Superston Seventy propeller alloy

Introduction

Superston seventy is a copper manganese aluminium alloy, developed from Novoston propeller alloy. Superston and Novoston are basically aluminium bronze with higher manganese content. They have many of the virtues of nickel aluminium bronze without some of the disadvantages. Its lower melting point improves handling in the foundry, it becomes malleable at lower temperatures from its melting point to sub zero temperatures.

Composition

	Superston seventy %	Novoston %
Copper	Balance	Balance
Aluminium	7.0 - 8.2	7.3 – 8.3
Tin	0.2 max	0.3 max
Manganese	13.5 – 15.5	11.0 – 13.5
Iron	2.0 – 4.0	2.0 – 4.0
Nickel	1.5 – 2.5	1.5 – 2.5
Lead	0.03 max	0.05 max
Silicon	0.15 max	0.15 max
Zinc	1.0 max	1.0 max

Superston alloy is supplied to meet the requirements of Lloyd's, DNV, GL, BV and ABS.

Mechanical Properties

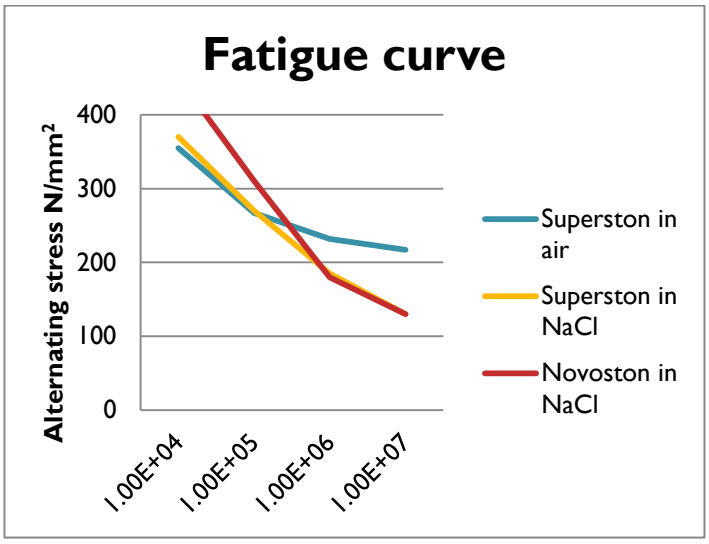
The mechanical properties of the manganese aluminium bronzes are given in the table below, and are superior to other copper base alloys used for the manufacture of large marine propellers.

	Superston 70		Novoston	
Property	Range	Typical	Range	Typical
0.1 % proof stress N/mm2	310 – 390	355	275 – 320	300
Tensile strength N/mm2	690 – 755	720	650 – 710	680
Elongation, % on 5.65√So	20 – 35	27	20 – 35	27
Hardness, Brinell	170 – 210	190	160 – 210	185
Izod N.m	26.5 – 47.1	40.2	26.5 – 47.1	40.2

Fatigue Resistance

It is important that propellers should resist the fluctuating stresses imposed on the rotating blades by the varying wake of the ship across the propeller disc, and this is one of the limiting factors of design stress.

The results of Wöhler fatigue tests, using single point loading and 9.3 mm diameter specimens spinning at 2850 rpm produced the following SN curve. The tests were also carried out in 3% sodium chloride solution spray to simulate sea water.



copper base alloys and stainless steels. Although, tests have shown that contact with the latter has no marked effect except under static conditions.

A few cases of stress corrosion cracking have come to light in Superston seventy in service have all been associated residual stresses left in the propeller after intense local heating. The cracking has usually been caused by welding without subsequent heat treatment or by local heating of the boss to assist propeller removal.

Corrosion Resistance

Under operating conditions propellers are subject to wastage also known as impingement corrosion, known sometimes as corrosion-erosion, in which the inner, slower moving parts of the propeller develop a film which is cathodic to, and stimulates corrosion of, the outer, faster moving parts. Superston seventy has high resistance to this type of attack, which the results of discs tested in sea water concluded. When cathodic protection was added the attack was almost completely prevented.

Superston seventy has been shown by the experience of years in service to have high resistance to corrosion in rapidly moving, turbulent sea water for most propeller applications.

Superston seventy is cathodic to zinc, aluminium alloys and mild steel, anodic to nickel base alloys and slightly anodic to most

Repair

Repair is relatively simple and the main point to watch is that no residual stresses are left in the propeller such as could lead to stress corrosion cracking in subsequent service. Such stresses can be avoided by making certain that temperature gradients are shallow, by cooling slowly after hot straightening, by using only gentle heating to assist propeller fitting and removal, and by heat treating welds.

Physical Properties

Property	Unit	Superston seventy	Novoston
Melting range	°C	935 – 980	950 – 990
Specific gravity		7.4	7.45
Coefficient of thermal expansion	per °C	17.7×10^{-6} (0-100°)	17.7×10^{-6} (0-100°)
Thermal conductivity At 20°C	Cal/cm^2 /cm/sec /°C	0.029	0.029
Electrical conductivity At 20°C	% I.A.C.S	55	55
Modulus of elasticity	kg/cm^2	1.2×10^6	1.2×10^6