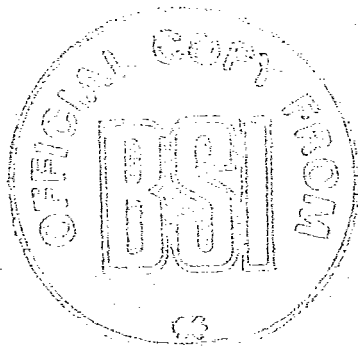


SPECIFICATION FOR
ELECTROPLATED
COATINGS OF GOLD
AND GOLD ALLOY

BS 4292 : 1968



BRITISH STANDARDS INSTITUTION

INCORPORATED BY ROYAL CHARTER

BRITISH STANDARDS HOUSE, 2 PARK ST., LONDON, W.1

TELEGRAMS: STANDARDS LONDON W1

TELEPHONE: 01-622 9000



Documents

Document Sharing Hub

BS 4292 : 1968

THIS BRITISH STANDARD, having been approved by the Surface Coatings (other than Paints) Industry Standards Committee and endorsed by the Chairman of the Engineering Divisional Council, was published under the authority of the General Council on 21st March, 1968.

SBN: 580 00123 7

The Institution desires to call attention to the fact that this British Standard does not purport to include all the necessary provisions of a contract.

In order to keep abreast of progress in the industries concerned, British Standards are subject to periodical review. Suggestions for improvements will be recorded and in due course brought to the notice of the committees charged with the revision of the standards to which they refer.

A complete list of British Standards, numbering over 4000, fully indexed and with a note of the contents of each, will be found in the British Standards Yearbook. The BS Yearbook may be consulted in many public libraries and similar institutions.

This standard makes reference to the following British Standards:

- BS 427. Method for Vickers hardness test.
Part 1. Testing of metals.
- BS 872. Abrasive papers and cloths (technical products).
- BS 1133. Packaging code. Section 14. Adhesive closing and sealing tapes.
- BS 3978. Water for laboratory use.

British Standards are revised, when necessary, by the issue either of amendment slips or of revised editions. It is important that users of British Standards should ascertain that they are in possession of the latest amendments or editions.

The following BSI references relate to the work on this standard:
Committee reference SRE/5

Draft for comment 66/5544

CONTENTS

	Page
Co-operating organizations	4
Foreword	5

SPECIFICATION

1. Scope	5
2. Definitions	6
3. Significant surface	6
4. Condition of surface	6
5. Finish and appearance	6
6. Sampling and testing	6
7. Tests	7
8. Requirements for undercoats	7
9. Requirements for coatings for electrical, electronic and other engineering applications	7
10. Requirements for coatings for general decorative applications	9
11. Requirements for coatings for specialized applications in the jewellery trade	10
12. Marking	12

APPENDICES

A. Determination of coating thickness	13
B. Determination of resistance to corrosion	22
C. Determination of purity	24
D. Adhesion tests	28
E. Determination of hardness	29

BS 4292 : 1968

CO-OPERATING ORGANIZATIONS

The Surface Coatings (other than Paints) Industry Standards Committee, under whose supervision this British Standard was prepared, consists of representatives from the following Government departments and scientific and industrial organizations:

- *Assay Offices Committee of Great Britain
- Association of Metal Sprayers
- British Bolt, Nut, Screw and Rivet Federation
- British Cycle and Motor Cycle Industries Association Limited
- British Electrical and Allied Manufacturers' Association
- *British Jewellers' Association
- *British Non-Ferrous Metals Research Association
- Chemical Industries Association
- Electricity Council, the Central Electricity Generating Board and the Area Boards in England and Wales
- *Electronic Engineering Association
- Engineering Equipment Users' Association
- Greater London Council
- *Institute of Metal Finishing
- Institute of Sheet Metal Engineers
- Institute of Vitreous Enamellers
- *Metal Finishing Association
- Ministry of Defence, Army Department
- *Ministry of Defence, Navy Department
- *Ministry of Technology
- Society of Motor Manufacturers and Traders Limited
- 'The Steel Industry'
- Tin Research Institute
- Vitreous Enamel Development Council
- Zinc Development Association

The Government departments and scientific and industrial organizations marked with an asterisk in the above list, together with the following, were directly represented on the committee entrusted with the preparation of this British Standard:

- Design and Research Centre for the Gold, Silver and Jewellery Industries
- National Association of Goldsmiths
- Post Office
- United Kingdom Cutlery and Silverware Manufacturers' Association



Documents

Document Sharing Hub

BRITISH STANDARD SPECIFICATION FOR ELECTROPLATED COATINGS OF GOLD AND GOLD ALLOY

FOREWORD

This British Standard relates to electroplated coatings of gold and gold alloy for use for electrical, electronic and other engineering applications, for general decorative and jewellery applications and for specialized applications in the jewellery trade where relatively thick coatings to withstand continuous wear over considerable periods are required. This wide field of application, and the fact that the standard is breaking new ground, has made it necessary to include a larger amount of explanatory text than is normal in a British Standard. This is particularly the case in the Appendices where the methods of test each have characteristics which dictate their suitability for a given coating and sometimes for the size of the article.

It should be appreciated that nothing in this standard alters the provisions of the Assay Laws about the hall-marking of wares of gold. In practice, the Assay Offices would not regard an article consisting of an electroplated coating of gold or gold alloy on basis metal as a ware of gold unless it contains more than 12.5% of gold.

When calling for plating to be carried out in accordance with this standard, it is essential that purchasers should state the nature of the basis metal and the Classification Number for the coating required, in addition to the number of this standard.

SPECIFICATION

1. SCOPE

This British Standard specifies requirements for electroplated coatings (single, double or multi-layer) of gold and its alloys for protective, decorative and functional purposes on copper, nickel, silver and their alloys, and also on ferrous metals, zinc, tin, lead and their alloys when provided with suitable undercoats.

In the case of double and multi-layer coatings, the thickness requirements apply to the whole of the coating, but the purity and hardness requirements apply to each layer.

By agreement between the purchaser and the supplier, chemical means may be used to apply coatings complying with this standard, but coatings applied by mechanical means are excluded.

2. DEFINITIONS

For the purposes of this British Standard the following definitions apply:

Surface. The surface on which the electroplater has to work.

Significant surface. The part of the surface which is to be covered by the coating and which is essential to the appearance or serviceability of the article.

Finished state. The condition after all finishing operations, excluding any lacquering.

Gold plated. The finished state of an article that has been given a coating of gold or gold alloy by electrolytic means, the coating having either:

- (1) an average thickness of not less than $0.5\text{ }\mu\text{m}$ and a purity of not less than 90% ('Au' Classification for purity), or
- (2) a local thickness of not less than $2\text{ }\mu\text{m}$ and a purity of not less than 62.5% ('G' Classification for purity).

3. SIGNIFICANT SURFACE

When necessary, the significant surface shall be the subject of agreement and shall be indicated on drawings or by the provision of suitably marked samples.

4. CONDITION OF SURFACE

The condition of the surface to be plated shall be the subject of agreement between the supplier and the purchaser, preferably by the exchange of samples.

NOTE. The condition of the surface to be plated will influence the finish and behaviour of the plated article.

5. FINISH AND APPEARANCE

Over the area of the significant surface, the plated article in the finished state, when inspected by normal vision, shall be free from visible plating defects such as blisters, pits, cracks or unplated areas, and shall not be stained or discoloured. On articles where a contact mark is inevitable, its position shall be the subject of agreement between the supplier and the purchaser.

The plated article shall be clean and free from damage. Where necessary a preliminary sample having the required finish and colour shall be supplied or approved by the purchaser.

6. SAMPLING AND TESTING

Unless otherwise agreed, 1% of a consignment with a minimum of one article shall be tested for compliance with this standard. If any of the samples fail, twice the number of articles in the original sample from the consignment shall

be tested and if any of the further selection fail, the whole consignment shall be deemed not to comply with the requirements of this standard.

7. TESTS

In cases of dispute, the methods of test specified in this standard shall be used for referee purposes.

The plated articles shall be tested in the finished state.

8. REQUIREMENTS FOR UNDERCOATS

8.1 Ferrous basis metals. Coatings on ferrous basis metals shall have an undercoat of nickel 10 μm (minimum) thick or undercoats of nickel 8 μm (minimum) thick on copper 8 μm (minimum) thick.

8.2 Zinc basis metal. Coatings on zinc or zinc alloys shall have undercoats of nickel 8 μm (minimum) thick on copper 8 μm (minimum) thick.

8.3 Tin and lead basis metals. Coatings on tin, tin alloys or lead alloys shall have undercoats of nickel 8 μm (minimum) thick on copper 2 μm (minimum) thick.

8.4 Other basis metals. Coatings on other basis metals or on basis metals with soldered joints may require an undercoat of nickel or copper to meet functional requirements or other requirements of this standard, and shall be applied according to agreement between the purchaser and the supplier.

9. REQUIREMENTS FOR COATINGS FOR ELECTRICAL, ELECTRONIC AND OTHER ENGINEERING APPLICATIONS

9.1 General. The requirements of this clause apply to coatings which are used for functional purposes for electrical, electronic and other engineering applications.

9.2 Thickness. Gold and gold alloy coatings shall be classified by thickness according to Table 1 and denoted by the Classification Number. The methods for determining the thickness of coatings less than 2 μm thick require some appreciable area to be taken from the plated article and therefore the coating thickness obtained is the average value over the area tested. Coatings 2 μm thick and thicker are suitable for local thickness measurements.

Local thickness shall be measured, using the method in Appendix A.2, at any desired number of points on the significant surface that can be touched by a ball 25 mm in diameter. Average thickness shall be determined using one of the methods in Appendix A.3, A.4 or A.5 as appropriate, over any desired number of areas from the significant surface.

TABLE 1
CLASSIFICATION OF COATING THICKNESS
FOR FUNCTIONAL PURPOSES

Classification Number	Minimum coating thickness
	μm^*
Au 0.5	0.5 (average)
Au 1	1 (average)
Au 2	2 (local)
Au 5	5 (local)
Au 10	10 (local)
Au 20	20 (local)

9.3 Corrosion resistance. Coated articles shall be tested for corrosion resistance by the appropriate method as given in Appendix B.

After testing, the significant surface shall be free from corrosion of the coating and of the underlying metal.

9.4 Purity. Coatings shall have a minimum purity of 90%. For some applications a purity greater than 90% is required and in such cases the purity level shall be agreed between the purchaser and the supplier.

The purity of the coating shall be measured by either of the methods given in Appendix C.

NOTE. Although this standard covers pure gold and alloy gold coatings, the requirements of this clause are restricted to coatings of between 90% and 100% purity, since it is considered that less pure alloys are unlikely to be employed to any great extent on electrical, electronic or similar 'engineering' components.

As the corrosion resistance of gold alloy coatings, however, will depend not only on their gold content but also on the specific alloying metals used with the gold, this standard requires that coatings shall withstand the corrosion resistance test as given in Appendix B. Alloy gold coatings which do not have satisfactory intrinsic corrosion resistance (or resistance to tarnishing), therefore, are excluded from this standard, even if they have a purity of 90% or more.

9.5 Adhesion. The adhesion of the coating shall be tested by either or both of the methods given in Appendix D as may be agreed. The coating shall show no signs of blistering after being subjected to the burnishing test, or shall show no signs of having been removed by the tape after being subjected to the adhesive tape test.

9.6 Hardness. Where a value for hardness is agreed between the supplier and the purchaser, the hardness of the coating shall be determined as micro-hardness by the method given in Appendix E.

* To convert 'micrometres' to 'micro-inches' multiply by 40 (approx.).

Unless it is agreed between the supplier and the purchaser to prepare special samples for the tests, hardness tests shall only be specified for coatings at least $10\text{ }\mu\text{m}$ thick, and the surface of the coating shall also be sufficiently smooth and bright as plated to enable the diagonals of the indentation to be clearly defined under the microscope of the micro-hardness instrument.

If the purchaser wishes to specify the hardness of gold coatings thinner than $10\text{ }\mu\text{m}$ he may only do so by agreement with the supplier to have special samples plated to a thickness of at least $10\text{ }\mu\text{m}$, which shall be deposited under the same conditions as those used for the parts being tested, except in so far as the plating time shall be prolonged to give the necessary thickness. In this case, it shall also be agreed that the hardness figures obtained on these special samples are sufficiently close to the real hardness of the thinner coatings to act as a control of the hardness of the latter.

10. REQUIREMENTS FOR COATINGS FOR GENERAL DECORATIVE APPLICATIONS

10.1 General. The requirements of this clause apply to coatings for most decorative applications, that is to coatings that are expected to give reasonable wear over relatively long periods of use including many applications in the jewellery trade. In contradistinction to certain specialized applications in the jewellery trade (see Clause 11), the marking or labelling of individual articles to indicate compliance with this standard is not mandatory. If marking of an article is desired, the requirements of Clause 12 shall apply.

10.2 Thickness. Gold and gold alloy coatings shall be classified by thickness according to Table 2 and denoted by the Classification Number. The methods for determining the thickness of coatings less than $2\text{ }\mu\text{m}$ thick require some appreciable area to be taken from the plated article and, therefore, the coating thickness obtained is the average value over the area tested. Coatings $2\text{ }\mu\text{m}$ thick and thicker are suitable for local thickness measurements.

TABLE 2
CLASSIFICATION OF COATING THICKNESS
FOR DECORATIVE PURPOSES

Classification Number	Minimum coating thickness
	μm^*
Au 0.5	0.5 (average)
Au 1	1 (average)
Au 2 or G 2	2 (local)

* To convert 'micrometres' to 'micro-inches' multiply by 40 (approx.).

Local thickness shall be measured, using the method in Appendix A.2, at any desired number of points on the significant surface that can be touched by a ball 25 mm in diameter. Average thickness shall be determined using one of the methods in Appendix A.3, A.4 or A.5 as appropriate, over any desired number of areas from the significant surface.

10.3 Corrosion resistance. Coated articles shall be tested for corrosion resistance by the appropriate method as given in Appendix B.

After testing, the significant surface shall be free from corrosion of the coating and of the underlying metal.

10.4 Purity. Coatings with an 'Au' Classification Number shall have a minimum purity of 90% and those with a 'G' Classification Number shall have a minimum purity of 62.5% (equivalent to 15 carat).

The purity of the coating shall be measured by the appropriate method given in Appendix C.

NOTE. As the corrosion resistance of gold alloy coatings will depend not only on their gold content but also on the specific alloying metals used with the gold, this standard requires that coatings shall withstand the corrosion resistance test as given in Appendix B. Alloy gold coatings which do not have satisfactory intrinsic corrosion resistance (or resistance to tarnishing), therefore, are excluded from this standard, even if they satisfy the purity requirements.

10.5 Adhesion. The adhesion of the coating shall be tested by either or both of the methods given in Appendix D as may be agreed. The coating shall show no signs of blistering after being subjected to the burnishing test, or shall show no signs of having been removed by the tape after being subjected to the adhesive tape test.

10.6 Hardness. Where a value for hardness is agreed between the supplier and the purchaser, the hardness of the coating shall be determined as micro-hardness by the method given in Appendix E.

For this test the supplier shall have special samples plated to a thickness of at least 10 μm , which shall be deposited under the same conditions as those used for the parts being tested, except in so far as the plating time shall be prolonged to give the necessary thickness. It shall also be agreed that the hardness figures obtained on these special samples are sufficiently close to the real hardness of the thinner coatings to act as a control of the hardness of the latter.

11. REQUIREMENTS FOR COATINGS FOR SPECIALIZED APPLICATIONS IN THE JEWELLERY TRADE

11.1 General. The requirements of this clause apply to coatings for those specialized applications in the jewellery trade where relatively thick coatings to withstand continuous wear over considerable periods are required and for which the marking or labelling of individual articles to indicate compliance with this standard is obligatory, such marking being to the requirements of Clause 12.