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**PERFORMANCE OF TESTS REQUIRED
IN
SPECIFICATION MIL-P-116D**

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TECHNICAL REPORT REVIEW

PERFORMANCE OF TESTS REQUIRED IN SPECIFICATION MIL-P-116D

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PERFORMANCE OF TESTS REQUIRED IN SPECIFICATION MIL-P-116D

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by

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Reviewed by:

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ABSTRACT

Military Specification MIL-P-116D "Preservation, Methods of" delineates the requirements for the cleaning, preservation and packaging of items, equipment and materials for protection against corrosion, physical damage and other forms of deterioration during handling, shipment and storage. This report details the procedures to be followed in performing the tests in order to determine conformance to the specification.

SUMMARY

PROBLEM

The objective of this report was to prepare a manual describing the performance of the tests required for conformance to Military Specification MIL-P-116D.

FINDINGS

A suggested procedure for performing each of the tests in MIL-P-116D is described. The equipment required and the performance of each test is explained in detail.

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PERFORMANCE OF TESTS REQUIRED IN SPECIFICATION MIL-P-116D

INTRODUCTION

The purpose of this report is to explain the performance of the tests required in Military Specification MIL-P-116D. An attempt has been made to explain the tests in as non-technical language as possible.

The proposed methods for performing the tests are based on the methods used for a scientific evaluation of the tests. It is not intended that the described methods be considered as the only means of performing the tests. They should be considered simply as guides for an effective testing program. Any simplification of the method that does not interfere with the intent of the test is appropriate.

The tests, as listed, are performed with the minimum of equipment, consistent with the requirements of the test. The required equipment for the performance of the test is detailed in Appendix A. To more effectively explain the performance of the tests, an attempt will be made in this report to pictorially represent every step in the test procedure.

The numbers at the beginning of each test refer to the numbered sections in MIL-P-116D. The Quality Assurance Provisions are included for ready reference.

4. QUALITY ASSURANCE PROVISIONS

4.1 General - Inspection shall be conducted as hereinafter stated to insure compliance with all the requirements of this specification. The contractor shall be responsible for performance of all inspection requirements of this specification except as otherwise stated herein, and he shall maintain detailed records of all examinations and tests performed. Such records shall be made available to the Government. Contractors not having the facilities to successfully accomplish the required tests shall engage the services of a testing facility acceptable to the procuring agency concerned. In instances wherein a test may necessitate an impossible or impractical manipulation of a mounted preserved item or where the over-all size or weight of the item or test equipment availability obviates compliance with a specific test requirement of this specification, the contractor may, through the cognizant Government inspector, submit a request accompanied by detailed justification for approval of an alternate test procedure.

4.2 Classification of Inspection - Inspection shall consist of the following:

a. Preproduction inspection (4.2.1) - Preproduction examination and testing shall be conducted when specified by the procuring agency (see 6.2).

b. Acceptance inspection (4.2.2) - Acceptance examination and testing shall be required in all cases.

4.2.1 Preproduction inspection - When preproduction inspection is specified in the contract or order (see 6.2), the contractor shall subject sample packages of the specified commodities to applicable examinations and tests to determine conformance with the requirements of this specification. Unless otherwise specified in the contract or order, applicable tests shall be as indicated in Table III for the selected method of preservation. When specified in the contract or order (see 6.2), preproduction packages shall be subjected additionally to the rough handling and cyclic exposure test(s) as specified and such test(s) shall be performed prior to the applicable leakage and preservative retention tests required in Table III. Preproduction testing shall be repeated when changes in materials, processes or designs have been made. Preproduction samples shall consist of the same materials and shall be produced by the same methods and shall be fully representative of the planned production package. In addition, when specified, (see 6.2), contractors shall be required to submit:

a. Descriptive details, plans, drawings and samples of the proposed materials or,

b. Preproduction packages of specified commodities to the

designated activity to establish that selected preservation materials and methods have been effectively combined in accordance with the applicable requirements of this specification. Preproduction packages submitted for Government approval shall be representative of and identical to a package that has previously been successfully tested and in the opinion of the contractor fully in conformance with and capable of meeting all the applicable requirements of this specification.

4.2.2 Acceptance inspection - Acceptance inspection concerns the selection of representative samples and the performance of applicable examinations and tests to determine conformance with the requirements of this specification. Unless otherwise specified in the contract or order, applicable tests shall be as indicated in Table III for the selected method of preservation. When specified in the contract or order (see 6.2), sample packages shall be subjected to rough handling and cyclic exposure test(s) as specified, and such test(s) shall be performed prior to the applicable leakage and preservative retention tests required in Table III. When necessary to perform inspection prior to application of preservatives, wrappings, or containers; when advantageous to the method of production; or when performed in order to eliminate the need for destroying completed packages, applicable acceptance examinations and tests shall be performed at one or more appropriate stages in the actual processing of the item. Except as provided above, all the acceptance examinations and tests of this specification are independent of each other to the extent that they may be performed on the same or on different sample units. Whether the examinations and tests are performed progressively during the stages of processing or accomplished upon completion of the package, the results shall show that the method of preservation, as accomplished, has the capability of withstanding all applicable tests indicated in Table III for the selected method of preservation.

4.2.2.1 Inspection lot - For the purpose of selecting samples to be inspected for compliance with the requirements of this specification, either items in process or completed packages may be combined into lots without regard to individual items, contracts or the quantities therein subject to the following:

4.2.2.1.1 Inspection lots for in-process inspection - Items processed under substantially the same conditions may be combined into lots for performance of group A examinations and tests by the test procedure and the operation being inspected. Such lots established for inspections performed prior to application of preservative, wrappings or container shall include items cleaned and, when applicable, dried by an identical process.

4.2.2.1.2 Inspection lots for final inspection. For performance of group B examinations and tests, preserved articles and packages may be combined in such a manner as to permit a single application of the

sampling or inspection procedures to a grouping of items subject to one of the following:

1. Packages processed by the same method and submethod of preservation and subjected to an identical test procedure.

2. Packages processed by different methods and submethods of preservation which employ identical flexible barrier materials (type, grade and class) or the same type of closure.

4.2.2.1.3 Inspection lots for group C tests - Unless otherwise specified, identical items processed in the same manner shall be combined into lots for performance of group C tests.

4.2.2.2 Grouping of inspections -

4.2.2.2.1 Group A -

	<u>Requirements</u>
Determination of the cleanliness of the item prior to application of preservative, wrap, bag or barrier	3.2, 3.3 and Table III
Required preservative properly applied	3.4.1 through 3.4.4 and Table III
Designated wraps, cushioning, flexible barrier, strippable compound, containers, desiccant, humidity indicators, windows and gaskets properly used in fabrication of the package	3.5.1 through 3.5.7 and Table III
Required cushioning, blocking, bracing or bolting used in fabrication of the package	3.6 through 3.6.3
Comparison of part number with package identification markings and quantity check	3.7 and 3.8

4.2.2.2.2 Group B -

<u>Examinations</u>	<u>Requirements</u>
Supplemental cartons, boxes or containers as required	3.7
Designated unit package markings properly applied	3.8 and Table III
Quality of workmanship consistent with the selected method of preservation	3.1.3 and Table III

<u>Test</u>	<u>Reference</u>	<u>Test Paragraph</u>
Leakage Tests	Table III	4.4.3 through 4.4.3.5.1
Heat Seal	Table III	4.4.4 through 4.4.4.3.1

4.2.2.2.3 Group C -

<u>Test</u>	<u>Reference</u>	<u>Test Paragraph</u>
Cyclic exposure (when applicable)	Table III	4.4.5 through 4.4.5.3
Rough handling (when applicable)	Table III	4.4.6 through 4.4.6.3.6
Determination of preservative retention (when applicable)	Table III	4.4.7 and 4.4.7.1

4.2.2.3 Sampling for Groups A, B and C inspections - Sampling procedures shall be in accordance with Standard MIL-STD-105. Unless otherwise specified in the contract or order, inspection levels and acceptable quality levels shall conform to 4.2.2.3.1, 4.2.2.3.2 and 4.2.2.3.3.

4.2.2.3.1 Sampling for Group A - Samples shall be selected at random from each lot at inspection level I. For purposes of sampling (when more than one inspection station is established for group A examinations and tests) the lot at any station shall consist of the same units of product as that at the preceding station, except for any defective units which may have been removed. Sample units shall be subjected to the group A examinations and tests listed in 4.2.2.2.1. If any sample unit shows deviation(s) from requirements, it shall be rejected. Unless otherwise specified in the contract or order, lots shall be accepted or rejected in accordance with acceptable quality level (AQL) 4.0 percent defective for all group A examinations and tests combined. When examinations and tests are performed on different sample units as is possible in accordance with 4.2.2, the sample size shall remain constant for each inspection station.

4.2.2.3.2 Sampling for Group B - Samples shall be selected at random from each lot at inspection level L-7 for normal inspection and L-5 for reduced inspection (procedure R-1). For purposes of sampling (when more than one inspection station is established for group B examination and tests) the lot at any station shall consist of the same units of product as that at the preceding station except for any defective units which may have been removed. Sample units shall be subjected to the group B examinations and tests listed in 4.2.2.2.2. If any sample unit show deviation(s) from requirements, it shall be rejected. Unless otherwise specified in the contract

or order, the acceptable quality level (AQL), for sample sizes greater than 7, shall be 4.0 percent defective for all group B examinations and test(s) combined; for sample sizes up to 7 inclusive, each such sample size shall be used and for these sample sizes, the acceptance number shall be zero for all group B examinations and tests combined. When examinations and tests are performed on different sample units as is possible in accordance with 4.2.2, the sample size shall remain constant for each inspection station.

4.2.2.3.3 Sampling for Group C - When group C (rough handling and cyclic exposure) tests are specified in the contract or order for acceptance inspection, samples shall be selected at random and subjected to the group C test(s) specified in the contract or order. The acceptable quality level (AQL), the level of inspection and the severity of inspection (i.e., normal, tightened or reduced) shall be as specified in the contract or order.

4.2.2.4 Optional sampling procedures for inspection and test - In lieu of the conventional lot-by-lot acceptance and test procedure of 4.2.2.1 and 4.2.2.3, other statistical sampling procedures may be employed. (See 6.9) In employing optional sampling procedures, the samples shall be selected, inspected and tested in accordance with the applicable test methods. The specific sampling plan to be employed shall be based on statistical methods, shall conform to an Average Outgoing Quality Limit (AOQL) not to exceed 5.0 percent defective or an acceptable quality level (AQL) of 4.0 percent defective. The statistical characteristics of optional sampling procedures shall be subject to the approval of the Government. Optional sampling procedures which may be employed are described as follows:

4.2.2.4.1 Continuous unit sampling procedure - Initially 100 percent of the units or packages shall be selected, inspected and tested. When a pre-established, consecutive number of such units have been found to conform to the inspection and test requirements, sampling is instituted at a pre-established rate (in which only a fraction of the subsequent units or items being produced are inspected and tested). When provided in the design of the continuous sampling plan, further reduction in the sampling rate may be possible through a systematic procedure of tabulating the number of consecutively sampled, conforming units or packages. If a defective unit or package is observed while sampling, inspection and test will revert to 100 percent inspection, or to an adjusted rate in accordance with the established procedure.

4.2.2.4.2 Continuous skip lot sampling procedure - In a manner similar to the continuous unit sampling procedure specified in 4.2.2.4.1, inspection and test under the continuous skip lot procedure normally prescribes that 100 percent of the manufactured lots must be subjected to sample inspection for a controlled period of

production. When a pre-established number of consecutive lots have been sample inspected and found acceptable, sampling shall be instituted for subsequent lots at a pre-established level (in which only a fraction of the subsequent lots produced are subjected to sample inspection and testing). Under this procedure, the rejection of a lot selected on a sampling basis generally requires that inspection and test revert to a sampling of 100 percent of the lots submitted.

4.2.2.4.3 Other sampling procedures - Other statistically valid sampling procedures may be employed providing that the criteria of 4.2.2.4 are satisfied. Procedures in this category include those new techniques which may be developed subsequent to the release of this specification, and which may have particular merit for use in this program.

4.2.2.5 Quality control system requirements - When contracts include provisions for the establishment by the contractor of a quality control system and the approved system includes sampling and inspection requirements to insure that packages meet the requirements of this specification, that system shall be used in lieu of the sampling and inspection provisions of 4.2.2.3 and 4.2.2.4.

4.2.2.6 Rejection - If any article or package is found nonconforming in one or more respects, it shall be rejected whether or not the lot as a whole is accepted.

4.2.2.6.1 Rejection in lot-by-lot inspections - If the number of defective articles or packages in any sample equals or exceeds the applicable rejection number, the lot represented by the sample also shall be rejected.

4.2.2.6.2 Rejection under optional sampling procedures - In addition to the special feature for adjusting the inspection rate for any of the alternative sampling procedures, action will be taken to provide for the screening and removal of all defective units from the unshipped quantity of material which is represented by the sample unit or sample quantity as the case may be.

4.3 Procedure in Case of Failure - Rejected items or lots may be reinspected for acceptance provided the contractor has removed all nonconforming materials, has corrected his procedures, methods or workmanship as necessary. Rejected units shall be corrected or replaced with nondefective units. The contractor shall maintain detailed records indicating all corrective action taken. When corrected lots are reinspected for acceptance inspection, the sampling procedure to be employed shall conform to the requirements for tightened inspection in accordance with Standard MIL-STD-105 as applicable.

4.4 Test Procedures - Tests of methods of preservation shall be made in accordance with the applicable tests specified hereinafter as indicated in Table III. When a combination of preservation methods is used for a specific item, tests applicable to the various methods employed shall be used.

4.4.1 Determination of Cleanliness -

4.4.1.1 Visual test - Surfaces shall be examined visually to determine freedom from dirt, corrosion, oil, grease and similar foreign residues.

4.4.1.1.1 Interpretation - The presence of visible contamination shall be cause for rejection.

Discussion - The purpose of the cleanliness tests is to determine whether all of any residues that might have resulted from the manufacture of the item have been removed. As the cleanliness of the item is an essential part of its preservation, these tests are as important as any other in the specification.

This test simply requires a close visual examination of the item. If possible, the item should be examined under a good source of light and held by a holder of some type to prevent contaminating the surface. If a holder is not available, the item should be held so that as small an area as possible is covered by the glove, paper or material used to hold the item. Care should be taken to prevent fingerprinting or other contamination of the item under examination.

Equipment Required (Fig. 1)

1. Lamp
2. Tongs or some type of holder or
3. Glove, barrier paper or other means of holding the item to prevent contamination.



Fig. 1. - Visual Test. Equipment required for the visual examination. A good source of light and some means of holding the item to prevent contamination are required. NAVSUPRANDFAC Neg. No. 541-25.

Procedure

1. Hold the item so that as little of it as possible is covered by the holder.
2. ~~Examine~~ the item on all sides under a strong light.

Figures 2 and 3 illustrate two different methods of holding the item so that as little of the surface as possible is obscured.

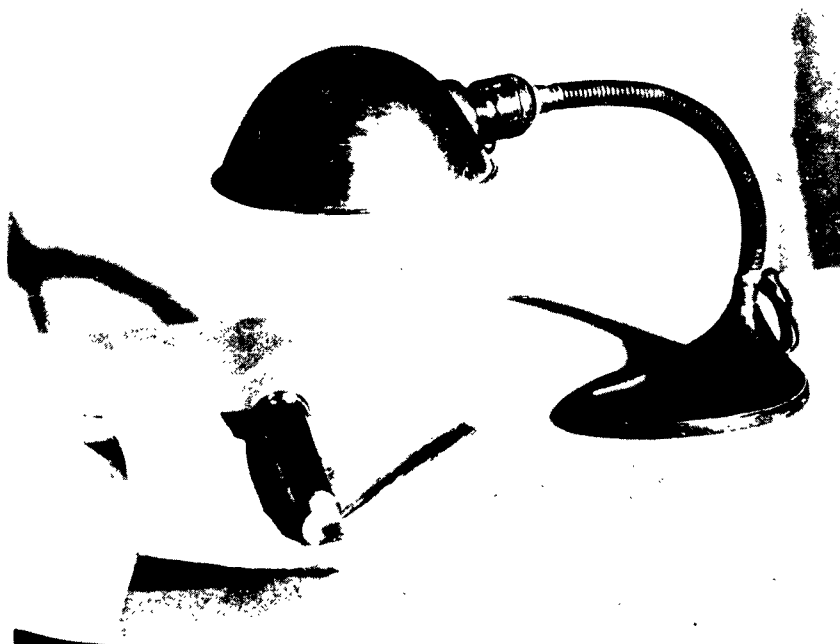
Interpretation

Any foreign material on the item indicates that it has not met the requirements of the test.



Fig. 2. - Visual Test.
Holding the item under
a strong light, using
tongs. If this method
is used, care should
be taken to avoid
scratching critical
surfaces.
NAVSUPRANDFAC Neg.
No. 541-16.

Fig. 3. - Visual Test.
Holding the item by
means of a piece of bar-
rier material.
NAVSUPRANDFAC Neg. No.
541-11.



4.4.1.2 Wipe Test - A portion of the item shall be wiped with a clean, white, lint-free cloth and another portion with a clean, dark, lint-free cloth.

4.4.1.2.1 Interpretation - Any visible deposit on either cloth shall be cause for rejection.

Discussion - This test requires that part of the item be wiped with a clean, white, lint-free cloth, and the remainder with a dark cloth in order to detect dark or light residues including oils and greases that may be present on the item. Any dark cloth which will show traces of dust or light colored foreign materials likely to be encountered in the cleaning process may be used for this test. After wiping, the cloth should be examined under a bright light.

Equipment Required (Fig. 4)

1. Source of light
2. Dark and light cloth - cloth should be clean and free from lint and foreign material.

Procedure

1. Hold the item under test so that as little of it as possible is covered and wipe a portion of it with a clean, lint-free, white cloth. (Fig. 5)
2. Wipe the remaining portion with a dark cloth. (Fig. 6)
3. Examine both cloths under a strong light (Fig. 7) for signs of any foreign material.

Interpretation

Any foreign material on either cloth indicates that the material was not properly cleaned and the item has not met the requirements of the test.

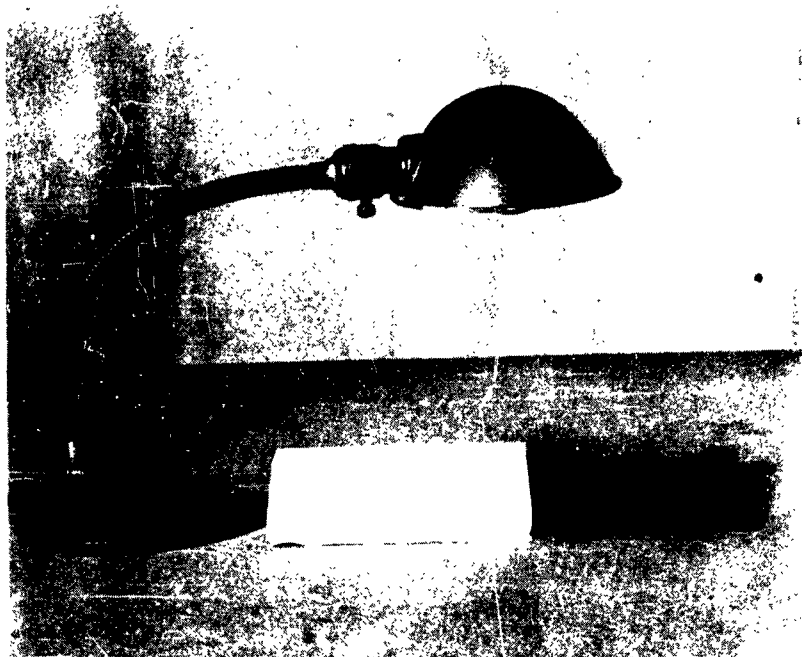


Fig. 4. - Wipe Test.
Equipment required for
wipe test. Clean lint-
free cloth as well as
a bright light is the
only equipment required
for this test.
NAVSUPRANDFAC Neg. No.
541-24.

Fig. 5. - Wipe Test.
Wiping the item with
a clean, lint-free
white cloth.
NAVSUPRANDFAC Neg. No.
541-23.





Fig. 6. - Wipe Test.
Wiping the item with
a dark cloth.
NAVSUPRANDFAC Neg. No.
541-13.

Fig. 7. - Wipe Test.
Examining the cloth
under a bright light.
Any foreign material
on either cloth indi-
cates that the item
is not clean.
NAVSUPRANDFAC Neg. No.
541-12.





Fig. 8. - Freedom from Alkalies and Acids. Methyl red and red litmus paper or universal indicating paper are required. In addition, if the item has to be rewet, distilled water and a medicine dropper are required. NAVSUPRANDFAC Neg. No. 571-2.

3. Examine the color of the paper - compare with color chart if universal indicator paper is used. (Figs. 11(a) and (b)).

Interpretation

The requirements of the test have not been met when

- a. The methyl red paper color turns to red, or
- b. The red litmus paper color turns to blue
- c. Universal indicator paper is used and the color indicates a pH below 6.4 or above 8.3.

Note: Many universal indicator paper charts show distinct color changes in steps of 1.0 pH units. It is, therefore, necessary to estimate the color intervals. If the color is so close to the upper or lower limits of the test (6.4 - 8.3) that there is a doubt in the observer's mind, the item does not pass the test. It is preferable to use the universal indicator paper which shows color changes in steps of 0.1 pH units.

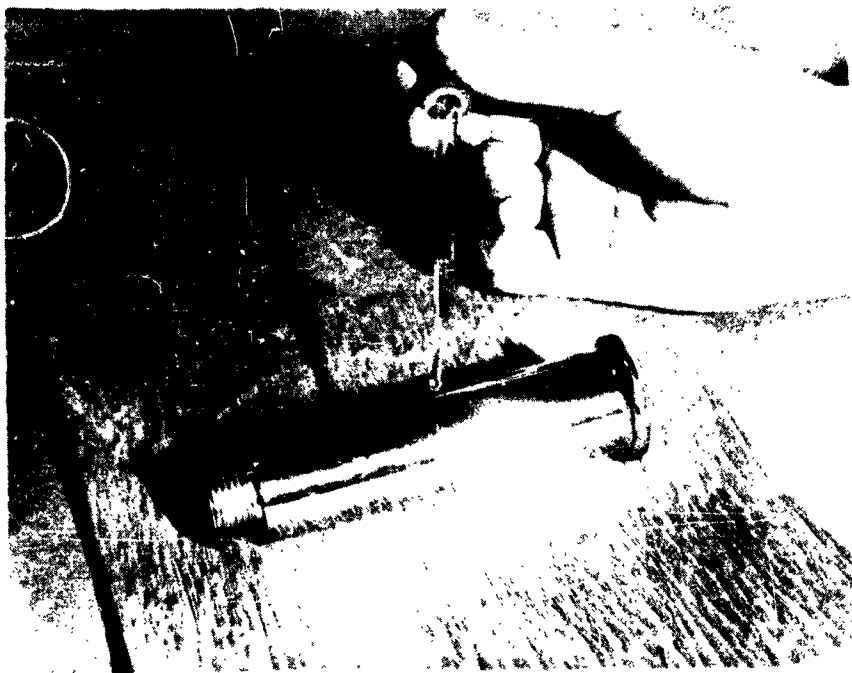


Fig. 9. - Freedom from Alkalies and Acids.
Wet the item with a few drops of distilled or deionized water if not still wet from the final rinse. NAVSUPRANDFAC Neg. No. 541-15.

Fig. 10. - Freedom from Alkalies and Acids.
Touch the indicating paper to the wet portion of the item. It is only necessary to wet about $\frac{3}{4}$ " or 1" of the paper. NAVSUPRANDFAC Neg. No. 541-8.

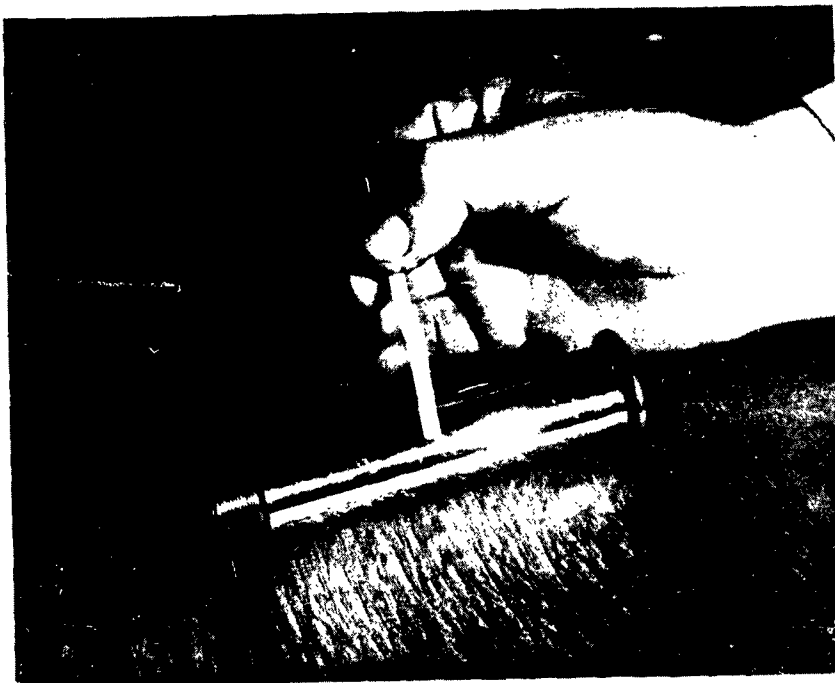




Fig. 11(a). -
NAVSUPRANDFAC Neg. No.
541-14.

Fig. 11(b). -
NAVSUPRANDFAC Neg. No.
524-2.



Freedom from Alkalies and Acids. Examine the color of the indicator paper. When universal indicating paper is used, compare the color with the color chart.

4.4.2 Determination of Preservative Compound Application - The continuity and appearance of preservatives after application shall be determined visually.

4.4.2.1 Interpretation - Coatings which are not uniform and homogeneous shall be cause for rejection. (Note: Hard preservative films shall be examined closely for breaks in the coating.)

Discussion - The preservative coatings should be examined visually. If the coating is not uniformly applied; that is, if there are streaks, or bare areas, or an accumulation of preservative in one area, the item has not met the requirements of the test. If a hard film preservative is used, the coating should not be cracked or broken.

Equipment Required

1. Lamp or source of light
2. Holder

Procedure

1. Examine item visually (Fig. 12)

Interpretation

If the preservative coating is not uniform or if any bare areas of accumulation of preservative are present, the item does not meet the requirements of the test.

If a hard film preservative is used, any cracks or breaks in the coating are cause for rejection of the item.

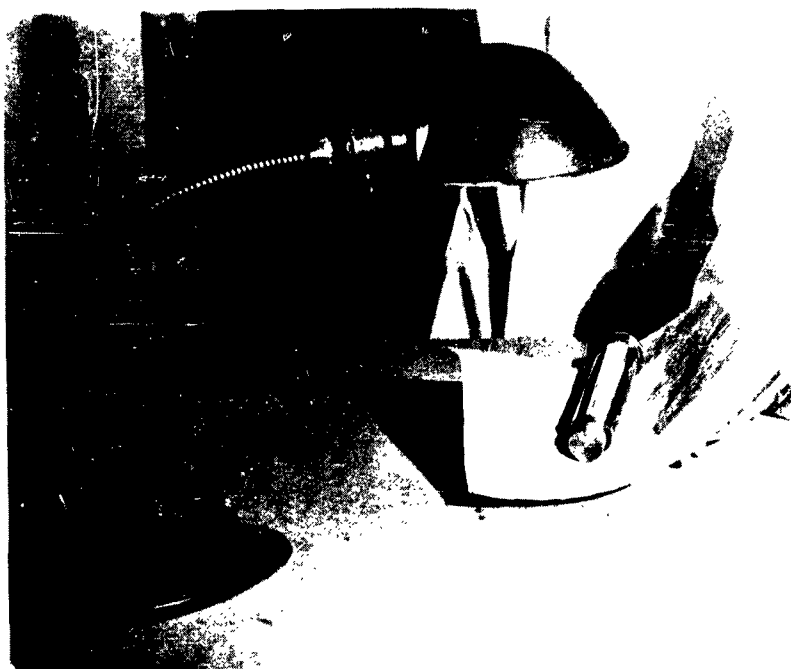


Fig. 12. - Determination of Preservative Compound Application.
The item is visually examined for defects in the application of the preservative. The surface should be uniform if the preservative application is to be acceptable. NAVSUPRANDFAC Neg. No. 541-21.

4.4.3 Leakage Tests

4.4.3.1 General - All samples shall be conditioned at ambient conditions for at least 4 hours prior to performing the quick leak test (4.4.3.2) or the waterproofness test (4.4.3.3). The time that the item and all processing materials have been maintained at ambient conditions prior to or during the processing period may be considered as part of the conditioning time. Wax-dipped packages, conditioned for the quick leak test in 4.4.3.2.1 shall be conditioned at a temperature not exceeding 60°F.

Discussion - The samples to be tested should be stored between 60° to 80° for at least four hours before performing the quick leak test and the waterproofness tests. This conditioning period is not necessary if the item and the packaging materials were stored under normal room temperature conditions prior to packaging.

4.4.3.1.1 Wetting agent - In order to remove surface air and entrapped air in scrim back barrier materials, a wetting agent or detergent shall be added to the test water. Approximately 5 cc of liquid aerosol OT, or equivalent wetting agent, shall be added per each gallon of water. The aerosol solution, or a solution of 4 grams of water-soluble detergent, conforming to Specification MIL-D-16791, type I, per gallon of test water will effectively release the entrapped air in scrim backed flexible barrier materials so that actual leakage of air through the barrier may be detected.

4.4.3.2 Quick leak test - Packages, conditioned as specified in 4.4.3.1, shall be tested for leakage by submerging the filled and sealed sample bag, package or can in water contained in a vacuum vessel and drawing a vacuum. For heat sealed packages and rigid metal containers, a vacuum differential of 216 mm (8 1/2 inches) of mercury from ambient conditions shall be held for 30 seconds (minimum) while observing for leakage of air. For wax-dipped packages and rigid containers other than all metal, a vacuum differential of 140 mm (5 1/2 inches), of mercury from ambient conditions shall be used. Repeat the test after inverting the sample. The inside diameter and depth of a cylindrically shaped vacuum vessel shall be not less than 9.85 inches (250 mm) and 8 inches (203 mm) respectively. The minimum inside length, width, and depth of a box shaped vacuum vessel shall be not less than 8.5 inches, 8.5 inches, and 8 inches respectively. When the size or shape of the package precludes the use of the vacuum vessel, the quick leak test described in 4.4.3.2.1 shall be used.

4.4.3.2.2 Interpretation of results - Observation of evolution of air bubbles shall be made at each position of the sample. Bubbles which appear on the surface of the package but are not released are not to be construed as indication of failure. A steady stream or recurring succession of bubbles from any surface or seam shall be cause for rejection.

Discussion - The purpose of this test is to create a lower pressure outside the package than exists within the package so that the air in the package is forced through any openings in the barrier. This is accomplished by evacuating the air from above a submerged package so that the pressure in the package is greater than that of the surroundings. This pressure will be released by faulty packages and will be evident in the form of bubbles escaping from the package into the water.

Equipment Required (Fig. 13)

1. Manometer or vacuum gage for measuring the vacuum
2. Vacuum pump or water aspirator for drawing the vacuum
3. Vacuum desiccator or other suitable apparatus which will maintain a vacuum
4. Wetting agent - Aerosol OT or water soluble detergent conforming to Specification MIL-D-16791, type I.

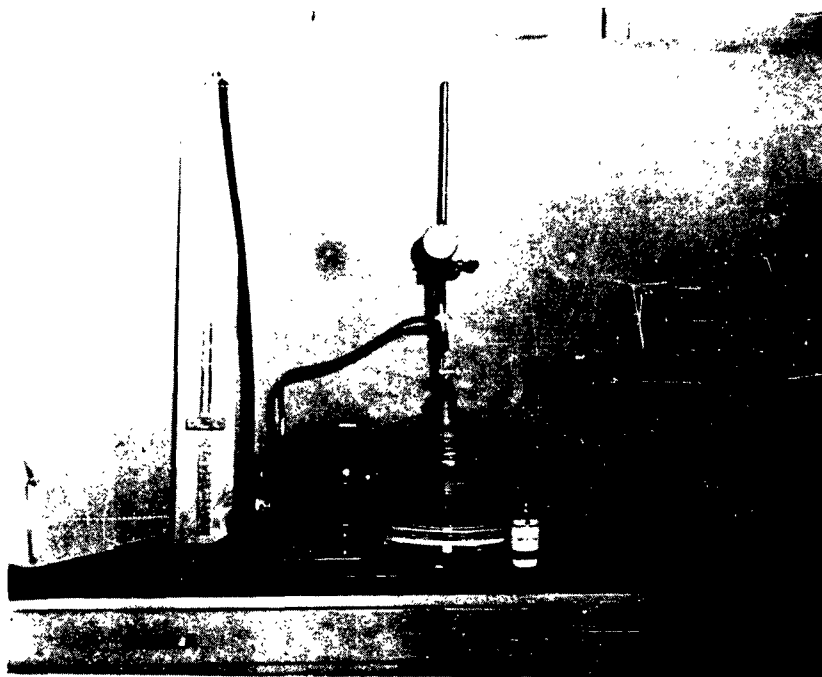


Fig. 13. - Quick Leak Test. Apparatus required for performing the test. Shown above is a manometer for measuring the vacuum drawn, a vacuum pump, a water aspirator, a vacuum desiccator with a vacuum gage and a wetting agent. Any suitable vessel that can maintain a vacuum may be used for this test.
NAVSUPRANDFAC Neg. No. 541-17.

Procedure

1. Partially fill the vacuum desiccator with water. The height of the water in the desiccator is dependent on the size of the package. Enough water should be present to completely cover the package.
2. Put some wetting agent in the water if scrim-back material is to be tested; 5 cc (approximately 1 teaspoon) of liquid wetting agent or 4 grams (approximately 2 teaspoons) of powdered wetting agent should be put into the water. (Fig. 14) This amount may be decreased to prevent the appearance of too many bubbles from the wetting agent.
3. Submerge the test package in the desiccator.
(Fig. 15)

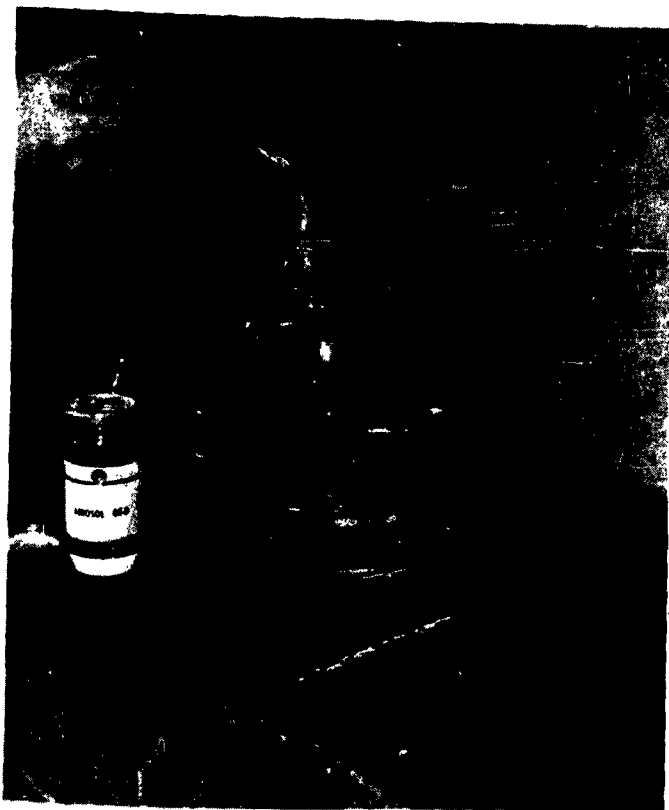


Fig. 14. - Quick Leak Test. Putting the wetting agent into the water in the desiccator prior to testing scrim-back barrier package. NAVSUPRANDFAC Neg. No. 509-20.

Fig. 15. - Quick Leak Test. Placing the scrim-back barrier package in the water. Note the evolution of bubbles from the scrim material. The upper face of the package is parallel to the surface and not more than one inch below the surface of the water. NAVSUPRANDFAC Neg. No. 509-18.



4. Place desiccator cover on and connect the desiccator to vacuum pump or aspirator by means of rubber tubing. Attach a manometer or vacuum gage in the line. (Figs. 16 and 17)

5. Start the vacuum by turning on the faucet or the vacuum pump.

6. Close the stopcock or clamp the vacuum hose after the desired vacuum has been reached. (Fig. 18) This is 5 1/2 inches or 140 mm of mercury for wax-dipped packages and rigid containers other than all metal and 8 1/2 inches or 216 mm of mercury for heat sealed packages and rigid metal containers.

7. The package shall be examined for at least 15 seconds and not more than 2 minutes. If any defect is present in the package, the bubbles will be readily seen. (Fig. 19)

8. Invert the package and test as above so that all faces and seams can be observed.

Interpretation

The appearance of any bubbles, in the water, or on the surface of the water, coming from the package indicates that the package has not met the requirements of the test. A few bubbles on the surface of the package, but not released from the package, are not indications of failure.

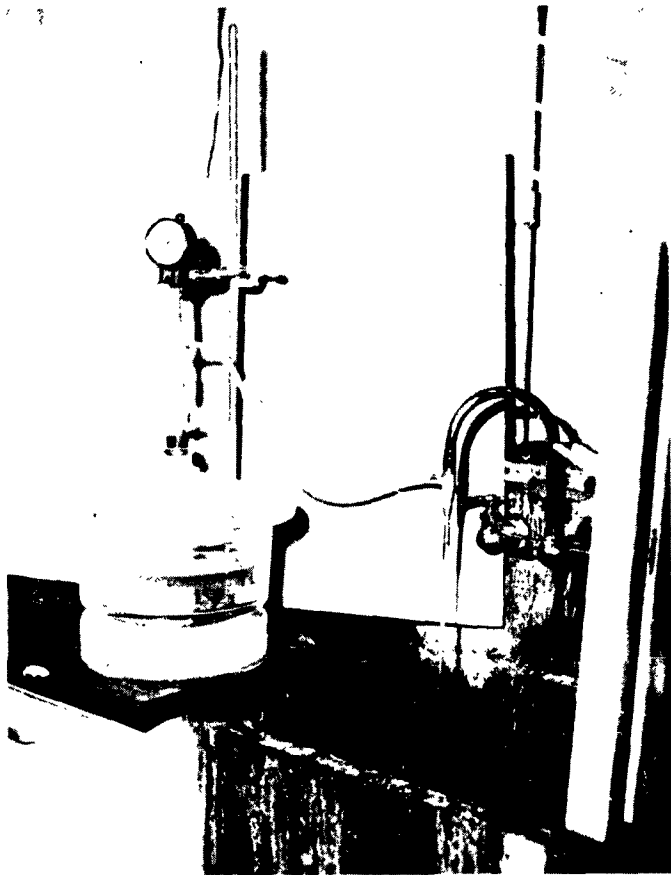


Fig. 16. - Quick Leak Test. Apparatus connected and test starting. Source of vacuum is an aspirator attached to a water faucet. NAVSUPRANDFAC Neg. No. 541-19.

Fig. 17. - Quick Leak Test. Apparatus connected and test starting. Source of vacuum is a vacuum pump. NAVSUPRANDFAC Neg. No. 524-46.





Fig. 18. - Quick Leak Test. Closing the stopcock after the required vacuum has been attained.
NAVSUPRANDFAC Neg. No. 524-11.

Fig. 19. - Quick Leak Test. Test in progress. Note the lamp to aid in the detection of the bubbles escaping from the package.
NAVSUPRANDFAC Neg. No. 541-4.



4.4.3.2.1 Packages exceeding the capacity of the vacuum vessel shall be conditioned as specified in 4.4.3.1 and immersed in water heated to a temperature of at least 50°F above the temperature at which the package was conditioned. For wax-dipped packages, the temperature of the test water shall not exceed 110°F. The upper face of the package shall be parallel to and not more than one inch below the surface of the water. Each face of the package shall be rotated to the same position until the entire surface of the container has been examined. Each seam and face of the package shall be observed for a minimum period of 15 seconds and a total elapsed time not to exceed 2 minutes.

4.4.3.1.1 Wetting agent - In order to remove surface air and entrapped air in scrim-back barrier materials, a wetting agent or detergent shall be added to the test water. Approximately 5 cc of liquid aerosol OT, or equivalent wetting agent, shall be added per each gallon of water. The aerosol solution, or a solution of 4 grams of water-soluble detergent, conforming to Specification MIL-D-16791, type I, per gallon of test water will effectively release the entrapped air in scrim-backed flexible barrier materials so that actual leakage of air through the barrier may be detected.

4.4.3.2.2 Interpretation of results - Observation of evolution of air bubbles shall be made at each position of the sample. Bubbles which appear on the surface of the package but are not released are not to be construed as indication of failure. A steady stream or recurring succession of bubbles from any surface or seam shall be cause for rejection.

Discussion - This test is for packages which are too large to fit into the desiccator or vacuum vessel. The pressure developed in these packages depends on the expansion of air caused by the change from a cold to a warmer temperature. The air pressure built up will escape from faulty packages and will be evident as bubbles released from the package into the water.

Equipment Required

1. Container large enough to completely submerge the package
2. Wetting agent (if required)

Procedure

1. Condition the package for not less than 4 hours at a temperature 50°F lower than the temperature of the test water. If wax-dipped packages are to be tested, it is necessary to cool the package to at least 60° since temperatures above 110° are extreme for this type of package. (Note: It is advisable to cool all

packages to at least 60° since temperatures above 110° are too warm to comfortably manipulate the package.)

The package should be conditioned so that there is at least a 50° differential in temperature as the proper pressures cannot be developed otherwise. A greater temperature spread will not harmfully affect the test results.

2. Fill the test vessel so that the water is at least one inch higher than the largest dimension of the container. The temperature of the water should be at least 50° higher than the temperature of the container under test.

3. Put some wetting agent in the water if scrim-back material is to be tested. Use approximately one teaspoon of liquid or two teaspoonsful of solid wetting agent for each gallon of water used.

4. Place the test package in the water so that its upper face is parallel to the upper surface of the water and not more than one inch below the surface. (Fig. 20)



Fig. 20. - Quick Leak Test. Placing the package in the water heated 50° above the temperature of the package. NAVSUPRANDFAC Neg. No. 524-1.

5. Observe for the presence of bubbles indicating air escaping from the package for at least 15 seconds and for not more than 2 minutes.

6. Turn package and examine each face of the package.
(Fig. 21)

Interpretation of Results

Bubbles escaping from the package indicate that the package has not met the requirements of the test.



Fig. 21. - Quick Leak Test. Turning the package and examining for the presence of escaping bubbles. NAVSUPRANDFAC Neg. No. 524-28.

4.4.3.3 Waterproofness Test - Packages, conditioned as specified in 4.4.3.1, shall be immersed in water at a temperature approximately 40°F cooler than the package for 15 minutes. The package shall be immersed so that the top surface is one inch below the surface of the water. After removal, the package shall be opened and inspected.

4.4.3.3.1 Interpretation of results - Evidence of moisture within the barrier shall be cause for rejection.

Discussion - This test depends on differences in internal and external pressure. In this test, the water is drawn into a defective package because the change from a warmer environmental temperature to a colder temperature causes a decrease in the volume of air in the container. This decrease in pressure causes the water to be drawn into the package.

Equipment Required

1. A vessel suitable for holding sufficient water to accommodate the package
2. Cold water or ice if necessary

Procedure

1. Cool the water to approximately 35° since average room temperature is approximately 75°. A mixture of ice and water easily brings the temperature to 35°. A holder or stand should be made for the item so that the top of the package can be kept about one inch below the surface of the water. (Fig. 22). In lieu of conditioning the package at room temperature and immersing in water 40° cooler, the package may be conditioned at a temperature 40° higher than the temperature of the test water.
2. Keep the package in the water for 15 minutes.
3. Open the package and inspect for evidence of water or corrosion on the item. (Fig. 23).

Interpretation

Any evidence of moisture within the barrier or corrosion of the item is cause for rejection of the package.



Fig. 22. - Waterproofness
Test. Placing the pack-
age in the water.
NAVSUPRANDFAC Neg. No.
509-5.

Fig. 23 - Waterproofness
Test. Opening the pack-
age and examining for
evidence of moisture.
NAVSUPRANDFAC Neg. No.
541-7.



4.4.3.4 Vacuum Retention Test - The flexible barrier enclosing the item shall be sealed except for an opening at one end to accommodate a tube which is connected to a vacuum producing apparatus (aspirator or vacuum pump). A vacuum of 9 mm $\pm$ 1 mm of mercury or 5 inches $\pm$ 1/2 inch of water measured by gage or manometer shall be drawn on the sealed package and the tube closed. The required vacuum may be drawn more than once to insure that equilibrium within the barrier has been reached. (CAUTION. An excessive vacuum may damage the flexible barrier material.) Loss of vacuum shall be determined after the package has remained undisturbed for 10 minutes. To facilitate performance of the vacuum retention test, a pneumatic tire valve may be installed in the barrier approximately 1 1/2 inch from the line of closure. Grooves should be cut across the base of the tire valve to prevent the flexible barrier from blocking the core opening. Soft rubber gaskets placed on each side of the barrier will prevent leakage around the valve when the assembly is tightened in place. Bags previously sealed may have one corner cut off to permit installation of the valve. The cut edge is resealed after the valve is installed. Unless otherwise specified, the valve shall be removed after the completion of the test.

4.4.3.4.1 Interpretation of results - A loss of vacuum from the sealed system shall not exceed 25 percent of the original vacuum after remaining undisturbed for 10 minutes.

Discussion - This test is based on the fact that a properly fabricated flexible barrier heat sealed package should maintain a measurable vacuum for a short period of time. This test will detect faulty packages and will not cause failure of a good package. Breaks in the aluminum foil of the barrier which do not extend through the plastic film will not allow the escape of enough vacuum, in the time interval of the test, to cause rejection.

Equipment Required (Fig. 24)

1. Tubeless tire valve with base grooved.
2. Soft rubber gaskets
3. Vacuum gage
4. Rubber tubing
5. Clamp to pinch rubber tubing
6. Source of vacuum (may be household type vacuum cleaner)
7. Vacuum relief valve

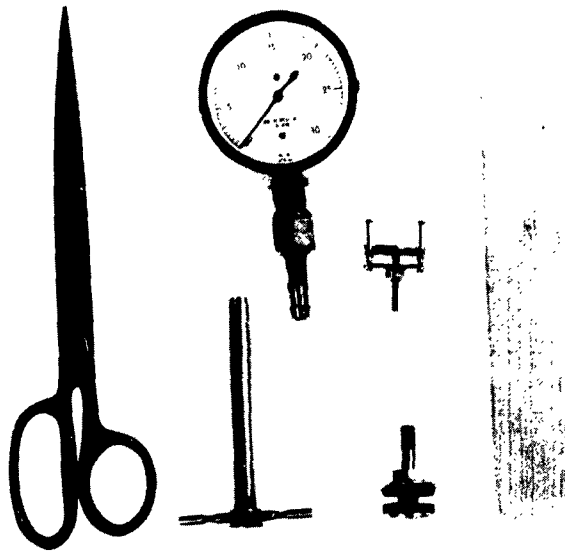


Fig. 24. - Vacuum Retention Test. Tubeless tire valve, clamp, vacuum gage, scissors and hole borer. NAVSUPRANDFAC Neg. No. 1162-11.

Procedure

1. Snip off a corner of the ear of a package (Fig. 25)
2. Cut a hole in one piece of the barrier near the seam area large enough to accommodate the tubeless tire valve. (Fig. 26)
3. Place the valve in the hole in the barrier. (Note: The rubber flange on the valve should be notched or grooved to prevent the constriction of the opening when the vacuum is drawn.) Place a soft rubber washer on each side of the barrier material. (Fig. 27)
4. Tighten the nut on the valve sufficiently to prevent leakage. (A wrench may be necessary to prevent leakage.) (Fig. 28)
5. Reseal the opening and attach the valve to a source of vacuum. (Fig. 29)
6. Withdraw the air from the package. A vacuum relief valve is recommended to prevent the withdrawal of too much air from the package. These valves are available for most home style vacuum cleaners. (Fig. 30)



Fig. 25. - Vacuum
Retention Test. Snip-
ping the ear of the
package prior to insert-
ing the valve.
NAVSUPRANDFAC Neg. No.
1162-4.

Fig. 26. - Vacuum
Retention Test. Cut-
ting a hole in the
barrier. The best way
to do this is to use a
laboratory cork borer.
NAVSUPRANDFAC Neg. No.
1162-3.





Fig. 27. - Vacuum Retention Test. Inserting the valve in the barrier. Be sure to use soft rubber washers on either side of the barrier material.
NAVSUPRANDFAC Neg. No. 1162-1.

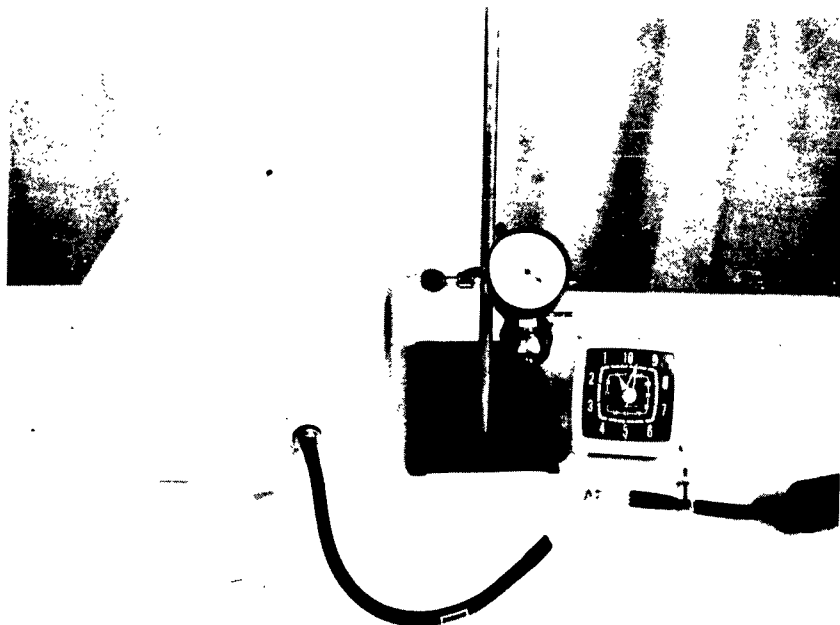
Fig. 28. - Vacuum Retention Test. Tighten the nut on the washer. A wrench tightening may be necessary to insure against leaks at this point.
NAVSUPRANDFAC Neg. No. 1162-2.





Fig. 29. - Vacuum Retention Test. Re-seal the barrier after insertion of the valve. NAVSUPRANDFAC Neg. No. 1162-10.

Fig. 30. - Vacuum Retention Test. Draw the required vacuum. Let stand for 10 minutes. Note reading on gage. NAVSUPRANDFAC Neg. No. 1162-8.



7. Remove the air until a vacuum of 9 mm is attained.
8. Let stand for 10 minutes.
9. Read the gage value.
10. Subtract the latter value from the previous reading.
11. Cut off that portion of the barrier that includes the valve and reseal. (Fig. 31)

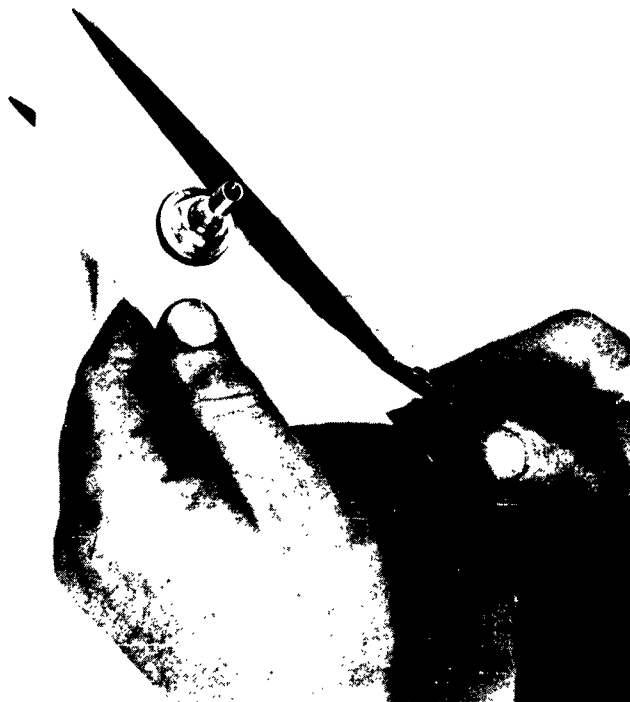


Fig. 31. - Vacuum Retention Test. Cut off the barrier section where the valve is located. NAVSUPRANDFAC Neg. No. 1162-9.

Interpretation

Loss of vacuum is to be not more than 25 percent of the original vacuum. If these values are exceeded, the package does not meet the requirements of the test.

4.4.3.5 Pressure Retention Test - Through an air connection installed in the container wall, dry air shall be introduced to create an internal pressure approximately 4 to 5 pounds gage pressure per square inch. The air supply shall then be closed. Evidence of leakage shall be detected by loss of pressure measured by means of a connected pressure gage graduated in ounces; or by observance for air bubbles either during immersion of the pressurized container in water or after coating the outer surface of the pressurized container with a water-soap solution.

4.4.3.5.1 Interpretation of results - Any loss of gage pressure over a 30 minute period shall be cause for rejection. When a water-soap solution or immersion is used, evidence of air leakage indicated by soap bubbles increasing in size or being blown away by escaping air, or evidence of a steady stream or a recurring succession of bubbles from any surface shall be cause for rejection.

Discussion - This test is designed to measure the air tightness of a container. Four to five pounds air pressure is developed in the container. If there is no decrease in this pressure or evidence of leakage after 30 minutes, the container is acceptable.

Apparatus - Source of air pressure - pressure gage, air fitting, tubing (Fig. 32.)

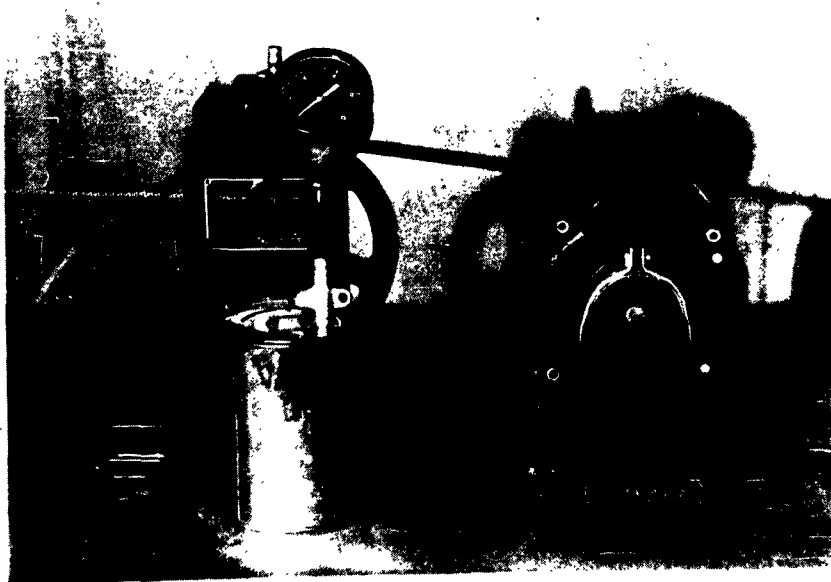


Fig. 32. - Pressure Retention Test. Source of pressure (pump), container under test, air fittings and pressure gage required for test. NAVSUPPRANDFAC Neg. No. 541-10.

Procedure

1. Install an airtight fitting in the container so that air under pressure can be introduced into the container and a pressure gage may be attached. A "T" or "Y" fitting may be used so that it is necessary to make only one hole in the container.
2. Attach a fitting so that there is no leak at the joint. Soldering is probably the easiest method of attachment.
3. Attach rubber tubing to the fitting. Attach the stop-cock fitting to an air pump and attach a gage to the other fitting or end of the "T" fitting. (Fig. 33)

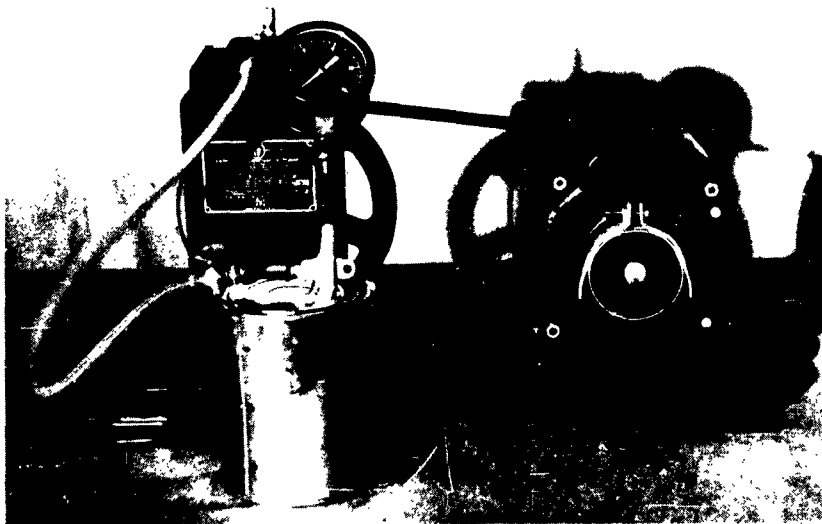


Fig. 33. - Pressure Retention Test. Container with fitting attached. When 4 or 5 pounds of air pressure is developed in the can, the fitting is closed to retain the air. After 30 minutes, the pressure on the gage is again read. NAVSUPRANDFAC Neg. No. 541-9.

4. After 4 to 5 pounds air pressure has been developed in the container, close the air supply. Note exact reading on gage. (Fig. 34)

5. Let stand for 30 minutes. Again note reading on gage.

6. Subtract final reading from initial reading.

Interpretation

Any loss in the gage reading in the 30 minutes indicates that the container does not meet the test requirements.

Alternate Procedure

The following procedure may also be followed:

1. Install air connection fitting

2. Attach to source of air

3. Fill to 4 to 5 pounds pressure

4. Close air supply

5. Coat the outer surface with a water-soap solution or immerse container in water and check for air bubbles. (Fig. 35)

Interpretation

The loss of any air from the container as evidenced by a steady stream of air bubbles in the water or soap bubbles increasing in size is indicative of failure to comply with the test requirements.



Fig. 34. - Pressure Retention Test. Container under test attached to a source of air pressure and a gage for measuring the pressure developed. NAVSUPRANDFAC Neg. No. 524-45.

Fig. 35. - Pressure Retention Test. Immersing container in water and observing for air bubbles. NAVSUPRANDFAC Neg. No. 541-5.



4.4.4 Heat Seal Test

4.4.4.1 Selection of samples for test - Sections of the heat seals shall be obtained from sealed packages. The number of heat sealed specimens required shall be in accordance with 4.2.2.3 and 4.2.2.3.2, except that when one of the optional sampling plans under 4.2.2.4 is used, a minimum of two tests shall be performed during each two hour production period.

4.4.4.2 Alternate sampling procedure for heat seal test - When heat seals are made on equipment conforming to MIL-S-4461, samples may be prepared from specimen heat seals in lieu of taking samples from sealed packages as specified in 4.4.4.1. Specimen heat seals shall be prepared daily prior to production from sample(s) of each barrier material sealed on each sealing device. Machine settings used in production shall be identical with the settings used in fabrication of the tested specimen. Additionally, tests of heat seals from actual packages shall be performed as necessary to assure that package seals meet the requirements of 4.4.4.3.

4.4.4.3 Performance of the heat seal test - After the heat sealed seams are thoroughly cooled, sections of the heat seals one inch in width cut perpendicular to the line of the seal, shall be obtained from the test specimens or package barriers as applicable. The length of the legs of the test section is not critical. The sections shall be unfolded and clamped with the line of the seal perpendicular to the direction of the load application. The seams shall be positioned midway between the jaws of the testing clamps. A static load shall be applied slowly and uniformly without impact and allowed to act for five minutes at ambient room temperature. Any separation at the heat sealed area shall be noted, without disturbing the seal, after 2 minutes and at the end of the 5 minute interval. The static load shall be 50 ounces for MIL-B-131 materials, 36 ounces for MIL-B-121, MIL-B-13239, and MIL-B-3959, type I materials and 22 ounces for materials conforming to MIL-B-3959, type II. A 5 percent reduction in static load is permitted when the room temperature in the test area exceeds 90°F.

4.4.4.3.1 Interpretation of results - Partial separation of the heat seal is acceptable within the first two minutes of the test to allow areas of partial fusion adjacent to the actual seal to pull apart. Delamination of laminated barrier material after application of the static load shall be cause for rejection. Any separation of the heat sealed area during the final three minutes of the test shall be cause for rejection.

Discussion - This test is designed to measure the strength characteristics of a heat seal. The seal, when properly made, is almost as strong as the heat sealable film. A one inch wide heat seal section should be able to support the specified weight for five minutes without appreciable separation.

Equipment Required

Sample cutter or scissors, 50 ounce, 36 ounce, 22 ounce weights, clamp or other holder to attach one end of the sample, ruler, stapler, bent nails or other clip. (Fig. 36).

Procedure

1. Measure a one inch section of the barrier material. (Fig. 37).

The sample is to be cut perpendicular to the line of the heat seal. The length of the specimen is not important.

2. Cut the one inch wide sample. (Fig. 38). If a calibrated sample cutter is used to cut the sample, it will not be necessary to measure the width of the sample.

3. Unfold the sample in order to staple the legs so that the weight may be hung from one leg and the other leg attached to the clamp or holders. (Fig. 39).

4. Staple both ends of the sample so that the sample and the weight can be supported. A simple way to support the weighted sample is by the use of a bent 6 penny or 8 penny nail. (Fig. 40).

5. Bend a 6 penny or 8 penny nail or any piece of metal in the shape of an open triangle. This is not necessary if any other method for supporting the sample is used. (Fig. 41).

6. Hang the sample on the clamp or other means of attachment. (Fig. 42).

7. Suspend the weight so that the seam is midway between the bent nail holding the weight and the attachment to the clamp. Attach the weight so that there is as little shock as possible on the seal (as little swinging of the weight as possible).

8. Note any separation of the seal after two minutes. Mark the sample lightly so that no motion is imparted to the hanging weight. Let the weight hang an additional three minutes.

9. After removing the weight, prepare the sample so that the heat seal area can be easily measured either by snipping off the ends or by spreading out the balance of the barrier material using a pencil or some other means. (Figs. 43 and 44).

10. Measure the remaining seal area. Note if there is any additional separation of the barrier material at the seal. (Fig. 45).

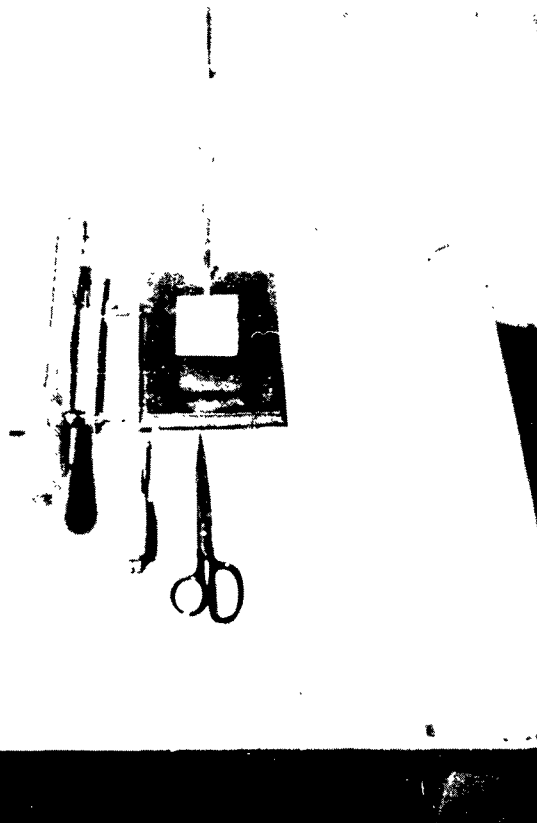


Fig. 36. Heat Seal Test.
Sample cutter, 50 ounce
weight, clamp, ruler,
scissors, stapler, bent
nails.
NAVSUPRANDFAC Neg. No.
524-16.

Fig. 37. Heat Seal Test.
Accurately measure a one
inch sample cut perpen-
dicular to the line of
the heat seal. This
should be done as ac-
curately as possible,
since the test measures
the delamination result-
ing from a weight hanging
from a definite width of
a seal.
NAVSUPRANDFAC Neg. No.
524-13.





Fig. 38. - Heat Seal Test.
Carefully cutting the one
inch wide sample.
NAVSUPRANDFAC Neg. No.
524-32.

Fig. 39. - Heat Seal Test.
Unfolding the sample so
that it may be stapled.
NAVSUPRANDFAC Neg. No.
524-10.





Fig. 40. - Heat Seal Test.
Stapling the sample so
that it can be hung prop-
erly.
NAVSUPRANDFAC Neg. No.
524-21.

Fig. 41. - Heat Seal Test.
Bending the nail in the
form of an open triangle.
The bent nail will be
used to support the sam-
ple and the weight.
NAVSUPRANDFAC Neg. No.
524-47.



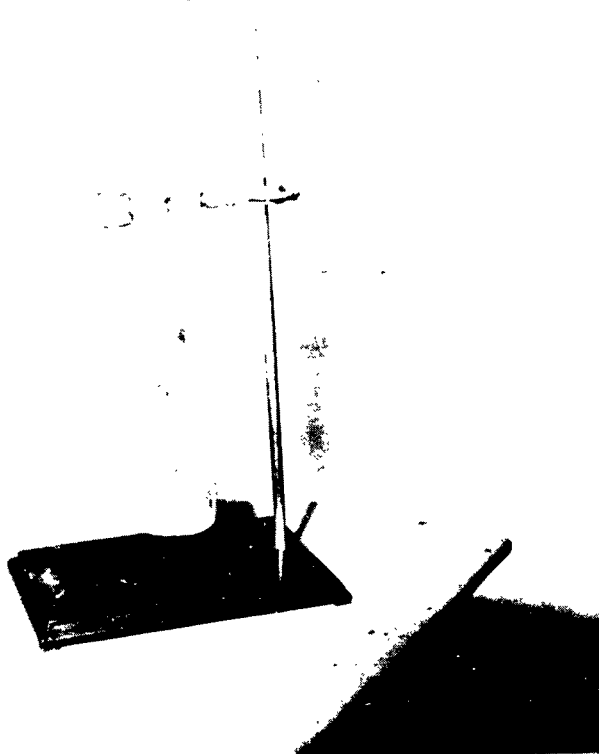


Fig. 42. - Heat Seal Test.
The 50 ounce weight hangs
from the heat seal for
five minutes.
NAVSUPRANDFAC Neg. No.
524-15.

Fig. 43. - Heat Seal Test.
Snipping the end of the
barrier material so that
the seal area may be
measured.
NAVSUPRANDFAC Neg. No.
524-12.





Fig. 44. - Heat Seal Test.
Spreading out the barrier
so that any separation
beyond the marked point
may be noted.
NAVSUPRANDFAC Neg. No.
524-36.

Fig. 45 Heat Seal Test.
Measuring the area of the
seal.
NAVSUPRANDFAC Neg. No.
524-14.



4.4.5 Cyclic Exposure Test - When specified (see 6.2), the cyclic exposure test shall be performed on the completed packages packed as for shipment. When cyclic exposure tests are required, the test specimens shall be subjected to cyclic exposure test A or test B specified in 4.4.5.1 and 4.4.5.2 before final acceptance. When the cyclic exposure test is required, such tests shall precede applicable leakage and preservative retention tests specified in table III. Examination and test for leaks in barrier materials, seals and closure and preservative retention as indicated in table III shall be performed on the contained unit package(s) following the cyclic exposure tests to determine existence or extent of detrimental effects.

4.4.5.1 Test A -

Overnight at 120° to 130°F.
Two hours of water spray at 50° to 60°F.
Two hours at -10° to 0°F.
Two hours of water spray at 120° to 130°F.
Two hours of water spray at 50° to 60°F.
Overnight at 35° to 50°F.

Four hours at 120° to 130°F.
Two hours of water spray at 50° to 60°F.
Two hours at 35° to 50°F.
Overnight at 120° to 130°F.

Two hours of water spray at 50° to 60°F.
Two hours at -10° to 0°F.
Three hours at 35° to 50°F.
Overnight at 120° to 130°F.

4.4.5.3 Interpretation of results - The tested package, when opened, shall show no evidence of moisture or corrosion.

Discussion - The object of this test is to accelerate the entry of water into the package and/or corrosion of the packaged item by exposing the container and its contents to drastic variations in temperature and humidity conditions.

Equipment Required - Test A

Oven (120° to 130°F), water spray (shower or some type of spray attachment), cooling chamber (-10° to 0°F), refrigerator (35° to 50°F).

Procedure

1. Place the container in a hot box or oven at 120° to 130°F overnight. (Fig. 46).

2. Place the container under a water spray (50° to 60°F). Any suitable shower or spray utilizing a shower head makes a satisfactory spray. Continue the spray for two hours. (Fig. 47). A spray of water equivalent to a light rain is sufficient for this purpose.

3. Place the container in a cold chamber at -10° to 0°F for two hours. (Fig. 48).

4. Place the container under a warm water spray at 120° to 130°F for two hours.

5. Place the container under a 50° to 60°F spray for an additional two hours.

6. Store the container overnight in a cold box or refrigerator at 35° to 50°F. (Fig. 49).

7. Continue the test by placing the container in the following:

Four hours at 120° to 130°F.
Two hours of water spray at 50° to 60°F.
Two hours at 35° to 50°F.
Overnight at 120° to 130°F.

8. Continue the next day:

Two hours of water spray at 50° to 60°F.
Two hours at -10° to 0°F.
Three hours at 35° to 50°F.
Overnight at 120° to 130°F.

9. Examine the contents of the container for moisture or corrosion. (Fig. 50).

Note: These tests can be stopped at any time in the cycle. If a weekend or holiday intervenes while the test is in progress, the sample may be left, preferably at the overnight part of the test. If it is not practicable to leave the container in the oven, it may be left at room temperature conditions for the required time.

Interpretation

When the container is opened, there should be no evidence of moisture within the sealed barrier or corrosion on the item.



Fig. 46. - Cyclic Exposure Test. Placing the container in the hot box for overnight conditioning at 120° to 130°F. NAVSUPRANDFAC Neg. No. 509-32.

Fig. 47. - Cyclic Exposure Test. Exposing the container to a water spray for two hours. NAVSUPRANDFAC Neg. No. 524-42.



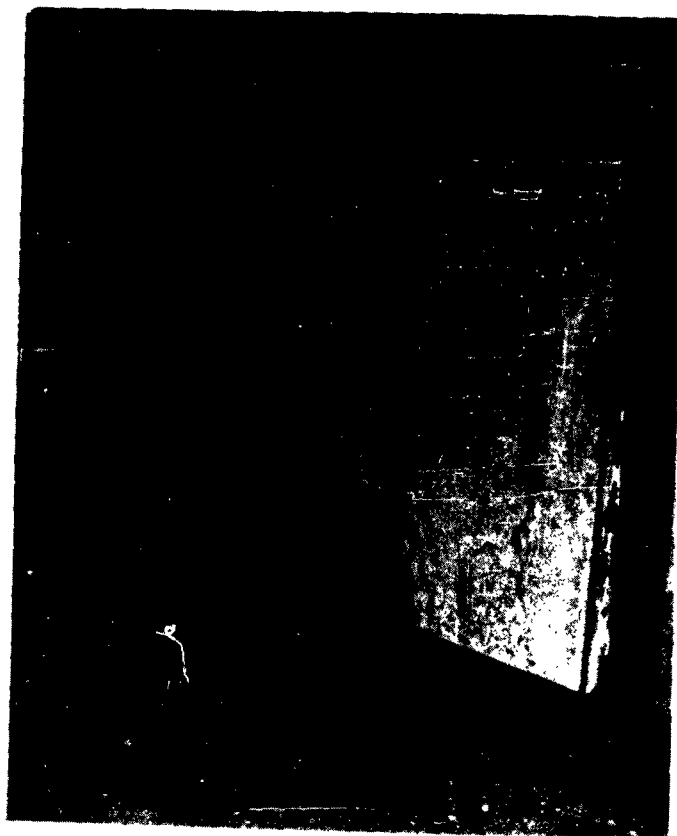


Fig. 48. - Cyclic Exposure Test. Placing the container in a cold chamber at -10° to 0°F . NAVSUPRANDFAC Neg. No. 509-2.

Fig. 49. - Cyclic Exposure Test. Placing the container in a refrigerator overnight at 35° to 50°F . NAVSUPRANDFAC Neg. No. 509-1.

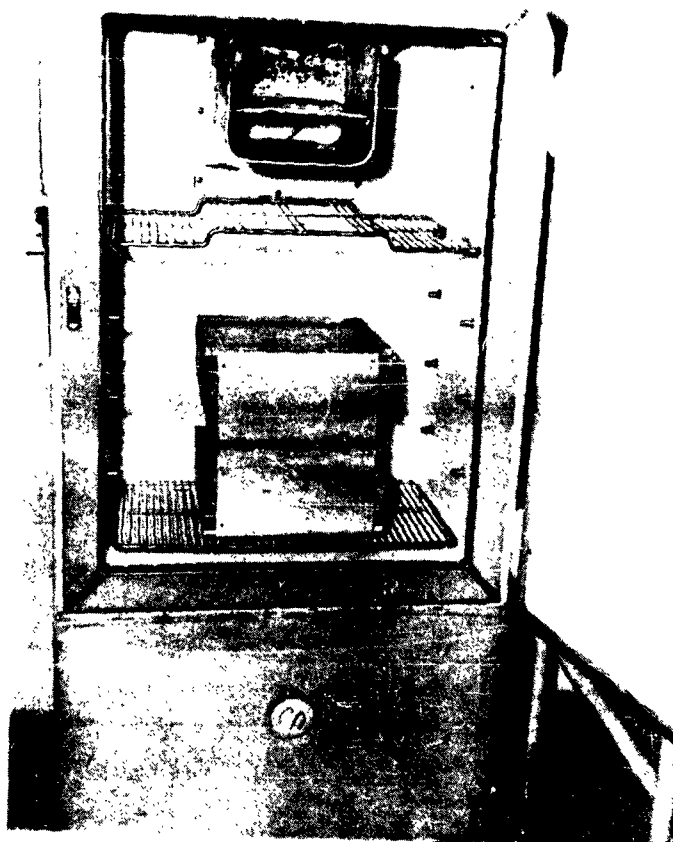




Fig. 50. - Cyclic Exposure Test. Examining the contents of the container for evidences of moisture or corrosion.
NAVSUPRANDFAC Neg. No. 571-1.

4.4.5.2 Test B - The following cyclic sequence shall be repeated for three days:

Overnight at 120° to 130°F.
Two hours of water spray at 50° to 60°F.
Four hours at 120° to 130°F.
Two hours of water spray at 50° to 60°F.
Overnight at 120° to 130°F.

4.4.5.3 Interpretation of results - The tested package, when opened, shall show no evidence of moisture or corrosion.

Equipment Required - Test B

This test requires a minimum of equipment - a hot box and a water spray are required. Fig. 51 details a hot box that may be easily made at a low cost.

Procedure

1. Place the container in the hot box at 120° to 130°F overnight.
2. Place the container under a water spray at 50° to 60°F for two hours.
3. Place the container in the hot box at 120° to 130°F for four hours.
4. Place the container under a water spray at 50° to 60°F for two hours.
5. Perform steps 1 through 4 three times; follow with a final overnight exposure in the hot box at 120° to 130°F.

Note: These tests can be stopped at any time in the cycle. If a weekend or holiday intervenes while the test is in progress, the sample may be left, preferably at the overnight part of the test. If it is not practicable to leave the container in the hot box, it may be left at room temperature conditions for the required time.

Interpretation

When the container is opened, there should be no evidence of moisture within the barrier or corrosion on the item.

CONSTRUCTION OF HOT BOX

ONE OF THREE THERMOSTATS
TO CONTROL TEMPERATURE
120°F OR 130°F

BOX LINING OF
MIL-B-131
BARRIER MATERIAL
ON ALL SIDES.
TOP AND BOTTOM

PALLET BOX
40" X 48"
WITH COVER

ONE OF
3 HEATING BULBS
300 WATTS EACH IN
SOCKETS CONTROLLED
BY THERMOSTATS

CIRCULATION FAN

Fig. 51

55

U. S. NAVAL SUPPLY RESEARCH AND DEVELOPMENT FACILITY
BAYONNE, N. J.

SUPPLY ENGINEERING DIVISION

DRAWN BY: ALS APPROVED: el

DATE: 12-20-56 DWG. NO.-SED-SK-883

4.4.6 Rough handling - When specified (see 6.2), rough handling tests shall be performed on the completed packages packed as for shipment. When rough handling tests are required, such tests shall precede applicable leakage and preservative retention tests specified in table III. Examination and tests for leaks in barrier materials, seals and closures and preservative retention as indicated in table III shall be performed on the contained unit package(s) following the rough handling tests to determine existence or extent of detrimental effects. Unless a specific test is specified by the procuring agency, selection of the applicable test shall be in accordance with 4.4.6.1 or 4.4.6.2, as applicable (see 6.7). For interpretation of results, see 4.4.6.3.6.

4.4.6.1 Packs not exceeding 200 pounds - Packs not exceeding 200 pounds and with no dimension greater than 60 inches shall be tested by the free fall method, (4.4.6.3.1), except that items having a net weight exceeding 100 pounds and which are secured to the base of the container shall be tested as indicated for packs exceeding 200 pounds (4.4.6.2).

4.4.6.2 Packs exceeding 200 pounds - Packs exceeding 200 pounds or having any dimension greater than 60 inches shall be tested first by the cornerwise drop test (4.4.6.3.2) followed by either the pendulum impact test (4.4.6.3.3) or the incline impact test (4.4.6.3.4). If the cornerwise drop test is impracticable because of the container size or shape, the edgewise drop test (4.4.6.3.5) may be substituted in lieu thereof.

4.4.6.3 Rough handling test

4.4.6.3.1 Free fall drop test - The container shall be dropped cornerwise from a height of 30 inches onto a steel, concrete or stone surface of sufficient mass to absorb the shock without deflection in such a manner that the corner of the container absorbs the full force of the fall. This test shall be repeated until each of the eight corners of the container has received a fall. (The height of 30 inches refers to the distance from the steel, concrete or stone surface to the nearest corner of the container when suspended prior to the fall.) The fall shall be a free fall, in that no ropes or other suspending media are attached to the container during the fall. If the container is of the drum type, the top and bottom of the drum shall be marked so that the circle of the top and bottom is quartered, and the above test shall be applied to each of the quartered sections.

Discussion - This test measures the protection from rough handling that the method of preservation offers to the item.

Equipment Required

Any equipment that will permit a free fall from a height of 30 inches, and a steel, concrete or stone surface that will absorb

the shock of the fall of the package without deflection.

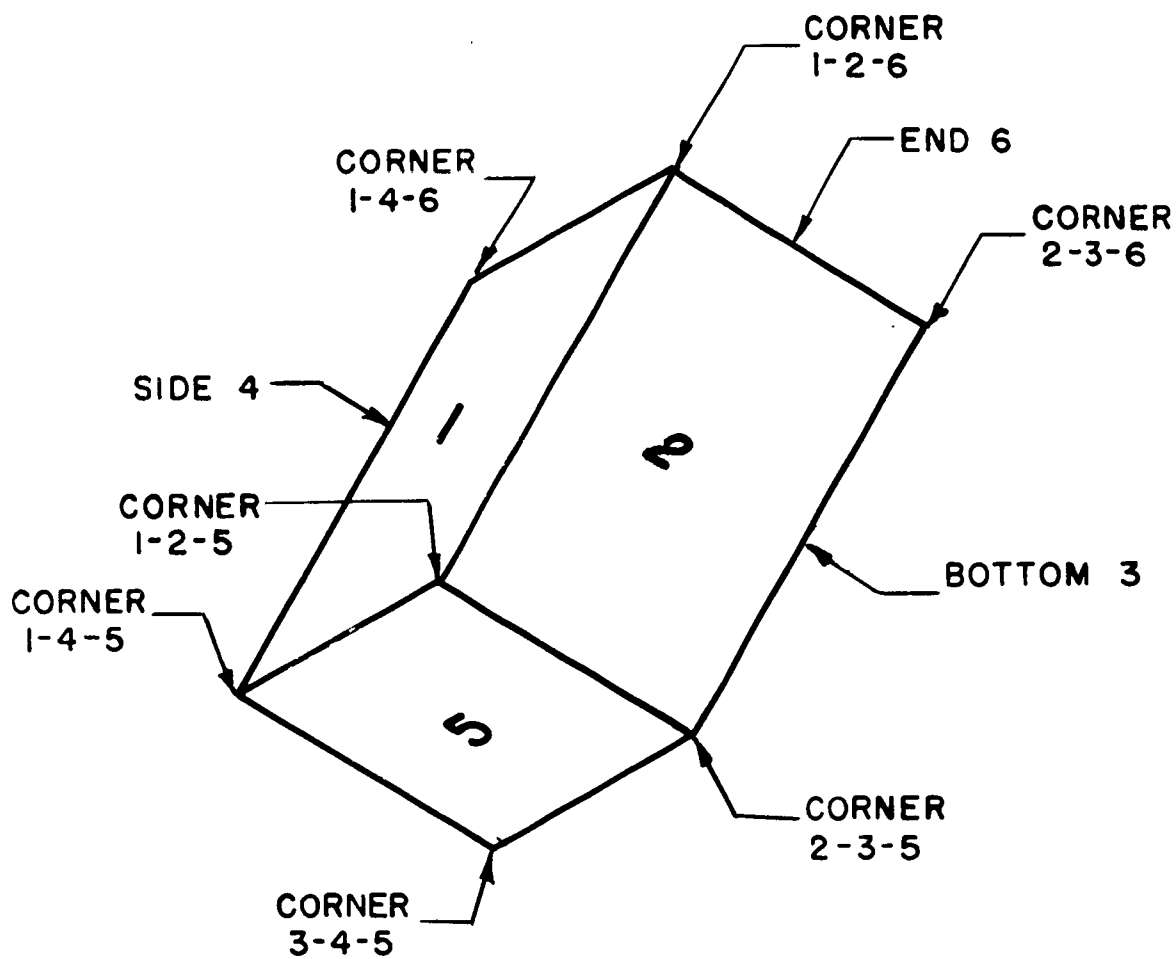
Note: The equipment used should permit accurate prepositioning of the container so that a true fall and impact will occur in the exact places desired and should permit an absolutely free, unobstructed fall.

Procedure

1. Identify all faces and corners of the container by numbering the top 1 and then numbering clockwise 2, bottom 3, other side 4, front end 5 and back end 6. (Fig. 52). This step is not absolutely necessary, as the corners on which the drops have been made may be identified by any simple method.
2. Position the container on the drop test apparatus or in the hooks of the hoist sling apparatus or whatever equipment is used so that the container falls on the desired corners. (Fig. 53).
3. Drop the container on all eight corners.

Interpretation

The items and the components of the package shall be free from damage. When required, the item shall be operated to determine if it operates properly.



CONTAINER IDENTIFICATION

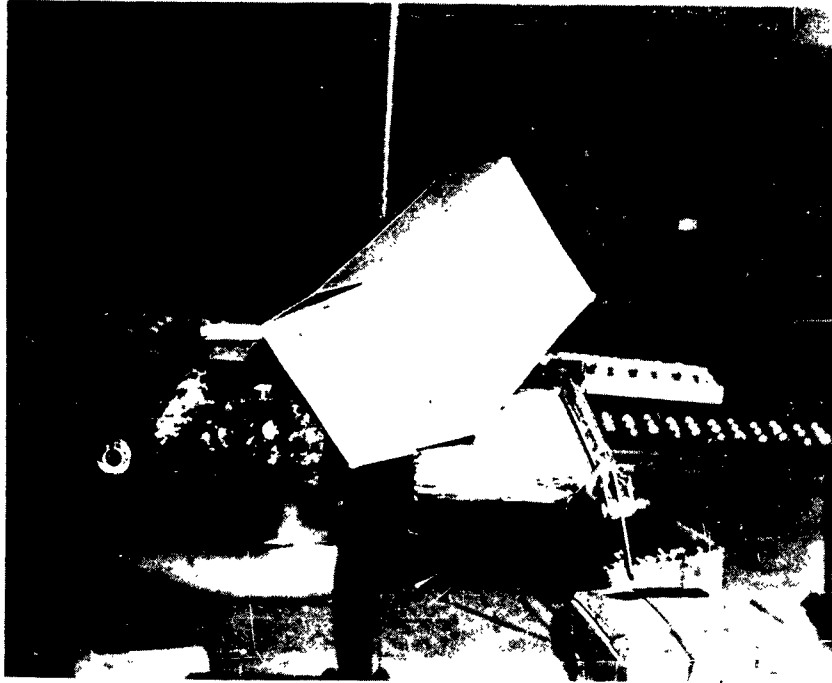


Fig. 53. - Free Fall Drop Test. Prepositioning the item so that it will drop freely cornerwise from a height of 30 inches.
NAVSUPRANDFAC Neg. No. 524-31.

4.4.6.3.2 Cornerwise drop test - The container shall be supported at one corner of its base on a block five inches in height. A 12 inch block shall be placed under the other corner of the same end of the container. The lowest point of the opposite end of the container shall then be raised to a height indicated for the weight in table II and allowed to fall freely onto a steel, stone or concrete surface of sufficient mass to absorb the shock without deflection.

Discussion - This method measures the ability of the method of preservation to protect the contents. It causes one corner to receive the full impact of the drop at the same time introducing twisting and distorting stresses.

Equipment Required

Five inch block, 12 inch block, means of raising the container, (fork truck or block and tackle), steel, stone or concrete surface of sufficient mass to absorb the shock without deflection.

Procedure

1. Raise one corner of the container so that it rests on a five inch wooden block. (Fig. 54).
2. Raise the other corner of the same end of the container and rest it on a 12 inch wooden block. (Fig. 55).
3. Raise the container so that the lowest point of the opposite end is raised the specified height (see below). (Fig. 56).

Gross Weight of Container
and Contents

<u>Weight in Pounds</u>	<u>Height of Drop (Inches)</u>
Through 250	30
Over 250 through 500	24
Over 500 through 1000	18
Over 1000	12

4. Drop the container on a firm steel, stone or concrete surface.
5. Repeat the procedure and again drop the container on the same corner.
6. Raise the end that was dropped and place the five inch block under the corner that the container was dropped on.
7. Raise the other corner of the same end of the container and rest it on a 12 inch block.

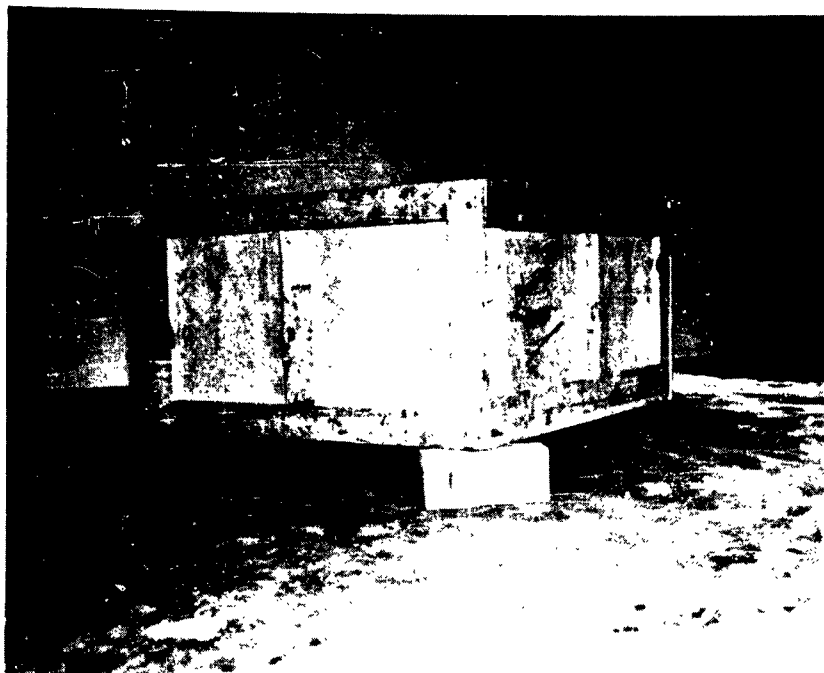


Fig. 54. - Cornerwise
Drop Test. Supporting
one corner of the con-
tainer on a five inch
block.
NAVSUPRANDFAC Neg. No.
577-1.

Fig. 55. - Cornerwise
Drop Test. Supporting
one corner of the con-
tainer on a five inch
block and the other cor-
ner of the same end on a
12 inch block.
NAVSUPRANDFAC Neg. No.
577-2.



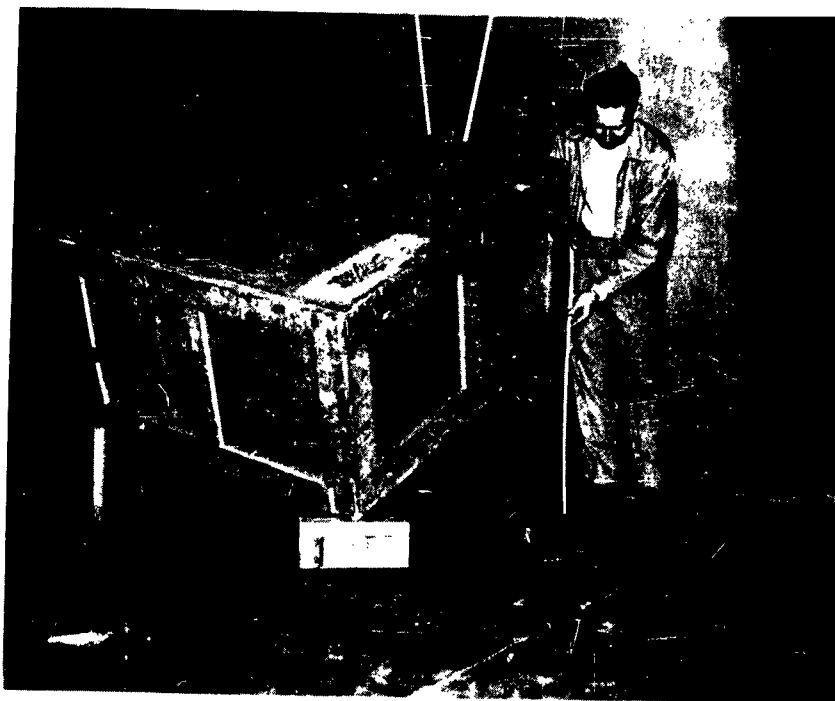


Fig. 56. - Cornerwise Drop Test. Supporting one end of a container and raising the lowest point of the opposite end the specified height. NAVSUPRANDFAC Neg. No. 577-3.

8. Raise the container so that the lowest point of the opposite end is raised to the specified height.

9. Drop the container.

10. Repeat the procedure and drop the container on the same corner.

Interpretation

The item and the components of the package shall be free from damage. When required, the item shall be operated to determine if it functions properly.

4.4.6.3.3 Pendulum impact test - The container shall be swung as a pendulum against a nominal 8 by 8 inch or larger timber resting horizontally on the floor and securely blocked and fastened to prevent any movement. The container shall be suspended by ropes, chains or cables so that its center of gravity will swing through an arc of 16 foot radius. When suspended, the base shall be parallel to the floor, and it shall clear the floor by 1 to 3 inches. The longitudinal axis of the container shall be perpendicular to the length of the timber, and the end shall rest lightly against it. The container shall be pulled back from the timber until the center of gravity is raised by an amount indicated for the weight in table II, then released and allowed to swing freely against the timber. The opposite end also shall be subjected to one impact.

Discussion - This test measures the protection from rough handling that the method of preservation offers to the item.

Equipment Required

Eight by eight inch timber, securely blocked and fastened to the floor to prevent any movement; chains, ropes or cables to suspend the container.

Procedure

1. Suspend the container by ropes, chains or cables so that its center of gravity will swing through an arc of a 16 foot radius. The base of the container should be parallel to the floor and raised 1 to 3 inches. The longitudinal axis of the container should be perpendicular to the length of the timber, and the end should rest lightly against it. (Figs. 57 and 58).

2. Pull the container back from the timber until the center of gravity is raised by an amount indicated for the weight below.

<u>Weight (Pounds)</u>	<u>Pendulum Impact (Inches)</u>
Through 250	14
Over 250 through 500	11
Over 500 through 1000	8
Over 1000	5

3. Release the container and allow it to swing freely against the timber.

4. Repeat the process for the opposite end.

Interpretation

The item and the components of the package shall be free from damage. When required, the item shall be operated to determine if it functions properly.

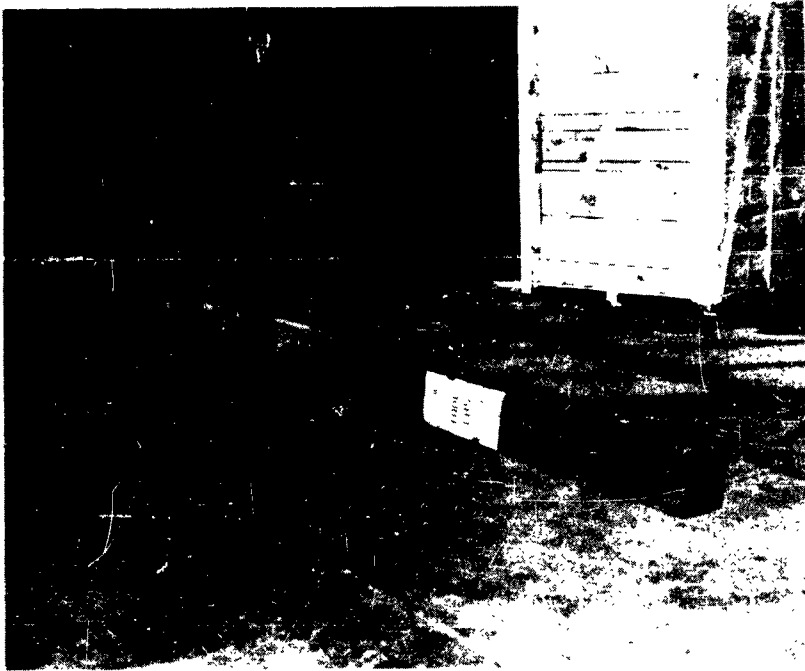
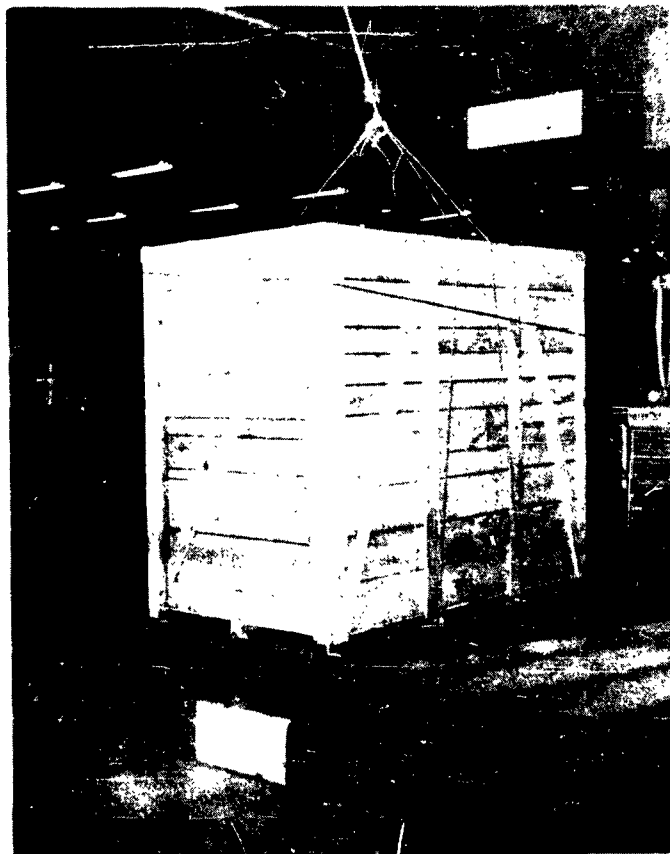


Fig. 57. - Pendulum
Impact Test. Eight by
eight inch timber
securely fastened to
prevent movement.
NAVSUPRANDFAC Neg. No.
529-2.

Fig. 58. - Pendulum
Impact Test. Test con-
tainer suspended so
that its center of
gravity will swing
through an arc of a 16
foot radius.
NAVSUPRANDFAC Neg. No.
529-1.



4.4.6.3.4 Incline impact test - This test shall be in accordance with the American Society for Testing Materials Incline Impact Test for Shipping Containers, Procedure B, ASTM Designation D880. The travel distance on the incline impact testing device shall be as indicated for the weight in table II.

Discussion - This test measures the ability of a container or interior packing, or both, to provide protection to the contents when subjected to impact stresses.

Equipment Required

A two rail steel track inclined 10 degrees from the horizontal, a rolling dolly or carriage and a rigid bumper of sufficient size to permit full contact with the shipping container.

Procedure

1. Place the container in the dolly so that one end will impact the bumper.
2. Bring the dolly back to the required height as indicated below.

<u>Weight (Pounds)</u>	<u>Incline Impact (Feet)</u>
Through 250	7.0
Over 250 through 500	5.5
Over 500 through 1000	4.0
Over 1000	2.5

3. Release the dolly so that the container strikes the bumper. (Fig. 59).

Interpretation

The item and the components of the package should be free from damage. When required, the item shall be operated to determine if it functions properly.

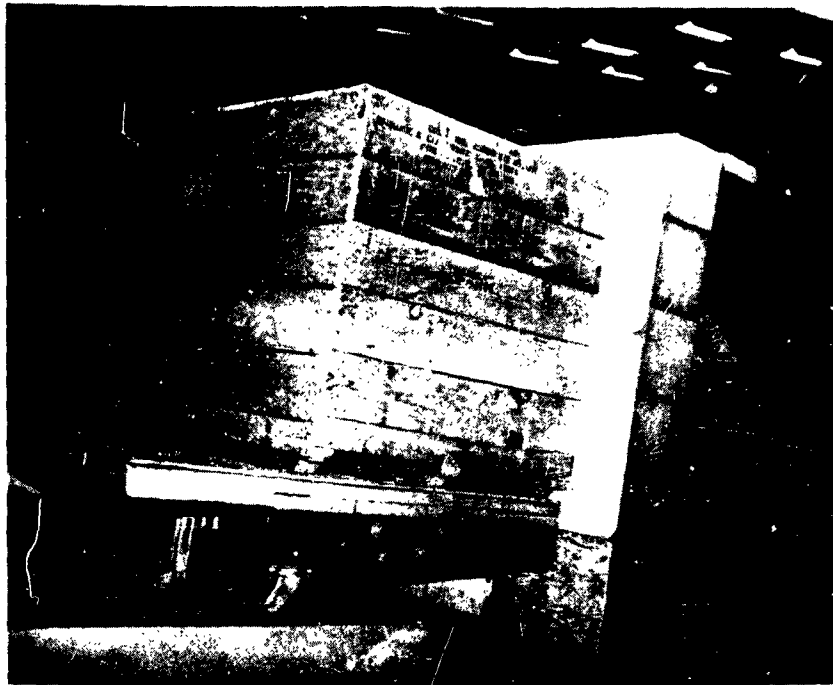


Fig. 59. - Incline Impact Test. The container on the rolling dolly has struck the rigid bumper. NAVSUPRANDFAC Neg. No. 541-26.

4.4.6.3.5 Edgewise drop test - The loaded container shall be supported at one end of its base on a sill or block 5 inches in height, and at right angles to the skids. The opposite end of the container shall be allowed to fall freely from the specified height indicated for the weight in table II onto a steel, concrete or stone surface of sufficient mass to absorb the shock without deflection. The test shall be applied twice to opposite ends of the container. If the size of the container and the location of the center of gravity are such that the drop tests cannot be made from the prescribed height, the greatest attainable height shall be the height of the drops.

4.4.6.3.6 Interpretation of results - All materials and components comprising the method of preservation shall be free from damage or evidence of displacement which affect the utility of the method of preservation. The material within the method of preservation shall show no visible signs of damage. When specified (see 6.2), functional tests, shall be conducted on the preserved item(s) or equipment(s) to determine freedom from operational malfunction.

Discussion - This test measures the protection from rough handling that the method of preservation offers to the item.

Equipment Required

Five inch high block or sill, steel, concrete or stone surface of sufficient mass to absorb the shock without deflection.

Procedure

1. Raise the loaded container so that a five inch block or sill can be placed under one end of its base at right angles to the skids. (Fig. 60).
2. Raise the opposite end of the container to the height specified below. (Fig. 61).

<u>Weight (Pounds)</u>	<u>Height of Drop (Inches)</u>
Through 250	30
Over 250 through 500	24
Over 500 through 1000	18
Over 1000	12

3. Drop the end so that it falls freely.
4. Repeat this test by dropping on the same end.
5. Place the block or sill under the end that was dropped.
6. Raise the other end to the height specified above.

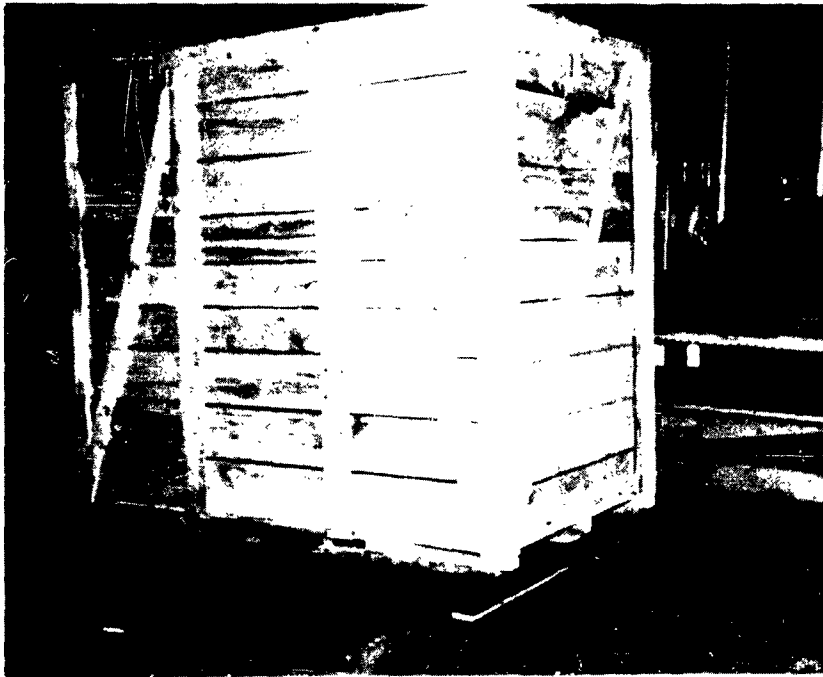


Fig. 60. - Edgewise Drop Test. Supporting one end of the container on a 5 inch block. The support is placed at right angles to the skids.
NAVSUPRANDFAC Neg. No. 524-44.

Fig. 61. - Edgewise Drop Test. Raising the opposite end of the container the specified height before dropping.
NAVSUPRANDFAC Neg. No. 524-41.



7. Drop the end so that it falls freely.

8. Repeat the test by dropping on the same end.

Interpretation

The item and the components of the package should be free from damage. When required, the item shall be operated to determine if it functions properly.

4.4.7 Determination of preservative retention - Samples shall be examined, where applicable, for retention of the preservative compounds.

4.4.7.1 Interpretation of results - Evidence of failure to retain compound on the part, or evidence of corrosion, particularly at points of contact of part with barrier, shall be cause for rejection.

Discussion - This test determines whether sufficient preservative has been retained on the item, after handling, to prevent corrosion.

Equipment Required

1. Lamp or source of light
2. Holder

Procedure

1. Examine the item visually.

Interpretation

If any bare areas are evident on the item or if the item has any sign of corrosion, it does not pass the test.

4.5 Disposition of Samples After Inspection and Test - All samples used for inspection and test shall be reprocessed as necessary. They may, after reprocessing in accordance with the original method of preservation, be considered a part of the original lot. When the packaged item may have been damaged as a result of testing, the item shall be inspected as necessary to determine its acceptability.

APPENDIX A

EQUIPMENT REQUIRED FOR TEST PERFORMANCE

4.4.1 Determination of Cleanliness

- Lamp
- Clamp (some means of holding the item)
- Dark and light cloth
- Indicator paper - methyl red, red litmus or universal indicating paper
- Distilled water
- Medicine dropper

4.4.2 Determination of Preservative Compound Application

- Lamp
- Holder

4.4.3 Leakage Tests

- Quick Leak
- Manometer or vacuum gage
- Vacuum pump or water aspirator
- Vacuum desiccator or any apparatus that will maintain a vacuum
- Wetting agent
- Container for submerging the container

4.4.3.3 Waterproofness Test.

- Container for submerging the container
- Ice

4.4.3.4 Vacuum Retention Test

- Valve (to connect barrier to rubber tubing)
- Hand heat sealer
- Vacuum gage
- Rubber tubing
- Clamp (to pinch rubber tubing)

4.4.3.5 Pressure Retention Test

- Air pump
- Pressure gage
- Air fittings
- Tubing

4.4.4 Heat Seal Test

- Sample cutter or scissors
- 50 ounce weight
- 36 ounce weight
- 22 ounce weight
- Clamp or holder

Ruler
Stapler
Clip

4.4.5 Cyclic Exposure Test

Test A - Oven or hot box (capable of being heated to 130°F)
Water spray - shower or some other attachment
Cooling chamber (-10° to 0°F)
Refrigerator - 35°F

Test B - Hot box
Water spray

4.4.6.3.1 Free Fall Drop Test

Drop test equipment (any equipment permitting a free fall from
a drop of 30 inches)
Steel, stone or concrete surface rigid enough to absorb the
shock of the fall

4.4.6.3.2 Cornerwise Drop Test

Five inch block
Twelve inch block
Fork truck or block and tackle
Steel, stone or concrete surface rigid enough to absorb the
shock of the drop

4.4.6.3.3 Pendulum Impact Test

Eight by eight inch timber
Chain, rope or cables to suspend container

4.4.6.3.4 Incline Impact Test

Incline impact tester

4.4.6.3.5 Edgewise Drop Test

Five inch sill
Steel, stone or concrete surface rigid enough to absorb the
shock of the drop

4.4.7 Determination of Preservative Retention

Lamp

Naval Supply Research & Development Facility, Bayonne, N. J. PERFORMANCE OF TESTS REQUIRED IN SPECIFICATION MIL-P-116D, by S. Stambler. 27 March 1961. xvii, 72 p. app. fig. Military specification MIL-P-116D "Preservation, Methods of" delineates the requirements for the cleaning, preservation and packaging of items, equipment and materials for protection against corrosion, physical damage and other forms of deterioration during handling, shipment and storage. This report details the procedures to be followed in performing the tests in order to determine conformance to the specification.		1. Packaging Test methods 2. Specifications-Instruction manuals I Stambler, S. II Title III Task No. NT-FO15-03-004 IV Sub Task No. NT-FO15-03-004-94 V Engineering Report No. 2.5005
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