

# AEROSPACE MATERIAL SPECIFICATION

AMS 2485K

Issued 1948-05  
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Superseding AMS 2485J

Coating, Black Oxide

## RATIONALE

AMS 2485K results from a Five Year Review and update of this specification.

### 1. SCOPE

#### 1.1 Purpose

This specification covers the requirements for black oxide coatings on parts.

#### 1.2 Application

This coating has been used typically to improve the anti-chafing and anti-friction properties of carbon and low-alloy steel parts, particularly for sliding or bearing surfaces, by providing a finish coating that retains an oil film, but usage is not limited to such applications.

#### 1.3 Safety - Hazardous Materials

While the materials, methods, applications, and processes described or referenced in this specification may involve the use of hazardous materials, this specification does not address the hazards which may be involved in such use. It is the sole responsibility of the user to ensure familiarity with the safe and proper use of any hazardous materials and to take necessary precautionary measures to ensure the health and safety of all personnel involved.

### 2. APPLICABLE DOCUMENTS

The issue of the following documents in effect on the date of the purchase order forms a part of this specification to the extent specified herein. The supplier may work to a subsequent revision of a document unless a specific document issue is specified. When the referenced document has been cancelled and no superseding document has been specified, the last published issue of that document shall apply.

#### 2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), [www.sae.org](http://www.sae.org).

AS2390                      Chemical Process Test Specimen Material

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## 2.2 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, [www.astm.org](http://www.astm.org).

ASTM G 46 Examination and Evaluation of Pitting Corrosion

## 3. TECHNICAL REQUIREMENTS

### 3.1 Preparation

- 3.1.1 The coating shall be applied to part surfaces free from water-breaks. The cleaning procedure shall not produce pitting or intergranular attack of the basis metal and shall preserve dimensional requirements
- 3.1.2 Unless otherwise specified, steel parts 36 HRC or higher and which have been ground or cold worked after heat treatment shall be stress relieved. Temperatures to which parts are heated shall be such that maximum stress relief is obtained without reducing the hardness of the parts below engineering drawing limits, but unless otherwise specified, not less than 275 °F (135 °C) for not less than four hours for parts with a hardness of 55 HRC or over, or not less than 375 °F (191 °C) for not less than four hours for all other parts. Black oxide is commonly used on steel parts carburized, carbonitrided or induction hardened. These surface or case hardened parts shall be stress relieved at a temperature of 275 °F (135 °C) or as specified by the cognizant engineering activity.

### 3.2 Procedure

- 3.2.1 The cleaned parts, while still wet, shall be immersed in one or more boiling aqueous alkali oxidizing baths for times and at temperatures which will produce coatings meeting the requirements of 3.3 and 3.4. See 8.3.
- 3.2.2 Coated parts shall be washed thoroughly in running tap water to remove all traces of processing solution and salts. Parts shall not be allowed to dry during the entire sequence of operations until completion of this rinse.
- 3.2.3 Parts shall be thoroughly dried unless a water-displacing oil is used in 3.2.4, in which case complete drying may be omitted.
- 3.2.4 Parts shall be dipped in a suitable corrosion-preventative oil.

### 3.3 Properties

Coated parts shall conform to the following requirements:

#### 3.3.1 Smut Test

Coatings on parts before oiling as in 3.2.4, or on oiled parts after degreasing, shall show no indications of reddish-brown or green smut when wiped with a clean, white cloth.

#### 3.3.2 Dimensional Change

When determined using a micrometer accurate to 0.0001 inch (2.5 mm), no dimensional change shall result from processing.

### 3.3.3 Oxalic Acid Spot Test

The coating, prior to application of corrosion preventative oil, shall be tested as follows. Clean, dry coated parts or specimens of the same composition and heat treat condition as the parts and processed with the parts represented shall be handled with clean gloves. Each sample shall have deposited three drops of a 5% (approximately) solution of oxalic acid on a flat surface. Permit the accompanying reaction to continue for not less than eight minutes, followed by rinsing in cool water and drying. When examined, the area which was directly under the acid test solution drops shall exhibit a black or dark brown center with a light border. Areas under the drop, which exhibit a gray center and lighter border are marginal coatings and are not acceptable.

### 3.3.4 Surface and Intergranular Attack

The cleaning and coating process shall not result in any surface pitting, as determined by ASTM G 46 and intergranular attack, determined on metallographically-prepared cross-sections examined unetched at 400X to 500X magnification.

## 3.4 Quality

Except as otherwise specified herein, the coating on polished surfaces shall be a uniformly lustrous black. Coating on other surfaces shall be black or dark gray in color, uniform on areas of equivalent surface roughness. Coating on all types of surfaces shall be free of spots of red oxide or an overall reddish-brown color but an overall reddish-brown cast on a basically black color is permissible. Coating shall be continuous, smooth, dense, and adherent and shall not rub off under any conditions incident to normal handling or storage.

## 4. QUALITY ASSURANCE PROVISIONS

### 4.1 Responsibility for Inspection

The processor of coated parts shall supply all samples for processor's tests and shall be responsible for the performance of all required tests. Parts if required for tests shall be supplied by purchaser. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that processing conforms to specified requirements.

### 4.2 Classification of Tests

#### 4.2.1 Acceptance Tests

Smut test (3.3.1), oxalic acid spot test (3.3.3), and quality (3.4) are acceptance tests and shall be performed on parts, or samples representing parts when permitted by cognizant engineering organization, from each lot.

#### 4.2.2 Periodic Tests

Surface and intergranular attack (3.3.4) when parts 36 HRC or higher are processed are periodic tests and shall be performed monthly unless frequency of testing is specified by the cognizant engineering organization. Tests of cleaning and coating baths are periodic tests and shall be performed at a frequency established by the processor unless frequency of testing is specified by the cognizant engineering organization. See 4.4.3 and 8.2.

4.2.3 All property verification tests (section 3.3) are preproduction tests and shall be performed prior to production or on the initial shipment of coated parts to a purchaser, and when the cognizant engineering organization requires confirmatory testing.

4.3 Sampling and testing shall be not less than the following; a lot shall be all parts made of the same material, heat treated to the same hardness or tensile strength level, processed in the same solution(s) in not longer than eight consecutive hours, and presented for processor's inspection at one time. Parts for tests shall be selected randomly from all parts in the lot.

4.3.1 Acceptance tests shall be as shown in Table 1.

TABLE 1 - SAMPLING FOR ACCEPTANCE TESTS

Lot Size	Quality	Smut Test	Oxalic Acid Spot Test
Up to 7	All	All or 3*	1
7 to 15	7	4	1
16 to 40	10	4	1
41 to 110	15	5	2
111 to 300	25	6	3
301 to 500	35	7	4
Over 500	50	8	5

\*Whichever is less

#### 4.3.1.1 Periodic Tests

Sample quantity shall be selected at the discretion of the processor unless otherwise specified by the cognizant engineering organization. As a minimum, one sample shall be tested for all periodic tests.

4.3.2 When coated parts are of such configuration or size as to not be readily adaptable to specified tests or when nondestructive testing is not practical on actual parts, or when it is not economically acceptable to perform destructive tests on actual parts, separate specimens of the same class of alloy and heat treat condition as the parts represented, cleaned and coated with the parts represents may be used.

#### 4.4 Approval

4.4.1 The process and control factors, a preproduction part, or both, whichever is specified, shall be approved by the cognizant engineering organization before production parts are supplied.

4.4.2 If the processor makes a significant change to any material, process or control factor from that which was used for process approval, all preproduction tests shall be performed and the results submitted to the cognizant engineering organization for process reapproval unless the change is approved by the cognizant engineering organization. A significant change is one which in the judgment of the cognizant engineering organization could affect the properties or performance of the parts.

4.4.3 Controls factors shall include, but not be limited to the following:

Cleaning method

Material designation and supplier

Corrosion preventive oil used

Periodic test plan for cleaning and processing solutions. See 8.2.

#### 4.5 Reports

The processor of coated parts shall furnish with each shipment a report stating that the parts have been processed and tested in accordance with the specified requirements and that they conform to the acceptance test requirements. This report shall include the purchase order number, lot number, AMS 2485K, part number, and quantity.

#### 4.6 Resampling and Retesting

4.6.1 If any acceptance test fails to meet specified test requirements, the parts in that lot may be stripped, recoated and retested. Alternatively, all parts in the lot may be inspected for the nonconforming attribute, and the nonconforming parts may be stripped, recoated, and retested.

4.6.1.1 When stripping is performed, the method shall be acceptable to the cognizant engineering organization and shall not roughen, pit, or embrittle the basis metal or adversely affect part dimensions. When parts have been stripped and recoated, the purchaser shall be informed.