NOT MEASUREMENT SENSITIVE

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15 OCTOBER 1989
SUPERSEDING
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MILITARY SPECIFICATION

COATING, IMMERSION ZINC FLAKE/CHROMATE DISPERSION

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

1. SCOPE

1.1 Scope. This specification covers zinc flake/chromate dispersion coatings which shall be topcoated with a clear, no sealer, or black sealer.

1.2 Classification

1.2.1 Classes. Zinc flake/chromate dispersion coatings shall be of the following classes, as specified (see 6.2):

Class 1
Class 2 SEE TABLE I
Class 3

1.2.2 Types. Zinc flake/chromate topcoatings shall be of the following types, as specified (see 6.2):

Type I - no sealer
Type II - clear sealer
Type III - black sealer

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document be addressed to: ASD/ENES, Wright-Patterson AFB OH 45433-6503, by using the self-addressed Standardization Document Improvement (DD FORM 1426) appearing at the end of this document or by letter.

AMSC N/A AREA MFFP

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2. APPLICABLE DOCUMENTS

2.1 Government documents

2.1.1 Specifications and standards. The following specifications and standards form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto in the solicitation (see 2.4.1 and 6.2).

SPECIFICATIONS

MILITARY

MIL-S-5002	Surfaces Treatments and Inorganic Coatings Metal Surfaces of Weapons Systems

(Unless otherwise indicated, copies of the military specifications and standards are available from the Naval Publications and Forms Center, (ATTN: NPODS), 5801 Tabor Avenue, Philadelphia, PA 19120-5099.

2.2 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted are those listed in the issue of the DODISS specified in the solicitation. Unless otherwise specified, the issues of documents not listed in the DODISS are the issues of the documents cited in the solicitation (see 6.2).

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM B-117-85	Salt Spray (Fog) Testing, Standard Method (DoD adopted)
ASTM B-487-85	Standard Method for Measurement of Metal and Oxide Coating Thickness by Microscopical Examination of a Cross Section (DoD adopted)
ASTM B-499-85	Standard Test Method for Measurement of Coating Thickness by the Magnetic Method: Nonmagnetic Coatings on Magnetic Basis Metals (DoD adopted)

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103-1137).

2.3 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 place. Nothing in this document, however, supersedes applicable laws and regulations unless a specific pexemption has been obtained.

3. REQUIREMENTS

3.1 Materials. The materials used shall be of such as to produce zinc flake/chromate coatings which conform to this specification.

3.2 Equipment and processes. The equipment and processes employed to produce coatings shall be capable of providing a uniform coating in accordance with the detailed requirements of this specification and shall be approved by the procuring activity.

3.2.1 Process. The process used to deposit the coating shall be such that a temperature rise in the parts shall not occur that will cause adverse action between the coating and the substrate, or adverse effects to the substrate.

3.3 Cleaning. Prior to coating, surfaces shall be free of scale, dirt, oils and other contaminants. Cleaning shall be accomplished using materials and processes which have no damaging effect on the substrate metal, including freedom from pits, integranular attack, embrittlement and significant etching.

3.4 Application. Unless otherwise specified, the coating shall be applied after all machining, bracing, welding, forming and perforating of the article have been completed.

3.4.1 Area of deposit. The coatings shall completely cover all visible surfaces, including roots of threads, recesses and sharp corners.

3.4.2 Deposit of basis metal. Unless otherwise specified by the procuring activity, coating shall be deposited directly on the basic metal, without a preliminary coating of other metal.

3.5 Appearance and cure. Type I and type II shall have a uniform metallic gray appearance free from tears and other discontinuities. Type III shall have a black finish. All classes shall be thoroughly cured when tested per 4.5.1.

3.6 High temperature. Type I and II shall not be used on parts which, in service, reach a temperature higher than 650°F or come in direct contact with parts which reach this temperature. For type III this temperature is 350°F.

3.7 Coating Weight. Unless otherwise specified, the coating weight shall be specified in table I.

TABLE I. Coating thickness and weight

	Thickness		Final Coating Weight	
Class	Millimeter	Inches	Grams/Square Meter	Milligrams/Square Foot
1	0.0025-0.0051	0.00010-0.00020	10.8-20.4	1000-1900
2	0.0051-0.010	0.00020-0.00040	20.4-30.1	1900-2800
2	0.010 -0.028	0.0004 -0.0020	30.1-64.6	2800-6000

3.7.1 Top Coating

3.7.1.1 Class 1. Class 1 coating shall have no sealer (type I).

3.7.1.2 Class 2. Class 2 shall be top coated with clear sealer (type II).

3.7.1.3 Class 3. Class 3 shall be top coated with black sealer (type III).

3.7.2 Applications. Class 1 shall be used for moderately corrosive exposure conditions. Classes 2 and 3 shall be used for severely corrosive exposure conditions.

3.7.3 Exceptions to class 1, class 2, and class 3 thickness. Holes, recesses, internal threads and other areas where a controlled deposit cannot normally be obtained shall not be subject to a thickness requirement, but there shall be no bare areas.

3.7.4 Engineering drawing dimensions. Unless otherwise specified, the dimensions given on an engineering drawing are the before-coating dimensions.

3.8 Stripping of coatings. Parts to be reached shall be stripped by techanical means or in a suitable caustic solution.

3.9 Corrosion resistance. Coated parts or specimens shall show no evidence of corrosion of the basis metal when exposed for the periods of time shown in table II in accordance with the method

specified in 4.5.4. The appearance of white corrosion products on the coating during the test period shall not be cause for rejection.

TABLE II. Salt spray test

Class 3	Test period (hours)
1	240
2	400
3	400

3.10 Adhesion characteristics. Parts to these specifications shall be tested as per 4.5.3.

3.11 Workmanship

3.11.1 Basis metal. The basis ;metal shall be substantially free from defects that will be detrimental to the appearance or the protective value of the coating. It shall be subjected to such deposits as hereinafter specified.

3.11.2 Coating. The immersion zinc flake/chromate dispersion coating shall be smooth, fine grained, adherent, uniform in appearance, free from straining, pits, burning and other defects. The coating shall show no indication of contamination of improper operation of equipment used to produce the deposit, such as excessively powdered or darkened coatings. All details of workmanship shall conform to the best practice for high quality coating.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.1.1 Responsibility for compliance. All items shall meet all requirements of sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of ensuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling in quality conformance does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to acceptance of defective material.

4.2 Classification. All the tests required for the testing are classified as quality conformance tests, for which necessary sampling techniques and the methods of testing are specified in this section.

4.3 Inspection conditions

4.3.1 Separate specimens. When the coated articles are of such form or material as to be not readily adaptable to a test specimen herein, or for destructive tests, or for the sampling of small lot sizes, the tests shall be made by use of separate specimens coated concurrently with the articles represented. The separate specimens shall be of a basis metal equivalent to that of the articles represented, except that corrosion resistance (3.9), shall be determined by coating 4130 alloy steel specimens. Equivalent basis metal includes a chemical composition and finish of surface prior to coating. For example, a cold-rolled steel surface should not be used to represent a hot-rolled steel surface. Due to the impracticality of forging or casting separate specimens, hot-rolled steel specimens may be used to represent forged and cast steel articles. Heat-treat histories should be as nearly identical as possible (see 6.3).

4.3.1.1 Specimen tests. The separate specimens shall be strips approximately 1-inch wide, 4 inches long, and 0.04-inch thick, for thickness and adhesion tests (4.5.2 and 4.5.3), but shall be at least 4 inches wide, 6 inches long, and any convenient thickness for all other tests. These specimens shall be introduced into a lot at regular intervals prior to the cleaning operation preliminary to coating and shall not be separated therefrom until after completion of the processing. Conditions affecting the coating of the specimens, including the spacing and positioning with respect to vapor sources and to other object being coated, shall correspond as nearly as possible to those affecting the significant surfaces of the articles represented. Separate specimens shall not be used for thickness measurements unless the necessity for their use has been demonstrated.

4.4 Quality conformance tests

4.4.1 Lot. A lot shall consist of coated articles of approximately the same size, shape, type, and class of coating. In the case of short production runs, a lot for inspection purposes may be made up of a group of small lots coverings several orders of parts similar in size and shape and coated under similar conditions.

4.4.2 Sampling for destructive tests of coating. Random samples for the 4.5 test methods shall be taken as follows:

4.4.2.1 For coating weight. A random sample shall be taken of enough coated parts/specimens to have at least 25 square inches or 160 square centimeters of surface area.

4.4.2.2 For thickness and adhesion. A random sample of two articles shall be taken from an inspection lot or two separately coated specimens shall be prepared in accordance with 4.3 to represent such inspection lot.

4.4.2.3 For corrosion resistance. A random sample of two articles shall be taken from an inspection lot at a minimum of once per month or two separately coated specimens shall be prepared in accordance with 4.3 to represent an inspection lot. Failure of any sample shall require random sampling as mentioned above for each inspection lot for five consecutive inspection lots without failure.

4.5 Test methods.

4.5.1 Appearance and cure. All classes shall be thoroughly cured as indicated by the appearance of a yellow color when 1 to 4 drops of concentrated ammonium hydroxide (NH4OH) is placed on the surface of a coated part (at room temperature) and left for 15 to 30 seconds. It shall have a uniform metallic gray appearance free from tears and other discontinuities. This test shall be run prior to any application of sealers.

4.5.2 Thickness. Thickness determinations may be made by micrometer measurements, or microscopic test, or magnetic test. The magnetic test is applicable only to ferrous alloy substrates. The microscopic test shall be made per ASTM B487. The magnetic test shall be made per ASTM B499. For reference tests, the microscopic test shall be used.

4.5.3 Adhesion. Coating shall show no evidence of blistering or other appearance changes after exposure to salt spray testing per ASTM B117, and shall show no more than 3.0 mm peel back from intersection of lines scribed and tape tested immediately after a 10-minute recovery period following exposure, and no other peeling in area under tape.

4.5.4 Corrosion resistance. The corrosion resistance tests shall be conducted in accordance with the procedure specified in ASTM B117 to determine conformance with 3.9.

5. PACKAGING

5.1 There are no packaging, packing or marking requirements applicable to this specification.

6. INFORMATION FOR GUIDANCE ONLY

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

6.1 Intended uses. This pollution-free zinc flake/chromate immersion process is intended to be used to replace processes such as cadmium and zinc plate processes which of themselves or because of subsequent treatment processes involve pollution generating activities. The coatings covered by this specification are intended for use as corrosive protective coatings on ferrous and aluminum alloy parts. High strength steel parts can be coated without causing hydrogen embrittlement and can be used at temperatures up to 650oF for class 1 and 2 and 350oF for class 3. It is recommended for use in lieu of anodize for fatigue-critical structure.

6.2 Acquisition requirements. Acquisition documents should specify the following:

a. Title, number and date of the specification.

b. Issue of DODISS to be cited in the solicitation, and if required, the specific issue of individual documents references (see 2.1.1 and 2.2).

c. Type and class of coating required (see 1.2).

d. Method of determining compliance with 4.3.

6.2.1 Options. Any desired options offered herein may be utilized in procurement documents.

6.3 Dimensional tolerance. The dimensional tolerance of most threaded articles, such as nuts, bolts, and similar fasteners with complementary threads do not permit the application of a coating thickness much greater than class 3. If heavier coatings are required for satisfactory corrosion resistance, allowance must be made in the manufacture of the threaded fasteners for tolerance necessary for coating buildup.

6.4 Samples. It is believed that this specification adequately describes the characteristics necessary to secure the desired material and that, normally no samples will be necessary prior to award to determine compliance with this specification. If, for any particular purpose, samples with bids are necessary, they should be specifically asked for in the invitation for bids, and the particular purpose to be served by the bid sample should be definitely stated. The specification will apply in all other respects.

6.5 Subject term (key word) listing

zinc flake/chromate coatings
clear and black sealer

6.6 Recycled material. It is encouraged that recycled material be used when practical as long as it meets the requirements of the document (see 3.1).

6.7 Changes from previous issues. Asterisks (or vertical lines) are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.

Custodians:
Air Force - 11
Army - MR

Reviewers:
Army - EL
Navy - YD

Preparing activity:
Air Force - 11

Project No. MFFP-0409

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STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions – Reverse Side)

1 DOCUMENT NUMBER	2 DOCUMENT TITLE
MIL-C-87115A	Coating, Immersion Zinc Flake/Chromate Dispersion

3a NAME OF SUBMITTING ORGANIZATION	4 TYPE OF ORGANIZATION *(Mark one)*
	☐ VENDOR
b ADDRESS *(Street, City, State, ZIP Code)*	☐ USER
	☐ MANUFACTURER
	☐ OTHER *(Specify)* _____

5 PROBLEM AREAS

a Paragraph Number and Wording

b Recommended Wording

c Reason/Rationale for Recommendation

6 REMARKS

7a NAME OF SUBMITTER *(Last, First, MI)* – Optional	b WORK TELEPHONE NUMBER *(Include Area Code)*–Optional
c MAILING ADDRESS *(Street, City, State, ZIP Code)* – Optional	8 DATE OF SUBMISSION *(YYMMDD)*

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