RTV 21 DISPLACEMENTS

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PURPOSE

A seal is needed for the cover of the Nitrogen Test Vessel in order to prevent leakage of the N_2 gas. This seal is to be molded out of RTV 21. In this experiment, the Modulus of Elasticity of the RTV was sought after, and the displacements of the RTV due to various stresses were measured to see if they were large enough to provide a tight seal between the vessel and its cover.

RTV 21

sample molding

mass: 0.257 lbs
thickness: 0.445 in

actual molding

width: 2 in
perimeter: 240 in
load: 6000 lbs
applied stress: approx. 12.5 psi

SET-UP

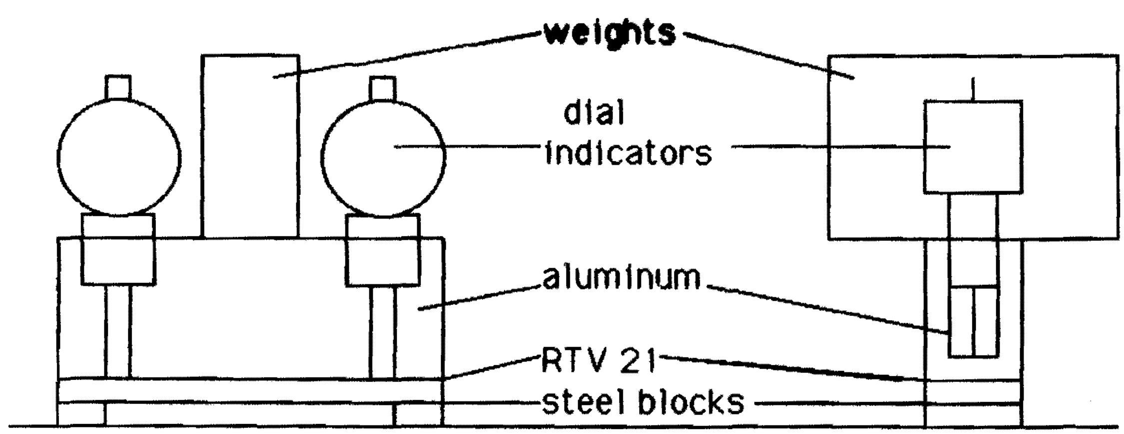


Fig. 1

The first time the experiment was performed, only one centrally located block was used. This, however, resulted in a rocking motion which greatly upset the readings on the dial indicators. To help eliminate any rocking, the blocks were cut in half, with one piece placed at each end of the sample molding. The area of the blocks in contact with the RTV provided the effective area of the applied load, and two dials were used to help account for any discrepancies in the straightness of the materials used. Two blocks, each 1"x2" were used to provide a loaded area of 4in^2, and two 1/2"x2" blocks were used for a resultant area of 2 in^2.

The experiment was performed twice with each set of blocks for seven different weights. In addition to the weight of the bricks, the weight of the aluminum piece to which the RTV sample was molded, also added to the load placed on the RTV. This piece had a weight of 0.833 lbs. The data table shows the weight of the brick plus the weight of the aluminum. See Table 1.

DISCUSSION

Upon graphing the results for each area and for both trials, it can be seen that a stress of 12.5 psi will produce a displacement of about 28-29 (.001") on a 2in^2 area and a displacement of about 24-25 (.001") on a 4in^2 area. Such displacements result in a modulus of elasticity of 230 for a 12.5 psi stress on a 4in^2 area and 195 for a 12.5 psi stress on a 2 in^2 area. The curve of the graph of displacement vs. weight was non-linear, and therefore, no set modulus of elasticity for RTV 21 could be found, as it seemed to vary with the application of different loads, becoming larger with greater loads. The moduli calculated at a stress of 12.5 psi for the areas of 4 in^2 and 2 in^2 suggest that a larger area of RTV has a higher modulus of elasticity with its slightly smaller values of displacements.

While these displacements should be sufficient to correct for any uneveness in the two surfaces in contact, the data seems to indicate that a larger area has a smaller displacement. Before any definite conclusions about this possibility can be drawn, more data should be taken, but unfortunately, I did not have the capability to find any additional useful results with the provided equipment and used set-up. However, upon taking this possibility into account, since the actual molding will be of a greater area, it is probably desirable to have a greater displacement factor to help insure for a better seal.

One way to accomplish a higher displacement capability would be to mold a layer of RTV with a thickness of more than 0.445 in. With the RTV layer molded directly to one of the aluminum surfaces, the remaining seal is to be made between the RTV and the other aluminum surface, see Fig. 2. If designed in this manner, the one layer of RTV would be responsible for correcting irregularities in the cover piece of aluminum.

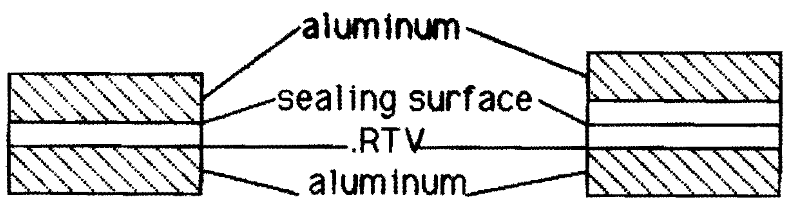


Fig. 2 Fig. 3

Another possible, and perhaps better way to complete the seal, instead of increasing the thickness of the RTV layer, would be to mold an additional layer of RTV to the underside of the cover, see Fig. 3. By doing this, the surface irregularities of the cover would be corrected in the molding of the RTV. This would result in the necessary seal to be made lying between the two layers of the RTV. Since the RTV has a lower modulus of elasticity than the aluminum, RTV-RTV sealing surfaces may more easily conform to each others imperfections than RTV-aluminum sealing surfaces, and hence, produce a better seal. By using two layers and essentially doubling the thickness of the RTV layer, there is a higher displacement factor which should be sufficient enough to provide a tight seal for the vessel.

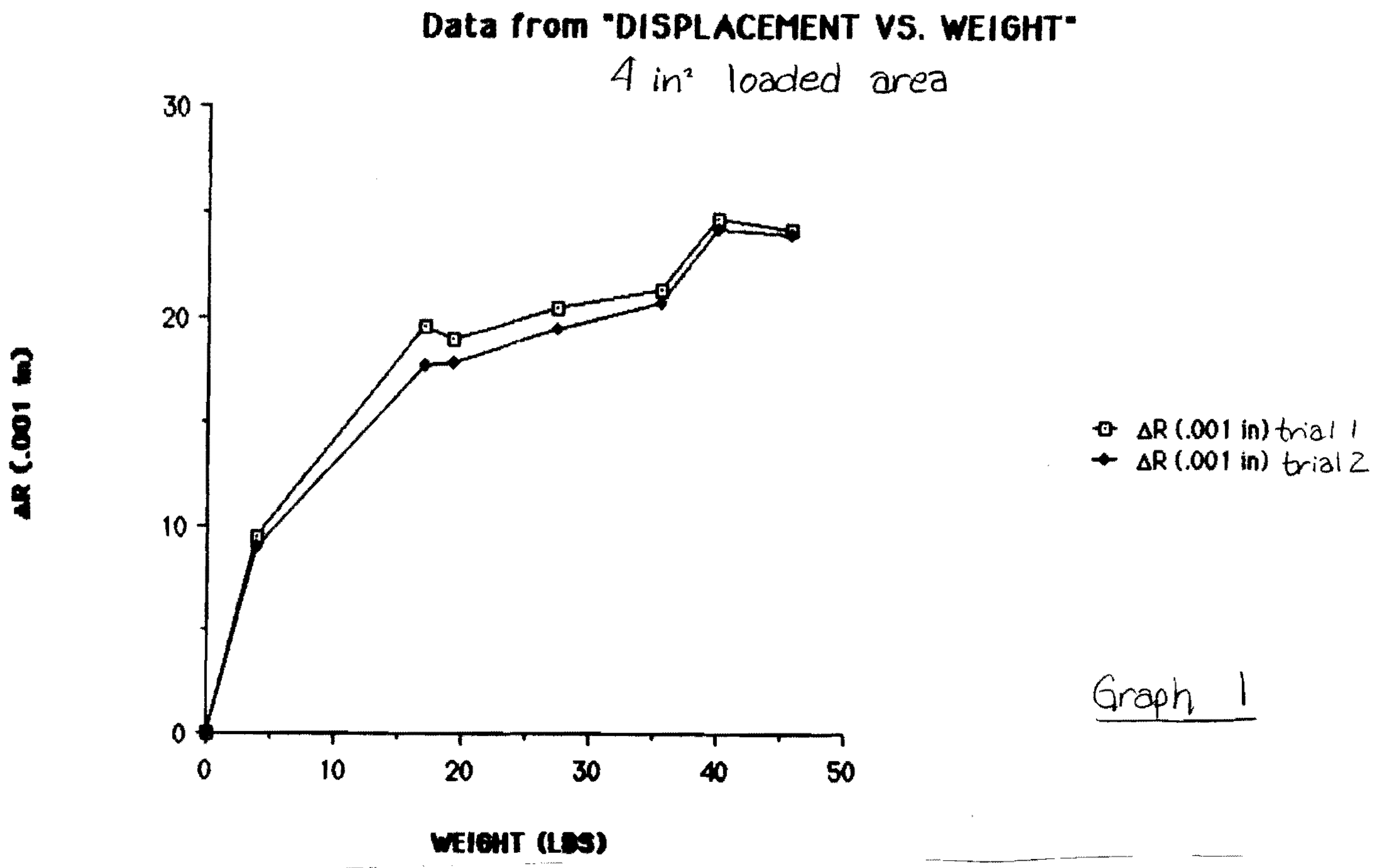
Upon looking over the results of the performed experiment, it is suggested that the vessel cover be sealed with the two layer method, one layer of RTV on each of the sealing surfaces. A layer of appproximately .500 in on each side should prove to be thick enough to produce the necessary tight seal, but a slightly thicker layer can be molded to better insure against leakage if so desired.

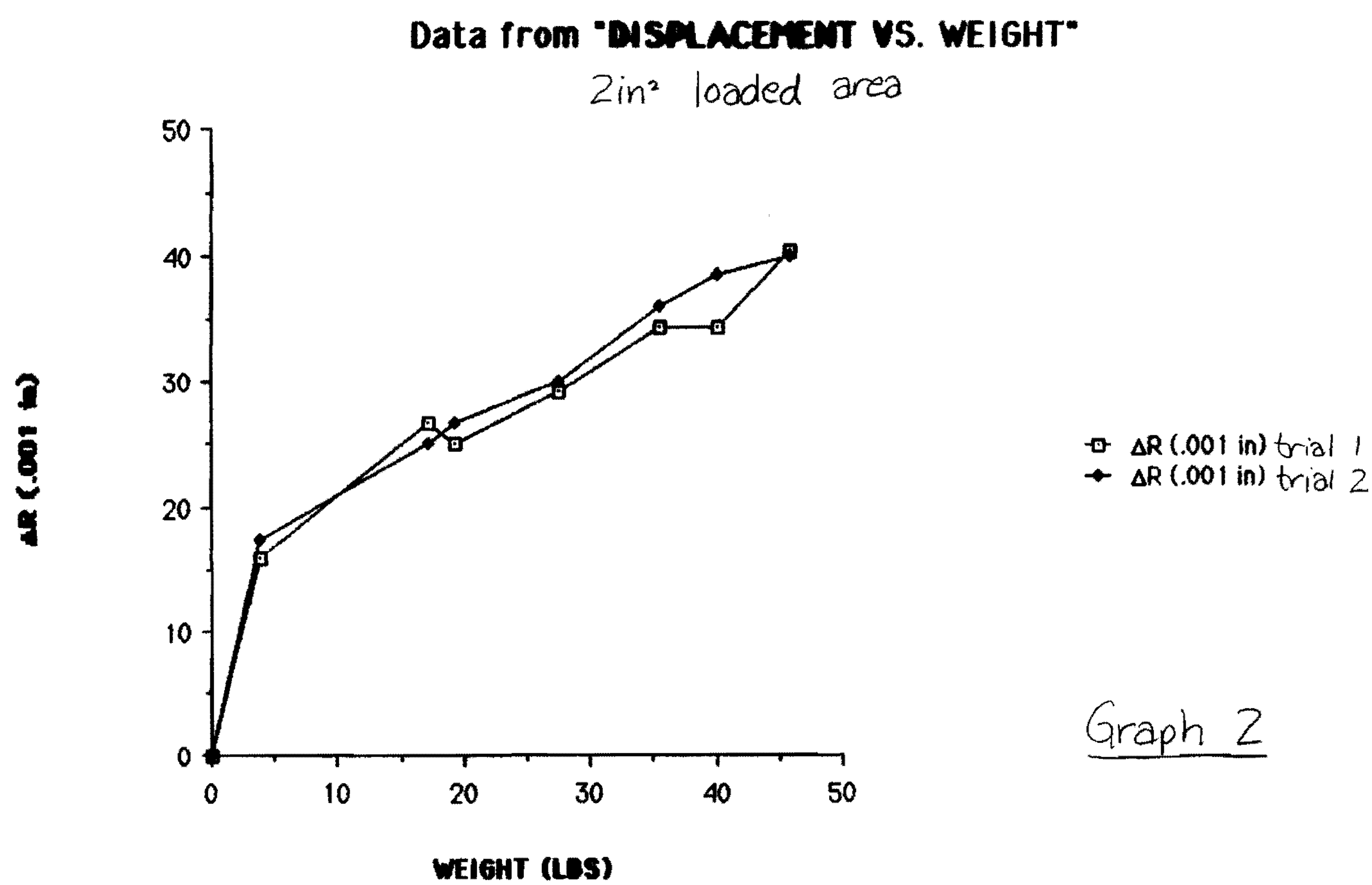
Cricket Graph Data

DISPLACEMENT VS. WEIGHT

	WEIGHT (LBS)	4 in² ΔR (.001 in) trial 1	4 in² ΔR (.001 in) trial 2	2 in² ΔR (.001 in) trial 1	2 in² ΔR (.001 in) trial 2
1	0.00	0.00	0.00	0.00	0.00
2	3.818	9.50	9.00	16.00	17.375
3	17.113	19.625	17.75	26.75	25.00
4	19.198	19.00	17.875	25.00	26.75
5	27.388	20.50	19.50	29.25	30.00
6	35.473	21.375	20.75	34.50	36.00
7	40.048	24.75	24.25	34.50	38.50
8	45.745	24.25	24.00	40.50	40.00

Table 1


Data from "DISPLACEMENT VS. WEIGHT"
4 in² loaded area
ΔR (.001 in)
WEIGHT (LBS)
0
10
20
30
40
50
ΔR (.001 in) trial 1
ΔR (.001 in) trial 2
Graph 1


Data from "DISPLACEMENT VS. WEIGHT"
2in² loaded area
ΔR (.001 in)
WEIGHT (LBS)
0
10
20
30
40
50
ΔR (.001 in) trial 1
ΔR (.001 in) trial 2
Graph 2