

THE INSTITUTE OF PAPER CHEMISTRY

Appleton, Wisconsin

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EVALUATION OF "CERTIFIED" DIAPHRAGMS

✓ Project 1108-26

Report Twelve

A Progress Report

to

TECHNICAL COMMITTEE  
FOURDRINIER KRAFT BOARD INSTITUTE INC.

December 1, 1964

## TABLE OF CONTENTS

	Page
SUMMARY	1
INTRODUCTION	2
TEST PROCEDURE - SIMULATED "LIFE" TEST	3
DISCUSSION OF RESULTS	4
LITERATURE CITED	9

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EVALUATION OF "CERTIFIED" DIAPHRAGMS

SUMMARY

The B. F. Perkins and Son, Inc. recently submitted a number of the new "certified" diaphragms which they are supplying to the industry. Favorable results were obtained with this type of diaphragm in past work as mentioned in Report 11. The new diaphragms were subjected to simulated "life" tests with the following results.

1. Each of the three diaphragms examined survived over 1050 tests using 42-lb. kraft liner.

2. The agreement in bursting strength between diaphragms appeared satisfactory.

3. At 3/8-inch distention, the diaphragm pressures were well above the upper limit of the present specifications of 23 to 30 p.s.i. by from 1 to 6 p.s.i. on the average. Lubrication of the diaphragm surface would be required to reduce pressures within specifications. These results are in conflict with the certification accompanying the diaphragms. The above findings are being relayed to "Perkins" and they will attempt to modify the diaphragms so as to directly comply with Rule 41.

In the meantime "Perkins" has submitted two additional lots of diaphragms for evaluation from their former and current suppliers. Tests on these are underway and will be reported on at the next meeting.

### INTRODUCTION

In early 1964 B. F. Perkins and Son, Inc. submitted a lot of experimental bursting strength diaphragms to the Institute for evaluation. The diaphragms were manufactured by a new supplier and were thought to possess superior life characteristics. Two of the diaphragms were evaluated at the Institute in a simulated "life" test involving over 5000 tests on 42-lb. kraft liner on each diaphragm (1). Both diaphragms survived the "life" tests and exhibited pressures within Rule 41 specifications.

Since that time, "Perkins" has begun marketing the new type diaphragms. Each diaphragm is individually packaged in an envelope bearing a printed guarantee that it complies with Rule 41 requirements.

Recently, four diaphragms from one of the nine cavity molds used in producing the new diaphragms were forwarded to the Institute for evaluation. The results obtained are summarized in this report.

TEST PROCEDURE - SIMULATED "LIFE" TEST

The diaphragms were evaluated using the experimental outline in Report One, Project 1108-26, September 21, 1960 (2). In brief, after giving each diaphragm 10 distentions to 0.71 inch to stabilize the pressure, 50 tests on a randomized 42-lb. liner sample (one test per sheet on each of 50 sheets) were made. Diaphragm pressure measurements were made before and after making the 50 tests. Two hundred "waste" tests on a sample of 42-lb. liner were then made followed by pressure measurements and bursting strength tests on the randomized 42-lb. liner sample. The procedure was repeated until a total of 1050 tests were made on each diaphragm.

All diaphragm measurements were made with the apparatus described in Report Five (3).

### DISCUSSION OF RESULTS

The thickness and hardness characteristics of the diaphragms are tabulated in Table I.

TABLE I  
CALIPER AND DUROMETER TEST RESULTS

Mold No.	Factory Rating, p.s.i.	Caliper, pt. <sup>a</sup>		Durometer Hardness "A" Scale
		Center	Rim	
1	30	96.3	68.0	72
3	27	98.0	70.2	64
7	31	97.2	69.7	68
Av.		97.2	69.3	68

<sup>a</sup>Standard caliper - 8 p.s.i. pressure.

The caliper measurements indicate the diaphragms have about the same thickness as the old style diaphragms evaluated in Report One while the hardness values were slightly higher than obtained with the old style diaphragms (2).

Simulated "life" test results for the three diaphragms are shown in Table II. It may be noted that

1. At 3/8-inch distention, the diaphragm pressures were above the upper limit of the present specifications of 23 to 30 p.s.i. Thus, these diaphragms would not be usable for testing as is but would require application of a lubricant to reduce the pressure. These results are in conflict with the certification accompanying the diaphragms that they comply with Rule 41 requirements. The above findings are being relayed to "Perkins" and efforts are underway to modify the diaphragms so as to directly obtain the required pressures at 3/8-inch.



2. The agreement in bursting strength between diaphragms appeared satisfactory.
3. At 3/8-inch distention the diaphragm pressures appeared reasonably constant through 1000 tests.
4. Thus, the new diaphragms exhibit satisfactory "life"; however, some adjustment in composition or molding process would be desirable to bring the pressure within 23 to 30 p.s.i. at 3/8 inch.

When the diaphragms were forwarded, "Perkins" advised that if a diaphragm was removed during use for some reason, any pucker in the diaphragm could be removed by soaking it in cold water overnight without harming the diaphragm characteristics. This would permit reinsertion of the diaphragm in the tester for additional use with less danger of trapping "air" under the diaphragm. Each of the diaphragms evaluated above were water soaked after completion of the 1050 tests. At that time the diaphragms exhibited a pucker of about 0.1 inch. Soaking removed the pucker and actually induced a reverse curvature (see Fig. 1).

After soaking, the diaphragms were reinserted in the tester. The results shown in Table III were obtained. In general, it appeared that the bursting strengths and diaphragm pressures after soaking were about equal or slightly higher than those obtained at the end of the "life" tests. At the same time, no difficulties were encountered with air entrapment when inserting the diaphragms.





A. After 1050 Tests

B. After Water Soaking

Figure 1. Effect of Water Soaking on Diaphragm Pucker

TABLE III

EFFECT OF WATER SOAKING ON DIAPHRAGM CHARACTERISTICS

	Diaphragm No.		
	1	3	7
Diaphragm pressure, p.s.i. <sup>a</sup>			
3/8 inch			
End of "life" test	34	30	34
After water immersion	36	33	36
0.71 inch			
End of "life" test	45	36	44
After water immersion	48	39	46
Bursting strength, p.s.i.			
End of "life" test	116	117	119
After water immersion	120	119	119

<sup>a</sup>Average of start and end determinations.

LITERATURE CITED

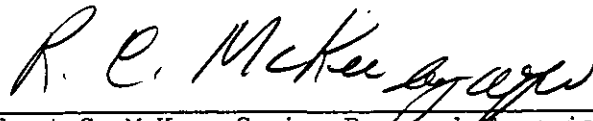
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