

Application Data Sheet Heat Exchanger Tube

rev 02

Other names

Condenser, cooler, boiler or heater tube

This document may be used as a basic alloy selection and cross reference guide



Cole & Swallow
PRECISION ENGINEERING SOLUTIONS

Introduction

Seamless heat exchanger tubes are almost always manufactured to national specification requirements. The most common being Euronorm **EN12451**, British **BS2871 Pt3** and USA based **ASTM B111 & ASME SB111**. Some organisations and applications require additional testing but often refer to these as parent specifications. The most common alloys are detailed in the table below; copper alloys are specified because they exhibit the best combination of corrosion resistance and thermal characteristics.

Seam welded tube is covered by other specifications but is not yet widely accepted in Europe.

The specifications include the required ordering instructions but a good supplier will recognise the end use and quote accordingly or assist in the development of a purchase specification if required.

Seamless tube is almost always cold drawn to finished size, the original raw material having been extruded to a larger diameter / wall thickness combination. This may take a number of process steps included drawing, lubrication, annealing or other specific heat treatment.

The specifications require a number of destructive tests and non-destructive examinations [NDE] to be performed to verify quality. For example either eddy current [usually] or pressure testing at the final stage of production. Additional or alternative testing may be specified as required; for example pneumatic pressure testing in lieu of standard eddy current.

NDE possibilities:

eddy current external

pressure [hydraulic – high pressure water] test

pressure [pneumatic – low pressure air] test

eddy current bore probe

ultrasonic examination

ultrasonic thickness verification

Other tests:

hardness test

expansion or 'drift'

residual stress verification

mechanical tests

bending / double bending

grain size verification

Minimum wall thickness

Unless specifically requested it is normal to quote & manufacture average wall thickness tube; i.e. with a +/- tolerance band. However some applications, like those calling up the ASME SB111 specification, require a minimum wall specification with means we work to a + + tolerance on the wall. This means a heavier wall with more weight of material has to be produced

Further fabrication

Heat exchanger tubes may be used in straight lengths direct from our mill, fabricated in U-bends and /or finned to enhance the surface area and therefore thermodynamic characteristics.

Double wall, bi-metallic or leak detector tubes

We produce double wall tubes with either plain or 'leak path' outer tubes. These can be used in difficult applications with hard to match corrosion/oxidation requirements or in critical cooling systems where complete coolant failure cannot be tolerated.

Tube or pipe?

Tube is generally considered to be specified by the outside diameter plus either the wall thickness or inside diameter. Pipe sizes are usually understood to relate to the inside diameter or bore size and may be expressed as a 'schedule' size.



| ALLOY | TYPE | BSI | BS EN | ISO | UNS/ASTM (similar CDA) | OTHER & COMMON NAMES | BS 2871 Pt3 (ASTM B111) (JIS H3300) |
|-----------------------|--------|-------|--------|--------------|---------------------------|--|---|
| Copper Nickel: | | | | | | | |
| | 90/10 | CN102 | CW352H | CuNi10Fe1Mn | C70600 | 90/10 CuproNickel, Kunifer 10 ³ | EN12451 |
| | 70/30 | CN107 | CW354H | CuNi30Mn1Fe | C71500 | 70/30 CuproNickel, Kunifer 30 ³ | EN12451 |
| | | | | | C71520 | low residual elements for welding | |
| | 66/2/2 | CN108 | CW353H | CuNi30Fe2Mn2 | C71640 | 66/2/2 CuproNickel, Yorcoron ³ | EN12451 |
| Brass: | | | | | | | |
| | 90/10 | CZ101 | CW501L | CuZn10 | C22000 | Gilding Metal, Red Brass, Bronze | |
| | 70/30 | CZ126 | CW707R | CuZn30As | - | Arsenical Brass | EN12451 |
| | 80/20 | CZ110 | CW702R | CuZn20Al2As | C68700 | Aluminium Brass, Yorcalbro ³ | EN12451 |
| | 72/28 | CZ111 | CW706R | CuZn28Sn1As | C44300 | Admiralty Brass | EN12451 |
| Copper: | | | | | | | |
| | 99.85 | C106 | CW024A | Cu-DHP | C12200 | Phosphorus Deoxidised, SF-Cu, PDO, Cu-b1 | EN12451 |

³ Tradename of IMI

Copper alloys are specified because they exhibit the best combination of corrosion resistance and thermal characteristics. In addition all the copper alloys are resistant to biofouling, meaning that encrustations of barnacles and seaweed rarely occur and subsequently blocked tubes are rarely experienced. These alloys are therefore extensively used in marine environments.

The **copper nickels** are widely considered the most corrosion resistant copper alloys and are also strong enough to consider if higher flow rates are expected or higher pressure systems are being designed. These alloys are almost immune to stress corrosion cracking and can also operate at cryogenic temperatures without becoming brittle and without special heat treatments.

The high manganese alloy, CuNi30Fe2Mn2, has been specifically designed to better resist abrasion from entrained sand particles.

Brasses offer a lower cost alternative and can show improved corrosion characteristics over copper nickels in some environments.

Admiralty brass is widely used in estuarine and brackish water situations.

Aluminium brass forms a unique complex oxide that is resistant to corrosion in clean waters; it should not be used in stagnant or polluted water situations.

Copper has a significant thermal transfer advantage over the alloys and should be considered wherever feasible.

Cole & Swallow Materials Limited has provided this information for the benefit of its customers, it is believed to be correct on all counts, however no liability is accepted for the accuracy of the information.



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