MIL-STD-276
2 February 1956

SUPERSEDING
MIL-I-7878
20 February 1952 and
MIL-I-17414(SHIPS)
15 November 1952
OD-3618
29 March 1945

MILITARY STANDARD
IMPREGNATION OF POROUS NONFERROUS METAL CASTINGS

For sale by the Superintendent of Documents, U.S. Government Printing Office
Washington 25, D. C. - Price 15 Cents

OFFICE OF THE ASSISTANT SECRETARY OF DEFENSE
WASHINGTON 25, D. C.

Supply and Logistics
Impregnation of Porous Nonferrous Metal Castings
MIL-STD-276

1. This standard has been approved by the Department of Defense and is mandatory for use by the Departments of the Army, the Navy, and the Air Force effective 1 April 1956. It is published to establish standard procedures for salvage of defective porous castings by impregnation.

2. In accordance with established procedure, the Standardization Division has designated the Ordnance Corps, Bureau of Ships, and Air Force as Army-Navy-Air Force custodians of this standard.

3. Recommended corrections, additions, or deletions should be addressed to the Standardization Division, Office of the Assistant Secretary of Defense (Supply and Logistics), Washington 25, D. C.

CONTENTS

1. INTRODUCTION

1.1 Scope. This standard covers the requirements and tests for the impregnation of structurally sound aluminum-alloy, magnesium-alloy, and copper-base-alloy castings.

1.2 Preliminary test for pressure tightness. Castings which have been thoroughly cleaned and completely machined shall be subjected to the hydrostatic or aerostatic pressure required by the applicable drawing or directive. (If pressure tests are made on castings before final skin machining and threading of bolt holes, the castings shall be retested after final machining and before impregnation.)

1.3 When castings may be impregnated. Castings shall be impregnated or reimpregnated *only* when specifically authorized in the detail drawings, directives, or when specifically authorized by the bureau or agency concerned. Castings exhibiting structural defects shall under no circumstances be impregnated; neither shall those which exhibit minute (interdendritic) porosity by "sweating" or "weeping", with test water pressure (see 4.1.2.1) coming through at a rate greater than 25 drops per minute per square foot of casting surface, unless specifically authorized by the bureau or agency concerned.

2. REFERENCED DOCUMENTS

2.1 The latest issue of the following specifications, form a part of this standard:

SPECIFICATIONS

MILITARY

MIL-I-6869	Impregnants for Aluminum Alloy and Magnesium Alloy Castings.
MIL-I-17563	Impregnating Compound, Copper Alloy Casting.

(Copies of specifications, standards, drawings, and publications required by contractors in connection with specific procurement functions should be obtained from the procuring agency or as directed by the contracting officer.)

3. MATERIALS AND PROCESS

3.1 Materials.

3.1.1 *Aluminum-alloy and magnesium-alloy.* The materials used to impregnate aluminum-alloy and magnesium-alloy castings shall conform to Specification MIL-I-6869.

3.1.2 *Copper alloy.* The materials used to impregnate copper-base-alloy castings shall conform to Specification MIL-I-17563.

3.1.3 When specified, impregnates of the heat polymerized type only shall be used.

3.2 Process.

3.2.1 *Preparation of castings for impregnation.*

3.2.1.1 *General.* Unless otherwise specifically authorized, impregnation shall be accomplished after all prescribed heat treatment. Castings shall not be treated until all welding or brazing and, where possible, machining operations have been completed. If the casting to be impregnated is to contain liquid or gas other than those considered in the specifications specified in 3.1.1 and 3.1.2, impregnations shall not be performed without permission from the authorizing bureau or agency concerned. When impregnation is approved, the impregnation shall be done under the cognizance of the Government inspector.

3.2.1.2 *Aluminum-alloy and magnesium-alloy.* If heating of castings prior to impregnation is desirable and practical, dry heat shall be used thereon unless the impregnant is an aqueous solution, in which case, live

steam may be used. Rough magnesium alloy castings shall be treated to remove surface skin to a depth of approximately 0.002 inch before impregnation. This may be accomplished by mechanical treatment or by pickling. Unless otherwise specified, anodizing, dichromate treatment or pickling, as applicable, shall be accomplished and the castings (except when impregnated with sodium silicate) thoroughly dried prior to impregnation. (Sodium silicate is a water solution and should be applied hot and cured by heating to vaporize water.) Oils or other machining compounds shall be cleaned from aluminum alloy and magnesium alloy castings prior to impregnation.

3.2.1.3 *Copper-base-alloy.* Castings shall be thoroughly cleaned and dried by heating in an oven at 150° to 180°F. for 1 to 1½ hours or longer.

3.2.2 *Impregnating methods.*

3.2.2.1 *Method A, internal pressure (individual castings).* All of the openings in the casting, except connections to fluid lines, shall be closed with plugs, or plates and gaskets. The impregnating solution shall be poured or injected into the casting until the casting is completely full, or shall be circulated through the casting under pressure. The casting and the solution shall be at a temperature compatible with the nature of the impregnating solution. Hydraulic pressure from 50 to 75 pounds per square inch above prescribed test pressure (if factor of safety of the castings will permit) shall be applied. This pressure shall be maintained until the liquid is observed seeping through the pores or, in the case of extremely fine porosity where the liquid may not come noticeably to the outside surface, until the Government inspector is satisfied that the pores are filled. Loss of solution by seepage may be stopped by spot curing, care being taken not to heat the castings unduly. In cases of minute porosity in heavy walls, 6 hours or more under pressure may be required to effect complete penetration of the solution through the wall.

3.2.2.2 *Method B, vacuum and pressure (batch immersion).* The clean and dry castings, heated if applicable, shall be placed in an empty pressure tank. The tank shall then be closed and the air exhausted therefrom until a vacuum of 27 or more inches of mercury is attained. The impregnating solution, which shall be at a temperature compatible with the nature of the impregnating solution, shall be drawn into the tank, at such a rate that the above specified vacuum is maintained. When the tank contains a sufficient amount of solution to cover the castings, to a level of at least six inches above the castings, pressure shall be applied. After a period which has been shown by experience to be sufficient to seal porosity, has elapsed, the pressure shall be released, the tank emptied of solution, and the castings removed.

3.2.2.3 *Alternate methods.* Other impregnating methods such as batch immersion of small castings under pressure in a vessel filled with impregnating fluid, may be used upon submission of adequate proof of their suitability for the intended use and consequent approval of the bureau or agency concerned. Drawings, specifications, or other directives will not normally designate a particular method of accomplishing the impregnation; however, when a specific method, or a particular impregnant, or other details are essential for the application under consideration, these shall be specified.

3.2.3 *Leakage.* The impregnation shall be so accomplished that the castings do not leak under proof tests hereinafter described. The seal shall not be of a superficial type and it shall be the contractor's or subcontractor's responsibility to determine that the castings are subjected to sufficient time under pressure or vacuum and pressure to permit the impregnating solution to disperse throughout the casting wall.

3.2.4 *Discoloration.* Discoloration which does not affect the quality of impregnation or the serviceability shall not be cause for rejection.

3.2.5 *After-treatment.*

3.2.5.1 *General.* The castings shall be well drained and the surface, including ducts, vents, and pockets, throughly rinsed free of impregnating material with a suitable solvent or cleaning agent prior to the curing cycle.

3.2.5.2 *Curing process.* The castings, after being freed of excessive compound, shall be heated for a suitable time at the proper temperature to insure complete setting of the impregnating compound. For compounds which contain a solvent, the curing cycle shall include heating at 175° to 200°F. for 2 hours to volatilize the solvent, then raising the oven temperature to 250° to 300°F. and holding for an additional 2 or 3 hours to polymerize. After heating, the castings shall be removed from the oven and allowed to cool in air to room temperature. If the compound is solventless or has a curing cycle prescribed by the manufacturer which differs from the above, the manufacturer's recommendation shall be followed.

3.2.6 *Marking.* Each casting which has been impregnated shall be stamped "IMP" on the stamping pad or in a conspicuous place that will not impair the strength or serviceability of the castings.

4. METHODS OF TEST

4.1 Test procedures.

4.1.1 *General.* The supplier shall be responsible for accomplishing the required tests. When inspection is conducted at the supplier's plant, all inspection and testing shall be under the supervision of the Government inspector. Suppliers not having laboratory testing facilities satisfactory to the Government shall engage the services of a commercial testing laboratory acceptable to the bureau or agency concerned. The supplier shall maintain a record, available to the Government inspector, showing quantitative results for all tests required by this standard, and signed by an authorized representative of the supplier or the laboratory, as applicable. In addition, all details of the process and the finished castings shall be subject to such examination as is required to determine conformance with this standard. Acceptance or approval of material during the course of manufacture shall in no case be construed as a guaranty of the acceptance of the finished product.

4.1.2 *Final pressure test.* Castings shall be subjected to the pressure test, either hydrostatic or aerostatic, as specified in the applicable drawings, directives, or specifications. If the applicable drawings, directives, or specifications do not specify the proof pressure, the requirements of 4.1.2.1 shall apply. All machining shall be performed prior to impregnation as required in 3.2.1.1; however, in the event machining is necessary after impregnation, the final pressure test shall be made after machining.

4.1.2.1 *Proof pressure test methods.* When proof pressure testing requirements are not otherwise specified, the following methods shall be used.

4.1.2.1.1 The proof pressure to which the castings shall be subjected shall be double the normal working pressure, but in no case less than 10 p.s.i. gage pressure. Air shall be forced into the castings at the required pressure while the casting is immersed in water. As an alternate, neutral soap solution or kerosene may be brushed on the external surfaces as a leak indicator. The casting shall be held under pressure for not less than 10 minutes.

4.1.2.1.2 *Alternate method.* With approval of the authorized Government inspector, castings may be filled with water, kerosene, or other liquid and subjected to internal pressure. The time of pressure when employing a liquid shall be not less than 5 minutes.

4.1.2.2 *Cleaning.* If a soap solution is used for testing, it shall be thoroughly rinsed from the castings. Castings shall be dry inside and out before storage.

4.1.2.3 *Reimpregnation.* Castings which are found to leak after the first impregnation may be reimpregnated *once* with the same materials used for the initial process, mixed in the same or in different proportions, unless there is reason to doubt the quality of the impregnation process or of the casting, as reflected by failure of the first impregnation to accomplish pressure tightness. Reimpregnation shall be carried out as soon after the initial impregnation as practicable. Castings which leak after one reimpregnation will not be accepted, except that if they have been machined after reimpregnation, two additional impregnations will be permitted before final rejection for weepage under final pressure test.

4.2 Sampling. Sampling of impregnated castings for acceptance inspection shall be as required in the directives or castings specifications as applicable.

Custodians:

Army—Ordnance Corps
Navy—Bureau of Ships
Air Force

Other interest:

Army—CEQSigT
Navy—AOr

☆ U. S. GOVERNMENT PRINTING OFFICE: 1975-603-115 4143

INSTRUCTIONS: In a continuing effort to make our standardization documents better, the DoD provides this form for use in submitting comments and suggestions for improvements. All users of military standardization documents are invited to provide suggestions. This form may be detached, folded along the lines indicated, taped along the loose edge *(DO NOT STAPLE)*, and mailed. In block 5, be as specific as possible about particular problem areas such as wording which required interpretation, was too rigid, restrictive, loose, ambiguous, or was incompatible, and give proposed wording changes which would alleviate the problems. Enter in block 6 any remarks not related to a specific paragraph of the document. If block 7 is filled out, an acknowledgement will be mailed to you within 30 days to let you know that your comments were received and are being considered.

NOTE: This form may not be used to request copies of documents, nor to request waivers, deviations, or clarification of specification requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document*(s)* or to amend contractual requirements.

(Fold along this line)

(Fold along this line)

DEPARTMENT OF THE NAVY

NO POSTAGE NECESSARY IF MAILED IN THE UNITED STATES

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE $300

BUSINESS REPLY MAIL
FIRST CLASS PERMIT NO. 12503 WASHINGTON D. C.

POSTAGE WILL BE PAID BY THE DEPARTMENT OF THE NAVY

Commander
Naval Ship Engineering Center
Center Building SEC- 6124B
Prince George's Center
Hyattsvilee MD 20782

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions – Reverse Side)

1. DOCUMENT NUMBER	2. DOCUMENT TITLE

3a. NAME OF SUBMITTING ORGANIZATION	4. TYPE OF ORGANIZATION *(Mark one)*
b. ADDRESS *(Street, City, State, ZIP Code)*	☐ VENDOR ☐ 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)*

(TO DETACH THIS FORM, CUT ALONG THIS LINE.)

DD FORM 1426 82 MAR

PREVIOUS EDITION IS OBSOLETE.