

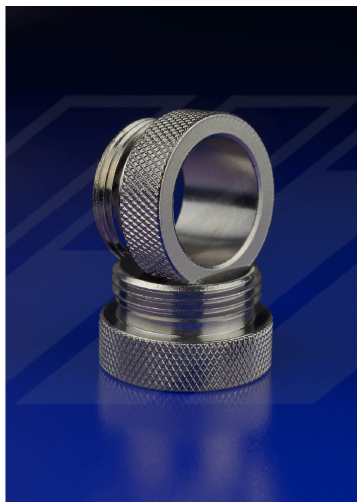
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405 W Cherry St.  
Milwaukee, WI 53212

MIL-DTL-45204D

29 June 2007

SUPERSEDING

MIL-G-45204C

7 June 1983

w/AMENDMENT 3

9 June 1993

## DETAIL SPECIFICATION

## GOLD PLATING, ELECTRODEPOSITED

This specification is approved for use by all Departments and Agencies of the Department of Defense.

## 1. SCOPE

1.1 Scope. This specification covers electrodeposited gold plating on metallic surfaces (see 6.1)

1.2 Classification. Gold plating will be furnished in the following types, classes, and hardness grade as specified (see 6.2).

1.2.1 Types. The following types will contain the minimum level (purity) of gold as specified in Table I.

1.2.2 Grades. The grades listed in Table II are assigned to the above types. If the hardness grade for the gold coating is not specified in the contract or purchase order, then Type I will be furnished at hardness Grade A and Type II will be furnished at hardness Grade C.

1.2.3 Purity (Type) and Hardness (Grade) relationship. The purity and hardness combinations will be as designated in Table III.

Comments, suggestions, or questions on this document should be addressed to: Director, U.S. Army Research Laboratory, Weapons and Materials Research Directorate, Materials Applications Branch, Specifications and Standards Office, Attn: AMSRD-ARL-WM-MC, Aberdeen Proving Ground, MD 21005-5069 or emailed to [rsquilla@arl.army.mil](mailto:rsquilla@arl.army.mil). Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at <http://assist.daps.dla.mil/>.

AMSC N/A

AREA MFFP

TABLE I. Types.

Type	Minimum Gold Percent
Type I	99.7 percent
Type II	99.0 percent
Type III	99.9 percent

TABLE II. Grades.

Grade	Hardness (Knoop)
Grade A	90 max.
Grade B	91 – 129, incl.
Grade C	130 – 200, incl.
Grade D	201 and over.

TABLE III. Purity vs. hardness.

Purity (Type)	Hardness (Grades)
Type I	A, B, or C
Type II	B, C, or D
Type III	A (only)

1.2.4 Classes. Unless otherwise specified in the contract or purchase order (see 6.2), the thickness will conform to the class designation specified in Table IV.

TABLE IV. Minimum class thickness.

Class	Minimum Thickness (Inches)
Class 00	0.00002
Class 0	0.00003
Class 1	0.00005
Class 2	0.00010
Class 3	0.00020
Class 4	0.00030
Class 5	0.00050
Class 6	0.00150

## 2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3, 4, or 5 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to

ensure the completeness of this list, document users are cautioned that they must meet all specified requirements of documents cited in sections 3, 4, or 5 of this specification, whether or not they are listed.

## 2.2 Government documents.

2.2.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

### DEPARTMENT OF DEFENSE STANDARDS

- MIL-STD-202 - Test Method Standard – Electronic and Electrical Component Parts
- MIL-STD-1916 - DoD Preferred Methods for Acceptance of Product

(Copies of these documents are available online at <http://assist.daps.dla.mil/quicksearch/> or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.3 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

### American Society for Quality (ASQ)

- ASQC-A8402 - Quality Management and Quality Assurance - Vocabulary (DoD Adopted)

(Copies of this document are available from [www.asq.org](http://www.asq.org) or American Society for Quality, 600 Plankinton Avenue, Milwaukee, WI 53203.)

### ASTM INTERNATIONAL

- ASTM B487 - Metal and Oxide Coating Thickness by Microscopical Examination of a Cross Section, Measurement of. (DoD Adopted)
- ASTM B567 - Measurement of Coating Thickness by the Beta Backscatter Method (DoD Adopted)
- ASTM B568 - Measurement of Coating Thickness by X-Ray Spectrometry (DoD Adopted)
- ASTM B578 - Coatings, Electroplated, Microhardness of (DoD Adopted)
- ASTM E8 - Materials, Metallic, Tension Testing of (DoD Adopted)
- ASTM E384 - Materials, Microindentation Hardness of (DoD Adopted)

(Copies of these documents are available from [www.astm.org](http://www.astm.org) or ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959.)

## INTERNATIONAL STANDARDIZATION AGREEMENTS

ISO 17025 - General requirements for the competence of testing and calibration laboratories (DoD Adopted)

(Copies of this document are available from <http://www.iso.ch> or from the International Organization for Standardization American National Standards Institute 11 West 42nd Street, 13th Floor New York, New York, United States, 10036.)

2.4 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

### 3. REQUIREMENTS

3.1 Plating materials and processes. The materials and processes used shall produce coatings that meet the requirements of this specification. Either bright or matte deposits are acceptable unless otherwise specified in the contract or purchase order (see 6.2).

3.2 Basis metal. The basis metal shall be free from defects, scratches, pits, non-conducting inclusions, and roll and die-marks that will adversely affect the appearance and the performance of coatings applied thereto despite the observance of the best plating practice.

3.2.1 Preplating operations. Unless otherwise specified in the contract or purchase order (see 6.2), plating shall be applied after all basis metal heat treatments and mechanical operations such as machining, brazing, welding, forming, and impregnating have been completed. This requirement does not prohibit certain required operations after plating to take place, such as, embrittlement relief, heat treatment and forming operations such as crimping electrical connections.

3.2.1.1 Plating of steel parts. Unless otherwise specified in the contract or purchase order (see 6.2), steel parts having an ultimate tensile strength of 220,000 psi or above shall not be plated without specific approval from the procuring activity.

3.2.2 Stress relief treatment. All steel parts shall be given a stress relief heat treatment at a range of  $375^{\circ} \pm 25^{\circ} \text{ F}$  ( $191^{\circ} \pm 14^{\circ} \text{ C}$ ) for 3 hours or more prior to cleaning and plating if they contain tensile stresses caused by machining, grinding, or cold forming operations. Parts which are cold straightened are considered to contain damaging stresses. The temperature and time at temperature shall be such that maximum stress relief is obtained without reducing the hardness below the specified minimum (see 6.2.1).

3.3 Pretreatment. Articles shall be cleaned, pickled, or otherwise pretreated as necessary. Acid pickling on high strength steels shall be prohibited.

3.4 Strikes. When gold plating is preceded by a strike or a strike and underplate, it shall be as specified in the contract or purchase order (see 6.2 and 6.3). For exterior use and when the basis

metal is low alloy steel or other non-copper base metal such as zinc, the thickness of the strike and underplate shall be a minimum of 0.001 inch minus the thickness of the specified gold plating. Unless otherwise specified in the contract or purchase order (see 6.2), gold over silver underplate combinations shall be excluded from electronic hardware. Silver or copper plus silver may not be used as an underplate unless required by item specification. Also, when gold is applied to a copper rich surface such as brass, bronze or beryllium copper or a copper plate or strike, an anti-diffusion underplate such as nickel shall be applied.

3.5 Plating equipment and processes. Unless otherwise specified in the contract or purchase order (see 6.2), the plating equipment and process used shall be at the option of the supplier (see 6.2.1).

### 3.6 Plating properties.

3.6.1 Thickness. The minimum thickness of deposited gold on significant surfaces for each class of gold plating shall be as shown in 1.2.3. Significant surfaces shall be all surfaces of the article which can be touched by a sphere 0.75 inch in diameter plus additional functional surfaces specified on the applicable drawings, contract or purchase order (see 6.2). However, the plating on non-significant, nonfunctional surfaces shall be of sufficient thickness to ensure plating continuity and uniform appearance.

3.6.2 Adhesion. Adhesion of the gold plating and of any underplating shall be such that the coating and undercoating shall not separate from each other or from the basis metal when tested according to 4.6.2.

3.6.3 Hardness. The Knoop hardness of the coating shall conform to the grade as specified in the contract or purchase order (see 1.2.2 and 6.2) and shall be determined in accordance with 4.6.3.

3.6.4 Heat resistance. When heat resistance is specified, gold plated parts shall show no blistering, discoloration, or visible white or crystalline film when tested in accordance with 4.6.4.

3.6.5 Smoothness. If a degree of surface smoothness of the finished article is required, the degree shall be specified in the contract or purchase order (see 6.2). Methods for measuring surface smoothness shall be approved by the procuring activity.

3.6.6 Solderability. When solderability is required by the procuring activity or specified in the contract or purchase order (see 6.2), the gold plating shall meet the following solderability requirements. When the gold plating is subjected to the solderability test of 4.6.5, the solder coating shall be even, free from lumps and shall not flake or peel when subjected to the adhesion test of 4.6.2.

3.6.7 Composition. The type (purity) of gold shall be as specified in the contract or purchase order (see 1.2.1 and 6.2).

#### 3.6.7.1 Impurities.

3.6.7.1.1 Type I, grade A and type III. Metallic impurities such as chromium, copper, tin, lead, silver, cadmium, or zinc shall not be present in the deposit at a concentration greater than 0.1 percent. The percent by weight of iron, nickel, and cobalt combined shall be less than 0.050 and no one of these three elements shall be present in amounts greater than 0.030 percent by weight.

3.6.7.1.2 Type I, grades B and C and type II. Individual metallic impurities in the deposit shall not exceed 0.1 percent. Metallic hardening agents, which are purposely added to a bath are not to be considered impurities.

### 3.7 Postplating procedures.

3.7.1 Removal of plating salts. Residual plating salts shall be removed from the plated articles. Articles difficult to clean, as spot-welded articles or other prefabricated articles with lap seams or joints, shall be cleaned after plating in well-agitated hot water (200° to 212° F). If any blisters appear after cleaning, the plated article shall be considered defective.

3.7.2 Heating of hardened parts (embrittlement relief). All steel parts having a hardness of Rockwell C40 and higher shall be baked at  $375^{\circ} \pm 25^{\circ}$  F ( $191^{\circ} \pm 14^{\circ}$  C) for 3 hours or more, within one hour after plating to provide hydrogen embrittlement relief. Plated springs or other parts subject to flexure shall not be flexed prior to baking operations. No plated part shall develop cracks or fail by fracture (see 4.6.6).

3.8 Workmanship. Gold plating shall be smooth, fine grained, adherent and free from exposed basis metal or underplate, visible blisters, pits, nodules, porosity, indications of burning, excessive edge buildup and other detrimental defects. Correction of a burned condition by burnishing or tumbling is not acceptable.

3.9 Identification marking. When specified in the contract or purchase order (see 6.2), the plated articles shall be marked with a fluid which is not affected by water and which shall not rub off or smear during shipment or storage, or shall carry a tag giving the following information:

- (a) The basis metal.
- (b) The type of gold plating.
- (c) The grade of gold plating.
- (d) The class of gold plating.
- (e) The number of this specification.
- (f) Strike, if used.
- (g) Underplate, if used.

## 4. VERIFICATION

4.1 Classification of inspections. The inspection requirements specified herein are classified as conformance inspection (see 4.2).

4.2 Conformance inspection. The supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified (see 6.2), the supplier may utilize his own or any other inspection facilities and services acceptable to the Government. Inspection records of the examination and tests shall be kept complete and available to the Government as specified in the contract or order (see 6.2). The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure that supplies and services conform to prescribed requirements.

4.2.1 Inspection terms and definitions. Reference shall be made to ASQC-A8402 to define the inspection terms used.

4.2.2 Inspection conditions. Unless otherwise specified (see 6.2), all inspections shall be performed in accordance with ISO 17025.

4.3 Lot. A lot shall consist of articles of the same basis metal, type, grade, and class, plated under the same conditions and of approximately the same size and shape, submitted for delivery at one time.

4.4 Sampling.

4.4.1 Submittal of product. Unless otherwise specified in the contract or purchase order (see 6.2), the contractor shall submit the product in accordance with MIL-STD-1916.

4.4.2 Visual examination. A representative sample from each lot shall be selected for examination of visual characteristics in accordance with MIL-STD-1916. The specific acceptance level shall be specified in the contract or purchase order (see 6.2). All nonconforming material shall be rejected.

4.4.3 Thickness, adhesion, hardness, heat resistance, embrittlement, and solderability. A representative sample from each lot shall be prepared in accordance with 4.4.3.1 or selected in accordance with MIL-STD-1916 with a specific acceptance level as specified in the contract or purchase order (see 6.2). All nonconforming material shall be rejected. When separate specimens are used for the hardness test and the as-plated gold composition (purity) test they shall be in accordance with 4.4.3.1, 4.4.3.1.1, 4.4.3.1.1.1, and 4.4.3.1.1.2.

4.4.3.1 Separate specimens. When the plated articles are not suitable for a test specified herein or in sampling small size lots for destructive tests, tests may be made on separate specimens plated concurrently with the articles represented. Unless otherwise specified in the contract or purchase order (see 6.2), at least two (2) specimens shall be used for each test and specimens may be used for more than one test where applicable. The separate specimens shall be prepared as follows except as modified in 4.4.3.1.1 and 4.4.3.1.2. The separate specimens shall be of a basis metal of the same chemical composition, temper, and surface finish as the articles represented. For still, rack or wire plating, the separate specimens shall be strips. Dimensions of the strip specimens shall be approximately 1 by 4 by 0.04 inch. All specimens shall be introduced into normal production at regular intervals and be pretreated, cleaned, plated, and processed with the articles comprising the lot. Conditions affecting plating of the specimens, such as spacing and positioning with respect to anodes and to other objects being plated, shall



correspond as nearly as possible to those affecting the significant surfaces of the articles represented. For barrel plating, rod specimens shall be used approximating the dimensions of the parts contained in the barrel, but of a size that can be easily separated from the bulk of the product.

4.4.3.1.1 Separate specimens for hardness. When separate specimens are prepared for hardness tests they shall be approximately 0.5 by 1 by 0.04 inch. The specimens shall be plated concurrently with the articles represented plus additional plating under the same conditions to a plating thickness necessary to accurately determine the Knoop hardness number. Plating thicknesses for measuring hardness shall be as listed in Table V. All specimens shall be overplated with at least 0.0005 inch of nickel or copper.

TABLE V. Hardness vs. minimum plating thickness.

Hardness (Grades)	Minimum Plating Thickness
Grades A and B	0.002 inch
Grades C	0.001 inch
Grades D	0.0005 inch

4.4.3.1.1.1 Frequency of hardness test using separate specimens. Hardness testing of deposit (gold plating) shall be determined initially on a weekly basis and should be continued until process stability and control are demonstrated (see 4.6.3). Documented process performance (data) shall be the indicator that the process is in control. Unless otherwise specified in the contract or purchase order (see 6.2), once the hardness test data is in conformance with the hardness range specified for the purity (type) and hardness (grade) designation, the frequency of the test can be revised to allow adjustment based upon process history. Once there is evidence that the process is stable and in control, the frequency of the hardness test shall be performed on a monthly basis, unless there is evidence that the process is no longer in control (see 4.8). If data indicates that the hardness is out of range, the weekly test should be reinstated until the process is stable and in control.

4.4.3.1.1.2 Frequency of testing versus process control. The hardness of the deposit is directly related to the condition of the bath. Process control procedures and process parameters have been developed by the suppliers of the chemical plating solutions to ensure that the plated products will meet the requirements of the military specification. Process control recommended by these suppliers involve measurement of the gold content, evaluation of the pH, verification of solution density, and analysis of the alloy hardening additives and other metal impurities in the bath. A spectrographic analysis of the electrodeposited gold coating will confirm that the purity of the deposit relates to the composition or purity specified for use (see 3.6.7 and 4.6.7).

NOTE: These process controls assure that the process and product remain consistent at each plating facility. With adequate control, the purity and hardness of the plated deposits will be consistent, and testing once a month will be sufficient to assure that the plating will perform as intended.

4.4.3.1.2 Separate specimens for embrittlement relief. Where separate specimens are to be subjected to the embrittlement test described in 4.6.6, separate test specimens shall be prepared of the same material, heat, and heat-treated to the same strength level and finish as the materials of the articles they represent. The configuration shall be in accordance with figure 8 of ASTM E8, for round specimens with the axis of the specimen perpendicular to the short transverse direction. Specimens shall have 60 degree V-notch with the area at the base of the Vee approximately equal to half the area of the full section of the specimen and  $0.010 \pm 0.0005$  inch radius of curvature at base of notch.

4.5 Visual examination. Each sample unit selected in accordance with 4.4.2 shall be visually examined for compliance with the requirements for removal of plating salts (see 3.7.1), workmanship (see 3.8), and identification marking (see 3.9). Unless otherwise specified in the contract or purchase order (see 6.2), the samples shall be examined at four diameters magnification.

#### 4.6 Test methods.

4.6.1 Thickness measurements. Thickness of the plating and strikes shall be determined by any method which will give results within  $\pm 10$  percent of the true thickness. With proper equipment, procedures, and reference standards, thicknesses can be determined within limitations as listed in Table VI (see 6.4).

TABLE VI. Thickness limitations.

Method	Thickness Limitation
Microscopic	100 microinches (0.0001 in.), minimum
Beta Backscatter Radiation	2000 microinches (0.002 in.), maximum
X-Ray Fluorescence	500 microinches (0.0005 in.), maximum

4.6.1.1 Microscopic test. Thickness shall be determined in accordance with ASTM B487 using the modification shown in Table VII.

4.6.1.2 Beta-backscatter radiation. Thickness shall be determined in accordance with ASTM B567 with back scatter radiation instruments consisting of a source of beta-radiation and a detector, so arranged that the rays from the source are backscattered from the surface at which the coating is being measured. The detector shall convert the backscatter rays to the thickness or a number which is a function of the thickness.

4.6.1.3 X-Ray fluorescence. Thickness shall be determined in accordance with ASTM B568 with X-Ray fluorescence instruments consisting of an x-ray source, dispersing crystal and detector so arranged that the x-rays generated within the sample are separated and measured. The detector shall convert the x-rays to the thickness or a number which is a function of the thickness.

TABLE VII. Modification in procedure for test method ASTM B487

Step in ASTM B487	Modification
Selection of section for test	Use a right angle cross section or longitudinal section.
Preparation of specimens	Plate the articles with a coating at least 0.001 inches thick of copper, nickel, or iron to protect the edges during grinding and polishing. The first layer or overplate shall be a copper strike deposited from a cyanide solution followed by the relatively thick overplate.
Preparation of section	Grind and polish, following the instructions for polishing zinc, cadmium, tin, and lead coatings.
Etching	Use an etching solution so as to obtain the maximum contrast between the coating and the adjacent metals. Obtain such contrast by etching either the coating or the adjacent metal by an appropriate reagent.
Procedure, Use of microscope	Using the metallographic microscope and a magnification of at least 1000 diameters, take a minimum of five (5) measurements at random locations on each specimen. Measurements shall be expressed to five (5) decimal places (0.00001 inches).

4.6.2 Adhesion tests. Adhesion of test specimens shall be performed at room temperature by means of the bend test (see 4.6.2.1) unless the plated articles are not readily adaptable. When not readily adaptable to the bend test, adhesion of the plated articles shall be determined by means of the cutting test or by the baking test.

4.6.2.1 Bend test. Plated articles shall be bent repeatedly through an angle of 180° on a diameter equal to the thickness of the specimen until fracture of the basis metal occurs. No detachment of the coating shall be possible by probing with a sharp instrument. Cracks in the basis metal or plating shall not be considered failure unless accompanied by flaking, peeling or blistering. Examination shall be at four (4) diameter magnification.

4.6.2.2 Cutting test. The adhesion of plated articles shall be determined by cutting the plating from the basis metal at the interface(s) with a sharp instrument. The specimens shall be visually examined at four (4) diameter magnification to determine whether removal has been caused by cutting away of an adherent plate or lifting of a non-adherent plate.

4.6.2.3 Baking Test. The adhesion shall be determined by heating the plated articles at 250° to 300° F for one (1) hour. After removal and cooling, the surface of the articles shall be examined at four (4) diameter magnifications for any evidence of flaking, peeling or blistering.

4.6.3 Hardness. The hardness shall be determined on the cross section of the plating in accordance with ASTM B578 and ASTM E384 by the use of the Knoop hardness tester using a test load of 25 grams-force. In accordance with ASTM E384, the Knoop hardness may be determined perpendicular to the plated surface if the thickness of the plate is at least ten (10) times the depth of the Knoop indentation.

4.6.4 Heat resistance. The heat resistance of gold plated articles shall be determined by subjecting samples selected in accordance with 4.4.3 to a temperature of  $500^{\circ} \pm 25^{\circ}$  F ( $260^{\circ} \pm 14^{\circ}$  C) for not less than 30 minutes and examining for compliance with 3.6.4.

4.6.5 Solderability test. When samples selected in accordance with 4.4.3 or separate specimens (see 4.4.3.1) are tested, method 208 of MIL-STD-202 shall be used. The specimens shall be examined and adhesion tested by the bend or cutting test of 4.6.2 for compliance with 3.6.6.

4.6.6 Embrittlement relief. When specified in the contract or purchase order (see 6.2), samples of parts for determining compliance with 3.7.2 shall be taken as specified in 4.4.3. The article shall be subjected to a sustained tensile test, using loads applicable to the parts as contained herein. The articles or parts shall be held under the load for at least 200 hours, unless otherwise specified (see 6.2.1), and then examined for cracks. The lot shall be rejected if any plated part develops cracks or fails by fracture.

4.6.6.1 Fasteners. Parts such as steel fasteners, threaded or not threaded, which are used for mechanical joining of metal shall be subjected to a sustained tensile loading not less than 75 percent of the material specification minimum ultimate tensile strength.

4.6.6.2 Spring pins, lock rings, etc. Parts such as spring pins, lock rings, etc., which are installed in holes or on rods shall be similarly assembled using the applicable parts specification or drawing tolerances which impose the maximum sustained tensile stress on the plated parts.

4.6.6.4 Other parts. Other parts, which will be subjected to a sustained static tensile load in excess of 25 percent of the material specification minimum tensile yield strength in service use, shall be subjected to a sustained tensile load equal to 75 percent of the materials notched tensile yield strength. Parts which require fixtures or extreme loads to comply with the above requirements shall be represented by four separate specimens prepared as specified in 4.4.3.1.2.

4.6.7 Composition. The purity and the level of individual impurities of the gold coating shall be determined at least monthly by any recognized chemical assay or instrumental method capable of accurately determining quantities of 0.1 percent or less. Tests for impurities may be waived by the procuring activity when it has been determined that the process and processing procedures will produce coatings conforming to the applicable requirements of 3.6.7 and 3.6.7.1.

#### 4.7 Rejection.

4.7.1 Examination defects. Any sample unit having one or more defects shall be rejected. If the number of nonconforming sample units in the sample exceeds the acceptance number specified in 4.4.2, the entire lot shall be rejected.

4.7.2 Tests. A lot shall be rejected for failure to meet any of the test requirements when tested in accordance with 4.6.

4.8 Reduced testing. If specified in the contract or purchase order (see 6.2), the frequency of testing may be reduced provided the process can be shown to be in statistical control and the manufacturer can ensure product conformance.

## 5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When packaging of materiel is to be performed by DoD or in-house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activities within the Military Service or Defense Agency, or within the military service's system commands. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

## 6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended use. Gold plating is intended for electrical application, good corrosion resistance, good solderability, and other applications.

6.1.1 Soldering. Metal finishers report that gold or gold with co-deposited impurities can make soldering more difficult. For this reason high purity gold coatings may be preferred. General purpose and high reliability engineering practices often specify soldering applications. Failure analysis data from space applications indicates that these soldering requirements are best achieved when gold coatings range between 0.00005 and 0.0001 inch in thickness.

6.2 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number, and date of the specification.
- b. Classification – specify types and classes, hardness and grade (see 1.2).
- c. Specify class thickness if different (see 1.2.4).
- d. If bright or matte deposits are unacceptable (see 3.1).
- e. If plating is to be applied differently (see 3.2.1).
- f. If specific approval is required (see 3.2.1.1).
- g. Strike or underplate requirement (see 3.4).
- h. If gold over silver underplate is acceptable (see 3.4).
- i. If plating equipment and processes is different then supplier (see 3.5).
- j. If additional functional surfaces are required (see 3.6.1).
- k. Specified grade (see 3.6.3).
- l. Degree of surface smoothness (see 3.6.5).
- m. If solderability is required (see 3.6.6).

- n. Specify type (purity) (see 3.6.7).
- o. If identification markings are required (see 3.9).
- p. If other inspection facilities are to be specified (see 4.2).
- q. How inspection records are to be maintained (see 4.2).
- r. If inspection conditions are different then ISO 17025 (see 4.2.2).
- s. If submittal of produce is different (see 4.4.1).
- t. Specify visual inspection level (see 4.4.2).
- u. Specify thickness, adhesion, hardness, heat resistance, embrittlement, and solderability acceptance levels (see 4.4.3).
- v. If other than 2 specimens are to be tested (see 4.4.3.1).
- w. If adjustments are allowed based upon process history (see 4.4.3.1.1.1).
- x. If magnification for visual inspection is different (see 4.5).
- y. If embrittlement relief is allowed (see 4.6.6).
- z. If reduced testing is allowed (see 4.8).
- aa. Specify packaging requirements (see 5.1).

6.2.1 Basis metal parts' manufacturer. The manufacturer of the basis metal parts should provide the plating facility with the following data:

- a. Whether heat treatment has been performed or is required for stress relief (see 3.2.2).
- b. Specify the plating equipment and processes (see 3.5)
- c. Tensile loads required for embrittlement relief test (see 4.6.6).

6.3 Strikes and underplating. A copper, nickel, or copper plus nickel underplate may be used, depending on the application and the environment. A soft gold strike from a separate plating tank should follow any other undercoating and precede the final gold coating to improve adhesion and prevent contamination of the main gold plating solution by metallic impurities.

6.3.1 Strike. Strike, as defined by this specification is the application of any plated material 10 microinches or less in thickness. An underplate is a deposit of greater thickness than a strike that will impart some characteristic to the finished plated surface which the overplate would not otherwise impart.

6.4 National Bureau of Standards Reference Material. Standards have been revised by the national Bureau of Standards for determining weight by unit area (thickness of gold plating). These are intended for calibrating coating thickness gages. For further information, contact the National Bureau of Standards, Office of Standard Reference Materials. Since measurements by beta backscatter and x-ray fluorescence methods not only depend on the coating thickness, but also on the density of the deposit, calibration standards should have the same density as the test specimen to be measured.

6.5 Superseding data. This specification supersedes MIL-G-14548 (Ord) and MIL-G-19788 (Navy Ord). Table VIII provides a cross-reference between MIL-G-45204 and the superseded specifications.

TABLE VIII. Classes vs. thickness cross reference.

Thickness of gold plating, minimum	Classes specified		
	MIL-G-45204	MIL-G-14548	MIL-G-19788
0.00002 inch	00	--	--
0.00003 inch	0	--	--
0.00005 inch	1	--	1
0.00010 inch	2	1	--
0.00020 inch	3	2	2
0.00030 inch	4	--	3
0.00050 inch	5	--	4
0.00150 inch	6	3	--

6.6 Subject term (key word) listing.

Brazing	Gold plating	Strike
Basis metal	Heat treatment	Undercoat
Electrodeposited	Knoop hardness	Underplating
Embrittlement relief	Metallic surfaces	Welding
Fasteners	Solderability test	

6.5 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extent of the changes.

## CONCLUDING MATERIAL

Custodian:  
 Army – MR  
 Navy - AS  
 Air Force - 11

Preparing activity:  
 Army – MR  
 (Project MFFP-2007-003)

Review Activities:  
 Army – AR, AV, CR, MI, PT  
 Navy – EC, MC, SH  
 Air Force – 13, 19, 99

NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST Online database at <http://assist.daps.dla.mil/>.