usually with appreciable amounts of the alloying elements mentioned above.

Although the properties of aluminium bronze have always been readily appreciated by designers, their use was originally restricted by difficulties in casting and fabrication. This was due principally to the use of production techniques developed for brass and bronze; these were unsuitable and resulted in a bias against aluminium bronzes which may still exist today in some sections of the brass foundry industry.

In France and the United States greater use was originally made of aluminium bronzes than in Britain, although the superiority of this group of alloys for certain applications aroused the interest of many British engineers. Over the past thirty years, however, aluminium bronzes have found increasing popularity and wartime experience led to the recognition of their ideal suitability for sea-water service. Intensive research by the Admiralty and other establishments on the problems involved has led to aluminium bronze now being specified on an increasing scale for numerous components in HM ships. These alloys have been widely adopted throughout all branches of industry and are readily available as both sand and diecastings, and in all wrought forms.

## CORROSION RESISTANCE

The aluminium bronzes are a family of copper-base alloys containing approximately 5% to 11% aluminium, some having additions of iron, nickel, manganese or silicon. They include alloys suitable for sand casting, gravity diecasting and for the production of forgings, plate, sheet, tube, strip, wire and extruded rods and sections. Compared with other copper alloys, the higher strength of the aluminium bronzes is combined with excellent corrosion resistance under a wide range of service conditions. Maximum corrosion resistance is provided by control of the composition and manufacturing history of the material.

No engineering alloy is immune to corrosion. Corrosion resistance depends upon the formation of a thin protective film or layer of corrosion products which prevents or substantially slows down the rate of attack. The aluminium content of aluminium bronzes imparts the ability to form, very rapidly, an alumina-rich protective film which is highly protective and is not susceptible to localised breakdown and consequent pitting in the presence of chlorides. Aluminium bronzes are, therefore, very resistant to corrosion by sea water and probably find more use in sea water service than in any other environment.

High resistance to corrosion fatigue is essential for marine propellers and it is principally for that reason that most large propellers are made from nickel aluminium bronze. This material is quite outstanding in resistance to corrosion fatigue in sea water, being much superior to high tensile brass or to stainless steels. Manganese aluminium bronze, which is also used for large propellers, also has high corrosion fatigue strength though somewhat inferior to nickel aluminium bronze.