

MIL-P-50002B
5 August 1981
SUPERSEDING
MIL-P-50002A
31 March 1970

MILITARY SPECIFICATION

PHOSPHATE COATING COMPOUNDS, FOR PHOSPHATING FERROUS METALS

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

1. SCOPE

1.1 Scope. This specification covers the requirements for both manganese and zinc base phosphating compounds to be used in the preparation of baths for phosphate coating of iron and steel.

1.2 Classification. Phosphating compounds shall consist of the following types and compositions as specified (see 6.2). Type designations have been changed from those of MIL-P-50002 (see 6.4).

Type M - Manganese phosphate base.

Composition A - Powder

Composition B - Liquid

Type Z - Zinc phosphate base.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications, standards, and handbooks. Unless otherwise specified, the following specification, standards, and handbooks of the issue listed in that issue of the Department of Defense Index of Specifications and Standards (DoDISS) specified in the solicitation form a part of this specification to the extent specified herein.

SPECIFICATIONS

FEDERAL

- PPP-C-1337 - Container, Composite, (Steel Drum with Polyethylene Insert)
- PPP-D-723 - Drum, Fiber
- PPP-D-729 - Drums, Shipping and Storage, Steel, 55 Gallon (208 Liters)

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Director, US Army Materials and Mechanics Research Center, ATTN: DRXMR-LS, Watertown, MA 02172 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

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- DOD-P-16232 - Phosphate Coating, Heavy, Manganese or Zinc Base (For Ferrous Metals)
- MIL-D-40030 - Drum, Plastic, Molded Polyethylene

STANDARDS

FEDERAL

- FED-STD-313 - Material Safety Data Sheets, Preparation and The Submission Of

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- MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes
- MIL-STD-129 - Marking for Shipment and Storage
- MIL-STD-147 - Palletized and Containerized Unit Loads 40 Inch x 48 Inch Pallets, Skids, Runners or Pallet Type Base
- MIL-STD-1188 - Commercial Packaging of Supplies and Equipment

HANDBOOKS

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- MIL-HDBK-205 - Phosphatizing and Black Oxide Coating of Ferrous Metals

(Copies of specifications, standards, handbooks, drawings, and publications required by manufacturers in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting officer.)

2.2 Other publications. The following document(s) form a part of this specification to the extent specified herein. The issues of the documents which are indicated as DoD adopted shall be the issue listed in the current DoDISS and the supplement thereto, if applicable.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- ASTM D97 Pour Point of Petroleum Oils
- ASTM D512 Chloride Ion in Water and Waste Water
- ASTM E11 Wire-Cloth Sieves for Testing Purposes
- ASTM E380 Metric Practice

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

(Technical society and technical association specifications and standards are generally available for reference from libraries. They are distributed among technical groups and using Federal agencies.)

3. REQUIREMENTS

3.1 Materials. The raw materials used in the manufacture of these compounds shall be of high quality, properly compounded and processed, and suitable for the purpose intended. The product shall conform to all the applicable requirements of this specification.

3.2 Chemical composition.

3.2.1 Type M compound.

3.2.1.1 Composition A. The compound shall be a free flowing, granular, manganese dihydrogen phosphate (see Appendix I) material conforming to the chemical requirements of Table I.

TABLE I. Chemical requirements for Type M, Composition A.

Ingredient	Requirement percent by weight	Applicable test paragraph
Manganese, Mn, minimum	18.0	4.3.5
Phosphate, PO_4^{3-}	65.0	4.5.2
Nickel, Ni, minimum	0.1	4.5.4
Ratio of PO_4^{3-} to Mn, maximum	3.6	---

3.2.1.2 Composition B. The compound shall consist of an aqueous solution of manganese dihydrogen phosphate plus accelerators and shall conform to the chemical requirements of Table II.

TABLE II. Chemical requirements for Type M, Composition B.

Ingredient	Requirement percent by weight, minimum	Applicable test paragraph
Manganese, Mn	6.2	4.5.3
Phosphate, PO_4^{3-}	25.0	4.5.2
Nitrate, NO_3^{-1}	1.0	4.5.5
Nickel, Ni	0.1	4.5.4

3.2.2 Type Z compound. The Type Z compound shall consist of an aqueous solution of zinc dihydrogen phosphate (see Appendix I) plus a nitrate accelerator conforming to the chemical requirements of Table III.

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TABLE III. Chemical requirements for Type 2 compound

Ingredient	Requirement percent by weight, minimum	Applicable test paragraph
Phosphate, PO_4^{3-}	30.0	4.5.2
Nitrate, NO_3^{-1}	15.0	4.5.5
Nickel, Ni	0.1	4.5.4
Zinc, Zn	$\frac{1}{2} \text{PO}_4^{3-} + \frac{1}{2} \text{NO}_3^{-1}$ 3.9	4.5.6

3.3 Extraneous elements.

3.3.1 Arsenic content. When tested in accordance with 4.5.7.1, the phosphate coating compound sample shall contain no more than 0.005 percent by weight of arsenic.

3.3.2 Lead content, (applicable to Type 2 only). When tested in accordance with 4.5.7.2, the zinc dihydrogen phosphate coating compound sample shall contain no more than 0.01 percent by weight of lead.

3.3.3 Chloride determination. When tested in accordance with 4.5.7.3, the phosphate coating compound shall contain no more than 0.1 percent chlorine as chlorides.

3.3.4 Other extraneous elements. When tested in accordance with 4.5.7.4, the phosphate coating compound shall contain no more than 0.5 percent by weight of the total solids of Na, K, Mg, Fe, Cr, and Al. The limit on Fe shall not apply to the Type M, Composition A powder.

3.4 Particle size, (Type M, Composition A only). A minimum of 96% shall pass through a No. 12 sieve and 90% shall pass through a No. 20 sieve when tested as specified in 4.5.8.

3.5 Performance. The compounds obtained under this specification shall be capable of forming phosphate coatings under the performance test of 4.5.9. The coating shall be evenly deposited, shall have a uniform crystalline texture with a pattern not visible to the unaided eye, shall be gray to black, and shall not have a mottled appearance. These coatings shall meet the coating weight specified in DOD-P-16232. The phosphate-coated items, prior to the application of any supplementary treatment shall show no signs of corrosion upon subjection to a salt spray test for the time shown in DOD-P-16232.

3.6 Low temperature stability. The Type M, Composition B or Type 2 phosphate coating compounds shall be subjected to the test specified in 4.5.10 and shall be free from precipitated chemicals or crystals at the conclusion of the 6 hour warm-up period.

3.7 Workmanship. The compounds obtained under this specification shall be free of dirt, wood chips, or other foreign material. The liquid compounds as furnished, shall be clear and free from insoluble matter.

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.

4.2 Lot. A lot shall consist of the phosphating compound produced by one manufacturer in 8 consecutive hours of continuous production, with no change in facilities, materials or process which would change the chemical or physical properties of the compound. In the event the process is a batch operation, each batch shall constitute a lot.

4.3 Sampling.

4.3.1 Sampling for nondestructive examination. A random sample of filled containers shall be selected in accordance with MIL-STD-105 at inspection level S-4 and acceptable quality level (AQL) equal to 2.5 percent defective to verify compliance with all requirements of this specification regarding physical form, fill, container, closure and marking.

4.3.2 Sampling for tests. Three separate 1-pound (0.45 kg) samples (whether liquid or dry) shall be taken from each inspection lot. When the material is produced by a batch process the three samples shall be taken at different locations within each batch or from three separate containers. When the material is produced by a continuous run process the three samples shall be taken to represent, respectively, the first part, the middle part, and the last part of the run of the constituted inspection lot. The samples shall be composited in clean, dry, glass containers, sealed and marked for identification.

4.4 Inspection.

4.4.1 Nondestructive examination. Each sample filled container as specified in 4.3.1 shall be examined for defects of the container and the closure, for evidence of leakage and for unsatisfactory markings. The compound in each container shall be examined for uniformity, segregation and caking to determine compliance with 3.2.1.1 and 3.7. Any container in the sample having one or more defects, or under required fill, shall be rejected, and if the number of defective containers in any sample exceeds the acceptance number of the appropriate sampling plan of MIL-STD-105, the lot represented by the sample shall be rejected.

4.5.3 Manganese determination, (Type M only). Pipette 10 ml of the dilute test solution (see 4.5.1) into a 100 ml volumetric flask and fill to the mark with distilled water. Mix the solution thoroughly and pipette 10 ml of this solution into a 500 ml flask. Add 10 ml of HNO_3 (specific gravity = 1.42) and 5 ml H_2SO_4 (specific gravity = 1.84), and digest at a low heat to fumes of SO_3 . Remove from the heat and allow to cool. Repeat acid additions and digestion until the fuming solution remains colorless or light amber in color. The solution should now be free of organic matter. Cool to room temperature and add 100 ml of distilled water slowly. Add 5 ml of approximately 0.1 N AgNO_3 solution. Add 3 g of ammonium persulfate. Heat to boiling and continue until all frothing has ceased. Cool to room temperature and add 10 ml of approximately 0.18 N $\text{Fe}(\text{NH}_4\text{SO}_4) \cdot 6\text{H}_2\text{O}$. Titrate with 0.1 N KMnO_4 to a pink end point which persists for 20 seconds. Run a blank determination following the above procedure except that the addition of the sample shall be omitted. Calculate the percentage of Mn as follows:

$$\% \text{ Mn} = (B - A) (N) (10.99)$$

Where B = ml of KMnO_4 for blank

A = ml of KMnO_4 for sample

N = normality of KMnO_4 solution

4.5.4 Nickel determination. The Ni content shall be determined using the following reagents and procedure. A blank determination shall also be run.

4.5.4.1 Preparation of reagents.

4.5.4.1.1 Sodium nitrate solution. A NaNO_3 solution shall be prepared by placing 24 g of NaNO_3 in a liter volumetric flask. Dilute to the mark with distilled water and mix well.

4.5.4.1.2 Chloride-pyrophosphate solution. A chloride-pyrophosphate solution shall be prepared by dissolving 100 g of $\text{Na}_4\text{P}_2\text{O}_7$, 50 g of NH_4Cl , 2 g of KI and 0.046 g of NiSO_4 in a 1 liter volumetric flask. Dilute to the mark and mix well.

4.5.4.1.3 Sodium cyanide solution. A NaCN solution shall be prepared by dissolving 5 g of NaCN (see 6.5) and 0.4 g of AgNO_3 in a 1 liter volumetric flask. Dilute to mark and mix well. The NaCN solution should not be kept for more than 3 months.

4.5.4.2 Determination of nickel factor. Weigh exactly 0.05 g of pure metallic Ni and dissolve in a 250 ml flask with a solution of 5 ml of concentrated H_2SO_4 , 5 ml of concentrated HNO_3 and 5 ml of distilled water. Evaporate the solution until dense white fumes of SO_3 are evolved and then cool it. Add a slight excess of NH_4OH and bring to a boil. Cool the solution to room temperature and add 75 ml of the chloride-pyrophosphate solution (4.5.4.1.2). Titrate with the standard NaCN solution (4.5.4.1.3) until the precipitate which formed has redissolved. Calculate the Ni factor as follows:

$$\text{Ni factor (K)} = \frac{\text{g of Ni}}{\text{ml of NaCN solution used}}$$

4.5.3 Manganese determination, (Type M only). Pipette 10 ml of the dilute test solution (see 4.5.1) into a 100 ml volumetric flask and fill to the mark with distilled water. Mix the solution thoroughly and pipette 10 ml of this solution into a 500 ml flask. Add 10 ml of HNO_3 (specific gravity = 1.42) and 5 ml H_2SO_4 (specific gravity = 1.84), and digest at a low heat to fumes of SO_3 . Remove from the heat and allow to cool. Repeat acid additions and digestion until the fuming solution remains colorless or light amber in color. The solution should now be free of organic matter. Cool to room temperature and add 100 ml of distilled water slowly. Add 5 ml of approximately 0.1 N AgNO_3 solution. Add 3 g of ammonium persulfate. Heat to boiling and continue until all frothing has ceased. Cool to room temperature and add 10 ml of approximately 0.18 N $\text{Fe}(\text{NH}_4\text{SO}_4) \cdot 6\text{H}_2\text{O}$. Titrate with 0.1 N KMnO_4 to a pink end point which persists for 20 seconds. Run a blank determination following the above procedure except that the addition of the sample shall be omitted. Calculate the percentage of Mn as follows:

$$\% \text{ Mn} = (B - A) (N) (10.99)$$

Where B = ml of KMnO_4 for blank

A = ml of KMnO_4 for sample

N = normality of KMnO_4 solution

4.5.4 Nickel determination. The Ni content shall be determined using the following reagents and procedure. A blank determination shall also be run.

4.5.4.1 Preparation of reagents.

4.5.4.1.1 Sodium nitrate solution. A NaNO_3 solution shall be prepared by placing 24 g of NaNO_3 in a liter volumetric flask. Dilute to the mark with distilled water and mix well.

4.5.4.1.2 Chloride-pyrophosphate solution. A chloride-pyrophosphate solution shall be prepared by dissolving 100 g of $\text{Na}_4\text{P}_2\text{O}_7$, 50 g of NH_4Cl , 2 g of KI and 0.046 g of NiSO_4 in a 1 liter volumetric flask. Dilute to the mark and mix well.

4.5.4.1.3 Sodium cyanide solution. A NaCN solution shall be prepared by dissolving 5 g of NaCN (see 6.5) and 0.4 g of AgNO_3 in a 1 liter volumetric flask. Dilute to mark and mix well. The NaCN solution should not be kept for more than 3 months.

4.5.4.2 Determination of nickel factor. Weigh exactly 0.05 g of pure metallic Ni and dissolve in a 250 ml flask with a solution of 5 ml of concentrated H_2SO_4 , 5 ml of concentrated HNO_3 and 5 ml of distilled water. Evaporate the solution until dense white fumes of SO_3 are evolved and then cool it. Add a slight excess of NH_4OH and bring to a boil. Cool the solution to room temperature and add 75 ml of the chloride-pyrophosphate solution (4.5.4.1.2). Titrate with the standard NaCN solution (4.5.4.1.3) until the precipitate which formed has redissolved. Calculate the Ni factor as follows:

$$\text{Ni factor (K)} = \frac{\text{g of Ni}}{\text{ml of NaCN solution used}}$$

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4.5.4.3 Test procedure. Weigh approximately 5 g of the sample as received into a 250 ml beaker. Add 15 to 20 drops each of concentrated HCl and the NaNO₃ solution (4.5.4.1.1) and stir for 2 minutes. Add 100 ml of the chloride-pyrophosphate solution (4.5.4.1.2). Add NH₄OH dropwise until the solution turns red litmus paper blue. At this point, the solution should be clear. Titrate the solution with the standard NaCN solution (4.5.4.1.3) as follows:

Add 0.5 ml of the NaCN solution and stir for 2 minutes. A precipitate should form. Continue adding the NaCN solution dropwise until the precipitate dissolves and the solution is clear. The point at which the solution clears is the end point. Calculate the percentage of Ni as follows:

$$\% \text{ Ni} = \frac{(A - B)(K)(100)}{W}$$

Where: A = ml of NaCN
 B = ml of NaCN for blank
 K = Ni factor (see 4.5.4.2)
 W = g of sample

4.5.5 Nitrate determination. The NO₃¹ content shall be determined using the following reagents and procedure.

4.5.5.1 Preparation of nitron reagent. A 10% nitron solution is prepared by dissolving 10 g of nitron (4,5-dihydro-1,4-diphenyl-3,5-phenylimino-1,2,4-triazole) in 100 ml of 50% glacial acetic acid and then filtering. Keep in a dark colored bottle.

4.5.5.2 Test procedure. Withdraw sufficient volume of dilute test solution (see 4.5.1) to contain 0.05 to 0.10 g of nitrates and weigh into a 250 ml beaker. Add 100 ml of distilled water and 2.0 ml of 6 N H₂SO₄ acid. Heat to boiling and add 10 ml of nitron reagent. Cool and place in an ice bath for 1.5 hours. Filter through a weighed, fritted glass crucible of medium porosity, and place a piece of ice in the crucible before filtering. The solution must be cooled to reduce the solubility of the nitron compound. Use the filtrate to effect transfer of all the precipitate. Wash the collected precipitate in the crucible with four 3 ml portions of ice water. Reboil the filtrate, and add a small quantity of nitron reagent to check the completeness of the precipitation. Dry the crucible at 105° ± 5°C (221° ± 9°F). Cool in a desiccator and weigh. Repeat the weighing procedure until a constant weight is obtained. Calculate the percentage of NO₃¹ as follows:

$$\% \text{ NO}_3^1 = \frac{(16.54)W_2}{W_1}$$

Where: W₁ = weight of sample represented by the aliquot
 W₂ = weight of precipitate after drying

4.5.6 Zinc determination, (Type Z only). The Zn content shall be determined using the following reagents and procedure.

4.5.6.1 Preparation of reagents.

4.5.6.1.1 Buffer solution. A buffer solution shall be prepared by dissolving 350 ml of concentrated NH_4OH and 54 g of NH_4Cl in water and diluting to 1 liter.

4.5.6.1.2 Indicator solution. An Eriochrome Black T indicator solution shall be prepared by dissolving 0.25 g of Eriochrome Black T and 2.2 g of $\text{NH}_2\text{OH} \cdot \text{HCl}$ in 50 ml of CH_3OH .

4.5.6.1.3 Ethylenediaminetetraacetate solution. An EDTA disodium solution shall be prepared by dissolving 37.2 g of the dried salt in 1 liter of water.

4.5.6.2 Determination of zinc factor. Weigh accurately about 0.05 g of ACS grade metallic Zn and dissolve in HCl . Using red litmus as an indicator, add NH_4OH until the last drop changes the litmus to blue. Add 30 ml of the buffer solution (4.5.6.1.1) and titrate with the EDTA disodium solution (4.5.6.1.3) using 15 to 20 drops Eriochrome Black T indicator (4.5.6.1.2). The end point is reached when the color changes from red to blue. Calculate the Zn factor as follows:

$$\text{Zn factor (Z)} = \frac{W}{A}$$

Where: W = g of Zn

A = ml EDTA required for titration

4.5.6.3 Test procedure. Pipette 10 ml of the dilute test solution (see 4.5.1) into a 250 ml beaker. Using red litmus as an indicator, add NH_4OH until the last drop changes the litmus to blue. Then add to the solution 30 ml of the buffer solution (4.5.6.1.1). Titrate with the standard EDTA disodium solution (4.5.6.1.3) using 10 to 15 drops Eriochrome Black T indicator (4.5.6.1.2) until the color just changes from purple to grey. Calculate the percentage of Zn as follows:

$$\% \text{ Zn} = (B)(Z)(100)$$

Where: Z = Zn factor (see 4.5.6.2)

B = ml of EDTA disodium solution used to reach the end point

4.5.7 Extraneous elements determination. Extraneous elements (see 3.3) shall be determined as follows:

4.5.7.1 Arsenic determination. The As content shall be determined using the following procedure, and a blank determination shall be run.

4.5.7.1.1 Test procedure. Place 10 g of the undiluted sample in a 200 ml flask. Add 5 g of CuCl and 75 ml of concentrated HCl . Mix well and insert a thermometer. Arrange a flask and a condenser for downward distillation. All rubber stoppers to be used must be washed in CS_2 (see 6.6), boiled in 6 N HCl and dried thoroughly. Wash all rubber stoppers under a fume hood to avoid inhalation of toxic vapors. Distill 35 ml of the mixture into a 400 ml beaker

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containing 150 ml of cold water. Before distilling, the beaker and water should be cooled in an ice bath. During distillation, the condenser tip must be below the surface of the water in the beaker, and the process must be watched carefully. If the temperature of the vapor exceeds 108°C (226°F) at any time, cease the distillation immediately, cool the flask and add 35 ml of concentrated HCl. Then the distillation may be continued. After completing the distillation, carefully add 25% NaOH to turn red litmus to blue. Then add just enough 6 N HCl to change the solution back to acid. Add 15 to 20 ml of cold saturated NaHCO₃ solution, 1 g of KI crystals and 5 ml of a 1% starch solution. Stir until the KI crystals have dissolved. Titrate the mixture with 0.01 N iodine solution until the color becomes slightly purple. Calculate the percentage of As as follows:

$$\% \text{ As} = \frac{(3.75) (A) (N)}{W}$$

Where: A = ml of iodine solution used
 N = normality of iodine solution
 W = g of sample

4.5.7.2 Lead determination (Type 2 only). The Pb content shall be determined using the following procedure.

4.5.7.2.1 Standard lead solution. Dissolve 0.16 g of Pb(NO₃)₂ in distilled water to make 1000 ml. One ml of the standard Pb solution contains 0.0001 g of Pb.

4.5.7.2.2 Procedure. Weigh 5 g of undiluted Type 2 compound and transfer it quantitatively into a 50 ml volumetric flask. Add 10 ml of distilled water and 15 ml of 1:1 NH₄OH. Dilute to mark with distilled water and mix well. Pipette a 30 ml aliquot into one 50 ml Nessler tube and a 10 ml aliquot into a second matching Nessler tube. Consider the 30 ml aliquot as the specimen and the 10 ml aliquot as the control. Dilute to 45 ml with distilled water. Add 1 ml of 10% NaCN solution and 1 ml of colorless Na₂S to each tube, mix well. Add 2 ml of standard Pb solution to the control, mix, and compare. The color developed by the specimen shall not exceed the color developed by the control.

4.5.7.3 Chloride determination. The sample shall be analyzed for chlorides in accordance with ASTM D512.

4.5.7.4 Other extraneous elements. Spectrographically analyze a portion of the diluted test solution (4.5.1) for Na, K, Mg, Fe, Cr, and Al.

4.5.8 Particle size. Select the required sieves conforming to ASTM E11 for compliance with 3.4. Weigh the dry sieves and nest on the bottom pan. Weigh 100 g of the sample to the nearest 0.1 g and transfer it to the sieve and then cover the assemble. Shake for 10 minutes by hand. Weigh the positions retained and passed by the sieves and calculate the percentage as required.

4.5.9 Performance test. A solution of the compound shall be made up using water and maintained at the operating temperature shown in Table IV. Two 3 by 6 inch (76 by 152 mm) SAE 1020 steel panels shall be cleaned, sandblasted and immersed in the phosphate coating solution for the time specified in Table IV. After processing time the panels shall be rinsed in clean water, dried and examined for compliance with paragraph 3.5. The coating weight and the accelerated corrosion tests shall be determined in accordance with the applicable methods of DOD-P-16232. A description of the process is given in MIL-HDBK-205.

TABLE IV. Phosphating solution and panel preparation.

Characteristic	Phosphating compound		Type Z
	Type M Composition A	Composition B	
Concentration, pounds per 100 gallons of solution	24 to 25	54 to 56	33 to 34
Operating temperature, °F (°C) Max.	210 (99)	210 (99)	210 (99)
Immersion time, minutes, max.	45	45	30 ^{1/}

^{1/}Minimum immersion requirement is 20 minutes.

4.5.10 Low temperature stability. A 40 ml sample shall be placed in a cold test jar used for "Cloud and Pour Points", ASTM D97, and held at the temperature specified in Table V for 72 hours. The sample shall then be allowed to stand at room temperature for 6 hours and during this warm-up period shall be inverted and returned to its original position three times at the end of each 3 hour period.

TABLE V. Cold test temperatures.

Temperature of cold test, max.	
Type M, Composition B	0°F (-18°C)
Type Z	25°F (-4°C)

4.6 Acceptance and rejection criteria. If the individual or composite samples fail to meet the test requirements of the specification, the lot shall be rejected. When rejected lots of the material are resubmitted for acceptance inspection, samples shall be retested in accordance with the provisions of MIL-STD-105 employing tightened inspection.

5. PACKAGING

5.1 Packaging (see 6.2).

5.1.1 Level A.

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5.1.1.1 Type M, Composition A (powder). This material shall be furnished in 100 pound (45 kg) capacity fiber drums conforming to PPP-D-723, Type II or III, grade A; or in 55-gallon (208-liter) steel drums conforming to PPP-D-729, Type III, as specified. The powder shall be inclosed in sealed polyethylene bag liners within the drums. The minimum thickness of the polyethylene liner shall be 0.004 inch (0.1 mm) for the 55-gallon (208-liter) drum.

5.1.1.2 Type M, Composition B, Type 2 (liquid). These materials shall be furnished in polyethylene drums or carboys as specified in the contract or order.

5.1.1.2.1 Polyethylene drum. The 5- or 15 gallon (19- or 57-liter) metal containers with polyethylene liners shall conform to PPP-C-1337, Type II. The 30- or 55-gallon (113- or 208-liter) polyethylene drums shall conform to MIL-D-40030, Style B.

5.1.1.2.2 Carboys. When specified, the material shall be furnished in 13-gallon (49-liter) polyethylene carboys in accordance with the MIL-STD-1188.

5.1.2 Level C. The compound shall be packaged in accordance with the supplier's commercial practice. Protection shall be such as to insure safe delivery at destination.

5.2 Packing.

5.2.1 Level A.

5.2.1.1 Type M, Composition A. The 5-gallon (19-liter) steel pails, 100 pound (45 kg) fiber drums and 55-gallon (208-liter) steel drums will require no overpacking.

5.2.1.2 Type M, Composition B and Type 2.

5.2.1.2.1 Polyethylene drum. The 30- and 55-gallon (113- and 208-liter) polyethylene drum specified in 5.1.1.2.1 shall be packed in exterior containers as specified in the Appendix of MIL-D-40030. The 5- and 15-gallon (19- and 57-liter) metal containers with polyethylene liners shall be palletized in accordance with MIL-STD-147 except pallets may be unseasoned hardwood or softwood. Quantities less than a full pallet load will not be palletized.

5.2.1.2.2 Polyethylene carboys. The polyethylene carboys shall be packed in fiberboard boxes in accordance with MIL-STD-1188.

5.2.2 Level C. The compound shall be packed for shipment in accordance with MIL-STD-1188.

5.3 Marking. In addition to any special marking required by the contract or order, marking shall be in accordance with MIL-STD-129 and FED-STD-313.

6. NOTES

6.1 Intended use. Phosphate compounds furnished under this specification are used in the preparation of phosphatizing baths for coating carbon and low alloy steels with a manganese or zinc phosphate coating. Ferrous metals may also be coated when in combination with zinc and cadmium.

6.1.1 Type M compound. Type M compound (Composition A or B) is intended for use in the production of manganese phosphate coatings that will conform to the requirements of DOD-P-16232, Type M.

6.1.2 Type Z compound. Type Z compound is intended for use in the production of zinc phosphate coatings that will conform to the requirements of DOD-P-16232, Type Z.

6.2 Ordering data. Procurement documents should specify the following:

- (a) Title, number and date of this specification.
- (b) Type and composition (if applicable) of compound required.
- (c) Type and capacity of container required (see Section 5).
- (d) Level of packaging and packing required (see Section 5).

6.3 Preparation and maintenance of phosphating solutions. Government agencies may obtain information on the preparation, operation and control of the phosphatizing solutions in MIL-HDBK-205.

6.4 Supersession data. Table VI shows the comparison between the types of this specification and those of the previous edition, MIL-P-50002.

TABLE VI. Classification comparison.

MIL-P-50002B	MIL-P-50002A	MIL-P-50002
Type M	Type M	Type I
Type Z	Type Z	Type II

6.4.1 Phosphating materials. Phosphating materials used in DOD-P-16232 are now covered in MIL-P-50002B. Phosphating materials complying with MIL-P-50002B should be procured and used by Government agencies to produce coatings conforming to DOD-P-16232.

6.5 Toxicity of sodium cyanide. Care should be taken in handling sodium cyanide. Small amounts of sodium cyanide (100-200 mg) may be fatal if ingested accidentally. Avoid skin contact. Do not store or eat food in the laboratory. Post laboratories with signs "No Eating, Drinking or Smoking." Do not store near acids. Protective clothing should include: coveralls, or aprons, butyl or neoprene rubber gloves, and chemical goggles.

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6.6 Toxicity of carbon disulfide. Carbon disulfide is highly toxic and gives off a pungent odor. Prolonged exposure to small concentrations of carbon disulfide has caused cerebrovascular changes. Carbon disulfide damages chiefly the central nervous system, the peripheral nerves, and the hemopoietic system. Ingestion of carbon disulfide causes congestion and edema of the gastrointestinal tract. Skin contact with carbon disulfide causes reddening and burning and may result in a second-degree burn. Protective clothing should include those mentioned in paragraph 6.5. In addition, respirator protection is required. A gas mask with a combination chin-style or front or back-mounted canister for organic vapors and acid gas, equipped with a full facepiece, should be used.

6.7 Chemical formulas. Chemical compounds, ions, and elements referred to in this specification are abbreviated as indicated in Appendices I and II.

6.8 Changes from previous issue. Asterisks are not used in this revision to identify changes with respect to the previous issue, due to the extensiveness of the changes.

Appendix I. Chemical formulas.

<u>Chemical Compound or Ion</u>	<u>Chemical Formula</u>
Ammonium chloride	NH_4Cl
Ammonium hydroxide	NH_4OH
Ammonium molybdate	$(\text{NH}_4)_2\text{MoO}_4$
Ammonium nitrate	NH_4NO_3
Ammonium sulfate	$(\text{NH}_4)_2\text{SO}_4$
Cuprous chloride	CuCl
Ethylenediaminetetraacetate	EDTA
Ferrous ammonium sulfate	$\text{Fe}(\text{NH}_4\text{SO}_4) \cdot 6\text{H}_2\text{O}$
Hydrochloric acid	HCl
Hydroxylamine hydrochloride	$\text{NH}_2\text{OH} \cdot \text{HCl}$
Lead nitrate	$\text{Pb}(\text{NO}_3)_2$
Manganese(II) dihydrogen phosphate	$\text{Mn}(\text{H}_2\text{PO}_4)_2 \cdot 2\text{H}_2\text{O}$
Methyl alcohol	CH_3OH
Nickel sulfate	NiSO_4
Nitrate ion	NO_3
Nitric acid	HNO_3
Phosphate ion	PO_4
Potassium chloride	KCl
Potassium permanganate	KMnO_4
Silver nitrate	AgNO_3
Sodium bicarbonate	NaHCO_3
Sodium cyanide	NaCN
Sodium nitrate	NaNO_3
Sodium pyrophosphate	$\text{Na}_4\text{P}_2\text{O}_7$
Sodium sulfide	Na_2S
Sulfur trioxide	SO_3
Sulfuric acid	H_2SO_4
Zinc (II) dihydrogen phosphate	$\text{Zn}(\text{H}_2\text{PO}_4)_2 \cdot 2\text{H}_2\text{O}$

Appendix II. Chemical symbols.

<u>Chemical Element</u>	<u>Chemical Symbol</u>
Aluminum	Al
Arsenic	As
Chromium	Cr
Iron	Fe
Lead	Pb
Magnesium	Mg
Manganese	Mn
Molybdenum	Mo
Nickel	Ni

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Preparing activity:

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