AD-A121 390 INVESTIGATION OF MIL-B-131 BARRIER MATERIAL HEAT SEALS
(U) AIR FORCE PACKAGING EVALUATION AGENCY
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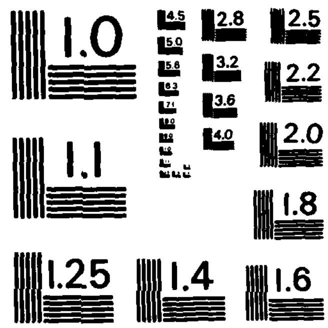

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INVESTIGATION OF MIL-B-131 BARRIER MATERIAL HEAT SEALS

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ABSTRACT

This study was performed to evaluate the severity of the 50 oz. dead weight test specified in MIL-P-116 for MIL-B-131 barrier material heat seals. Many of the Air Logistics Centers were reporting a high incidence of heat seal rejections. The study indicated the current test requirement and procedure to be realistic and attainable provided that proper techniques for equipment cleaning and set-up are followed. Also careful attention to temperature and pressure settings is necessary.

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INTRODUCTION

This investigation was initiated because of the difficulties many air force packaging activities were reporting in producing heat sealed seams on flexible packages that would meet the seal strength test specified in MIL-P-116, Preservation, Methods Of, for MIL-B-131 Barrier Material, Watervaporproof, Flexible, Heat Sealable. Some of the Air Logistics Centers (ALCs) felt that the 50 oz. seam strength test of MIL-P-116 was too severe and should be modified to a lower value. As an interim measure permission was granted by AFALD/PTP to reduce the 50 oz. weight requirement of the MIL-P-116 test to the 32 oz. weight specified in MIL-S-4461, Sealing Machines, Heat: Hot Jaw and Continuous, until a thorough evaluation could be performed.

TEST SAMPLES

Twelve sets of test samples consisting of MIL-B-131 barrier materials from three manufacturers were obtained from the Air Logistics Centers. Each test sample was assigned an identification number which relates to a specific manufacturer, lot number and the ALC from which the material was received (Table I).

SAMPLING

The roll/sheet stock was sampled according to the sampling pattern position number 1 prescribed in MIL-B-131 (Figure 1). The bags were sampled randomly according to MIL-B-117, Bags, Sleeves and Tubing - Interior Packaging.

QUALITY CONFORMANCE

The evaluation was performed using a 4.0% AQL according to MIL-B-117.

TEST EQUIPMENT

1. Doboy Continuous Heat Sealer, Model HS-B (Figure 2).

2. Sentinel Heat Sealer, Model 12-12ASC (Figure 3).

3. Electric Timer, Labline, Inc. Lab-Chron 1400 (Figure 4).

4. Seam Strength Test Device (Two clamping jaws suspended from a stationary beam. Lower jaw weight 50 oz.). (Figure 5).

TEST PROCEDURE

The test procedure used for the heat sealed seam strength test was Method 2024 of Federal Test Method Standard 101. The test specimens were conditioned at 72°F and 50% RH for a minimum of 24 hours. The seam strength tests were performed in the same environment.

Method 2024 specifies hanging a one-inch sample between [illegible]ping jaws. The top jaw is mounted to a stationary beam and the lower [illegible] weighted to

50 oz. total weight (includes jaw weight). The sample is clamped perpendicular in the upper jaw. The weighted lower jaw is then gently suspended on the sample. The weight is suspended for 5 minutes with no seam separation allowed during the last 3 minutes. A black felt tip mark was made across the seam to aid in visual inspection of seam separation.

In addition to the standard test procedure prescribed for determination of heat seal strength a special test procedure was developed for this study to determine the ultimate strength of the heat seal seam. The seam strength test device (Figure 5) was modified to hang a metal can from the lower jaw. Lead shot was added to the can until the total weight was 50 oz. The weighted jaw was suspended from the sample for 5 minutes. An additional 5 oz. of lead shot was added to the can and suspended for 3 more minutes. Each time the sample survived the additon of a weight increment another 5 oz. of shot was added to the can and suspended for an additional 3 minutes. The procedure was continued until the sample failed.

The test used by the Department of the Navy was from MIL-B-131 (para. 4.6.2.2.2 - Test at Room Temperature). This test is identical to Method 2024 above except the heat seals are produced on a bar sealer and a 56 oz. weight is used.

TEST RESULTS

Initial experiments were done using both the Sentinel Heat Sealer and the Doboy Heat Sealer to determine the optimum sealing temperatures, pressures and dwell times. This preliminary testing indicated that acceptable seals could readily be made with the Sentinel, but the Doboy seals were more difficult to produce, being more sensitive to operating conditions.

Since the Doboy sealer was an older machine with significant wear, it was necessary to disassemble, thoroughly clean and reassemble the sealer with careful attention being given to proper alignment. Subsequent experiments showed that it was necessary to set the heating bars wide enough apart (approximately 1/8 inch) to avoid drag on the barrier material. Also, the compression wheels were set exactly parallel to each other and the degree of compression was varied by adjusting the spring tension with a trial and error procedure until optimum seals were obtained, usually at the higher pressure settings.

Table II shows the results of tests run on the Doboy at various sealing temperatures. The results indicate that the optimum sealing temperature for this machine is 250°C. Temperatures of 275°C and above produced acceptable seals but resulted in physical damage to the seal area.

The results of the basic quality control tests run on the various materials from the Air Logistics Centers are presented in Table III. These results indicate that all materials passed except for specimens A, D and J. Materials A and J exceeded by only one the number of defects permitted to pass but unfortunately there was not enough material for a retest; however, there was sufficient material to retest specimen D. Table III also shows the results of the retest of material D, as well as material E, which was retested as a control. Both materials were tested on the Doboy and the Sentinel heat sealers. The results in Table III show that all material D specimens passed on retest and only one seal failure occurred with material E.

The six heat sealed specimens tested in Table IV were made with the Doboy Heat Sealer using the same settings used for the specimen in Table III. Table IV provides the total weight suspended on each sample when it failed.

Table V provides the results of tests run by the Naval Air Development Center, the OPR for MIL-B-131. These tests were run using the test prescribed in MIL-B-131 using a 56 oz. weight.

CONCLUSIONS

The 50 oz. heat seal test specified for MIL-B-131 barrier materials in MIL-P-116 is a realistic quality control test. Appropriate attention to details in producing the heat seals is necessary because only seals made at the proper temperature and pressure can be expected to pass the test.

Our investigation indicated that heat seals which fail the test are primarily the fault of improper condition and adjustment of the heat sealing equipment. Proper cleaning, accurate alignment and careful adjustment of sealing temperature and pressure (250°C and high pressure for the Doboy used in this project) are mandatory for acceptable seals. Also, operator training and experience play an important part in reducing test failures.

The heat seal failure values of Table IV indicate that the 50 oz. test requirement is well below the ultimate strength of a seal produced at the proper temperature and pressure.

The tests performed by the Navy, Table V, indicate that the barrier material was of acceptable quality for heat sealing.

RECOMMENDATIONS

1. Heat sealers used in sealing MIL-B-131 materials should be on a strict preventative maintenance schedule.

2. Heat sealer operators should be knowledgeable of the machine and thoroughly trained.

3. Constant surveillance of the heat seals is necessary to insure high quality seals.

4. Experimentation with the heat seal machine is necessary to establish the proper operating temperatures and pressures.

5. Care should be exercised in quality control tests to clamp the samples in the test device perpendicular to the jaws such that the weight pulls uniformly across the heat seal area.

6. Variable dwell times for cooling/compression as well as heating are features to be desired for future procurements of heat sealers.

SAMPLING PATTERN

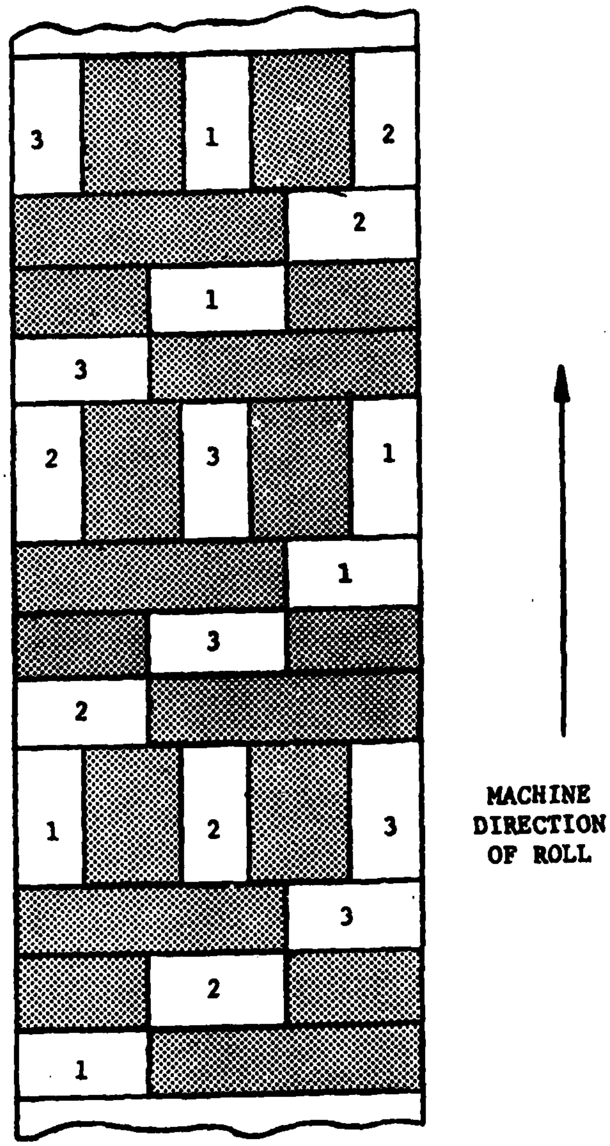
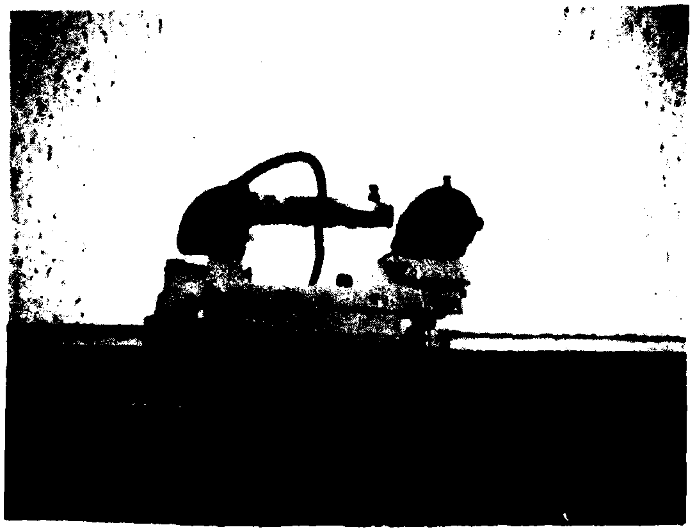


FIGURE 1

MODEL HS-B DOBOY CONTINUOUS HEAT SEALER



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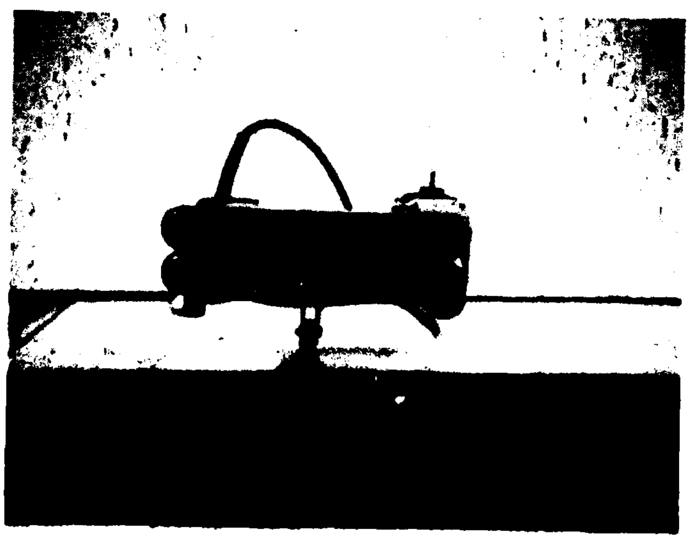

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FIGURE 2

MODEL 12-12ASC
SENTINEL HEAT SEALER

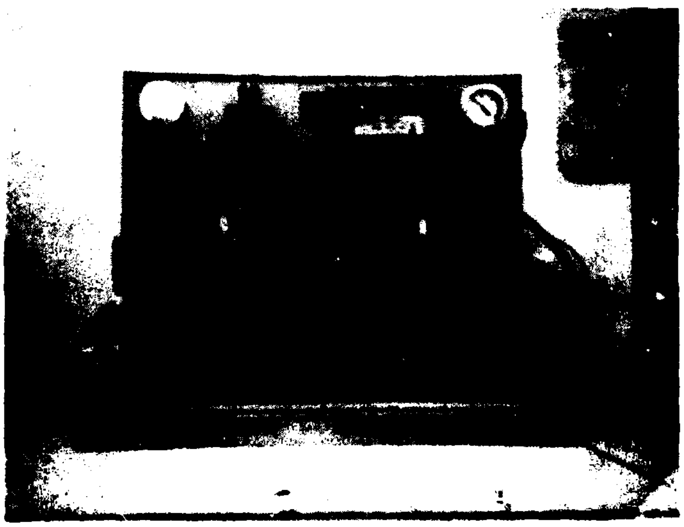

FIGURE 3

LAB-CHRON ELECTRIC TIMER

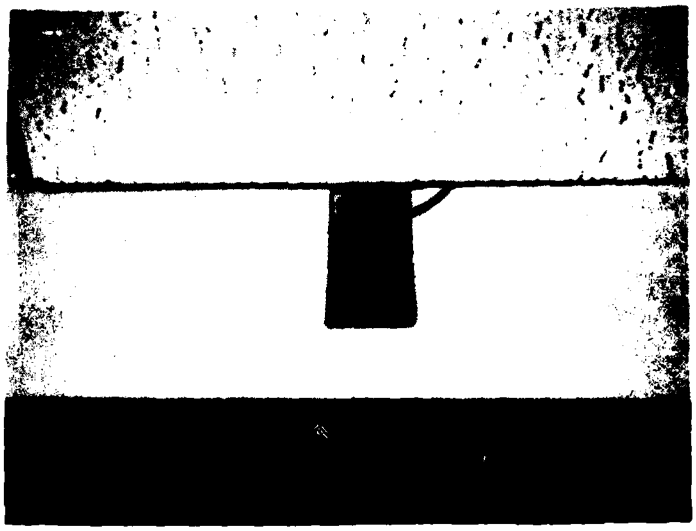

FIGURE 4

DEAD WEIGHT HEAT SEAL
TEST FIXTURE WITH SAMPLE

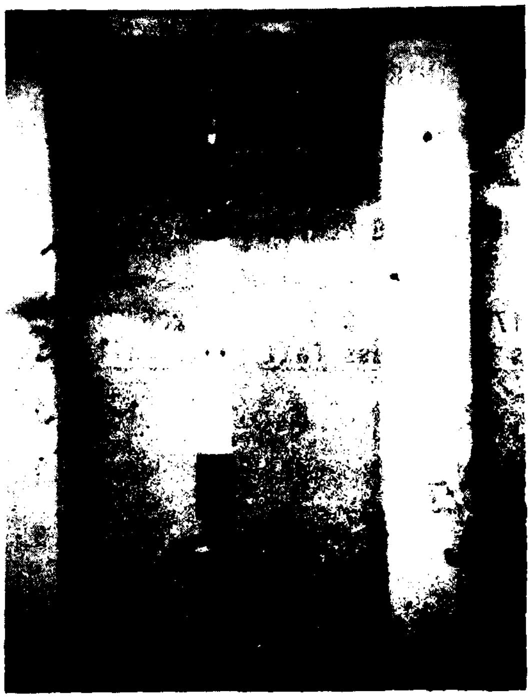

FIGURE 5

TABLE I - MIL-B-131 SAMPLE MATERIALS EVALUATED

Sample Identification Number	Lot #	ALC	Form
A	1	Warner Robins	Roll/Sheets
B	2	Sacramento	Roll/Sheets
C	1	Oklahoma City	Roll/Sheets
D	H3562	Ogden	Roll/Sheets
E	1	Ogden	Bags
F	1300	Ogden	Bags
G	2	Ogden	Roll/Sheets
H	H1208	Ogden	Roll/Sheets
I	H1201	Ogden	Bags
J	5	Ogden	Bags
K	H3054	Ogden	Bags
L	H1824	AFPEA	Roll/Sheets

TABLE II - TEMPERATURE vs HEAT SEAL PERFORMANCE

	150		175		200		225		250		275		300	
*Material	Pass	Fail	Pass	Fail	Pass	Fail	Pass	Fail	Pass	Fail	Pass	Fail	Pass	Fail
B	1	2	1	2	1	2	2	1	3	0	3	0	3	0
C	1	2	1	2	1	2	1	2	3	0	3	0	3	0
D	2	1	0	3	0	3	3	0	3	0	2	1	3	0
E	2	1	0	3	0	3	3	0	3	0	3	0	3	0

*NOTE: Total of 84 specimens evaluated

TABLE III - QUALITY CONTROL TESTS

*Material	Number Pass	Number Fail	Reject/ Accept
A	15	3	Reject
B	18	0	Accept
C	18	0	Accept
D	31	5	Reject
E	8	1	Accept
F	18	0	Accept
G	16	2	Accept
H	16	2	Accept
I	18	0	Accept
J	7	2	Reject
K	8	1	Accept
D(retest-Doboy)	18	0	Accept
D(retest-Sentinel)	18	0	Accept
E(retest-Doboy)	17	1	Accept
E(retest-Sentinel)	6	0	Accept

*NOTE: Total of 249 specimens evaluated

TABLE IV - TEST TO FAILURE OF HEAT SEAL

Material	Failure Weight (oz)
E	106
E	133
D	96
D	116
C	132
C	147

NAVAL AIR DEVELOPMENT CENTER
AIRCRAFT AND CREW SYSTEMS TECHNOLOGY DIRECTORATE
WARMINSTER, PA 18974

6061
9 Sep 1982

EVALUATION OF MIL-B-131 MATERIALS
SUBMITTED BY AIR FORCE BASES

All of the materials submitted were tested for room temperature seam strength (paragraph 4.6.2 of MIL-B-131) and found to be satisfactory:

Air Force Base	Material	Sealing Conditions	Results
McClellan	B	400°F, 3-sec	Passed
Robins	A	400°F, 3-sec	Passed
	M	350°F, 3-sec	Passed
Tinker	C	350°F, 3 sec	Passed

Table V - Mil-B-131 Room Temperature Test

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

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