

Specification for

# Copper beryllium crinkle washers

ICS 49.030.50

This British Standard, having been approved by the Aerospace Industry Standards Committee and endorsed by the Chairman of the Engineering Divisional Council was published under the authority of the General Council of the Institution on 20 September 1968

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## Foreword

This British Standard is published by BSI Standards Limited, under licence from The British Standards Institution.

BS SP 134 to SP 138:1968+A1:2012 supersedes BS SP 134 to SP 138:1968, which is withdrawn.

Text introduced or altered by Amendment No. 1 is indicated in the text by tags **A1** ~~A1~~. Minor editorial changes are not tagged.

This British Standard has been prepared at the request of the Aerospace Industry to provide a series of copper beryllium crinkle washers, having a range of alternative finishes, suitable for aerospace applications. It is based upon BS 3401, “*Beryllium copper crinkle washers*”, and differs from that specification in that it lists a range of washers in current use together with their part or code numbers.

**CAUTION.** BS SP 135 washers have cadmium as a plating material, which has been restricted and/or banned for use in many countries owing to environmental and health concerns; it should not be used in new product designs. Local officials should be consulted about any concerns on the use of cadmium-plated parts.

This standard makes reference to the following publications:

*British Standards*

BS 1872, *Specification for electroplated coatings of tin*

BS EN 1652, *Copper and copper alloys – Plate, sheet, strip and circles for general purposes*

BS EN 1654, *Copper and copper alloys – Strip for springs and connectors*

BS EN 2133, *Cadmium plating of steels with specified tensile strength  $\leq 1450$  MPa, copper, copper alloys and nickel alloys*

BS EN ISO 6507-1, *Metallic materials – Vickers hardness test – Part 1: Test method*

Def Stan 03-19, *Electro-Deposition of Cadmium*

Def Stan 03-9, *Process specification for silver plating*

Def Stan 03-10, *Process specification for nickel plating*

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

**Compliance with a British Standard cannot confer immunity from legal obligations.**

### Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 and 2 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.

## 1 Scope

This standard specifies dimensions, tolerances and general requirements for a series of copper beryllium crinkle washers suitable for use with screwed fasteners ranging from 0.060 in (Unified No. 0) to 0.750 in nominal diameter. It provides for natural finish, BS SP 134; cadmium coating, BS SP 135; silver coating, BS SP 136; nickel coating, BS SP 137; and tin coating, BS SP 138.

NOTE The values stated in British units are to be regarded as the standard and the metric equivalents are approximate. More accurate conversions should be based upon the data in BS 350, "Conversion factors and tables".

## 2 Nomenclature

For the purposes of this British Standard the washers shall be known as "Copper beryllium crinkle washers".

## 3 Material

**A1** Washers conforming to this specification shall be manufactured from material conforming to BS EN 1652, designation CW101C, or BS EN 1654, designation CW101C, such that after suitable heat treatment they shall have a hardness in the range 350 HV to 380 HV, when tested in accordance with the provisions of BS EN ISO 6507-1. **A1**

## **A1** 4 Protective finish

Washers conforming to these British Standards shall be finished to the latest issue of the standards specified in Table 1. **A1**

## 5 Freedom from defects

The surfaces of the washers shall be clean, smooth and free from scale or harmful defects.

## 6 Dimensions

The dimensions of the finished washers in the unplated condition shall be in accordance with Table 3.

## 7 Identification

**7.1** The washers shall be identified for ordering purposes by the relevant British Standard number (see Table 1) and the appropriate part number or code letter (see Table 3), for example a self-coloured washer for a 0.25 in diameter fastener would be identified as **A1** SP134E **A1**.

**7.2** The British Standard number and code letter shall not be applied direct onto the washers, but they shall be marked on the labels or parcels containing washers complying with this British Standard.

## 8 Closing test for permanent set

Sample washers shall be selected from batches in accordance with Clause 9. The samples shall be completely closed: on release of the pressure the overall height of each washer shall be not less than twice its sectional thickness. This application and removal of pressure shall then be repeated twenty times in quick succession, after which the overall height of the washer shall not have been reduced to less than 1.8 times its sectional thickness.

## 9 Sampling procedure

**9.1 Definition of a batch.** For the purpose of this standard a batch shall consist of a number of washers of the same size made from material of the same strip (or cast).

**9.2 Sampling size.** For the test specified in Clause 8, a sample shall be selected in accordance with Table 2.

**9.3 Testing samples.** The samples selected shall be given the test specified in Clause 8 and if there are no failures the batch shall be accepted.

**9.4 Repeat tests.** Should not more than 20 % of the first sample fail to pass the test in Clause 8 a repeat test may be carried out on a new sample of the same size. If all the washers in this second sample pass the test then the batch shall be deemed to comply with the standard.

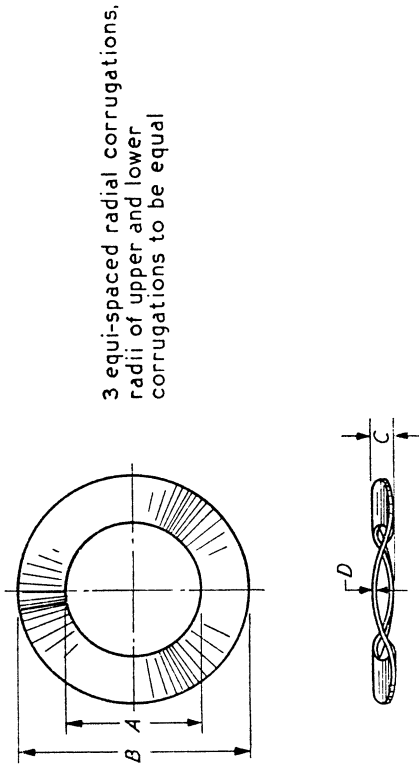
**9.5 Rejection.** If more than 20 % of the first sample or any of the second sample fail to pass the test, then the batch shall be deemed not to comply with the standard.

Table 1 — Finishes

BS No.	<b>A1</b> Protective finishes
BS SP 134	Self coloured
BS SP 135	Cadmium coated to Def Stan 03-19 or BS EN 2133
BS SP 136	Silver coated to Def Stan 03-9
BS SP 137	Nickel coated to Def Stan 03-10
BS SP 138	Tin coated to BS 1872 Cu/Cu/Sn/8/m <b>A1</b>

Table 2 — Batch sampling sizes

Batch size	Sample
1–500	5
501–5 000	10
5 001–20 000	20
20 001 and over	50



3 equi-spaced radial corrugations, radii of upper and lower corrugations to be equal

Table 3 — Dimensions of copper beryllium crinkle washers

1 Code letter	2 Nominal size		3 Internal diameter A			4 External diameter B			5 Height C			6 Thickness D <sup>a</sup>			
	Unified No.	BA <sup>b</sup> No.	max. in	min. in	max. mm	min. mm	max. in	min. in	max. mm	min. mm	max. mm	min. mm	nominal in	nominal mm	
Y	0	10	0.080	0.075	2.03	1.90	0.155	0.145	3.94	3.68	0.020	0.014	0.36	0.0060	0.152
Z	2	8	0.100	0.095	2.54	2.41	0.211	0.201	5.36	5.11	0.021	0.013	0.38	0.0060	0.152
A	4	6	0.130	0.125	3.30	3.18	0.255	0.245	6.48	6.22	0.024	0.018	0.46	0.0060	0.152
B	6	4	0.157	0.152	3.99	3.86	0.305	0.295	7.75	7.49	0.031	0.025	0.64	0.0084	0.213
C	8	—	0.181	0.176	4.60	4.47	0.345	0.335	8.76	8.51	0.033	0.027	0.84	0.0108	0.274
D	10	2	0.208	0.203	5.28	5.16	0.380	0.370	9.65	9.40	0.035	0.029	0.74	0.0124	0.315
E	0.250 in		0.271	0.266	6.88	6.76	0.505	0.495	12.83	12.57	0.045	0.039	1.14	0.0148	0.376
G	0.312 in		0.337	0.332	8.56	8.43	0.605	0.595	15.37	15.11	0.055	0.049	1.40	0.0148	0.376
J	0.375 in		0.411	0.406	10.43	10.31	0.705	0.695	17.91	17.65	0.067	0.061	1.70	0.0220	0.559
L	0.437 in		0.474	0.469	12.04	11.91	0.825	0.815	20.96	20.70	0.075	0.065	1.90	0.0220	0.559
N	0.500 in		0.536	0.531	13.61	13.49	0.955	0.945	24.26	24.00	0.081	0.071	2.06	0.0220	0.559
Q	0.625 in		0.661	0.656	16.79	16.66	1.175	1.165	29.84	29.59	0.095	0.085	2.41	0.0280	0.711
S	0.750 in		0.786	0.781	19.96	19.84	1.395	1.385	35.43	35.18	0.105	0.085	2.67	0.0280	0.711

<sup>a</sup> [A] The tolerances on the thickness shall be in accordance with the normal tolerance specified for the material in Table 4 of BS EN 1652:1998 and Table 3 of BS EN 1654:1998 for strip up to and including 150 mm (6 in) wide. [A]

<sup>b</sup> BA threads to BS 93. This specification has been rendered obsolescent by Amendment No. 3 (PD 5903).



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