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TAPE VERSUS HEAT SEAL CLOSURE OF MIL-B-131 BARRIER MATERIAL,(U)
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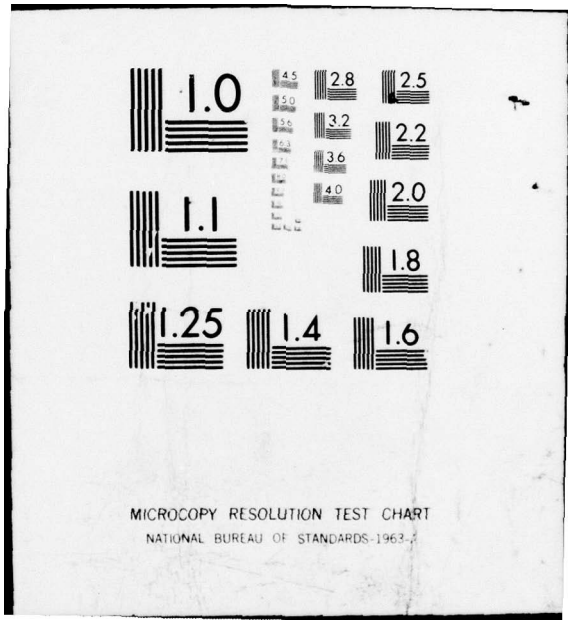
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JOHN A. HINCKS

Materials Engineer

Autovon 787-4292
Commercial (513) 257-4292

STUDY OF TAPE VS. HEAT SEAL CLOSURE OF MIL-B-131 MATERIAL

HQ AFALD/PTP
AIR FORCE PACKAGING EVALUATION AGENCY
Wright-Patterson AFB OH 45433

April 1977

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ABSTRACT

The objective of this study was to measure the water vapor permeability of MIL-B-131 bags sealed with different tapes and to compare the results with those obtained on standard heat sealed bags. From the data obtained, it was concluded that taped closures will provide a limited degree of protection from the ingress of water vapor. However, tape closures are recommended only when there is no heat sealing equipment at a facility or the equipment is inoperative.

PREPARED BY: John A. Hincks
JOHN A. HINCKS
Materials Engineer
Materials Engineering Division

REVIEWED BY: Matthew A. Venetos
MATTHEW A. VENETOS
Chief, Matl's Engineering Div
Air Force Packaging Eval Agency

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1 APR 1977

APPROVED BY: JACK E. THOMPSON
Director, Air Force Packaging
Evaluation Agency

TABLE OF CONTENTS

INTRODUCTION

The scope of this study was to determine the effectiveness, in terms of water vapor tightness, of taped closures as compared to conventional heat sealed closures on MIL-B-131 (class 1 or 2) barrier bags. The study was initiated because some Air Force bases do not have heat sealing equipment available; yet under some circumstances are required to ship items in accordance with MIL-P-116 protection. Permission to use a tape closure on reparable water vapor sensitive items being shipped from remote bases to repair depots would potentially minimize further damage to the item.

SPECIMEN PREPARATION

A roll of MIL-B-131, Class 1 and 2 barrier material was used to fabricate twenty pouches for testing. Twelve inch by four inch sheets were cut from the roll. The sheets were folded in half to form a 6 inch by 4 inch pouch, open on the sides and top. A 1/4-inch heat seal was then made along the two sides. Two one unit desiccant bags were then placed into each of four pouches and the open ends were heat sealed. These hermetically sealed pouches were used as standards in this test study. The remaining sixteen pouches were fabricated and two units of desiccant were also placed into each. These pouches were divided into four groups and four different tapes were applied to form a closure of the open ends (see Figure 1).

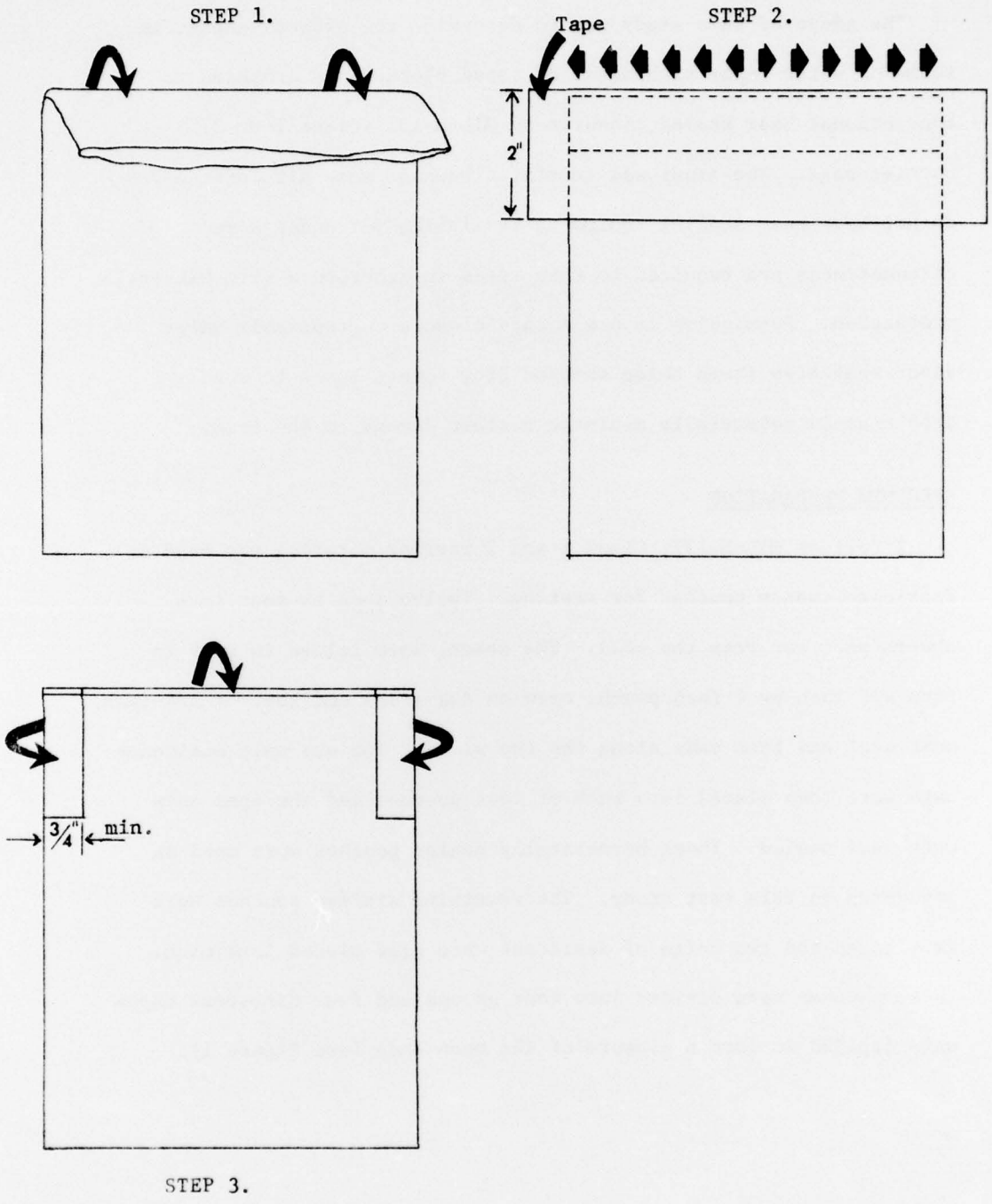

Figure 1. Technique of applying Tape to Pouch

TEST PROCEDURE

All bags were subjected to an accelerated laboratory environmental test. The test was conducted in compliance with Federal Test Method Standard No. 101B, Method 3030, "Water Vapor Permeability Test of Packaging Materials," Procedure B. The only variable evaluated in this test study was the sealing quality of the different tapes and their ability to prevent moist air from entering the pouch. The water vapor transmission rate (WVTR) test used for measuring the water vapor permeability employes a gravimetric technique. All test pouches were individually weighed on an analytical balance to the nearest milligram, then placed into a constant temperature humidity chamber (100 $\pm$ 2°F; 90 $\pm$ 2% RH). The stabilization period for the test pouches was 16 hours. The exposure period between weighings was 24 hours. The duration of the test was 10 days.

RESULTS

The results of the WVTR test of the four different tapes studied are presented in Table I. The PPP-T-60 tape was by far the most effective tape used in sealing the pouch. This tape was approximately 1-1/2 times better than the PPP-T-22085 tape, 1-3/4 times better than the L-T-90 (Scotch tape), and approximately 3 times better than the 3 M, #SJ8052X experimental tape.

TABLE I

RESULTS OF WATER VAPOR PERMEABILITY TESTS

TYPE OF CLOSURE	WVTR* (Gm/100 Sq. In./24 Hrs)
Standard (Heat Seal)	.006
TAPES	
PPP-T-60, Type III, Class 1 or 2	.070
PPP-T-22085, Type II	.100
Scotch, L-T-90	.123
Tacky Sealant 3M, #SJ8052X	.192

*Avg. of 4 Readings of 4 Samples each.

DISCUSSION

The temperature and humidity conditions used in this test (100°F; 90% RH) represent accelerated conditioning well above the 70°F and 40% RH designated as the upper safe limit for moisture sensitive items established many years ago from a Navy study. As a general rule, for every ten degrees rise in temperature, the rate of reaction doubles. With every 10% RH rise, the reaction rate (rusting/corroding) also doubles. For simultaneous increases in both temperature and humidity, it can be expected that the reaction rate would be increased significantly. It is estimated that the corrosion rate was accelerated approximately 200 times beyond that at the upper safe limit conditions (70°F and 40% RH). This estimated accelerated rate of test was arrived at as follows:

The 100°F test temperature was 30°F above the previously referenced upper safe temperature limit of 70°F. As stated above, the corrosion reaction rate doubles every 10°F increase. Thus, an accelerated corrosion rate that is a factor of 8 (2^3) can be established for this rise in temperature.

The 90% test RH was 50% RH above the upper safe humidity limit of 40% RH. As stated above, the corrosion reaction rate doubles with every 10% RH increase. Thus, an accelerated corrosion rate that is a factor of 32 (2^5) can be presummed for this rise in humidity. The product of these two factors (8 x 32), represents a

combined acceleration factor of 256.

CONCLUSION

Based on the results of this study, it is concluded that MIL-B-131 pouches can be effectively sealed using PPP-T-60 Type III, Class 1 or 2 pressure-sensitive film tape. The tape method of sealing should be permitted only when heat sealing equipment is not available or when the equipment is inoperative. The water vaporproofness is only assured for 4 to 6 months (Method 1A or II protection, MIL-P-116). The waterproofness can be assured up to 1 year (Method 1C protection).

RECOMMENDATIONS

When serviceable returns or reparable moisture sensitive items are being prepared for shipment to Air Force Depots, MIL-B-131 barrier pouches sealed with PPP-T-60 tape may be used provided the shipping and storage time does not exceed six months. It is also recommended that the new T.O. 00-85B-3, "How to Package AF Depot Reparable Items For Shipment", include the tape closure technique as a substitute for heat sealing when the heat sealers are not available.

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