

Procedure for

Inspection, testing and acceptance of wrought copper alloys

Committees responsible for this British Standard

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- Aluminium Federation
- British Forging Industry Association
- British Investment Casting Trade Association
- British Non-ferrous Metals Federation
- Copper Development Association
- Light Metal Founders' Association
- Ministry of Defence
- Society of British Aerospace Companies Limited

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Foreword

This British Standard has been prepared under the direction of the Aerospace Standards Policy Committee. It specifies procedures for the inspection, testing and acceptance of wrought copper base alloys to be used for aerospace purposes. The procedures specified are for use in conjunction with the relevant material specifications in the British Standard Aerospace B series. The procedures are also applicable to other British Standard material specifications for wrought copper base alloys for aerospace use, where appropriate. The format adopted is similar to that used by AECMA (Association Européenne des Constructeurs de Matériel Aérospatial) for European aerospace technical specifications.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 20, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

Section 1. General

1.1 Scope

This British Standard specifies procedures for inspection, testing and acceptance of wrought copper-based alloys for aerospace purposes. It is applicable to the following, which are covered in separate sections of the standard:

- a) rod and sections (section 2);
- b) forging stock (section 3);
- c) forgings (section 4);
- d) seamless tube (section 5);
- e) sheet, strip and foil (section 6);
- f) wire (section 7).

The standard is applicable to material specifications in the British Standard Aerospace B series and also to other British Standard material specifications for wrought copper base alloys which are suitable for aerospace use. Rules for the application of values for chemical composition and mechanical properties given in material specifications are covered in Appendix A.

NOTE The titles of the publications referred to in this standard are listed on the inside back cover.

1.2 Definitions

For the purposes of this British Standard the following definitions apply. For convenience, some of the definitions given in BS 6931 are repeated here.

1.2.1

batch

quantity of a product of the same nominal dimensions and treated as a set for quality control purposes

NOTE Batch sizes for specific products are given in the relevant sections of this standard.

1.2.2

cast

metal taken from the same melt in a furnace or crucible or from several melts mixed in the same furnace or crucible; or, when a continuous process is used, metal taken from the furnace before the next charge

1.2.3

design authority

the organization responsible for the detailed design of materiel and which has the responsibility for certifying designs and/or for sealing drawings and specifications

1.2.4

foil¹⁾

a wrought material of uniform thickness of 0.15 mm, or less, of any width over 10 times the thickness supplied flat, folded or in coil

1.2.5

forging¹⁾

a shape produced by hammering or pressing between open or closed dies, including hammering between flat surfaces, normally when hot

NOTE The term "forging" includes the processes of forging, drop forging, hot stamping and hot pressing; the term "forgings" includes the products resulting from any of these processes of manufacture.

1.2.6

forging stock¹⁾

extruded, rolled, drawn or cast material intended for the production of forgings, usually in the form of rod, bar or sections

1.2.7

harmful defect

any defect prejudicial to the suitable and proper use of the material

1.2.8

hollow rod

a hollow wrought product of uniform cross section with only one enclosed void along its whole length

1.2.9

manufacturer

the company that produces the material in the form and condition in which it is supplied to the purchaser

1.2.10

pre-production forgings

forgings produced to a particular design to qualify the method of manufacture and equipment configuration and to demonstrate that the requirements of the purchaser can be met

1.2.11

purchaser

the company which orders and purchases the product

1.2.12

quality assurance authority

the body responsible for authorizing the manufacturer or supplier to issue certification, when to certify means to attest as meeting a standard

¹⁾ Repeated from BS 6931.

**1.2.13
rod²⁾**

a solid wrought product of uniform cross section along its whole length, usually supplied in straight lengths

NOTE The term “bar” is often used to denote a rod of comparatively large cross section, and, especially a heavy rectangular cross section.

**1.2.14
section²⁾**

a wrought product of uniform cross section along its whole length with a cross-sectional shape other than that of a rod, bar, hollow rod, wire, tube, sheet or strip, usually supplied in straight lengths

**1.2.15
sheet²⁾**

a flat wrought product of exact length and of rectangular cross section with uniform thickness over 0.15 mm up to and including 10.0 mm, supplied in straight lengths (i.e. flat) and usually with sheared or sawn edges. The thickness does not exceed one-tenth of the width

**1.2.16
strip²⁾**

a product of rectangular cross section with a uniform thickness over 0.15 mm, usually supplied in coils but may be flat or folded. The edges are usually slit to size but the length is not exact. The thickness does not exceed one-tenth of the width

**1.2.17
supplier**

an organization which has not necessarily made the product, but which supplies it to the purchaser

**1.2.18
test piece**

a test sample, or a portion of a test sample, as finally prepared for testing

**1.2.19
test sample**

that portion of the material selected for testing

**1.2.20
tube²⁾**

a hollow wrought product of uniform cross section with only one enclosed void along its whole length, and with a uniform wall thickness, supplied in straight lengths or in coiled form

**1.2.21
wire²⁾**

a solid wrought product of uniform cross section along its whole length supplied in coil form or on spools, reels or drums

1.3 Information and requirements to be agreed and to be documented**1.3.1 Information to be supplied by the purchaser**

The following information to be supplied by the purchaser, which is specified in the clauses referred to, shall be fully documented on the order, drawing or inspection schedule, on which the number of this British Standard shall also be given.

Both the definitive requirements specified throughout the standard and the following documented items shall be satisfied before a claim of compliance with the standard can be made and verified.

General

- a) the number of the material specification with which this standard is to be used;
- b) the required delivery condition of the material, if other than that specified in the material specification (see 1.4.3);
- c) the maximum limits for elements not named in the material specification, if no limits for these elements are given in the material specification (see 1.6.2.6);
- d) if ultrasonic testing is required, in cases where this is not a requirement of the material specification (see 2.3.2.2, 3.3.2.2 and 4.4.3.1);
- e) the dimensional tolerances required, if no tolerances are given in the material specification or if tolerances other than those given in the material specification are required for a particular use (see 2.3.2.3, 3.3.2.3, 5.3.2.3, 6.3.1.2 and 7.3.2.2);
- f) the tensile properties required if other than those given in the material specification (see 3.3.3.5 and 4.4.4.5);
- g) the hardness required if other than that given in the material specification (see 3.3.4.3);

Forgings only

- h) any particular procedure required for visual examination (see 4.4.3.2.1);
- i) if ultrasonic testing is required, the stage of manufacture at which this is to be carried out (see 4.4.3.3.2);

²⁾ Repeated from BS 6931.

- j) any dimensions which require checking on each forging (see 4.4.3.4.2);
 - k) the procedure required for producing batch release tensile test samples (see 4.4.4);
 - l) the required location of the test pieces for tensile tests if other than that specified in 4.4.4.2;
 - m) the required sampling frequency for tensile tests, if other than that specified in 4.4.4.1;
 - n) if grain flow examination is required, the type and frequency (see 4.4.6.1) and the required characteristics (see 4.4.6.2);
 - o) any markings required in addition to those specified in 4.5.1 a) to e);
 - p) the required position of the markings (see 4.5.2);
- Sheet, strip and foil only*
- q) if more than one sample is required from a coil (see 6.3.2.1.5).

1.3.2 Items to be agreed between the contracting parties

The following items to be agreed between the contracting parties, which are specified in the clauses referred to, shall be fully documented.

Both the definitive requirements specified throughout the standard and the following documented items shall be satisfied before a claim of compliance with the standard can be made and verified.

General

- a) the ultrasonic testing technique to be used and the acceptance level, where these are not given in the material specification (see 2.3.2.2, 3.3.2.2, and 4.4.3.3.1);

Forgings only

- b) the dimensional tolerances of the forgings (see 4.4.3.4.1);
- c) the sampling requirements for the residual stress test (see 4.4.7.2);

Sheet, strip and foil only

- d) the method for taking one or more additional samples from a coil, where applicable (see 6.3.2.1.5).

1.4 Manufacture and freedom from defects

1.4.1 The method of manufacture shall comply with the material specification. If alternative methods are given in the material specification, or if no method is specified, the selection of the method shall be at the discretion of the manufacturer.

1.4.2 The material shall be delivered in the condition specified in the material specification or on the order [see 1.3.1 b)].

1.4.3 The material shall be free from harmful defects.

1.4.4 Notwithstanding prior acceptance of a material as complying with this standard, any defect in the material which is found at a later stage and which is likely to be detrimental to subsequent use, shall be a cause for rejection.

1.5 Heat treatment

1.5.1 Heat treatment shall be carried out in accordance with the material specification.

1.5.2 Temperature control during heat treatment shall be in accordance with BS M 54.

1.5.3 If a specific temperature (value and tolerance) is given in the material specification, that temperature shall be used. If a temperature range is given in the material specification, a temperature within that range, reduced by the tolerance, shall be selected that will give the properties specified in the material specification. The charge shall be maintained at the heat treatment temperature $\pm 5^\circ\text{C}$ for the period given in the material specification. If no period or temperature are given in the material specification these shall be at the discretion of the manufacturer.

1.6 Testing

1.6.1 General

1.6.1.1 The tests carried out and the test methods used shall comply with either:

- a) the material specification; or
- b) the relevant section of this standard; or
- c) the order or inspection schedule.

(See 1.3.)

1.6.1.2 The frequency of sampling shall be as given in the relevant section of this standard.

1.6.2 Chemical composition

1.6.2.1 The chemical composition shall comply with the material specification.

NOTE The manufacturer should carry out chemical analysis of samples at the casting stage so that any necessary corrective action can be taken at that stage to ensure subsequent compliance with the material specification.

1.6.2.2 The chemical composition of each batch of material shall be determined.