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TECHNICAL REPORT 6802

PHYSICAL PROPERTIES OF SILICONE FOAM (RTV 385/RTV 386)

Reported by

John W. Hodge, Jr.

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U. S. ARMY MEDICAL BIOMECHANICAL RESEARCH LABORATORY
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ABSTRACT

An evaluation of the physical properties of a silicone foam (RTV 385/RTV 386) was conducted to determine the effects of varying the amounts of the solid and foam components in specimen composition.

The physical properties in this instance are significant in terms of the application of the foam as a therapeutic medium for therapists.

It was determined that the properties could be varied by changing the amount of the components in the foam composition. Additionally, with the results one can prepare a foam specimen with predetermined compressive strength characteristics.

I. INTRODUCTION

Silicone materials are being used in many and varied applications. Of particular interest are the therapeutic applications in patient rehabilitation. The therapeutic applications considered here are those where a knowledge of the physical properties of the foam is significant. As an exercise medium for improving grasp, a wide range of compressive forces can be obtained by varying the consistency of the foam. This evaluation was designed to look at some of the physical properties of the foam under various conditions. During this evaluation, foam samples with varying amounts of ingredients were prepared and tested for density, compressive forces and tear resistance. The material considered was a composition of RTV 385 solid elastomer, RTV 386 foam elastomer, and catalyst 386. This material was supplied by the Dow Corning Corporation, Midland, Michigan.

II. EXPERIMENTAL PROCEDURES

The sample formulations evaluated are listed in Table I. These sample formulations are based on a hundred grams total of the elastomers plus six grams of the catalyst. The elastomer is a combination of the solid and foam components according to the weights shown in the Table except for the extremes (Samples 1 and 11) which is one or the other of the elastomer components.

The samples were prepared such that essentially a free rise was obtained. The dimensions were 1-3/16 in. x 1-3/16 in. x 3-3/16 in. for the samples from which density and compression observations were taken. Tear test samples were 6 in. x 1 in. x 1 in.

Foam density was determined by taking the weight of each specimen and dividing by the specimen volume.

Compression tests were conducted on a table model Instron Testing Machine. Compressive forces were observed at 15 and 50 per cent deformation and reported as pressure in pounds per square inch.

Tear tests were conducted in accordance with ASTM Method D1564-64T. The test rate was 2 inches per minute.

III. RESULTS AND DISCUSSION

Density determinations are tabulated in Table II. Maximum density was found to be approximately 68 pounds per cubic foot. Observations of Figure II shows that density increases at a higher rate when the specimen composition contains more than 50 per cent RTV 385. Density ranged from 7.6 lb. per cu. ft. for a sample containing 100 per cent RTV 386 to 68.3 lb. per cu. ft. for a sample containing 100 per cent RTV 385.

In considering compressive forces of the foam, Table III presents compressive forces at 15 per cent deformation of the foam specimen. The compressive force at this deformation was found to be 0.4 pounds per square inch with no RTV 385. On observing a sample with 100 per cent RTV 385, it was seen that the compressive forces increased a hundred fold to 42.86 psi. In looking at the changes graphically Figure II shows that foam samples containing above 50 per cent RTV 385 gave more pronounced changes in compressive forces at both 15 per cent (Fig. II) and 50 per cent (Fig. III)deformations. Compressive forces at 50 per cent deformation are also tabulated in Table IV. In determining compressive forces at 50 per cent deformation a sample composition containing 90 parts RTV 385 and 10 parts RTV 386 gave results greater than 51 pounds per square inch. The test sample containing 100 parts RTV 385 exceeded the instrument load range. However, assuming the behavior of the material to follow the pattern similar to that at 15 per cent deformation one could expect the compressive forces to exceed 128 pounds per square inch or be 100 times greater than the forces of the test sample with no RTV 385.

Tear Resistance (Table V) was found to be very low with this foam mechanism. The maximum tear resistance was 2 lbs. per inch for a 100 per cent RTV 385 sample. A sample containing 100 per cent RTV 386 gave a tear resistance of 0.4 pounds per inch. Tear Resistance is shown graphically in Figure IV.

SUMMARY AND CONCLUSIONS

A number of the physical properties of silicone foams prepared from RTV 385 and RTV 386 with an appropriate amount of catalyst were observed. The properties specifically considered were density, compressive forces, and tear resistance. These properties were considered because of the ability to change them by varying the amount of each component in the formulation which appears de-

sirable in the therapeutic applications of the foam material.

The results obtained show comparable changes and their magnitudes. Additionally, these results may be used to choose a formulation to give predetermined compressive forces. In analyzing the results it is seen that the more significant change in the physical properties occur when an amount greater than 50 per cent of RTV 385 is used in the formulation. This being the case a rather precise consideration must be given to weighing out quantities of RTV 385 for higher compressive forces, particularly in the region of 80 to 100 parts of RTV 385. Slight changes in the amount of the components in this region produce very large changes in compressive forces.

Tear resistance was found to be very low for this foam system. This result was in keeping with all foam systems since foam materials offer little resistance in tension or tear.

Finally, it is felt that the results obtained from this evaluation provides a wide range of choices to the therapist in the selection of a foam specimen with a desired set of properties. Additionally, one can expect good results when using the foam material in a compressive manner. In tension or tear the foam material will very likely fail with a minimal of force.

TABLE I

FORMULATIONS

SAMPLE NO.	RTV 385	RTV 386	CATALYST 386
1*	0 Grams	100 Grams	6 Grams
2	10 "	90 "	6 "
3*	20 "	80 "	6 "
4	30 "	70 "	6 "
5	40 "	60 "	6 "
6*	50 "	50 "	6 "
7	60 "	40 "	6 "
8	70 "	30 "	6 "
9*	80 "	20 "	6 "
10	90 "	10 "	6 "
11*	100 "	0 "	6 "

* Tear Test Samples

TABLE II

FOAM DENSITY

SAMPLE NO.	DENSITY ($Lb/Ft.^3$)
1	7.6
2	9.0
3	10.0
4	11.4
5	13.4
6	15.5
7	18.6
8	22.8
9	29.6
10	39.6
11	68.3

TABLE III

COMPRESSION TEST
PRESSURE AT 15% DEFORMATION (psi)

SAMPLE	PRESSURE AT 15% DEFORMATION
1	0.40 psi
2	0.51
3	0.61
4	0.84
5	1.02
6	1.28
7	2.04
8	3.31
9	5.61
10	12.76
11	42.86

TABLE IV

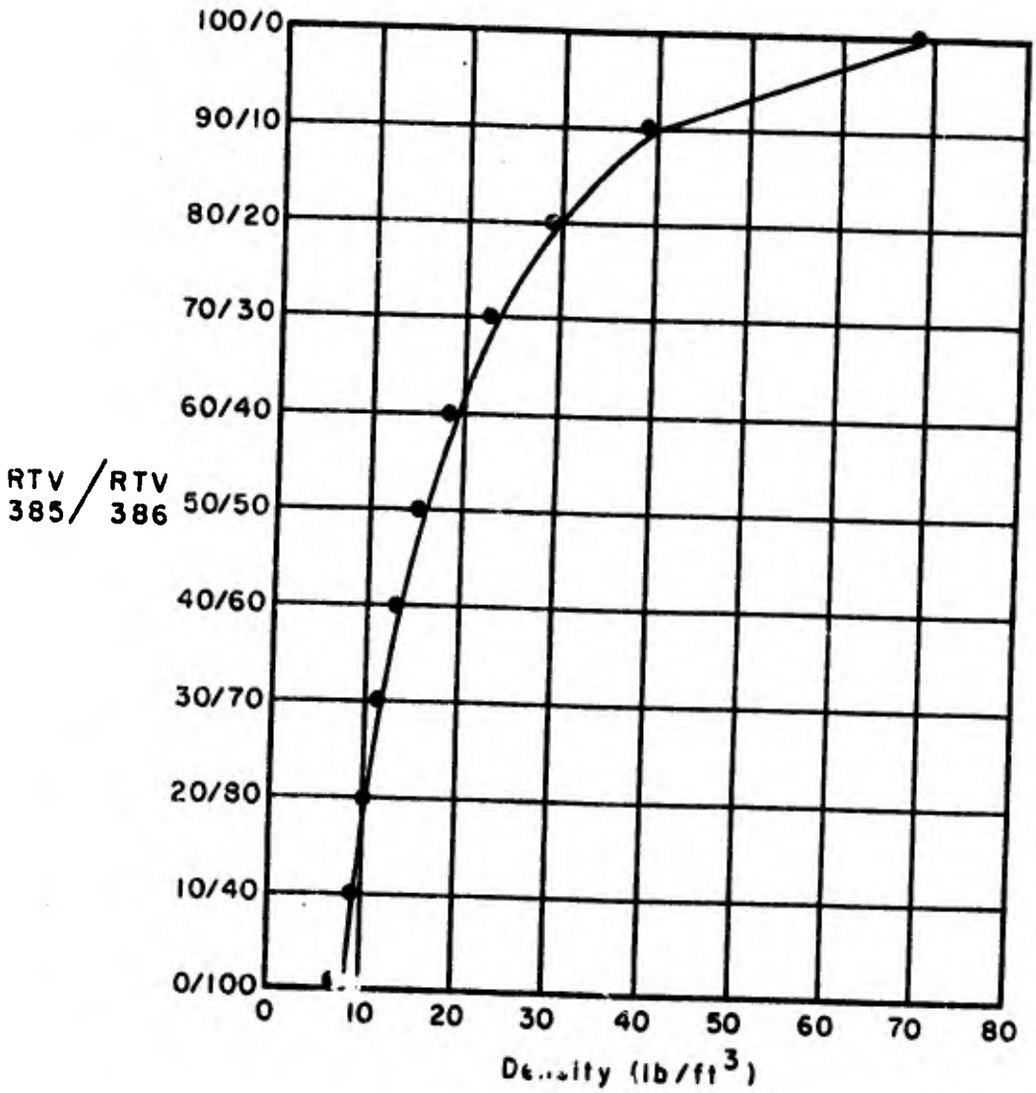
COMPRESSION TEST
PRESSURE AT 50% DEFORMATION (psi)

SAMPLE	PRESSURE AT 50% DEFORMATION
1	1.28 psi
2	1.53
3	1.66
4	2.42
5	3.11
6	4.21
7	6.63
8	11.48
9	28.06
10	51.00
11	Beyond Instrument Range

TABLE V

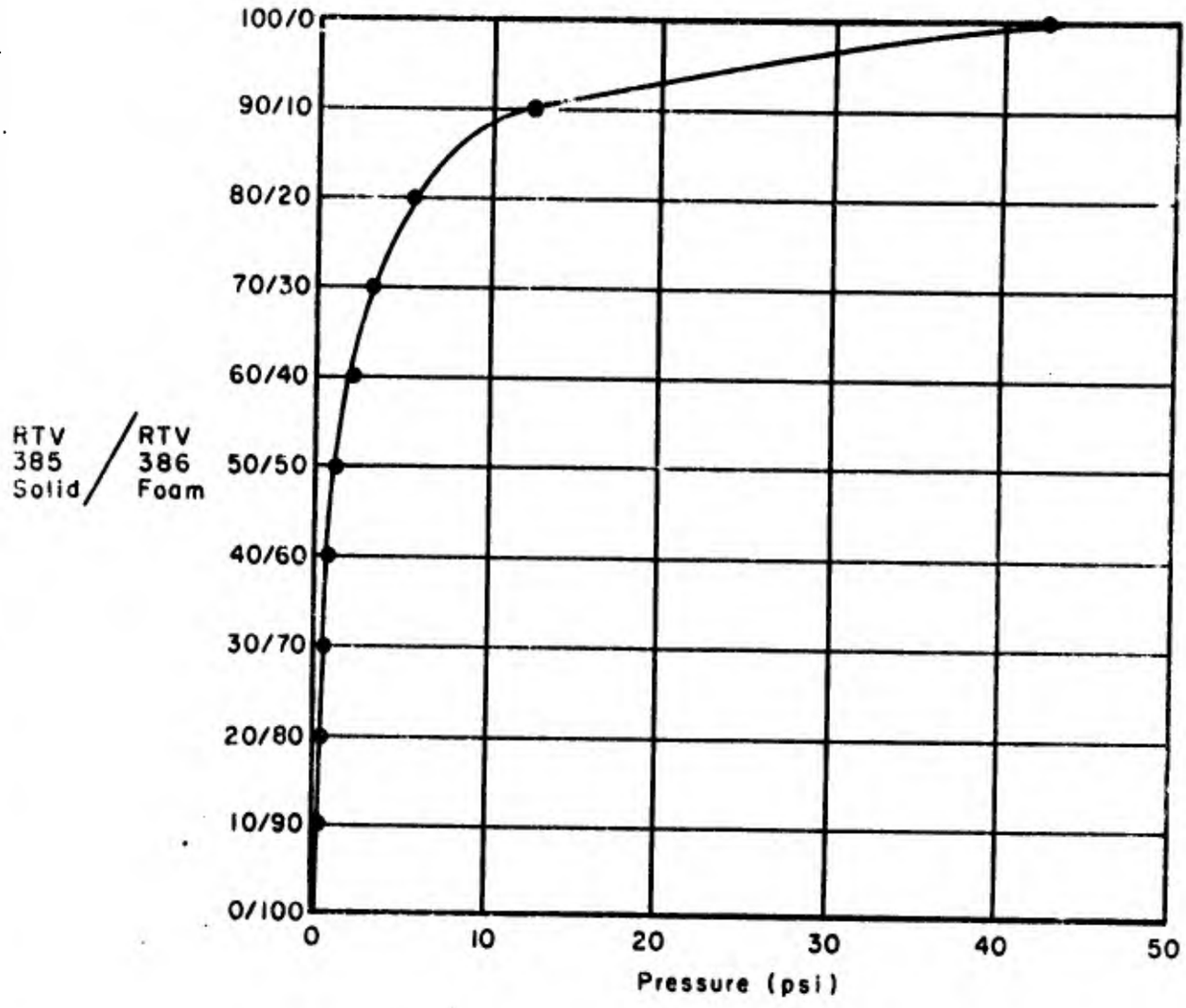
TEAR RESISTANCE - ASTM D1564-64T

SAMPLE	AV. TEAR RESISTANCE (pi)
1	0.4
3	0.5
6	0.7
9	1.5
11	2.0



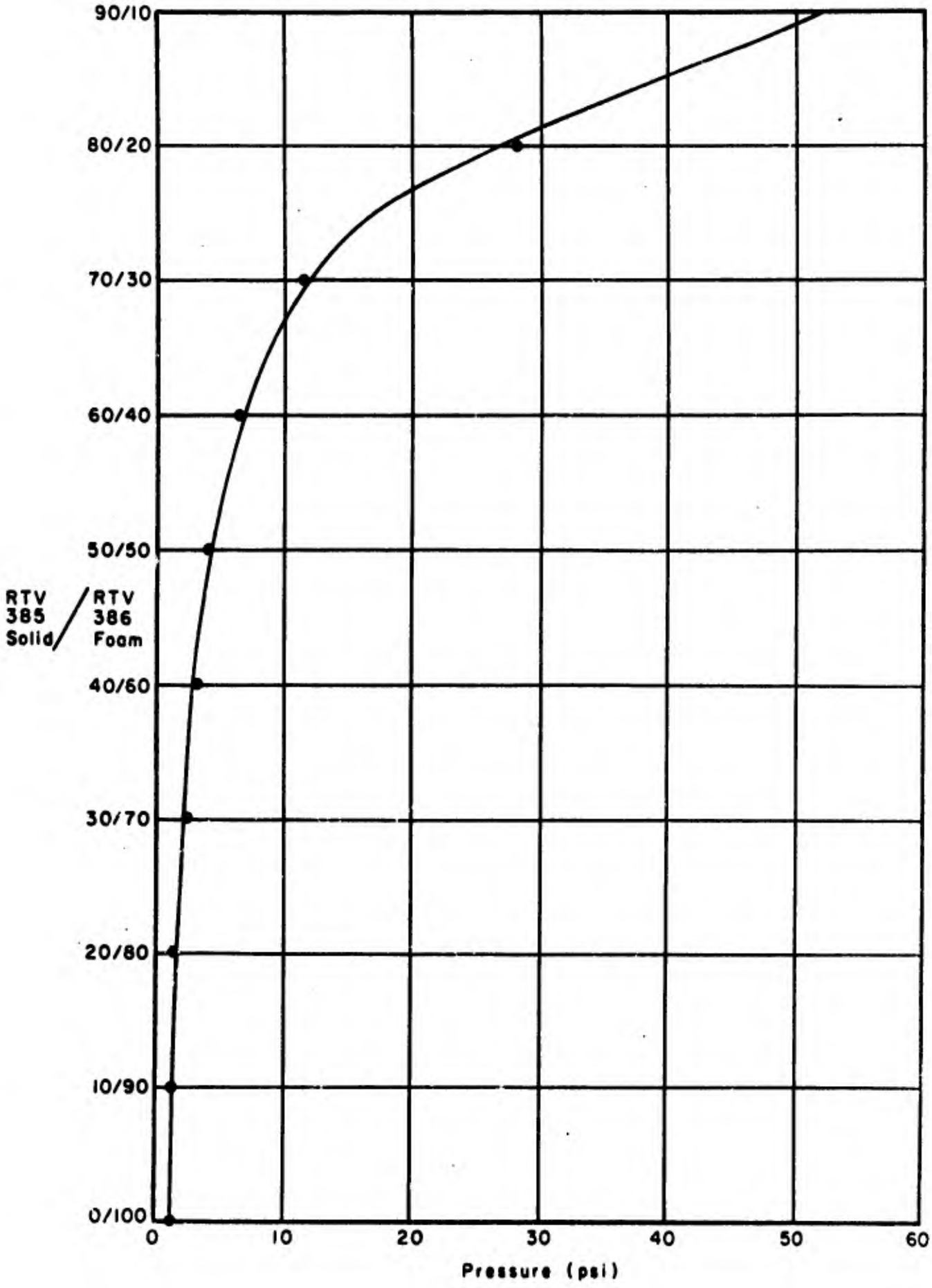
FOAM DENSITY

(Figure I)



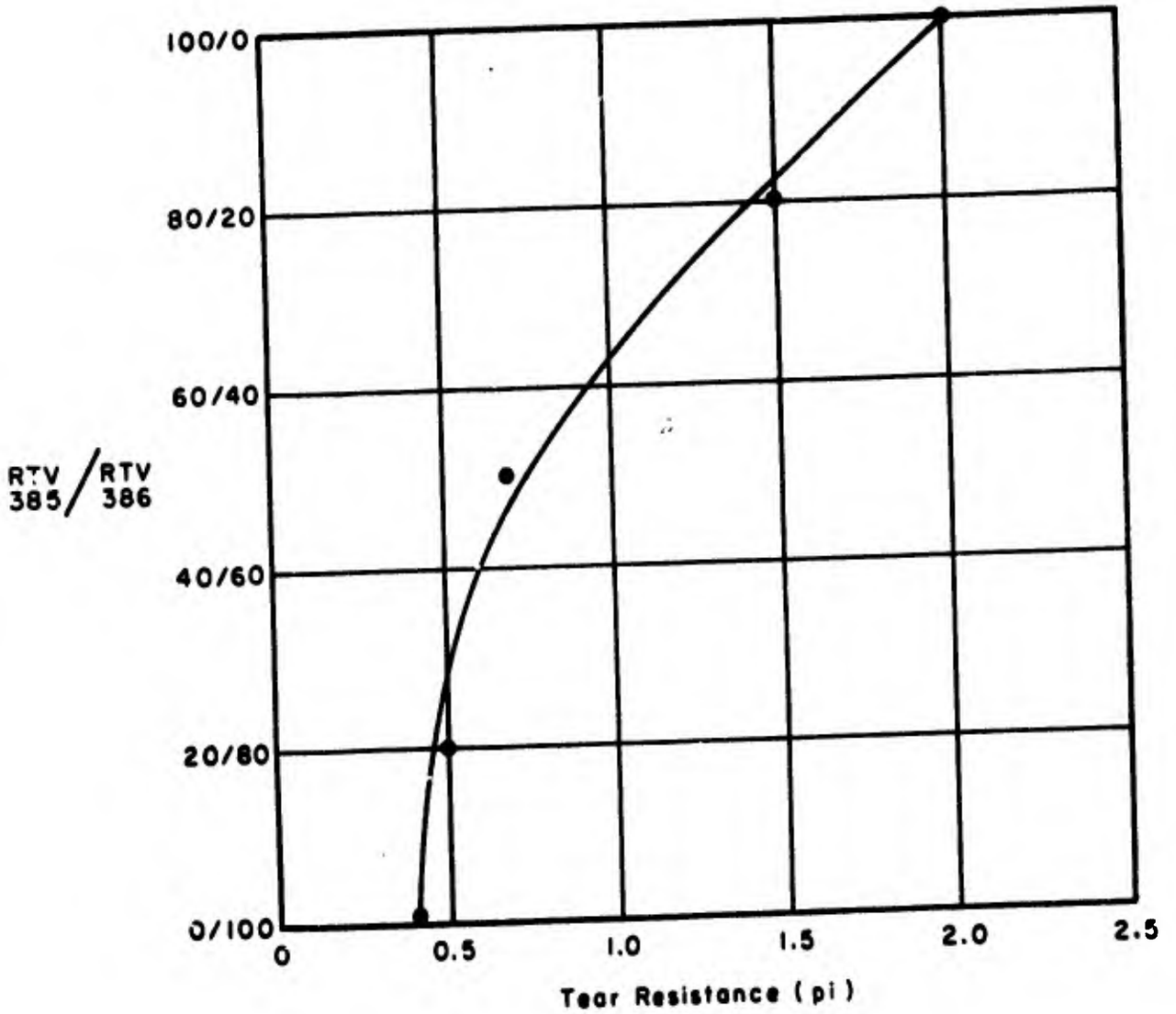
PRESSURE AT 15% DEFORMATION

(Figure II)



PRESSURE AT 50% DEFORMATION

(Figure III)



FOAM TEAR RESISTANCE

(Figure IV)

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