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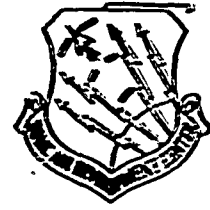
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Final Technical Report
April 1975

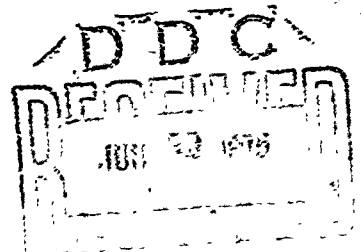


INVESTIGATION OF MICROCIRCUIT SEAL TESTING

Texas Instruments Incorporated

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GAFB, NY 13441.

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) The purpose of this investigation was to determine the detection ranges of Test Conditions A, B, C, and E of Method 1014, MIL-STD-883. Also to examine test variables and modifications of the methods for possible expansion of the detection ranges, and to improve the overall test results. This report discusses the various tests conducted and the results of these tests. In addition to the standard test conditions, various exposure pressures and times of both helium and radioisotope tracer gases are		

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20. Abstract (Cont'd)

examined. Surface absorption, gettering materials, and controlled orifice helium testing are each examined and discussed. Also the gross leak bubble and weight gain test methods are evaluated for sensitivity and effectiveness using various pressures, pressurization times, and fluids for the purpose of optimizing test conditions and defining reject criteria.

Based on the data analysis of this testing, recommendations of leak rate limits and parameter conditions are made which will provide the highest degree of reliability in the most cost-effective manner.

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EVALUATION

The purpose of this effort was to evaluate hermeticity testing, primarily the determination of the sensitivity ranges for the helium, radioisotope, fluorocarbon bubble and weight gain test techniques of MIL-STD-883. A main objective was to establish a single test that would ensure coverage of the complete hermeticity range required for microelectronics devices used in Air Force equipment. The evaluation showed that no single test is effective over the entire fine and gross leak rate ranges for all packages. However, it did indicate for certain packages, a weight gain test will suffice.

This study utilized packages and fabricated leaks of various shapes, volumes and materials categorized by leak range to determine test conditions and sensitivities. The same test sample was used to evaluate all test procedures. The program results, detailed in this report, are considered highly successful in defining leak testing as it is known today, thereby, providing a sound technical basis for revising existing hermetic seal testing procedures. The findings and recommendations of this evaluation are useful as a whole, but in the following areas are considered significant:

- a. Tightened helium and radioisotope test reject limits.
- b. Verification of the Howl and Mann equation, using molecular flow, to define gas behavior within specified limits of leak range and package volume.
- c. Radioisotope and helium leak detection techniques are comparable if proper test conditions and equipment operation are utilized.
- d. Weight gain testing, the most effective of the gross leak test methods, is the only hermetic seal test required for packages whose internal volume is greater than 0.4cc.

In the area of leak testing at high temperature, the report results are unfavorable. However, in-house testing at RADC/RBRM indicates that a problem may exist in certain type packages. Also the data indicates that the proper gettering material could enhance test results. Therefore evaluations in these two areas will continue.

RADC, the preparing activity of MIL-STD-883, is responsible for studying and updating the microcircuit quality and reliability assurance procedures to provide reliable, accurate and cost effective test methods. Results of this effort will be factored into Methods 1014, 5004 and 5005 of MIL-STD-883.

John P. Farrell

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SECTION I

INTRODUCTION

This investigation was conducted under Rome Air Development Center Contract No. F30602-73-C-0150 to determine the sensitivity ranges of Conditions A, B, and C of Method 1014 and proposed Condition E to determine if the ranges could be extended by changes in test parameters or preconditioning of the test devices.

Seven microcircuit package types were screened to secure devices having leak rates ranging from $>10^{-3}$ $<10^{-8}$ atmospheric cm^3 per second. The leak rates were confirmed by Test Conditions A and B and by a weight gain technique.

All the test samples were subjected to a matrix of test times and pressures in helium and measured with mass spectrometers. Veeco Model MS-12 and MS-90 UFT machines were used to determine if pump-down rates had significant effects on the resultant data. Test times ranged from 2 to 8 hours and pressures from 30 to 90 psig. Curves were constructed for each package at each test condition utilizing the formula in Method 1014 of MIL-STD-883. This permitted the formula to be tested for validity and if valid, provided a base for testing the effects of the various conditions.

All the test samples were then subjected to a matrix of test conditions utilizing radioisotope techniques. Tests were conducted with zero, one, and three wash cycles and with three levels of specific activity: 277, 600, and 1397 microcuries per cm^3 . IsoVac Mark IV and CEC 24-510 machines were used for this part of the investigation. Tests were conducted at three different storage pressure levels to determine possible effects on the results.

Helium tests were then conducted utilizing a controlled orifice to determine if such a method would extend Test Condition A to cover the gross leak range. Special fixtures were fabricated to permit each device to be tested for gross leak, then immediately for fine leak.

Temperature preconditioning was also evaluated using both helium and radioisotope conditions. Two packages, one metal and one ceramic, were pressurized while maintaining temperatures of 50°C, 75°C, 100°C, and 125°C. The devices were read immediately upon removal from pressurization in each case.

Pre-encapsulated polyimide as well as bombed-in fluorocarbons (FC-48 and PP-9) and vacuum pump oil were tested as possible gettering materials. This was to determine if either the helium or radioisotope range could be extended to cover the entire gross leak range.

Case and sealing materials were also evaluated to determine their gettering characteristics for either helium or krypton-85. This portion of the study was performed to learn whether or not acceptable devices were being rejected in some cases because of the absorption ability of these materials.

C₁ bubble test was conducted on all test samples using FC-40 and PP-9 to evaluate the fluids, repeatability of the test, and sensitivity of the test.

C₂ bubble test was performed on all test samples using FC-78/FC-40 and PP-1/PP-9 fluid combinations. This was to determine the best fluid combination, sensitivity, and repeatability of the condition.

All the test samples were subjected to a series of weight gain tests. Tests were conducted on each package type using FC-77, FC-78, PP-1, and PP-2 as the indicator fluid. This was to determine if all the fluids were acceptable and if not, which was the best. Each package type was subjected to a test at 30, 60, and 90 psig to determine possible effect upon the results. The condition was also evaluated to determine if the vacuum step is necessary.

SECTION II

SCREENING AND FABRICATING LEAKERS

Phase I of the project was devoted to selection of samples from production line hermetic seal rejects and fabrication of glass "standard leakers." The test devices were first categorized into leak-range decades utilizing the radioisotope technique of Condition B, Method 1014 of MIL-STD-883. This technique provided device categories of 10^{-8} , 10^{-7} , 10^{-6} , and $>10^{-6}$ atm cc/s and "nonleakers." Condition B resulted in some gross leakers being detected as fine leakers and therefore being grouped in the fine-leak ranges. The " $>10^{-6}$ " and "nonleaker" categories were then subjected to an FC-75 weight gain test utilizing the fluid fill rate data published by Raytheon in "Raytheon Weight Test Method for Detecting Gross Leaks in Small Internal Volume Semiconductor Packages." The Raytheon data has been verified by Texas Instruments (Figure 1). This method provided leak-range classifications of 10^{-5} , 10^{-4} , and $\geq 10^{-3}$ atm cc/s. Each test device was then assigned a serial number and grouped as shown in Table I.

Glass^{*} "standard leakers" were fabricated by drawing glass tubing down into orifice sizes. The "standard leakers" were fabricated from thin-wall and thick-wall glass tubing of 1/4 inch O.D. The procedure for fabricating the thin-wall tubing was as follows:

The tubing was cut into 6-inch lengths and heated with a torch, a distance 2 inches from one end until the tubing was soft.

The tubing was then pulled so as to cause the tubing to "neck down" and separate. The pull rate was controlled so as to produce a neck 1/2- to 3/4-inch long with an orifice of varying size. There is no control on the size of orifice produced in this manner; therefore, several units were required to produce one acceptable unit.

The units were then connected to a dry nitrogen supply with a controlled pressure that could be varied from 0 to 100 psig. The orifice end was submerged in isopropanol and the pressure inside the unit increased until the pressure required to initiate bubbling was obtained. This pressure was recorded and used to determine the leak rate.

The open ends of the units were then heated with a torch and sealed approximately one inch from the neck. The open end which extended beyond the seal was cut off and discarded.

*Pyrex glass

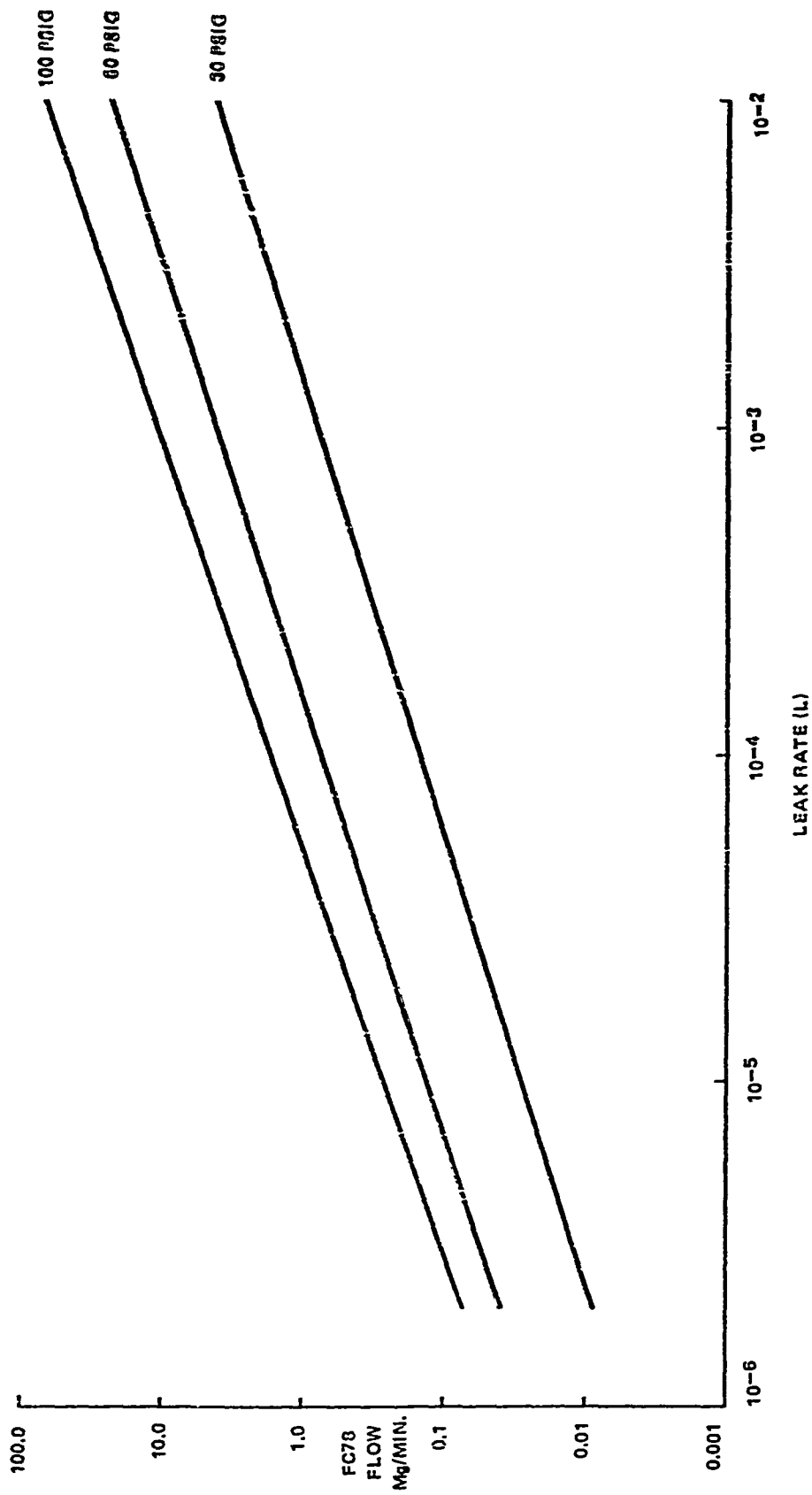


Figure 1. Fluid Flow versus Leak Rate

Table I. RADC Microcircuit Leak Rate Values

TO-84			Ceramic Dual In-Line (C-DIP)			TO-100			
Leak Rate	No. Units	SN	Leak Rate	No. Units	SN	Leak Rate	No. Units	SN	
Nonleakers	10	40-49	Nonleakers	10	1-10	Nonleakers	11	1-11	
10 ⁻⁸	5	1-9	10 ⁻⁸	14	11-24	10 ⁻⁸	12	12-24	
10 ⁻⁷	12	10-21	10 ⁻⁷	20	25-44	10 ⁻⁷	20	25-44	
10 ⁻⁶	18	22-39	10 ⁻⁶	12	45-57	10 ⁻⁶	15	45-59	
10 ⁻⁵	15	50-64	10 ⁻⁵	12	58-70	10 ⁻⁵	15	60-74	
10 ⁻⁴	7	65-71	10 ⁻⁴	14	71-84	10 ⁻⁴	18	75-93	
>10 ⁻³	29	72-99	>10 ⁻³	19	85-103	>10 ⁻³	9	93-102	
Total	100		Total	103		Total	102		
¼ by ¼ All Ceramic with Gettering (C-PAK)			MOS Dual In-Line (MOS DIP)			Ceramic 1 Inch by 1 Inch			
Leak Rate	No. Units	SN	Leak Rate	No. Units	SN	Leak Rate	No. Units	SN	
Nonleakers	12	1-12	Nonleakers	10	1-10	Nonleakers			
10 ⁻⁸	12	13-24	10 ⁻⁸	15	11-25	10 ⁻⁸			
10 ⁻⁷	21	25-45	10 ⁻⁷	18	26-43	10 ⁻⁷			
10 ⁻⁶	15	46-60	10 ⁻⁶	7	44-50	10 ⁻⁶	71	1-71	
10 ⁻⁵	6	61-66	10 ⁻⁵	23	51-73	10 ⁻⁵			
10 ⁻⁴	8	94-101	10 ⁻⁴	6	74-79	10 ⁻⁴			
>10 ⁻³	27	67-93	>10 ⁻³	22	80-101	>10 ⁻³		Units did not fit distribution.	
Total	101		Total	101					
TO-3			Glass Standards			¼ by ¼ All Ceramic (C-PAK)			
Leak Rate	No. Units	SN	Leak Rate	No. Units (Small Vol.)	No. Units (Large Vol.)	SN	Leak Rate	No. Units	SN
Non Leakers	15	26-49					Nonleakers	10	98-107
10 ⁻⁸	15	1-15	10 ⁻⁷	4		1-4	10 ⁻⁸	8	90-97
10 ⁻⁷	20	50-69	10 ⁻⁶	5	8	5-17	10 ⁻⁷	19	71-89
10 ⁻⁶	15	70-84	10 ⁻⁵	4	9	18-30	10 ⁻⁶	16	55-70
10 ⁻⁵	11	85-95	10 ⁻⁴	4	6	31-40	10 ⁻⁵	6	53-54; 110-113
10 ⁻⁴	19	96-115	>10 ⁻³		11	40-51	10 ⁻⁴	20	33-52
>10 ⁻³	6	20-25					>10 ⁻³	32	1-32
Total	101		Total	17	34		Total	113	

The thick wall units were produced as follows:

The tubing was cut into 6-inch lengths and the heat applied with a torch to the end of the tubing. The units were slowly rotated while being heated, causing the tubing to shrink until the inside diameter was of the desired size.

The units were then checked for bubbling in the same manner as the thin-wall units. If the unit did not produce the desired value, it was reheated and checked again.

After obtaining the desired value, the units were sealed by heating the tubing and twisting so as to seal the unit 1 inch from the orifice end. The open end which extended beyond the seal was cut off.

The thin-wall leakers produced by this method were classed as large-volume units and the thick-wall units were classed as small-volume units.

The leak sizes were then verified by helium mass spectrometer techniques. After sealing, the fine leakers were further verified by Test Condition A, Method 1014, MIL-STD-883 and the gross leakers by the weight gain techniques. The categories fabricated are included in Table I.

Effort was also devoted to the evaluation of laser drilling as a means of creating microelectronic package leakers of specific leak rates. The laser is controlled by a Texas Instruments 960A computer which controls the beam diameter as well as the number of pulses. The application of this laser does not require as close a tolerance on the beam diameter as would be required to drill deep holes with very small diameters. Two types of material and package types were used during this investigation: the TO-100 which is metal, and the 1 X 1 ceramic.

The laser would penetrate the TO-100 packages; however, the beam could not be focused to produce a hole smaller than 0.015 inch in diameter. It was felt that since the energy of the LASER beam was not uniform over the entire beam spot, that if the correct number of pulses were applied, the "hot spots" would burn through, producing a much smaller hole. Due to the tolerance of the material thickness and the lack of precise control of the laser beam, this could not be achieved. The large 1 inch by 1 inch ceramic packages obtained from the production lines were nonleakers. An attempt was made to create leakers by using the laser drill. The ceramic was so thick that after drilling half way through the material, the beam was adjusted so as to penetrate the material. This produced a hole 0.015 inch in diameter which was considered too large for use in this study. It can be concluded that for laser drilling to be effective in producing standard leakers, that the laser should be designed to drill deep holes and maintain control on the diameter of the beam to within 0.5 micrometers. Since the fabrication of leakers from glass tubing had proved to be a successful and controllable process, further attempts at laser drilling were not made.

The internal volume of the devices was calculated by opening each package and measuring the internal dimensions. The measurements were made using a microscope with a scale scribed on the lens. The calculations were verified by drilling a small hole in the package and filling the unit with FC-78. The volume of FC-78 was determined by measuring the weight gained by the device. This information is included in Table II.

Table II. Calculated Internal Volume of Typical Devices

Package	Volume
TO-84	0.0060 cc
1/4 by 1/4 All Ceramic (C-PAK)	0.0120 cc
Ceramic Dual In-Line (C-DIP)	0.0145 cc
*MOS Dual In-Line	0.0412 cc
TO-100	0.0858 cc
Ceramic 1 Inch by 1 Inch	0.4475 cc
TO-3	1.0712 cc
*Large Volume Glass Standard	1.3100 cc
*Small Volume Glass Standard	0.0320 cc

*See Figure 2

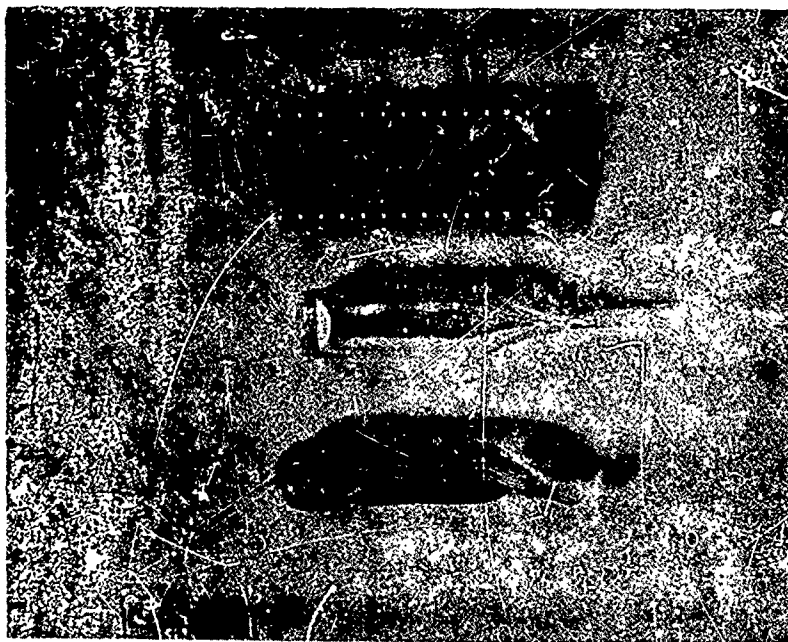


Figure 2. Examples of MOS Dual In-Line Device, Large Volume Glass Standard Sample, and Small Volume Glass Standard Sample

Prior to initiation of evaluation of the test methods, each device's leak rate was measured by radioisotope and helium techniques. The leak rate in terms of Q_s for the radioisotope technique and R for the helium technique was recorded. The R value was converted to L value using the graphs (Figures 3 through 47) and the gross leak data. The gross leak data was used to indicate that the device was on the portion of the curve that indicated a leak rate greater than the spectrometer was able to detect due to gas escape rate. Pressurization values and bomb times were determined by the equations below. The reject criteria for comparison purposes were based upon calculated leak rates (L, Q) of 5×10^{-7} to provide a common data baseline.

Helium equation:

$$R_1 = \frac{LP_E}{P_0} \left(\frac{M_A}{M} \right)^{1/2} \left\{ 1 - e^{- \left[\frac{Lt_1}{VP_0} \left(\frac{M_A}{M} \right)^{1/2} \right]} \right\} e^{- \left[\frac{Lt_2}{VP_0} \left(\frac{M_A}{M} \right)^{1/2} \right]} \quad (1)$$

where

R_1 = the measured leak rate of tracer gas (He) through the leak in atm cc/s

L = the equivalent standard leak rate in atm cc/s

P_E = the pressure of exposure in atmospheres absolute

P_0 = the atmospheric pressure in atmospheres absolute (1)

M_A = the molecular weight of air in grams (28.7)

M = the molecular weight of the tracer gas (He) in grams (4)

t_1 = the time of exposure to P_E , in seconds

t_2 = the dwell time between release of pressure and leak detection, in seconds

V = the internal volume of the device package cavity in cubic centimeters

Radioisotope equation:

$$Q_s = \frac{R}{SKTPt} \quad (2)$$

The parameters of Equation (2) are defined as follows:

Q_s = The maximum leak rate allowable, in atm cc/s, for the devices to be tested.

R = Counts per minute above the ambient background after activation if the device leak rate were exactly equal to Q_s .

s = The specific activity, in microcuries per atmosphere cm^3 , of the Krypton-85 tracer gas in the activation system.

k = The overall counting efficiency of the scintillation crystal in counts per minute per microcurie of Krypton-85 in the internal void of the specific component being evaluated.

This factor depends upon component configuration and dimensions of the scintillation crystal.

T = Soak time, in hours, that the devices are to be activated.

$\bar{P} = P_e^2 - P_i^2$, where P_e is the activation pressure in atmospheres absolute and P_i is the original internal pressure of the devices in atmospheres absolute. The activation pressure (P_e) may be established by specification or if a convenient soak time (T) has been established, the activation pressure (P_e) can be adjusted to satisfy Equation (2).

t = Conversion of hours to seconds and is equal to 3600 seconds per hour.

Applying the parameters defined by solution of Equation (2), the actual leak rate of the device can be calculated as follows:

$$Q = \frac{(\text{Actual Readout in Net Counts Per Minute}) \times Q_s}{R} \quad (3)$$

where Q = actual leak rate of the device, Q_s and R are as defined above.

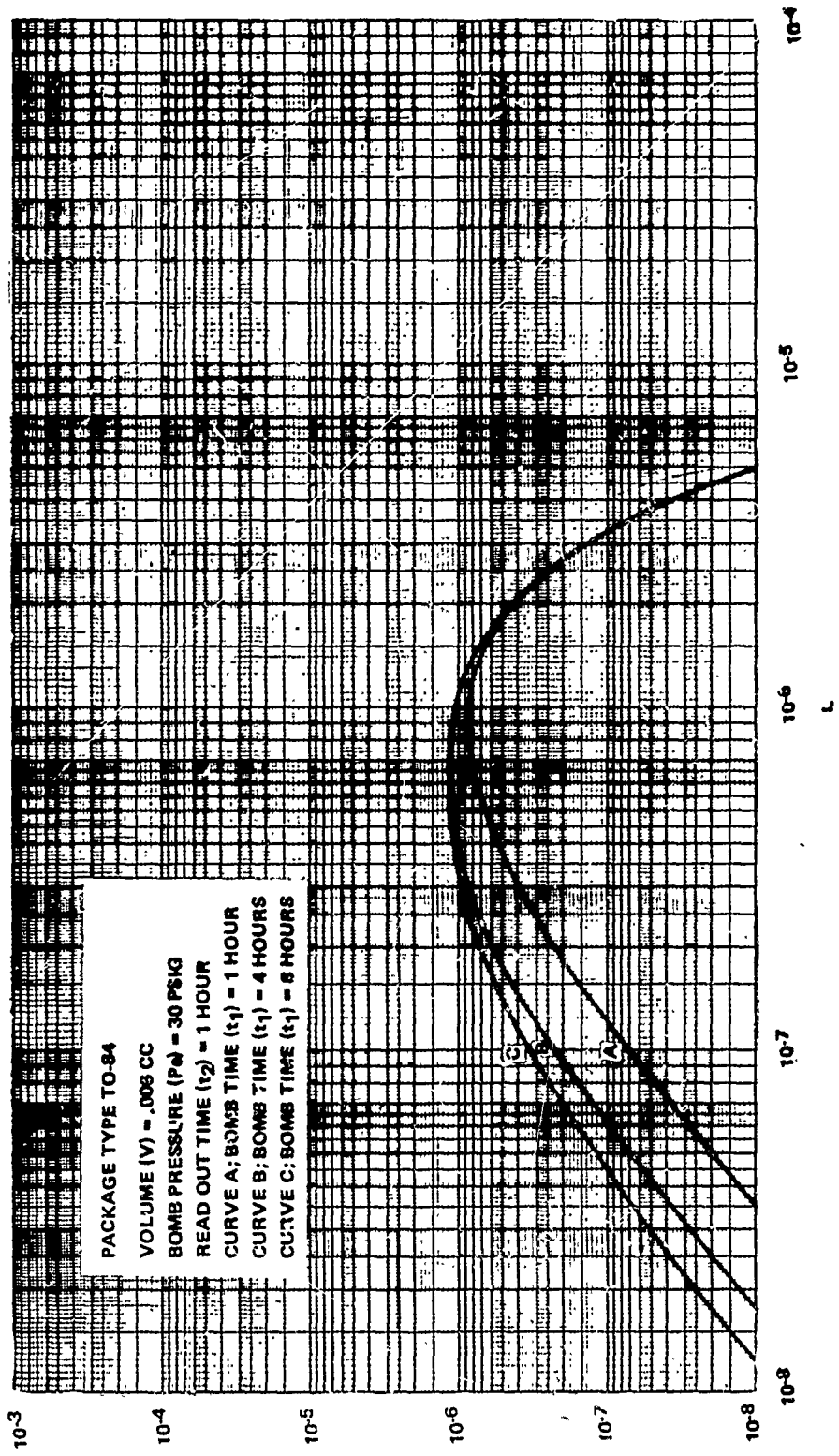


Figure 3. TO-84 Time/Pressure Sequence-Bomb Pressure = 30 psig

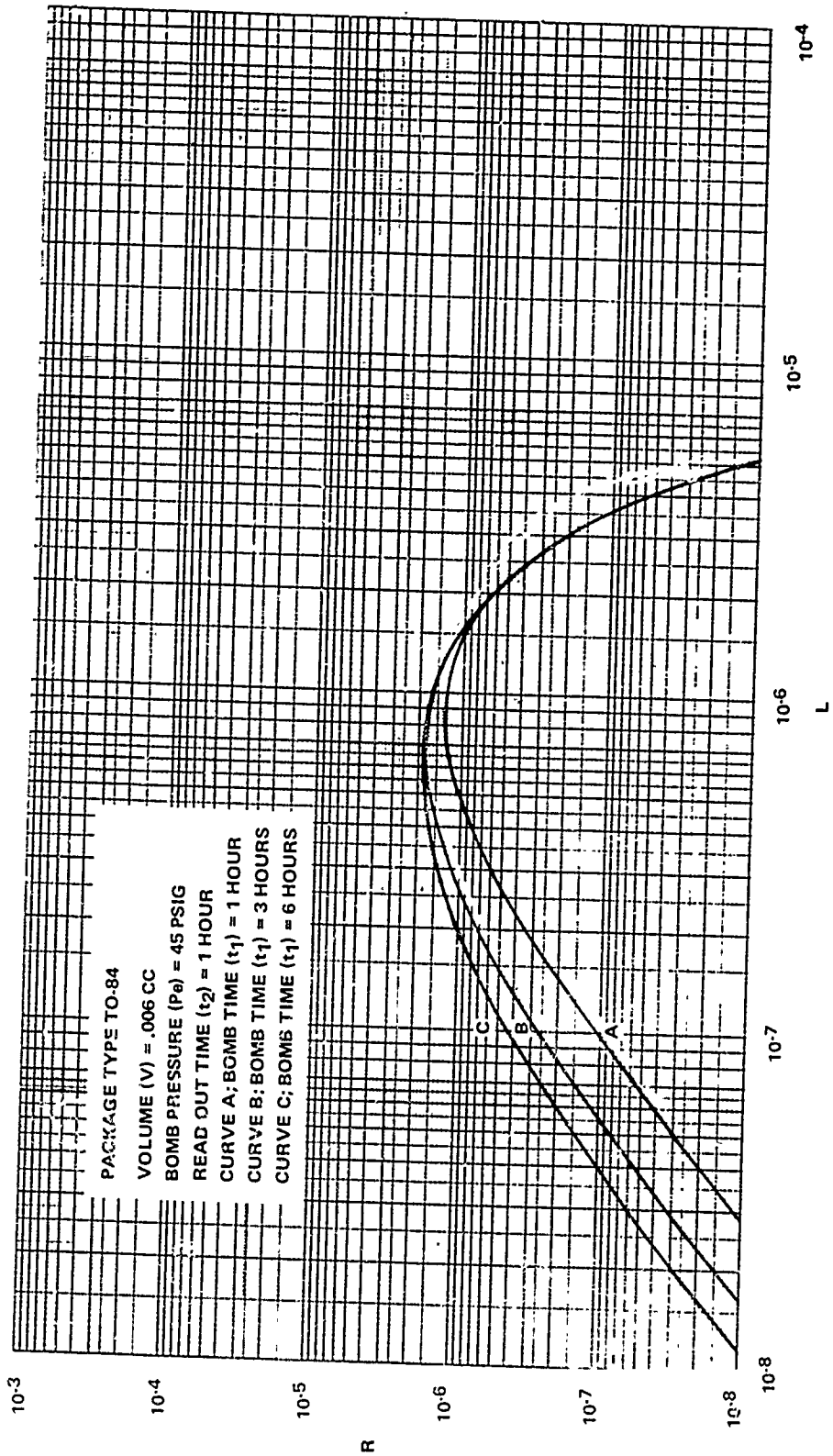


Figure 4. TO-84 Time/Pressure Sequence-Bomb Pressure = 45 psig

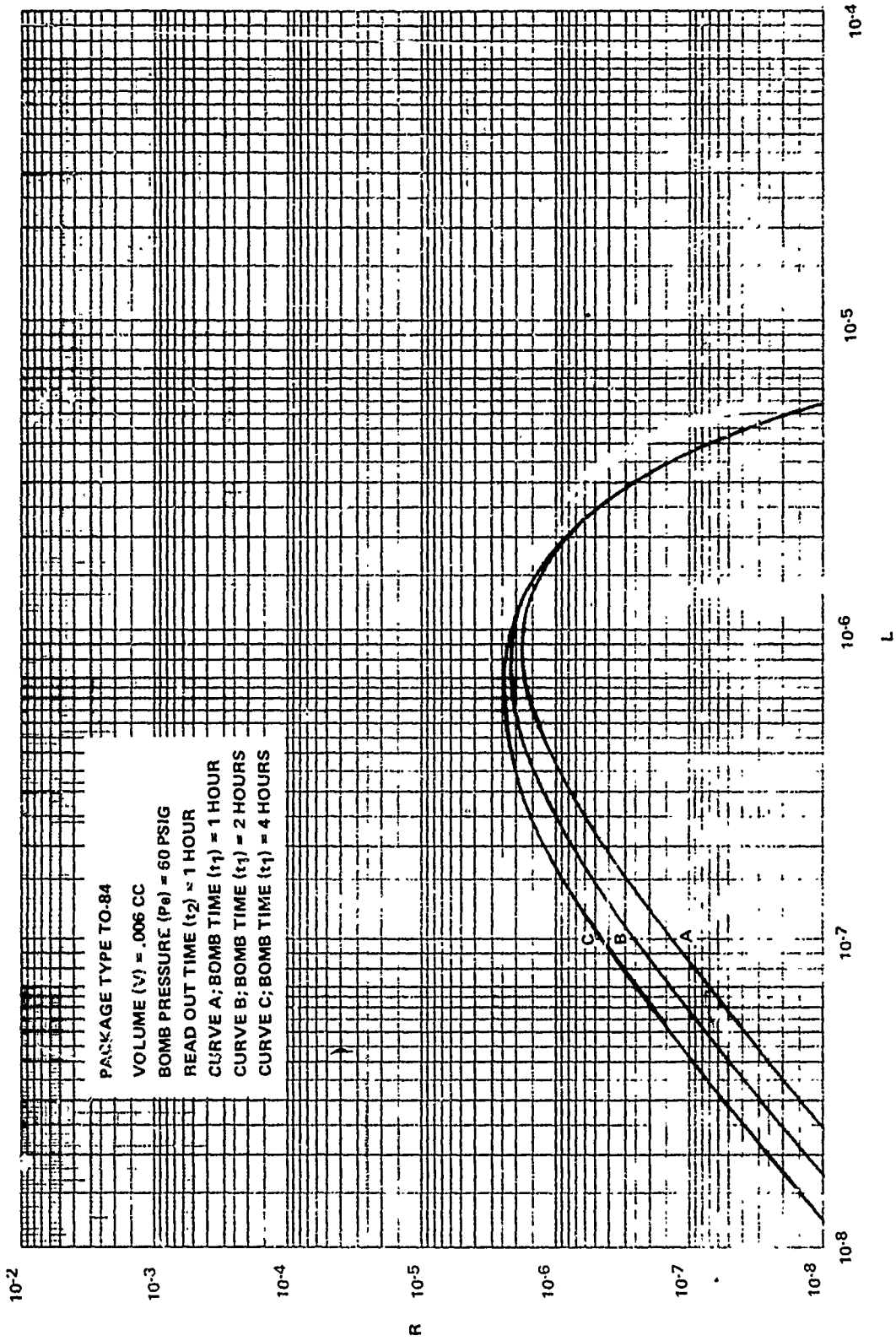


Figure 5. TO-84 Time/Pressure Sequence-Bomb Pressure = 60 psig

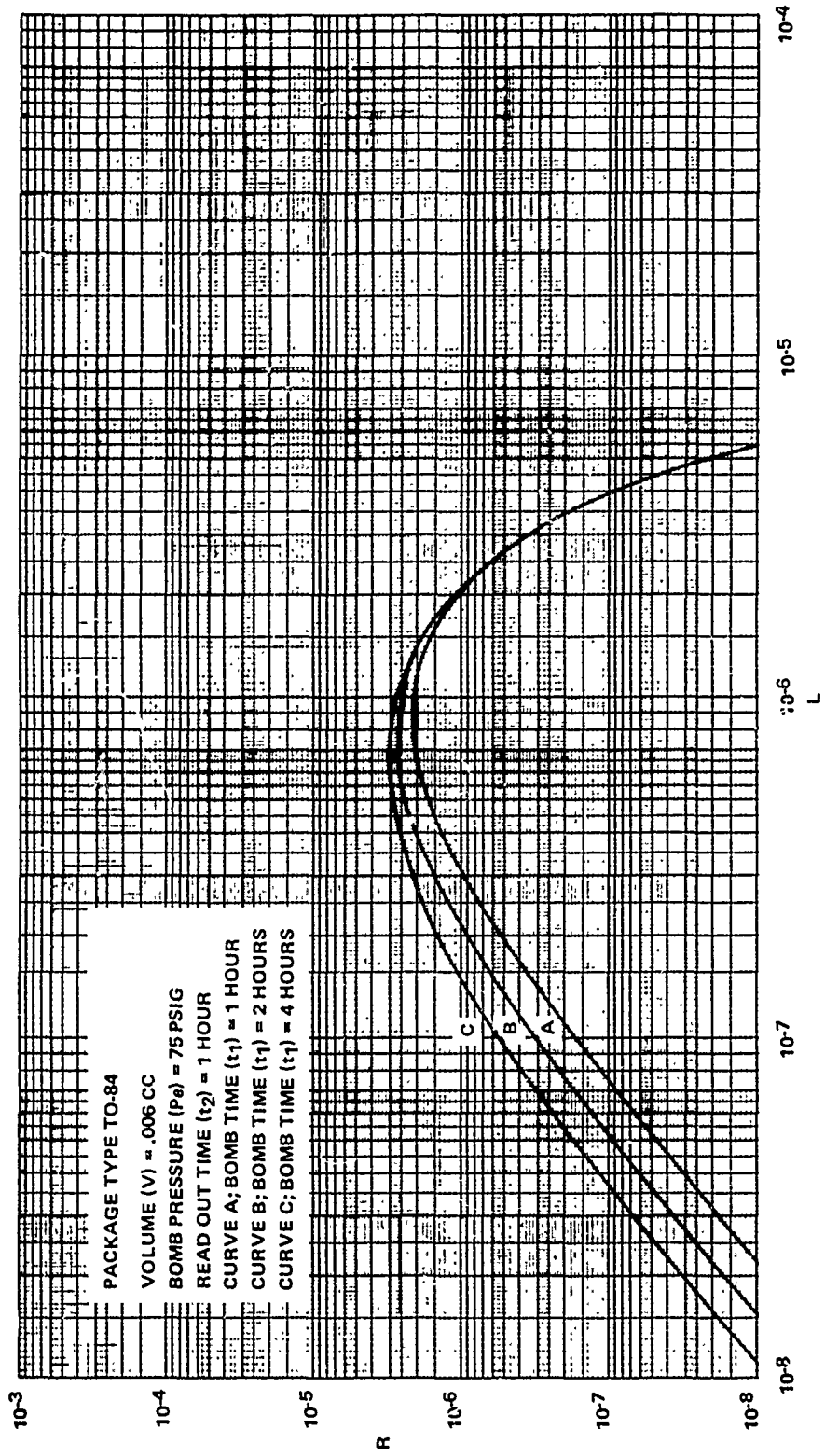


Figure 6. TO-84 Time/Pressure Sequence-Bomb Pressure = 75 psig

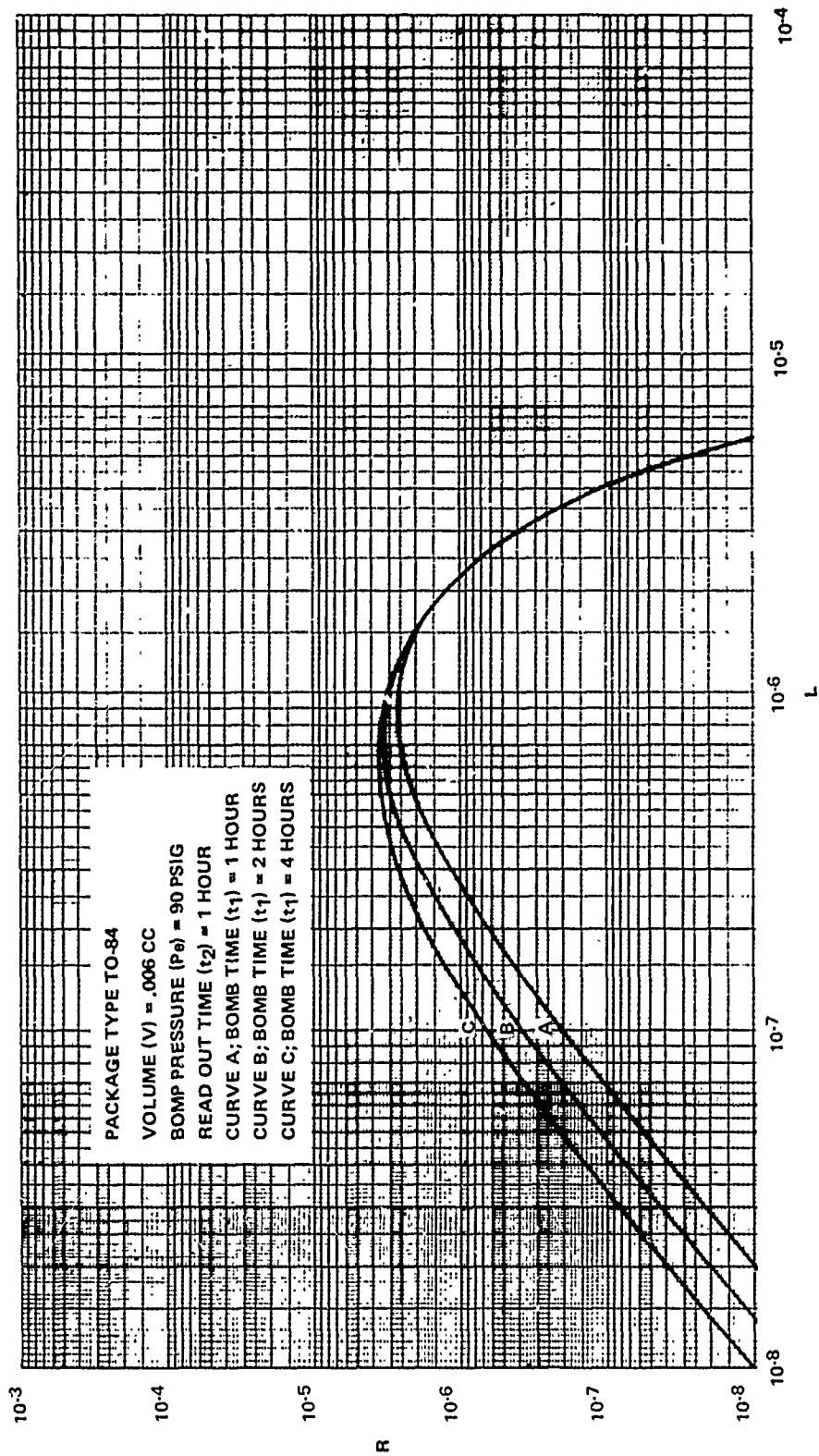


Figure 7. TO-84 Time/Pressure Sequence-Bomb Pressure = 90 psig

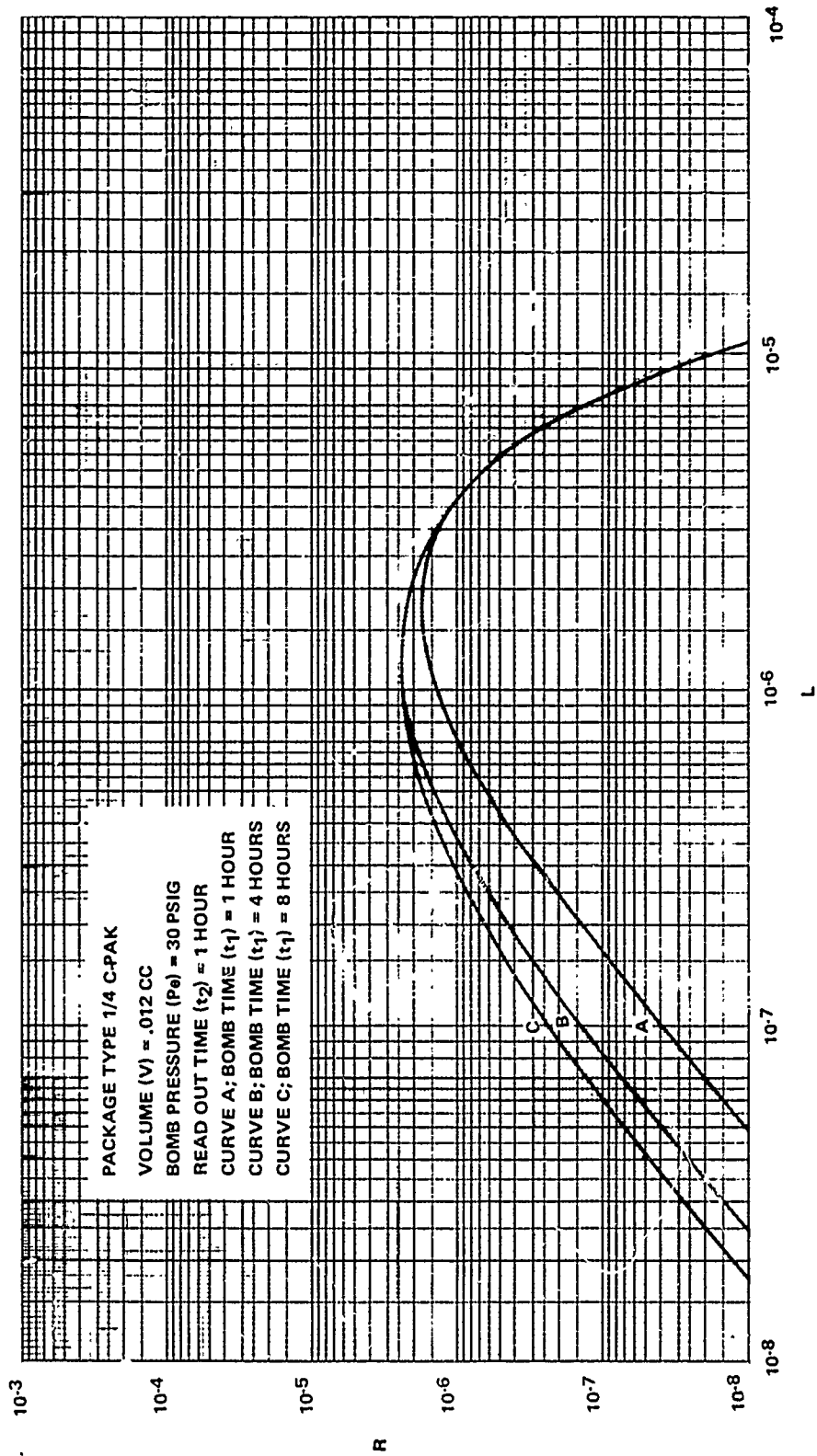


Figure 8. C-PAK Time/Pressure Sequence-Bomb Pressure = 30 psig

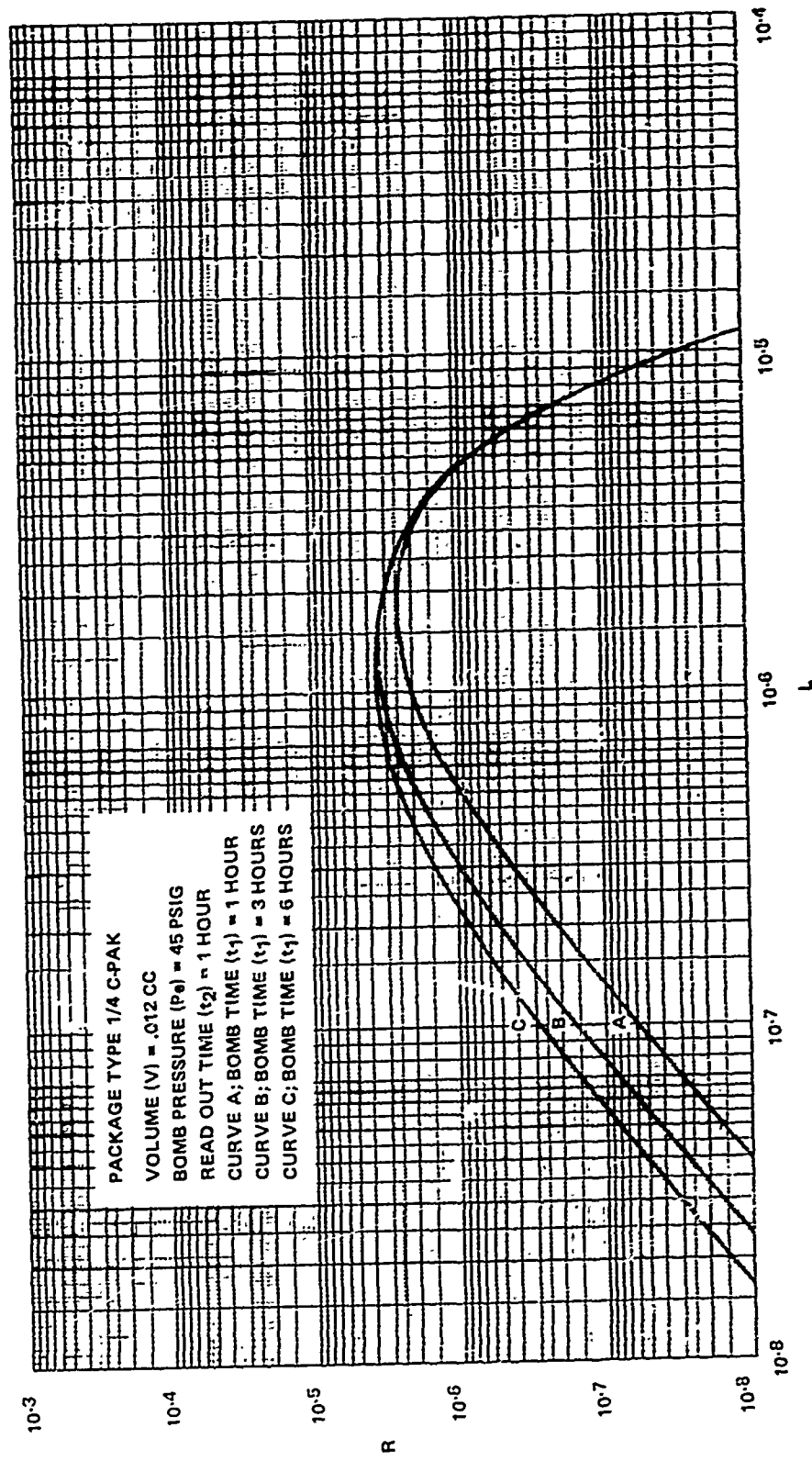


Figure 9. C-PAK Time/Pressure Sequence-Bomb Pressure = 45 psig

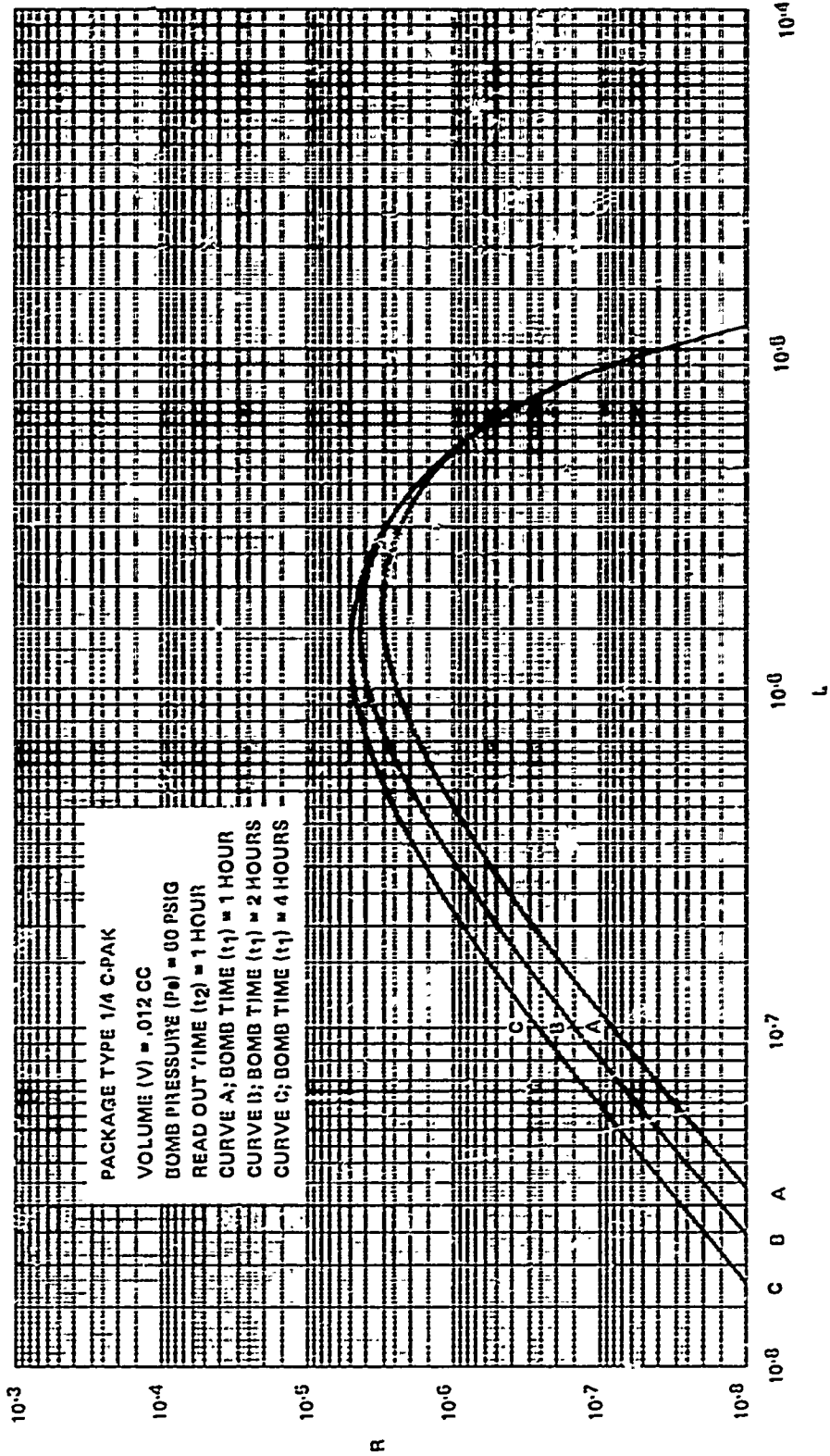


Figure 10. C-PAK Time/Pressure Sequence-Bomb Pressure = 60 psig

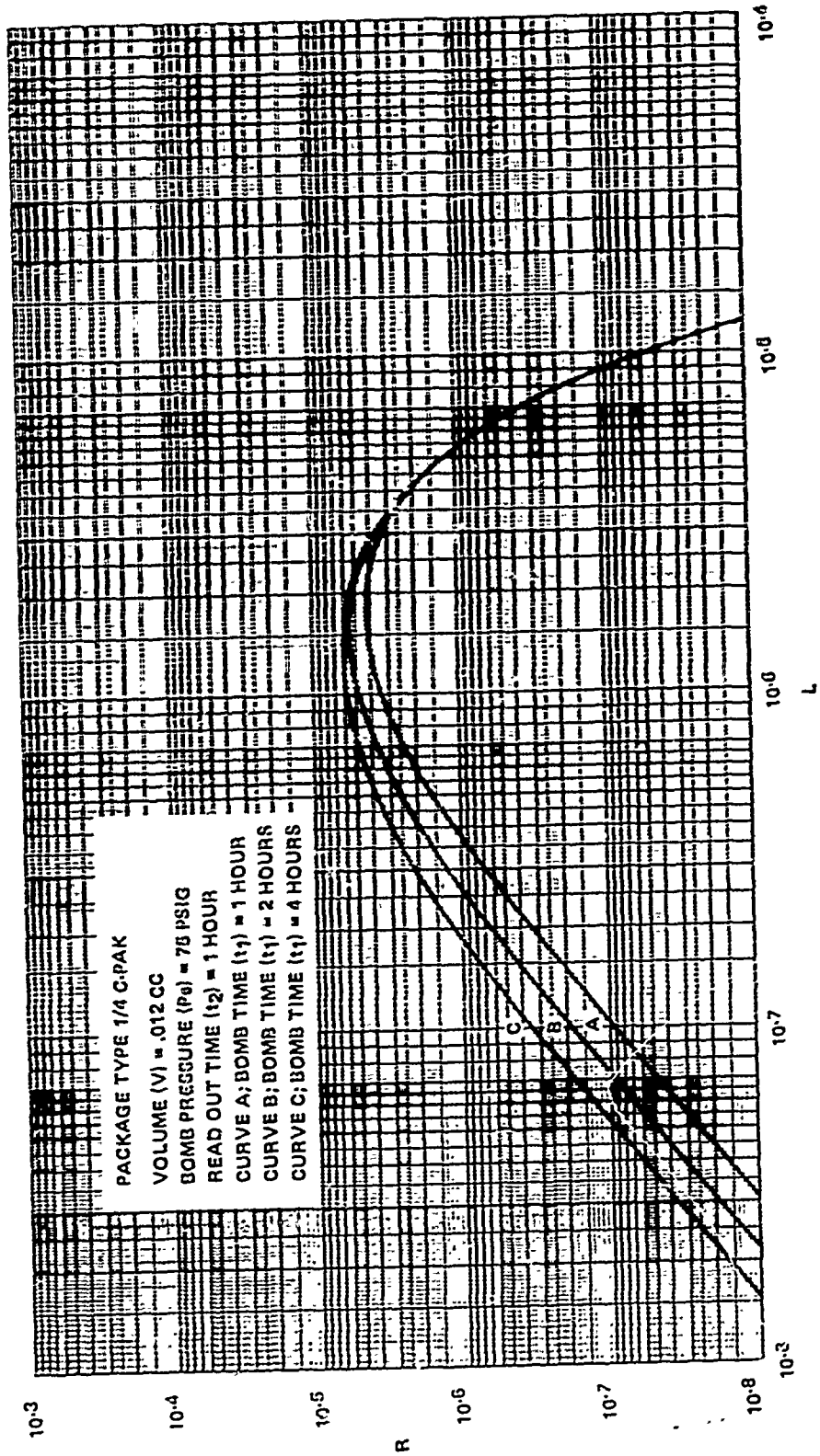


Figure 11. C-PAK Time/Pressure Sequence-Bomb Pressure = 75 psig

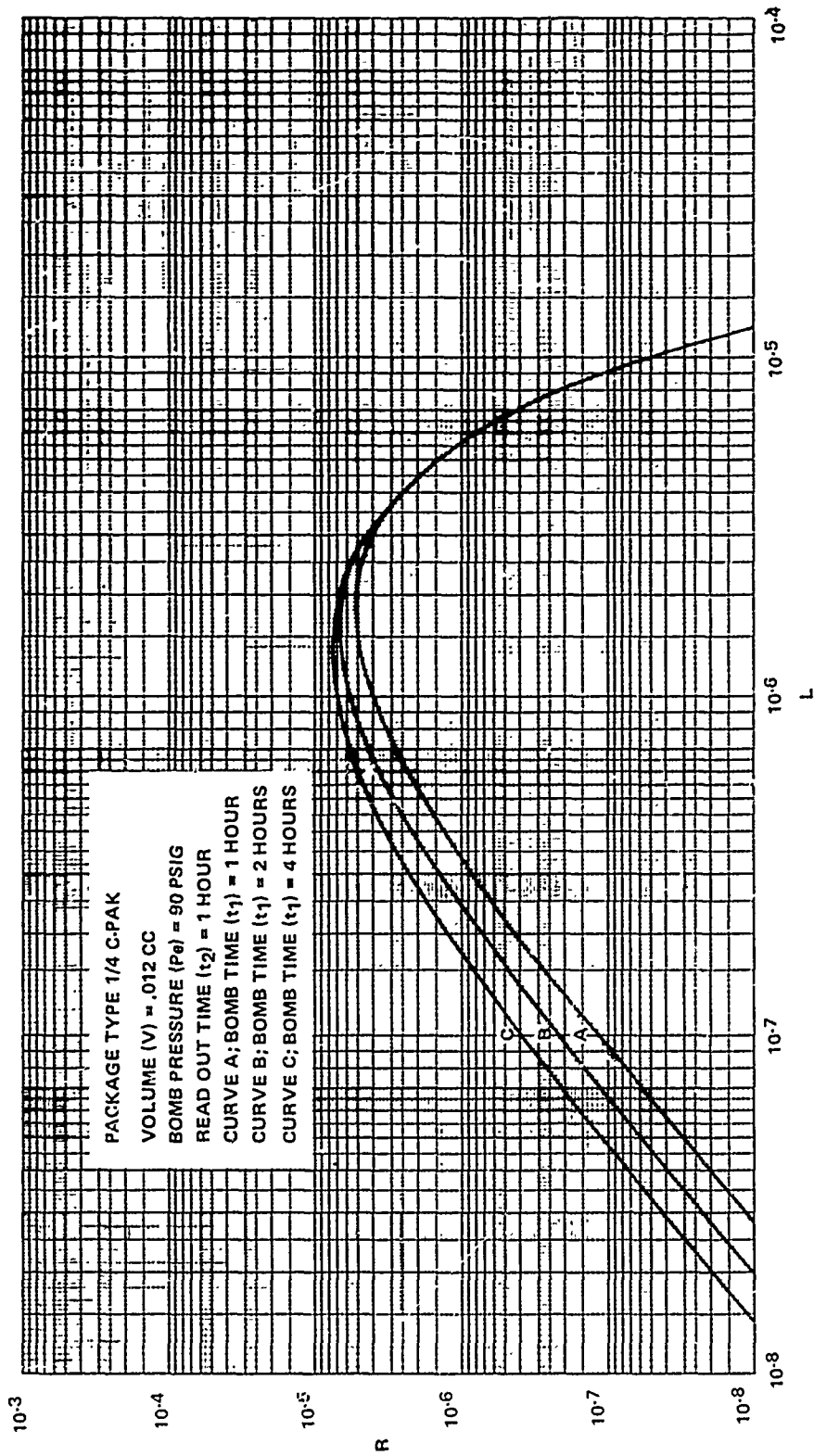


Figure 12. C-PAK Time/Pressure Sequence-Bomb Pressure = 90 psig

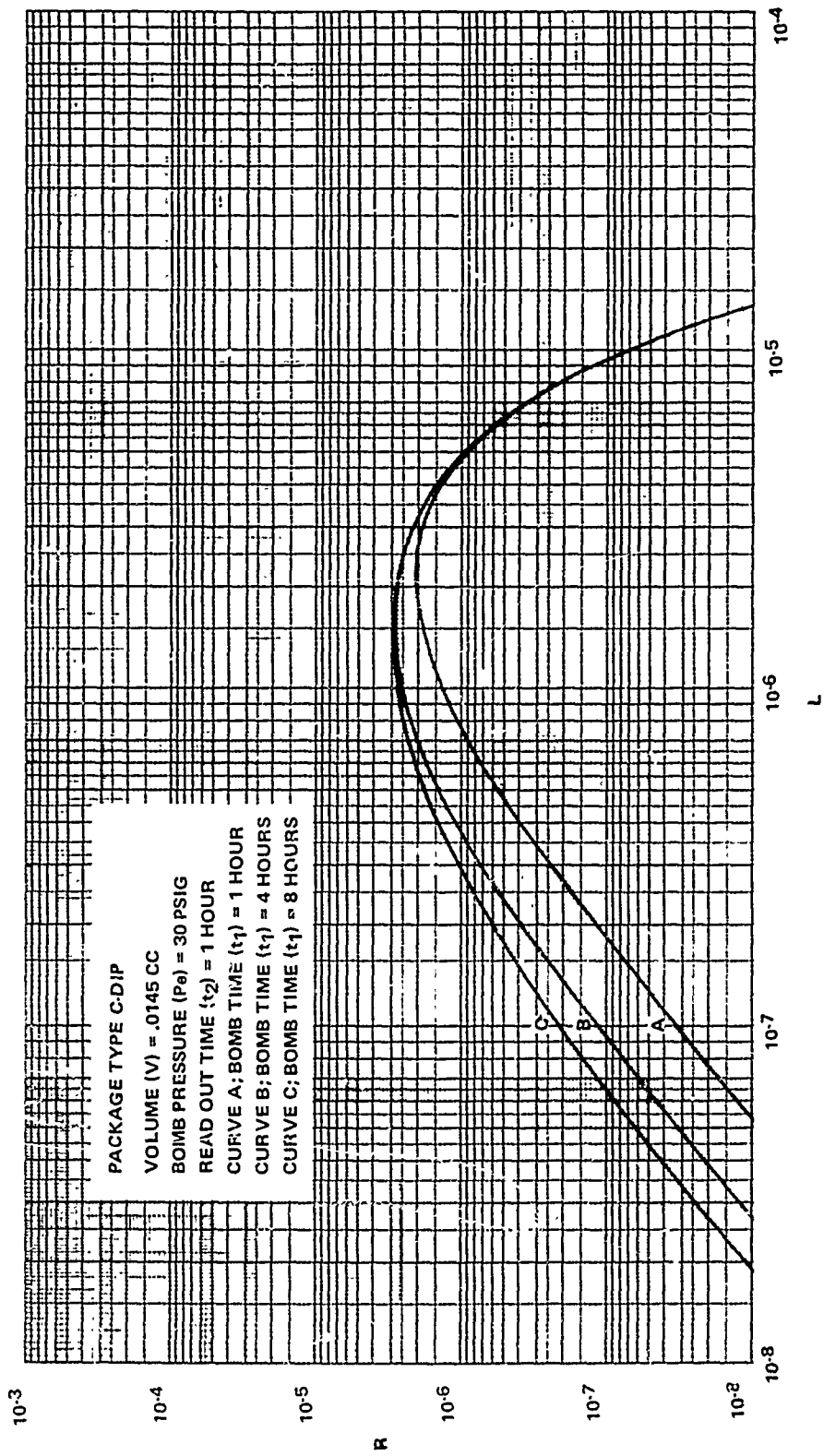


Figure 13. C-CIP Time/Pressure Sequence-Bomb Pressure = 30 psig

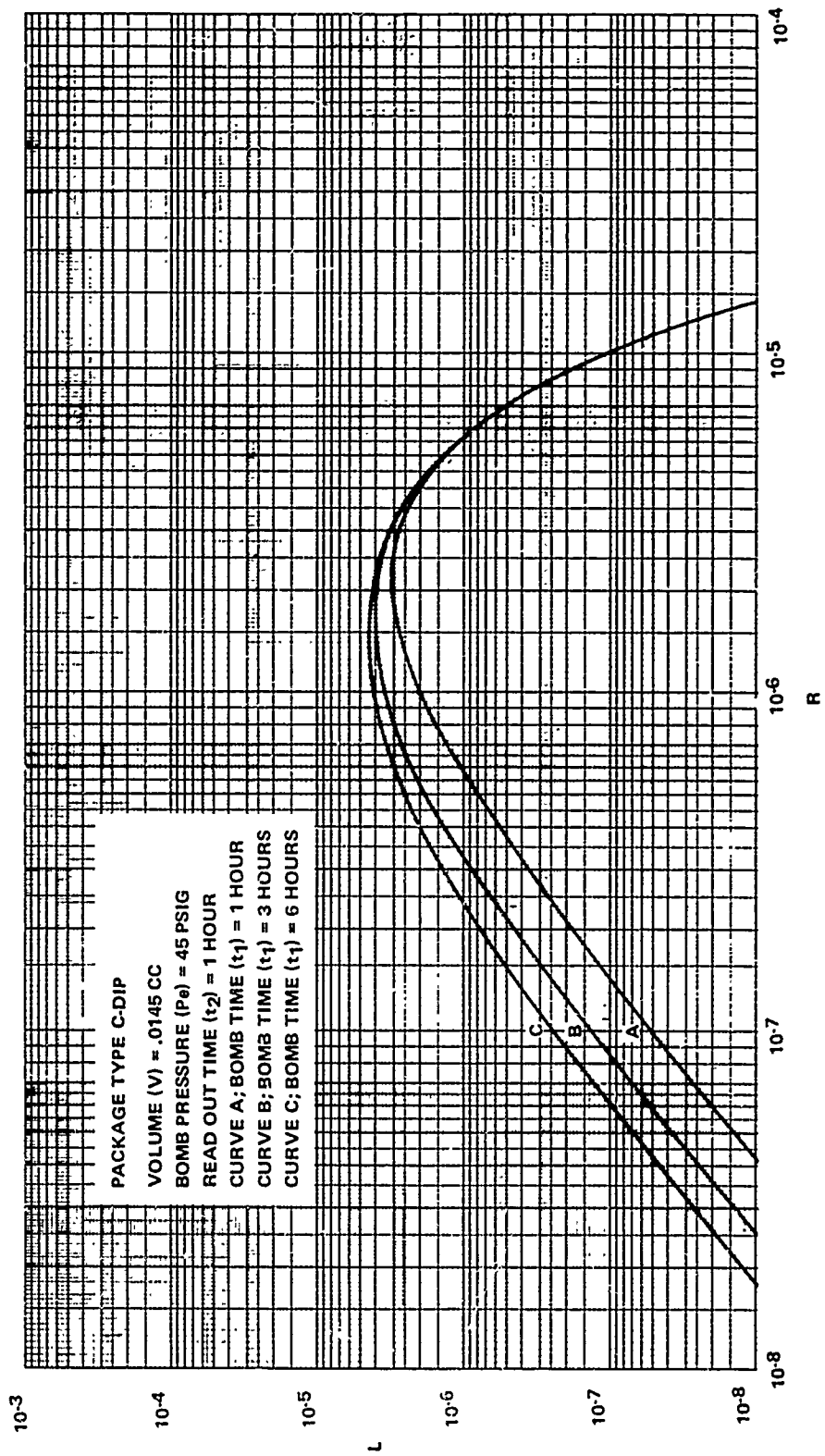


Figure 14. C-DIP Time/Pressure Sequence-Bomb Pressure = 45 psig

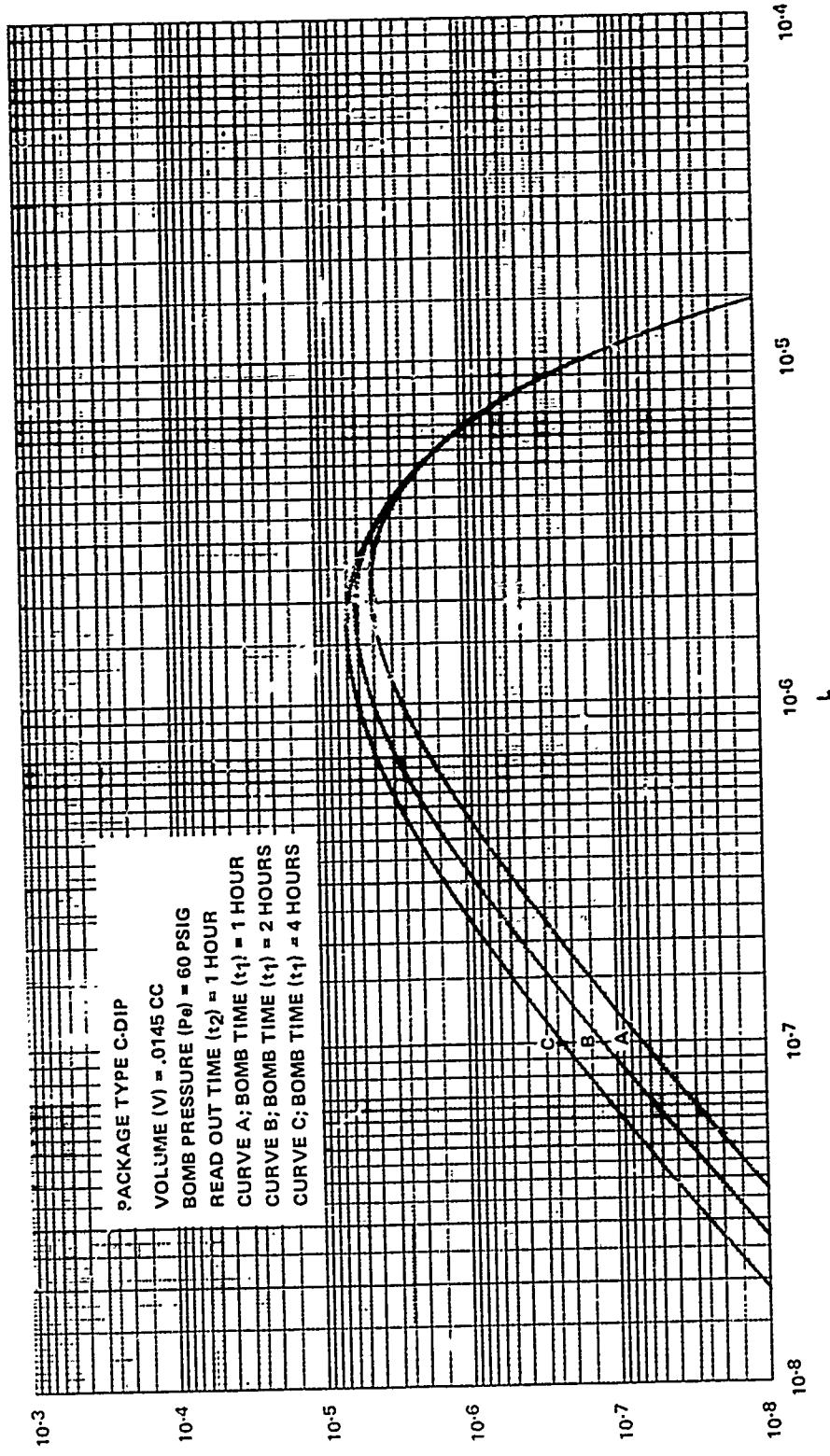


Figure 15. C-DIP Time/Pressure Sequence-Bomb Pressure = 60 psig

R

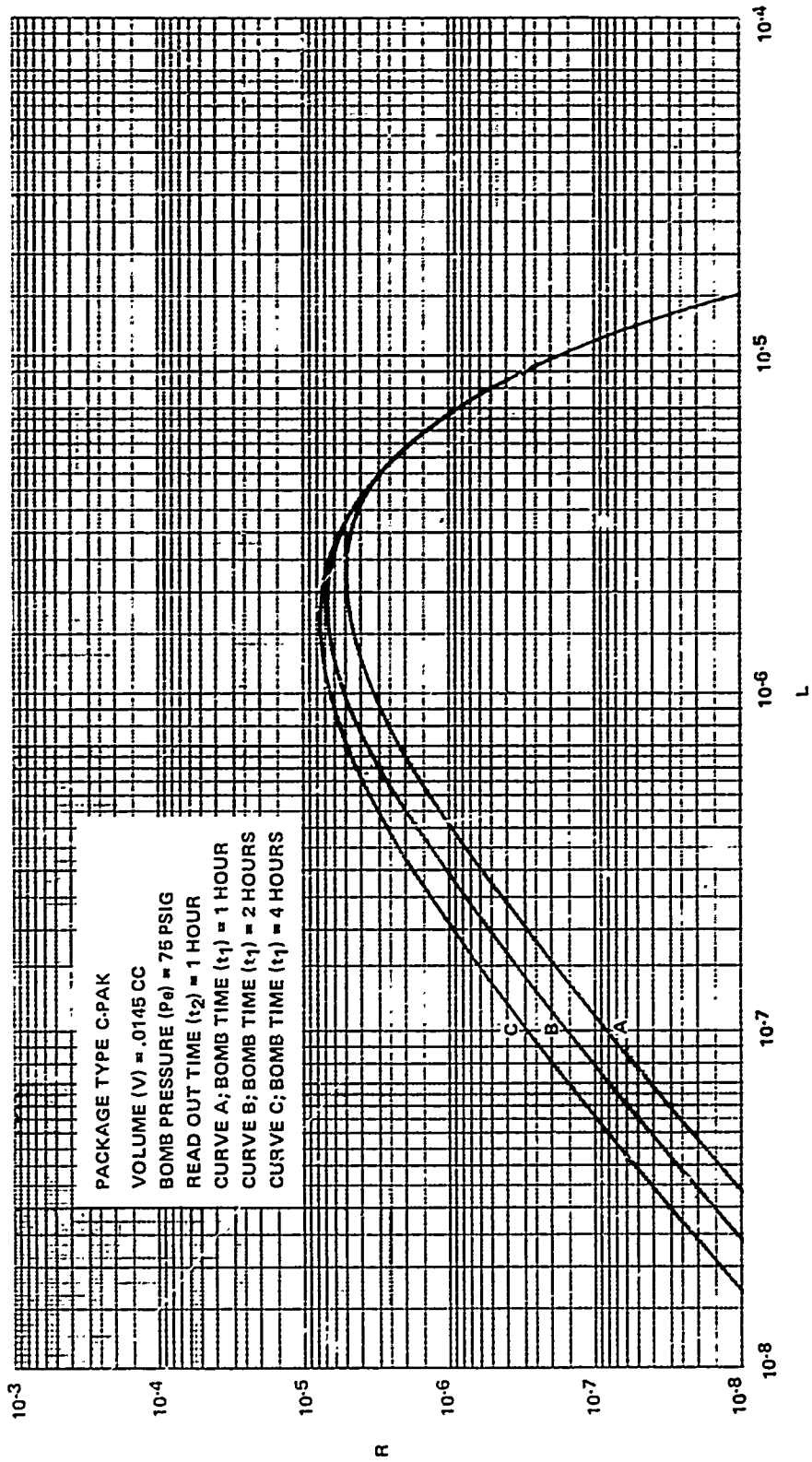


Figure 16. C-DIP Time/Pressure Sequence-Bomb Pressure = 75 psig

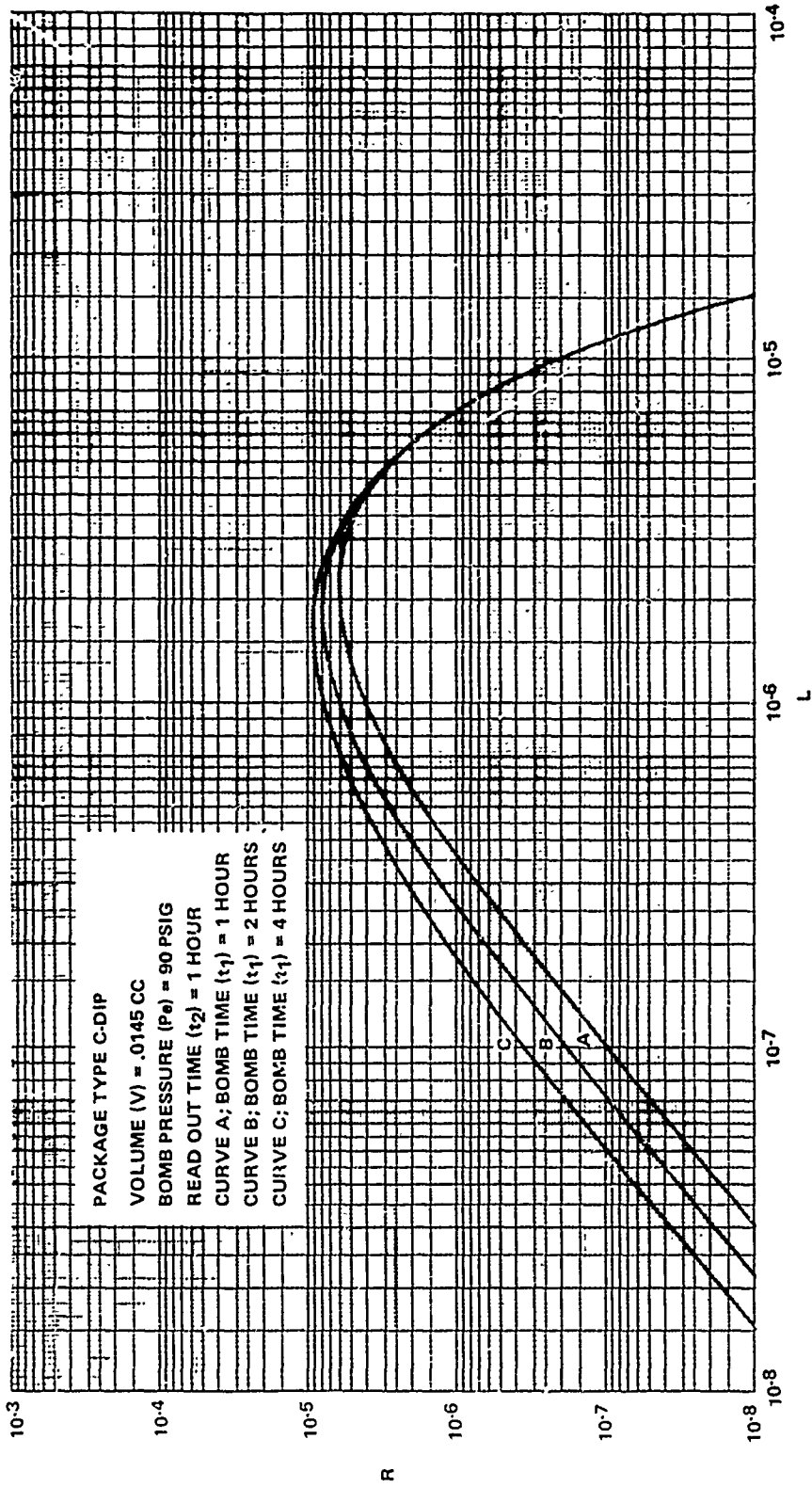


Figure 17. C-DIP Time/Pressure Sequence-Bomb Pressure = 90 psig

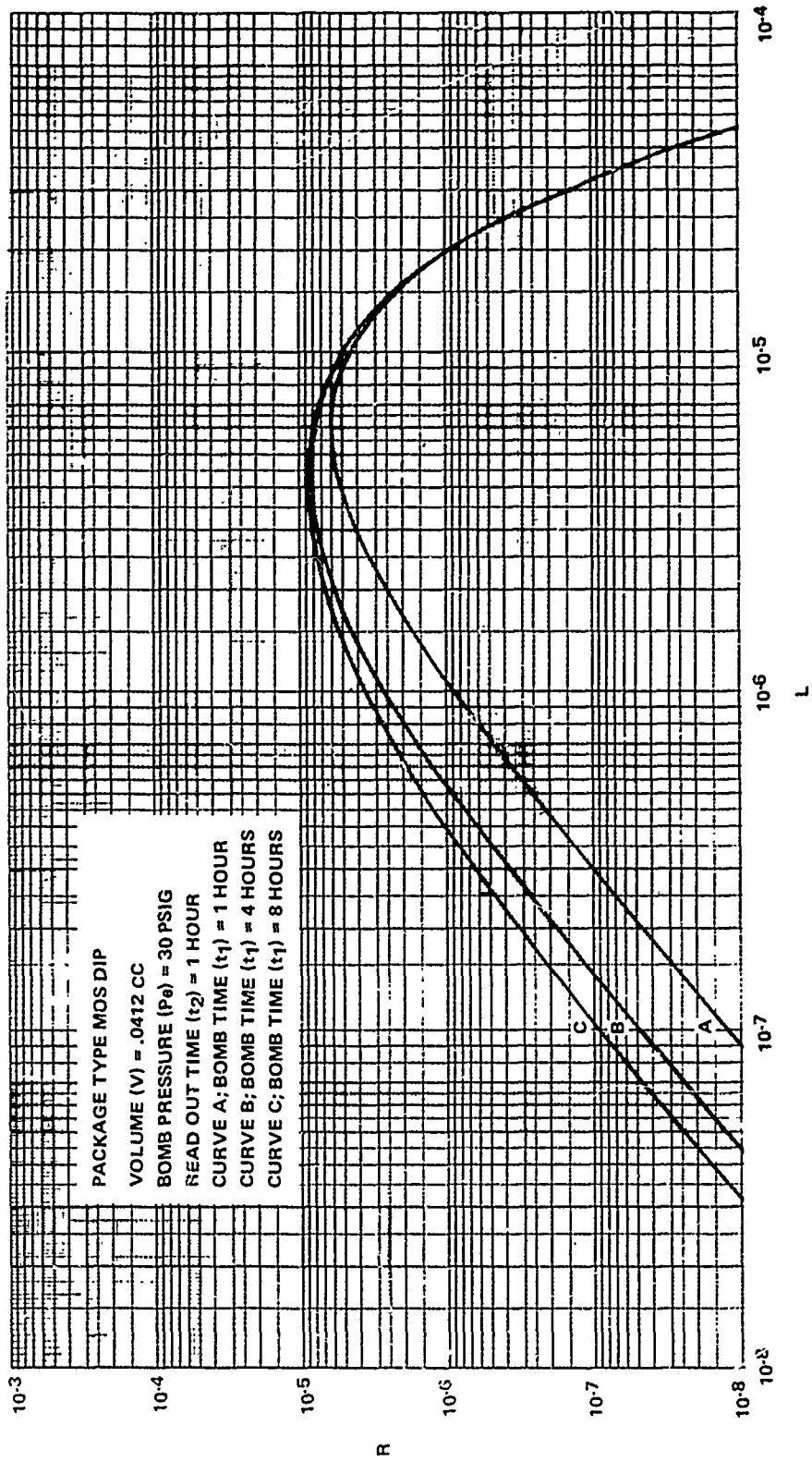


Figure 18. MOS DIP Time/Pressure Sequence-Bomb Pressure = 30 psig

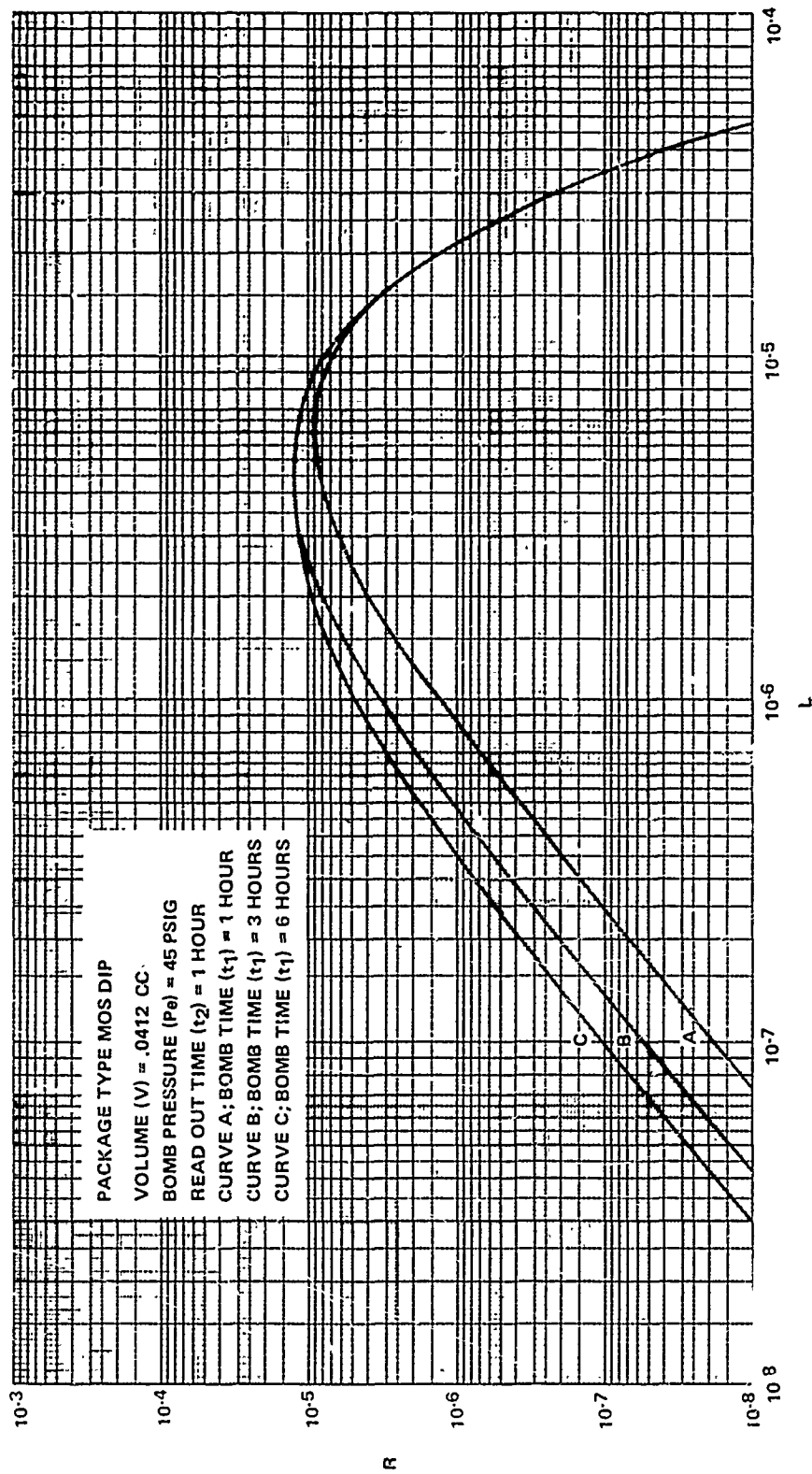


Figure 19. MOS DIP Time/Pressure Sequence-Bomb Pressure = 45 psig

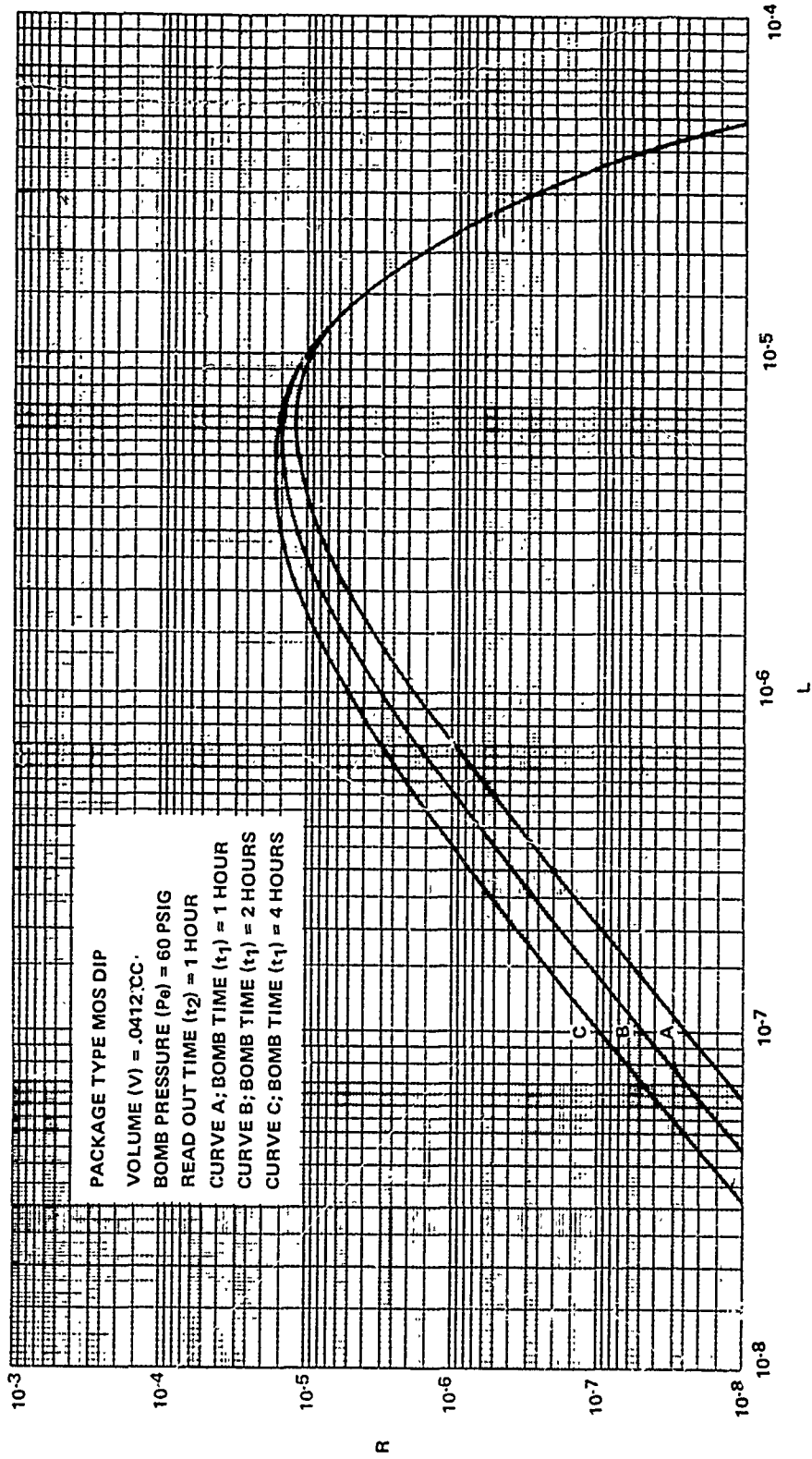


Figure 20. MOS DIP Time/Pressure Sequence-Bomb Pressure = 60 psig

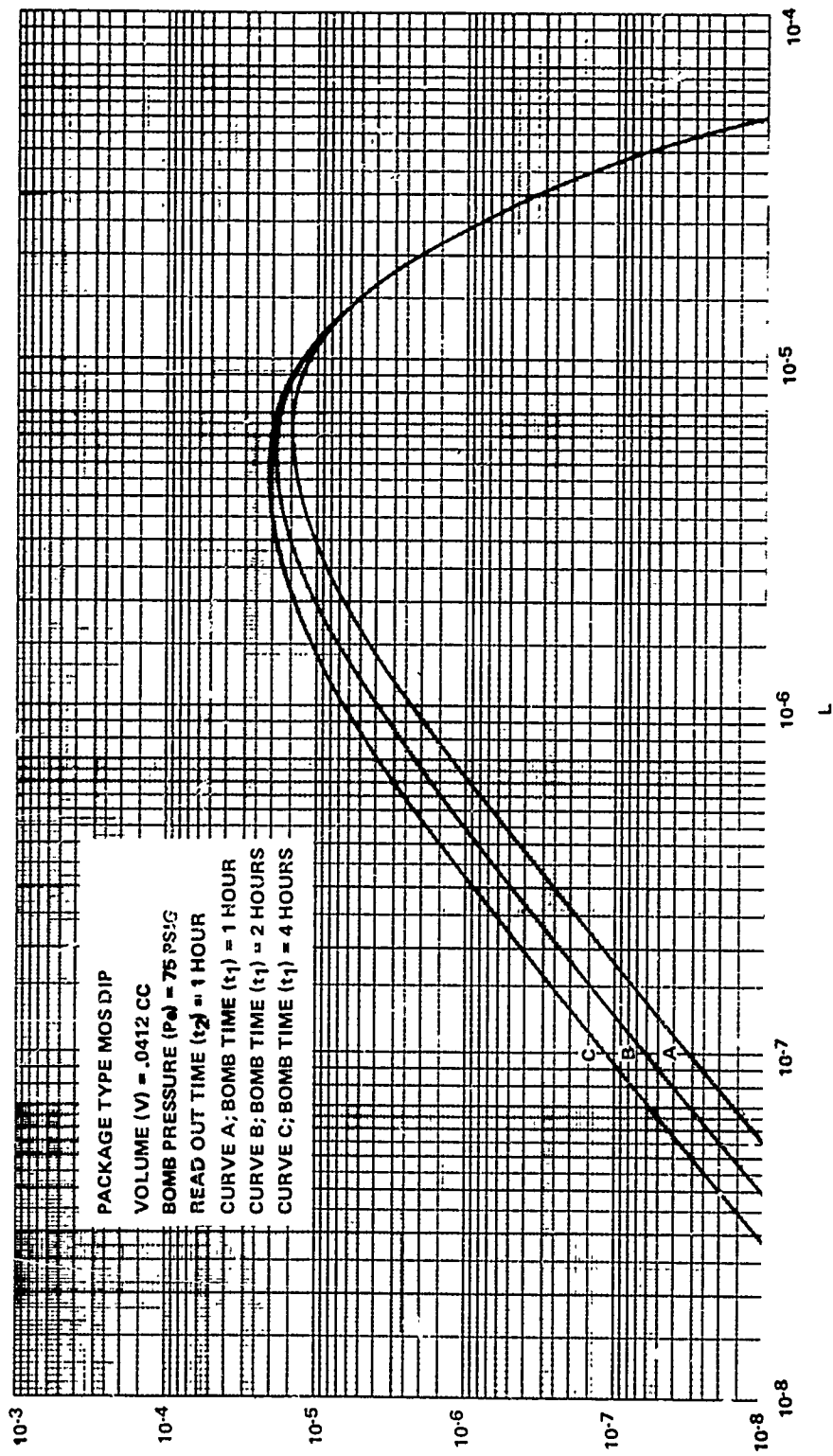


Figure 21. MOS DIP Time/Pressure Sequence-Bomb Pressure = 75 psig

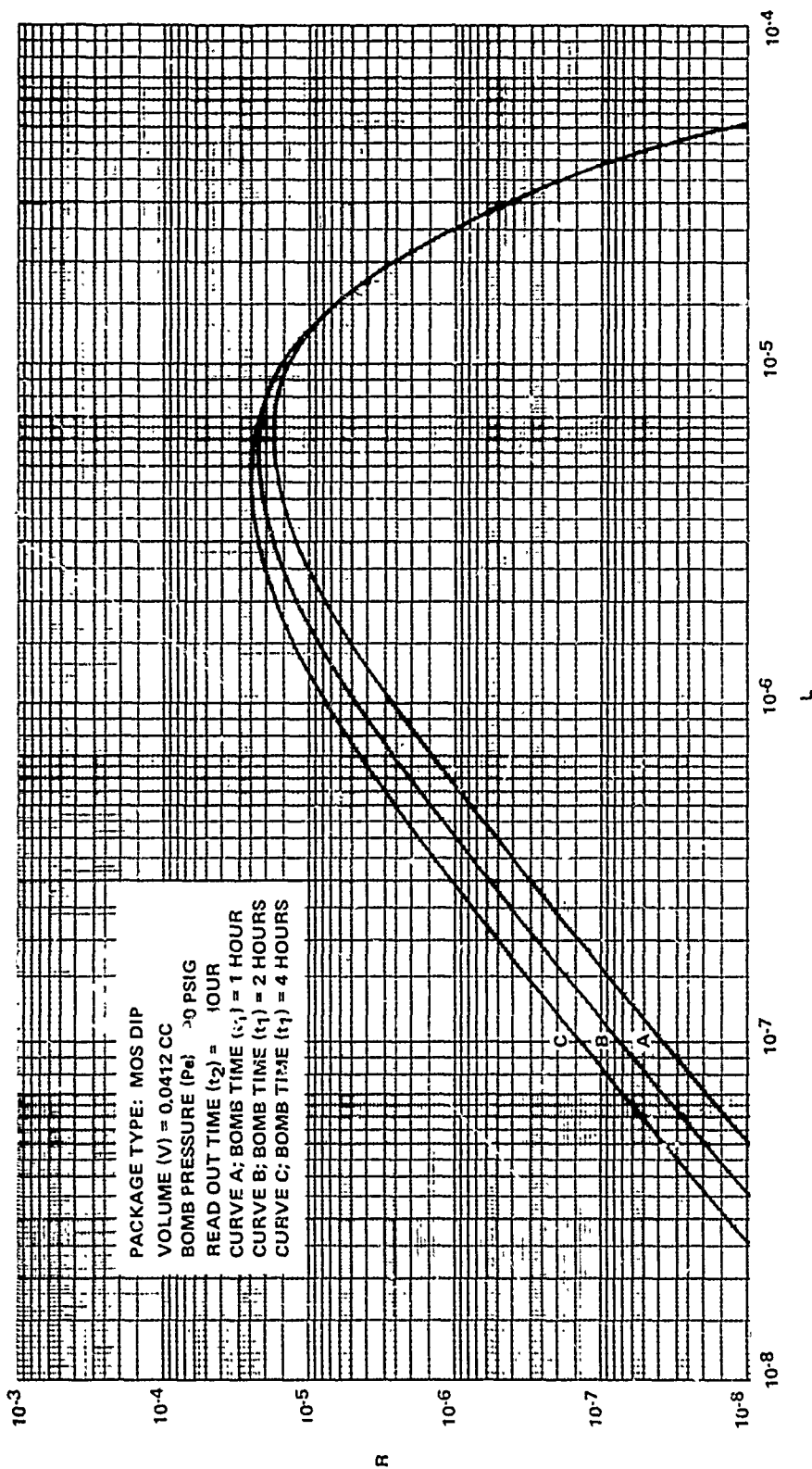


Figure 22. MOS DIP Time/Pressure Sequence-Bomb Pressure = 90 psig

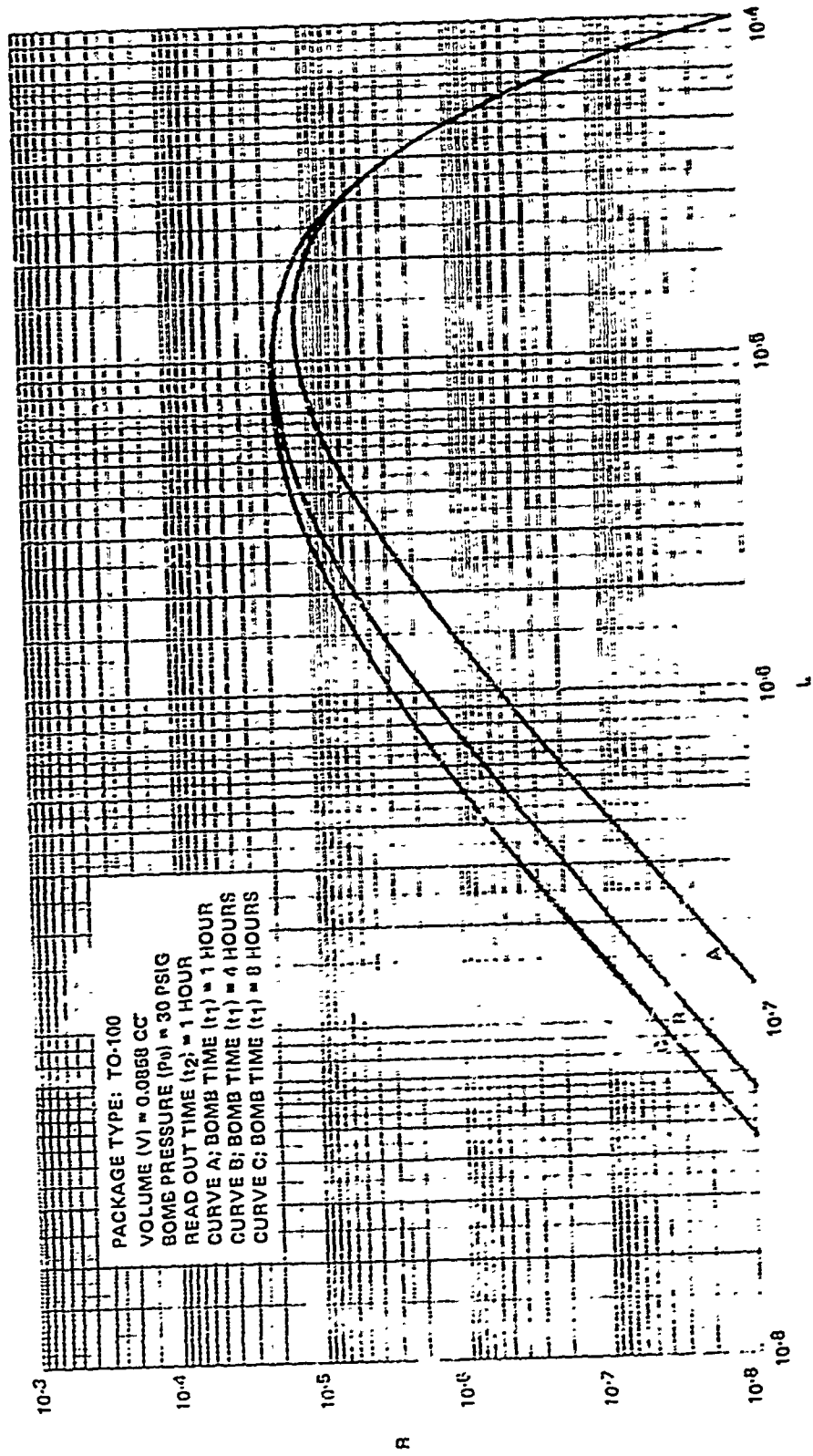


Figure 23. TO-100 Time/Pressure Sequence-Bomb Pressure = 30 psig

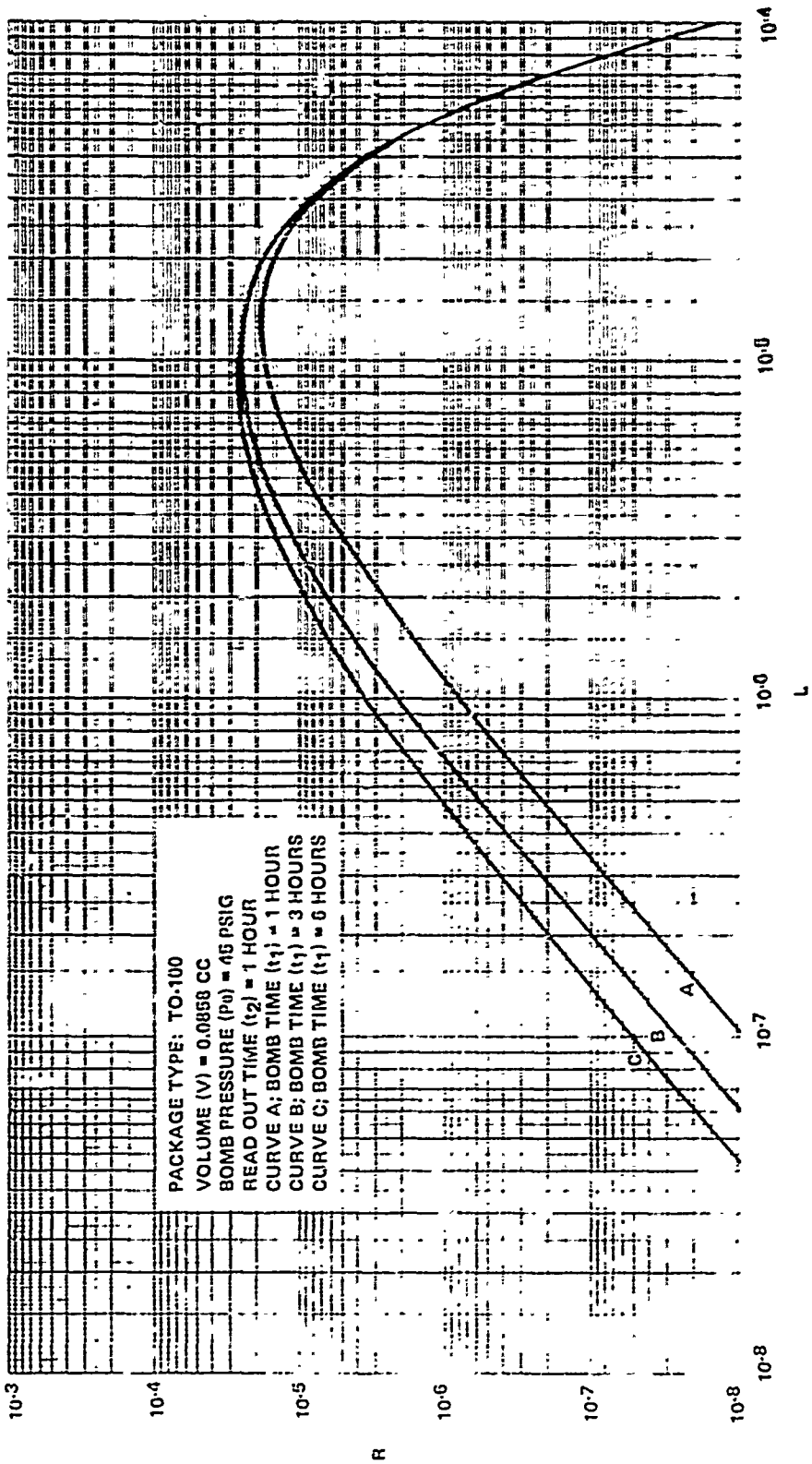


Figure 24. TO-100 Time/Pressure Sequence-Bomb Pressure = 45 psig

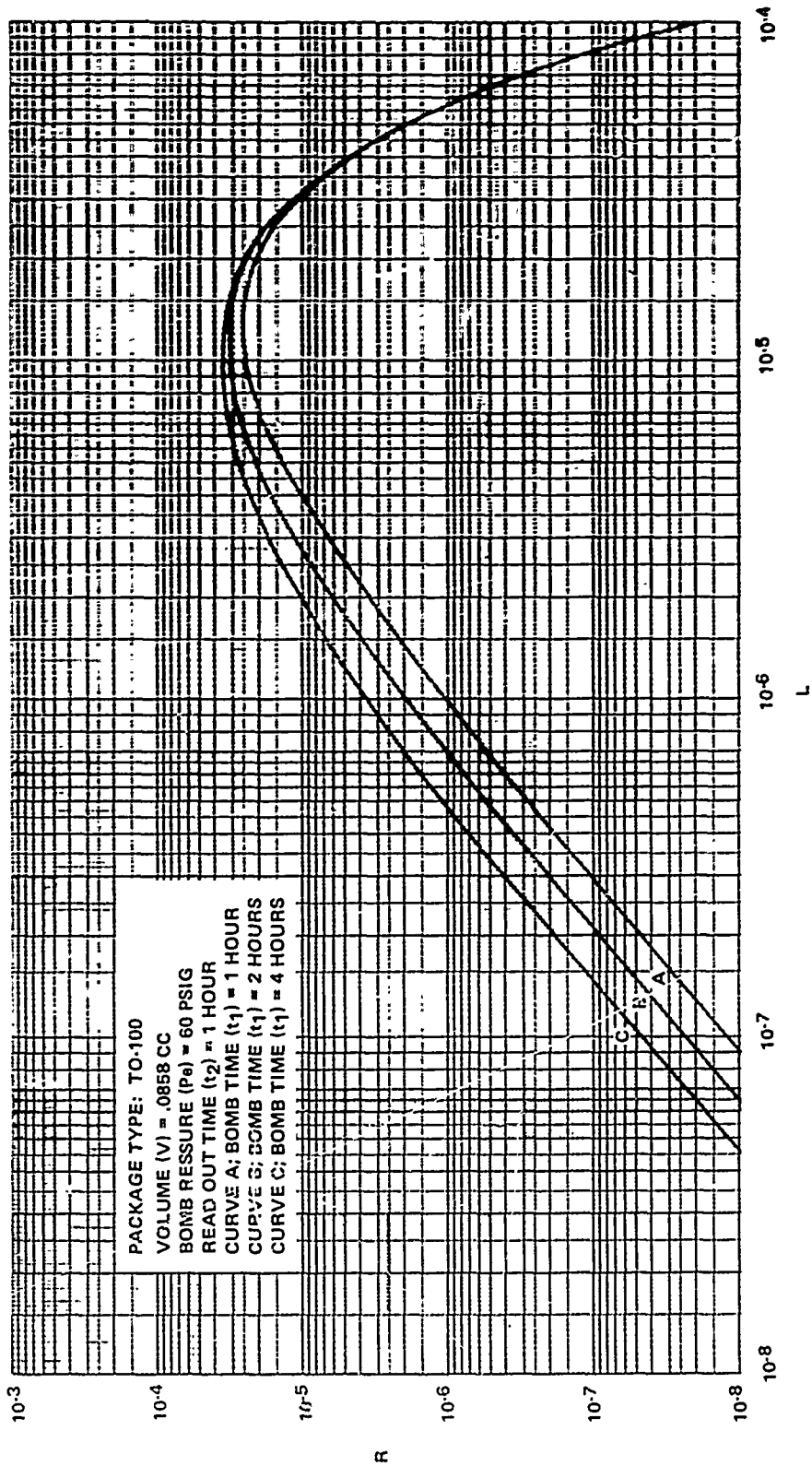


Figure 25. TO-100 Time/Pressure Sequence-Bomb Pressure = 60 psig

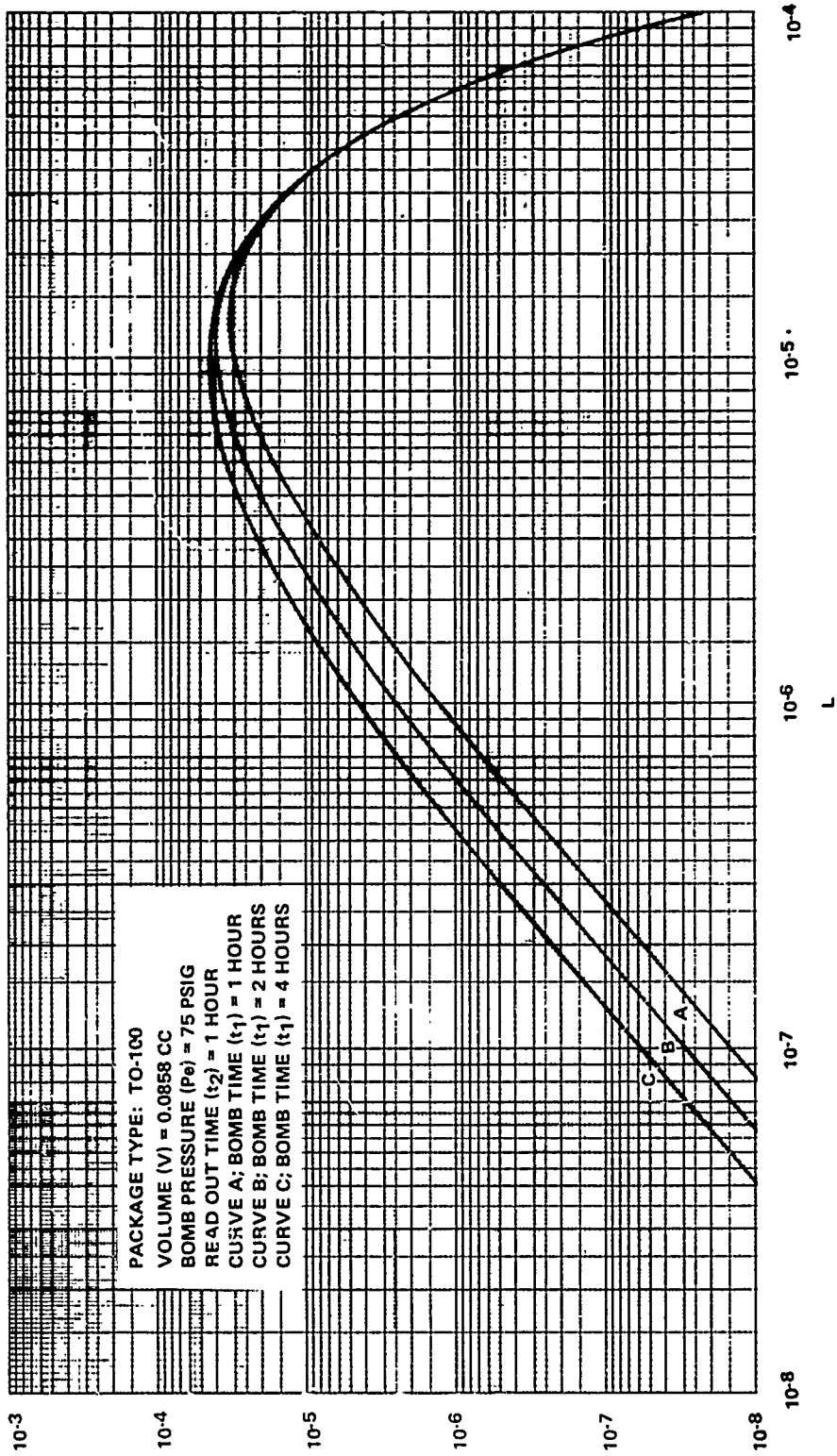


Figure 26. TO-100 Time/Pressure Sequence-Bomb Pressure = 75 psig

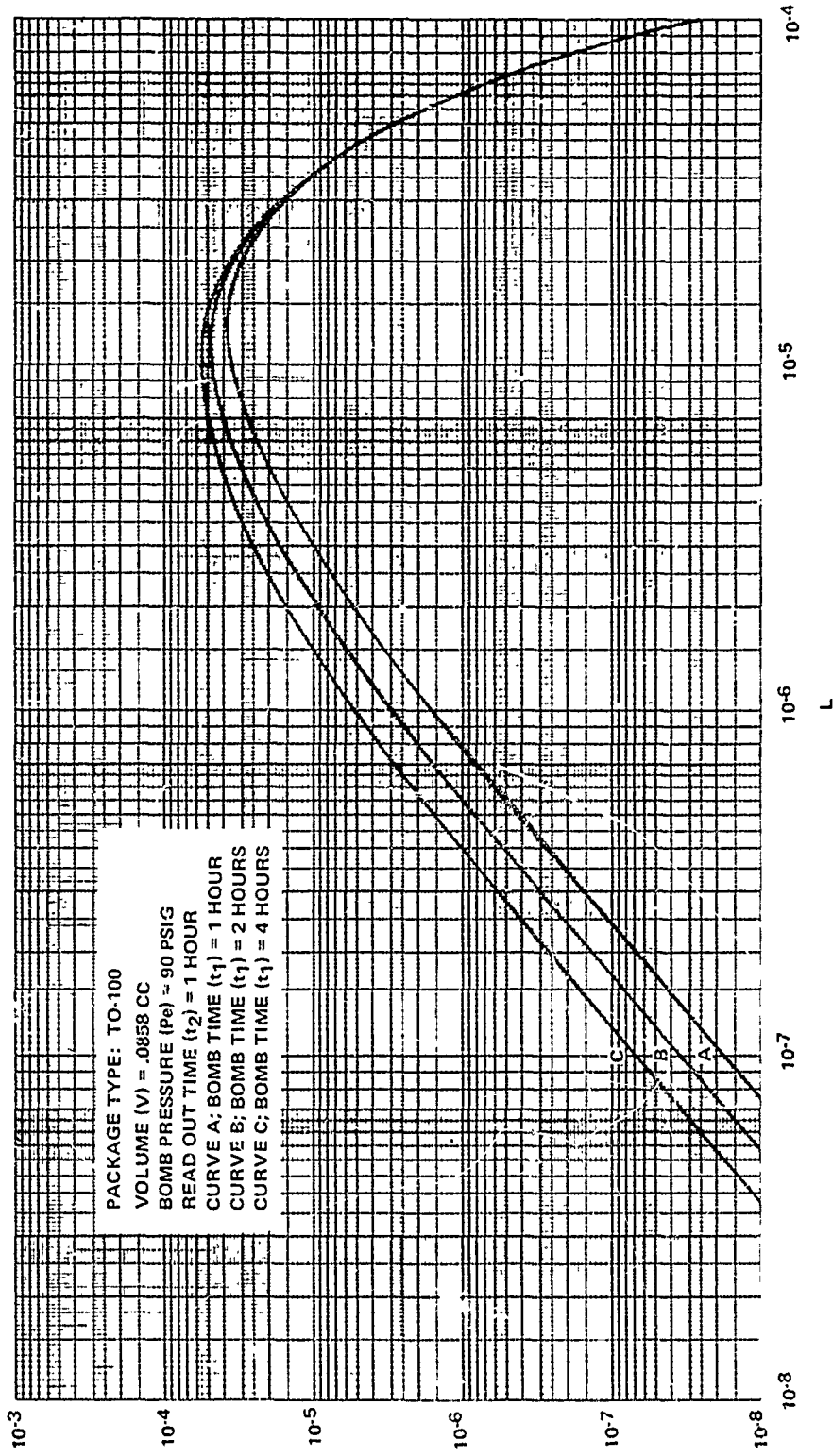


Figure 27. TO-100 Time/Pressure Sequence-Bomb Pressure = 90 psig

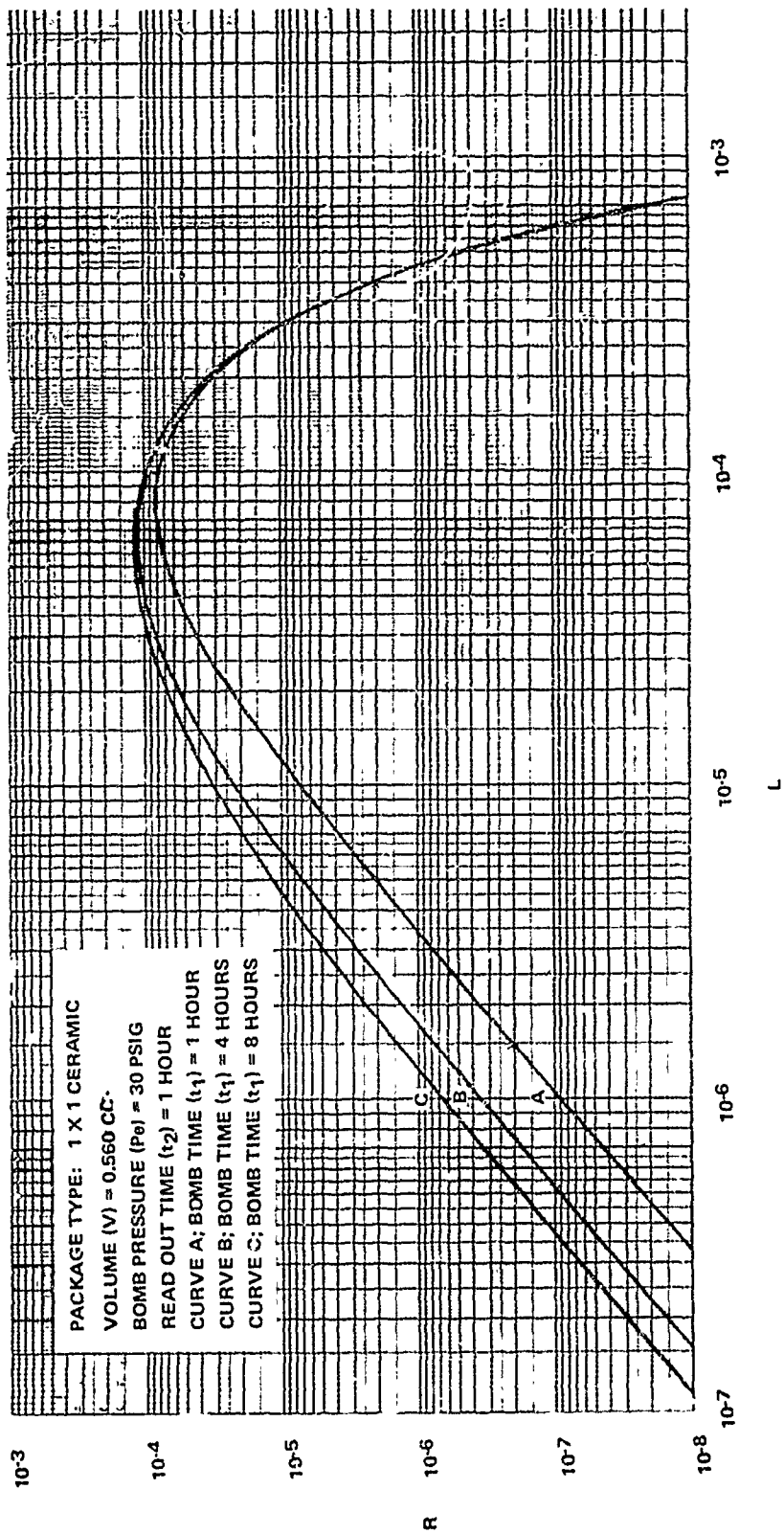


Figure 28. 1 X 1 Ceramic Time/Pressure Sequence-Bomb Pressure = 30 psig

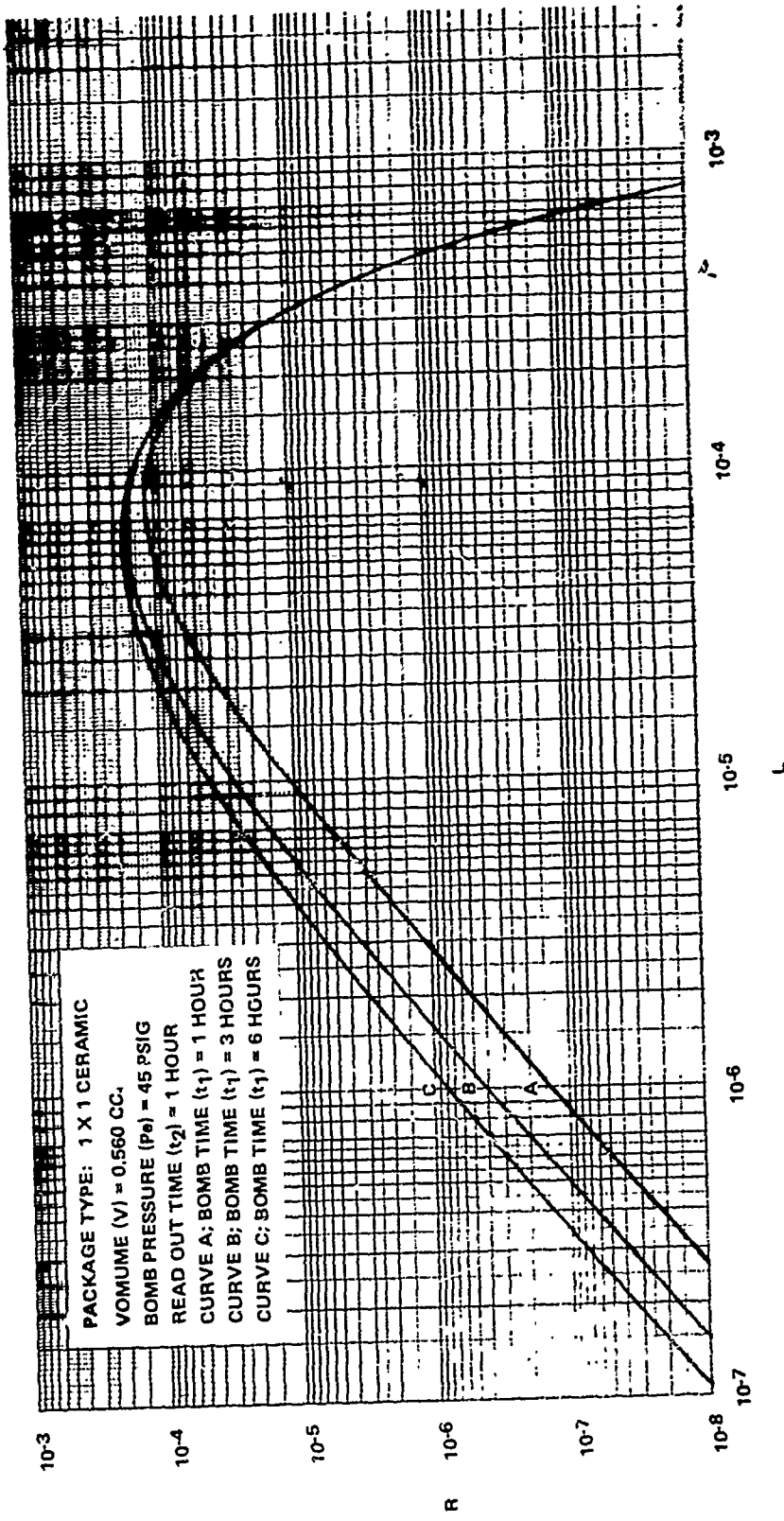


Figure 29. 1 X 1 Ceramic Time/Pressure Sequence-Bomb Pressure = 45 psig

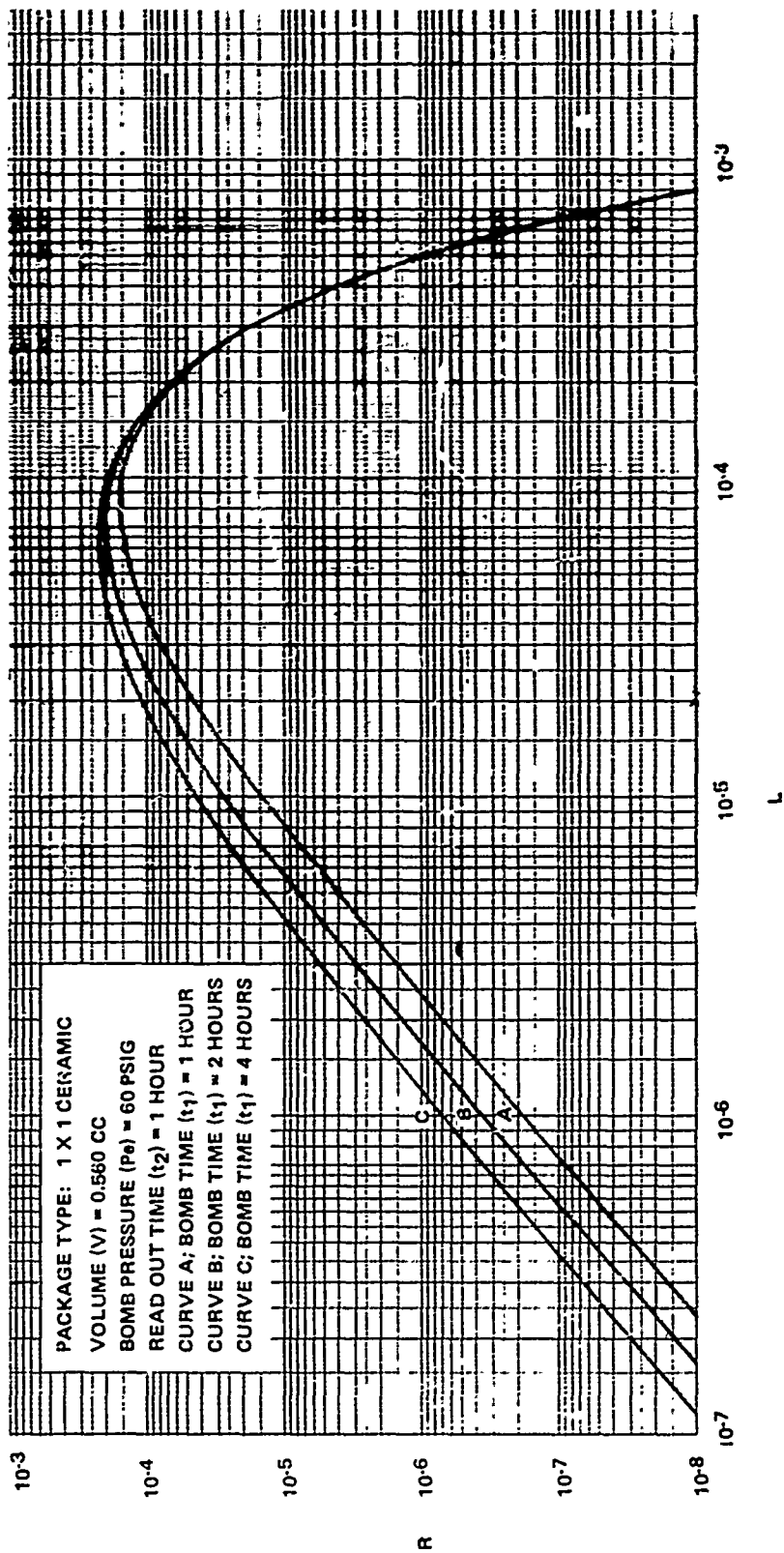


Figure 30. 1 X 1 Ceramic Time/Pressure Sequence-Bomb Pressure = 60 psig

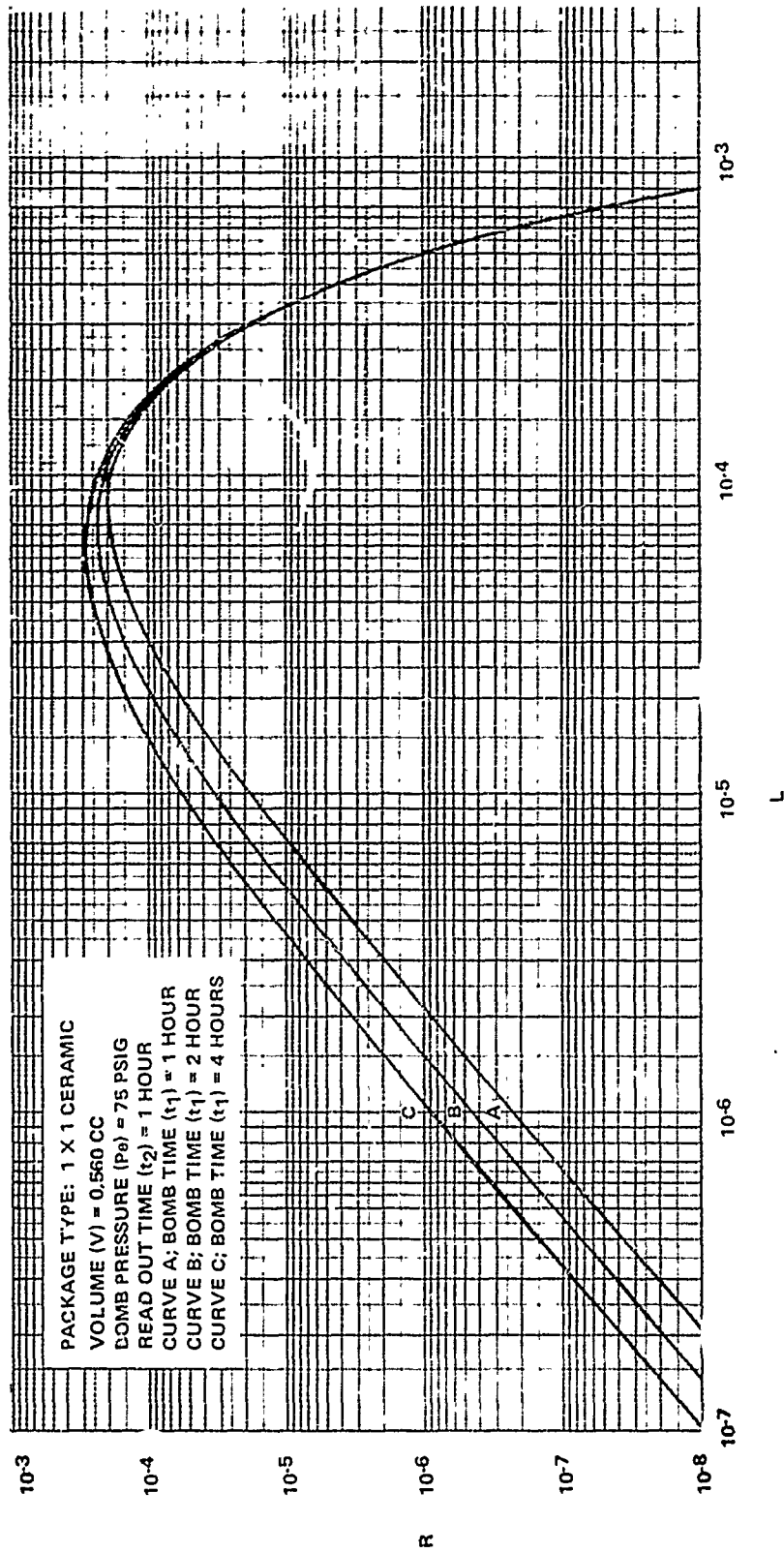


Figure 31. 1 X 1 Ceramic Time/Pressure Sequence-Bomb Pressure = 75 psig

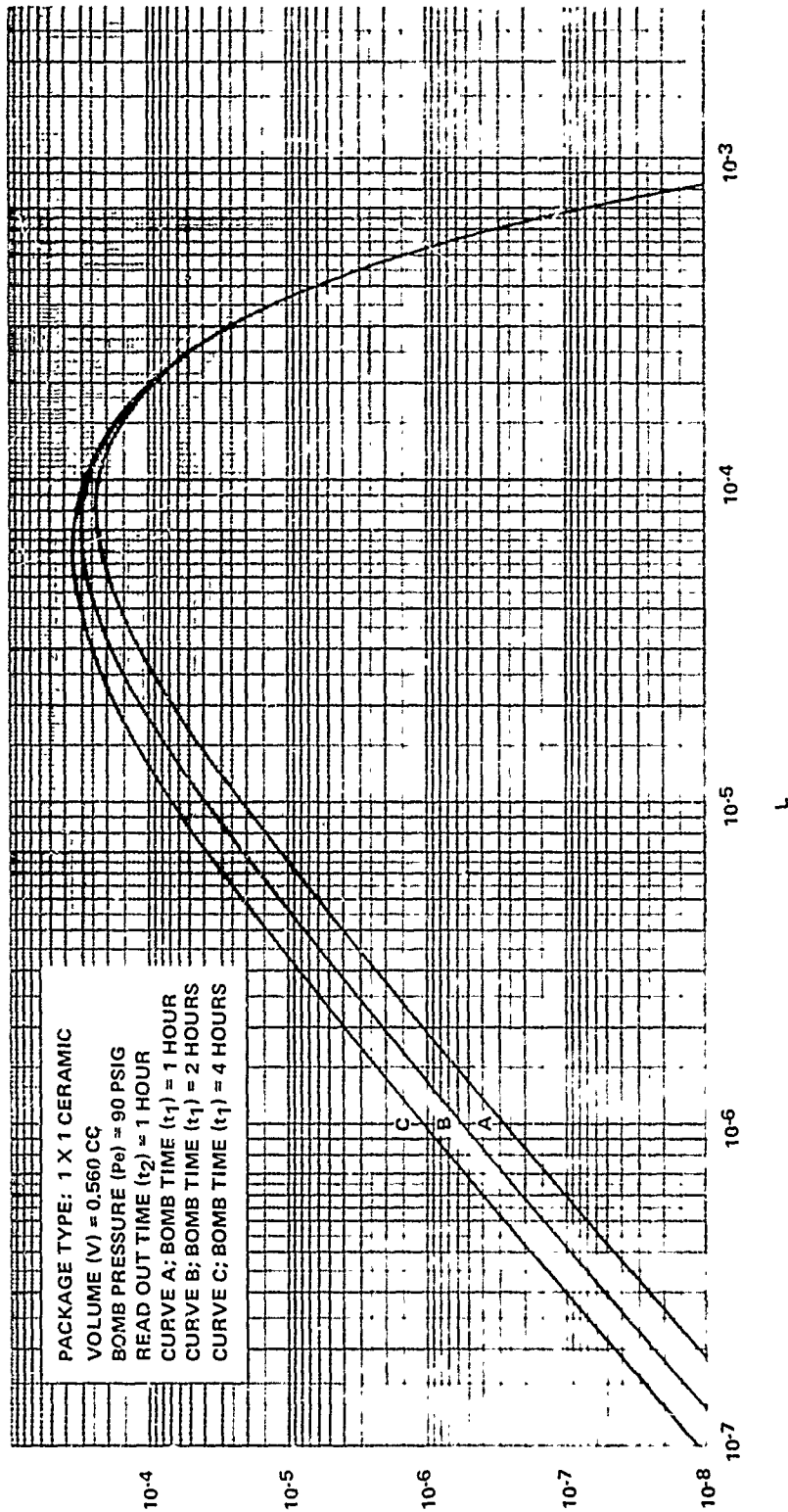


Figure 32. 1 X 1 Ceramic Time/Pressure Sequence-Bomb Pressure = 90 psig

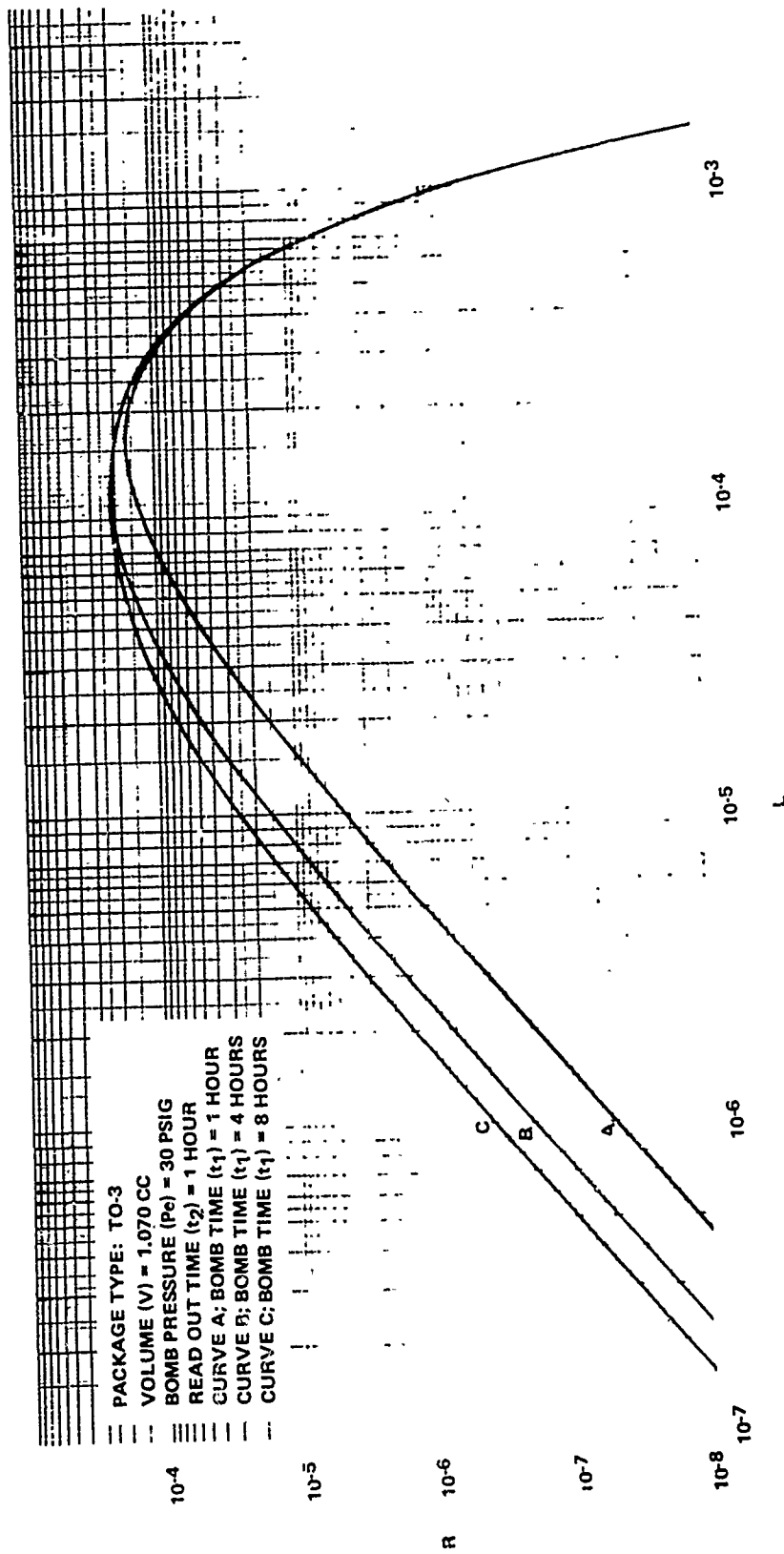


Figure 33. TO-3 Time/Pressure Sequence-Bomb Pressure = 30 psig

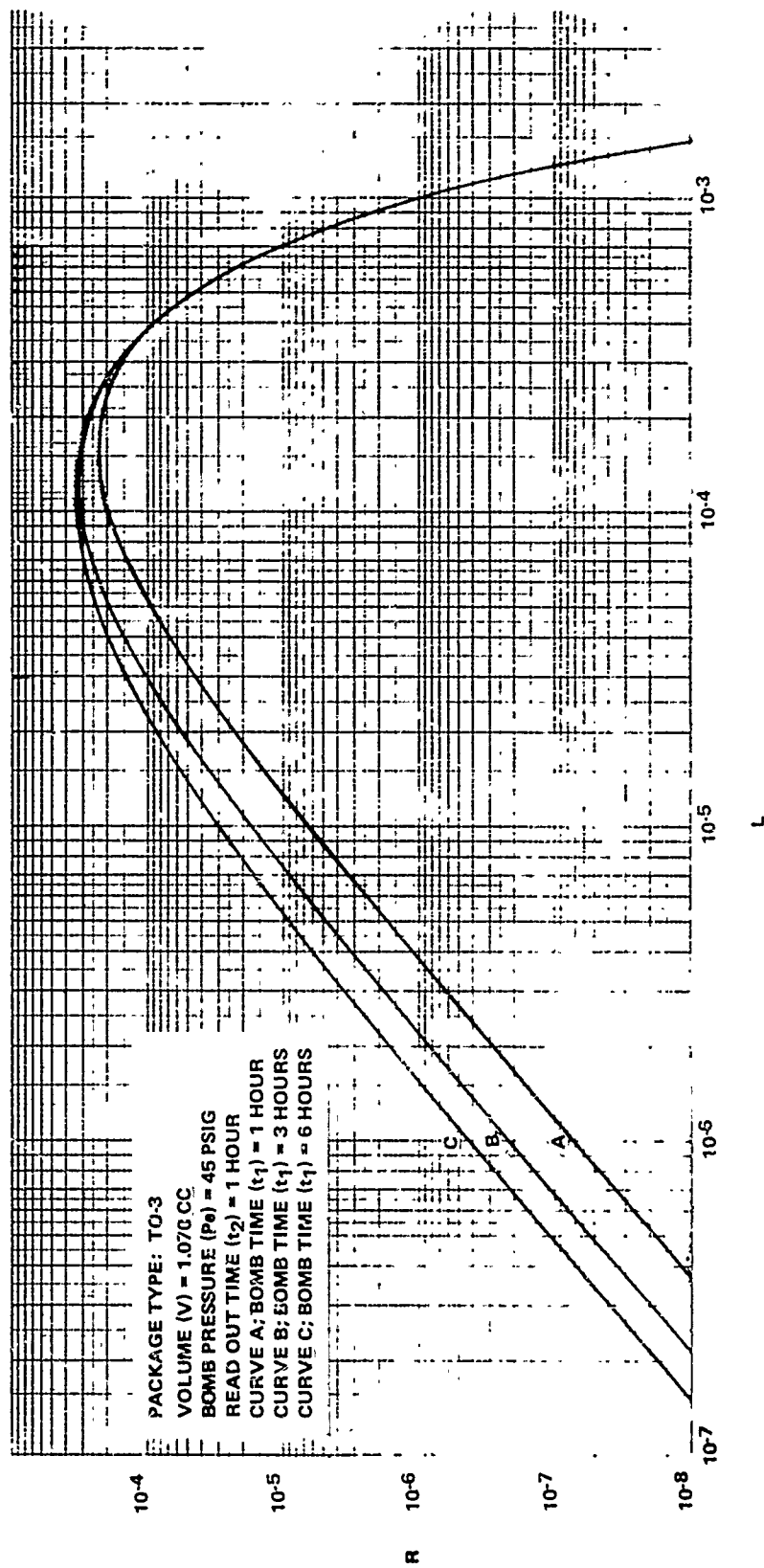


Figure 34. TO-3 Time/Pressure Sequence-Bomb Pressure = 45 psig

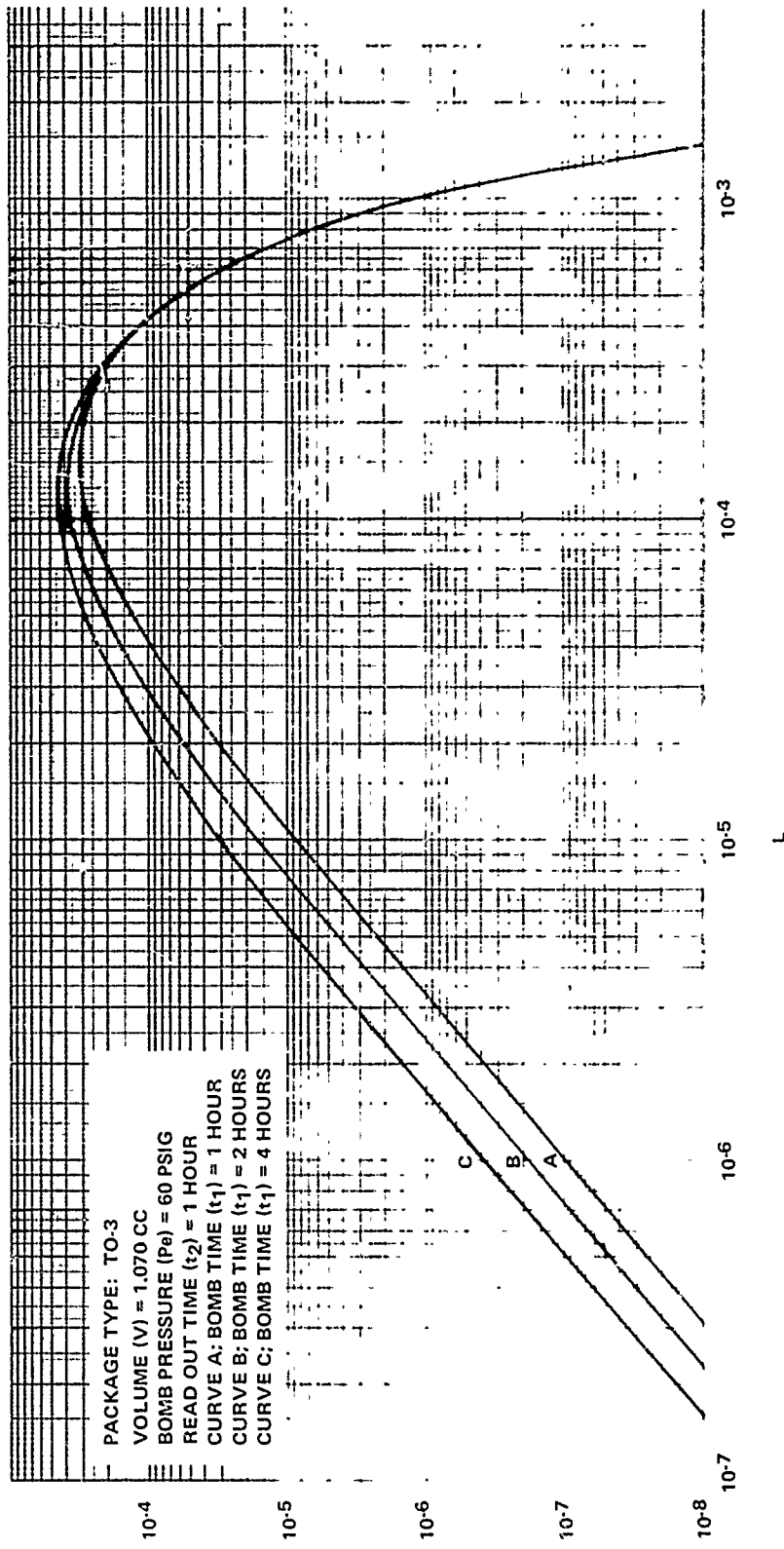


Figure 35. TO-3 Time/Pressure Sequence-Bomb Pressure = 60 psig

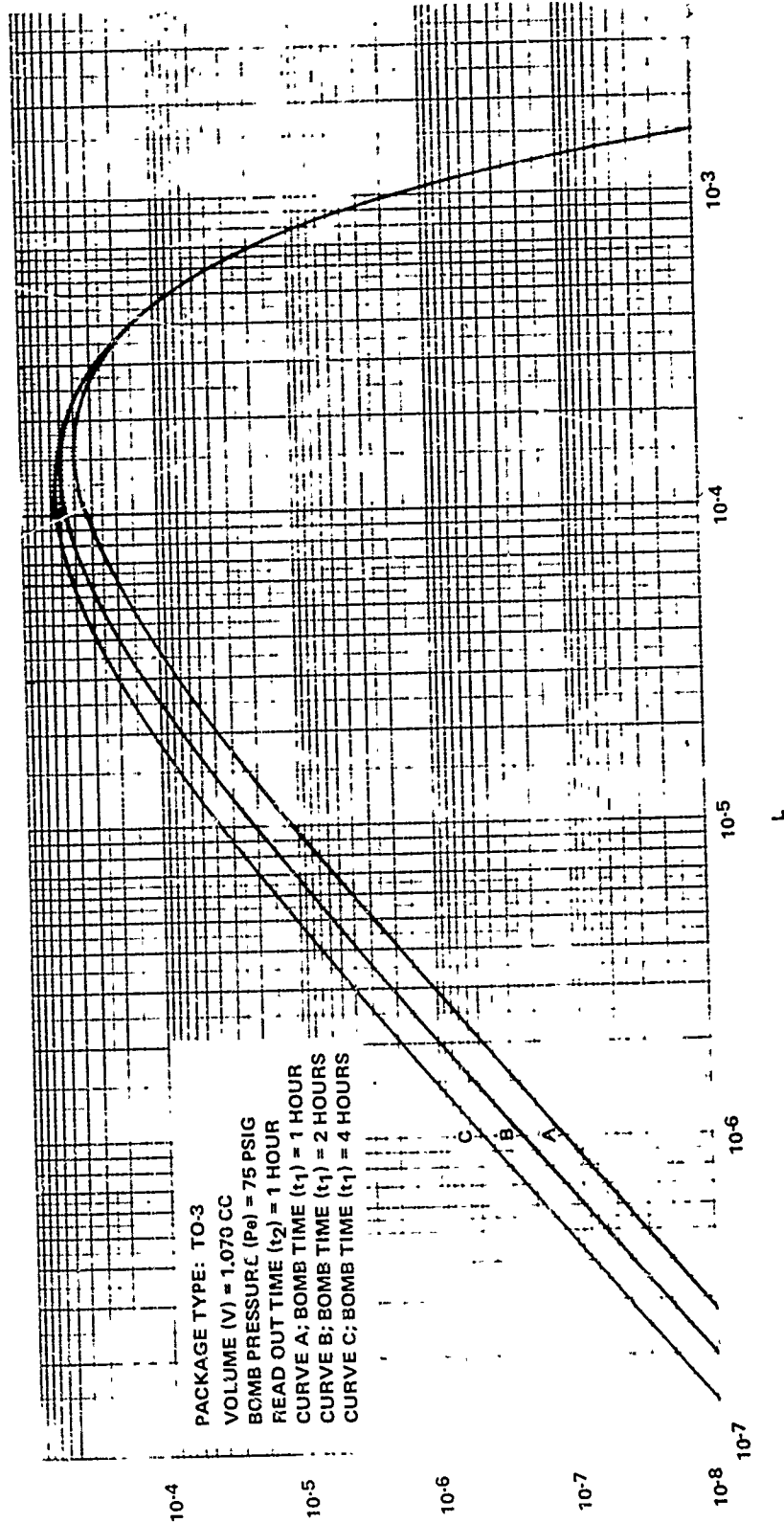


Figure 36. TO-3 Time/Pressure Sequence-Bomb Pressure = 75 psig

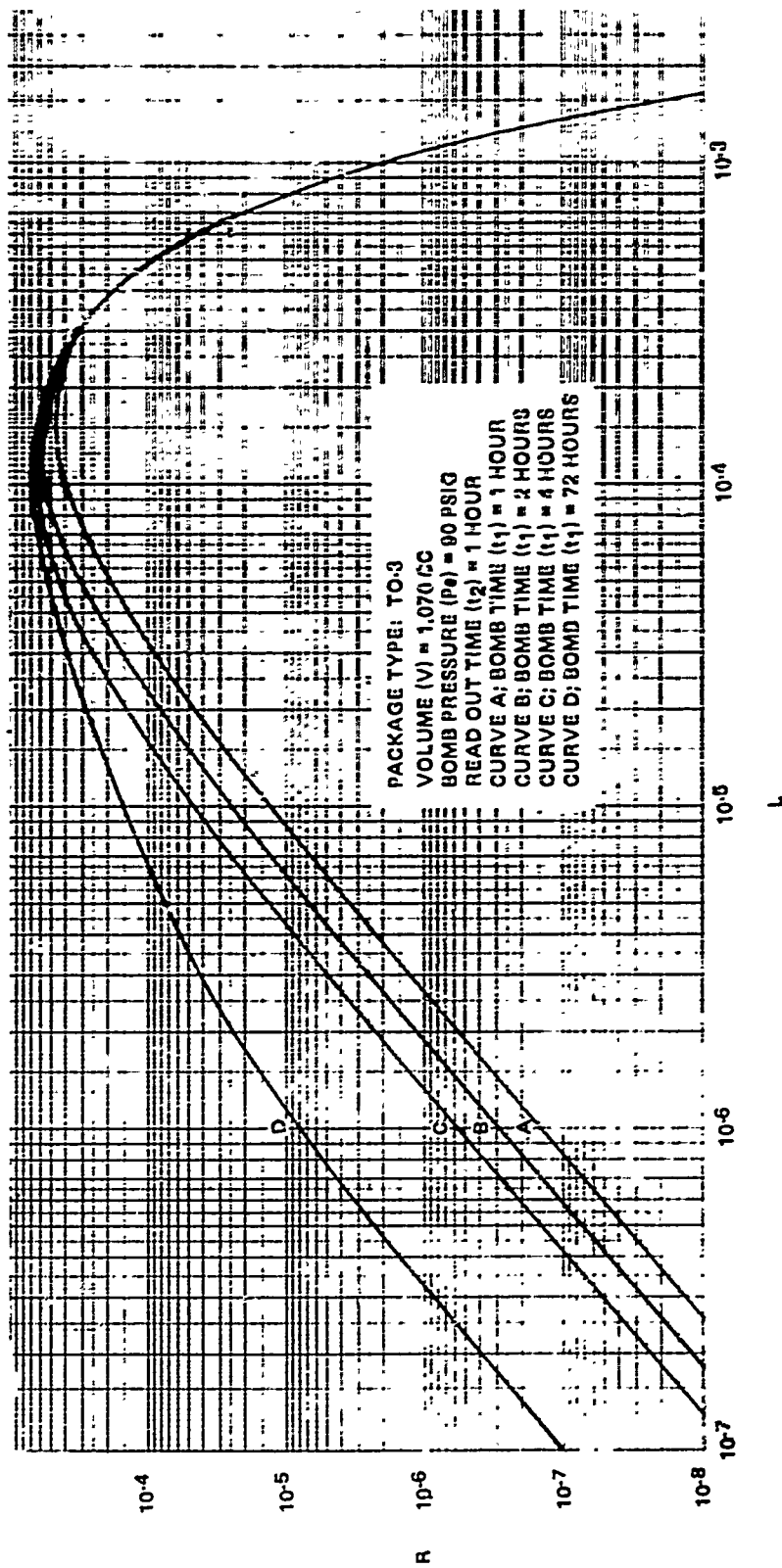


Figure 37. TO-3 Time/Pressure Sequence-Bomb Pressure = 90 psig

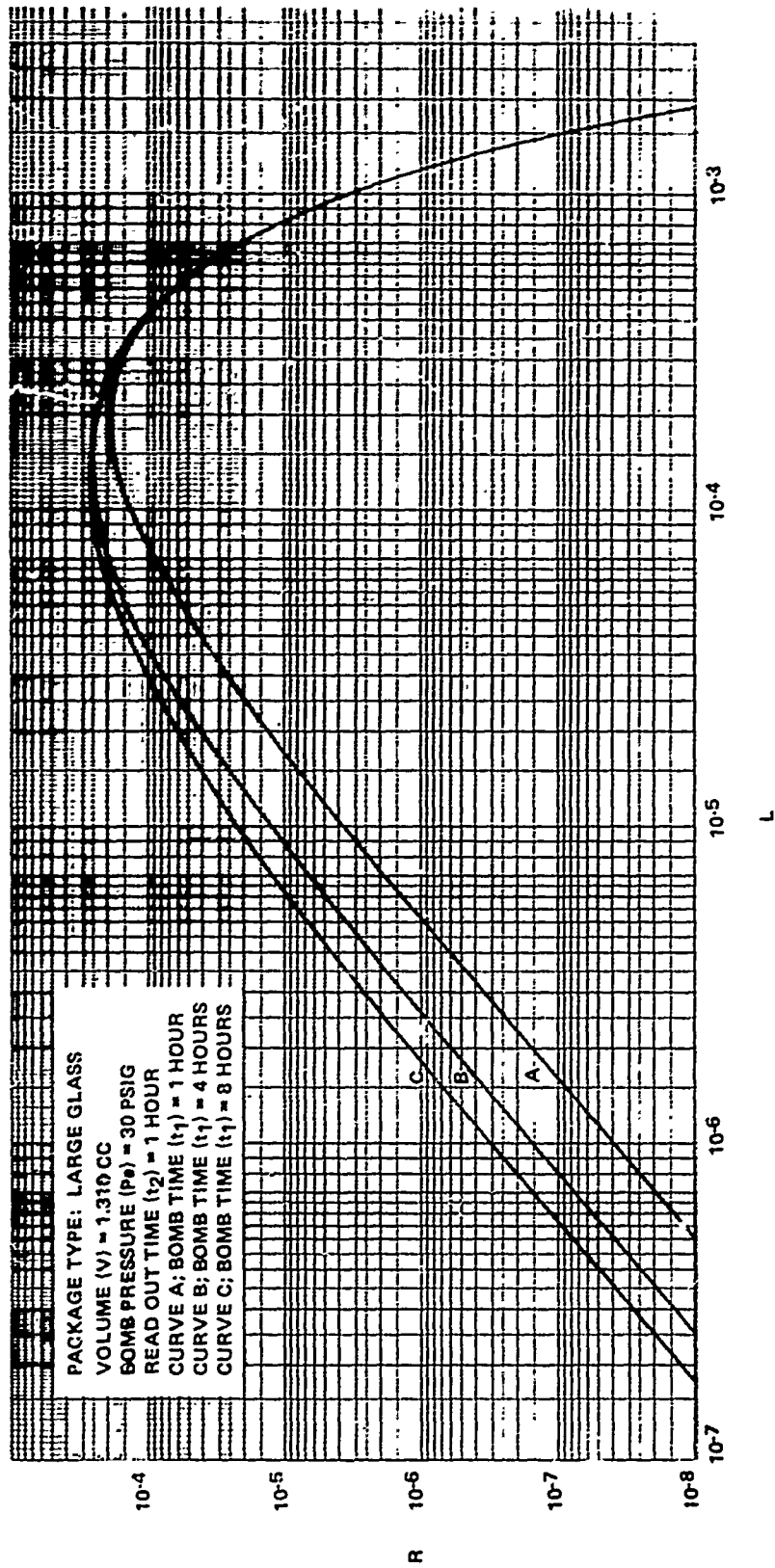


Figure 38. Large Glass Time/Pressure Sequence-Bomb Pressure = 30 psig

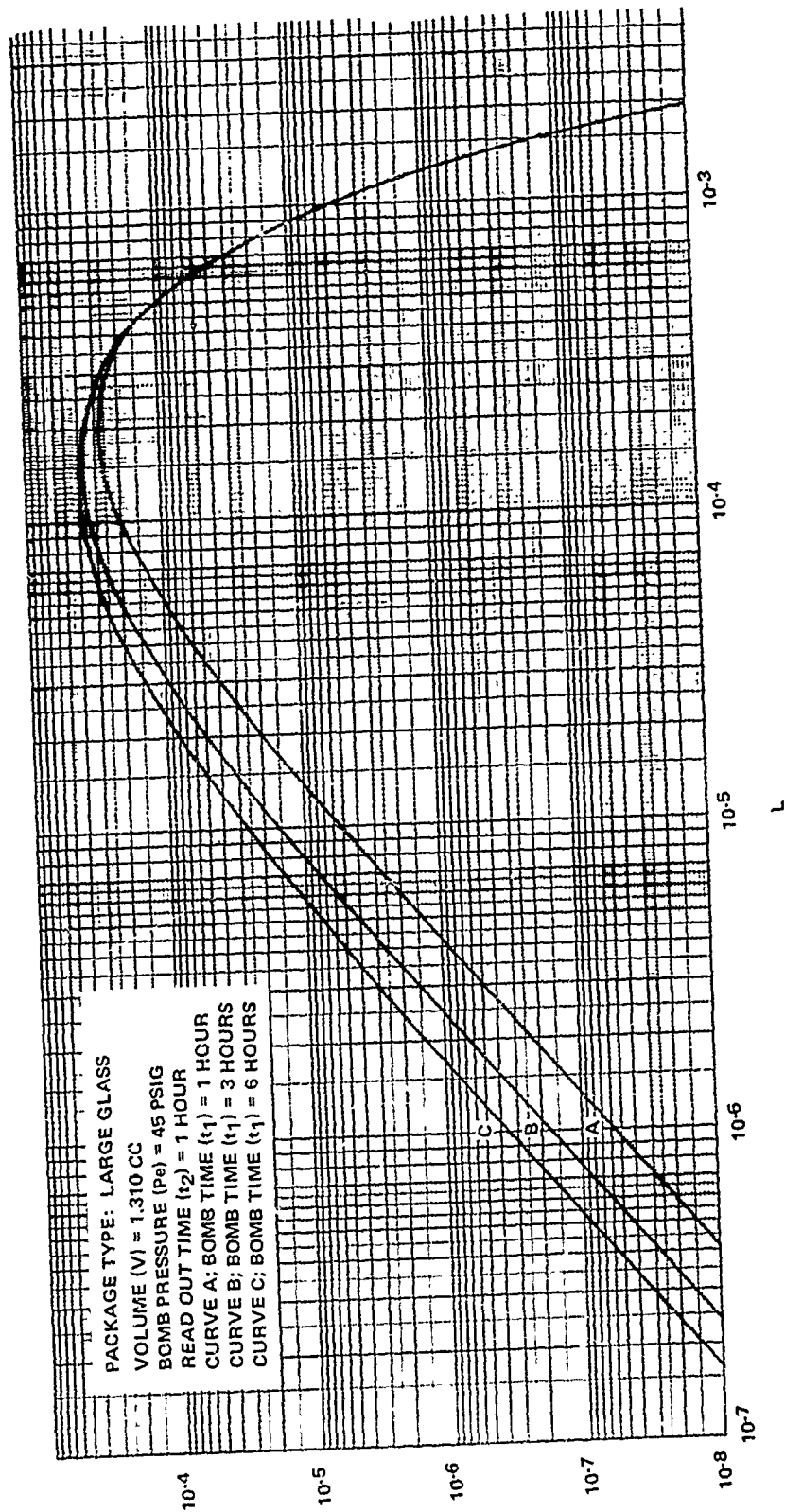


Figure 39. Large Glass Time/Pressure Sequence-Bomb Pressure = 45 psig

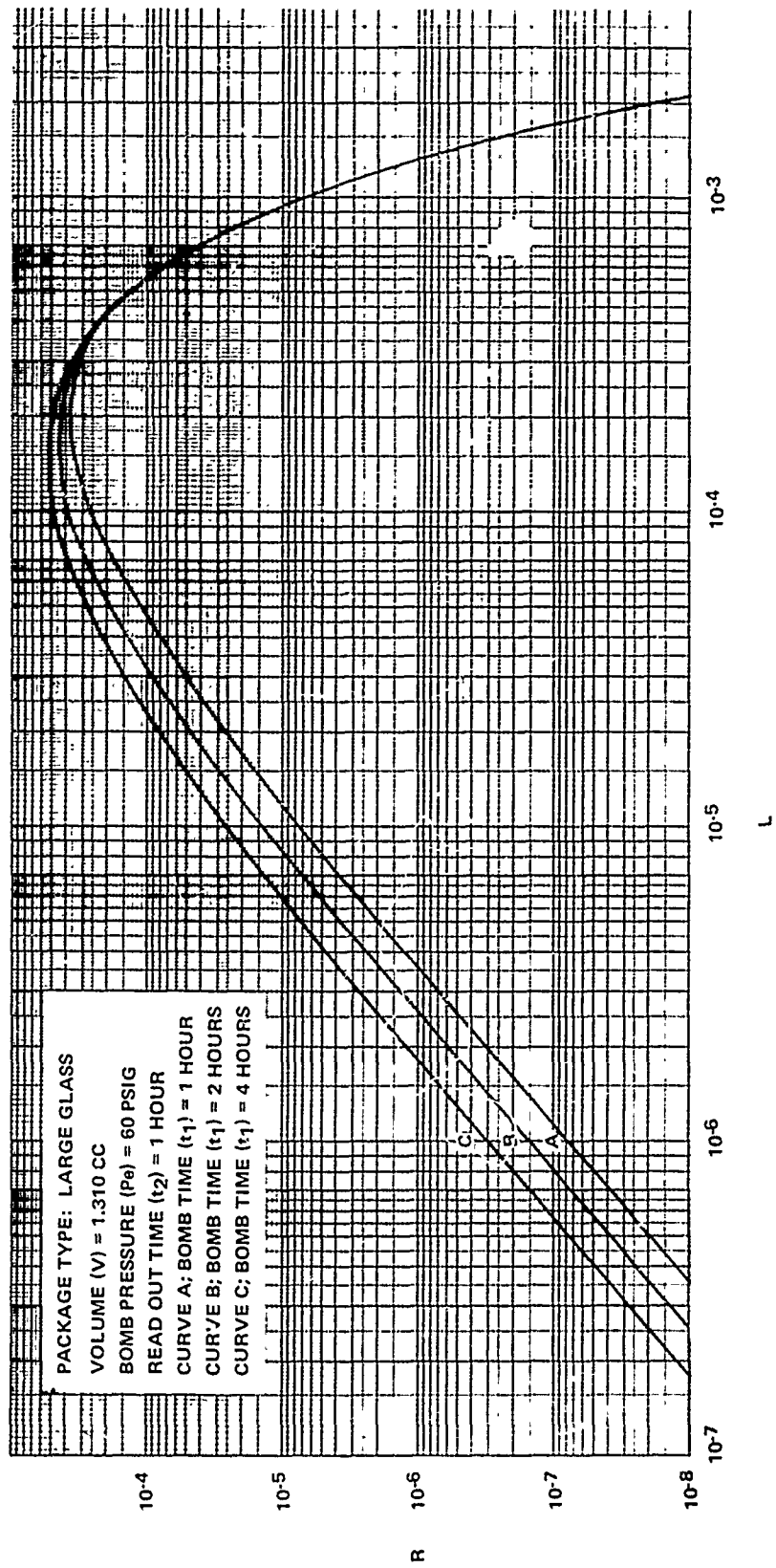


Figure 40. Large Glass Time/Pressure Sequence-Bomb Pressure = 60 psig

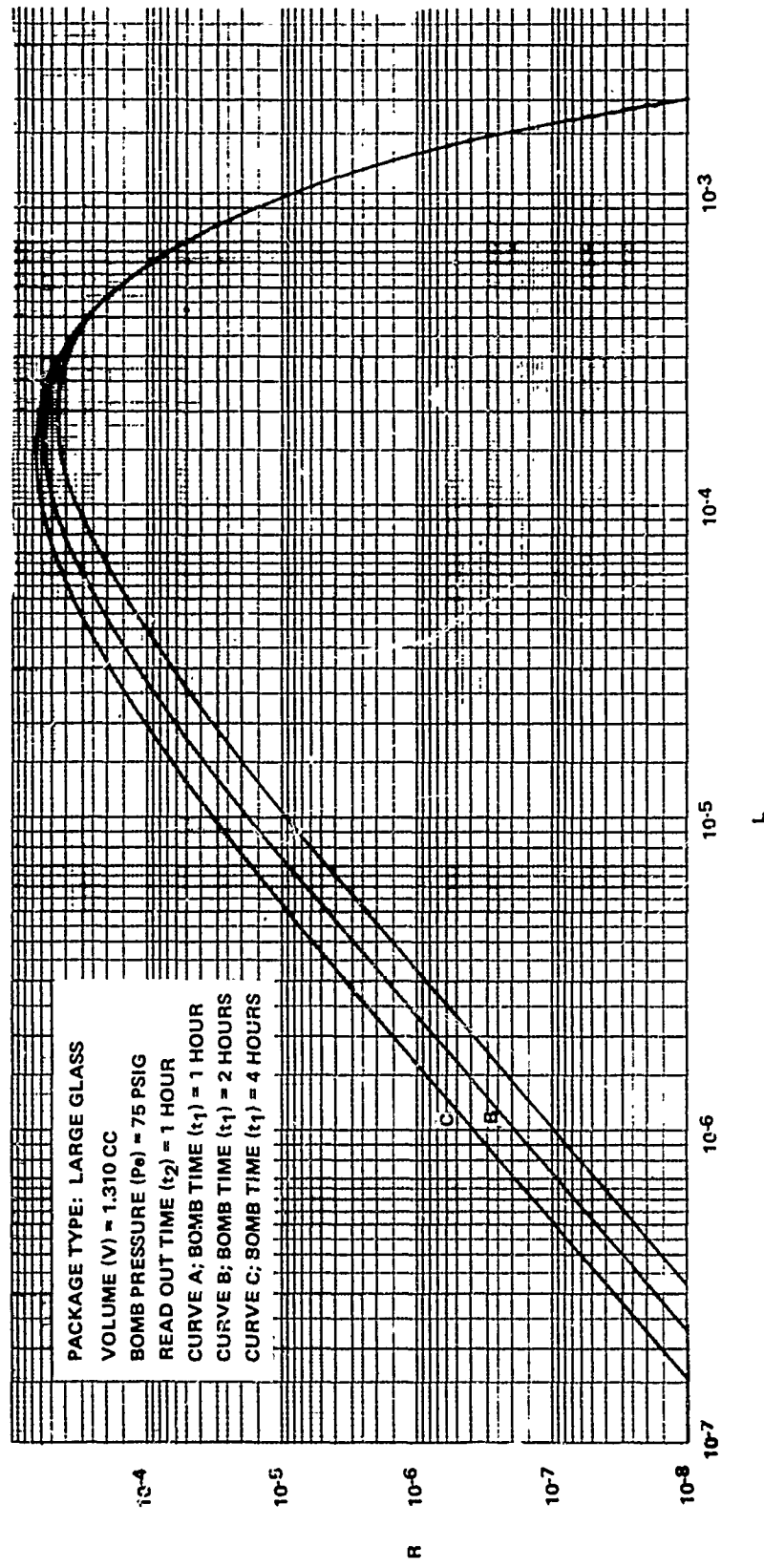


Figure 41. Large Glass Time/Pressure Sequence-Bomb Pressure = 75 psig

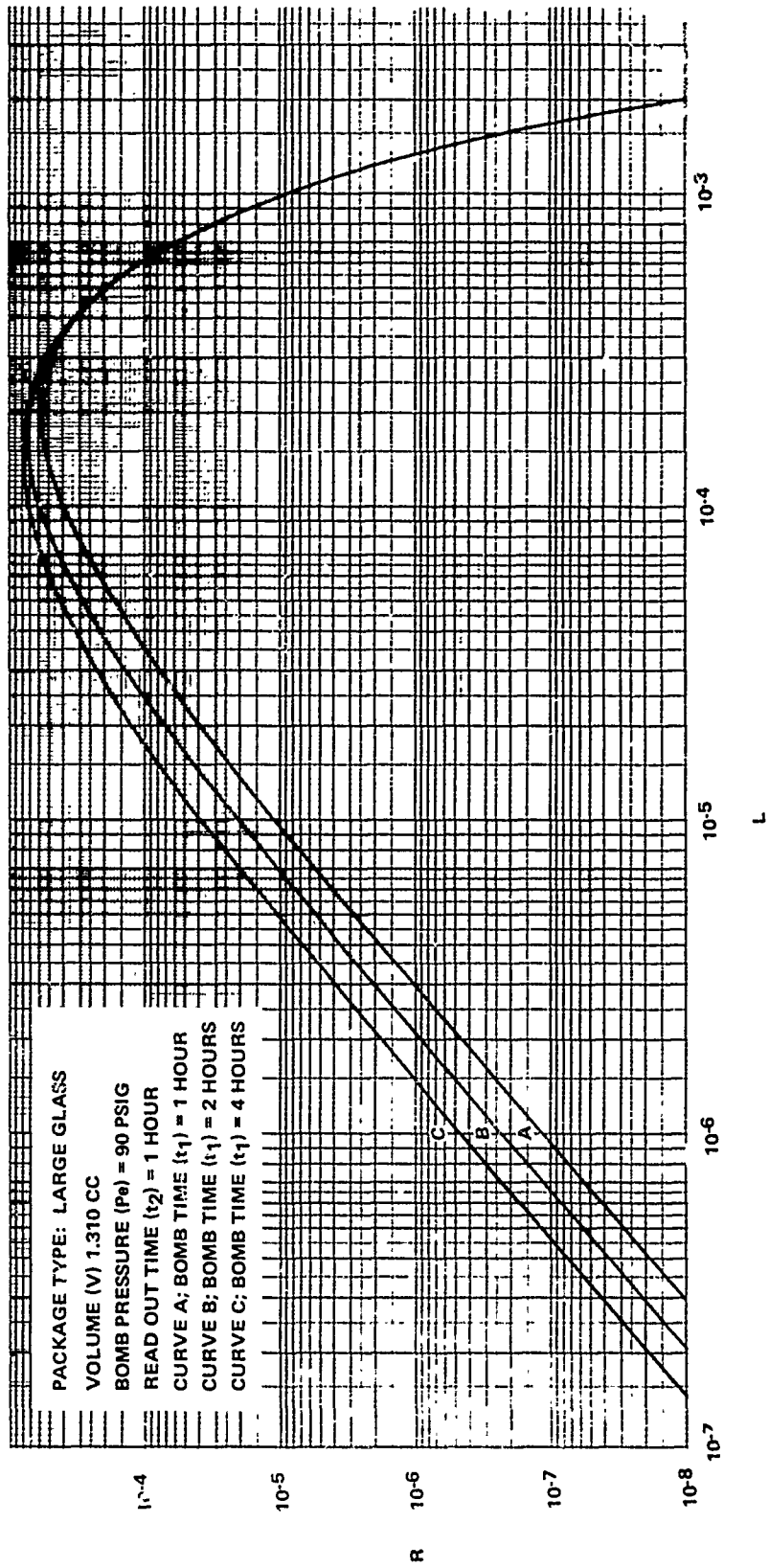


Figure 42. Large Glass Time/Pressure Sequence-Bomb Pressure = 90 psig

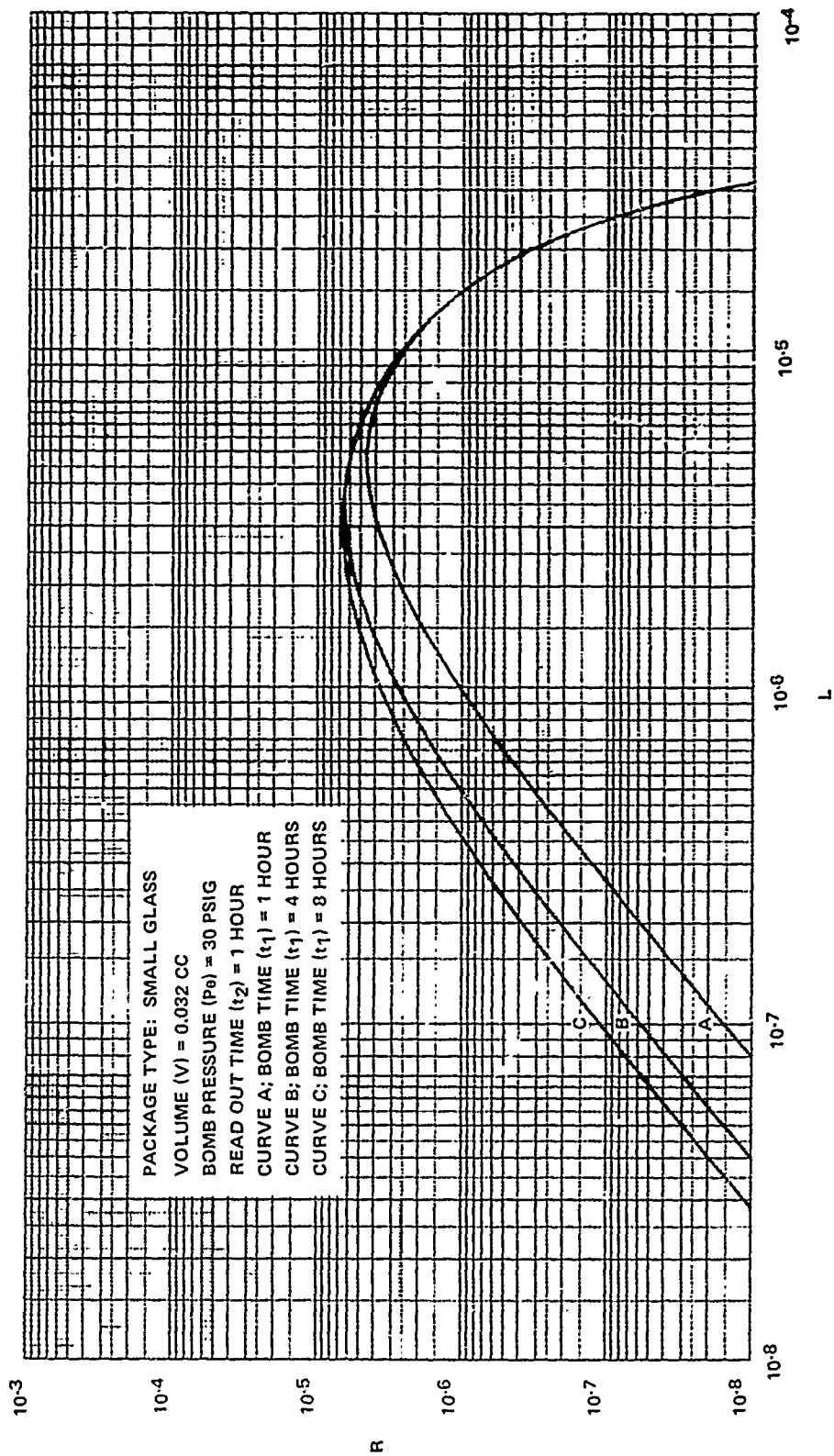


Figure 43. Small Glass Time/Pressure Sequence-Bomb Pressure = 30 psig

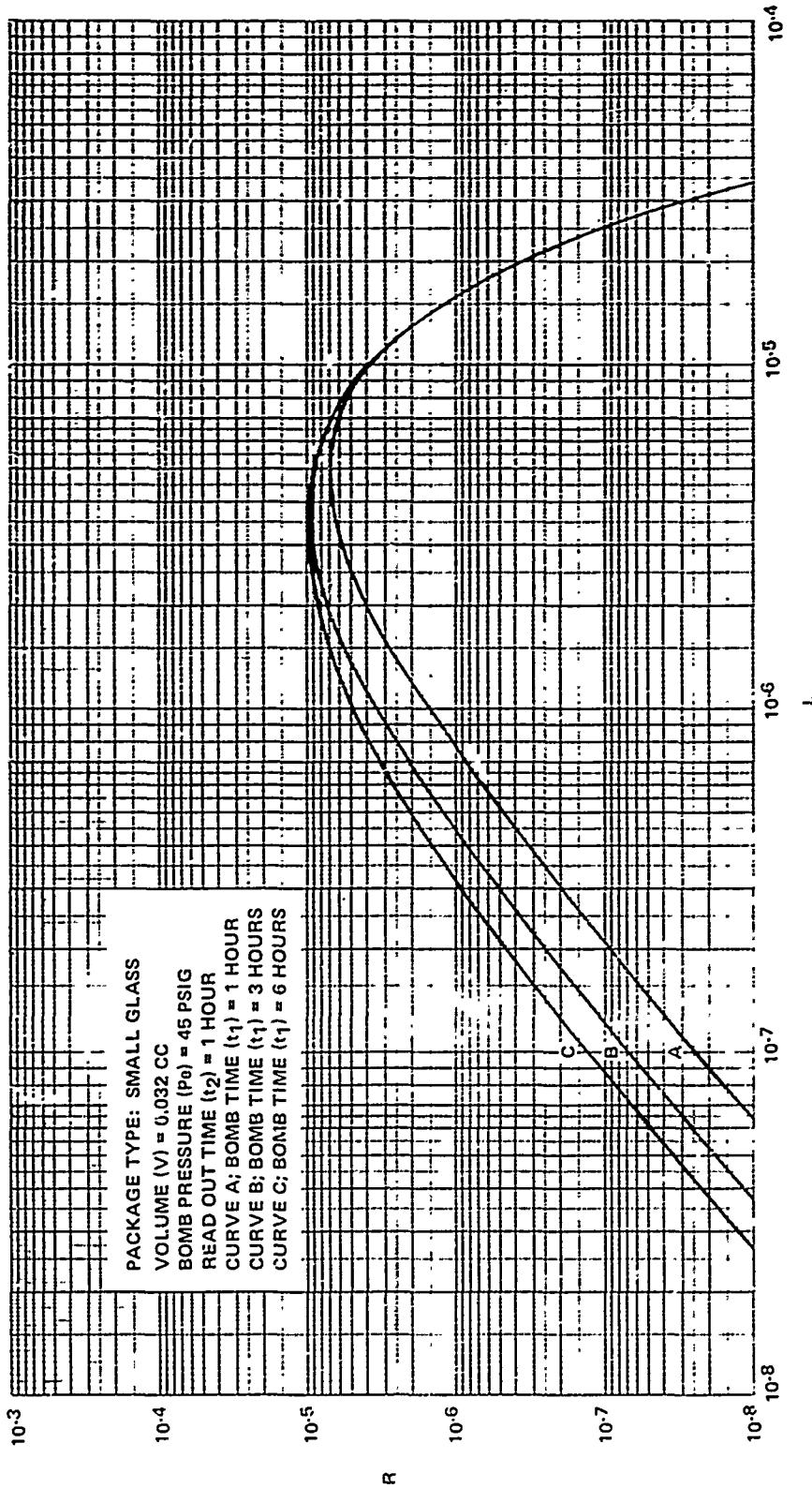


Figure 44. Small Glass Time/Pressure Sequence-Bomb Pressure = 45 psig

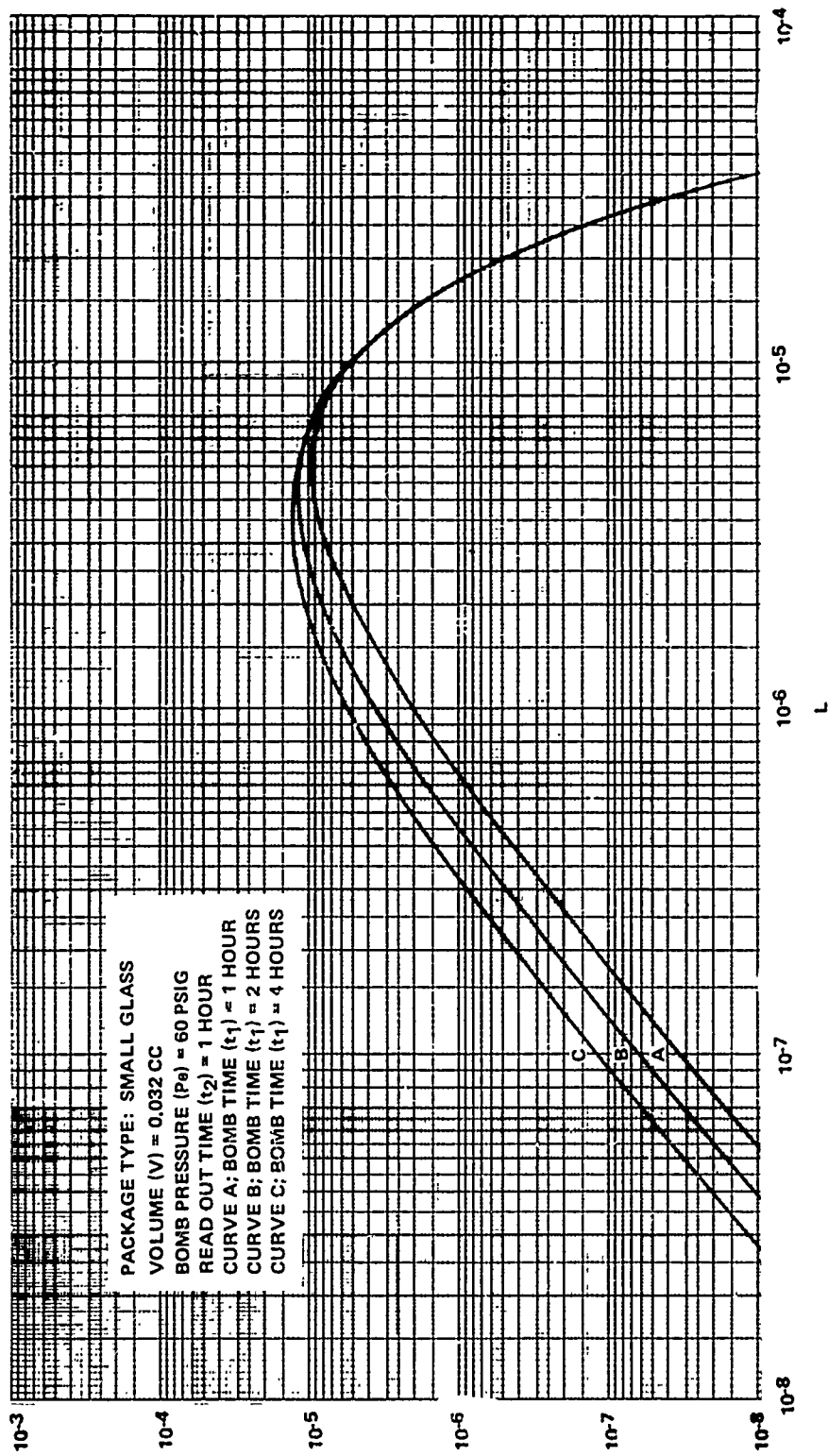


Figure 45. Small Glass Time/Pressure Sequence-Bomb Pressure = 60 psig

R

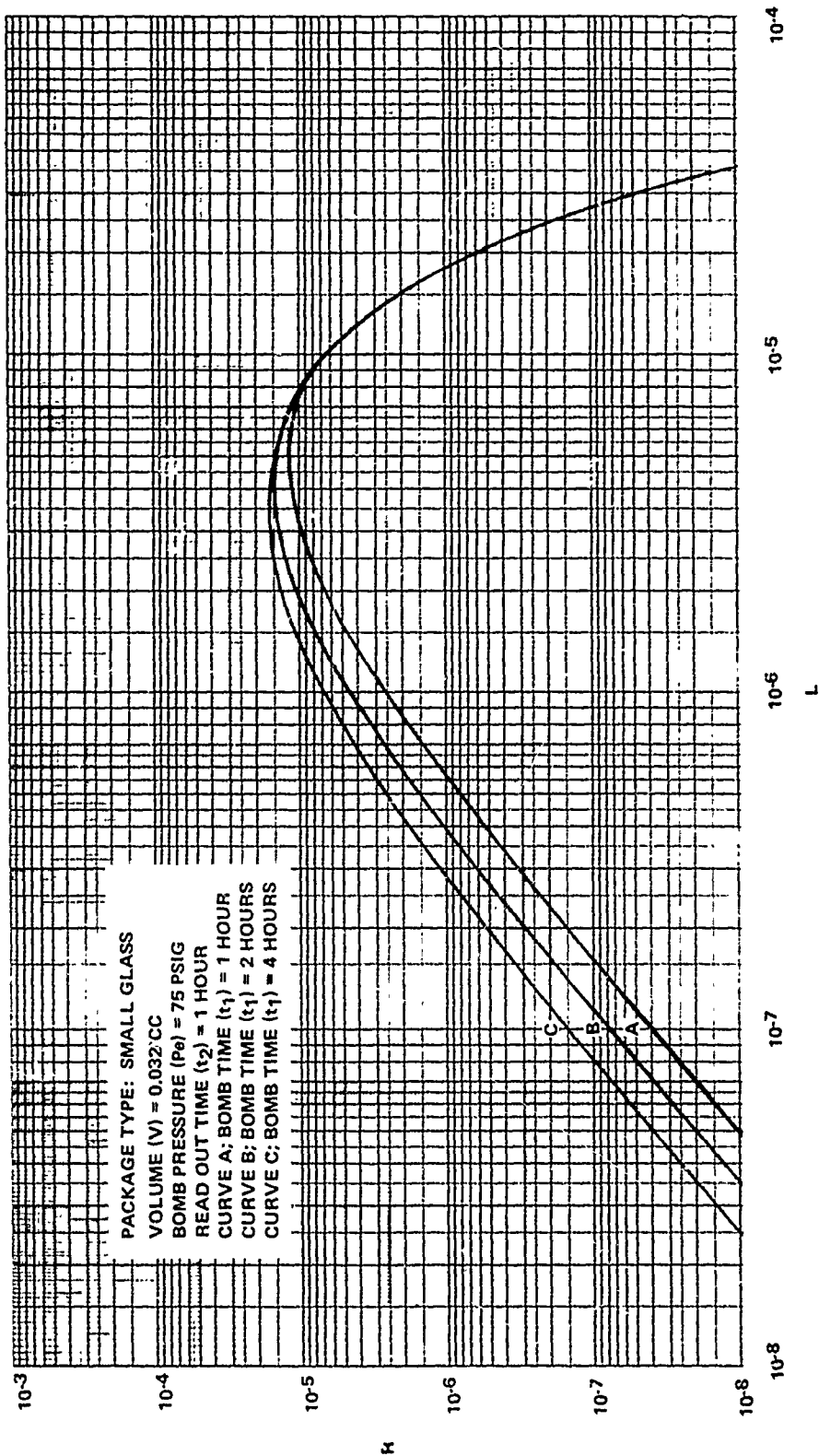


Figure 46. Small Glass Time/Pressure Sequence-Bomb Pressure = 75 psig

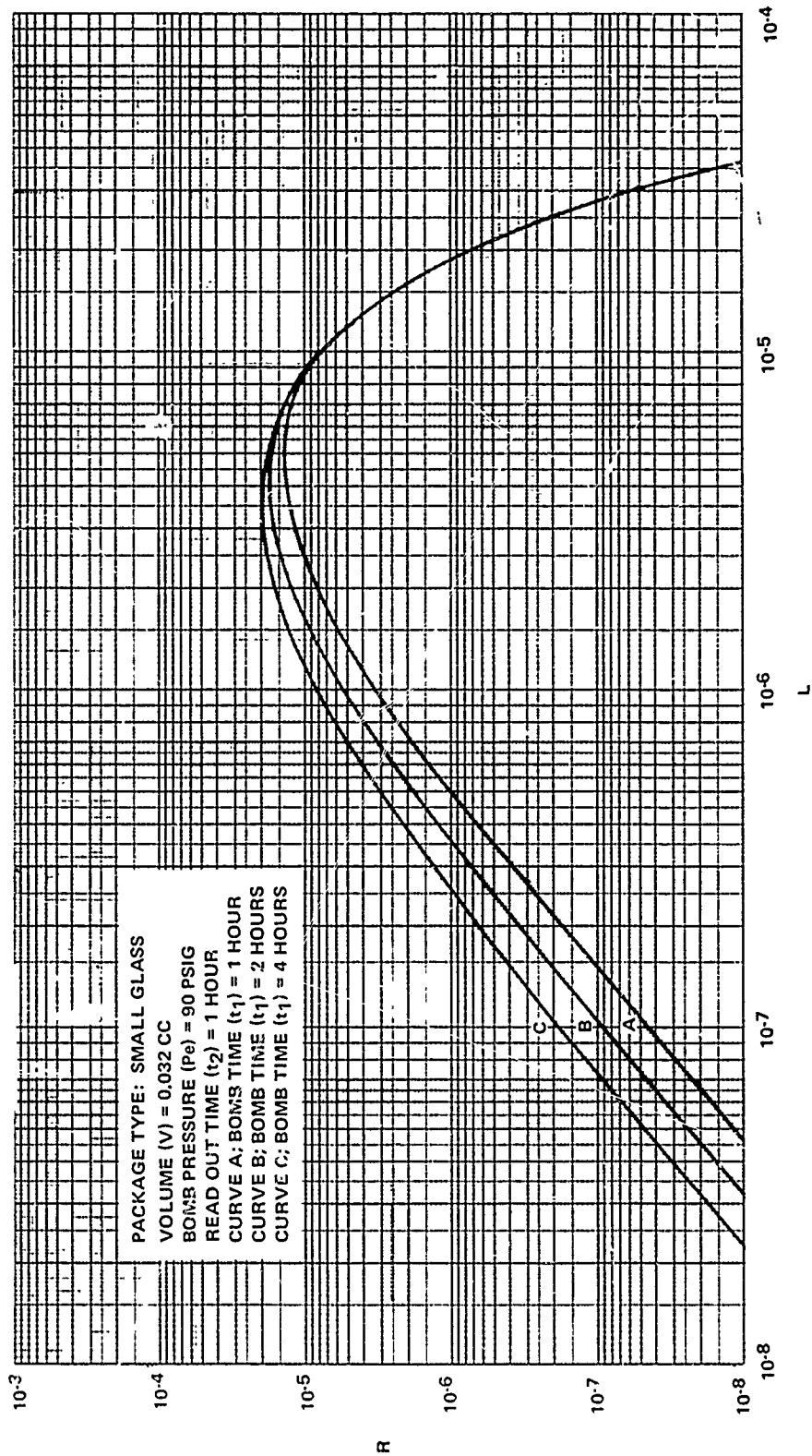


Figure 47. Small Glass Time/Pressure Sequence-Bomb Pressure = 90 psig

SECTION III

EVALUATION OF HELIUM METHOD

Phase II of the project was devoted to the evaluation of Test Condition A, Method 1014 of MIL-STD-883, the equipment used for this method, and the effect of test parameter variables on the sensitivity of the method.

This phase consisted of subjecting each test device and each glass standard to each of the pressurization conditions shown in Table III. The following format was used as a guideline for this phase:

Table III. Helium Time Pressure Matrix

Time (Hours)	Pressure (psig)				
	30	45	60	75	90
1	X	X	X	X	X
2			X	X	X
3		X			
4	X		X	X	X
6		X			
8	X				

Graphs were plotted using Equation (1) for all units for each time and pressure sequences (Figures 3-47). The units were subjected to each of the test conditions and leak values recorded. Using the graphs for each type of unit, the calculated leak rate values were determined and tabulated. The units were subjected to a minimum of 16 hours vacuum bake between each test condition to ensure no residual gas. The evaluation was performed using MS-12 and MS-90 UFT Veeco mass spectrometers. The calibration of the spectrometers was checked each hour to ensure no drift in calibration.

It appears from a rearrangement of Equation (1), that the graph could be plotted for 30 psia and the calculated leak rate determined for any pressure by dividing the indicated value by the bomb pressure in atmospheres to reduce the indicated reading to 1 atmosphere. This is shown by the following:

$$R_1 = P_E \frac{L}{P_0} \left(\frac{M_A}{M} \right)^{1/2} \left\{ 1 - e^{- \left[\frac{Lt_1}{VP_0} \left(\frac{M_A}{M} \right)^{1/2} \right]} \right\} e^{- \left[\frac{Lt_2}{VP_0} \left(\frac{M_A}{M} \right)^{1/2} \right]} \quad (4)$$

When P_E increases to 2, 3--N the value of R increases by a factor of 2, 3--N. Therefore, by using a graph plotted at one atmosphere and bombing at four atmospheres, for example, the R value would be four times larger than the value on the graph. The true L value could be determined by dividing the R value by four to reduce it to the one atmosphere graph value. It was verified from the test results that the above statement is true. However, to eliminate any possibility of error, graphs were plotted for all test pressures. The values on the down side of the curve, 10^{-6} , 10^{-5} , and 10^{-4} , were determined by using the initial weight gain data, which indicated the leak range. If the evaluation had been performed as a production test, a horizontal line would have been drawn on the curve to screen for the smallest value specified and all readings above the line would have been rejected (Figures 48-51). The graphs were plotted assuming that all units would be read-out one hour after removal from the bomb. The units were, in fact, read within one hour, which resulted in the gross leakers reading different values for different conditions due to the readout time (Figure 52).

The test results on the packages with internal volumes ≤ 0.086 cc verified that the equation defines the gas behavior from 1×10^{-8} L to approximately 5×10^{-5} L as shown in Figure 53. The results also show that the devices with L values greater than the value under the curve read less than 1×10^{-8} in a very short time span. It can be concluded that the equation is true for devices with internal volumes ≤ 0.086 cc. The data verified that the equation defines the gas behavior from 1×10^{-8} L to approximately 5×10^{-5} L for devices with internal volumes ≥ 0.45 cc. The data shows that for the large volume packages (≥ 0.45 cc), the escape rate which is defined by the expression

$$e^{- \left[\frac{Lt_2}{VP_0} \left(\frac{M_A}{M} \right)^{1/2} \right]} \quad (A)$$

is not valid beyond approximately 5×10^{-5} L. Based upon the results of the 1 X 1 ceramic and the TO-3, the magnitude of the escape rate is greater than that defined by the equation. The data show that for the large package, as with the smaller package, the devices with leak rates greater than the values under the curve read R values significantly less than the reject limit in a very short time span. The escape rate of devices with leak rates in the 10^{-5} range was verified by monitoring the decay rate over a 2-hour period on the glass standard leaks (Figure 54). It can be concluded that the equation is true for all evaluated packages over the range of 1×10^{-8} L to 5×10^{-5} L. The equation was found to be invalid for L values greater than 5×10^{-5} L. It should be noted that the

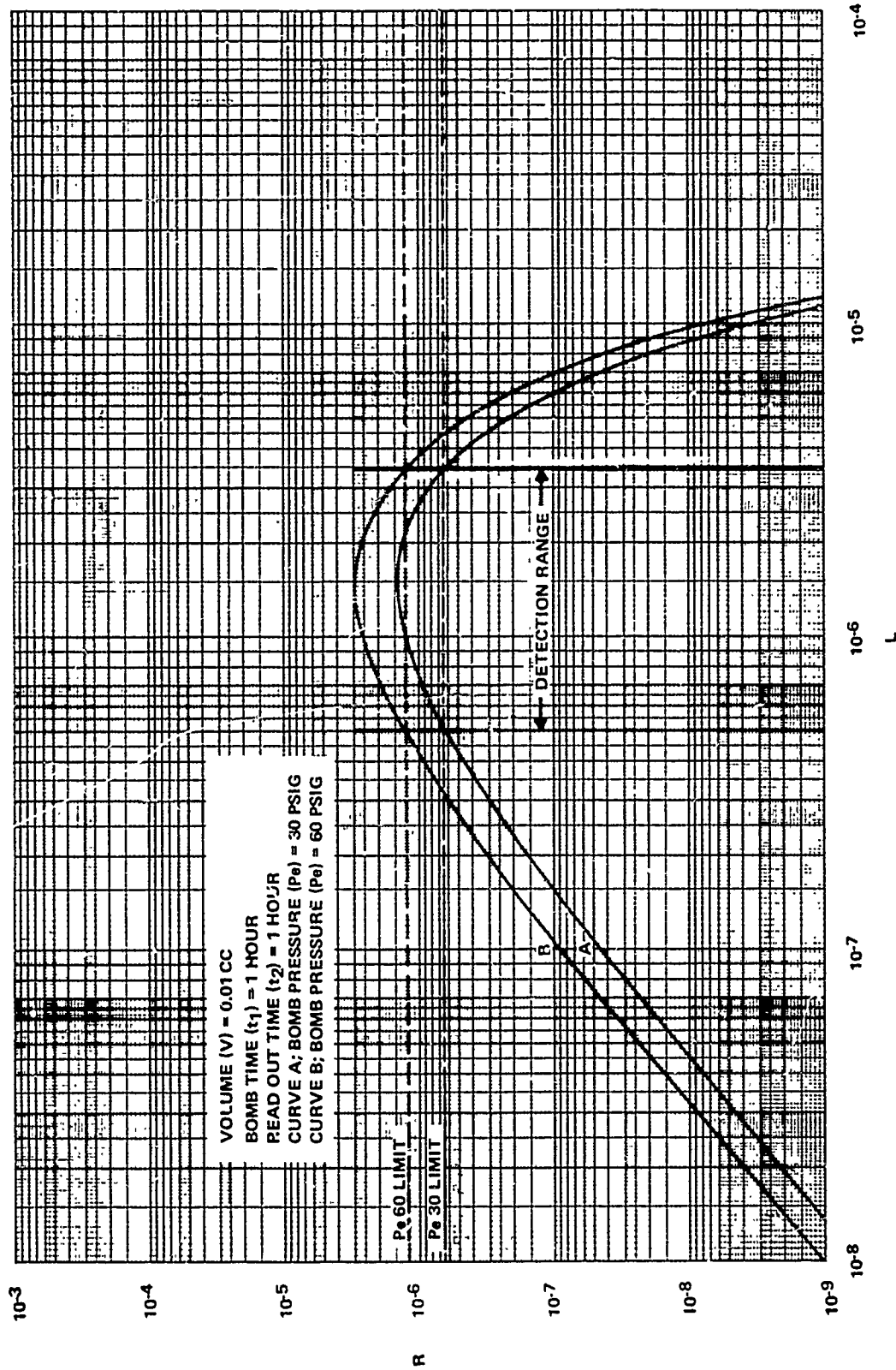


Figure 48. Effects of Pressure Increase for 0.01 cc Volume

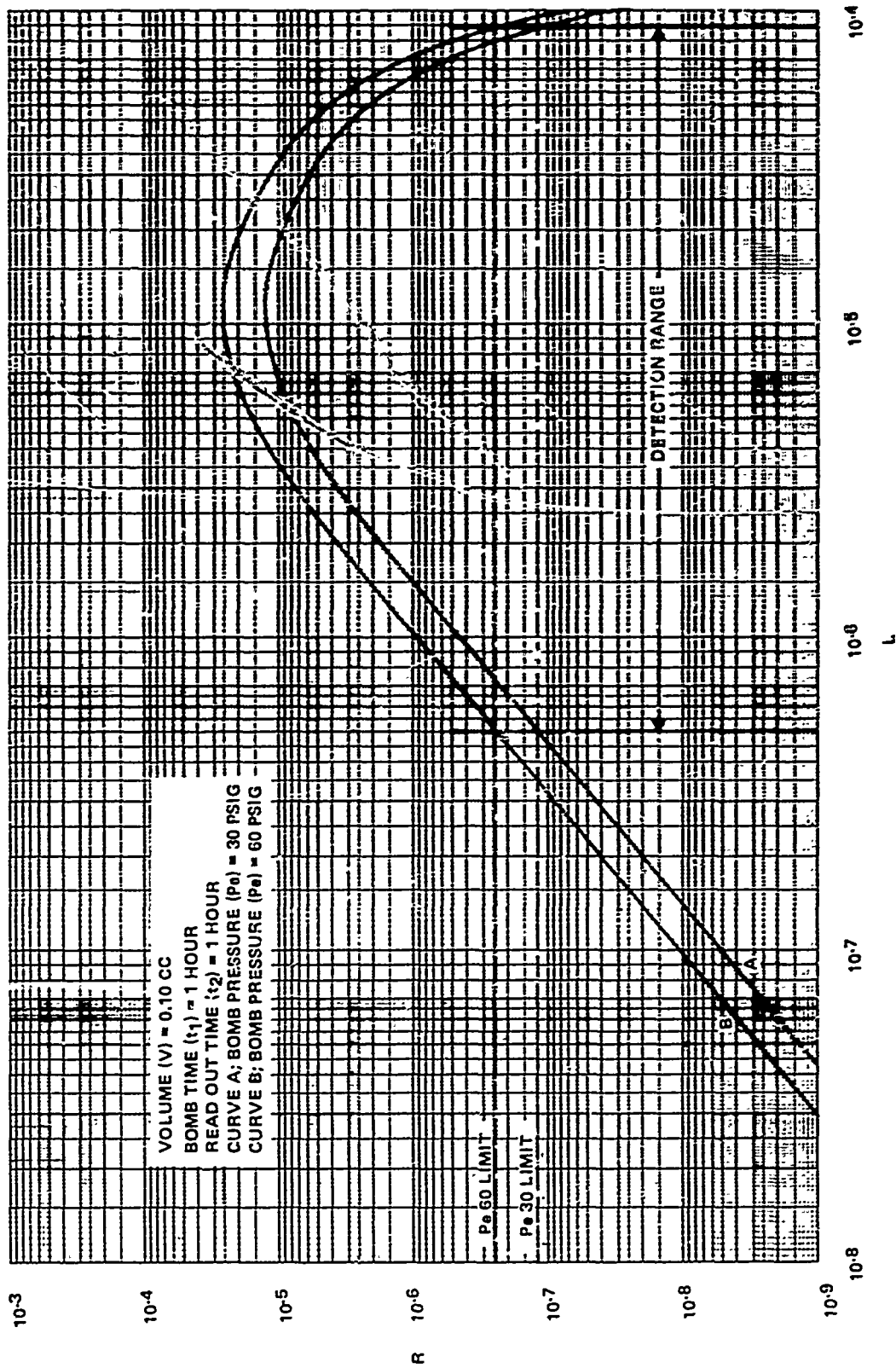


Figure 49. Effects of Pressure Increase for 0.10 cc Volume

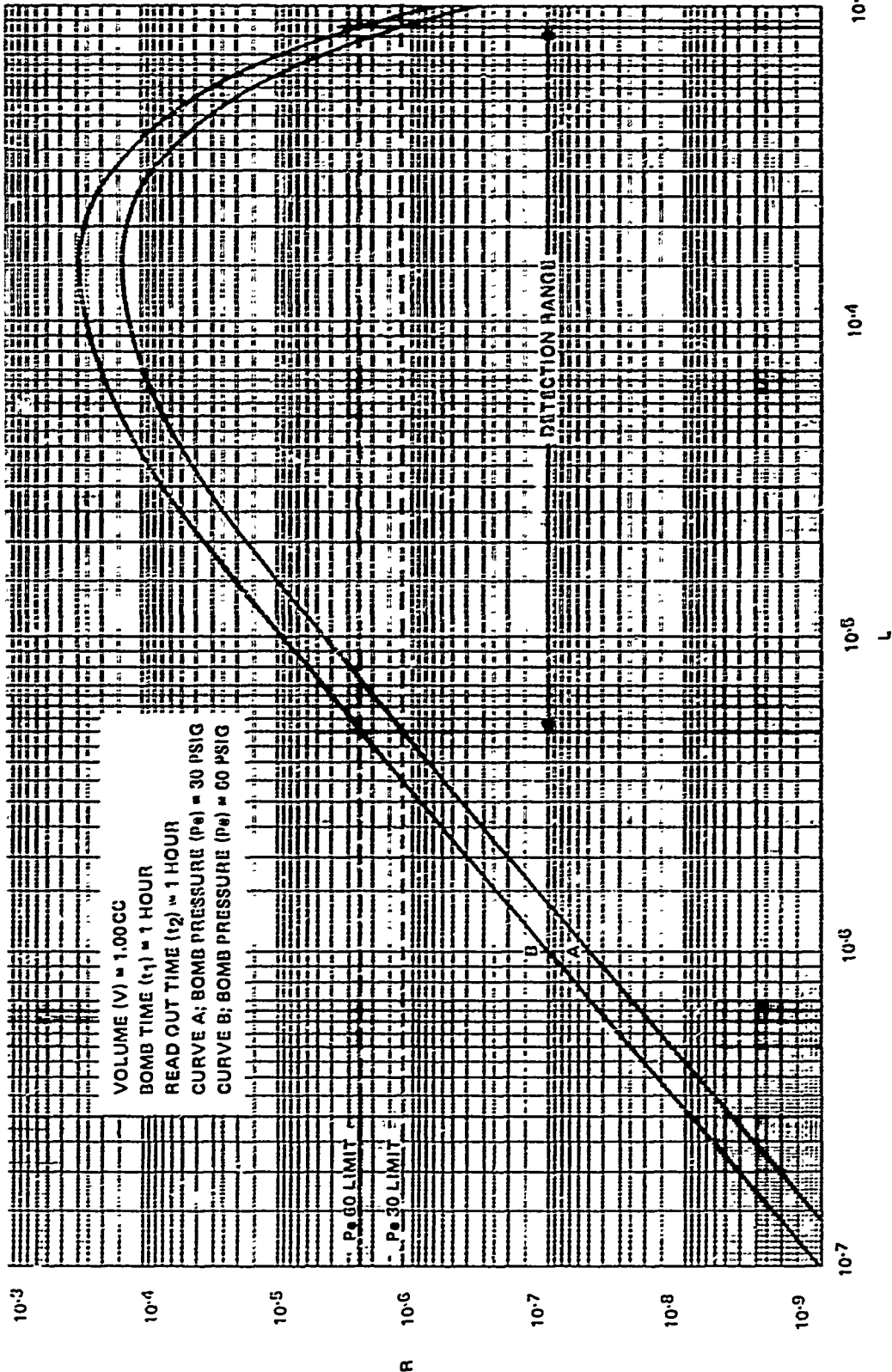


Figure 50. Effects of Pressure Increase for 1.00 cc Volume

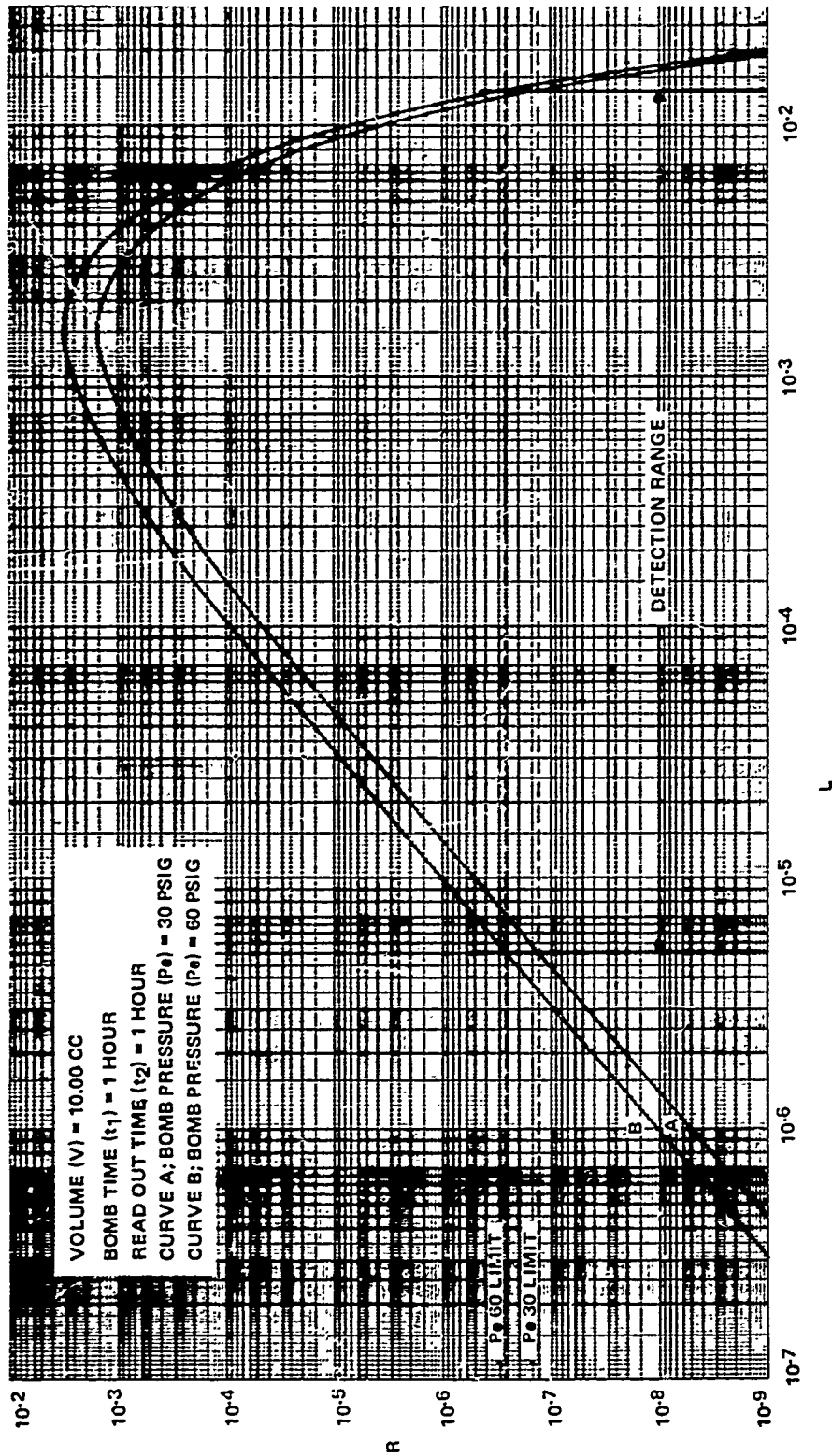


Figure 51. Effects of Pressure Increase for 10.00 cc Volume

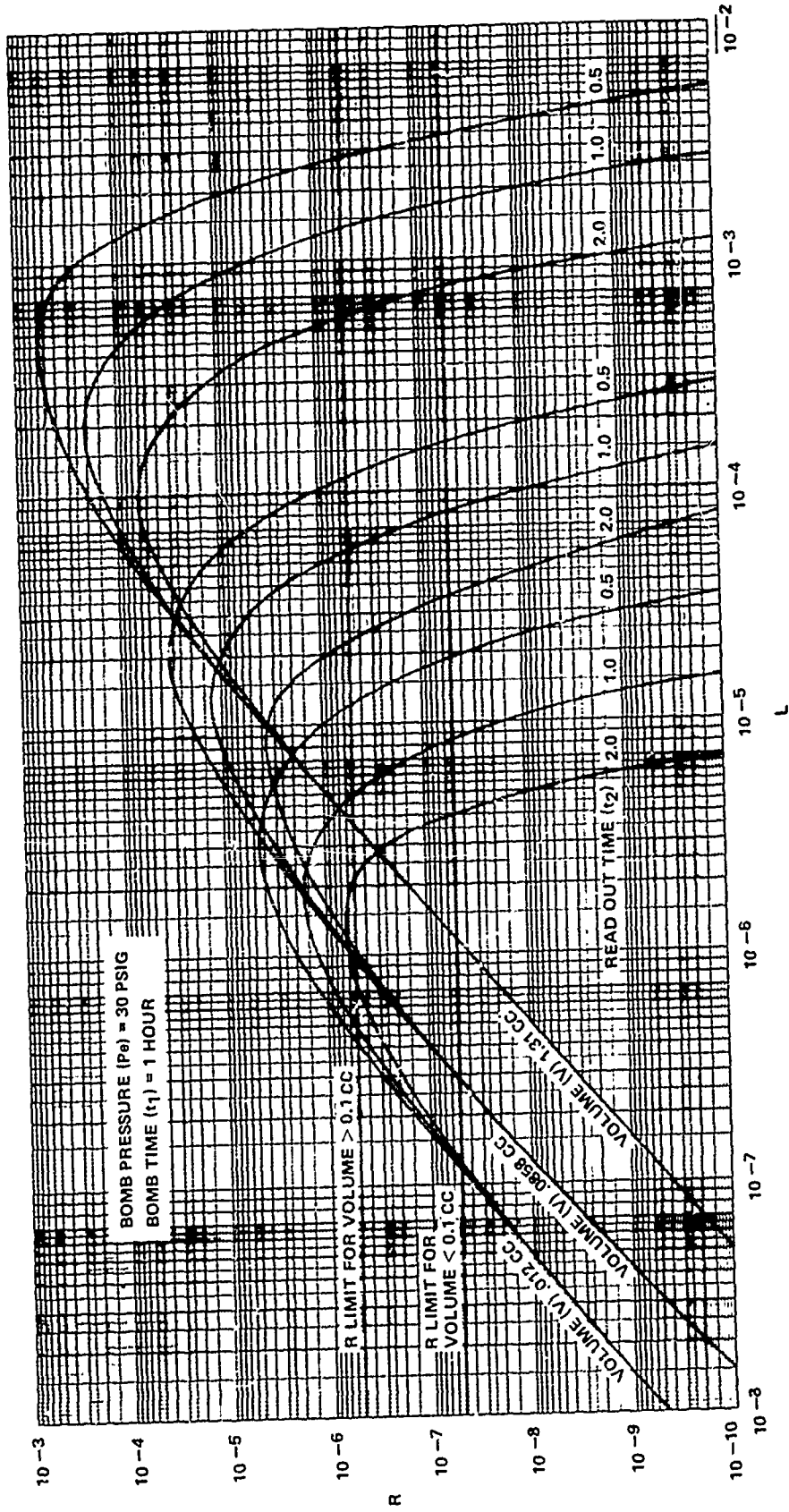


Figure 52. Effects of Time Out of Bomb on Indicated Leak

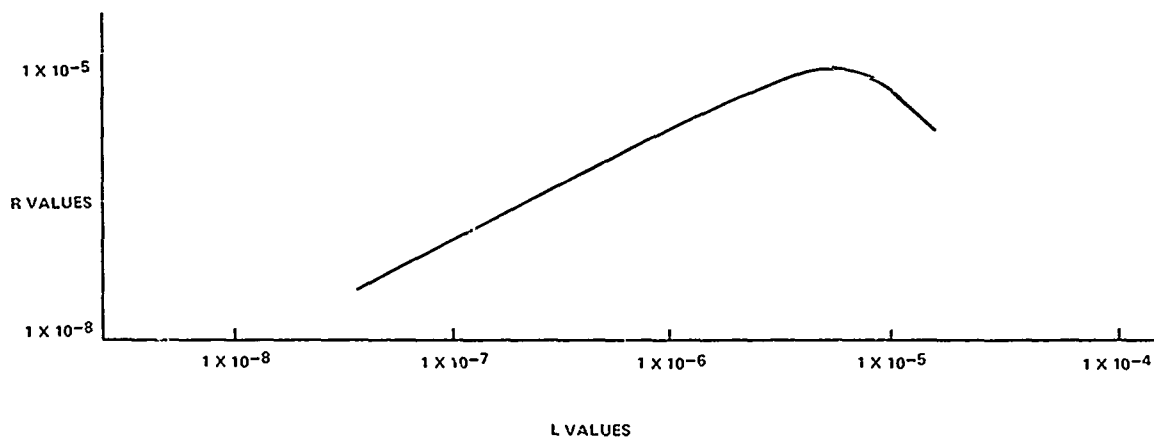


Figure 53. R Values versus Calculated L Values

test condition will detect leakers greater than 5×10^{-5} L, however, the escape rate is high under normal production test procedures and will be discussed under test results.

When testing some of the units, the mass spectrometer amplifier was reduced by a factor of 10 to enable readings to be made in the 10^{-5} range. The machine was calibrated using a diffusion-type calibrator with a helium output rate of 5.2×10^{-8} . All scales from 10^{-8} to 10^{-6} could be checked for one point linearly; however, the 10^{-9} and 10^{-10} could be questionable but the reject criteria in all cases required the unit to have an indicated value of 10^{-8} or greater. All units were tested a total of four times using the same pressure and exposure time to verify the repeatability of the method.

Several significant points resulted from this evaluation.

- 1) The sensitivity of this technique proved to be more dependent on pressurization time, time out of bomb, and package volume, than on the pressure used for exposure to the tracer gas (Figure 55). Examination of Equation (1) shows that as t_1 in the expression

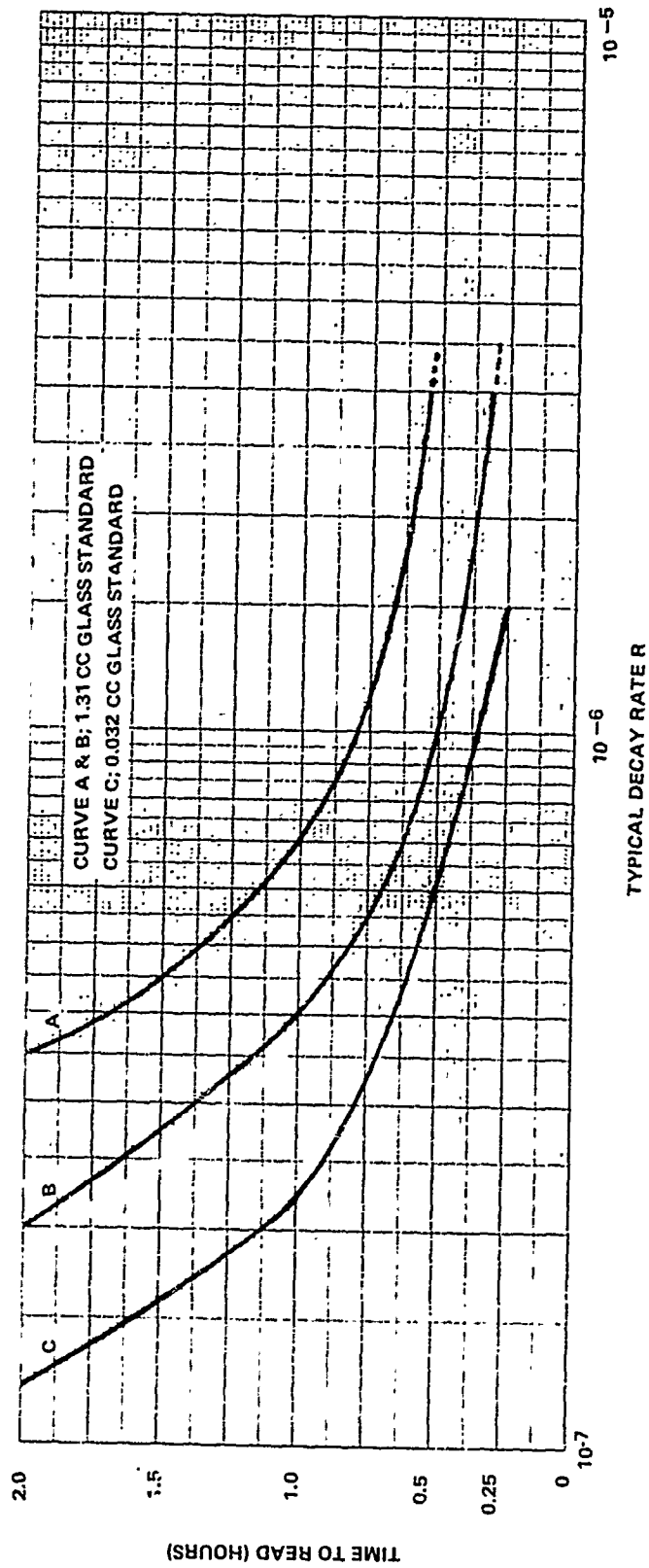


Figure 54. Typical Decay Rates

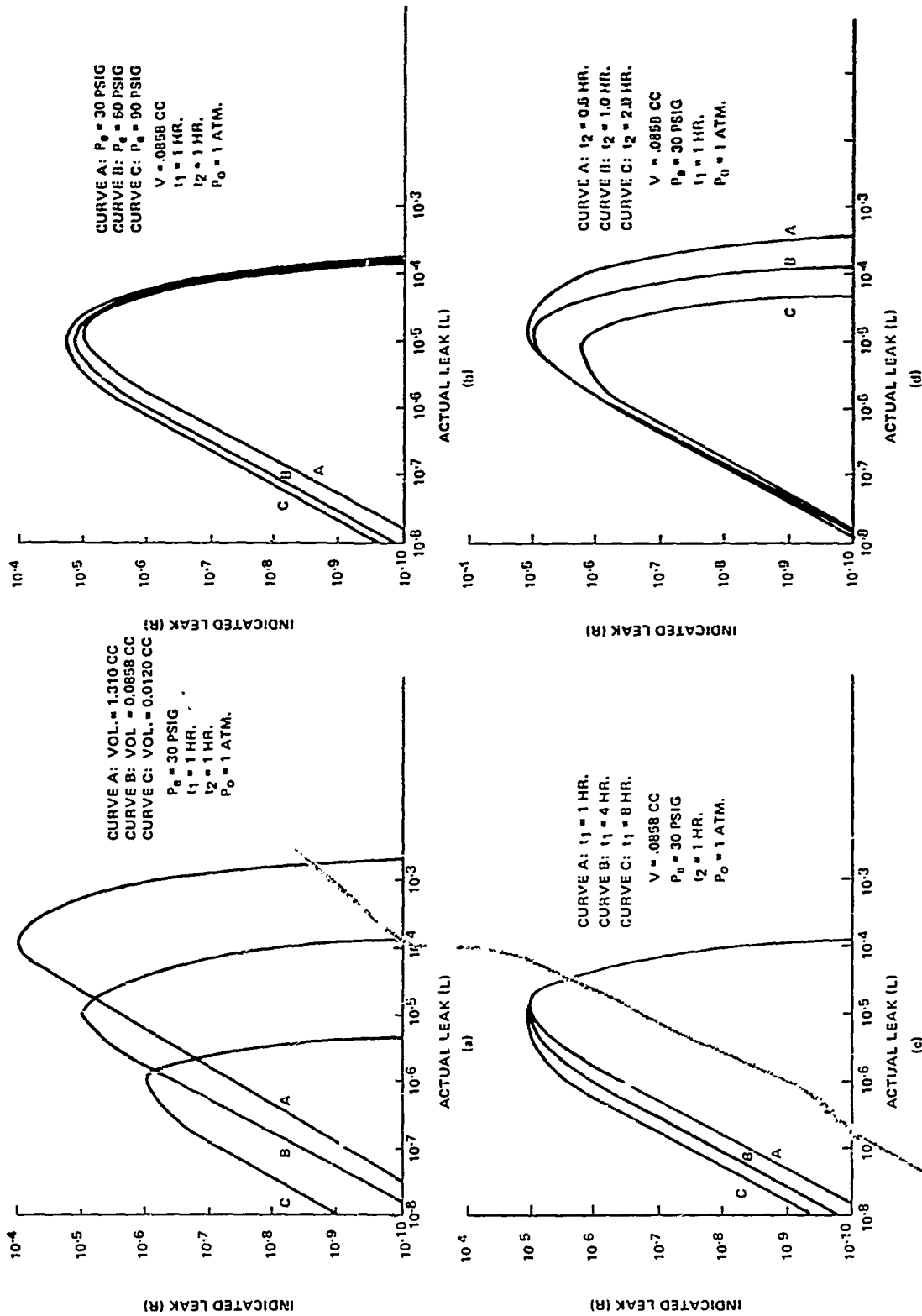


Figure 55. Graphical Comparisons of (a) Volume Changes, (b) Pressure Changes, (c) Bomb Time Changes, and (d) Readout Time Changes of the Helium Leak Rate Formula

$$1 - e^{-\left[\frac{Lt_2}{VP_0} \left(\frac{M_A}{M} \right)^{1/2} \right]} \quad (B)$$

approaches ∞ the value of e^{-x} approaches 0, resulting in this term approaching 1 and thus producing a larger R reading. From the expression

$$e^{-\left[\frac{Lt_2}{VP_0} \left(\frac{M_A}{M} \right)^{1/2} \right]} \quad (A)$$

When t_2 is 0 this expression becomes equal to 1. As t_2 approaches ∞ the value of e^{-x} approaches 0, resulting in the value of R approaching 0. Examining expressions (B) and (A) with respect to V as V gets larger, and if t_1 and t_2 are constant, then the value of L must get larger to make expression (B) equal to expression (A), as this is the point where the curve starts down. As L gets larger the expression

$$\frac{LP_E}{P_0} \left(\frac{M_A}{M} \right)^{1/2} \quad (C)$$

gets larger, resulting in a larger R reading. The exposure pressure appears in expression (C) only, and since the term is in atmospheres the effect on R is not as great as the terms in the exponential function. Therefore, the sensitivity of the method is affected very little by increasing the pressure above 60 psig.

- 2) Table IV depicts the data resulting from the matrix (Table III) in terms of the number of leakers, assuming reject values of $R > 5 \times 10^{-8}$ and $L > 5 \times 10^{-7}$ for volumes ≤ 0.1 cc, and $R > 5 \times 10^{-7}$ and $L > 5 \times 10^{-6}$ for volumes > 0.1 cc, detected at each pressure. The table shows that in most cases, if an R value is used as a reject criteria, the number of rejects increases as the bomb time increases at each pressure. As R increases, the actual leak rate L decreases. As an example, the L value for the TO-100 is equal to 3×10^{-7} when bombed at 30 psig for 1 hour, with R equal to 5×10^{-8} but the L value is equal to 8×10^{-8} when bombed at 90 psig for four hours using the same 5×10^{-8} R value (Figures 23 and 27). If the units are to be submitted to a helium test and rejected when R is equal to or greater than 5×10^{-8} , the bomb pressure and dwell time must be specified and observed; otherwise the actual leak rate L will vary greatly [Figure 55(b) and (d)].

Table IV. Helium Evaluation – Number of Rejects at Test Conditions

$R > 5 \times 10^{-8}, L > 5 \times 10^{-7}$ for volume < 0.1 cc

$R > 5 \times 10^{-7}, L > 5 \times 10^{-6}$ for volume > 0.1 cc

Bomb Conditions		Package									
Press psig	Time Hours	TO-84		C-PAK		C-DIP		MOS		TO-100	
		R	L	R	L	R	L	R	L	R	L
30	1	18	16	75	61	39	33	23	20	68	64
30	4	15	13	69	64	50	36	27	24	69	62
30	8	19	15	75	52	58	38	25	20	67	61
45	1	16	12	67	63	48	40	19	19	67	62
45	3	18	12	71	60	54	36	27	20	68	63
45	6	16	13	59	44	57	38	23	19	71	61
60	1	16	14	62	51	54	40	21	19	67	60
60	2	17	14	71	57	56	40	27	20	67	56
60	4	24	21	78	52	56	35	52	39	79	69
75	1	17	15	68	54	53	33	25	19	54	46
75	2	17	12	60	36	48	31	28	22	55	40
75	4	18	14	70	46	52	31	25	19	61	50
90	1	18	13	68	62	49	35	49	30	52	44
90	2	19	15	66	40	53	35	41	26	53	45
90	4	20	16	67	54	53	36	46	31	55	44

Bomb Conditions		Package							
Press psig	Time Hours	1 X 1 Ceramic		TO-3		Large Glass		Small Glass	
		R	L	R	L	R	L	R	L
30	1	14	4	58	43	19	17	17	7
30	4	18	6	52	40	27	18	17	6
30	8	28	6	64	33	50	19	17	4
45	1	22	7	45	33	32	22	17	9
45	3	21	7	49	29	33	20	17	4
45	6	44	6	51	30	20	19	16	4
60	1	26	7	41	32	31	21	17	9
60	2	35	4	51	33	34	21	17	7
60	4	37	5	55	34	32	19	17	6
75	1	42	11	43	35	26	16	17	3
75	2	50	13	46	32	28	16	17	3
75	4	53	11	44	32	33	16	17	3
90	1	47	12	52	40	28	14	17	7
90	2	57	6	53	44	34	13	17	6
90	4	60	13	55	43	32	12	17	3

- 3) Table IV shows that if an L value was used as the reject criteria, the number of rejects was essentially the same for all bomb pressures and times up to 60 psi. One advantage of specifying the L value as the reject criteria is that if the bomb pressure or dwell time is inadvertently different than what is specified, all units will still be tested at the proper value since L is a calculated value. Also, all units will be tested to the same actual leak rate. In this case the R value will vary but will not affect the results of the test.
- 4) The repeatability of the procedure is very dependent on the leak rates and time to read of the devices being tested. Repeatability as discussed here is the machine's ability to read within the same decade on four data runs, not necessarily the ability to detect the same rejects four times. In the so-called fine-leak range, repeatable readings occurred on from 70 to 87 percent of the devices on each of four test runs at the same conditions. Lack of repeatability was caused primarily by devices with leak rates in the 10^{-6} range and higher rates on small volume ceramic packages than on metal can packages. Table V shows the percentage of fine leakers of each case type which exhibited repeatable readings throughout the four test runs and also the percentage of the total sample, fine and gross leakers, which had repeatable readings.

Table V. Test Condition A Repeatability

Package	Percent Fine-Leak Range Only	Percent Including Gross Leakers
TO-84	83	94
C-PAK	70	26
C-DIP	71	64
MOS	87	89
TO-100	77	93
1 X 1 Ceramic	80	56
TO-3	86	85

The object of the MS-90 UFT evaluation was to determine the capability of this mass spectrometer in detecting gross leakers and number of units that can be tested per hour. This machine is designed to have a very rapid pump-down time, thus testing the devices before the helium has a chance to escape. This rapid pump-down time frame occurs in the first 1-1/2 seconds after the unit has been placed in the test chamber and pumping has begun. During the next one second, a Pirani gauge is exposed to the pressure in the test chamber and if the pressure is low enough, the test valve is allowed to open. If the pressure is too high, the "gross leak" lamp will light

and the test portion of the cycle will be bypassed. In order for this machine to be consistent in detecting gross leakers, the magnitude of expression

$$e \left[\frac{L t_2}{V P_0} \left(\frac{M_A}{M} \right)^{1/2} \right] \quad (A)$$

must be small enough to make the value of R larger than the reject point.

Test conditions were chosen to relate to a specific condition utilized in the MS-12 AB variable data runs (Table VI). The devices were subjected to a minimum of 16 hours vacuum bake and tested for residual helium prior to this test sequence.

Table VI. MS-90 UFT – Device Preconditioning

Package	Bomb Pressure (psig)	Time (t ₁ – hours)
TO-84	30	1
C-PAK	30	1
C-DIP	30	1
MOS	60	2
TO-100	60	2
1 X 1 Ceramic	60	1
TO-3	60	2
Glass Standards	45	1

The MS-90 UFT was calibrated as follows prior to the start of this sequence:

- 1) Checked and set the filament current.
- 2) "Peaked out" the machine to read the leakage of helium, which was marked on the side of the calibrator.
- 3) Verified the zero and calibrator reading to ensure no residual helium in the system.

A sensitivity check was made at the beginning and at the conclusion of the test sequence on each package type. The leak indicator gauge was adjusted to indicate the leak rate limit and the devices were categorized as good or reject.

An attempt was made to read variable data with the mass spectrometer operating in the automatic mode. Unless the approximate leak rate is known, it is impossible to obtain reliable variable readings because the 1-second sample time inherent in the equipment is inadequate to seek out the proper indicator range. Therefore only fail/pass data was recorded. The data results indicate

no significant differences in the number of gross rejects detected by this machine. A few were detected due to the faster read time and therefore gas still being in the units. This is a function of read time and therefore a percentage cannot be placed on the number. The number of rejects detected at each condition is shown in Table VII.

Table VII. MS-90 UFT Helium Evaluation – Number of Rejects
 $R > 5 \times 10^{-8}$ and 5×10^{-7}

Package	Pressure/Time (t ₁)			
	30/1	45/1	60/1	60/2
TO-84	18			
C-PAK	56			
C-DIP	38			
MOS				23
TO-100				69
1 X 1 Ceramic			40	
TO-3				61
Glass Standards		47		

The time required to classify as good or reject on an MS-90 UFT was approximately three times as fast as the MS-12 AB system. The test sequence time on this particular machine varied from 8 to 9 seconds depending upon the volume of the empty fixture used. The spectrometer is more efficient when the internal cavity of the fixture and the overall volume of the package is approximately the same. There was no evidence of rapid pump-down being significantly more effective in detecting gross leakers. The residual helium was a problem when testing devices which had large leaks.

The results of this study indicate that the mass spectrometer, when set up as described above, can be used to detect microcircuit seal leaks with a high degree of accuracy in the leak range defined by the equation for each package type. The leak range limits of each package are discussed under test results.

SECTION IV

EVALUATION OF RADIOISOTOPE

Phase III of the project was devoted to evaluation of radioactive tracer gas methods described in Condition B, Method 1014 of MIL-STD-883.

Equation (2) in Section III was solved for each package type for $Q_s = 1 \times 10^{-8}$. The equation indicates that the gas does not escape from the units, this did not prove to be true. All the gross leakers detected by weight gain were not detected. The equation appears to be valid for the fine leakers as both Test Conditions A and B produced the same results for the fine leakers. In order for the equation to be completely valid, there should be a function to describe the escape rate of the gas. The equation was solved using different (600 and 1200) internal count reject parameters, and three (277, 600, and 1397) specific activity values. The results are discussed below.

The units were subjected to a varying number of wash cycles (Table VIII) to determine the effect on each package type (Table IX). The units were vacuum baked for a minimum of 16 hours between each test sequence to ensure no residual gas. The testing was performed on two different systems, a CEC 24-510 and an IsoVac Mark IV to verify correlation between systems. The test results indicate that the number of wash cycles, up to three, made no significant difference in the readings. The repeatability testing was performed a total of four times on each unit, using one wash cycle.

Two of the repeatability runs were made with a specific activity of 600 and two with a specific activity of 1397. The specific activity, when testing with the Mark IV, was 277. The data showed that there was no significant difference in the results as long as the other parameters are chosen to satisfy the equation. The units were tested using an internal count of 1200 and 600 counts per minute as the R parameter of the equation. Varying the specific activity and the R parameters allowed a varying bomb time with no significant difference in the results. The tracer gas was stored

Table VIII. Krypton-85 Matrix

Wash Cycles	Microcuries per cm ³		
	277	600	1397
0	X		X
1	X	X	X
3	X		X

Table IX. Radioisotope Test Results –
Number of Units Detected as Rejects

Devices	CEC 24-510			IsoVac MARK IV		
	0W	1W	3W	0W	1W	3W
TO-84	19	20	22	22	23	23
C-PAK	56	51	52	49	50	47
C-DIP	29	32	29	22	37	33
MOS	22	21	20	17	31	19
TO-100	42	44	48	44	47	42
1 X 1 Ceramic	1	5	4	6	6	8
TO-3	29	26	31	36	52	51
Glass Standard	12	17	16	13	15	15

ACTIVATION PRESSURE AND TIME FOR $Q_s = 1 \times 10^{-8}$
 VOLUME OF 0.1 cc AND LESS REJECT Q = 5×10^{-7}
 VOLUME GREATER THAN 0.1 cc REJECT Q = 5×10^{-6}

at 0.3, 0.4, and 0.5 torr with no effect on the results. The data is shown in Table VIII and will be discussed for each package type under test results.

The following describes the procedure used for Phase III. The equation

$$Q_s = \frac{R}{SKT\bar{P}t} \quad (2)$$

was solved for each package type assuming Q_s equal to 1×10^{-8} and R equal to 1200 and 600 counts per minute. The time T was selected in tenths of an hour as this is controlled by the design of the equipment. \bar{P} was calculated so that the pressure applied to the units would not exceed 100 psia. The specific activity S of the gas was determined by comparing a sealed sample gas source supplied by the Atomic Energy Commission with an activity of $24.5 \mu\text{curies/cc}$ and corrected for its decay rate by using the following formula.

$$A = A_0 e^{-\frac{0.693 t}{T_{1/2}}} \quad (5)$$

where

A = activity now

A_0 = the original activity on the given date

$e =$ the natural log of 2

$t =$ the elapsed time between the original measurement and now

$T^{1/2} =$ the half-life of the isotope

This value was calculated to be $10.54 \mu\text{curies/cc}$ and read $22,000 \text{ cts/min}$. A sample of gas was then taken from the system. This sample volume was 0.05 cc and measured with a pipette mercury assembly. The specific activity was then calculated by the equation

$$S \mu\text{curies/atm cc} = \frac{\frac{R_1 \text{ cts/min System Sample}}{V_{\text{cc}} P \text{ atm}}}{\frac{R_2 \text{ cts/min Std}}{A \mu\text{curies}}} \quad (6)$$

This equation will give a ratio of the cts/min to $\mu\text{curies/cc}$ of the system sample compared to the standard as shown.

$$\frac{R_1 \text{ cts/min}}{S \mu\text{curies/cc}} = \frac{R_2 \text{ cts/min}}{A \mu\text{curies/cc}} \quad (7)$$

Knowing R_2 , A and measuring R_1 , S can be calculated for a true value although the counting efficiency of the system is much less than one. The specific activity of the system was calculated as $10 \mu\text{curies/cc}$ with a $6.2 \times 10^4 \text{ cts/min}$ for a 0.05 cc volume. Calculating the cts/min for this volume with a concentration of $600 \mu\text{curies/cc}$, the reading should be $6.5 \times 10^7 \text{ cts/min}$. This reading is off by a factor of 1.06×10^3 due to the counting efficiency of the system. This is compensated for by determining a K factor for each package type as the material and geometrical configuration will affect the counting efficiency. The K factor was determined by drilling a small hole in six devices of each package type and attaching a small copper tube so that a known amount of gas could be placed inside the device. The device was connected to the pipette mercury assembly and 0.02 cc of gas placed inside the device. The copper tube was then pinched closed at the device and the cts/min read. Six devices of each package type were read and an average reading calculated. The K factor for the device was then calculated by the equation

$$K \text{ cts/min } \mu\text{curies} = \frac{R \text{ cts/min}}{S \mu\text{curies/atm cc } P \text{ atm } V_{\text{cc}}} \quad (8)$$

This can be reduced to the following

$$K \text{ cts/min } \mu\text{curies} = \frac{R \text{ cts/min}}{C \mu\text{curies}} \quad (9)$$

where $C \mu\text{curies}$ is equal to the activity of the gas inside the unit. This is a product of the volume of gas times the specific activity of the gas. Now if the cts/min for a given volume of gas contained inside a given package type was calculated, it would produce

$$R = V_{cc} s k \quad (10)$$

with V_{cc} equal to the volume of gas. This approach allows for a system-type calibration on each package type being tested. Based upon the test results of this study, the radioactive-tracer-gas test method will detect leakers within the leak range limits of each package with a high degree of accuracy. The leak range limits of each package will be discussed in the test section of this report.

As with Condition A, the repeatability of the procedure is dependent on the leak rates being within the sensitivity range for the devices being tested volume. Table X shows the percentage of fine leakers of each case type which exhibited repeatable readings throughout the four test runs and also the percentage of the total sample, fine and gross, which had repeatable readings.

Table X. Test Condition B Repeatability

Package	Percent Fine-Leak Range Only	Percent Including Gross Leakers
TO-84	98	97
C-PAK	30	65
C-DIP	92	92
MOS	95	95
TO-100	97	97
1 X 1 Ceramic	97	93
TO-3	97	98

SECTION V

TEST RESULTS OF CONDITIONS A AND B

Phases III and IV test results show that each package size must be handled individually, as any general statement would not hold true for all packages. Results are based on the reject limits of 5×10^{-7} for volumes greater than 0.1 cc. For both methods to have a common baseline, the results are based upon L, a calculated leak rate for Condition A and upon Q, a calculated value for Condition B. The R value was determined by drawing a horizontal line on the graph starting at $L = 5 \times 10^{-7}$ or 5×10^{-6} as applicable and rejecting all values above the line (Figures 48-51). The results show that for the units with a volume less than 0.04 cc there was not an overlap between Test Conditions A and B and Test Condition C. The gap between the test conditions could be closed in most cases by lowering the reject value for the device. Test Condition A has a slightly broader detection range than Condition B. The total test time for Condition B is much less than Condition A due to the bomb times required. The accuracy of both Condition A and Condition B depend upon the strict adherence to exact bomb pressures, dwell time, and time to readout. The sensitivity of the test conditions and the number of rejects detected using current MIL-STD-883 conditions are based upon single test runs with the results displayed in Table XI. The result of performing the tests using the three reject criteria of MIL-STD-883 is displayed in Table XII.

Table XI shows that the results of the test are dependent upon the test condition used and the reject criteria of that condition. If the same Condition A, L value and Condition B, Q value are

Table XI. Comparison of Rejects Detected by Test Condition A
and Test Condition B, using a Common Baseline
Q and $L > 5 \times 10^{-7}$ for volume ≤ 0.1 cc
Q and $L > 5 \times 10^{-6}$ for volume > 0.1 cc

Device Type	Rejects Detected	
	Condition A 60/1 Table III	Condition B
TO-84	14	20
C-PAK	51	53
C-DIP	40	30
MOS	19	21
TO-100	60	44
1 X 1 Ceramic	7	6
TO-3	32	29
Large Glass	21	15
Small Glass	9	5

**Table XII. Rejects per Failure Criteria of MIL-STD-883,
Condition A and Condition B**

Device Type	R	L	Q
TO-84	16	14	34
C-PAK	62	51	75
C-DIP	54	40	45
MOS	21	19	33
TO-100	67	42	64
1 X 1 Ceramic	26	7	8
TO-3	41	32	75
Large Glass	31	21	32
Small Glass	17	9	14

used, the results will be similar on those devices within the detection range as shown in Table XI. Test Condition A has a slightly broader detection range for some package types than does Condition B. This is pointed out by the escape rate percentage for each package (Table XIII).

The overkill and escape percentages are based on four test runs performed on each device. The overkill percentage is based on the number of times the test condition called a device in the 10^{-7} or smaller range a gross leaker, with a gross leaker being defined as a device having a leak rate of 1×10^{-6} or greater. The escape percentage is based upon the condition not detecting a leaker in a specific range. The leak rate of the escaping devices was known from the gross leak data. This data is displayed in Table XIII.

1. SENSITIVITY OF TEST CONDITIONS A AND B

A. TO-84 Package (0.006 cc Internal Volume)

The TO-84 was the smallest volume package tested. It can be seen from the graphs (Figures 3-7) that if the 5×10^{-7} L value is used as a reject point, the sensitive range of the test is from 5×10^{-7} to 2×10^{-6} . If the R value of 5×10^{-8} is used with 1-hour bomb time at 60 psig, the sensitive range is extended to include from 6×10^{-8} to approximately 3×10^{-6} . These ranges are verified by the fact that 92% of the devices known to have leak rates larger than 1×10^{-5} were not detected by Condition A. Test Condition B data indicate that it has slightly less range than Condition A towards the gross end. Eight-nine percent of the devices known to have leak rates larger than 1×10^{-5} were not detected, which is not significantly different from Condition A. However, 33% of the devices having leak rates of 10^{-6} escaped; whereas 4% of this group escaped on the Condition A test. The 10^{-6} group escape rate is reduced to 17% if a reject point of 5×10^{-8} (current limit) is used and to zero if a 1×10^{-8} limit is used.

Table XIII. Test Conditions A and B, Overkill and Escape Rates
 When L and Q = 5×10^{-7} on Volumes of < 0.1 cc
 and 5×10^{-6} on Volumes > 0.1 cc

Package Volume (cc)	TO-84		C-PAK		C-DIP		MOS DIP		TO-100		1 X 1 Ceramic		TO-3	
	0.006		0.012		0.014		0.041		0.086		0.41		1.07	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B
Overkill %/Range <10 ⁻⁶	1	2.5	5	7.5	3.3	2.4	1	0	1.4	2.3	-	-	11	17
Escape %/Range 10 ⁻⁶	4	33	41	61	15	46	0	43	2.2	24	86	98	43	53
10 ⁻⁵	92	89	42	53	-	-	46	50	2.8	22	50	100	32	33
10 ⁻⁴	-	-	55	43	68	80	55	56	1.7	3.5	25	100	5	5
10 ⁻³	-	-	-	-	-	-	-	-	0	0	45	93	0	0
10 ⁻²	-	-	-	-	-	-	-	-	-	-	37	89	14	28

The overkill on Condition A was 1% and on Condition B 2.5% with an overkill being defined as a fine leaker which is classified as a gross leaker by the test condition.

There is not an effective overlap of either Condition A or Condition B with gross leak test conditions for packages of this volume.

B. C-PAK (0.012 cc Internal Volume)

The graphs (Figures 8-12) which result from the solution of the Test Condition A formula indicate that if a 5×10^{-7} L value is used, the sensitive range extends to 5×10^{-6} . If the 5×10^{-8} R value is used with a 1-hour bomb at 60 psig, the range is 9×10^{-8} to 9×10^{-6} . The data tend to support these ranges with the 42% escape rate of devices known to be in the 10^{-6} range. However, the escape rates in the 10^{-5} (42%) and 10^{-4} (55%) points out that Condition A does have some sensitivity beyond the point indicated by the graphs on packages of this volume. Time from release of pressure to read this sensitivity into the gross range is a function of (t_2) and in a practical sense cannot be utilized to replace a gross leak test. The Test Condition B data indicate that the sensitivity range is essentially the same as that of Condition A. The escape rates in the 10^{-6} and 10^{-5} ranges were slightly higher, 61 and 53% respectively, but the escape rate in the 10^{-4} group was lower, 43%. The escape rate in the 10^{-6} group is reduced to 37%, comparable with Condition A, if a 5×10^{-8} limit is used.

The overkill rates were higher (5% on Condition A and 7.5% on Condition B) than on the metal can TO-84 devices. Because of the makeup of the population being tested, that is the majority of the devices being leakers of some magnitude, these overkill rates may be higher than would be encountered in a population having a normal distribution.

As indicated by the escape rates in the gross ranges (10^{-5} and 10^{-4}), there is an overlap but it must be defined as helpful but not dependable in terms of removing these gross leakers.

C. C-DIP (0.014 cc Internal Volume)

Figures 13-17 show that at an L value of 5×10^{-7} , the sensitivity range extends to 6×10^{-6} and at an R value of 5×10^{-8} using standard bomb conditions, the range is from 9×10^{-8} to 1×10^{-5} . An analysis of the data indicates that the range is slightly less than indicated since 15% of the devices having leak rates in the 10^{-6} range escaped using the 5×10^{-7} L value and 6% of this group escaped using the 5×10^{-8} R value. However, some of the leakers in the 10^{-4} group were detected by the method which, as with the C-PAK, indicates that t_2 is a critical factor in detecting gross leakers by Condition A. The sensitivity range of Condition B is apparently slightly less than that of Condition A since 46% of the devices in the 10^{-6} group escaped detection using

the 5×10^{-7} limit. However, if the current 5×10^{-8} Q limit is used, the escape rate in the 10^{-6} group is reduced to 3%.

The overkill rates were 3.3 and 2.4% respectively for Conditions A and B using the 5×10^{-7} limit in both cases. Some slight increase is noted if the limits are lowered, but as pointed out earlier, these are not normal distributions.

Based on the fact that some escapes do occur in the 10^{-6} range with the conditions, an overlap with the bubble gross methods does not exist but the fine and gross methods do meet if the proper limits are chosen for the fine leak tests.

D. MOS DIP (0.041 cc Internal Volume)

Figures 18-22 show that at an L value of 5×10^{-7} , the sensitivity range extends to 2.5×10^{-5} and that if an R value of 5×10^{-8} is used at standard bomb conditions (1 hour at 60 psig), this range is extended from 1.7×10^{-7} to 3.7×10^{-5} . The data verifies this because all of the devices in the 10^{-6} group were detected as leakers and the escape rate in the 10^{-5} group was 46%. If the 5×10^{-7} limit is used for Condition B, the sensitivity is reduced significantly because with this limit the 10^{-6} group had an escape rate of 43%, although the escape rate in the 10^{-5} was 50%, about the same as Condition A. If the current Condition B limit of 5×10^{-8} is used, the escape rate in the 10^{-6} group is 11%, again indicating that Condition B is slightly less sensitive than Condition A on a package of this volume.

The overkill rates on this package were 1% on Condition A and zero on Condition B.

There is an overlap with gross leak methods with this volume as indicated by approximately 50% of the devices in the 10^{-5} range being detected on both of the test conditions.

E. TO-100 (0.086 cc Internal Volume)

Figures 23-27 show that with the 5×10^{-7} L limit, the sensitivity extends to 7×10^{-5} and with the 5×10^{-8} limit at standard conditions the range is from 2×10^{-7} to 9×10^{-5} . The data indicates that this range is covered since the escape rates were 2% in the 10^{-6} group and 3% in the 10^{-5} group when the 5×10^{-7} L limit was used. Only 2% of the devices in the 10^{-4} group escaped which indicates that with a short t_2 time many gross leakers will be detected when Condition A is used. With the 5×10^{-7} baseline limit, the sensitivity of Condition B was significantly less than that of Condition A since 24% of the 10^{-6} group and 22% of the 10^{-5} group escaped. However if the 5×10^{-8} MIL-STD-883 limit is used these escape rates are reduced to zero

and 3% respectively. The escape rate in the 10^{-4} group was 3.5% with either of the limits which indicates good extension into this range.

The overkill factors were 1.4% for Condition A and 2.3% for Condition B which are about the same as experienced with other packages.

There is a good overlap with the gross leak conditions provided the proper fine leak reject limits are used. This is pointed out by the low escape rates in the 10^{-5} and 10^{-4} groups.

F. Ceramic Package (0.45 cc Internal Volume)

Figures 28-32 show that if the 5×10^{-6} L value is used, the sensitivity extends to 4×10^{-4} , and that if the 5×10^{-7} R value is used, the sensitivity range is from 2×10^{-6} to 5×10^{-4} at standard bomb conditions. The data failed to verify these sensitivity ranges. Escape rates ranged from 86% in the 10^{-6} group to 25% in the 10^{-4} group with 10^{-5} , 10^{-3} , and 10^{-2} groups falling between these extremes when the 5×10^{-6} L reject value was used. However if an L value of 1×10^{-6} is used, the escape rate drops to 1.4% in the 10^{-6} group to zero in all other groups including 10^{-2} . If the L value is further reduced to 7×10^{-7} , no escapes occur.

The sensitivity of Condition B was poor on this package because of the high surface count rate. Table XIV shows that the surface absorption causes indications of leaks in the 10^{-7} range through the first hour after removal from the bomb. This sorption on the actual devices varied over a wide range and by the time desorption occurred, the internal tracer gas level was reduced to a point

Table XIV. Surface Absorption on 1 X 1 Ceramic Lids with Epoxy Sealant (All Data $\times 10^{-8}$ atm cc/sec)

Epoxy	Time to Read After Conditioning (Minutes)				
	1-5	30-35	60-65	90-95	120-125
A	40.0	20.0	10.0	4.0	2.0
A	40.0	19.0	9.0	3.0	1.0
A	39.0	19.0	9.0	3.0	1.0
D	38.0	18.0	9.0	3.0	1.4
D	40.0	20.0	9.0	2.5	1.0
D	41.0	20.0	9.0	3.0	1.2

A = Ablestick

D = Duraseal

which allowed the escapes. The situation is further complicated by some percentage of the beta particles apparently having sufficient energy to penetrate the ceramic. This part of the count cannot be differentiated from surface count.

There were no devices in this group in the fine-leak range so an overkill factor could not be established.

Test Condition A overlaps through the 10^{-2} range but the escape rates on Condition B require that the gross range be fully tested by other methods if Condition B is used.

G. TO-3 (1.07 cc Internal Volume)

Figures 33-37 show that if the L value of 5×10^{-6} is used, the sensitivity extends to 9×10^{-4} and that if the 5×10^{-7} R value is used, the range is from 2×10^{-6} to 1×10^{-3} . As with the large ceramic package, the data did not verify this range. The escape rate was 32% in the 10^{-5} group using the limits stated above. Escape rates in the 10^{-4} , 10^{-3} , and 10^{-2} groups were 5, 0, and 14% respectively. The escape rate is reduced to zero in the 10^{-5} group and 10% in the 10^{-4} group if the L limit is reduced to 5×10^{-7} .

The sensitivity range of Condition B was essentially the same as that of Condition A if the same baseline limit of 5×10^{-6} was used. The escape rate was 33% in the 10^{-6} group, 5% at 10^{-4} , zero at 10^{-3} and 28% in the 10^{-2} group. These escape rates are reduced to 11% in the 10^{-5} group and to zero in the 10^{-4} and 10^{-3} groups if the current specification limit of 5×10^{-8} is used.

Overkill rates were unacceptably high on this package, 11% on Condition A and 17% on Condition B. Further analysis of this test group indicated that the problem was caused by voiding in the weld flange area on the devices and not by the test conditions themselves.

The overlap with gross leak test conditions is good extending through the 10^{-3} range and well into the 10^{-2} range provided the proper fine-leak limits are used.

Maximum sensitivity in terms of extending Conditions A and B into the gross leak ranges is shown in Table XV. It requires that all Condition A limits be lowered and that Condition B limits for packages having internal volumes of less than 0.01 cc be lowered.

Table XV. Test Condition Limits Required to Achieve Minimum Escape Rates

Package Volume (cc) Test Condition	TO-84 0.006		C-PAK 0.012		C-DIP 0.014		MOS DIP 0.041		TO-100 0.086		1 X 1 Ceramic 0.45		TO-3 1.07	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B
	Limit (L or Q) X 10 ⁻⁸ atm cc/s	5	1	10	5	10	5	10	5	10	5	100	5	100
Escape %/Range	4	0	35	37	6	3	0	11	0	0	1	54	18	7
10 ⁻⁶	16	81	41	20	-	-	29	50	0	3	0	0	25	11
10 ⁻⁵	-	-	51	28	50	65	11	55	0	4	0	50	5	0
10 ⁻⁴	-	-	-	-	-	-	-	-	-	-	0	0	0	0
10 ⁻³	-	-	-	-	-	-	-	-	-	-	0	53	0	0
10 ⁻²	-	-	-	-	-	-	-	-	-	-	0	44	0	11

2. CONDITION A REPEATABILITY (TABLE V)

A. TO-84

Ninety-four percent of these devices read in the same leak rate decade on all four of the data runs. One of these failing to repeat was in the 10^{-5} range, four were in the 10^{-6} range, and only one in the $<10^{-6}$ range. Even though these readings failed to repeat, the device in the 10^{-5} range and three of those in the 10^{-6} range would have been rejected on all four of the test runs.

B. C-PAK

Overall repeatability on this ceramic package was very poor, only 26% of the devices had consistent readings on all four data runs. On the devices which had leak rates of $<10^{-6}$, however, the readings did repeat on 70% of the devices. The devices in this $<10^{-6}$ group which failed to repeat were called gross leakers on one of the tests and in the case of one device, two of the tests.

C. C-DIP

Overall repeatability on this package was 64% with a 71% repeatability on those devices having leak rates of $<10^{-6}$. As with the C-PAK, the cause of nonrepeatability in the fine-leak range was due to the devices being called gross leakers on one or more of the test runs.

D. MOS DIP

Eighty-nine percent of the devices in this group had readings which repeated on all four of the test runs. Eighty-seven percent of the devices in the $<10^{-6}$ range had readings which would have consistently rejected or accepted them to a 5×10^{-8} R criteria.

E. TO-100

Ninety-three percent of these devices had repeating readings in each of the test runs. All of the devices which failed to repeat were called rejects on one or more of the test runs.

F. 1 X 1 Ceramic

Fifty-six percent of the devices in this group had readings which could be termed repeatable. This seems low, but it must be pointed out that all the devices in this group had leak rates of 10^{-6} or greater. If one considers only those devices with leak rates of $<10^{-3}$, then 70% of the readings were repeatable and if the population is further reduced to include only those devices with leak

rates of $<10^{-4}$, 72% of the readings are repeatable. Eighty percent of devices in the 10^{-6} range had consistent readings in all four of the test runs.

G. TO-3

Eighty-five percent of this group had repeatable readings on all four of the test runs. Twenty-seven percent of those failing to repeat had leaks of 10^{-4} or larger and the rest were in the 10^{-6} range.

3. CONDITION B REPEATABILITY (TABLE X)

A. TO-84

Ninety-seven percent of the devices had readings which repeated on all four of the test runs. Those which failed to repeat with one exception were in the 10^{-5} range. More than 98% of the devices with leak rates of $\leq 10^{-6}$ had repeatable readings on all runs.

B. C-PAK

Sixty-five percent of these devices had readings which repeated in all four test runs. Sixty percent of the devices having leak rates $\leq 10^{-6}$ repeated each time; however, only 10% of those not repeating were in the $<10^{-6}$ range.

C. C-DIP

Ninety-two percent had repeated readings in the four test runs. Those which failed to repeat were in the 10^{-5} and 10^{-6} ranges with some of the test runs classifying them as rejects and others as good devices to the present 5×10^{-8} specification limit.

D. MOS DIP

Ninety-six percent of the devices in this group had repeatable readings through the four test runs. Those which were nonrepeating were devices which shifted between the 10^{-8} and 10^{-7} ranges. If only the devices in the $\leq 10^{-6}$ range are considered, 95% had repeatable readings

E. TO-100

Ninety-seven percent of these devices had readings which repeated on all four test runs. Those not repeating were in the 10^{-6} range and were not detected as leakers on one or more of the test runs. The 97% is also true if only the devices in the $\leq 10^{-6}$ range are considered.

F. 1 X 1 Ceramic

Ninety-three percent of these devices had repeatable readings and with the exception of one device, the nonrepeaters were in the 10^{-2} , 10^{-3} , and 10^{-4} ranges. If only the 10^{-6} range is considered, 97% of the devices had repeatable readings.

G. TO-3

Ninety-eight percent of the devices had readings which repeated on all four test runs. Both of those not repeating were in the 10^{-6} range and were read in the 10^{-8} range on two of the four test runs. In the $\leq 10^{-6}$ range, the readings were 97% repeatable.

SECTION VI

SURFACE ABSORPTION

This phase of the study was conducted with 25 C-DIP lids, 30 1 X 1 ceramic lids, CV98 sealing glass, and Ableseal and Duraseal sealing compounds. The C-DIP and 1 X 1 packages will be discussed separately.

The 25 C-DIP lids were subjected to a 60 psig, 4-hour bomb in helium. Five each of the lids were read at intervals of 1, 30, 60, 90, and 120 minutes. Readings in each case were completed within 5 minutes. This procedure was used to negate the effect of previous vacuum cycles on the lids. The readings progressed downward from a maximum of 2.8×10^{-8} at 1 minute to 3×10^{-9} at 30 minutes to 3×10^{-9} at 60 minutes to 5×10^{-10} at 90 minutes to zero at 120 minutes. This indicates that surface sorption would be a problem only on marginal devices read immediately after removal from bomb if a limit of $<5 \times 10^{-8}$ was being used.

This procedure was repeated with krypton-85 using a bomb time and pressure equivalent to a test with a 1×10^{-8} limit on a package of this volume. All 25 of the lids read zero at >1 minute so no further readings were taken. The vacuum cycle inherent in the Radiflo systems for storage of the krypton-85 evidently removes all gas which has been absorbed by the ceramic.

The C-DIP lids were then cured with the sealing glass by processing through a furnace at normal sealing temperatures. The lids were then rebombed at the same conditions used previously. There was not a significant change in the values. The maximum readings were: 3×10^{-8} at 1 minute, 4×10^{-9} at 30 minutes, 2×10^{-9} at 60 minutes, 5×10^{-10} at 90 minutes, and zero at 120 minutes.

The lids were then resubjected to the radioisotope test with significantly different results. The maximum readings were: 7.8×10^{-8} at 1 minute, 7×10^{-8} at 30 minutes, 5.8×10^{-8} at 60 minutes, 5.5×10^{-8} at 90 minutes, and 5.1×10^{-8} at 120 minutes. There were also lids that read zero and 1×10^{-8} at one minute, this led to an examination of the lids which showed seal glass voiding to be more pronounced in some than in others.

For the C-DIP package, it can be concluded that surface sorption is not a problem during helium testing if the test limit being used is in the 10^{-7} range but that it could result in overkill if the limit were less than 5×10^{-8} . The sorption resulting from voids in the sealing glass can result in overkill of this package at the normal 5×10^{-8} radioisotope limit.

Twenty-five of the 1 X 1 ceramic lids were subjected to the same initial procedures as were the C-DIP lids. The maximum readings after helium bomb were: 8×10^{-8} at 1 minute, 2.7×10^{-8} at 30 minutes, 2.2×10^{-8} at 60 minutes, 1.5×10^{-8} at 90 minutes, and 8×10^{-9} at 120 minutes. This indicates that the surface sorption would be a factor at limits of 1×10^{-7} or less. The lids all read zero after subjection to the radioisotope test. As with the C-DIP, this can be attributed to the vacuum portion of the Radiflo store cycle.

The lids were then divided into two groups with Ableseal strips being cured onto one group and Duraseal onto the other group. After subjection to the same helium bomb conditions, the maximum readings in the Ableseal group were: 2.1×10^{-6} at 1 minute, 1.2×10^{-6} at 30 minutes, 6.2×10^{-7} at 60 minutes, 4.5×10^{-7} at 90 minutes, and 2.5×10^{-7} at 120 minutes. In the Duraseal group the maximums were: 3.5×10^{-7} at 1 minute, 6.2×10^{-8} at 30 minutes, 3.5×10^{-7} at 60 minutes, 2.5×10^{-8} at 90 minutes, and 1.5×10^{-8} at 120 minutes. Similar results were obtained on the radioisotope test. The maximum readings in the Ableseal group were: 4×10^{-7} at 1 minute, 2×10^{-7} at 30 minutes, 1×10^{-7} at 60 minutes, 4×10^{-8} at 90 minutes, and 2×10^{-8} at 120 minutes. In the Duraseal group the maximums were: 4.1×10^{-7} at 1 minute, 2×10^{-7} at 30 minutes, 9×10^{-8} at 60 minutes, 3×10^{-8} at 90 minutes, and 1.4×10^{-8} at 120 minutes. Voids in the sealant contributed to these values.

These results point out that each ceramic and sealing system must be evaluated to determine what the absorption problems are. Appropriate wait times must be established from out-of-bomb to read but must be kept within limits which will allow detection of the actual hermetic seal failures. It is apparent from this data that high overkill and/or escape rates can occur with large ceramic packages unless these absorption factors are considered.

The total data, C-DIP and large ceramic, also point out that no general rule can be applied and that each package having a different type of ceramic and/or different sealing material must be evaluated prior to starting a test program on the package.

SECTION VII

TEMPERATURE PRECONDITIONING

This phase of the study was conducted using the TO-100 and C-DIP units. The test was conducted by installing a heater inside a helium pressure bomb and maintaining temperatures of 50°C, 75°C, 100°C, and 125°C while bombing the units at 60 psig for 1 hour. Upon completion of the hour bombing, the units were tested while maintaining the specified temperature until time of reading. The units were then placed into a large brass fixture and heated to 75°C, 100°C, and 125°C. The units still in the fixture and at temperature were then subjected to a radioisotope test.

The test results are shown in Figure 56. The ceramic devices exhibited the same characteristics in both helium and krypton. That is, the devices characterized towards the gross end of the range at 25°C moved towards the finer end of the leak range at increased temperature. Devices which indicated leaks in the 10^{-6} and 10^{-7} atm cc/s range moved toward or into the 10^{-8} range. The metal can device leak rates tended to spread in helium as the temperature was increased, moving from the 10^{-6} and 10^{-7} range toward the 10^{-8} and 10^{-5} ranges. At 125°C the population showed a strong tendency to move back toward the fine end of the range. The same spreading occurred in krypton at 75°C as with the helium but further increases in temperature shifted the population toward the gross end of the range, resulting in significantly different distributions at 125°C.

The resulting conclusion is that temperature preconditioning does not improve the sensitivity of either of the fine leak test conditions. In fact, it adds a variable which would allow unacceptable ceramic devices to be accepted and causes some metal devices which are acceptable at room temperature to be rejected and others which should be rejected to be accepted. Because of these factors, temperature conditioning and/or testing is not recommended for microcircuit seal testing.

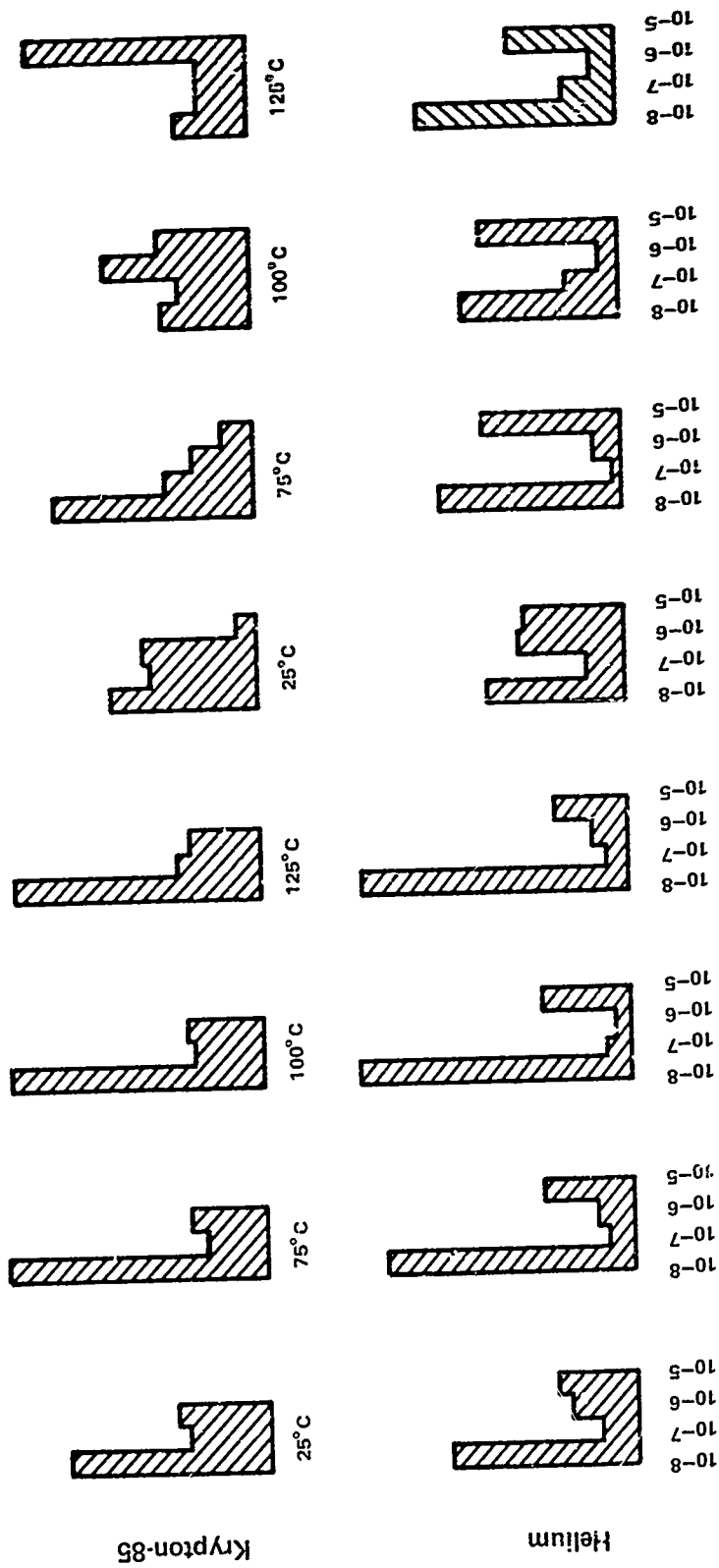


Figure 56. Temperature and Leak Rates

SECTION VIII

GETTERING EVALUATION

This phase of the study was conducted to determine the feasibility of using encapsulated in or bombed in gettering materials to detect gross leakers by either the helium or radioisotope fine-leak conditions. Polyimide, FC-48 fluorocarbon, PP-9 fluorocarbon, and vacuum pump oil were evaluated as gettering agents. The package types used were the TO-84, the C-PAK, and the MOS DIP. The evaluation of the fluorocarbons utilized 100 devices of each package type. The polyimide evaluation was conducted on 100 C-PAK devices and the vacuum oil evaluation was conducted with ten MOS DIP packages. Small volume packages were used because normal Condition A and B escape rates in the gross range are much higher than with relatively large volume packages.

The C-PAK devices containing polyimide were rejects from a special process line. They were screened and categorized by the procedures described in the discussion of Screening and Fabricating Leakers. The leak rate categories of the devices are shown in Table I. The devices were tested at the standard conditions of Conditions A (helium) and B (radioisotope).

The helium results are shown in Table XVI. There was a noted improvement in terms of escape rate in the 10^{-6} and 10^{-5} ranges over those devices which did not contain polyimide. The escape rate in the 10^{-6} group was 6% where it was 41% in the ungettered group. In the 10^{-5} group, the devices containing the polyimide had an escape rate of 33% and the ungettered group had an escape rate of 42%. There was also a marked change in overkill rates however. The nongettered group had a 5% overkill rate, this increased to 18% with the use of the polyimide.

Table XVI. Overkill and Escape Rates
with Getters Using Helium

	Polyimide	FC-48	PP-9
Overkill %/Range < 10^{-6}	18	0	0
Escape %/Range 10^{-6}	6	91	100
10^{-5}	33	88	100
10^{-4}	100	100	85
10^{-3}	100	—	—

The radioisotope results are shown in Table XVII. The improvement in escape rate in the 10^{-6} range was very significant. The escape rate in the 10^{-6} range was zero as compared to 37% in the ungettered devices. In the 10^{-5} group, the escape rates were 17% for the gettered devices and 20% for the ungettered ones. The overkill rate in the gettered group was 2%.

Table XVII. Overkill and Escape Rates with Getters Using Krypton-85

	Polyimide	FC-48	PP-9
Ovt. kill %/Range < 10^{-6}	2	10	2
Escape %/Range			
10^{-6}	0	48	36
10^{-5}	17	54	67
10^{-4}	100	22	30
10^{-3}	96	—	—

The TO-84, C-PAK and MOS DIP devices which were used to evaluate the fluorocarbons are the same ones used in other phases of the investigation. Their leak rate values are shown in Table I. They were processed in the following manner.

The devices were placed in a pressure vessel and the pressure reduced to 1 torr, this condition was maintained for 1 hour. The fluorocarbon which had been preconditioned by bubbling helium through it was then introduced into the vessel without breaking the vacuum. It was pressured to 60 psig with helium and this condition was maintained for a period of 2 hours. Each unit was allowed to air dry for a period of 2 minutes prior to testing to allow the fluorocarbon on the external surfaces to evaporate.

Results were negative in that the escape rates were much higher in the gross ranges than when no gettering was used. In the 10^{-6} range, the escape rates were 91% with FC-48, 100% with PP-9, and 41% with no getter. This was caused by fluorocarbon vaporization during the initial pump-down of the mass spectrometer which resulted in excessively long pump-down times being required for the machine to reach test vacuum levels. With the MS-90 UFT system, this results in all devices being classified as gross leakers.

After a 16-hour vacuum bake which was also used between each FC-48 and PP-9 test run, the devices were subjected to the radioisotope test. The devices were baked at 100°C for 1 hour and immediately immersed in the fluorocarbon when removed. After 30 minutes in the fluorocarbon, they were removed, allowed to air dry for 2 minutes, then bombed in krypton-85 at the 1×10^{-8}

conditions for each package. The escape rates were not improved over the no gettering process; in the 10^{-6} group, the escape rate was 48% with FC-48, 36% with PP-9, and 37% with no gettering.

The MOS DIP devices, which had been specially prepared by drilling a hole in each lid, were used to evaluate the vacuum pump oil. This was done to prevent the test samples used for the other phases from possibly being contaminated rendering them unusable for further testing. The devices were baked at 100°C for a period of 1 hour and immersed in the vacuum pump oil. After 30 minutes they were removed and the external oil removed with freon. The devices were then bombed with krypton-85 at conditions equivalent to 1×10^{-8} Condition B test. All of the devices were detected as leakers when they were read after removal from the bomb.

It was noted that oil had leaked out of some of the devices contaminating the surface of other devices. In a normal distribution of devices this might result in overkill but could be prevented by proper holding fixtures for use in the pressure vessel.

None of the gettering agents proved to be feasible from a production standpoint. The fluorocarbons were ineffective, the polyimide allowed all or most leakers in the 10^{-4} and 10^{-3} ranges to escape, and the vacuum pump oil process is not cost-effective because of the clean-up procedures required to assure that all oil is removed from the external surfaces prior to exposure to the tracer gas.

The data indicate however that an agent which could be encapsulated into the device and which had better gettering characteristics than the polyimide would work. The polyimide significantly reduced the escape rates in the 10^{-6} range; therefore it is reasonable to assume that a material which would absorb better would improve the escape rates in larger leak rate ranges. The data also indicate that a material which had the gettering characteristics of the vacuum pump oil and which could be removed from the external surfaces by an inexpensive process could be successfully used to detect gross leakers with the fine leak test conditions.

SECTION IX

CONTROLLED ORIFICE EVALUATION

This phase of the study was devoted to an evaluation of using a mass spectrometer to detect gross leaks by using an orifice at the input to limit the flow of tracer gas into the machine. It was assumed that if a constant pressure, having a magnitude that would allow the spectrometer to remain in the "Test" mode, could be maintained, that gross leakers could be detected. This would be accomplished by constantly monitoring the gas flowing out of the device through the orifice from the time the device was inserted in the fixture rather than having to wait until the fixture cavity was pumped down after insertion. This delay to pump down the fixture is believed to contribute to gross leaker escapes by allowing the helium concentration in the device to reach a nondetectable level before the machine reaches test pressures.

A special test fixture having two ports was fabricated for this evaluation. One of the ports was connected to the intake manifold of the mass spectrometer through a Veeco type VV-50 adjustable leak valve which was used as the orifice. The other port was connected to the manifold of the mass spectrometer through a Hoke valve. This arrangement is shown in block form in Figure 57.

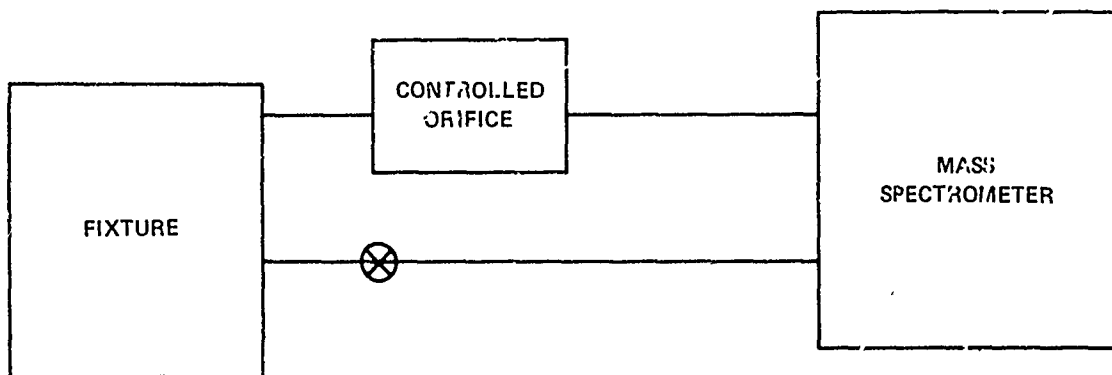


Figure 57. Block Diagram of Controlled Orifice Test Setup

The test sequence used was to bomb the device in helium, insert it in the fixture immediately upon removal from the bomb, read the device through the orifice (Hoke valve closed), and if no indication of a gross leak occurred, then read through the no-orifice line. The devices were left connected through the orifice for a period of 1 minute and were classified as gross leakers if the reading increased one major scale division within the period. For example, if the reading was 5×10^{-8} at time zero, the device was rejected if the reading increased to 6×10^{-8} during the 1-minute period.

Three metal can package types were used for this evaluation, the TO-84, the TO-100, and the TO-3, in order to cover a large internal volume range. The TO-84s were subjected to three test runs and the other packages to one test each, making a total of 500 test samples. All devices were bombed at 60 psig in helium, the TO-84s for 2 hours, and the larger packages for 1 hour.

The results are shown in Table XVIII. The method did detect some of the TO-84 gross leakers which had been missed when the orifice was not used, however the escape rate was still 38%. The test was less effective on the other packages yielding larger escape rates than had occurred without the orifice being used. The overkill rates were very high, 9% on the TO-84, 51% on the TO-100 and 35% on the TO-3.

**Table XVIII. Overkill and Escape Rates Using
Controlled Orifice Helium Testing**

	TO-84	TO-100	TO-3
Overkill %/Range 10^{-6}	9	51	35
Escape %/Range >math>10^{-6}</math>	38	26	67

These facts, high escape rates, and high overkill rates coupled with the longer time required to test each unit led to the conclusion that controlled orifice testing would not provide any effectivity improvement for microcircuit seal testing.

SECTION X

INTRODUCTION TO GROSS LEAK TEST CONDITIONS C AND E

The object of this part of the study was to evaluate Test Condition C of MIL-STD-883, Method 1014, and the proposed weight gain test, Condition E. The units which were used in the evaluation of Test Conditions A and B were used for this study also. Prior to starting the study, all leak rate values were verified to ensure that the units had not plugged or opened-up in such a way as to give erroneous indications. The units were grouped and retained the original SN, although the L value may not have remained the same. The number of devices in each leak rate decade is shown in Table XIX. This study was conducted using the following fluorocarbons:

3M	Flutec
FC-40	PP-9
FC-78	PP-1
FC-77	PP-2

The purpose of using six fluorocarbons was to determine if there was an optimum fluid or combination of fluids for Condition C or Condition E. In order to perform the testing with a minimum probability of damage to the units, the following test sequence was followed:

1. C₁ bubble
2. Weight gain
3. C₂ bubble

**Table XIX. RADIC Microcircuit Leak Rate Values
(Condition C and E)**

TO-84		½ by ½ All Ceramic (C-PAK)		Ceramic Dual In-Line (C-DIP)		MOS Dual-In-Line (MOS DIP)	
Leak Rate	No. Units	Leak Rate	No. Units	Leak Rate	No. Units	Leak Rate	No. Units
<10 ⁻⁶	57	<10 ⁻⁶	10	<10 ⁻⁶	45	<10 ⁻⁶	60
10 ⁻⁶	6	10 ⁻⁶	47	10 ⁻⁶	18	10 ⁻⁶	14
>10 ⁻⁵	36	10 ⁻⁵	16	10 ⁻⁵	0	10 ⁻⁵	6
		>10 ⁻⁴	27	>10 ⁻⁴	14	>10 ⁻⁴	20
Total	96	Total	100	Total	77	Total	100
TO-100		Ceramic 1 Inch by 1 Inch		TO-3		Glass Standards	
Leak Rate	No. Units	Leak Rate	No. Units	Leak Rate	No. Units	Leak Rate	No. Units
<10 ⁻⁶	56	10 ⁻⁶	35	<10 ⁻⁶	45	<10 ⁻⁶	5
10 ⁻⁶	16	10 ⁻⁵	1	10 ⁻⁶	25	10 ⁻⁶	9
10 ⁻⁵	6	10 ⁻⁴	4	10 ⁻⁵	9	10 ⁻⁵	16
>10 ⁻⁴	1	10 ⁻³	15	10 ⁻⁴	10	>10 ⁻³	20
		10 ⁻²	16	10 ⁻³	3		
				10 ⁻²	8		
Total	79	Total	71	Total	100	Total	50

SECTION XI

EVALUATION OF TEST CONDITION C

This phase was performed in two parts, part one was the evaluation of Condition C₁ and part two the evaluation of Condition C₂. This phase was conducted using four different fluorocarbons.

3M	Flutec
FC-40	PP-9
FC-78	PP-1

C₁ evaluation was performed by subjecting each package to two test sequences using FC-40 and two test sequences using Flutec PP-9. The test was performed by immersing the uppermost portion of the unit to a minimum of two inches below the surface of the fluid. The fluid was maintained at a temperature of $125 \pm 5^\circ\text{C}$ during this test. The units were observed at a magnification of 3X and any unit which produced a stream of bubbles or a growing bubble was considered a reject. Surface bubbles or trapped nongrowing bubbles were not considered cause for rejection. The devices were observed against a dull, nonreflective black background for a period of 30 seconds in the center of a collimated light beam. Each unit was recorded as good or reject by serial number.

Each group of devices was tested two times in the FC-40 fluid and two times in the PP-9 fluid at the conditions described above. The results by package type are shown in Table XX. The C₁ test has been assumed to be sensitive from 10^{-3} through 10^{-1} leak sizes. Only two of the sample groups contained devices known to be in the 10^{-3} and 10^{-2} ranges. One other group, the glass standards, contained devices in the 10^{-3} range but none in the 10^{-2} decade. The data indicate that under ideal conditions (i.e., the glass standards with no weld flanges or seal interfaces) the method is sensitive in the 10^{-3} decade. No escapes occurred in this range on these devices. However, escapes did occur in both the 10^{-3} and 10^{-2} groups on the TO-3 and 1 X 1 ceramic packages. In the TO-3 package group, 33% of the devices in each decade escaped in either of the test fluids. The ceramic escape rates were significantly less, 3.3% and 6.5% with FC-40 and 6.6% and 0% with the PP-9.

The data also indicate that the test condition sensitivity extends into the 10^{-4} and 10^{-5} decades. For example, on the TO-84 package, the escape rates were 8.4% with FC-40 and 9.7% with PP-9 in the 10^{-5} decade. Similar observations can be made on each of the other package types (Table XX). The overkill rates (devices in the less than 1×10^{-5} leak size group which were rejected for bubbles) varied with the package type. These rates are higher on ceramic packages than

Table XX. C₁ Escape and Overkill Rates in FC-40 and PP-9

Package Fluid	TO-84		C-PAK		C-DIP		MOS DIP		TO-100		1 X 1 Ceramic		TO-3		Glass Standards	
	FC-40	PP-9	FC-40	PP-9	FC-40	PP-9	FC-40	PP-9	FC-40	PP-9	FC-40	PP-9	FC-40	PP-9	FC-40	PP-9
Overkill %/Range																
<10-5	11	4.8	18	31	11	14	13	20	2	10	41	67	45	34	5.5	0
Escape %/Range																
10-5	8.4	9.7	38	34	-	-	33	25	50	42	0	0	50	55	6.3	6.3
10-4	-	-	39	9	14	14	12	5	0	100	25	25	30	45	-	-
10-3	-	-	-	-	-	-	-	-	-	-	3.3	6.6	33	33	0	0
10-2	-	-	-	-	-	-	-	-	-	-	6.5	0	33	33	-	-

on metal packages with the exception of the TO-3 which had a large weld flange area from which bubbles emanated. For example, the overkill rates on the C-DIP were 11% in FC-40 and 14% in PP-9 versus 2% in FC-40 and 10% in PP-9 on the TG-100 package.

To determine whether or not there was a significant difference in the two fluids used, the data on all of the devices were compiled to determine overall escape and overkill rates. This is shown in Table XXI.

Table XXI. Comparison of FC-40 and PP-9 on Total Sample Population

	3M FC-40	Flutac PP-9
Overkill %/Range 10^{-5}	18	22
Escape %/Range 10^{-5}	21	21
10^{-4}	16	16
10^{-3}	8.4	11
10^{-2}	32	24

The overkill rate was 18% in the FC-40 and 22% in the PP-9. The escape rates are 21% in each fluid in the 10^{-5} range and 16% in each fluid in the 10^{-4} range. In the 10^{-3} group the escape rates were 8.4% in FC-40 and 11% in PP-9. In the 10^{-2} group the rates were 32% in FC-40 and 24% in PP-9 but the data base in this decade (24 devices) is too limited to draw a firm conclusion as to whether one fluid is better than the other in this range.

Repeatability, the ability to detect or accept specific devices in a leak range, was very poor. This is pointed out by the large overkill and escape percentage shown in Table XX. The ability of the test condition to detect a "bubble" or "no bubble" condition consistently when subjected to four test runs was poor. Table XXII shows the repeatability of the condition for the devices with leak rates $\geq 10^{-5}$ and the overall results even though the effectivity is very poor in the 10^{-4} and 10^{-3} ranges. The table shows that for the TO-84 and the C-DIP package the ability to produce consistent bubble or no bubble results is much better than the ability to detect all the units in a range. For example the overkill and escapes on the TO-84 in FC-40 was 11% and 8.4%, but the bubble, no bubble results were 96%. The C-DIP results showed 11% and 14% overkill and escape with a bubble no bubble result of 100% and 94%.

Table XXII. C₁ Gross Leak Repeatability

Package	>10 ⁻⁵ (%)	Overall (%)
TO-8:	95	92
CPAK	54	49
C-DIP	100	83
MOS DIP	20	69
TO-180	94	78
1 X 1 Ceramic	25	52
TO-3	35	40
Glass	54	51

The data resulting from these tests indicate there is not a significant difference in the test fluids. Either 3M FC-40 or Flutec PP-9 can be used to conduct the test. It also shows that although the sensitivity extends into the 10⁻⁵ range, the test cannot be termed reliable because of the escape rates which occur in the larger leak rate decades and because of the overkill rates which occur with some package types.

The overkill problem discussed above was also reported by Raytheon in the paper "Raytheon Weight Test Method for Detecting Gross Leaks in Small Internal Volume Semiconductor Packages." The overkill rates reported in the paper were higher than those experienced during this investigation. The overkill rate could be reduced by using only a "steady stream of bubbles" as the reject criteria but there is an associated risk of increasing the escape rate.

It must be concluded that Test Condition C₁ will have some escape rate and some overkill rate even under carefully controlled conditions.

C₂ evaluation was performed by subjecting each unit to two test sequences using 3M FC-78/FC-40 combination and two sequences using Flutec PP-1/PP-9 combination. The procedure was as follows: The units were placed inside a vacuum/pressure bomb and the pressure reduced to 1 torr and maintained for 1 hour. Without breaking the vacuum, the fluid (FC-78 or PP-1) was admitted to the bomb. Devices with internal cavity volume equal to or less than 0.1 cc were then pressurized to 90 psig with dry nitrogen. Devices with an internal cavity volume greater than 0.1 cc were pressurized to 50 psig. The pressure was maintained for a period of 3 hours. The units were then removed from the bomb and retained in a bath containing the bomb fluid (FC-78 or PP-1). The units were removed from the bath and allowed to dry 3 ± 1 minute in the air prior to immersion in the indicator fluid. The units were immersed a depth of 2 inches below the surface of

the indicator fluid (FC-40 or PP-9). The indicator fluid was maintained at a temperature of $125 \pm 5^\circ\text{C}$ during the testing. The units were observed at a magnification of 3X and any unit which produced a stream of bubbles or a growing bubble was considered a reject. During this test procedure, as with the C_1 procedure, a surface or trapped bubble was not considered a reject. The devices were observed against a dull, nonreflective black background for a period of 30 seconds in the center of a collimated light beam. Each unit was recorded as good or reject by serial number.

The results show that Condition C_2 detects most of the leaking devices in the 10^{-5} and larger ranges (Table XXIII). The exceptions are the TO-S4, 1 X 1 ceramic, and TO-3 packages. The escapes on the TO-S4 package are probably due to the small volume of liquid inside the package vaporizing and blowing out of the package before the device is completely submerged in the fluid. Failure to monitor the device from the time of entry into the fluid allows a greater number of devices to escape. The results show that approximately 40% of the devices in the 10^{-6} range were detected as rejects, which indicates the method does extend into the 10^{-6} range. However, it cannot be termed a reliable method in this range because of the 60% which escaped. The overkill was much higher on the TO-3 than any of the other packages. This is probably due to a wide seal flange area containing weld voids. The results also show a high escape rate in the 10^{-3} and 10^{-2} ranges on the 1 X 1 ceramic and TO-3 devices. It could not be determined if these same escape rates would apply to the smaller volume packages as none of the small volume devices leaked in the 10^{-3} or 10^{-2} range.

Repeatability, the ability to detect specific devices in a leak range, was good for leak rates $\geq 10^{-5}$. The devices in the $\leq 10^{-6}$ did not produce results as good as the results of the gross leakers (Table XXIII). The ability of the condition to produce consistent "bubble," "no bubble" results over four test runs was good. Table XXIV shows that the condition has a high percentage of repeatability with respect to consistently detecting bubble, no bubble conditions for units with leak rates $\geq 10^{-5}$ with the exception of the TO-3 package. The overall results are not as good, which indicate that the condition produces most of the erroneous results in the $\leq 10^{-6}$ leak ranges. This is also shown in Table XXIII.

The overall test results indicate there is no significant difference in the fluids (Table XXV). Either combination can be used for Condition C_2 testing.

One test run in each of the fluid combinations was conducted without the vacuum cycle but with the bomb pressure increased one atmosphere above specification values. The results indicate that escape rates are higher on packages having an internal volume of < 0.10 cc if the vacuum cycle is omitted. There is no significant difference on packages having volumes larger than 0.10 cc.

It can be concluded that Condition C_2 is more effective and repeatable than Condition C_1 . If Test Condition C_2 is used, it is not necessary to run Condition C_1 .

Table XXIII. C₂ Escapes and Overkill Rates in FC-78/FC-40 and PP-1/PP-9

Package Fluid	TO-84		C-PAK		C-DIP		MOS DIP		TO-100		1 X 1 Ceramic		TO-3		Glass Standards	
	FC-78/ FC-40	PP-1/ PP-9	FC-78/ FC-40	PP-1/ PP-9	FC-78/ FC-40	PP-1/ PP-9	FC-78/ FC-40	PP-1/ PP-9	FC-78/ FC-40	PP-1/ PP-9	FC-78/ FC-40	PP-1/ PP-9	FC-78/ FC-40	PP-1/ PP-9	FC-78/ FC-40	PP-1/ PP-9
Overkill %/Range <10-E	23	23	50	30	14	10	25	8.4	17	29	-	-	44	32	50	60
Escape %/Range 10-6	42	25	37	38	64	58	42	32	27	12	56	45	19	17	56	50
10-5	17	0	3	5.8	-	-	8.4	25	8	0	0	0	22	38	-	-
10-4	-	-	0	0	0	7	5	0	0	0	25	25	10	10	6.3	0
10-3	-	-	-	-	-	-	-	-	-	-	10	6.5	0	0	15	10
10-2	-	-	-	-	-	-	-	-	-	-	3	0	22	28	-	-

Table XXIV. C₂ Gross Leak Repeatability

Package	>10 ⁻⁵ (%)	Overall (%)
TO-84	88	70
C-PAK	93	73
C-DIP	93	79
MOS DIP	85	69
TO-100	94	78
1 X 1 Ceramic	92	70
TO-3	78	65
Glass	96	94

Table XXV. Comparison of Test Fluids
FC-78/FC-40 and PP-1/PP-9

Fluid	FC-78/FC-40	PP-1/PP-9
Overkill %/Range <10 ⁻⁶	26	21
Escape %/Range 10 ⁻⁶	41	30
10 ⁻⁵	5	3.4
10 ⁻⁴	2.3	2
10 ⁻³	4.2	2.8
10 ⁻²	10	20

SECTION XII

EVALUATION OF CONDITION E

In preparation for evaluating the weight gain test, the fluid flow rate through leak sizes in the gross range versus pressure was determined. The leak size at which fluid flow ceases was also determined. A control valve (Veeco type VV-50) was used to provide verifiable leak sizes which were measured with the MS-12 mass spectrometer. The equation

$$R = \frac{LP_E}{P_0} \left(\frac{M_A}{M} \right)^{1/2} \left\{ \left[1 - e^{-\frac{Lt_1}{VP_0} \left(\frac{M_A}{M} \right)} \right]^{1/2} \right\} \quad (11)$$

is obtained from Equation (1) and defines the indicated leak rate of the device at the end of the bomb period. The system used allowed the volume of gas inside the control valve to become ∞ . This makes e^{-x} approach zero and makes the portion of the equation inside the braces equal to one. A pressure bottle with a regulator was used to supply the helium to the inlet side of the orifice with the outlet side under vacuum. A vacuum had been pulled on the inlet side of the orifice to remove the normal air prior to introduction of the helium. Therefore, the atmosphere was approximately 100% helium at 1 atmosphere. The expression

$$e^{-\left[\frac{LP_E}{P_0} \left(\frac{M_A}{M} \right)^{1/2} \right]} \quad (A)$$

defines the escape rate of the gas through the orifice. The regulator and pressure bottle kept the amount of helium to the orifice constant. Therefore, time t_2 was always effectively 0, making the expression equal to 1. Now the equation can be written as:

$$R = \frac{LP_E}{P_0} \left(\frac{M_A}{M} \right)^{1/2} \quad [1] [1] \quad (12)$$

This allowed the valve to be set to exact L values by adjusting the valve to produce the proper R value at each test pressure (30, 60, 90 psig).

The valve was plumbed in such a way as to allow helium, liquid, vacuum or a drain to be applied at the inlet of the valve. The outlet of the valve fed directly to a glass vial which was fitted tightly to the valve. By removing the glass vial, the outlet could be connected to the Veeco machine. The valve was mounted in such a way that it could be rotated to drain the fluid at the end of each test point.

The procedure for setting and checking an R value was as follows:

1. With the control valve outlet connected to the mass spectrometer, the inlet was subjected to a vacuum.
2. With the inlet under the vacuum, helium was supplied to the inlet at a pressure set to approximately 1/4 psig. This ensured a 100% helium atmosphere supplied to the orifice.
3. The orifice was adjusted to L values ranging from 3×10^{-4} to 1×10^{-6} .
4. The pressure was removed and the inlet side of the valve pressure was reduced to the vacuum condition.
5. The line from the valve outlet to the mass spectrometer was removed and a glass vial was attached.
6. With the inlet still under vacuum, the fluid FC-78 was admitted to the inlet side and pressurized to the value of interest (30, 60, or 90 psig). The maintenance of vacuum until the fluid was introduced ensured that trapped air did not produce erroneous readings.
7. The time of pressurization was measured with a stopwatch and varied from 40 minutes to 6 hours. The times were varied to provide several data points for each leak size at each pressure. Accuracy of the data was assured if the flow rate in mg/min did not vary with total time.
8. Upon completion of the dwell time, the vial was removed and the amount of fluid the vial had gained was determined by using balance scales which would measure to 0.1 milligram. From this data the gain in milligrams per minute was determined.
9. To ensure that the leak rate had remained constant, the pressure was removed from the inlet and the fluid drained from the valve. Then the inlet was subjected to a vacuum in order to evaporate all of the FC-78.

10. The valve was then connected to the mass spectrometer and while under a vacuum, helium was supplied to the inlet at approximately 1/4 psig. If the reading did not repeat, the data point was considered to be in error. The valve setting was not adjusted in any way after the initial setting until completion of verifying the L value after the flow rate was determined.

The above procedure was performed for each data point at each pressure and plotted on the curves (Figure 1).

The testing was performed in the following manner: Each device was weighed and this initial weight recorded. The units were then placed inside a vacuum/pressure bomb and the pressure reduced to 1 torr. This pressure was maintained for 1 hour. The indicator fluid (FC-78, FC 77, PP-1, or PP-2) was then admitted to the pressure bomb without breaking the vacuum and the pressure increased to the desired value (30, 60 or 90), which was maintained for 2 hours. Upon completion of the 2-hour period, the devices were removed from the bomb and maintained in a bath of the indicator fluid. They were then removed from the bath and allowed to air dry for 3 ± 1 minute prior to being reweighed. The delta weight was determined for each device and recorded along with the weight gained per minute value for devices that did not fill. The fluid flow rate for a 2×10^{-6} leaker was then taken from the graphs (Figure 1) and the weight calculated that a device would gain in 2 hours with this leak rate. All devices that gained at least this amount were classified as leakers. The devices that gained less than the calculated amount were considered to be acceptable. It was assumed that any weight less than the calculated value was a combination of scale repeatability, surface retention of fluid, and fluid inside the seal area.

The weight gain test was performed to provide answers to the following questions:

1. What is the best fluid?
2. What is the best test pressure?
3. What is the sensitivity of this test?

To determine the best fluid, all devices were subjected to a test sequence using FC-78, FC-77, PP-1, and PP-2. The bomb pressure in all cases was 60 psig, with a bomb time of 2 hours. The data showed that FC-78 provided lower overkill and escape rates than did any of the other fluids (Table XXVI). The remaining tests were performed using FC-78 because of better escape and overkill rates shown in Table XXVI.

The devices were then subjected to a test sequence at pressures of 30, 60, and 90 psig. The test result show that the weight gain test is effective for all package types in the 10^{-5} and larger range. Tables XXVII through XXXIV list the results for individual package types. The preceding statement

Table XXVI. Comparison of Fluids at 60 psig with a Reject Limit Equal to L of 2×10^{-6} which is 4.8 Mg Gain

Fluid	FC-78	FC-77	PP-1	PP-2
Overkill %/Range 10^{-6}	5	10	8.4	5.8
Escape %/Range 10^{-6}	69	70	62	70
10^{-5}	1.1	5	1.1	1.7
10^{-4}	1	3.5	1	1.5
10^{-3}	0	2.7	2.7	2.7
10^{-2}	0	0	4	8

Table XXVII. Escape and Overkill Rates at Varying Pressures and Limits, TO-84

Pressure	30	60	90	60	90
Reject Limit Milligrams	0.78	4.8	8.3	0.7	0.9
Overkill %/Range 10^{-6}	3.5	0	1.8	7.0	12
Escape %/Range 10^{-6}	83	67	53	33	33
10^{-5}	0	2.8	8.5	0	0

Table XXVIII. Escape and Overkill Rates at Varying Pressures and Limits, C-PAK

Pressure	30	60	90	60	90
Reject Limit Milligrams	0.78	4.8	8.3	1.0	1.0
Overkill %/Range 10^{-6}	40	0	30	20	50
Escape %/Range 10^{-6}	55	62	47	50	36
10^{-5}	32	0	12	0	12
10^{-4}	7.5	0	0	0	0

Table XXIX. Escape and Overkill Rates at Varying Pressures and Limits, C-DIP

Pressure	30	60	90	60	90
Reject Limit Milligrams	0.78	4.8	8.3	1	1
Overkill %/Range					
<10 ⁻⁶	11	2.2	2.2	13	18
Escape %/Range					
10 ⁻⁶	70	89	84	39	33
10 ⁻⁵	-	-	-	-	-
10 ⁻⁴	7	7	7	0	0

Table XXX. Escape and Overkill Rates at Varying Pressures and Limits, MOS DIP

Pressure	30	60	90	60	90
Reject Limit Milligrams	0.78	4.8	8.3	0.9	2
Overkill %/Range					
<10 ⁻⁶	21	1.5	1.5	8.4	11
Escape %/Range					
10 ⁻⁶	20	63	50	35	14
10 ⁻⁵	17	0	0	0	0
10 ⁻⁴	0	5	0	0	0

Table XXXI. Escape and Overkill Rates at Varying Pressures and Limits, TO-100

Pressure	30	60	90	60	90
Reject Limit Milligrams	0.78	4.8	8.3	1	1
Overkill %/Range					
<10 ⁻⁶	8	3.6	0	12	7
Escape %/Range					
10 ⁻⁶	50	76	76	37	50
10 ⁻⁵	0	0	0	0	0
10 ⁻⁴	0	0	0	0	0

Table XXXII. Escape Rates at Varying Pressures and Limits, 1 X-1 Ceramic

Pressure	30	60	90	60	90
Reject Limit Milligrams	0.78	4.8	8.3	1	1
Overkill %/Range					
<10 ⁻⁶	-	-	-	-	-
Escape %/Range					
10 ⁻⁶	95	92	80	92	56
10 ⁻⁵	0	0	0	0	0
10 ⁻⁴	25	0	25	0	25
10 ⁻³	6.6	0	13	0	13
10 ⁻²	12	0	12	0	12

Table XXXIII. Escape and Overkill Rates at Varying Pressures and Limits, TO-3

Pressure	30	60	90	60	90
Reject Limit Milligrams	0.78	4.8	8.3	1	1
Overkill %/Range					
<10 ⁻⁶	16	2.2	4.8	20	28
Escape %/Range					
10 ⁻⁶	15	23	30	3.8	3.8
10 ⁻⁵	0	10	0	0	0
10 ⁻⁴	0	0	0	0	0
10 ⁻³	0	0	0	0	0
10 ⁻²	0	0	0	0	0

Table XXXIV. Escape and Overkill Rates at Varying Pressures and Limits, Glass

Pressure	30	60	90	60	90
Reject Limit Milligrams	0.78	4.8	8.3	1	1
Overkill %/Range					
<10 ⁻⁶	0	0	0	20	0
Escape %/Range					
10 ⁻⁶	100	100	100	67	100
10 ⁻⁵	63	0	0	0	0
10 ⁻⁴	-	-	-	-	-
10 ⁻³	0	0	0	0	0

is based on the 60 psig data using the so-called optimum limits.* It should be noted that no escapes (Table XXXV) occurred in the 10^{-5} or larger ranges under these conditions. Overkill rates were slightly higher at these conditions but it must be remembered that these are not normal distributions of devices and therefore many of the "fine leakers" had values larger than fine-leak test limits. Under normal conditions, the overkill rates should be lower because these devices would have been rejected at the fine-leak test.

Table XXXV. Weight Gain, Escape and Overkill Rates at Fill Rate and Optimum Limits

Pressure	30	60	90	60	90
Reject Limit Milligrams	0.78	4.8	8.3	1.0	1.0
Overkill %/Range					
< 10^{-6}	13	5	2.9	12	16
Escape %/Range					
10^{-6}	58	69	62	48	48
10^{-5}	3.8	1.1	1.1	0	1.1
10^{-4}	2	1	1	0	0.5
10^{-3}	2.8	0	5.5	0	5.5
10^{-2}	8	0	8	0	8

This method is not effective for the entire 10^{-6} range, as escape rates are 69% and 62% at 60 and 90 psig respectively. The results can be greatly improved by lowering the reject limits to the optimum conditions as shown in Table XXXV. If these limits are used, the escape rates will be lowered to 48% and 38% at the 60 and 90 psig test pressures. This points out that 90 psig is more effective in the 10^{-6} range, however the 90 psig condition allows escapes in the 10^{-5} and larger range which are detected when 60 psig is used. The additional devices detected in the 10^{-6} range are believed to be those with leak rates near the fluid flow cut-off point. These devices would normally be detected by fine-leak conditions since the flow rate data indicates that their leak rates are 2×10^{-6} or smaller. Based on the above, 60 psig appears to be the optimum pressure for the weight gain test.

The results of the no-vacuum cycle indicated that for the TO-84 package with a volume of 0.006 cc, the number of escapes increased by 20. The C-PAK overall results were essentially the same as five additional units that were detected and six units that were detected before escaped. The C-DIP results allowed six additional escapes with no additional detections. The MOS DIP resulted in six additional escapes and one additional detected. The TO-100, 1 X 1 ceramic, TO-3, and glass packages had no significant difference in the results. It can be concluded that the vacuum cycle is necessary for packages with a volume smaller than 0.10 cc (Table XXXVI).

*1.0 Milligram

**Table XXXVI. Comparison of Results at 90 psig With Vacuum
and 105 psig Without Vacuum**

Device Type	No. of Rejects Detected at 90 psig	No. of Escapes at 105 psig Which Were Detected at 90 psig	No. of Rejects at 105 psig Which Were Accepted at 90 psig
TO-84	34	20	1
C-PAK	64	6	5
C-DIP	20	6	0
MOS DIP	33	6	1
TO-100	12	1	0
1 X 1 Ceramic	37	2	2
TO-3	49	0	3
Glass Standard	36	2	0

It can be concluded that the weight gain test (Condition E) is the most effective of the Gross Leak Methods when conducted at the specified limits. Figure 1 shows that five times more fluid is forced into the device when bombed at 60 psig than when bombed at 30 psig. This indicates that if 30 psig is used as the bomb pressure, the bomb time must be five times greater than the 60 psig time in order to obtain the same amount of fluid in the device. There were some escapes at 30 psig and 90 psig that did not occur at the 60 psig level, therefore, if possible, the test should be conducted at 60 psig. FC-78 was the most effective fluid used. The higher evaporation rate results in less error from surface retention than resulted from the other fluids.

The vacuum cycle is required for packages having internal volumes of less than 0.1 cc but provides no improvement on packages with larger internal volumes.

SECTION XIII

SUMMARY

The investigation was not successful in isolating a single test condition which would be effective over the entire fine- and gross-leak rate ranges for all packages. Isolation of such a condition for all package sizes would have provided the most cost-effective testing solution for determining whether or not microcircuit packages were hermetic.

The investigation was successful in determining that a maximum of two test conditions are required to cover the entire leak rate range. It also pointed out that if the 1×10^{-6} L limit being proposed for packages having an internal volume of greater than 0.4 cc, is an acceptable limit, then the weight gain test (proposed Condition E) can be used as a single test for hermetic seal on microcircuit packages of that size.

It was also determined that no particular piece of equipment provides more valid results than the others used if conditions are properly chosen and the equipment properly set up and operated in accordance with the manufacturers instructions.

The MS-90 UFT machine is more efficient than the MS-12 in terms of time per unit tested but the results are not improved because of this faster speed.

It is important that nonabsorptive filler blocks be used with large radioisotope systems to occupy the space in the pressure vessel which is not taken up by the parts being tested. If this is not done, the longer pump-down times required will result in more escapes in the mid-range than will occur with the small system or Condition A.

The helium data (Condition A) was analyzed to determine the validity of the formula in MIL-STD-883. It was determined that for all pressurization conditions, the devices did fit the curve. This confirms that the molecular flow assumed in the formula is correct in the fine-leak range. It should be pointed out that in actual practice, however, many of the gross leakers would have been accepted as good product instead of being categorized as rejects. Their values could be located on the down slope of the curve (see Figures 3-47) only by reference to the initial data. All other data analyses were conducted under the assumption that the leak-rate value of each device was unknown. The fact that the formula could be verified, however, made it possible to establish the sensitivity of the helium test under any given set of conditions. The sensitivity of the helium test as presently specified in Test Condition A does not provide adequate range. This is shown by the escape rates shown in Table XIII for the 10^{-6} and 10^{-5} ranges. This can be corrected by changing the limits to

those suggested in Table XV which minimize escape rates in the mid-ranges. The use of the controlled orifice technique will also provide increased range on volumes of less than 0.01 cm^3 , but it was too time consuming for production-type operations. The controlled orifice provided no improvement in sensitivity or range on packages having volumes greater than 0.01 cm^3 .

Evaluation of the radioisotope data indicated that the number of wash cycles (≤ 3) was not significant; therefore, all additional testing was performed with one wash cycle. It was also determined that specific activity within the range (277 to 1397 microcuries per cm^3) used did not affect the results as long as bomb times and pressures satisfied the equation in Condition B of Method 1014. Although curves were not constructed for this condition, the data indicate that the fine-leak range covered is essentially the same as that of Condition A. In most cases, however, the escape rates were higher in the gross-leak range (Table XV). This is believed to be the result of the vacuum cycle required to store the krypton-85 and does not make Condition B less effective than Condition A for fine-leak testing of microcircuits.

Evaluation of package materials indicated that the major sorption area is the seal-package interface or the seal material, and in most cases, not the ceramic itself. Each material/package configuration must be tested and appropriate delay times installed if necessary.

Temperature preconditioning of the devices provided interesting results which negated the idea of improving the method by this means. Leak rates on metal can devices increased; whereas, leak rates on ceramic devices decreased. The degree of shift in the leak-rate range was dependent on the temperature and was inconsistent. Temperature preconditioning proved to be deleterious to securing valid results.

The evaluation of gettering materials established that fluorocarbons provided no increase in test sensitivity for Test Condition A or B. The polyimide improved the escape rates in the 10^{-6} and 10^{-5} ranges on both Conditions A and B but did not entirely eliminate escapes (Tables XVI and XVII). It also caused an unacceptably high (18%) overkill rate on Condition A. The vacuum pump oil does work using Condition B but tends to be drawn out of gross leakers during pump-down, contaminating good devices. It is concluded that gettering is a possible means of testing the entire leak-rate range with a single test; but extensive work is still required to determine the proper material(s) to be used.

Condition C₁ bubble testing evaluation data indicated that either 3M FC-40 or Flutec PP-9 fluid could be used to conduct the test. It could be assumed from this that fluids cited by each manufacturer as being equivalent could also be used. These would include 3M FC-43 and FC-48 and the Flutec PP-7.

The test results indicated that overkill (good devices rejected) and escape (nonhermetic devices accepted) rates will occur even under carefully controlled conditions. These rates are package dependent, being higher on ceramic and large seal area metal devices than on small all metal/glass ones.

The results also indicate that some gross leakers in the 10^{-4} and 10^{-5} range are detected by Condition C₁ but the escape rates are so large that the condition could not be used as a single test for these ranges.

Condition C₂ bubble test results show it to be a more reliable technique for detecting gross leaks than Condition C₁. This is true even in the 10^{-3} and 10^{-2} ranges which C₁ is intended to cover.

As with the C₁ test, similar results were obtained with 3M and Flutec fluids. The 3M FC-78/FC-40 combination was not significantly different from the Flutec PP-1/PP-9 combination. Both yielded good repeatability and relative to C₁, low escape rates.

The vacuum cycle presently specified is necessary on packages having internal volumes of less than 0.10 cc to minimize escape rates. It could be omitted on larger packages with no significant difference in escape or overkill rates.

Condition C₂ is recommended as a more effective and repeatable procedure than C₁ over the entire gross-leak range.

The weight gain test (proposed Condition E) proved to be the most effective of the gross-leak methods. Sixty psig was determined to be the pressure at which the escape rate could be reduced to zero for all devices having leak rates of 10^{-5} or larger.

The fluids evaluated did not prove to be equivalent as had occurred with the bubble tests. The 3M FC-78 provided better results in terms of overkill and escape rates than did the FC-77, PP-1, or PP-2.

The vacuum cycle is required on the weight gain test for devices having internal volumes of <0.10 cc but does not improve results on larger packages.

The data was also analyzed to determine the effectiveness of subjecting the units to a series of fine-leak and gross-leak testing. The results of the fine-leak repeatability and the result of the gross-leak testing was considered to be a combination test. The sequences were matched by pairing the fine-leak runs 1, 2, 3, and 4 with the corresponding gross-leak runs. The results show that with

Conditions A or B followed by Condition E there will be no escapes in any range which are greater than 1×10^{-5} . The greatest escape rate occurred on the C-PAK, a ceramic package. One problem with the ceramic packages is that occasionally the seal area will form voids in the sealing glass and trap the tracer gas when fine-leak testing is performed, and the device will be rejected. When these units are then subjected to gross-leak Conditions C or E, they will hold enough fluid in the void to bubble but not enough to weigh 1.0 milligram. This is indicated by the test results shown in Table XXXVII. This anomaly would also result in Condition A detecting more leakers than Condition B as more of the tracer gas would be removed by the store cycle of Condition B than the natural diffusion which occurs with Condition A. Table XXXVII shows that fine-leak testing followed by Condition C₂ allows some escapes in the 10^{-5} range that do not occur when Condition E is used. It can be concluded that Condition E is more sensitive than Condition C₂, and even under ideal conditions, there will be some escape in the 10^{-6} range for some package types as the present fine and gross methods do not detect all leakers.

Recommendations for application of these results are discussed in Section XIV.

Table XXXVII. Fine-Leak Testing Followed by Gross-Leak Testing

Device	TO-84		C-PAK		C-DIP		MOS DIP		TO-100		1 X 1 Ceramic		TO-3	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B
Condition E (psig)	60	30	60	30	60	30	60	30	60	30	60	30	60	30
Limit (Mg)	4	1	4	1	4	1	4	1	4	1	4	1	4	1
Condition A followed by Condition E														
Escape %/Range 10 ⁻⁶ ≥10 ⁻⁵	0	0	4	24	21	21	6	3	3	0	0	0	0	0
	0	0	0	-	-	8	-	-	2	-	-	12	-	-
Escape %/Range 10 ⁻⁶ ≥10 ⁻⁵	0	0	0	25	24	22	3	1.5	1.5	9	9	0	0	0
	-	-	-	-	-	17	-	7	-	-	-	17	-	-
Condition B followed by Condition E														
Escape %/Range 10 ⁻⁶ ≥10 ⁻⁵	0	0	0	25	24	22	3	1.5	1.5	9	9	0	0	0
	-	-	-	-	-	17	-	7	-	-	-	17	-	-
Condition A or B followed by Condition C2														
Escape %/Range 10 ⁻⁶ 10 ⁻⁵ 10 ⁻⁴ 10 ⁻³ 10 ⁻²	TO-84		C-PAK		C-DIP		MOS DIP		TO-100		1 X 1 Ceramic		TO-3	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B
10 ⁻⁶	0	0	0	1.7	2.8	5.6	0	4	0	0	0.7	60	12	3.9
10 ⁻⁵	6.7	6.7	1.9	0	-	-	1.3	1.3	0	3	0	0	0	0
10 ⁻⁴	-	-	0	0	0	0	0	0	0	0	0	25	2.5	0
10 ⁻³	-	-	-	-	-	-	-	-	-	-	0	3.4	0	0
10 ⁻²	-	-	-	-	-	-	-	-	-	-	0	0	22	0

SECTION XIV

RECOMMENDATIONS

The following recommendations are made to provide the highest levels of confidence that nonhermetic microcircuits will be detected by the test or sequence of tests conducted. That in the case of sequential tests maximum overlap of the conditions will be provided and that overkill rates be minimized to the extent possible commensurate with detection of the nonhermetic devices.

For helium testing, Condition A, three limits must be established to cover the broad range of microcircuit package volumes. The limits recommended are L (actual leak rate) values.

Internal Volume cc	L Limit atm cc/s
<0.01	5×10^{-8}
$\geq 0.01 \leq V < 0.4$	1×10^{-7}
≥ 0.4	1×10^{-6}

These limits are lower in value, one decade, one-half decade, and one-half decade, respectively, than presently specified but are necessary to minimize escape rates in the 10^{-6} and upper end of the gross leak range.

Helium tests may be performed at bomb pressures from 30 to 60 psig but the limit value and time chosen must provide an R (indicated leak rate) value which can be accurately read on the mass spectrometer being used. A maximum t_2 (time from removal of bomb pressure to read) of one hour is recommended with a 30-minute maximum being preferred.

For radioisotope testing, Condition B, two limits must be used to minimize escape rates in the 10^{-6} and upper gross leak ranges. The limits recommended are Q values.

Internal Volume cc	Q Limit atm cc/s
<0.01	1×10^{-8}
≥ 0.01	5×10^{-8}

Radioisotope tests may be conducted at any pressure of at least 30 psig. It is recommended that a minimum bomb time of 0.2 hour be used. Conditions chosen must satisfy the equation $Q_S = R/SKTP$ stated in MIL-STD-883 with the above time and pressure limitations. Microcircuits must be read within 1 hour after removal of bomb pressure with a 30-minute maximum being preferred.

It is recommended that the present Method 1014 Condition C₁ followed by Condition C₂ be deleted and that C₂ only be used as the bubble test condition. Based on the fluid fill rate data, a bomb condition of 2 hours at 60 psig is recommended. Also for packages having an internal volume greater than 0.1cc a bomb condition of 10 hours at 30 psig may be permitted. These conditions insure that fluid in a sufficient quantity, to cause observable bubbling, will be forced into the package.

The failure criteria should be changed to read: Devices are considered rejects if during the 30-second test period, a definite stream of bubbles or two or more large bubbles originating from the same point are observed.

The weight gain test is recommended for inclusion in MIL-STD-883. Sixty psig for a period of 2 hours is recommended for bombing. If the package will not withstand 60 psig the pressure may be lowered to 30 psig and the bomb time increased to 10 hours. The pressurization should be preceded by a 1-hour vacuum cycle on devices having internal volumes of less than 0.1 cc.

The limits to be specified are 1.0 milligram for packages of <0.01 cc and 2 milligrams for packages larger than 0.01 cc. Batch categorization may be used if the devices are separated into cells of 0.5 or 1 milligram depending on volume. They may then be accepted if they shift no more than one cell in value after bombing. Weight loss should not be considered as cause for rejection.

It is recommended that the following tests be performed for detection of nonhermetic devices.

Volume cc	Test Condition followed by Test Condition	
<0.4	A or B	C, D or E
>0.4	A or B	C or D
*>0.4	E	None

*If reliability requirements can be satisfied by a leak rate of $\leq 1 \times 10^{-6}$ atm cc/s.

It is recommended that the changes made to Method 1014 of MIL-STD-883 as a result of this study be incorporated into Method 1071 of MIL-STD-750. This will provide consistent test procedures for microelectronic and discrete devices used in military systems.

APPENDIX
MICROCIRCUIT SEAL
TESTING DATA

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PACKAGE TOURS - HELIUM L VALUES
HELIUM VAPORANT CONVICTION EVALUATION
ALL DATA FROM APR-67/525

UNIT NO.	ESTIMATED WEIGHT GAIN	30 PSIG 1 HOUR	4 HOURS	8 HOURS	24 HOURS	48 HOURS	72 HOURS	96 HOURS	120 HOURS	144 HOURS	168 HOURS	192 HOURS	216 HOURS	240 HOURS
1	25.0	0.0	2000.0	2000.0	2000.0	2000.0	2000.0	2000.0	2000.0	2000.0	2000.0	2000.0	2000.0	2000.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	2.2	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	3333.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10	3000.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11	0.0	0.0	2000.0	2000.0	2000.0	2000.0	2000.0	2000.0	2000.0	2000.0	2000.0	2000.0	2000.0	2000.0
12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16	3333.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
17	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
18	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
19	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
22	3000.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23	3000.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
24	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
25	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26	3000.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
27	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
28	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
29	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	3000.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
31	2000.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
32	3000.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
33	3000.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
34	3000.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
35	3000.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
36	3000.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
37	3000.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
38	3000.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
39	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
41	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
42	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
43	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
44	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
45	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
46	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
47	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
48	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
49	3000.0	1000.0	650.0	650.0	650.0	650.0	650.0	650.0	650.0	650.0	650.0	650.0	650.0	650.0
50	0.0	1000.0	650.0	650.0	650.0	650.0	650.0	650.0	650.0	650.0	650.0	650.0	650.0	650.0

ALL L VALUES GREATER THAN 1000 ARE ESTIMATED VALUES KNOWING THAT THESE DEVICES ARE GROSS LEAKERS.

1. TO-84 Helium L Values Variable Condition (Sheet 1 of 2)

PACKAGE CDIP - HELIUM L VALUES
HELIUM VARIABLE CONDITION EVALUATION
ALL DATA X10-8 ATM-CC/SEC

UNIT NUM.	INITIAL VEECO	WEIGHT GAIN	30 PSIG			45 PSIG			60 PSIG			75 PSIG			90 PSIG		
			1 HOUR	4 HOURS	8 HOURS	1 HOUR	3 HOURS	6 HOURS	1 HOUR	2 HOURS	4 HOURS	1 HOUR	2 HOURS	4 HOURS	1 HOUR	2 HOURS	4 HOURS
1	3.3	0.0	3.4	1.0	0.9	1.6	2.3	1.5	7.0	2.4	3.3	2.1	1.9	1.5	3.0	2.9	1.5
2	1.9	0.0	2.6	0.0	1.1	3.6	1.0	2.0	4.5	2.1	1.9	4.1	2.5	1.5	2.5	2.9	1.5
3	2.4	0.0	3.6	1.5	1.7	3.1	1.0	1.6	3.1	1.7	2.4	4.5	3.7	1.3	2.5	5.3	2.2
4	0.0	0.0	4.8	2.6	0.9	1.3	1.0	0.6	5.0	2.1	0.0	3.5	1.9	1.4	1.5	2.3	1.7
5	3.8	0.0	6.6	2.7	1.9	3.8	2.8	2.6	6.5	4.2	3.8	3.8	3.0	2.6	5.4	3.9	3.0
6	0.0	0.0	2.1	0.0	0.9	3.6	1.4	1.4	3.8	1.4	0.0	3.7	3.9	1.1	2.3	1.3	1.3
7	1.4	0.0	3.4	2.3	1.7	1.9	2.2	2.6	6.5	2.4	1.4	6.4	4.3	1.7	3.5	3.5	3.6
8	0.0	0.0	4.2	2.3	2.1	2.5	2.2	2.0	3.8	3.2	1.0	3.2	2.4	1.1	5.4	5.6	2.0
9	1.6	0.0	6.2	1.5	3.4	3.4	2.3	2.5	4.0	3.2	1.6	2.5	3.0	2.4	2.7	3.8	3.2
10	1.2	0.0	3.4	0.0	1.0	5.2	1.7	5.1	5.2	2.4	1.2	2.5	2.4	2.1	2.8	1.8	2.5
11	10.0	0.0	8.0	8.8	13.0	8.5	8.5	9.0	13.0	9.6	10.0	10.0	7.0	7.0	8.4	8.6	8.3
12	12.0	0.0	9.2	6.8	23.0	11.0	9.0	12.5	13.0	13.0	12.0	14.0	11.0	12.0	11.0	3.5	4.2
13	9.0	0.0	6.6	7.0	11.0	8.8	7.5	9.0	9.0	11.0	9.0	11.0	7.8	9.0	10.0	9.2	4.2
14	2.4	0.0	8.6	2.5	3.6	4.7	2.5	2.9	6.2	3.6	2.4	7.9	5.6	4.0	4.0	6.0	4.7
15	20.0	0.0	9.5	9.5	26.0	14.0	12.0	16.0	15.0	20.0	20.0	7.6	4.5	8.2	7.0	9.6	9.6
16	4.0	0.0	4.2	5.0	7.8	6.2	3.7	7.0	6.5	7.9	4.0	12.0	9.8	6.1	5.5	5.5	3.0
17	5.0	0.0	1.7	2.8	1.5	2.1	1.4	2.0	3.8	2.5	5.0	2.7	2.4	1.8	3.9	2.2	1.9
18	5.2	0.0	3.5	2.7	2.5	4.3	2.9	2.3	6.5	3.0	5.2	4.1	3.6	2.4	3.1	3.2	3.2
19	15.0	0.0	5.4	7.5	22.0	33.0	4.6	12.0	28.0	15.0	18.0	8.0	8.2	15.0	13.0	1.8	2.5
20	18.0	0.0	12.0	14.0	30.0	14.0	15.0	16.0	19.0	18.0	18.0	7.8	5.2	12.0	6.3	5.3	6.5
21	9.0	0.0	5.8	6.5	11.0	0.0	7.5	9.0	9.5	9.8	9.0	6.5	5.2	4.9	4.9	5.0	4.7
22	13.0	0.0	8.5	10.0	19.0	12.0	9.8	16.0	14.0	17.0	13.0	3.0	2.4	2.1	7.0	4.2	4.0
23	4.6	0.0	2.4	2.7	1.3	3.0	2.0	2.0	4.6	2.2	4.6	7.3	5.0	2.1	4.1	2.5	3.2
24	12.0	0.0	7.5	7.0	13.0	9.5	6.0	10.0	11.0	12.0	12.0	8.0	3.9	6.1	3.2	2.4	3.4
25	3000.0	0.0	80.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0
26	3000.0	0.0	75.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0
27	3000.0	0.0	58.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0
28	3000.0	0.0	200.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0
29	3000.0	0.0	58.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0
30	3000.0	0.0	98.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0
31	3000.0	0.0	130.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0
32	3000.0	0.0	75.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0
33	3000.0	0.0	46.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0
34	3000.0	0.0	75.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0
35	3000.0	0.0	42.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0
36	23.0	0.0	12.0	18.0	21.0	6.3	16.0	15.0	6.5	7.9	23.0	3.0	4.9	4.5	32.0	80.0	3000.0
37	21.0	0.0	10.0	14.0	25.0	14.0	12.0	16.0	19.0	16.0	21.0	7.0	4.9	4.5	6.4	5.5	3000.0
38	22.0	0.0	3.5	6.0	26.0	5.2	3.5	12.0	8.0	13.0	22.0	8.2	4.9	13.0	5.3	3.1	1100.0
39	3000.0	0.0	4.5	3000.0	3000.0	52.0	95.0	15.0	100.0	72.0	3000.0	12.0	12.0	10.0	11.0	5.0	3.4
40	3000.0	0.0	8.6	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0
41	3000.0	0.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0
42	2.7	0.0	54.0	3000.0	5.2	19.0	37.0	9.0	3000.0	15.0	2.7	36.0	68.0	150.0	24.0	110.0	3030.0
43	3000.0	0.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0
44	1.4	0.0	3.0	3000.0	1.2	75.0	4.2	2.0	720.0	2.7	1.4	4.0	3.2	2.1	2.7	3000.0	3000.0
45	3000.0	0.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0
46	1400.0	0.0	3.5	1000.0	1300.0	1400.0	4.3	1.3	1400.0	1400.0	1400.0	7.4	7.5	1400.0	4.0	3.5	3.6
47	3000.0	0.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0
48	3000.0	0.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0
49	1300.0	0.0	3.5	1700.0	1500.0	0.0	1400.0	1500.0	1700.0	1300.0	1300.0	5.4	1.9	1400.0	2.4	1.8	1.5
50	3000.0	0.0	5.0	1500.0	3000.0	3000.0	450.0	3000.0	3000.0	3000.0	3000.0	62.0	68.0	450.0	8.2	2.2	2.2

ALL L VALUES GREATER THAN 2X10-6 ARE ESTIMATED VALUES KNOWING THAT THESE DEVICES ARE GROSS LEAKERS.

3. C-DIP Helium L Values Variable Condition (Sheet 1 of 2)

PACKAGE CERM - HELIUM L VALUES
 HELIUM VARIABLE CONDITION EVALUATION
 ALL DATA X10-8 ATM-CC/SEC

UNIT NUM.	INITIAL VELOC	WEIGHT GAIN	30 PSIG			45 PSIG			60 PSIG			75 PSIG			90 PSIG		
			1 HOUR	2 HOURS	4 HOURS	1 HOUR	2 HOURS	4 HOURS	1 HOUR	2 HOURS	4 HOURS	1 HOUR	2 HOURS	4 HOURS	1 HOUR	2 HOURS	4 HOURS
51	3000.0	901.9	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0
52	65.0	0.0	31.0	120.0	120.0	65.0	220.0	220.0	160.0	160.0	160.0	160.0	160.0	160.0	160.0	160.0	160.0
53	110.0	0.1	193.0	130.0	110.0	110.0	380.0	72.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0
54	65.0	0.4	220.0	150.0	150.0	65.0	130.0	80.0	140.0	140.0	140.0	140.0	140.0	140.0	140.0	140.0	140.0
55	49000.0	684.6	60000.0	49000.0	49000.0	49000.0	58000.0	57000.0	60000.0	60000.0	60000.0	60000.0	60000.0	60000.0	60000.0	60000.0	60000.0
56	3000.0	734.2	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0
57	52000.0	711.1	52000.0	48000.0	48000.0	48000.0	50000.0	50000.0	50000.0	50000.0	50000.0	50000.0	50000.0	50000.0	50000.0	50000.0	50000.0
58	48000.0	935.5	50000.0	52000.0	48000.0	48000.0	50000.0	45000.0	45000.0	45000.0	45000.0	45000.0	45000.0	45000.0	45000.0	45000.0	45000.0
59	47000.0	744.4	50000.0	53000.0	47000.0	47000.0	53000.0	42000.0	42000.0	42000.0	42000.0	42000.0	42000.0	42000.0	42000.0	42000.0	42000.0
60	90.0	0.0	180.0	160.0	160.0	80.0	260.0	80.0	160.0	160.0	160.0	160.0	160.0	160.0	160.0	160.0	160.0
61	220.0	0.0	260.0	300.0	220.0	220.0	450.0	140.0	110.0	110.0	110.0	110.0	110.0	110.0	110.0	110.0	110.0
62	95.0	0.0	110.0	110.0	110.0	95.0	170.0	170.0	140.0	140.0	140.0	140.0	140.0	140.0	140.0	140.0	140.0
63	50000.0	892.7	45000.0	50000.0	50000.0	50000.0	45000.0	70000.0	42000.0	42000.0	42000.0	42000.0	42000.0	42000.0	42000.0	42000.0	42000.0
64	52.0	0.0	65.0	78.0	78.0	52.0	92.0	47.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0
65	177.0	0.0	150.0	150.0	150.0	150.0	130.0	120.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0
66	95.0	0.0	340.0	78.0	78.0	95.0	130.0	82.0	85.0	85.0	85.0	85.0	85.0	85.0	85.0	85.0	85.0
67	95.0	0.2	130.0	70.0	70.0	95.0	230.0	37.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0
68	46.0	0.1	50.0	50.0	50.0	46.0	160.0	60.0	91.0	91.0	91.0	91.0	91.0	91.0	91.0	91.0	91.0
69	32.0	0.5	65.0	580.0	580.0	32.0	400.0	26.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0
70	32.0	1.8	150.0	55.0	55.0	32.0	73.0	18.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0
71	95.0	0.4	90.0	44.0	44.0	95.0	15.0	30.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0

ALL L VALUES GREATER THAN 6X10-5 ARE ESTIMATED VALUES KNOWING THAT THESE DEVICES ARE GROSS LEAKERS.

6. Ceramic Helium L Values Variable Condition (Sheet 2 of 2)

PACKAGE TOB4 - HELIUM R VALUES
HELIUM VARIABLE CONDITION EVALUATION
ALL DATA X10-9 ATM-CC/SEC

UNIT NO.	INITIAL WEIGHT VECCN	GAIN	30 PSIG				45 PSIG				60 PSIG				75 PSIG				90 PSIG			
			1 HOUR	4 HOURS	8 HOURS	1 HOUR	3 HOURS	6 HOURS	1 HOUR	2 HOURS	4 HOURS	1 HOUR	2 HOURS	4 HOURS	1 HOUR	2 HOURS	4 HOURS	1 HOUR	2 HOURS	4 HOURS		
1	2000.0	0.0	70.0	0.3	7.0	1.0	400.0	1400.0	200.0	800.0	3200.0	3000.0	700.0	1000.0	3000.0	1000.0	1000.0	700.0	1000.0	1700.0		
2	0.1	0.0	0.0	0.0	0.2	0.3	0.1	0.1	0.1	0.1	0.4	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.3		
3	5.7	0.0	0.1	0.0	1.0	0.1	9.0	0.1	0.7	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2		
4	0.1	0.0	0.1	0.0	0.2	0.6	0.4	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2		
5	3000.0	0.0	180.0	3.6	10.0	0.2	0.7	0.1	0.3	3000.0	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2		
6	0.2	0.0	0.1	0.1	0.1	0.6	0.3	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2		
7	0.0	0.0	0.1	0.1	0.1	0.6	1.4	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2		
8	0.0	0.0	0.1	0.1	0.1	0.3	1.6	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1		
9	0.0	0.0	0.1	0.1	0.1	0.3	0.6	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1		
10	3900.0	0.0	2600.0	50.0	300.0	0.2	0.3	0.1	0.1	3000.0	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.2		
11	17.7	0.0	0.1	0.1	2.5	1.6	0.2	0.2	0.0	10.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2		
12	0.0	0.0	0.1	0.1	0.1	0.2	0.4	0.1	0.2	0.0	0.6	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1		
13	0.0	0.0	0.1	0.1	0.1	1.2	0.4	0.1	0.2	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1		
14	0.1	0.0	0.1	0.1	0.1	0.1	2.0	0.1	0.3	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2		
15	200.0	0.0	0.1	0.1	0.1	0.0	3.0	0.2	0.4	200.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2		
16	3000.0	0.0	320.0	3000.0	1500.0	520.0	400.0	720.0	1100.0	3000.0	1200.0	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.2		
17	1.0	0.0	0.1	0.1	1.0	0.0	0.3	0.1	0.1	1.0	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2		
18	0.0	0.0	0.1	0.1	0.1	0.0	0.3	0.1	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1		
19	0.0	0.0	0.1	0.1	0.1	0.1	1.4	0.1	0.3	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1		
20	0.1	0.0	0.1	0.1	0.1	0.1	1.4	0.1	0.3	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1		
21	0.0	0.0	0.1	0.1	0.1	0.0	2.4	0.2	0.2	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1		
22	3000.0	0.0	100.0	0.1	0.2	5.0	0.0	0.8	600.0	3000.0	450.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1		
23	0.0	0.0	1300.0	3000.0	1000.0	1800.0	500.0	1000.0	550.0	3000.0	1900.0	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.1		
24	0.2	0.0	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1		
25	3000.0	0.0	850.0	3000.0	1000.0	2600.0	600.0	3000.0	3000.0	3000.0	2900.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1		
26	0.0	0.0	0.1	0.1	0.1	0.0	0.3	0.1	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1		
27	0.1	0.0	0.1	0.1	0.1	0.1	3.8	0.2	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0		
28	3000.0	0.0	0.1	0.1	0.1	0.3	0.4	0.1	0.3	0.0	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.0		
29	3000.0	0.0	350.0	3000.0	1200.0	350.0	300.0	400.0	350.0	3000.0	750.0	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.1		
30	0.0	0.0	1400.0	1.5	3000.0	2200.0	0.7	1400.0	3000.0	3000.0	2700.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1		
31	0.7	0.0	320.0	0.7	10.0	60.0	550.0	850.0	400.0	5.0	2600.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.3		
32	3000.0	0.0	530.0	3000.0	0.5	0.4	180.0	0.3	0.3	3000.0	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.3		
33	0.0	0.0	0.1	0.1	0.1	0.3	1.5	0.2	0.1	3000.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1		
34	500.0	0.0	1570.0	3000.0	700.0	1200.0	300.0	1000.0	620.0	500.0	1000.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1		
35	300.0	0.0	42.0	480.0	300.0	50.0	1400.0	450.0	1600.0	3.5	180.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1		
36	3000.0	0.0	650.0	3000.0	0.1	0.1	0.3	420.0	3000.0	3000.0	2000.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1		
37	3000.0	0.0	0.0	0.1	0.1	0.3	0.2	0.2	0.7	3000.0	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.1		
38	1.5	0.0	0.0	0.1	1.4	0.3	0.2	0.2	0.3	3000.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1		
39	0.0	0.0	0.0	0.1	0.4	3.0	0.3	0.1	0.1	0.0	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.2		
40	0.0	0.0	0.0	0.1	0.1	0.1	0.6	0.1	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2		
41	0.0	0.0	0.0	0.1	0.2	0.6	0.3	0.1	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2		
42	0.0	0.0	0.0	0.1	1000.0	1.0	1.0	0.1	0.1	0.0	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2		
43	0.0	0.0	0.1	0.1	0.2	0.4	0.7	0.2	0.3	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2		
44	0.0	0.0	0.1	0.1	0.2	0.0	0.0	0.2	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1		
45	0.0	0.0	0.0	0.1	1.6	0.1	1.6	0.1	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1		
46	0.0	0.0	0.0	0.1	0.1	0.3	0.2	0.2	0.2	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1		
47	0.0	0.0	0.0	0.1	0.1	0.1	0.2	0.1	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1		
48	0.0	0.0	0.0	0.1	1.0	0.1	1.0	0.2	0.3	0.0	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1		
49	0.0	0.0	0.0	0.1	0.4	1.5	0.1	0.1	0.3	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1		
50	0.0	1000.0	0.0	0.0	0.2	0.3	1.0	0.1	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2		

9. TO-84 Helium R Values Variable Condition (Sheet 1 of 2)

PRECEDING PAGE BLANK. NOT FILMED

PACKAGE T084 - HELIUM R VALUES
 HELIUM VARIABLE CONDITION EVALUATION
 ALL DATA X10-8 ATM-CC/SEC

UNIT NUM.	INITIAL VEECO	WEIGHT GAIN	30 PSIG		45 PSIG		60 PSIG		75 PSIG		90 PSIG						
			1 HOUR	4 HOURS	1 HOUR	8 HOURS	1 HOUR	2 HOURS	4 HOURS	1 HOUR	2 HOURS	4 HOURS	1 HOUR	2 HOURS	4 HOURS		
51	0.0	1000.0	0.0	0.1	0.2	0.4	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.2
52	0.0	1000.0	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.2
53	0.0	1000.0	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.2
54	0.0	1000.0	24.0	0.1	0.5	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6
55	3700.0	1000.0	0.0	240.0	0.4	0.3	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
56	0.0	1000.0	0.1	0.1	0.2	0.7	0.3	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.2
57	0.0	1000.0	0.1	0.1	0.2	0.7	0.3	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.2
58	0.1	1000.0	0.1	0.1	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
59	3000.0	1000.0	200.0	0.2	700.0	0.7	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
60	3700.0	1000.0	190.0	560.0	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
61	3000.0	1000.0	250.0	520.0	1500.0	400.0	350.0	350.0	400.0	350.0	350.0	350.0	400.0	350.0	350.0	400.0	350.0
62	0.0	1000.0	0.0	500.0	700.0	500.0	17.0	0.0	0.2	0.5	0.0	0.0	0.2	0.4	0.2	0.4	0.2
63	300.0	1000.0	280.0	0.1	40.0	0.6	0.6	0.7	0.2	0.2	0.5	0.5	0.3	0.3	0.3	0.3	0.3
64	0.5	1000.0	0.0	320.0	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
65	0.0	1000.0	0.0	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
66	3.0	1000.0	0.2	0.4	1.8	0.7	1.0	0.7	1.4	1.0	0.7	1.4	1.0	0.7	1.4	1.0	0.7
67	0.7	1000.0	0.2	0.4	1.4	2.3	1.4	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6
68	1.8	1000.0	0.8	0.6	3.0	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8
69	0.0	1000.0	0.0	0.6	1.0	0.2	0.9	0.1	0.0	0.5	0.0	0.1	0.2	0.1	0.1	0.1	0.2
70	0.0	1000.0	0.1	0.1	1.0	1.2	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
71	0.5	10000.0	0.2	0.3	0.9	0.1	0.8	0.3	0.5	0.5	0.6	0.5	0.6	0.5	0.5	0.6	0.5
72	0.5	10000.0	0.1	0.3	0.9	1.2	0.9	0.5	0.7	0.9	0.9	0.7	0.9	0.9	0.9	0.7	0.9
73	7.4	10000.0	0.2	0.3	0.8	1.4	1.2	0.5	0.7	1.0	0.4	1.0	0.8	1.0	0.8	1.0	0.8
74	0.4	10000.0	1.9	0.3	0.4	0.6	0.6	0.3	0.3	700.0	0.4	0.5	0.6	0.6	0.6	0.6	0.6
75	0.5	10000.0	0.2	0.3	0.5	0.7	0.6	0.4	0.7	0.7	0.4	0.5	0.6	0.6	0.6	0.6	0.6
76	0.7	10000.0	0.2	0.5	1.0	1.6	1.0	0.7	0.7	0.7	0.4	0.9	0.7	0.5	0.9	0.7	0.5
77	0.9	10000.0	0.2	0.3	0.7	1.0	1.0	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
78	0.6	10000.0	0.2	0.3	1.0	1.0	1.0	0.4	1.0	0.6	0.9	0.8	1.2	1.5	1.0	1.5	1.5
79	0.5	10000.0	0.2	0.3	0.9	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
80	0.4	10000.0	0.1	0.3	0.4	1.0	0.4	0.1	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
81	0.4	10000.0	0.2	0.2	1.0	1.2	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
82	0.5	10000.0	0.1	0.3	1.0	1.0	1.0	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
83	0.3	10000.0	0.3	0.3	0.6	0.7	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
84	1.0	10000.0	0.1	0.3	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
85	0.4	10000.0	0.3	0.2	0.6	1.4	1.0	0.5	0.1	0.7	0.4	0.4	0.4	0.4	0.4	0.4	0.4
86	0.4	10000.0	0.2	0.3	1.0	2.2	1.0	0.3	1.0	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
87	0.3	10000.0	0.2	0.2	0.8	0.7	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
88	0.4	10000.0	0.2	0.2	1.0	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
89	0.7	10000.0	1.1	0.3	1.0	3000.0	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
90	0.4	10000.0	0.2	0.3	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
91	0.3	10000.0	0.1	0.3	0.6	0.5	0.7	0.6	0.2	0.2	0.4	0.4	0.4	0.4	0.4	0.4	0.4
92	0.4	10000.0	0.2	0.3	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
93	0.4	10000.0	0.2	0.3	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
94	0.4	10000.0	0.2	0.2	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
95	0.4	10000.0	0.3	0.2	0.7	1.0	0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
96	0.3	10000.0	0.1	0.2	0.6	1.0	0.6	0.7	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
97	0.3	10000.0	0.1	0.2	0.6	1.0	0.6	0.7	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

9. T0-84 Helium R Values Variable Condition (Sheet 2 of 2)

PACKAGE C-PAK - HELIUM R VALUES
 HELIUM VARIABLE CONDITION EVALUATION
 ALL DATA X10-8 ATM-CC/SEC

UNIT NUM.	INITIAL WEFCO	WEIGHT GAIN	30 PSIG			45 PSIG			60 PSIG			75 PSIG			90 PSIG		
			1 HOUR	4 HOURS	8 HOURS	1 HOUR	3 HOURS	6 HOURS	1 HOUR	2 HOURS	4 HOURS	1 HOUR	2 HOURS	4 HOURS	1 HOUR	2 HOURS	4 HOURS
1	0.3	7.0	0.1	0.2	0.0	0.5	0.4	0.3	0.3	0.3	3.5	350.0	1000.0	1200.0	1100.0	1500.0	
2	3000.0	0.0	450.0	3000.0	500.0	1200.0	550.0	0.4	0.3	3000.0	45.0	1000.0	550.0	500.0	500.0	1500.0	
3	0.1	0.0	0.6	0.5	0.3	1.0	0.4	0.3	0.3	0.3	700.0	460.0	1600.0	1000.0	1700.0		
4	240.0	0.0	9.0	160.0	40.0	0.6	0.4	0.3	0.3	240.0	610.0	1400.0	1000.0	1000.0	2700.0		
5	0.3	0.0	0.2	0.1	0.2	3.5	5.0	0.8	0.4	0.3	260.0	260.0	800.0	800.0	65.0	36.0	
6	30.0	0.0	30.0	32.0	14.0	0.4	0.5	0.2	0.1	300.0	900.0	1100.0	1000.0	1000.0	2400.0		
7	300.0	0.0	4.0	3.0	3.0	0.5	0.6	0.2	0.1	300.0	130.0	1100.0	1000.0	1000.0	750.0		
8	600.0	0.0	0.3	0.4	0.0	0.5	0.1	0.2	0.1	600.0	450.0	1600.0	1000.0	1000.0	1600.0		
9	300.0	0.0	0.8	170.0	30.0	3.0	0.9	0.2	0.1	300.0	160.0	900.0	400.0	400.0	650.0		
10	18.0	0.0	0.1	0.1	0.4	1.0	0.3	0.2	0.1	18.0	120.0	750.0	140.0	140.0	1200.0		
11	3000.0	0.0	0.2	1.2	1.0	0.5	0.6	0.7	0.3	3000.0	65.0	1000.0	400.0	400.0	500.0		
12	0.2	0.0	400.0	3000.0	800.0	1500.0	4.4	3.0	0.2	800.0	58.0	1500.0	1500.0	1500.0	1200.0		
13	0.2	0.0	2.8	3000.0	0.6	1.2	700.0	0.6	0.3	3000.0	50.0	136.0	400.0	400.0	300.0		
14	0.3	0.0	0.0	0.0	0.1	1.0	1.5	0.5	0.3	3000.0	1.1	1.8	2900.0	22.0	650.0		
15	3000.0	0.0	30.0	3000.0	0.0	0.4	1.5	0.5	0.5	3000.0	6.2	13.0	500.0	500.0	900.0		
16	3000.0	0.0	270.0	3000.0	3000.0	1.8	400.0	0.3	0.4	3000.0	7.7	78.0	1800.0	1300.0	650.0		
17	300.0	0.0	75.0	3000.0	3000.0	0.2	2000.0	1200.0	0.4	3000.0	1600.0	2000.0	1800.0	3000.0	1500.0		
18	3000.0	0.0	50.0	3000.0	150.0	0.2	100.0	0.5	0.1	3000.0	2800.0	3000.0	3000.0	1200.0	2600.0		
19	C-2	0.0	8.0	3000.0	100.0	3000.0	30.0	5.5	2000.0	3000.0	58.0	30.0	3000.0	3000.0	450.0		
20	3000.0	0.0	300.0	3000.0	250.0	1800.0	2000.0	0.7	0.2	3000.0	420.0	2700.0	2700.0	1700.0	550.0		
21	0.2	0.0	17.0	0.0	16.0	3000.0	0.0	3.0	1.5	3000.0	800.0	3000.0	2500.0	5.0	140.0		
22	3000.0	0.0	0.0	3000.0	600.0	2.8	500.0	0.5	0.5	3000.0	1300.0	500.0	1500.0	280.0	680.0		
23	3000.0	0.0	104.0	3000.0	800.0	3000.0	600.0	0.0	0.0	3000.0	500.0	180.0	300.0	280.0	680.0		
24	3000.0	0.0	30.0	560.0	150.0	70.0	400.0	1.1	0.8	3000.0	0.5	1.0	1.0	0.4	72.0		
25	3000.0	0.0	22.0	300.0	40.0	1.5	10.0	0.4	0.2	3000.0	0.2	0.3	35.0	0.5	1.1		
26	3000.0	0.0	0.8	4.0	4.0	2.5	1.0	2.0	0.8	3000.0	380.0	350.0	3000.0	1.1	5.2		
27	3000.0	0.0	60.0	3000.0	700.0	3.0	2000.0	2.0	2.0	3000.0	1900.0	3000.0	1000.0	500.0	2400.0		
28	3000.0	0.0	140.0	3000.0	300.0	180.0	800.0	2.5	800.0	3000.0	400.0	1100.0	1200.0	420.0	2000.0		
29	500.0	0.0	250.0	3000.0	240.0	850.0	10.0	2.5	1000.0	900.0	400.0	1100.0	1200.0	420.0	2000.0		
30	400.0	0.0	6.1	3000.0	200.0	0.6	0.8	0.2	1100.0	740.0	300.0	7000.0	1200.0	67.2	1700.0		
31	3000.0	0.0	1000.0	3000.0	500.0	550.0	3000.0	0.3	0.3	3000.0	0.4	2500.0	3000.0	8.0	1100.0		
32	14.0	0.0	6.1	0.1	0.1	0.2	1.0	0.2	500.0	400.0	0.8	1.6	1.3	0.1	0.7		
33	3000.0	0.0	800.0	3000.0	500.0	900.0	3000.0	3.5	0.6	3000.0	0.7	470.0	1000.0	400.0	2800.0		
34	3000.0	0.0	700.0	3000.0	1500.0	160.0	600.0	0.0	3000.0	3000.0	0.2	0.6	0.7	0.4	0.6		
35	3000.0	0.0	500.0	3000.0	600.0	1400.0	3000.0	0.5	3000.0	3000.0	0.6	170.0	290.0	300.0	350.0		
36	3000.0	0.0	630.0	3000.0	500.0	1500.0	2000.0	0.3	0.5	3000.0	45.0	900.0	1600.0	700.0	2700.0		
37	3000.0	0.0	240.0	3000.0	0.3	0.7	0.9	0.3	3000.0	3000.0	550.0	3000.0	2000.0	1500.0	1700.0		
38	3000.0	0.0	2500.0	3000.0	0.2	3000.0	60.0	2.0	14.0	500.0	280.0	250.0	1500.0	550.0	1900.0		
39	500.0	0.0	1900.0	3000.0	0.1	1.0	2.0	0.6	3000.0	500.0	2.2	280.0	3500.0	52.0	2500.0		
40	3000.0	0.0	490.0	3000.0	1200.0	2000.0	3000.0	2.0	1000.0	3000.0	1.3	1.6	1.6	4.0	3.5		
41	30.0	0.0	600.0	3000.0	350.0	700.0	3000.0	0.4	2400.0	3000.0	0.4	10.0	1.6	4.0	3.5		
42	3000.0	0.0	0.1	0.1	200.0	1.6	40.0	0.1	30.0	3000.0	0.4	0.4	0.3	1.1	2.0		
43	3000.0	0.0	500.0	3000.0	400.0	400.0	1500.0	0.2	1600.0	3000.0	100.0	300.0	400.0	52.0	140.0		
44	3000.0	0.0	3000.0	3000.0	200.0	4.0	0.2	0.2	3000.0	3000.0	90.0	260.0	1200.0	1000.0	2200.0		
45	3000.0	0.0	2400.0	3000.0	120.0	800.0	3000.0	0.4	1000.0	3000.0	240.0	350.0	1000.0	800.0	480.0		
46	3000.0	0.0	800.0	3000.0	400.0	1400.0	3000.0	240.0	600.0	3000.0	850.0	750.0	3000.0	70.0	1300.0		
47	0.3	1000.0	0.8	0.2	0.5	3.0	0.6	0.4	600.0	3000.0	100.0	1000.0	1000.0	3200.0	1600.0		
48	3000.0	10000.0	150.0	3000.0	200.0	20.0	160.0	0.2	400.0	3000.0	75.0	3000.0	2000.0	220.0	1100.0		
49	3000.0	10000.0	3000.0	0.2	0.0	0.3	0.2	0.2	400.0	3000.0	1300.0	800.0	2800.0	1000.0	1300.0		
50	100.0	10000.0	1000.0	360.0	400.0	500.0	3000.0	280.0	600.0	3000.0	160.0	700.0	2500.0	700.0	1800.0		

PACKAGE C-PAK - HELIUM R VALUES
 HELIUM VARIABLE CONDITION EVALUATION
 ALL DATA X10-8 AT4-CC/SEC

UNIT NO.	INITIAL WEIGHT GAIN	30 PSIG			45 PSIG			60 PSIG			75 PSIG			90 PSIG		
		1 HOUR	4 HOURS	8 HOURS	1 HOUR	3 HOURS	6 HOURS	1 HOUR	2 HOURS	4 HOURS	1 HOUR	2 HOURS	4 HOURS	1 HOUR	2 HOURS	4 HOURS
51	140.0	10000.0	0.2	1.0	1000.0	2000.0	0.6	850.0	10.0	140.0	0.3	0.4	0.2	0.3	0.4	0.3
52	300.0	10000.0	10.0	2.0	500.0	3000.0	3000.0	35.0	1000.0	3000.0	500.0	1000.0	1100.0	750.0	620.0	1200.0
53	300.0	10000.0	10.0	40.0	3000.0	280.0	190.0	550.0	900.0	3000.0	0.4	0.2	0.2	0.4	0.4	0.8
54	30.0	10000.0	30.0	70.0	280.0	80.0	5.6	220.0	250.0	30.0	450.0	0.1	1.2	0.7	0.4	0.1
55	3000.0	10000.0	140.0	3000.0	700.0	3000.0	220.0	52.0	700.0	3000.0	250.0	0.2	300.0	3.0	1.1	650.0
56	24.0	10000.0	200.0	3.6	120.0	1.2	700.0	0.3	3000.0	24.0	0.3	470.0	0.2	3.0	3.2	2.8
57	3000.0	10000.0	120.0	200.0	700.0	1000.0	260.0	200.0	120.0	3000.0	0.5	0.5	290.0	1.6	1.7	2.4
58	3000.0	10000.0	3.2	36.6	700.0	3000.0	0.3	480.0	2000.0	3000.0	0.4	1.1	1.0	0.4	4500.0	1.6
59	1.4	10000.0	0.1	0.6	800.0	0.3	0.3	380.0	0.6	1.4	1.9	0.2	1.3	0.4	0.7	0.6
60	0.1	10000.0	700.0	3000.0	300.0	700.0	3000.0	450.0	1000.0	0.1	0.6	0.7	1.1	1.0	0.5	0.7
61	0.2	10000.0	200.0	280.0	300.0	700.0	3000.0	300.0	3000.0	0.2	1.5	0.7	1.3	4.0	0.3	1.6
62	10.0	10000.0	500.0	3000.0	1400.0	1500.0	0.4	180.0	3000.0	10.0	160.0	0.6	5.0	0.7	240.0	250.0
63	0.1	10000.0	220.0	3000.0	630.0	700.0	3000.0	175.0	700.0	0.1	550.0	0.6	750.0	3000.0	1000.0	1200.0
64	120.0	10000.0	70.0	3000.0	1200.0	1500.0	3000.0	120.0	600.0	120.0	60.0	0.3	9.8	1200.0	60.5	3.8
65	0.2	10000.0	400.0	0.1	170.0	0.3	1.5	0.7	2.0	0.2	0.2	0.3	0.3	0.3	0.5	0.4
66	500.0	10000.0	0.1	0.6	100.0	3000.0	320.0	40.0	190.0	500.0	0.7	0.3	2.3	1.0	1.0	0.4
67	3000.0	10000.0	30.0	0.8	500.0	3000.0	460.0	1200.0	40.0	3000.0	850.0	43.0	1100.0	1000.0	200.0	650.0
68	3000.0	10000.0	2000.0	3000.0	1700.0	3000.0	3000.0	750.0	2000.0	3000.0	1.0	0.6	0.3	0.3	0.4	0.7
69	13.0	10000.0	600.0	600.0	1800.0	1000.0	3000.0	3000.0	1700.0	13.0	2700.0	210.0	240.0	3000.0	3000.0	400.0
70	200.0	10000.0	3000.0	60.0	3000.0	500.0	160.0	1100.0	1800.0	200.0	900.0	600.0	200.0	650.0	320.0	2200.0
71	0.4	10000.0	40.0	3000.0	1200.0	1000.0	44.0	170.0	3000.0	0.4	170.0	0.3	0.5	0.6	35.0	0.7
72	100.0	10000.0	500.0	3.2	2500.0	1.0	2.4	200.0	1200.0	100.0	2.0	3.2	1.9	1.2	1.1	0.8
73	28.0	10000.0	120.0	3.2	600.0	0.5	0.6	1400.0	0.2	28.0	850.0	240.0	1100.0	2000.0	0.9	2.7
74	6.0	10000.0	0.5	0.6	750.0	0.8	0.5	1000.0	4.0	6.0	250.0	230.0	380.0	90.0	320.0	240.0
75	0.1	10000.0	0.1	0.1	1.2	0.6	0.6	3.2	0.3	0.1	0.0	0.0	0.7	0.4	0.6	0.8
76	0.8	10000.0	100.0	0.4	3000.0	7.0	0.9	1.0	2.0	0.8	1.0	3.0	1.6	2.5	0.6	0.6
77	95.0	10000.0	800.0	3000.0	400.0	3000.0	3000.0	320.0	3000.0	95.0	1.4	0.4	0.4	0.2	0.8	0.8
78	120.0	10000.0	140.0	3000.0	700.0	3000.0	3000.0	600.0	3000.0	120.0	1.0	35.0	58.0	1.5	1.2	1.4
79	35.0	10000.0	700.0	480.0	500.0	3000.0	360.0	1200.0	1700.0	35.0	800.0	1.3	2200.0	600.0	480.0	1000.0
80	100.0	10000.0	600.0	3000.0	90.0	150.0	100.0	620.0	400.0	100.0	0.5	0.3	1000.0	0.2	180.0	560.0
81	2.0	10000.0	0.1	0.1	1000.0	0.2	0.0	0.6	1.5	2.0	700.0	1300.0	7300.0	550.0	820.0	1200.0
82	3000.0	10000.0	0.1	3000.0	0.0	0.3	0.3	0.5	0.5	3000.0	0.4	0.9	300.0	50.0	0.5	1.0
83	90.0	10000.0	300.0	3000.0	450.0	2500.0	3000.0	0.3	1200.0	90.0	380.0	450.0	3800.0	700.0	500.0	1800.0
84	0.3	10000.0	0.2	0.5	0.3	0.3	1.7	0.4	1.0	0.3	300.0	3000.0	3000.0	900.0	160.0	1500.0
85	3000.0	10000.0	600.0	3000.0	600.0	2000.0	3000.0	2000.0	3000.0	3000.0	0.5	0.4	4.2	2000.0	1000.0	1.5
86	0.6	10000.0	60.0	3000.0	200.0	500.0	200.0	58.0	140.0	0.6	350.0	950.0	1200.0	1000.0	220.0	1000.0
87	3000.0	10000.0	450.0	3000.0	700.0	3000.0	3000.0	780.0	1000.0	3000.0	1500.0	850.0	750.0	700.0	3000.0	1200.0
88	140.0	10000.0	500.0	3000.0	500.0	2000.0	3000.0	1100.0	2500.0	140.0	1500.0	720.0	1100.0	3000.0	350.0	1900.0
89	180.0	10000.0	700.0	3000.0	2000.0	2800.0	3000.0	1200.0	3000.0	180.0	150.0	100.0	250.0	100.0	100.0	300.0
90	0.8	10000.0	500.0	3000.0	400.0	400.0	520.0	120.0	350.0	0.8	650.0	170.0	1300.0	2000.0	1200.0	1000.0
91	3000.0	10000.0	0.6	2.8	60.0	0.4	9.0	0.5	30.0	3000.0	750.0	15.0	1800.0	2500.0	450.0	2000.0
92	8.0	10000.0	800.0	3000.0	500.0	3000.0	3000.0	650.0	1200.0	8.0	0.2	0.4	28.0	0.2	0.8	0.7
93	100.0	10000.0	40.0	80.0	150.0	3000.0	600.0	100.0	50.0	100.0	2.0	1.8	950.0	1000.0	1000.0	1000.0
94	3000.0	10000.0	400.0	3000.0	180.0	3000.0	3000.0	250.0	1800.0	3000.0	0.6	0.5	580.0	1.2	0.6	1.3
95	200.0	10000.0	180.0	3000.0	550.0	3000.0	3000.0	620.0	1600.0	200.0	1300.0	750.0	3000.0	3000.0	880.0	2000.0
96	200.0	10000.0	180.0	3000.0	300.0	2000.0	3000.0	1000.0	3000.0	300.0	400.0	3000.0	3000.0	3000.0	3000.0	2900.0
97	3000.0	10000.0	160.0	4.0	250.0	3000.0	3000.0	550.0	3000.0	3000.0	0.4	0.5	1.0	0.7	0.5	1.3
98	3000.0	10000.0	3000.0	400.0	850.0	1000.0	3000.0	1700.0	1000.0	3000.0	120.0	170.0	350.0	100.0	100.0	4500.0
99	70.0	10000.0	1000.0	280.0	1000.0	3000.0	3000.0	480.0	1200.0	20.0	0.0	0.5	0.2	0.2	0.4	0.3
100	100.0	10000.0	400.0	3000.0	400.0	1000.0	3000.0	1700.0	1500.0	100.0	2500.0	1300.0	220.0	1000.0	21.0	300.0

10. C-PAK Helium R Values Variable Condition (Sheet 2 of 2)

PACKAGE GRID - HELIUM R VALUES
 HELIUM VARIABLE CONDITION EVALUATION
 ALL DATA FROM A 154-02750C

UNIT NUM	INITIAL WEIGHT DIFFERENTIAL	10 PSI/G	4 HOURS	8 HOURS	16 HOURS	24 HOURS	48 HOURS	72 HOURS	96 HOURS	192 HOURS	384 HOURS	768 HOURS	1536 HOURS
51	1000.0	1.00	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
52	200.0	1.2	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
53	400.0	1.4	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
54	600.0	1.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
55	800.0	1.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
56	1000.0	2.0	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
57	1200.0	2.2	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
58	1400.0	2.4	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
59	1600.0	2.6	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
60	1800.0	2.8	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
61	2000.0	3.0	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3
62	2200.0	3.2	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4
63	2400.0	3.4	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
64	2600.0	3.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6
65	2800.0	3.8	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
66	3000.0	4.0	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
67	3200.0	4.2	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
68	3400.0	4.4	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
69	3600.0	4.6	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1
70	3800.0	4.8	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2
71	4000.0	5.0	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3
72	4200.0	5.2	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4
73	4400.0	5.4	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
74	4600.0	5.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6
75	4800.0	5.8	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7
76	5000.0	6.0	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8
77	5200.0	6.2	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9
78	5400.0	6.4	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
79	5600.0	6.6	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1
80	5800.0	6.8	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2
81	6000.0	7.0	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
82	6200.0	7.2	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4
83	6400.0	7.4	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
84	6600.0	7.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6
85	6800.0	7.8	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7
86	7000.0	8.0	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8
87	7200.0	8.2	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9
88	7400.0	8.4	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
89	7600.0	8.6	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1
90	7800.0	8.8	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2
91	8000.0	9.0	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3
92	8200.0	9.2	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4
93	8400.0	9.4	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
94	8600.0	9.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6
95	8800.0	9.8	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7
96	9000.0	10.0	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8
97	9200.0	10.2	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9
98	9400.0	10.4	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
99	9600.0	10.6	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1
100	9800.0	10.8	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2

11. C-DIP Helium R Values Variable Condition (Sheet 2 of 2)

PACKAGE TO100 - HELIUM R VALUES
HELIUM VARIABLE CONDITION EVALUATION
ALL DATA X10-8 ATM-CC/SEC

UNIT NUM.	INITIAL VEEO	WEIGHT GAIN	30 PSIG			45 PSIG			60 PSIG			75 PSIG			90 PSIG		
			1 HOUR	4 HOURS	8 HOURS	1 HOUR	3 HOURS	6 HOURS	1 HOUR	2 HOURS	4 HOURS	1 HOUR	2 HOURS	4 HOURS	1 HOUR	2 HOURS	4 HOURS
1	3.2	C-0	0.3	0.5	0.6	1.0	2.2	3.0	1.8	1.0	1.5	1.8	2.1	1.5	1.5	0.8	
2	1.8	C-0	0.2	0.7	0.8	1.2	4.5	0.4	0.6	0.6	0.8	0.9	0.8	0.5	0.5	1.9	
3	2.9	C-0	0.5	0.7	1.8	1.2	4.5	0.4	0.6	0.6	1.0	0.9	0.8	0.5	0.5	1.9	
4	2.8	C-0	0.5	0.9	0.5	1.2	4.5	0.4	0.6	0.6	1.0	0.9	0.8	0.5	0.5	1.9	
5	4.2	C-0	0.3	0.7	1.0	1.2	4.5	0.4	0.6	0.6	1.0	0.9	0.8	0.5	0.5	1.9	
6	2.9	C-0	0.3	0.8	0.5	2.0	2.0	3.0	2.8	1.0	2.0	1.6	1.8	1.5	1.5	1.4	
7	5.0	C-0	0.3	1.5	1.7	1.0	4.0	3.0	1.6	2.0	3.5	1.8	1.8	1.5	1.5	1.4	
8	2.1	C-0	0.6	1.5	0.4	0.8	4.0	0.6	1.0	0.3	0.4	3.2	0.8	0.5	0.9	1.9	
9	2.2	C-0	0.2	0.9	1.0	0.7	3.0	0.3	0.6	1.0	1.0	1.3	0.6	0.6	0.5	4.0	
10	2.8	C-0	0.5	0.6	0.4	0.4	3.0	0.3	0.6	1.0	1.0	1.3	0.6	0.6	0.5	4.0	
11	2.4	C-0	0.7	1.2	0.5	1.2	2.0	0.7	1.6	1.0	1.5	1.0	1.0	1.0	0.5	2.7	
12	15.0	C-0	1.4	3.0	3.0	1.0	5.0	2.0	5.2	5.0	1.9	1.1	2.2	1.5	2.7	2.0	
13	10.0	C-0	0.2	0.7	0.5	1.0	0.8	1.8	0.9	2.5	0.7	2.0	0.5	0.5	1.0	2.5	
14	1.6	C-0	0.2	1.0	0.2	0.8	3.0	1.2	1.4	1.0	0.8	1.0	1.6	0.9	0.8	2.5	
15	15.0	C-0	0.2	1.2	0.8	1.6	2.0	2.0	2.0	10.0	0.8	1.2	1.0	0.7	1.0	1.5	
16	53.0	C-0	0.4	0.7	0.5	1.3	3.0	0.8	1.0	20.0	0.8	1.2	1.0	0.7	1.0	1.5	
17	1.8	C-0	0.5	6.6	0.7	1.3	0.2	2.7	0.8	1.0	1.7	1.2	1.1	1.4	2.8	6.1	
18	1.8	C-0	3000.0	3000.0	420.0	3000.0	700.0	240.0	40.0	3000.0	3000.0	3000.0	3000.0	3000.0	85.0	3000.0	
19	59.0	C-0	1.5	1.2	3.2	1.9	4.7	2.0	3.2	12.0	1.6	1.2	1.2	1.4	0.5	1.5	
20	31.0	C-0	0.9	2.4	3.6	1.4	2.5	1.5	4.0	5.0	1.1	2.4	1.2	1.0	1.0	1.5	
21	15.0	C-0	0.2	2.1	2.6	1.0	5.5	2.0	3.6	7.0	2.5	1.2	1.2	3.0	2.5	5.0	
22	2.4	C-0	0.7	1.2	0.5	0.9	0.7	1.4	3.2	1.0	1.4	1.6	1.4	0.6	0.6	1.4	
23	4.4	C-0	0.3	1.2	1.0	0.5	2.4	0.9	4.0	1.7	1.9	1.5	1.4	3.0	0.9	2.7	
24	81.0	C-0	0.5	3.0	1.0	1.0	2.5	3.0	1.5	20.0	7.5	2.5	1.9	1.0	0.9	2.7	
25	3000.0	C-0	0.6	36.0	2.5	15.0	24.0	7.9	20.0	600.0	6.6	2.3	0.8	2.2	3.0	6.5	
26	3000.0	C-0	56.0	180.0	120.0	120.0	85.0	13.0	600.0	600.0	7.0	3.7	1.0	1.0	0.8	2.0	
27	142.0	C-0	3.4	1.5	4.4	0.8	1.2	0.4	1.6	50.0	1.8	3.0	0.8	1.0	0.8	2.0	
28	53.0	C-0	2.0	0.2	1.0	0.6	12.0	2.1	1.0	30.0	7.0	1.6	1.1	1.0	1.2	1.6	
29	3000.0	C-0	100.0	720.0	510.0	300.0	500.0	100.0	44.0	500.0	1.0	9.0	2.0	1.2	1.2	1.5	
30	100.0	C-0	7.5	42.0	23.0	7.0	26.0	3.0	4.0	800.0	0.5	4.0	1.4	4.0	0.6	1.5	
31	3000.0	C-0	1.4	1.4	0.6	0.8	0.6	0.9	1.4	400.0	2.0	2.0	3.0	1.0	1.2	1.5	
32	3000.0	C-0	60.0	450.0	310.0	220.0	200.0	120.0	70.0	700.0	100.0	110.0	30.0	150.0	150.0	320.0	
33	3000.0	C-0	3000.0	480.0	380.0	200.0	180.0	75.0	70.0	3000.0	5.7	4.0	4.0	9.0	4.5	4.0	
34	3000.0	C-0	80.0	420.0	310.0	200.0	1800.0	20.0	240.0	500.0	1.0	2.0	4.0	0.6	0.6	0.8	
35	170.0	C-0	2.6	4.5	3.5	1.0	1.8	0.9	1.2	40.0	1.3	1.8	2.5	1.5	1.6	3.0	
36	3000.0	C-0	9.0	54.0	58.0	20.0	24.0	8.5	28.0	200.0	1.4	1.7	2.0	1.2	0.6	3.0	
37	3000.0	C-0	6.0	42.0	45.0	20.0	28.0	6.0	24.0	120.0	3.9	1.2	10.0	8.0	10.0	10.0	
38	220.0	C-0	0.3	1.3	1.3	1.0	15.0	1.4	2.4	50.0	1.3	1.8	1.2	1.5	4.5	1.4	
39	3000.0	C-0	70.0	300.0	290.0	280.0	600.0	400.0	280.0	700.0	70.0	90.0	220.0	200.0	300.0	500	
40	3000.0	C-0	40.0	420.0	250.0	140.0	300.0	15.0	560.0	3000.0	0.7	3.5	14.0	1000.0	3000.0	3000.0	
41	3000.0	C-0	27.0	300.0	230.0	200.0	240.0	50.0	40.0	200.0	10.0	10.0	58.0	0.6	0.8	1.0	
42	3000.0	C-0	14.0	27.0	27.0	14.0	25.0	6.5	20.0	120.0	10.0	10.0	25.0	0.6	0.8	1.0	
43	130.0	C-0	1.5	9.0	5.2	0.8	1.6	0.5	2.0	30.0	0.5	1.9	1.1	2.0	1.9	1.1	
44	3000.0	C-0	55.0	300.0	250.0	150.0	280.0	85.0	40.0	700.0	65.0	80.0	200.0	70.0	100.0	200.0	
45	3000.0	C-0	100.0	600.0	600.0	400.0	700.0	250.0	300.0	1000.0	210.0	160.0	630.0	400.0	500.0	1000.0	
46	3000.0	C-0	260.0	3000.0	1000.0	1300.0	2000.0	240.0	2000.0	3000.0	400.0	400.0	500.0	0.8	0.8	4.0	
47	3000.0	C-0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	
48	3000.0	C-0	100.0	350.0	410.0	250.0	500.0	85.0	240.0	3000.0	9.5	7.1	3.5	0.7	1.0	1.3	
49	3000.0	C-0	120.0	750.0	500.0	2.4	780.0	1000.0	64.0	3000.0	1.8	1.0	71.0	1.2	0.7	1.4	
50	3000.0	C-0	180.0	3600.0	500.0	400.0	400.0	35.0	58.0	3000.0	5.7	1.4	71.0	1.0	3.5	6.5	

13. TO-100 Helium R Values Variable Condition (Sheet 1 of 2)

PACKAGE CERM - HELIUM R VALUES
HELIUM VARIABLE CONDITION EVALUATION
ALL DATA X10-8 ATH-CC/SEC

UNIT NUM.	INITIAL VELOC	WEIGHT GAIN	30 PSIG			45 PSIG			60 PSIG			75 PSIG			90 PSIG		
			1 HOUR	4 HOURS	8 HOURS	1 HOUR	3 HOURS	6 HOURS	1 HOUR	2 HOURS	4 HOURS	1 HOUR	2 HOURS	4 HOURS	1 HOUR	2 HOURS	4 HOURS
1	18.0	750.0	100.0	7.0	7.0	30.0	11.0	55.0	34.0	70.0	18.0	37.0	32.0	42.0	65.0	120.0	
2	20.0	0.0	10.0	50.0	1.0	6.0	60.0	17.0	8.0	20.0	24.0	24.0	35.0	38.0	50.0	60.0	
3	21.0	0.8	1.3	12.0	10.0	3.2	25.0	8.0	40.0	10.0	24.0	24.0	35.0	38.0	50.0	60.0	
4	22.0	0.0	62.0	19.0	3.2	30.0	4.5	12.0	12.0	22.0	8.0	8.0	19.0	20.0	30.0	30.0	
5	18.0	0.0	12.3	2.8	10.0	15.0	100.0	10.0	12.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	
6	20.0	0.0	12.0	35.0	10.0	40.0	15.0	6.1	40.0	6.0	6.0	6.0	15.0	15.0	26.0	35.0	
7	20.0	2.1	3.2	10.0	3.0	70.0	17.0	150.0	150.0	12.0	8.0	8.0	110.0	80.0	180.0	180.0	
8	20.0	3.0	2.4	18.0	7.0	30.0	4.0	12.0	12.0	20.0	12.0	10.0	22.0	20.0	70.0	1300.0	
9	12.0	3.0	13.0	0.3	11.0	8.0	90.0	12.0	12.0	12.0	12.0	10.0	20.0	55.0	100.0	100.0	
10	30.0	565.8	9.0	60.0	10.0	50.0	27.0	100.0	40.0	30.0	30.0	30.0	60.0	42.0	1500.0	1500.0	
11	10.0	2.0	2.6	2.2	18.0	4.0	7.8	10.0	10.0	10.0	10.0	10.0	15.0	15.0	60.0	60.0	
12	15.0	1.6	1.6	3.0	8.0	10.0	3.0	5.0	11.0	10.0	15.0	17.0	20.0	17.0	150.0	150.0	
13	30.0	0.0	2.8	12.0	25.0	4.5	20.0	45.0	5.5	30.0	11.0	19.0	30.0	14.0	50.0	45.0	
14	10.0	1.6	9.3	14.0	10.0	2.5	16.0	15.0	15.0	10.0	10.0	19.0	30.0	100.0	200.0	200.0	
15	90.0	0.0	16.0	9.0	50.0	16.0	50.0	60.0	18.0	72.0	90.0	80.0	75.0	200.0	500.0	500.0	
16	70.0	0.0	11.0	45.0	30.0	25.0	24.0	40.0	40.0	40.0	40.0	35.0	100.0	55.0	60.0	80.0	
17	70.0	0.0	6.8	5.0	200.0	8.0	26.0	70.0	14.0	30.0	70.0	70.0	100.0	3000.0	3000.0	3000.0	
18	30.0	798.9	30.0	100.0	30.0	14.0	20.0	18.0	22.0	22.0	20.0	26.0	3000.0	3000.0	3000.0	3000.0	
19	220.0	1.9	22.0	21.0	70.0	20.0	12.0	240.0	65.0	22.0	40.0	50.0	150.0	110.0	150.0	2500.0	
20	40.0	0.0	3.2	15.0	9.0	10.0	8.0	9.0	9.0	28.0	40.0	15.0	42.0	85.0	75.0	75.0	
21	309.0	753.0	45.0	120.0	140.0	12.0	100.0	240.0	80.0	30.0	300.0	100.0	240.0	190.0	300.0	500.0	
22	30.0	0.4	32.0	200.0	20.0	26.0	16.0	52.0	16.0	85.0	30.0	80.0	65.0	70.0	100.0	160.0	
23	55.0	0.0	45.0	12.0	25.0	18.0	24.0	80.0	18.0	78.0	55.0	110.0	110.0	35.0	200.0	120.0	
24	30.0	67.0	85.0	40.0	40.0	25.0	40.0	130.0	13.0	220.0	30.0	67.0	700.0	1400.0	600.0	3000.0	
25	50.0	710.8	72.0	8.5	30.0	40.0	22.0	65.0	18.0	31.0	50.0	75.0	80.0	300.0	140.0	200.0	
26	30.0	748.7	8.0	12.0	45.0	220.0	30.0	100.0	30.0	300.0	30.0	65.0	120.0	100.0	160.0	3000.0	
27	30.0	889.1	7.0	19.0	26.0	70.0	60.0	36.0	60.0	55.0	30.0	3000.0	3000.0	3000.0	3000.0	3000.0	
28	40.0	893.5	51.0	27.0	60.0	260.0	30.0	18.0	200.0	100.0	80.0	180.0	180.0	100.0	350.0	300.0	
29	90.0	841.0	20.0	15.0	50.0	20.0	20.0	70.0	20.0	200.0	80.0	180.0	180.0	300.0	300.0	300.0	
30	3000.0	842.1	78.0	3000.0	-3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	1000.0	2100.0	3000.0	3000.0	3000.0	3000.0	
31	55.0	0.0	19.0	15.0	30.0	100.0	60.0	80.0	80.0	38.0	55.5	35.0	42.0	180.0	100.0	1200.0	
32	30.0	810.5	18.0	50.0	30.0	22.0	22.0	100.0	35.0	80.0	80.0	50.0	250.0	170.0	200.0	200.0	
33	120.0	729.2	11.0	15.0	60.0	80.0	20.0	100.0	41.0	41.0	120.0	3000.0	3000.0	3000.0	3000.0	3000.0	
34	40.0	818.1	30.0	10.0	160.0	160.0	20.0	60.0	180.0	35.0	40.0	320.0	1000.0	3000.0	550.0	550.0	
35	3000.0	790.1	3000.0	3000.0	3000.0	3000.0	2800.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	
36	300.0	916.3	16.0	120.0	40.0	160.0	100.0	170.0	140.0	100.0	300.0	140.0	280.0	190.0	350.0	200.0	
37	100.0	1.2	60.0	8.0	100.0	40.0	48.0	120.0	72.0	100.0	100.0	60.0	200.0	100.0	78.0	240.0	
38	300.0	697.4	15.0	15.0	100.0	120.0	80.0	1000.0	200.0	250.0	300.0	1000.0	1000.0	1900.0	3000.0	3000.0	
39	16.0	0.1	15.0	3.0	18.0	60.0	32.0	32.0	15.0	12.0	16.0	14.0	25.0	23.0	45.0	45.0	
40	100.0	0.4	13.0	7.0	40.0	16.0	16.0	42.0	20.0	25.0	100.0	82.0	43.0	70.0	55.0	100.0	
41	50.0	0.4	50.0	70.0	18.0	14.0	12.0	47.0	15.0	47.0	50.0	26.0	80.0	45.0	50.0	100.0	
42	3000.0	748.2	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	2000.0	2000.0	3000.0	3000.0	3000.0	3000.0	3000.0	
43	300.0	773.8	27.0	3000.0	24.0	30.0	55.0	50.0	30.0	55.0	40.0	400.0	1000.0	3000.0	1500.0	3000.0	
44	40.0	704.0	10.0	3000.0	15.0	1400.0	40.0	400.0	24.0	400.0	300.0	600.0	3000.0	400.0	30.0	45.0	
45	20.0	234.0	7.5	5.0	10.0	16.0	30.0	45.0	26.0	70.0	100.0	12.0	65.0	90.0	65.0	45.0	
46	55.0	457.0	26.0	70.0	90.0	35.0	80.0	100.0	70.0	100.0	55.0	200.0	150.0	130.0	60.0	100.0	
47	100.0	0.0	10.0	3000.0	60.0	20.0	60.0	70.0	20.0	60.0	100.0	40.0	50.0	110.0	60.0	100.0	
48	60.0	0.0	22.0	18.0	100.0	90.0	32.0	72.0	70.0	80.0	60.0	41.0	50.0	160.0	120.0	140.0	
49	100.0	0.0	7.0	16.0	40.0	35.0	3000.0	35.0	150.0	41.0	100.0	100.0	100.0	110.0	50.0	80.0	
50	1.0	925.8	8.0	80.0	100.0	40.0	42.0	300.0	60.0	100.0	60.0	190.0	240.0	350.0	200.0	120.0	

14. Ceramic Helium R Values Variable Condition (Sheet 1 of 2)

PACAGE CERM - HELIUM R VALUES
 HELIUM VARIABLE CONDITION EVALUATION
 ALL DATA X10-8 ATM-CC/SEC

UNIT NUM.	INITIAL VEECC	HEIGHT GAIN	30 PSIG			45 PSIG			60 PSIG			75 PSIG			90 PSIG		
			1 HOUR	4 HOURS	8 HOURS	1 HOUR	3 HOURS	6 HOURS	1 HOUR	2 HOURS	4 HOURS	1 HOUR	2 HOURS	4 HOURS	1 HOUR	2 HOURS	4 HOURS
51	3000.0	901.9	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	
52	30.0	0.0	8.0	40.0	45.0	25.0	20.0	125.0	42.0	3000.0	3000.0	2000.0	100.0	210.0	450.0	90.0	
53	80.0	0.1	33.0	80.0	200.0	45.0	32.0	100.0	40.0	100.0	100.0	30.0	7.0	2100.0	55.0	100.0	
54	30.0	0.4	42.0	180.0	60.0	300.0	30.0	140.0	60.0	30.0	30.0	80.0	7.0	50.0	55.0	100.0	
55	120.0	689.6	8.5	5.2	40.0	20.0	40.0	5.2	28.0	50.0	5.2	27.0	60.0	3000.0	500.0	1000.0	
56	3000.0	834.2	3000.0	3000.0	3000.0	3000.0	400.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	
57	70.0	711.1	32.0	18.0	90.0	80.0	28.0	150.0	32.0	110.0	110.0	70.0	240.0	50.0	220.0	250.0	
58	120.0	835.5	38.0	120.0	120.0	120.0	80.0	210.0	300.0	300.0	300.0	150.0	280.0	50.0	150.0	150.0	
59	150.0	744.4	43.0	27.0	120.0	120.0	36.0	220.0	100.0	70.0	70.0	60.0	300.0	70.0	170.0	170.0	
60	45.0	0.0	29.0	22.0	45.0	55.0	60.0	190.0	100.0	45.0	45.0	45.0	300.0	50.0	75.0	140.0	
61	280.0	0.0	11.0	45.0	60.0	25.0	46.0	78.0	6.5	300.0	300.0	280.0	200.0	70.0	80.0	100.0	
62	60.0	892.7	100.0	180.0	50.0	90.0	3.2	130.0	35.0	100.0	100.0	80.0	50.0	48.0	150.0	150.0	
63	20.0	0.0	3.9	15.0	10.0	40.0	9.0	250.0	75.0	20.0	20.0	20.0	30.0	17.0	22.0	40.0	
64	70.0	0.0	18.0	27.0	100.0	10.0	56.0	35.0	30.0	22.0	22.0	70.0	0.0	65.0	75.0	140.0	
66	60.0	0.0	100.0	25.0	24.0	10.0	28.0	240.0	500.0	78.0	78.0	60.0	130.0	22.0	25.0	45.0	
67	60.0	0.2	17.0	7.0	40.0	6.0	5.6	21.0	12.0	17.0	17.0	60.0	35.0	13.0	15.0	25.0	
68	16.0	0.1	2.2	12.0	3000.0	35.0	15.0	62.0	6.0	8.8	8.8	16.0	24.0	50.0	13.0	20.0	
69	8.0	0.5	5.2	5.0	6.0	2.0	2.8	30.0	5.0	13.0	13.0	8.0	8.0	270.0	40.0	60.0	
70	8.0	1.8	16.0	3.0	7.5	9.0	2.8	20.0	20.0	11.0	11.0	8.0	160.0	10.0	20.0	20.0	
71	60.0	0.4	7.0	1.5	6.5	45.0	3.6	1.7	40.0	6.8	6.8	60.0	7.0	3.8	5.0	7.5	

PACKAGE GLASS - HELIUM R VALUES
 HELIUM VARIABLE CONDITION EVALUATION
 ALL DATA X10-8 ATM-CC/SEC

UNIT NUM.	INITIAL WEIGHT GAIN VECCO	30 PSIG				45 PSIG				60 PSIG				75 PSIG				90 PSIG			
		1 HOUR	4 HOURS	8 HOURS	1 HOUR	3 HOURS	6 HOURS	1 HOUR	2 HOURS	4 HOURS	1 HOUR	2 HOURS	4 HOURS	1 HOUR	2 HOURS	4 HOURS	1 HOUR	2 HOURS	4 HOURS		
1	10.0	0.0	10.0	1200.0	30.0	35.0	28.0	1500.0	55.0	36.0	31.0	140.0	60.0	1200.0	58.0						
2	1000.0	0.0	1000.0	78.0	3000.0	30.0	3000.0	20.0	3000.0	3000.0	3000.0	1500.0	3000.0	3000.0	1100.0						
3	5000.0	0.0	3000.0	1500.0	40.0	40.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	45.0						
4	8.0	0.0	8.0	30.0	36.0	30.0	45.0	8.0	24.0	24.0	18.0	40.0	80.0	100.0							
5	9.0	0.0	9.0	12.0	28.0	24.0	68.0	40.0	60.0	45.0	45.0	45.0	75.0	100.0							
6	1000.0	0.0	3000.0	3006.0	3000.0	3000.0	47.0	3000.0	3000.0	3000.0	14.0	30.0	35.0	40.0							
7	3000.0	0.0	3000.0	3000.0	44.0	3000.0	3000.0	30.0	3000.0	3000.0	1800.0	3000.0	3000.0	3000.0							
8	9.0	0.0	9.0	54.0	35.0	60.0	52.0	50.0	30.0	30.0	39.0	70.0	60.0	120.0							
9	20.0	0.0	20.0	50.0	30.0	28.0	42.0	38.0	20.0	20.0	42.0	55.0	45.0	55.0							
10	10.0	1000.0	10.0	3000.0	20.0	50.0	48.0	60.0	24.0	24.0	27.0	60.0	100.0	150.0							
11	3000.0	1000.0	3000.0	3000.0	450.0	1600.0	3000.0	3000.0	200.0	200.0	100.0	170.0	1000.0	3000.0							
12	10.0	1000.0	10.0	32.0	44.0	13.0	3000.0	3000.0	20.0	20.0	75.0	65.0	45.0	100.0							
13	20.0	1000.0	20.0	45.0	110.0	24.0	100.0	50.0	30.0	30.0	30.0	55.0	30.0	3000.0							
14	35.0	10000.0	35.0	80.0	110.0	75.0	52.0	90.0	30.0	30.0	65.0	80.0	100.0	110.0							
15	60.0	10000.0	60.0	75.0	150.0	250.0	51.0	300.0	30.0	30.0	35.0	180.0	100.0	120.0							
16	10.0	10000.0	10.0	20.0	33.0	45.0	78.0	50.0	32.0	32.0	20.0	300.0	650.0	190.0							
17	10.0	10000.0	10.0	16.0	25.0	14.0	40.0	50.0	30.0	30.0	19.0	45.0	60.0	56.0							
18	62.0	0.0	62.0	60.0	200.0	140.0	65.0	120.0	80.0	80.0	37.0	170.0	120.0	120.0							
19	10.0	0.0	10.0	3000.0	80.0	3000.0	3000.0	3000.0	3000.0	3000.0	23.0	70.0	70.0	29.0							
20	1700.0	0.0	1700.0	3000.0	1400.0	3000.0	3000.0	3000.0	3000.0	3000.0	40.0	140.0	55.0	170.0							
21	16.0	0.0	16.0	120.0	130.0	24.0	80.0	130.0	40.0	40.0	72.0	55.0	55.0	200.0							
22	3000.0	0.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0							
23	50.0	0.0	50.0	40.0	140.0	60.0	85.0	100.0	44.0	44.0	90.0	160.0	45.0	90.0							
24	1000.0	0.0	1000.0	1500.0	600.0	1500.0	1200.0	1400.0	3000.0	3000.0	38.0	45.0	100.0	200.0							
25	20.0	0.0	20.0	22.0	70.0	55.0	25.0	70.0	70.0	70.0	85.0	100.0	100.0	100.0							
26	3000.0	1000.0	3000.0	3000.0	30.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0							
27	3000.0	1000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0							
28	3000.0	1000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0							
29	21.0	1000.0	21.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0							
30	50.0	1000.0	50.0	90.0	160.0	150.0	75.0	120.0	80.0	80.0	120.0	150.0	150.0	210.0							
31	3000.0	1000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	1500.0							
32	28.0	1000.0	28.0	32.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0							
33	3000.0	1000.0	3000.0	3000.0	50.0	50.0	50.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0							
34	20.0	10000.0	20.0	22.0	60.0	60.0	60.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	220.0							
35	3000.0	10000.0	3000.0	3006.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	1500.0							
36	3000.0	10000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0							
37	3000.0	10000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0							
38	3000.0	10000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	250.0							
39	3000.0	10000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0							
40	40.0	10000.0	40.0	50.0	83.0	18.0	65.0	120.0	40.0	40.0	60.0	190.0	300.0	140.0							
41	3000.0	010000.0	3000.0	150.0	200.0	580.0	300.0	600.0	12.0	12.0	1000.0	3000.0	150.0	300.0							
42	3000.0	010000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	1400.0	3000.0	3000.0	3000.0							
43	3000.0	010000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	2200.0	3000.0	3000.0	3000.0							
44	20.0	010000.0	20.0	70.0	210.0	28.0	60.0	150.0	60.0	60.0	140.0	180.0	60.0	35.0							
45	3000.0	010000.0	3000.0	1500.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0							
46	63.0	010000.0	60.0	80.0	85.0	30.0	85.0	100.0	20.0	20.0	65.0	160.0	100.0	130.0							
47	40.0	010000.0	40.0	150.0	300.0	50.0	100.0	100.0	50.0	50.0	35.0	150.0	50.0	120.0							
48	20.0	010000.0	23.0	55.0	52.0	40.0	50.0	130.0	40.0	40.0	75.0	100.0	100.0	75.0							
49	20.0	010000.0	23.0	48.0	100.0	40.0	140.0	130.0	50.0	50.0	75.0	100.0	120.0	290.0							
50	30.0	010000.0	30.0	60.0	150.0	150.0	300.0	1000.0	40.0	40.0	35.0	140.0	45.0	80.0							
51	20.0	010000.0	20.0	30.0	1300.0	65.0	45.0	100.0	40.0	40.0	42.0	35.0	40.0	100.0							

16. Glass Standards Helium R Values Variable Condition

PACKAGE 1084 - HELIUM R VALUES
 HELIUM REPEATABILITY EVALUATION
 ALL DATA X10-8 ATM-CC/SEC

UNIT NUM.	RUN 1	RUN 2	RUN 3	RUN 4
1	0.3	0.4	0.2	0.3
2	0.5	0.3	0.4	0.5
3	0.1	0.1	0.1	0.1
4	0.1	0.0	0.1	0.1
5	0.1	0.0	0.1	0.1
6	0.2	0.1	0.2	0.2
7	0.1	0.2	0.1	0.1
8	0.1	0.0	0.2	0.1
9	0.2	0.1	0.1	0.2
10	0.3	0.3	0.3	0.3
11	3000.0	9.0	3000.0	3000.0
12	0.1	0.1	0.2	0.1
13	0.1	0.1	0.2	0.1
14	0.1	0.1	0.2	0.1
15	1.0	0.1	0.2	1.0
16	3000.0	3000.0	3000.0	3000.0
17	0.1	0.1	0.1	0.1
18	0.1	0.1	0.3	0.1
19	0.2	0.0	0.1	0.2
20	0.2	0.1	0.1	0.2
21	0.1	0.1	0.6	0.1
22	0.1	0.0	0.1	0.1
23	0.3	0.3	0.5	0.3
24	0.2	0.1	0.2	0.2
25	3000.0	3000.0	3000.0	3000.0
26	0.3	0.0	0.1	0.3
27	0.1	0.0	0.1	0.1
28	0.1	0.1	0.2	0.1
29	0.2	0.2	0.3	0.2
30	0.2	0.0	0.1	0.2
31	0.2	0.1	0.2	0.2
32	0.1	0.3	0.3	0.1
33	0.1	0.2	0.2	0.1
34	0.2	0.2	0.2	0.2
35	100.0	180.0	50.0	100.0
36	0.2	0.0	0.2	0.2
37	0.1	0.0	0.2	0.1
38	0.3	0.1	0.1	0.3
39	0.2	0.1	0.2	0.2
40	0.2	0.1	0.1	0.2
41	0.1	0.1	0.2	0.1
42	0.2	0.3	0.1	0.2
43	0.1	0.1	0.1	0.1
44	0.2	0.4	0.1	0.2
45	0.2	0.1	0.2	0.2
46	0.1	0.1	0.2	0.1
47	3000.0	0.1	3000.0	3000.0
48	0.1	0.2	0.2	0.1
49	0.2	0.1	0.1	0.2
50	0.1	0.1	3000.0	0.1

17. TC 34 Helium Repeatability R Values (Sheet 1 of 2)

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PACKAGE 1084 - HELIUM R VALUES
 HELIUM REPEATABILITY EVALUATION
 ALL DATA X10-8 ATM-CC/SEC

UNIT NUM.	RUN 1	RUN 2	RUN 3	RUN 4
51	0.2	0.2	0.1	0.2
52	0.1	0.1	0.1	0.1
53	0.2	0.2	0.1	0.2
54	0.1	0.2	0.1	0.1
55	0.4	0.7	0.4	0.4
56	0.1	0.1	0.2	0.1
57	0.2	0.1	0.1	0.2
58	0.2	0.2	0.2	0.2
59	100.0	50.0	100.0	100.0
60	3000.0	280.0	3000.0	3000.0
61	0.3	0.4	0.3	0.3
62	3000.0	3000.0	3000.0	3000.0
63	0.2	0.2	0.2	0.2
64	0.3	0.2	0.2	0.3
65	3000.0	3000.0	3000.0	3000.0
66	0.2	0.1	0.1	0.2
67	2.0	1.5	1.5	2.0
68	3.8	1.5	1.8	3.8
69	3.0	2.9	2.5	3.0
70	0.2	0.2	0.2	0.2
71	0.9	1.6	1.0	0.9
72	1.1	2.0	1.0	1.1
73	0.8	1.3	1.2	0.8
74	1.2	0.8	1.2	1.2
75	1.0	1.0	0.9	1.0
76	0.9	0.8	1.0	0.9
77	0.8	1.0	0.6	0.8
78	0.9	1.2	1.0	0.9
79	1.3	1.0	1.0	1.3
80	1.1	0.8	0.7	1.1
81	0.3	0.3	0.2	0.3
82	1.0	0.8	1.0	1.0
83	1.1	1.2	1.0	1.1
84	0.8	0.8	0.6	0.8
85	0.8	0.9	0.8	0.8
86	1.0	1.3	0.9	1.0
87	0.9	1.5	0.6	0.9
88	3000.0	3000.0	3000.0	3000.0
89	1.4	1.0	0.8	1.4
90	1.2	1.0	1.0	1.2
91	0.7	0.6	0.6	0.7
92	0.7	1.3	0.6	0.7
93	1.0	0.9	1.0	1.0
94	0.8	1.0	1.0	0.8
95	0.8	0.7	0.6	0.8
96	1.0	0.8	0.7	1.0
97	0.8	1.0	1.0	0.8
98	0.8	0.7	0.7	0.8

17. TO-84 Helium Repeatability R Values (Sheet 2 of 2)

PACKAGE C-PAK - HELIUM R VALUES
 HELIUM REPEATABILITY EVALUATION
 ALL DATA X10-8 ATM-CC/SEC

UNIT NUM.	RUN 1	RUN 2	RUN 3	RUN 4
1	3000.0	0.3	0.3	0.3
2	0.1	0.4	0.6	0.4
3	3000.0	0.2	3000.0	0.2
4	3000.0	3000.0	0.2	3000.0
5	3000.0	0.1	0.8	0.1
6	3000.0	0.1	20.0	0.1
7	3000.0	3000.0	3000.0	3000.0
8	3000.0	0.1	3000.0	0.1
9	0.3	0.2	0.3	0.2
10	200.0	0.3	140.0	0.3
11	3000.0	0.2	3000.0	0.2
12	3000.0	3000.0	3000.0	3000.0
13	3000.0	0.2	50.0	0.2
14	3000.0	2.0	3000.0	2.0
15	110.0	3000.0	80.0	3000.0
16	0.4	3000.0	0.2	3000.0
17	3000.0	0.7	3000.0	0.7
18	0.3	1.8	0.2	1.8
19	0.2	0.2	0.4	0.2
20	3000.0	0.0	3000.0	0.0
21	3000.0	0.2	3000.0	0.2
22	3000.0	0.2	3000.0	0.2
23	3000.0	0.3	3000.0	0.3
24	8.0	0.1	3.8	0.1
25	150.0	0.7	3000.0	0.7
26	3000.0	0.5	3000.0	0.5
27	3000.0	0.3	3000.0	0.3
28	3000.0	2.0	0.9	2.0
29	3000.0	0.1	3000.0	0.1
30	3000.0	3000.0	0.6	3000.0
31	0.2	3000.0	3000.0	3000.0
32	3000.0	0.1	3000.0	0.1
33	160.0	3000.0	100.0	3000.0
34	260.0	3000.0	3000.0	3000.0
35	3000.0	3000.0	0.2	3000.0
36	0.1	0.1	0.3	0.1
37	3000.0	0.1	3000.0	0.1
38	3000.0	0.1	0.7	0.1
39	0.3	3000.0	0.3	3000.0
40	0.2	3000.0	0.5	3000.0
41	3000.0	4.2	3000.0	4.2
42	3000.0	0.3	3000.0	0.3
43	0.2	3000.0	0.2	3000.0
44	3000.0	80.0	3000.0	80.0
45	0.8	0.2	0.3	0.2
46	3000.0	280.0	3000.0	280.0
47	3000.0	2.6	3000.0	2.6
48	3000.0	3000.0	3000.0	3000.0
49	3000.0	4000.0	3000.0	3000.0
50	0.0	0.3	0.0	0.3

PACKASC C-PAK - HELIUM R VALUES
 HELIUM REPEATABILITY EVALUATION
 ALL DATA X10-8 ATM-CC/SEC

UNIT NUM.	RUN 1	RUN 2	RUN 3	RUN 4
51	70.0	3000.0	50.0	3000.0
52	0.6	3000.0	3.4	3000.0
53	3000.0	3000.0	3000.0	3000.0
54	80.0	3000.0	120.0	3000.0
55	0.1	3000.0	0.1	3000.0
56	290.0	3000.0	3000.0	3000.0
57	4.8	3000.0	0.4	3000.0
58	3000.0	3000.0	3000.0	3000.0
59	3000.0	3000.0	3000.0	3000.0
60	0.7	0.4	0.3	0.4
61	3000.0	0.4	3000.0	0.4
62	0.8	3000.0	1.2	3000.0
63	3000.0	250.0	3000.0	350.0
64	0.3	160.0	0.7	140.0
65	3000.0	220.0	3000.0	220.0
66	0.1	0.3	0.7	0.3
67	0.1	3000.0	0.1	3000.0
68	0.5	3000.0	0.3	3000.0
69	3000.0	0.4	0.2	0.4
70	3000.0	0.1	3000.0	0.1
71	0.8	3000.0	1.0	3000.0
72	0.2	3000.0	0.3	3000.0
73	0.2	3000.0	0.1	3000.0
74	0.6	3000.0	0.1	3000.0
75	1.6	3000.0	0.4	3000.0
76	0.1	3000.0	0.3	3000.0
77	0.5	3000.0	0.4	3000.0
78	3000.0	0.2	0.7	0.2
79	0.1	3000.0	0.7	3000.0
80	3000.0	3000.0	3000.0	3000.0
81	0.1	3000.0	0.0	3000.0
82	3000.0	3000.0	3000.0	3000.0
83	0.6	3000.0	1.3	3000.0
84	3000.0	3000.0	3000.0	3000.0
85	3000.0	75.0	3000.0	75.0
86	0.2	0.4	0.1	0.4
87	0.2	3000.0	0.7	3000.0
88	0.4	0.6	6.5	0.3
89	0.3	0.2	0.2	0.3
90	0.1	3000.0	0.8	3000.0
91	0.3	3000.0	0.2	3000.0
92	0.2	3000.0	0.1	3000.0
93	3000.0	3000.0	2.0	3000.0
94	0.6	3000.0	3000.0	3000.0
95	0.2	3000.0	0.5	3000.0
96	0.4	3000.0	0.2	3000.0
97	3000.0	3000.0	3000.0	3000.0
98	0.1	3000.0	0.0	3000.0
99	0.5	0.7	0.7	0.7
100	0.2	100.0	0.9	100.0

18. C-PAK Helium Repeatability R Values (Sheet 2 of 2)

PACKAGE C-DIP - HELIUM R VALUES
 HELIUM REPEATABILITY EVALUATION
 ALL DATA X10-8 ATM-CC/SEC

UNIT NUM.	RUM 1	RUM 2	RUM 3	RUM 4
1	3.5	1.7	1.6	0.3
2	1.7	2.5	0.6	1.9
3	0.7	3.9	0.4	2.2
4	1.4	3.3	1.0	0.4
5	3.0	3.2	1.8	2.0
6	1.0	4.5	0.8	0.6
7	3.0	2.5	21.0	1.6
8	1.0	1.0	3.5	0.8
9	1.2	4.2	0.7	1.4
10	2.0	0.5	0.3	0.1
11	10.0	4.0	4.0	5.5
12	10.0	6.8	18.0	1.8
13	5.5	2.2	15.0	5.3
14	2.8	1.7	14.0	4.0
15	10.0	1.4	3.0	7.5
16	3.0	0.8	0.6	1.7
17	1.0	4.6	1.0	2.3
18	3.0	2.1	2.1	1.5
19	50.0	1.1	19.0	1.0
20	22.0	8.5	3.0	3.0
21	6.0	7.5	7.5	4.8
22	12.0	1.7	1.0	3.0
23	1.4	6.0	0.8	3.4
24	4.0	102.0	1.5	1.7
25	400.0	3000.0	11.0	3000.0
26	400.0	0.6	0.5	0.7
27	300.0	3000.0	3000.0	3000.0
28	800.0	1.9	3600.0	0.8
29	300.0	1.7	2.0	4.0
30	500.0	0.1	6.0	35.0
31	120.0	2000.0	2000.0	300.0
32	300.0	49.0	3.5	1.3
33	200.0	3000.0	3000.0	3000.0
34	300.0	120.0	1.0	110.0
35	100.0	19.0	200.0	55.0
36	3.0	6.5	3.5	2.2
37	42.0	3.0	1.5	4.0
38	4.5	6.2	7.0	2.1
39	240.0	3000.0	1000.0	3000.0
40	1000.0	37.0	180.0	30.0
41	500.0	3000.0	3000.0	3000.0
42	1000.0	3000.0	4.0	3000.0
43	1000.0	3000.0	3000.0	3000.0
44	60.0	2.8	2.2	1.6
45	3000.0	12.0	10.0	3000.0
46	1.6	2.6	1.5	1.2
47	2200.0	48.0	3000.0	3000.0
48	1800.0	3000.0	3000.0	3000.0
49	1.4	0.4	2.0	0.8
50	1000.0	6.0	5.0	3000.0

19. C-DIP Helium Repeatability R Values (Sheet 1 of 2)

PACKAGE CODE - HELIUM R VALUES
 HELIUM REPEATABILITY EVALUATION
 ALL DATA AT 10-0 ATM-CG/SEC

UNIT NUM.	MUN 1	MUN 2	MUN 3	MUN 4
51	1000.0	1.5	2.4	0.8
52	3000.0	11.0	4.0	270.0
53	1.2	0.0	1.4	1.6
54	2.5	1.1	0.8	0.6
55	0.4	0.5	0.0	0.4
56	1.2	1.3	0.5	0.6
57	1.0	4.0	1.0	3.5
58	1600.0	3000.0	3000.0	3000.0
59	3000.0	2.0	0.0	1.0
60	3000.0	3000.0	3000.0	3000.0
61	700.0	3000.0	3000.0	3000.0
62	1.0	1.1	1.0	0.6
63	1000.0	7.8	5.0	2.7
64	800.0	3000.0	3000.0	3000.0
65	3000.0	0.8	3000.0	3000.0
66	1000.0	3000.0	3000.0	3000.0
67	1.1	3.8	0.6	1.9
68	300.0	1000.0	3000.0	3000.0
69	300.0	3000.0	3000.0	3000.0
70	3000.0	1000.0	1000.0	3000.0
71	1.0	0.4	2.0	1.9
72	2.4	4.5	2.0	4.1
73	2.0	4.6	0.5	1.8
74	0.3	0.4	0.7	2.1
75	3.0	1.1	3.2	1.4
76	1.0	2.1	2.0	3.0
77	500.0	3000.0	3000.0	3000.0
78	1.0	1.9	0.4	1.3
79	1500.0	3000.0	3000.0	3000.0
80	1.5	0.4	0.4	0.4
81	3000.0	3000.0	3000.0	3000.0
82	1000.0	3000.0	3000.0	3000.0
83	10.0	3000.0	3000.0	3000.0
84	1.6	1.1	2.0	0.8
85	3.0	1.4	1.8	2.8
86	2.0	0.5	1.0	0.8
87	0.6	1.4	2.3	0.8
88	0.7	0.4	0.7	1.4
89	2.0	0.6	0.5	0.8
90	2.5	1.3	1.2	6.0
91	1.1	6.5	3000.0	6.5
92	1.5	1.0	0.8	5.5
93	1.2	3.9	2.0	3.8
94	200.0	14.0	110.0	4.5
95	2.4	1.1	0.6	1.0
96	2.2	220.0	3000.0	1.3
97	3000.0	3000.0	3000.0	3000.0
98	3000.0	3000.0	3000.0	3000.0
99	1.3	110.0	20.0	3.0
100	10.0	70.0	3000.0	210.0

19. C-DIP Helium Repeatability R Values (Sheet 2 of 2)

PACKAGE MOSDIP - HELIUM R VALUES
 HELIUM REPEATABILITY EVALUATION
 ALL DATA X10⁻⁸ ATM-CC/SEC

UNIT NUM.	RUN 1	RUN 2	RUN 3	RUN 4
1	10.0	1.2	5.0	1.8
2	4.0	2.6	2.6	2.1
3	10.0	0.3	6.0	1.3
4	2.0	6.5	1.8	0.3
5	3.5	4.5	5.0	2.5
6	2.4	1.2	4.0	1.2
7	1.0	3.5	1.2	0.8
8	0.8	0.6	2.2	2.5
9	5.0	2.3	10.0	2.1
10	0.7	0.8	2.0	0.8
11	0.8	6.5	4.5	0.6
12	8.0	15.0	10.0	2.3
13	0.6	0.4	0.2	0.4
14	7.0	1.1	0.3	1.4
15	1.0	4.2	2.2	1.4
16	0.8	1.2	1.5	1.4
17	0.4	0.0	0.2	0.0
18	8.0	6.5	1.0	1.5
19	0.6	0.6	0.6	0.1
20	0.4	4.2	5.0	3.5
21	0.6	0.4	1.2	1.2
22	4.0	6.5	0.7	3.5
23	3.0	1.9	0.5	0.8
24	3000.0	0.4	0.3	0.0
25	1.2	2.6	2.6	0.5
26	1.2	0.5	0.7	0.8
27	24.0	14.0	15.0	10.0
28	5.0	1.5	4.0	1.0
29	8.0	0.2	12.0	10.0
30	3000.0	3000.0	3000.0	3000.0
31	12.0	0.2	0.1	0.1
32	30.0	1.4	0.8	0.9
33	15.0	62.0	70.0	40.0
34	7.0	60.0	50.0	30.0
35	120.0	75.0	100.0	28.0
36	3.0	3.8	6.0	10.0
37	24.0	30.0	35.0	30.0
38	0.3	35.0	35.0	21.0
39	0.6	2.7	0.3	1.2
40	30.0	0.7	0.5	7.5
41	0.6	0.4	4.5	0.5
42	8.5	15.0	30.0	7.2
43	2.5	3.1	2.0	1.5
44	400.0	3000.0	3000.0	3000.0
45	50.0	30.0	30.0	20.0
46	55.0	140.0	150.0	120.0
47	3000.0	3000.0	3000.0	3000.0
48	400.0	3000.0	3000.0	3000.0
49	200.0	3000.0	3000.0	3000.0
50	650.0	3000.0	3000.0	3000.0

PACKAGE MOSDIP - HELIUM R VALUES
 HELIUM REPEATABILITY EVALUATION
 ALL DATA X10-8 ATM-CC/SEC

UNIT NUM.	RUN 1	RUN 2	RUN 3	RUN 4
51	0.2	0.1	0.0	0.3
52	0.1	0.6	0.2	0.3
53	850.0	3000.0	3000.0	150.0
54	0.8	0.0	0.6	2.1
55	3000.0	0.4	1.2	0.0
56	3000.0	3000.0	3000.0	3000.0
57	10.0	0.3	0.0	0.1
58	3000.0	3000.0	3000.0	3000.0
59	0.4	0.5	0.0	0.1
60	10.0	0.6	0.0	0.1
61	0.2	0.5	0.6	0.5
62	0.4	0.1	0.3	0.4
63	700.0	0.5	0.4	0.6
64	0.8	0.1	0.2	0.0
65	5.0	0.3	1.2	0.3
66	0.2	0.5	0.4	0.1
67	0.6	0.5	0.2	0.3
68	0.2	0.1	0.1	0.1
69	0.2	0.0	0.0	0.0
70	0.1	0.2	0.0	0.1
71	0.1	0.1	0.7	0.1
72	700.0	3000.0	3000.0	3000.0
73	34.0	1.6	1.5	0.2
74	3400.0	3000.0	3000.0	3000.0
75	3000.0	3000.0	3000.0	3000.0
76	500.0	3000.0	3000.0	3000.0
77	1000.0	3000.0	3000.0	3000.0
78	3000.0	3000.0	3000.0	3000.0
79	3000.0	3000.0	3000.0	3000.0
80	0.2	0.2	0.1	0.4
81	0.1	0.1	0.3	0.1
82	0.8	3.9	1.5	1.2
83	4.0	1.5	0.6	0.6
84	3000.0	3000.0	3000.0	3000.0
85	3000.0	3000.0	3000.0	3000.0
86	500.0	3000.0	3000.0	3000.0
87	3000.0	210.0	240.0	200.0
88	2000.0	3000.0	3000.0	3000.0
89	2000.0	3000.0	3000.0	3000.0
90	3000.0	3000.0	3000.0	3000.0
91	2600.0	3000.0	3000.0	3000.0
92	1800.0	3000.0	3000.0	3000.0
93	2500.0	3000.0	3000.0	3000.0
94	0.3	3.5	1.2	4.5
95	0.6	3.8	0.5	1.4
96	0.4	0.8	0.6	1.1
97	0.8	1.5	4.0	0.8
98	1.6	0.3	1.2	0.6
99	0.4	0.7	0.5	0.8
100	2.2	1.4	1.4	2.6

PACKAGE TO100 - HELIUM R VALUES
 HELIUM REPEATABILITY EVALUATION
 ALL DATA X10-8 ATA-CC/SEC

UNIT NUM.	RUN 1	RUN 2	RUN 3	RUN 4
1	1.3	0.6	0.5	0.6
2	1.6	0.2	0.2	0.2
3	0.5	0.4	0.7	0.4
4	0.9	0.7	0.3	1.0
5	1.6	0.7	0.4	0.7
6	0.8	1.6	0.9	1.6
7	2.7	0.4	0.6	0.4
8	0.3	0.5	1.3	0.5
9	1.1	0.3	0.3	0.3
10	1.0	0.2	1.3	0.2
11	1.0	1.1	0.4	1.1
12	0.9	1.2	1.0	1.2
13	0.4	0.3	0.8	0.3
14	0.7	0.5	0.3	0.5
15	0.4	0.6	0.3	0.6
16	0.7	57.0	0.3	57.0
17	0.6	0.4	1.0	0.4
18	0.5	0.3	0.3	0.3
19	0.4	69.0	1.2	69.0
20	0.8	0.8	2.2	0.8
21	0.4	0.3	0.2	0.3
22	0.5	0.3	0.5	0.3
23	2.8	1.5	2.8	1.5
24	75.0	0.4	0.5	0.4
25	0.5	0.4	0.5	0.4
26	1.5	0.3	1.2	0.3
27	0.4	0.6	1.8	0.6
28	0.8	0.3	0.5	0.3
29	0.6	1.0	0.9	1.0
30	1.2	0.7	1.2	0.7
31	48.0	2.0	50.0	2.0
32	1.7	1.0	2.3	1.0
33	0.3	0.4	1.2	0.4
34	0.4	1.1	0.2	1.1
35	0.6	1.0	0.5	1.0
36	1.0	0.4	0.4	0.4
37	0.7	0.4	0.8	0.4
38	70.0	5.0	65.0	5.0
39	3000.0	3000.0	3000.0	3000.0
40	1.6	1.1	0.7	1.1
41	6.1	2.2	5.8	2.2
42	2.0	0.3	1.5	0.3
43	17.0	10.0	18.0	10.0
44	130.0	100.0	120.0	100.0
45	5.5	1.2	0.4	1.2
46	3000.0	3000.0	3000.0	3000.0
47	1.9	0.5	0.5	0.5
48	2.3	1.3	2.2	1.3
49	1.4	0.5	0.3	0.5
50	150.0	85.0	110.0	85.0

PACKAGE TO100 - HELIUM R VALUES
 HELIUM REPEATABILITY EVALUATION
 ALL DATA X10⁻⁸ ATM-CC/SEC

UNIT NUM.	RUN 1	RUN 2	RUN 3	RUN 4
51	0.6	23.0	0.4	23.0
52	24.0	11.0	21.0	11.0
53	4.0	1.0	27.5	1.0
54	25.0	27.0	27.0	27.0
55	22.0	20.0	20.0	20.0
56	230.0	170.0	170.0	170.0
57	110.0	130.0	95.0	130.0
58	0.5	0.9	0.9	0.9
59	0.8	1.2	0.8	1.2
60	2.0	1.9	1.1	1.9
61	11.0	3.0	15.0	3.0
62	0.8	1.0	0.4	1.0
63	0.3	0.7	0.9	0.7
64	240.0	160.0	200.0	160.0
65	27.0	22.0	22.0	22.0
66	45.0	40.0	1.6	40.0
67	3000.0	270.0	260.0	270.0
68	3000.0	3000.0	3000.0	3000.0
69	3000.0	3000.0	3000.0	3000.0
70	7.8	5.2	6.8	5.2
71	2.3	14.0	2.3	14.0
72	30.0	20.0	20.0	20.0
73	3000.0	3000.0	3000.0	3000.0
74	3000.0	3000.0	3000.0	3000.0
75	3000.0	200.0	3000.0	200.0
76	1.0	0.4	0.3	0.4
77	190.0	190.0	170.0	190.0
78	3000.0	3000.0	3000.0	3000.0
79	1.3	0.5	0.3	0.5
80	3000.0	3000.0	3000.0	3000.0
81	1.2	1.1	14.0	1.1
82	230.0	210.0	200.0	210.0
83	3000.0	3000.0	3000.0	3000.0
84	0.4	0.8	2.8	0.8
85	110.0	80.0	78.0	80.0
86	3000.0	3000.0	3000.0	3000.0
87	130.0	70.0	120.0	70.0
88	3000.0	3000.0	3000.0	3000.0
89	3000.0	3000.0	3000.0	3000.0
90	3000.0	3000.0	3000.0	3000.0
91	3000.0	3000.0	3000.0	3000.0
92	3000.0	3000.0	3000.0	3000.0
93	3000.0	3000.0	3000.0	3000.0
94	3000.0	3000.0	3000.0	3000.0
95	1.4	0.3	0.5	0.3
96	3000.0	3000.0	3000.0	3000.0
97	3000.0	3000.0	3000.0	3000.0
98	3000.0	3000.0	3000.0	3000.0

21. TO-100 Helium Repeatability R Values (Sheet 2 of 2)

PACKAGE GERM - HELIUM R VALUES
 HELIUM REPEATABILITY EVALUATION
 ALL DATA X10-8 ATM-CC/SEC

UNIT NUM.	KUN 1	KUN 2	KUN 3	KUN 4
1	37.0	3000.0	3000.0	3000.0
2	24.0	48.0	3000.0	25.0
3	24.0	30.0	28.0	35.0
4	8.0	120.0	50.0	12.0
5	10.0	30.0	160.0	3000.0
6	12.0	30.0	12.0	50.0
7	8.0	150.0	40.0	18.0
8	45.0	42.0	14.0	40.0
9	10.0	290.0	10.0	14.0
10	30.0	100.0	50.0	3000.0
11	20.0	45.0	12.0	110.0
12	27.0	30.0	15.0	30.0
13	13.0	45.0	28.0	70.0
14	10.0	6.0	14.0	110.0
15	55.0	73.0	140.0	80.0
16	80.0	210.0	160.0	50.0
17	35.0	110.0	40.0	35.0
18	3000.0	3000.0	180.0	3000.0
19	280.0	3000.0	140.0	3000.0
20	50.0	45.0	25.0	45.0
21	100.0	180.0	180.0	3000.0
22	80.0	3000.0	200.0	3000.0
23	110.0	80.0	100.0	35.0
24	600.0	3000.0	250.0	3000.0
25	75.0	72.0	150.0	280.0
26	65.0	3000.0	3000.0	3000.0
27	3000.0	3000.0	3000.0	3000.0
28	180.0	250.0	110.0	200.0
29	65.0	220.0	60.0	180.0
30	2100.0	3000.0	3000.0	260.0
31	35.0	3000.0	70.0	3000.0
32	50.0	130.0	110.0	3000.0
33	5000.0	3000.0	3000.0	3000.0
34	320.0	150.0	3000.0	180.0
35	3000.0	3000.0	3000.0	3000.0
36	140.0	220.0	3000.0	75.0
37	60.0	3600.0	70.0	3000.0
38	1000.0	3000.0	3000.0	3000.0
39	14.0	70.0	50.0	50.0
40	82.0	70.0	45.0	140.0
41	26.0	100.0	25.0	120.0
42	3000.0	3000.0	50.5	3000.0
43	3000.0	3000.0	3000.0	260.0
44	400.0	3000.0	3000.0	3000.0
45	12.0	38.0	70.0	28.0
46	200.0	180.0	68.0	120.0
47	40.0	140.0	3000.0	150.0
48	41.0	3000.0	45.0	3000.0
49	120.0	140.0	75.0	40.0
50	170.0	3000.0	3000.0	140.0

PACKAGE CERM - HELIUM R VALUES
 HELIUM REPEATABILITY EVALUATION
 ALL DATA X10-8 ATM-CC/SEC

UNIT NUM.	RUN 1	RUN 2	RUN 3	RUN 4
51	2000.0	240.0	3000.0	3000.0
52	100.0	260.0	180.0	55.0
53	300.0	100.0	40.0	50.0
54	35.0	3000.0	50.0	3000.0
55	27.0	3000.0	3000.0	3000.0
56	3000.0	3000.0	110.0	120.0
57	100.0	3000.0	150.0	3000.0
58	70.0	3000.0	220.0	3000.0
59	60.0	150.0	110.0	3000.0
60	150.0	100.0	3000.0	50.0
61	450.0	120.0	85.0	55.0
62	65.0	85.0	100.0	40.0
63	220.0	200.0	200.0	70.0
64	120.0	80.0	26.0	18.0
65	100.0	240.0	70.0	55.0
66	35.0	100.0	40.0	22.0
67	120.0	82.0	15.0	12.0
68	57.0	29.0	3000.0	15.0
69	400.0	3000.0	110.0	28.0
70	24.0	27.0	26.0	14.0
71	5.5	24.0	4.2	4.0

PACKAGE TO 3 - HELIUM R VALUES
 HELIUM REPEATABILITY EVALUATION
 ALL DATA X10-8 ATM-CC/SEC

UNIT NUM.	RUN 1	RUN 2	RUN 3	RUN 4
1	3000.0	3000.0	3000.0	3000.0
2	0.3	10.0	0.6	0.0
3	0.3	0.2	0.5	0.0
4	700.0	3000.0	3000.0	3000.0
5	400.0	1.0	27.0	40.0
6	0.3	0.1	20.0	40.0
7	3.5	1.2	15.0	18.0
8	3000.0	3000.0	3000.0	3000.0
9	0.3	0.1	0.6	1.0
10	1.4	0.0	0.5	0.0
11	0.3	0.2	0.7	0.1
12	0.3	50.0	3000.0	3000.0
13	0.6	1.0	0.4	0.2
14	0.1	0.0	0.5	0.4
15	0.3	7.0	0.7	4.0
16	3000.0	3000.0	3000.0	3000.0
17	3000.0	83.0	3000.0	3000.0
18	3000.0	3000.0	3000.0	3000.0
19	3000.0	3000.0	3000.0	3000.0
20	3000.0	3000.0	3000.0	3000.0
21	3000.0	3000.0	3000.0	3000.0
22	0.1	0.3	0.3	0.3
23	0.2	0.7	0.4	0.3
24	0.1	0.3	0.4	0.2
25	0.1	0.4	0.8	0.1
26	0.7	0.8	0.9	0.7
27	0.1	0.2	0.3	0.4
28	0.2	0.3	0.3	0.5
29	0.3	0.4	0.5	0.3
30	0.2	0.3	0.5	0.1
31	1.4	0.5	0.6	0.2
32	0.6	0.2	0.5	0.2
33	0.0	0.3	0.4	1.0
34	0.1	0.3	0.4	0.5
35	0.1	0.1	0.9	0.2
36	0.1	0.2	0.5	1.8
37	15.0	10.0	120.0	0.4
38	0.1	0.5	33.0	1.0
39	3000.0	3000.0	3000.0	3000.0
40	0.3	0.2	0.4	0.2
41	1.0	0.1	2.1	2.4
42	0.2	0.0	0.2	0.0
43	3000.0	3000.0	3000.0	3000.0
44	0.4	0.2	0.1	0.2
45	6.8	6.0	5.0	3.0
46	220.0	20.0	81.0	65.0
47	0.3	0.1	0.2	0.0
48	0.3	0.1	0.3	0.2
49	350.0	210.0	300.0	3000.0
50	3000.0	3000.0	3000.0	3000.0

PACKAGE TO 3 - HELIUM R VALUES
 HELIUM REPEATABILITY EVALUATION
 ALL DATA X10-8 ATM-CC/SEC

UNIT NUM.	RUN 1	RUN 2	RUN 3	RUN 4
51	70.0	0.4	11.0	18.0
52	0.4	0.2	0.3	0.2
53	2400.0	3000.0	3000.0	3000.0
54	3000.0	3000.0	3000.0	3000.0
55	3000.0	3000.0	3000.0	3000.0
56	3000.0	3000.0	3000.0	3000.0
57	3000.0	3000.0	3000.0	3000.0
58	20.0	3000.0	3000.0	3000.0
59	550.0	3.5	100.0	210.0
60	3.0	1.4	10.0	1.8
61	0.3	0.1	0.2	1.0
62	0.2	0.1	0.5	0.0
63	3.0	0.3	2.1	1.6
64	600.0	3000.0	3000.0	3000.0
65	350.0	140.0	3000.0	3000.0
66	90.0	60.0	90.0	80.0
67	24.0	4.0	4.1	5.0
68	0.7	0.4	0.3	0.1
69	140.0	30.0	120.0	200.0
70	350.0	50.0	100.0	140.0
71	0.4	0.2	0.7	0.3
72	28.0	2.0	4.2	5.0
73	3000.0	3000.0	3000.0	3000.0
74	320.0	60.0	130.0	150.0
75	3000.0	3000.0	3000.0	3000.0
76	10.0	0.3	0.3	0.0
77	550.0	140.0	260.0	3000.0
78	300.0	0.3	130.0	280.0
79	3000.0	3000.0	3000.0	3000.0
80	3000.0	3000.0	3000.0	3000.0
81	3000.0	3000.0	3000.0	3000.0
82	3000.0	3000.0	3000.0	3000.0
83	1800.0	3000.0	3000.0	3000.0
84	0.5	0.5	1.4	0.3
85	1.8	0.3	1.0	0.3
86	700.0	300.0	3000.0	3000.0
87	1600.0	40.0	55.0	280.0
88	3000.0	3000.0	3.5	3000.0
89	400.0	42.0	59.0	80.0
90	0.3	45.0	3000.0	3000.0
91	0.3	0.1	0.8	0.4
92	90.0	15.0	51.0	75.0
93	200.0	12.0	170.0	180.0
94	90.0	15.0	18.0	70.0
95	3000.0	0.2	0.2	0.3
96	600.0	200.0	3000.0	3000.0
97	3000.0	2000.0	3000.0	3000.0
98	0.4	0.5	3.0	1.5
99	3000.0	3000.0	3000.0	3000.0
100	3000.0	60.0	3000.0	3000.0

23. TO-3 Helium Repeatability R Values (Sheet 2 of 2)

PACKAGE GLASS - HELIUM R VALUES
 HELIUM REPEATABILITY EVALUATION
 ALL DATA X10-8 ATM-CG/SEC

UNIT NUM.	RUN 1	RUN 2	RUN 3	RUN 4
1	1500.0	18.0	30.0	30.0
2	75.0	3000.0	40.0	3000.0
3	3000.0	110.0	100.0	25.0
4	45.0	45.0	30.0	70.0
5	68.0	230.0	3000.0	30.0
6	47.0	48.0	28.0	50.0
7	5000.0	20.0	50.0	40.0
8	52.0	110.0	3000.0	109.0
9	42.0	100.0	72.0	60.0
10	48.0	58.0	40.0	30.0
11	650.0	19.0	1.8	3000.0
12	3000.0	3000.0	3000.0	70.0
13	100.0	160.0	100.0	30.0
14	52.0	58.0	25.0	20.0
15	51.0	35.0	30.0	50.0
16	78.0	180.0	150.0	60.0
17	40.0	150.0	100.0	100.0
18	65.0	48.0	35.0	40.0
19	3000.0	150.0	150.0	70.0
20	3000.0	85.0	55.0	3000.0
21	90.0	3000.0	3000.0	110.0
22	3000.0	220.0	80.0	70.0
23	85.0	200.0	65.0	3000.0
24	1200.0	3000.0	3000.0	3000.0
25	25.0	3000.0	3000.0	100.0
26	3000.0	90.0	50.0	20.0
27	3000.0	50.0	90.0	3000.0
28	3000.0	3000.0	3000.0	3000.0
29	3000.0	3000.0	200.0	3000.0
30	75.0	130.0	60.0	3000.0
31	3000.0	230.0	3000.0	3000.0
32	3000.0	3000.0	3000.0	3000.0
33	3000.0	3000.0	3000.0	120.0
34	55.0	70.0	100.0	120.0
35	3000.0	24.0	70.0	3000.0
36	3000.0	3000.0	40.0	3000.0
37	3000.0	3000.0	3000.0	40.0
38	3000.0	140.0	40.0	120.0
39	3000.0	42.0	40.0	40.0
40	65.0	35.0	30.0	5.0
41	300.0	150.0	280.0	3000.0
42	3000.0	3000.0	3000.0	3000.0
43	3000.0	3000.0	3000.0	40.0
44	60.0	230.0	160.0	3000.0
45	3000.0	3000.0	3000.0	90.0
46	85.0	140.0	55.0	3000.0
47	100.0	3000.0	3000.0	40.0
48	50.0	90.0	40.0	50.0
49	140.0	3000.0	50.0	60.0
50	300.0	22.0	35.0	50.0
51	45.0	90.0	120.0	50.0

24. Glass Standards Helium Repeatability R Values

PACKAGE TOB4 - RADIFLO Q VALUES
 RADIFLO VARIABLE CONDITION EVALUATION
 ALL DATA X10-8 ATM-CC/SEC

UNIT NUM.	2451C SYSTEM			MARK IV SYSTEM		
	RD1 0-WASH	RD2 1-WASH	RD3 3-WASH	RH1 0-WASH	RH2 1-WASH	RH3 3-WASH
1	250.0	0.0	150.0	130.0	12.0	36.0
2	4.6	3.0	3.0	2.6	2.6	2.2
3	16.0	8.4	6.3	5.0	8.7	6.0
4	10.0	6.7	5.0	6.0	5.2	4.3
5	170.0	0.0	0.0	0.0	0.0	0.0
6	21.0	9.0	10.0	10.0	11.0	10.0
7	10.0	5.0	5.3	4.3	7.8	3.4
8	12.0	10.0	6.3	5.2	6.0	5.2
9	14.0	6.7	5.0	6.7	7.8	6.0
10	27.0	10.0	10.0	13.0	12.0	13.0
11	410.0	230.0	160.0	220.0	140.0	93.0
12	40.0	1.8	20.0	22.0	19.0	19.0
13	0.0	1.3	0.0	1.7	1.7	0.5
14	7.5	5.8	4.2	6.0	4.3	2.9
15	5.8	7.4	3.0	1.7	2.1	2.6
16	620.0	310.0	420.0	5.2	410.0	290.0
17	210.0	87.0	87.0	130.0	130.0	130.0
18	190.0	80.0	75.0	120.0	119.0	120.0
19	15.0	13.0	7.5	8.7	7.8	8.7
20	580.0	320.0	370.0	550.0	93.0	64.0
21	100.0	400.0	43.0	47.0	50.0	50.0
22	82.0	130.0	330.0	790.0	690.0	520.0
23	710.0	250.0	300.0	270.0	340.0	340.0
24	0.0	3.0	0.0	0.0	0.0	0.0
25	790.0	380.0	270.0	310.0	380.0	170.0
26	67.0	30.0	31.0	35.0	33.0	29.0
27	0.0	1.2	0.0	1.7	0.8	0.0
28	250.0	57.0	150.0	240.0	210.0	220.0
29	540.0	320.0	360.0	1100.0	600.0	180.0
30	840.0	380.0	450.0	550.0	430.0	270.0
31	920.0	150.0	500.0	330.0	190.0	180.0
32	870.0	3.4	150.0	550.0	480.0	520.0
33	0.0	8.0	1.8	2.2	0.0	0.0
34	940.0	140.0	140.0	580.0	500.0	530.0
35	350.0	13.0	2.5	16.0	22.0	310.0
36	750.0	3.5	0.0	450.0	460.0	460.0
37	150.0	58.0	5.3	59.0	77.0	75.0
38	240.0	67.0	6.0	6.9	84.0	84.0
39	0.0	0.0	0.0	0.0	0.0	0.0
40	0.0	0.0	0.0	0.0	0.8	0.0
41	0.0	0.0	0.0	0.0	0.0	0.0
42	0.0	0.0	0.0	0.8	0.0	0.0
43	0.0	0.0	0.0	0.0	0.0	0.0
44	0.0	0.0	0.0	0.0	0.5	0.0
45	0.0	0.0	0.0	9.0	0.0	0.0
46	0.0	0.0	0.0	0.0	0.8	0.0
47	0.0	0.0	0.0	0.0	0.0	0.0
48	0.0	0.0	0.0	0.0	0.0	0.0
49	240.0	0.0	250.0	150.0	280.0	270.0
50	0.0	1.2	0.0	0.0	0.0	0.0

25. TO-84 Radiflo Q Values Variable Conditions (Sheet 1 of 2)

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PACKAGE T084 - RADIFLO Q VALUES
 RADIFLO VARIABLE CONDITION EVALUATION
 ALL DATA X10-8 ATM-CC/SEC

UNIT NUM.	24510 SYSTEM			MARK IV SYSTEM			RH3 3-MASH
	RD1 0-MASH	RD2 1-MASH	RD3 3-MASH	RH1 0-MASH	RR2 1-MASH	RH3 3-MASH	
51	0.0	0.0	0.0	0.0	0.0	0.0	0.0
52	0.0	0.0	0.0	0.0	0.0	0.0	0.0
53	0.0	0.0	0.0	0.0	0.0	0.0	0.0
54	0.0	0.0	0.0	0.0	0.0	0.0	0.0
55	200.0	70.0	110.0	150.0	140.0	14.0	14.0
56	0.0	0.0	0.0	0.0	0.0	0.0	0.0
57	0.0	0.0	0.0	0.0	0.0	0.0	0.0
58	0.0	0.0	0.0	0.0	0.0	0.0	0.0
59	280.0	23.0	260.0	270.0	340.0	350.0	350.0
60	380.0	34.0	63.0	160.0	190.0	170.0	170.0
61	572.0	160.0	150.0	120.0	140.0	94.0	94.0
62	75.0	58.0	57.0	59.0	220.0	400.0	400.0
63	440.0	0.0	0.0	1.7	2.6	6.6	6.6
64	1.6	4.3	37.0	14.0	22.0	5.2	5.2
65	0.0	0.0	0.0	0.0	0.0	0.0	0.0
66	0.0	0.0	0.0	0.0	0.0	0.0	0.0
67	4.1	1.1	2.3	6.0	13.0	1.7	1.7
68	0.0	0.0	0.0	0.0	0.0	0.0	0.0
69	0.0	1.2	1.6	0.0	0.0	0.0	0.0
70	10.0	3.4	3.0	11.0	1.7	1.2	1.2
71	0.0	0.0	0.0	0.0	0.0	0.0	0.0
72	0.0	1.1	0.0	0.0	0.0	0.0	0.0
73	0.0	0.0	0.0	0.0	0.0	0.0	0.0
74	0.0	0.0	0.0	0.0	0.0	0.0	0.0
75	0.0	0.0	0.0	0.0	0.0	0.0	0.0
76	0.0	0.0	0.0	0.0	0.0	0.0	0.0
77	0.0	0.0	0.0	0.0	0.0	0.0	0.0
78	0.0	0.0	0.0	0.0	0.0	0.0	0.0
79	0.0	0.0	0.0	0.0	0.0	0.0	0.0
80	0.0	0.0	0.0	0.0	0.0	0.0	0.0
81	0.0	0.0	0.0	0.0	0.0	0.0	0.0
82	10.0	0.0	0.0	0.0	0.0	0.0	0.0
83	0.0	0.0	0.0	0.0	0.0	0.0	0.0
84	0.0	1.1	0.0	0.0	0.0	0.0	0.0
85	0.0	0.0	0.0	0.0	0.0	0.0	0.0
86	0.0	0.0	0.0	0.0	0.0	0.0	0.0
87	0.0	0.0	0.0	0.0	0.0	0.0	0.0
88	0.0	0.0	0.0	0.0	0.0	0.0	0.0
89	0.0	0.0	0.0	0.0	0.0	0.0	0.0
90	0.0	0.0	0.0	0.0	0.0	0.0	0.0
91	0.0	0.0	0.0	0.0	0.0	0.0	0.0
92	0.0	0.0	0.0	0.0	0.0	0.0	0.0
93	0.0	0.0	0.0	0.0	0.0	0.0	0.0
94	0.0	0.0	0.0	0.0	0.0	0.0	0.0
95	0.0	0.0	0.0	0.0	0.0	0.0	0.0
96	1.6	1.3	1.6	0.0	0.0	0.0	0.0
97	0.0	0.0	0.0	0.0	0.0	0.0	0.0

25. T0-84 Radiflo Q Values Variable Conditions (Sheet 2 of 2)

PACKAGE C-PAK - RADIFLO Q VALUES
 RADIFLO VARIABLE CONDITION EVALUATION
 ALL DATA X10-8 ATM-CG/SEC

UNIT NUM.	24510 SYSTEM		MARK IV SYSTEM		RH3 3-WASH
	ROI O-WASH	ROI 1-WASH	RH1 O-WASH	RH2 1-WASH	
1	140.0	240.0	110.0	150.0	120.0
2	98.0	220.0	86.0	150.0	120.0
3	220.0	220.0	160.0	140.0	100.0
4	39.0	170.0	42.0	92.0	40.0
5	82.0	180.0	89.0	150.0	82.0
6	71.0	190.0	190.0	70.0	69.0
7	32.0	91.0	47.0	13.0	31.0
8	18.0	41.0	27.0	13.0	25.0
9	310.0	160.0	190.0	260.0	260.0
10	2.6	26.0	64.0	4.2	30.0
11	34.0	55.0	22.0	1.0	35.0
12	62.0	29.0	28.0	1.0	35.0
13	100.0	190.0	92.0	140.0	100.0
14	150.0	370.0	180.0	250.0	160.0
15	82.0	310.0	140.0	180.0	160.0
16	86.0	17.0	49.0	40.6	43.0
17	0.1	200.0	270.0	420.0	430.0
18	93.0	0.2	0.0	28.0	0.0
19	78.0	190.0	82.0	120.0	90.0
20	0.0	0.2	0.0	0.0	0.0
21	26.0	6.0	110.0	200.0	280.0
22	39.0	67.0	39.0	38.0	47.0
23	97.0	100.0	79.0	38.0	47.0
24	70.0	230.0	140.0	100.0	73.0
25	70.0	100.0	90.0	90.0	69.0
26	0.0	16.0	39.0	210.0	33.0
27	75.0	1.5	2.8	0.0	0.0
28	50.0	240.0	200.0	140.0	28.0
29	40.0	130.0	82.0	45.0	47.0
30	100.0	77.0	120.0	42.0	45.0
31	62.0	230.0	180.0	73.0	45.0
32	130.0	300.0	180.0	210.0	230.0
33	74.0	160.0	83.0	10.0	53.0
34	24.0	200.0	110.0	250.0	300.0
35	12.0	470.0	440.0	330.0	350.0
36	45.0	63.0	55.0	30.0	31.0
37	45.0	22.0	6.4	4.2	18.0
38	100.0	7.5	37.0	28.0	30.0
39	130.0	82.0	76.0	65.0	43.0
40	130.0	91.0	65.0	43.0	43.0
41	170.0	50.0	38.0	26.0	36.0
42	130.0	110.0	20.0	20.0	30.0
43	130.0	180.0	300.0	300.0	300.0
44	24.0	210.0	309.0	50.0	50.0
45	24.0	55.0	17.0	37.0	14.0
46	36.0	260.0	160.0	290.0	300.0
47	37.0	72.0	44.0	25.0	39.0
48	52.0	37.0	39.0	22.0	37.0
49	13.0	0.0	2.5	0.0	0.0
50	94.0	0.0	12.0	7.5	21.0
			14.0	53.0	98.0
			15.0	80.0	69.0
			27.0	92.0	23.0
			13.0	13.0	23.0
			82.0	120.0	100.0

PACKAGE C-PAK - RACIFLO Q VALUES
 RADIFLO VARIABLE CONDITION EVALUATION
 ALL DATA X10-8 ATM-CG/SEC

UNIT NUM.	24510 SYSTEM		RC2		RD3		MARK IV SYSTEM		RH3	
	R01 O-WASH	R01 1-WASH	R02 1-WASH	R03 3-WASH	R01 O-WASH	R02 1-WASH	RH1 O-WASH	RH2 1-WASH	RH3 O-WASH	RH3 3-WASH
51	40.0	130.0	65.0	66.0	68.0	15.0	68.0	15.0	42.0	
52	52.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4	
53	50.0	1.0	17.0	21.0	13.0	10.0	13.0	10.0	20.0	
54	0.7	1.5	0.0	3.0	1.0	20.0	1.0	20.0	20.0	
55	190.0	210.0	140.0	300.0	130.0	170.0	130.0	170.0	100.0	
56	170.0	200.0	230.0	140.0	170.0	1.0	170.0	1.0	1.1	
57	180.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	
58	120.0	42.0	83.0	130.0	130.0	140.0	130.0	140.0	100.0	
59	68.0	1.7	0.0	0.0	0.0	2.3	0.0	2.3	0.0	
60	130.0	190.0	176.0	210.0	92.0	130.0	92.0	130.0	120.0	
61	120.0	230.0	160.0	310.0	42.0	160.0	42.0	160.0	160.0	
62	200.0	10.0	4.1	5.8	15.0	28.0	15.0	28.0	47.0	
63	69.0	100.0	170.0	180.0	98.0	130.0	98.0	130.0	140.0	
64	110.0	1.0	0.0	2.3	73.0	280.0	73.0	280.0	280.0	
65	88.0	180.0	130.0	120.0	120.0	98.0	120.0	98.0	52.0	
66	100.0	200.0	250.0	540.0	230.0	260.0	230.0	260.0	310.0	
67	60.0	180.0	140.0	120.0	48.0	100.0	48.0	100.0	65.0	
68	160.0	180.0	130.0	210.0	89.0	210.0	89.0	210.0	210.0	
69	130.0	0.0	1.0	2.0	0.0	0.0	0.0	0.0	0.0	
70	170.0	140.0	96.0	130.0	120.0	170.0	120.0	170.0	200.0	
71	71.0	0.2	0.0	13.0	72.0	140.0	72.0	140.0	47.0	
72	52.0	0.7	0.0	2.5	56.0	98.0	56.0	98.0	150.0	
73	56.0	28.0	25.0	31.0	31.0	35.0	31.0	35.0	32.0	
74	66.0	92.0	120.0	3.2	6.0	7.8	6.0	7.8	12.0	
75	14.0	33.0	2.5	3.2	0.0	1.1	0.0	1.1	2.5	
76	16.0	31.0	6.0	6.0	0.0	0.0	0.0	0.0	0.0	
77	33.0	29.0	40.0	40.0	40.0	37.0	40.0	37.0	52.0	
78	140.0	260.0	150.0	310.0	100.0	260.0	100.0	260.0	300.0	
79	71.0	1.7	0.0	0.0	6.7	6.0	6.7	6.0	0.0	
80	71.0	36.0	60.0	35.0	20.0	20.0	20.0	20.0	13.0	
81	75.0	150.0	230.0	310.0	140.0	140.0	140.0	140.0	100.0	
82	110.0	120.0	130.0	310.0	130.0	130.0	130.0	130.0	80.0	
83	23.0	0.0	0.0	0.0	0.0	31.0	0.0	31.0	35.0	
84	40.0	94.0	74.0	95.0	37.0	31.0	37.0	31.0	35.0	
85	69.0	0.3	10.0	2.5	0.0	0.0	0.0	0.0	0.0	
86	13.0	95.0	20.0	9.3	5.8	9.2	5.8	9.2	28.0	
87	0.4	12.0	14.0	96.0	63.0	63.0	63.0	63.0	27.0	
88	5.2	240.0	200.0	120.0	230.0	310.0	230.0	310.0	310.0	
89	12.0	17.0	22.0	22.0	16.0	22.0	16.0	22.0	23.0	
90	2.7	4.0	5.0	4.2	2.7	4.2	2.7	4.2	4.0	
91	0.3	0.3	0.0	2.5	0.0	0.0	0.0	0.0	830.0	
92	9.0	2.1	3.0	4.0	0.0	0.0	0.0	0.0	2.5	
93	4.5	2.9	6.7	5.0	3.5	5.8	3.5	5.8	4.5	
94	7.3	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
95	0.0	20.0	2.8	43.0	57.0	73.0	57.0	73.0	32.0	
96	22.0	46.0	10.0	55.0	33.0	33.0	33.0	33.0	38.0	
97	7.5	0.2	0.0	1.8	0.0	0.0	0.0	0.0	0.0	
98	0.1	0.2	0.0	1.0	0.0	0.0	0.0	0.0	0.0	
99	93.0	200.0	160.0	190.0	82.0	180.0	82.0	180.0	90.0	
100	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

26. C-PAK Radiflo Q Values Variable Conditions (Sheet 2 of 2)

PACKAGE CQIP - RADFLO Q VALUES
 RADFLO VARIABLE CONDITION EVALUATION
 ALL DATA 310-0 ATM-CC/SEC

UNIT NUM.	RR1		RR2		RR3		RR4		MARK IV SYSTEM		RR3	
	0-WASH	1-WASH	0-WASH	1-WASH	0-WASH	1-WASH	0-WASH	1-WASH	0-WASH	1-WASH	0-WASH	1-WASH
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
17	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
18	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
19	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
22	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
24	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
25	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
27	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
28	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
29	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
32	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
33	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
34	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
35	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
36	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
37	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
38	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
39	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
41	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
42	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
43	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
44	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
45	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
46	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
47	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
48	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
49	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

PACKAGE GDP - RADIFLO Q VALUES
 RADIFLO VARIABLE CONDITION EVALUATION
 ALL DATA 310-N ATM-CC/SEC

UNIT NUM.	24510 SYSTEM			MAKK (Y) SYSTEM			MU2 3-WASH
	RD1 0-WASH	RD2 1-WASH	K03 3-WASH	RH1 0-WASH	RH2 1-WASH	MU1 3-WASH	
51	170.0	330.0	310.0	12.0	410.0	280.0	
52	120.0	110.0	150.0	140.0	220.0	200.0	
53	0.0	0.0	0.0	1.4	0.0	0.0	
54	0.1	0.0	0.0	0.0	0.8	0.0	
55	0.0	0.0	0.0	0.0	0.0	0.0	
56	0.1	0.0	0.0	0.0	0.8	1.8	
57	0.1	0.0	0.0	0.0	0.8	0.0	
58	170.0	200.0	250.0	160.0	310.0	310.0	
59	170.0	370.0	360.0	340.0	400.0	320.0	
60	160.0	310.0	170.0	12.0	420.0	310.0	
61	210.0	330.0	360.0	140.0	480.0	380.0	
62	0.0	0.0	0.0	0.0	0.0	0.0	
63	120.0	130.0	180.0	150.0	260.0	230.0	
64	54.0	130.0	160.0	130.0	230.0	200.0	
65	160.0	300.0	260.0	94.0	450.0	280.0	
66	150.0	160.0	200.0	140.0	290.0	270.0	
67	0.0	0.0	0.0	0.0	0.0	0.0	
68	170.0	330.0	280.0	94.0	360.0	270.0	
69	99.0	27.7	5.7	1.7	5.4	5.8	
70	130.0	330.0	230.0	54.0	380.0	250.0	
71	0.0	0.0	0.0	0.4	0.0	0.0	
72	0.0	0.0	0.0	0.0	0.4	0.0	
73	0.1	0.0	2.3	0.0	5.8	0.3	
74	0.0	0.0	0.0	0.0	0.0	0.8	
75	0.0	0.0	0.0	0.0	0.0	0.0	
76	0.0	0.0	0.0	0.0	0.0	0.0	
77	61.0	260.0	260.0	60.0	290.0	270.0	
78	0.0	0.0	0.0	0.0	0.0	0.0	
79	170.0	380.0	300.0	120.0	370.0	300.0	
80	110.0	3.0	0.0	0.0	0.0	0.0	
81	180.0	310.0	280.0	110.0	430.0	320.0	
82	140.0	200.0	260.0	23.0	300.0	350.0	
83	130.0	120.0	150.0	310.0	300.0	250.0	
84	1.0	0.0	0.0	0.2	0.8	0.5	
85	0.5	0.0	0.0	0.0	0.0	0.0	
86	0.0	0.0	0.0	0.0	0.0	0.0	
87	0.1	0.0	0.0	0.0	0.0	0.0	
88	0.0	0.0	0.0	0.0	0.0	0.0	
89	0.0	0.0	0.0	0.0	190.0	0.0	
90	0.2	0.0	0.0	0.0	0.0	0.0	
91	2.3	0.0	0.0	0.0	0.0	2.5	
92	0.2	0.0	0.0	0.0	0.0	1.1	
93	0.3	0.0	0.0	0.0	0.0	1.1	
94	2.1	27.0	42.0	2.0	18.0	15.0	
95	0.2	0.0	0.0	0.0	0.0	0.0	
96	3.0	5.7	0.0	16.0	0.0	2.8	
97	140.0	200.0	230.0	150.0	320.0	250.0	
98	46.0	300.0	360.0	9.3	370.0	350.0	
99	0.0	0.0	0.0	0.7	1.6	0.0	
100	0.0	7.3	7.0	12.0	150.0	5.8	

27. C-DIP Radiflo Q Values Variable Conditions (Sheet 2 of 2)

PACKAGE MOSDIP - RADFLO Q VALUES
 RADFLO VARIABLE CONDITION EVALUATION
 ALL DATA X10-8 ATM-CC/SEC

UNIT NO.	245% SYSTEM		MARK IV SYSTEM		RH2 3-WASH
	ROI 0-WASH	ROI 0-WASH	RH1 0-WASH	RH2 1-WASH	
1	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0
5	0.0	1300.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0
7	0.0	0.0	0.0	0.0	0.0
8	0.0	0.0	0.0	0.0	0.0
9	0.0	0.0	0.0	0.0	0.0
10	0.0	0.0	0.0	0.0	0.0
11	1.4	0.0	0.0	0.0	1.6
12	6.0	6.3	0.0	2.1	2.1
13	2.5	3.9	0.0	3.6	5.0
14	5.0	4.7	0.0	5.0	4.5
15	1.6	1.5	0.0	1.3	2.0
16	0.0	1.2	0.0	1.3	1.6
17	3.3	1.5	0.0	2.1	3.0
18	5.0	4.5	0.0	5.8	6.2
19	1.6	2.3	0.0	3.3	3.1
20	3.4	4.7	0.0	5.0	4.1
21	0.0	3.0	0.0	2.5	2.5
22	3.4	11.0	0.0	5.0	4.0
23	4.1	3.5	0.0	3.3	4.5
24	1.6	1.3	0.0	1.3	1.6
25	1.6	3.6	0.0	2.2	2.1
26	1.6	1.5	0.0	1.3	2.0
27	2.0	2.0	0.0	3.3	3.3
28	1.0	2.8	0.0	1.1	1.1
29	1.6	0.5	0.0	0.5	0.8
30	220.0	130.0	42.0	28.0	31.0
31	0.0	7.0	0.0	57.0	48.0
32	1.6	2.5	1.0	2.5	2.5
33	0.0	0.2	0.0	1.2	1.2
34	15.0	6.3	16.0	140.0	120.0
35	0.0	0.0	0.0	0.0	0.0
36	0.0	1.3	0.0	0.0	0.0
37	4.0	8.1	6.7	4.1	3.3
38	40.0	38.0	37.0	45.0	45.0
39	3.1	3.0	3.4	2.3	2.8
40	6.0	12.0	4.2	5.0	5.0
41	0.0	0.0	0.0	0.0	0.0
42	3.4	0.6	5.3	0.0	0.0
43	12.0	9.5	10.0	16.0	16.0
44	16.0	9.8	12.0	100.0	9.0
45	26.0	20.0	25.0	200.0	110.0
46	0.0	0.0	0.0	0.0	0.0
47	1.6	1.3	0.0	0.0	0.0
48	0.0	0.0	0.0	0.0	0.0
49	20.0	19.0	20.0	73.0	73.0
50	160.0	152.0	100.0	50.0	30.0

28. MOS DIP Radflo Q Values Variable Conditions (Sheet 1 of 2)

PACKAGE MCS DIP - RADIFLO Q VALUES
 RADIFLO VARIABLE CREDIT EVALUATION
 ALL DATA X10⁻⁹ ATM-CC/SEC

UNIT NUM.	24510 SYSTEM			PARK IV SYSTEM		
	RD1 0-WASH	RD2 1-WASH	RD3 3-WASH	RH1 0-WASH	RH2 1-WASH	RH3 3-WASH
51	0.0	0.5	0.0	0.1	0.0	0.0
52	0.0	1.0	0.0	0.4	0.5	0.8
53	30.0	26.0	42.0	30.0	360.0	310.0
54	0.0	0.0	0.0	0.2	1.6	1.1
55	71.0	2.0	0.0	0.0	0.8	51.0
56	270.0	320.0	340.0	3000.0	460.0	0.0
57	1.7	3.9	0.0	0.1	0.0	0.0
58	250.0	250.0	250.0	140.0	260.0	30.0
59	0.0	0.0	0.0	0.0	0.0	0.0
60	210.0	210.0	220.0	27.0	300.0	30.0
61	0.8	0.0	0.0	0.5	0.0	0.0
62	0.6	0.0	0.0	0.0	0.0	2.5
63	0.0	0.0	0.0	41.0	360.0	41.0
64	0.0	0.0	0.0	0.0	1.3	0.0
65	0.6	0.0	0.0	0.0	0.0	0.0
66	0.0	0.0	0.0	0.0	0.0	0.0
67	0.8	2.0	0.0	0.0	0.0	0.0
68	0.0	1.6	0.0	0.0	0.0	0.0
69	0.0	1.0	0.0	0.0	0.0	0.0
70	0.6	0.0	0.0	0.1	0.0	0.0
71	1.3	6.8	0.0	0.3	0.0	0.8
72	440.0	82.0	1100.0	3000.0	1000.0	1200.0
73	1.5	0.0	0.0	0.5	0.0	0.0
74	100.0	1200.0	940.0	130.0	660.0	750.0
75	220.0	1000.0	910.0	56.0	550.0	330.0
76	110.0	460.0	630.0	3000.0	660.0	710.0
77	10.0	7.6	8.5	26.0	300.0	280.0
78	220.0	230.0	300.0	3000.0	910.0	1100.0
79	930.0	1500.0	920.0	66.0	660.0	630.0
80	0.0	3.9	0.0	0.0	0.0	0.0
81	2.5	0.0	0.0	0.5	0.0	2.0
82	0.0	0.4	0.0	0.0	2.5	0.0
83	10.0	0.0	0.0	0.5	0.0	0.0
84	95.0	950.0	840.0	58.0	600.0	380.0
85	500.0	300.0	270.0	28.0	150.0	13.0
86	1400.0	430.0	340.0	33.0	230.0	20.0
87	680.0	850.0	870.0	3000.0	1000.0	1000.0
88	800.0	850.0	270.0	56.0	480.0	330.0
89	880.0	860.0	840.0	51.0	710.0	680.0
90	300.0	1100.0	100.0	140.0	710.0	20.0
91	680.0	550.0	400.0	33.0	300.0	680.0
92	1000.0	990.0	1100.0	110.0	680.0	66.0
93	850.0	1000.0	800.0	56.0	530.0	58.0
94	0.0	0.7	0.0	0.0	0.0	0.8
95	0.0	2.2	0.0	0.0	0.0	0.0
96	0.0	1.8	1.6	0.0	0.5	0.0
97	1.0	0.0	0.0	0.0	0.0	0.0
98	0.0	1.0	0.0	0.0	0.0	0.0
99	0.0	3.1	0.0	0.0	0.0	0.0
100	0.0	1.1	0.0	0.1	0.8	0.0

28. MOS DIP Radiflo Q Values Variable Conditions (Sheet 2 of 2)

PACKAGE TO100 - RADIFLO Q VALUES
 RADIFLO VARIABLE CONDITION EVALUATION
 ALL DATA X10-5 4TH-C/SEC

UNIT NUM.	24510 SYSTEM			MARK IV SYSTEM			PH3 3-WASH
	RDI C-WASH	RD1 O-WASH	RD2 1-WASH	RD3 3-WASH	RH1 O-WASH	RH2 1-WASH	
1	0.1	1.0	1.6	0.0	0.0	0.0	0.0
2	0.1	1.1	0.0	0.0	0.0	0.0	0.0
3	0.2	0.0	0.0	3.0	0.0	0.0	0.0
4	0.1	0.0	1.6	0.0	0.0	0.0	0.0
5	0.1	0.0	1.5	0.0	0.0	0.0	0.0
6	0.1	0.0	0.0	0.0	0.0	2.5	2.5
7	0.1	0.0	2.5	0.0	0.0	0.0	0.0
8	0.2	0.0	1.7	0.0	0.0	2.5	0.0
9	0.1	1.1	2.5	2.0	0.0	0.0	0.0
10	0.2	0.0	0.0	2.0	0.0	0.0	0.0
11	0.2	0.0	0.0	0.0	0.0	1.7	2.8
12	1.9	1.1	4.7	6.3	4.8	9.2	10.0
13	0.6	0.0	0.0	0.0	1.4	0.0	2.5
14	0.1	0.0	0.0	0.0	0.0	0.0	0.0
15	1.3	0.0	0.0	0.0	0.0	0.0	0.0
16	2.9	0.0	0.0	0.0	1.4	0.0	0.0
17	0.4	1.5	0.0	0.0	0.0	0.9	0.0
18	113.0	460.0	590.0	470.0	170.0	570.0	270.0
19	2.1	1.5	3.0	3.0	2.9	2.9	6.7
20	1.9	0.0	2.2	3.7	1.6	0.0	3.4
21	1.5	0.0	0.0	2.0	1.4	1.7	3.4
22	0.5	0.0	1.6	1.5	0.0	0.9	3.0
23	0.6	0.0	0.0	0.0	0.0	2.5	0.0
24	4.1	0.0	0.0	2.0	1.9	0.0	0.0
25	14.0	3.0	5.0	6.4	4.5	4.7	5.0
26	31.0	6.0	5.0	10.0	7.7	5.0	5.0
27	6.2	1.0	0.0	1.5	1.6	0.0	0.0
28	3.8	12.0	12.0	13.0	7.7	13.0	15.0
29	27.0	35.0	40.0	67.0	48.0	50.0	38.0
30	34.0	0.0	0.0	0.0	1.4	0.0	0.0
31	27.0	0.0	0.0	2.0	0.0	0.0	2.5
32	44.0	37.0	41.0	67.0	37.0	55.0	39.0
33	42.0	22.0	22.0	30.0	18.0	32.0	26.0
34	70.0	10.0	6.7	10.0	2.9	2.5	1.7
35	6.0	0.0	0.0	0.0	0.9	0.0	0.0
36	13.0	4.2	3.7	5.0	2.9	4.2	4.2
37	11.0	4.2	8.3	15.0	5.8	10.0	5.8
38	6.9	0.0	1.6	1.3	0.9	0.9	0.0
39	42.0	30.0	33.0	5.0	26.0	53.0	40.0
40	14.0	7.8	10.0	14.0	8.8	23.0	22.0
41	14.0	23.0	21.0	35.0	13.0	14.0	11.0
42	12.0	4.2	7.5	9.2	3.9	10.0	8.3
43	5.9	0.0	0.0	2.5	0.0	3.2	0.0
44	31.0	18.0	18.0	26.0	16.0	25.0	20.0
45	54.0	54.0	60.0	83.0	67.0	98.0	73.0
46	104.0	54.0	67.0	83.0	62.0	98.0	73.0
47	49.0	340.0	370.0	350.0	340.0	530.0	400.0
48	54.0	25.0	25.0	12.0	18.0	18.0	13.0
49	59.0	32.0	33.0	43.0	20.0	23.0	23.0
50	69.0	13.0	16.0	27.0	13.0	28.0	25.0

PACKAGE TO100 - RADIFLC Q VALUES
 RADIFLO VARIABLE CONDITION EVALUATION
 ALL DATA X10-R ATM-CC/SEC

UNIT NUM.	24510 SYSTEM			MARK IV SYSTEM		
	RD1 O-WASH	RD2 1-WASH	RD3 3-WASH	RH1 O-WASH	RH2 1-WASH	RH3 3-WASH
51	71.0	83.0	100.0	96.0	130.0	100.0
52	47.0	50.0	73.0	57.0	73.0	50.0
53	74.0	57.0	77.0	74.0	130.0	90.0
54	91.0	23.0	40.0	19.0	35.0	28.0
55	54.0	47.0	60.0	47.0	65.0	50.0
56	57.0	50.0	70.0	57.0	65.0	50.0
57	59.0	74.0	97.0	96.0	110.0	90.0
58	158.0	94.0	130.0	130.0	180.0	140.0
59	79.0	64.0	97.0	86.0	110.0	90.0
60	212.0	300.0	300.0	300.0	300.0	300.0
61	1.5	0.0	0.0	0.0	0.9	0.0
62	6.5	0.0	0.0	0.0	0.0	0.0
63	27.0	28.0	20.0	5.8	15.0	8.3
64	261.0	300.0	300.0	300.0	300.0	300.0
65	74.0	30.0	37.0	23.0	40.0	28.0
66	1.5	0.0	0.0	0.0	0.0	0.0
67	143.0	60.0	79.0	72.0	150.0	100.0
68	126.0	81.0	84.0	99.0	120.0	90.0
69	184.0	34.0	50.0	38.0	38.0	31.0
70	394.0	340.0	320.0	170.0	380.0	300.0
71	124.0	110.0	180.0	150.0	220.0	150.0
72	301.0	310.0	300.0	350.0	400.0	380.0
73	335.0	270.0	250.0	330.0	400.0	310.0
74	124.0	47.0	67.0	37.0	73.0	35.0
75	143.0	78.0	83.0	72.0	120.0	90.0
76	133.0	97.0	130.0	125.0	140.0	130.0
77	355.0	440.0	440.0	483.0	630.0	460.0
78	247.0	450.0	500.0	370.0	630.0	460.0
79	106.0	100.0	140.0	130.0	180.0	140.0
80	27.0	110.0	140.0	150.0	270.0	170.0
81	148.0	110.0	180.0	170.0	270.0	150.0
82	143.0	150.0	200.0	190.0	270.0	210.0
83	3000.0	120.0	140.0	160.0	310.0	300.0
84	148.0	160.0	210.0	220.0	310.0	220.0
85	147.0	3.0	0.0	0.0	15.0	18.0
86	144.0	120.0	150.0	150.0	210.0	160.0
87	113.0	100.0	140.0	150.0	180.0	150.0
88	133.0	120.0	140.0	150.0	190.0	150.0
89	169.0	110.0	130.0	150.0	180.0	140.0
90	340.0	1000.0	110.0	340.0	1000.0	630.0
91	111.0	60.0	83.0	67.0	100.0	73.0
92	3000.0	1000.0	1000.0	410.0	920.0	800.0
93	3000.0	1100.0	850.0	480.0	1400.0	910.0
94	3000.0	1300.0	1600.0	380.0	1500.0	850.0
95	3000.0	1300.0	1600.0	390.0	1400.0	800.0
96	3000.0	670.0	670.0	530.0	830.0	620.0
97	3000.0	690.0	700.0	570.0	1000.0	700.0
98	197.0	780.0	950.0	630.0	1200.0	910.0
99	394.0	470.0	190.0	390.0	720.0	670.0
100	3000.0	590.0	750.0	630.0	1000.0	700.0

29. TO-100 Radiflo Q Values Variable Conditions (Sheet 2 of 2)

PACKAGE CERH - RADIOLO Q VALUES
 RADIFLO VARIABLE CONDITION EVALUATION
 ALL DATA X10-8 ATM-CC/SEC

UNIT NUM.	24510 SYSTEM			MARK IV SYSTEM			RH3 3-WASH
	RO1 0-WASH	RO2 1-WASH	RO3 3-WASH	RH1 0-WASH	RH2 1-WASH	RH3 3-WASH	
1	3.3	1.1	0.0	2.1	62.0	5.0	5.0
2	0.0	0.0	0.0	0.7	2.5	2.5	2.5
3	0.0	0.0	0.0	0.8	4.2	1.6	1.6
4	3.3	0.0	0.0	0.8	5.0	2.5	2.5
5	0.0	0.0	0.0	0.5	2.5	1.6	1.6
6	0.0	0.0	0.0	0.8	5.0	2.5	2.5
7	0.0	0.0	0.0	0.5	3.3	5.0	5.0
8	0.0	0.0	0.0	1.0	6.7	2.3	2.3
9	0.0	0.0	0.0	1.8	9.3	3.8	3.8
10	1.0	0.0	0.0	1.2	6.7	3.3	3.3
11	0.0	0.0	0.0	0.5	4.2	2.5	2.5
12	0.0	0.0	0.0	0.6	3.3	1.6	1.6
13	1.0	0.0	0.0	0.8	5.8	2.5	2.5
14	0.0	0.0	0.0	0.6	4.2	1.6	1.6
15	0.0	0.0	0.0	1.1	7.5	3.0	3.0
16	0.0	0.0	0.0	0.5	3.3	1.6	1.6
17	1300.0	1000.0	830.0	3000.0	27.0	1600.0	1600.0
18	0.0	0.0	0.0	0.9	7.5	3.3	3.3
19	0.0	0.0	0.0	0.8	3.3	8.3	8.3
20	0.0	0.0	0.0	2.1	14.0	2.5	2.5
21	1.6	3.0	1.6	11.0	67.0	2.5	2.5
22	0.0	0.0	0.0	1.2	67.0	2.5	2.5
23	1.3	0.0	0.0	3000.0	930.0	630.0	630.0
24	340.0	380.0	240.0	2.8	20.0	10.0	10.0
25	5.8	230.0	23.0	3000.0	3000.0	1300.0	1300.0
26	1200.0	3000.0	3000.0	3000.0	3000.0	1300.0	1300.0
27	3000.0	1.8	0.0	2.1	5.8	4.5	4.5
28	0.0	0.0	0.0	2.0	15.0	8.3	8.3
29	2.5	2.5	1.3	8.0	1000.0	680.0	680.0
30	750.0	600.0	660.0	0.9	5.8	3.3	3.3
31	0.0	0.0	0.0	2.6	15.0	9.2	9.2
32	5.8	4.5	3.8	3000.0	3000.0	1100.0	1100.0
33	1200.0	3000.0	1300.0	3.4	8.3	15.0	15.0
34	2.5	1.6	1.6	12.0	37.0	150.0	150.0
35	67.0	300.0	100.0	2.9	14.0	9.2	9.2
36	4.1	5.0	2.5	0.8	6.7	4.2	4.2
37	0.0	0.0	0.0	3.1	21.0	9.2	9.2
38	5.0	4.7	3.7	1.1	5.8	2.5	2.5
39	0.0	0.0	0.0	0.9	5.8	2.5	2.5
40	0.0	0.0	0.0	0.7	5.8	1.6	1.6
41	0.0	0.0	0.0	7.6	18.0	23.0	23.0
42	5.9	70.0	0.0	3000.0	3000.0	1000.0	1000.0
43	210.0	230.0	89.0	2.8	16.0	12.0	12.0
44	0.0	5.0	0.0	0.4	5.8	2.2	2.2
45	0.0	0.0	0.0	1.4	9.2	1.6	1.6
46	0.0	0.0	0.0	0.8	1.6	2.5	2.5
47	0.0	0.0	0.0	0.8	4.7	5.0	5.0
48	0.0	0.0	0.0	0.7	5.0	2.8	2.8
49	0.0	0.0	0.0	2.4	11.0	5.5	5.5
50	1.6	2.0	0.0	0.0	0.0	0.0	0.0

30. Ceramic Radiflo Q Values Variable Conditions (Sheet 1 of 2)

PACKAGE CERM - RADIFLO Q VALUES
 RADIFLO VARIABLE CONDITION EVALUATION
 ALL DATA X10-8 ATM-CC/SEC

UNIT NUM.	24510 SYSTEM			MARK IV SYSTEM			MARK IV SYSTEM		
	RDI 0-WASH	RDI 1-WASH	RDI 3-WASH	RH1 0-WASH	RH2 1-WASH	RH3 3-WASH	RH1 0-WASH	RH2 1-WASH	RH3 3-WASH
51	2.5	260.0	0.0	2.6	10.0	1.6			
52	0.0	0.0	0.0	0.8	5.8	23.0			
53	0.0	0.0	0.0	1.3	6.8	1000.0			
54	0.0	0.0	0.0	0.6	5.8	12.0			
55	390.0	0.0	1.3	3.0	16.0	2.2			
56	0.0	38.0	0.0	1.6	8.3	4.2			
57	0.0	0.0	0.0	0.9	7.5	1.6			
58	0.0	1.3	0.0	2.6	11.0	2.5			
59	0.0	1.2	0.0	2.7	12.0	2.8			
60	2.1	2.5	0.0	1.3	6.3	5.5			
61	0.0	0.0	0.0	1.5	7.5	4.2			
62	0.0	1.6	0.0	0.8	8.3	4.2			
63	1.6	2.0	1.1	3.5	16.0	12.0			
64	0.0	1.2	0.0	1.1	4.2	3.0			
65	0.0	1.6	0.0	1.4	5.8	3.2			
66	0.0	0.0	0.0	1.4	7.5	3.0			
67	0.0	0.0	0.0	1.1	6.7	4.2			
68	0.0	0.0	0.0	1.4	6.7	3.3			
69	0.0	0.0	0.0	1.4	5.3	5.8			
70	0.0	0.0	0.0	1.3	5.3	5.8			
71	0.0	0.0	0.0	0.4	0.8	2.5			

30. Ceramic Radiflo Q Values Variable Conditions (Sheet 2 of 2)

PACKAGE TO 3 - RADIFLO Q VALUES
 RADIFLO VARIABLE CONDITION EVALUATION
 ALL DATA X10-9 ATM-CC/SEC

UNIT NUM.	24510 SYSTEM		RD1		RD2		RD1		MARK IV SYSTEM		RH3	
	0-WASH	1-WASH	0-WASH	1-WASH	0-WASH	1-WASH	0-WASH	1-WASH	0-WASH	1-WASH	0-WASH	1-WASH
1	7.0	18.0	38.0	18.0	35.0	35.0	5.0	52.0	48.0	48.0	52.0	48.0
2	0.0	0.0	0.0	1.6	0.0	1.6	0.0	0.0	0.0	0.0	1.6	1.3
3	0.0	0.0	1.6	0.0	0.0	0.0	2.7	3.5	1.7	1.7	3.5	1.7
4	1.1	0.0	0.0	0.0	0.0	0.0	4.7	23.0	0.0	23.0	0.0	0.0
5	78.0	130.0	230.0	130.0	500.0	500.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0
6	2.8	0.0	0.0	6.7	0.5	6.7	0.3	7.5	2.2	7.5	2.2	2.2
7	3.4	10.0	10.0	6.7	5.0	6.7	11.0	7.5	4.7	7.5	4.7	4.7
8	9.4	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0
9	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.7
10	3.0	10.0	10.0	10.0	5.0	10.0	13.0	13.0	3.3	13.0	3.3	3.3
11	7.4	110.0	110.0	92.0	160.0	160.0	74.0	630.0	610.0	630.0	610.0	610.0
12	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.0
13	0.0	0.0	0.0	0.0	0.0	0.0	0.8	3.5	0.0	3.5	0.0	0.0
14	0.0	0.0	0.0	0.0	0.0	0.0	2.9	0.0	1.7	0.0	1.7	1.7
15	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.0	0.0	0.0	0.0	0.0
16	0.0	0.0	0.0	0.0	0.0	0.0	11.0	0.0	5.8	0.0	5.8	5.8
17	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	1.7	0.0	1.7	1.7
18	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
19	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.0
20	0.0	0.0	0.0	0.0	0.0	0.0	3.8	1.6	1.7	1.6	1.7	1.7
21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.2	0.0	2.2	2.2
22	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0
23	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	0.0	2.5	2.5
24	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
25	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	2.0	0.0	2.0	2.0
26	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.0	0.0	0.0	0.0	0.0
27	25.0	58.0	58.0	40.0	89.0	89.0	0.3	0.0	0.0	0.0	0.0	1.7
28	4.0	1.6	1.6	12.0	0.8	12.0	0.7	4.2	2.5	4.2	2.5	2.5
29	42.0	24.0	24.0	27.0	35.0	35.0	0.8	120.0	12.0	120.0	12.0	12.0
30	36.0	41.0	41.0	41.0	78.0	78.0	27.0	230.0	220.0	230.0	220.0	220.0
31	14.0	18.0	18.0	18.0	35.0	35.0	8.8	90.0	73.0	90.0	73.0	73.0
32	110.0	25.0	25.0	13.0	45.0	45.0	13.0	100.0	110.0	100.0	110.0	110.0
33	50.0	23.0	23.0	22.0	20.0	20.0	3.8	57.0	35.0	57.0	35.0	35.0
34	5.0	11.0	11.0	9.3	9.6	9.6	1.6	12.0	14.0	12.0	14.0	14.0
35	82.0	110.0	110.0	70.0	230.0	230.0	99.0	760.0	800.0	760.0	800.0	800.0
36	54.0	130.0	130.0	82.0	210.0	210.0	92.0	920.0	910.0	920.0	910.0	910.0
37	30.0	32.0	32.0	34.0	35.0	35.0	5.4	40.0	40.0	40.0	40.0	40.0
38	55.0	65.0	65.0	63.0	100.0	100.0	31.0	220.0	250.0	220.0	250.0	250.0
39	76.0	200.0	200.0	11.0	200.0	200.0	190.0	3000.0	3000.0	3000.0	3000.0	3000.0
40	16.0	20.0	20.0	23.0	23.0	23.0	3.4	32.0	30.0	32.0	30.0	30.0
41	50.0	130.0	130.0	75.0	240.0	240.0	90.0	700.0	800.0	700.0	800.0	800.0
42	60.0	75.0	75.0	72.0	75.0	75.0	12.0	180.0	100.0	180.0	100.0	100.0
43	72.0	32.0	32.0	44.0	33.0	33.0	2.9	73.0	73.0	73.0	73.0	73.0
44	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0
45	15.0	18.0	18.0	18.0	20.0	20.0	2.4	23.0	23.0	23.0	23.0	23.0
46	32.0	37.0	37.0	37.0	37.0	37.0	5.2	38.0	38.0	38.0	38.0	38.0
47	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	22.0	680.0	480.0	680.0	480.0	480.0
48	150.0	18.0	18.0	22.0	28.0	28.0	4.3	31.0	31.0	31.0	31.0	31.0
49	200.0	480.0	480.0	260.0	910.0	910.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0
50	48.0	15.0	15.0	9.3	9.3	9.3	4.3	27.0	22.0	27.0	22.0	22.0

PACKAGE TO 3 - RADIFLO Q VALUES
 RADIFLO VARIABLE CONDITION EVALUATION
 ALL DATA X10-8 ATH-CC/SEC

UNIT NUM.	24510 SYSTEM			MARK IV SYSTEM			
	RDI 0-WASH	RD1 0-WASH	RD2 1-WASH	RD3 3-WASH	RH1 0-WASH	RH2 1-WASH	RH3 3-WASH
51	100.0	92.0	95.0	95.0	17.0	150.0	130.0
52	92.0	130.0	110.0	200.0	610.0	430.0	460.0
53	150.0	200.0	95.0	310.0	110.0	830.0	700.0
54	130.0	230.0	130.0	430.0	220.0	3720.0	3000.0
55	160.0	410.0	250.0	780.0	3000.0	3000.0	3000.0
56	95.0	200.0	110.0	280.0	130.0	910.0	870.0
57	70.0	120.0	85.0	210.0	72.0	700.0	660.0
58	140.0	160.0	100.0	310.0	130.0	1000.0	1000.0
59	120.0	130.0	100.0	1000.0	200.0	3000.0	3000.0
60	3000.0	500.0	310.0	430.0	3000.0	3000.0	3000.0
61	3.0	0.0	0.0	2.0	1.3	6.7	5.8
62	1.4	0.0	4.2	0.6	3.4	4.2	3.0
63	2.5	11.0	0.0	21.0	5.2	11.0	7.5
64	0.0	0.0	1.3	0.3	0.5	3.5	3.3
65	4.0	3.3	2.7	7.0	2.5	15.0	16.7
66	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0
67	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0
68	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0
69	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0
70	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0
71	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0
72	88.0	180.0	95.0	230.0	97.0	750.0	770.0
73	3000.0	3000.0	92.0	3000.0	3000.0	3000.0	3000.0
74	3000.0	800.0	450.0	100.0	3000.0	3000.0	3000.0
75	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0
76	240.0	150.0	110.0	200.0	74.0	700.0	660.0
77	3000.0	1000.0	730.0	1400.0	3000.0	3000.0	3000.0
78	3000.0	250.0	85.0	300.0	600.0	580.0	630.0
79	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0
80	3000.0	1000.0	900.0	3000.0	3000.0	3000.0	3000.0
81	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0
82	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0
83	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0
84	3000.0	1100.0	1000.0	130.0	3000.0	3000.0	3000.0
85	120.0	68.0	65.0	65.0	17.0	990.0	1000.0
86	3000.0	830.0	500.0	1200.0	3000.0	3000.0	3000.0
87	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0
88	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0
89	3000.0	580.0	300.0	830.0	3000.0	3000.0	3000.0
90	3000.0	160.0	62.0	960.0	3000.0	3000.0	3000.0
91	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0
92	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0
93	44.0	160.0	78.0	250.0	140.0	920.0	830.0
94	170.0	200.0	110.0	300.0	160.0	1200.0	1100.0
95	3000.0	3000.0	1400.0	3000.0	3000.0	3000.0	3000.0
96	3000.0	900.0	630.0	1300.0	3000.0	3000.0	3000.0
97	3000.0	3000.0	3000.0	1100.0	3000.0	3000.0	3000.0
98	2.0	16.0	4.0	0.0	3.2	11.0	42.0
99	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0
100	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0

PACKAGE GLASS - RADIFLO Q VALUES
 RADIFLO VARIABLE CONDITION EVALUATION
 ALL DATA X10-8 ATM-CC/SEC

UNIT NUM.	24510 SYSTEM			MARK IV SYSTEM		
	RO1 O-WASH	RO1 1-WASH	RO3 3-WASH	RH1 O-WASH	RH2 1-WASH	RH3 3-WASH
1	510.0	30.0	250.0	2.7	73.0	40.0
2	375.0	180.0	350.0	43.0	230.0	260.0
3	4.0	10.0	10.0	0.3	5.8	11.0
4	4.8	10.9	10.3	0.7	1.0	5.8
5	4.3	6.5	14.0	0.1	5.8	9.2
6	5.6	4.8	13.0	0.2	11.0	5.0
7	580.0	630.0	580.0	32.0	580.0	480.0
8	5.0	10.0	32.0	1.4	16.0	5.9
9	86.0	82.0	86.0	12.0	150.0	11.0
10	4.8	10.0	4.9	1.1	13.0	3.0
11	240.0	99.0	20.0	1.1	13.0	18.0
12	7.0	47.0	22.0	1.1	5.8	25.0
13	7.0	5.6	19.0	0.4	0.0	3.3
14	4.8	4.0	7.3	0.3	5.8	23.0
15	4.0	10.0	8.0	0.2	13.0	13.0
16	3.1	5.6	7.3	0.0	16.0	3.3
17	5.8	5.6	40.0	0.3	16.0	3.3
18	5.6	65.0	10.0	1.8	1.6	18.0
19	1600.0	3.1	1400.0	3000.0	3000.0	3000.0
20	3000.0	1600.0	1500.0	3000.0	3000.0	3000.0
21	11.0	65.0	24.0	1.2	16.0	4.2
22	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0
23	2.3	9.0	37.0	0.1	48.0	26.0
24	660.0	4.0	560.0	82.0	0.0	930.0
25	6.0	7.3	4.0	1.3	1.6	0.0
26	3000.0	4.8	3000.0	3000.0	3000.0	3000.0
27	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0
28	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0
29	1300.0	3000.0	3000.0	160.0	1600.0	1600.0
30	3.0	10.0	6.5	0.9	1.6	16.0
31	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0
32	3000.0	9.0	3000.0	3000.0	3000.0	3000.0
33	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0
34	4.3	35.0	19.0	1.1	11.0	8.5
35	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0
36	10.0	760.0	49.0	10.0	22.0	18.0
37	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0
38	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0
39	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0
40	5.6	7.3	7.3	0.4	1.6	4.2
41	9.0	30.0	25.0	2.3	10.0	5.8
42	17.0	320.0	32.0	9.5	37.0	25.0
43	19.0	350.0	40.0	9.5	10.0	37.0
44	14.0	19.0	47.0	0.8	16.0	12.0
45	9.0	250.0	14.0	7.9	14.0	25.0
46	7.3	30.0	9.0	8.1	4.2	15.0
47	5.6	22.0	44.0	1.8	10.0	8.4
48	10.0	32.0	14.0	1.3	7.5	10.0
49	7.3	32.0	27.0	1.8	22.0	23.0
50	4.8	49.0	5.6	0.4	1.6	6.7
51	12.0	25.0	25.0	0.9	30.0	2.5

32. Glass Standard Radiflo Q Values Variable Conditions

PACKAGE TCH4 - RADIFLO Q VALUES
 RADIFLO REPEATABILITY EVALUATION
 ALL DATA X10-8 ATM-CC/SEC

UNIT NO.	RUN 1	RUN 2	RUN 3	RUN 4
1	140.0	116.0	120.0	190.0
2	1.3	1.2	1.2	4.2
3	3.1	2.4	2.9	2.1
4	2.4	2.4	2.1	2.1
5	0.0	0.0	0.0	0.0
6	4.5	4.1	4.3	4.9
7	2.3	2.4	1.6	2.1
8	2.8	2.9	2.4	3.4
9	2.8	3.1	2.4	2.6
10	5.4	5.3	4.6	5.8
11	140.0	460.0	210.0	150.0
12	7.5	8.2	7.1	8.3
13	0.0	0.0	0.0	0.0
14	1.6	1.5	1.6	1.6
15	1.6	1.2	1.2	1.2
16	180.0	360.0	250.0	230.0
17	11.0	10.0	9.5	12.0
18	39.0	34.0	34.0	38.0
19	3.3	3.6	3.3	3.8
20	120.0	24.0	110.0	120.0
21	8.0	18.0	19.0	19.0
22	53.0	138.0	48.0	60.0
23	0.0	0.0	0.0	0.0
24	0.0	0.0	0.0	0.0
25	190.0	460.0	350.0	250.0
26	14.0	13.0	12.0	13.0
27	0.0	0.0	0.0	0.0
28	78.0	73.0	66.0	69.0
29	8.3	9.1	5.8	6.9
30	0.0	0.0	0.0	0.0
31	54.0	51.0	49.0	56.0
32	3.1	38.0	2.8	3.3
33	0.0	0.0	0.0	0.0
34	12.0	15.0	13.0	14.0
35	24.0	39.0	38.0	41.0
36	120.0	120.0	99.0	110.0
37	26.0	24.0	24.0	26.0
38	29.0	29.0	26.0	32.0
39	0.0	58.0	58.0	6.0
40	0.0	0.0	0.0	0.0
41	0.0	0.0	0.0	0.0
42	0.0	0.0	0.0	0.0
43	59.0	74.0	160.0	71.0
44	0.0	0.0	0.0	0.0
45	0.0	0.0	0.0	0.0
46	0.0	0.0	0.0	0.0
47	74.0	220.0	220.0	110.0
48	0.0	0.0	0.0	0.0
49	0.0	0.0	0.0	0.0
50	99.0	20.0	95.0	12.0

33. TO-84 Radiflo Repeatability Q Values (Sheet 1 of 2)

PACKAGE TOB4 - RADIFLO Q VALUES
 RADIFLO REPEATABILITY EVALUATION
 ALL DATA X10-8 ATM-CC/SEC

UNIT NUM.	RUN 1	RUN 2	RUN 3	RUN 4
51	0.0	1.2	0.0	0.0
52	0.0	0.0	0.0	0.0
53	0.0	0.0	0.0	0.0
54	0.0	0.0	0.0	0.0
55	0.0	0.0	0.0	0.0
56	0.0	0.0	0.0	0.0
57	0.0	0.0	0.0	0.0
58	0.0	0.0	0.0	0.0
59	1.6	3.4	4.1	1.6
60	78.7	99.0	120.0	120.0
61	3.6	4.9	9.9	9.9
62	83.0	170.0	230.0	110.0
63	4.6	2.0	3.8	4.6
64	3.4	3.5	3.3	3.6
65	14.0	170.0	120.0	23.0
66	0.0	0.0	0.0	0.0
67	0.0	1.2	0.0	0.0
68	0.0	1.2	1.6	0.0
69	0.0	0.0	0.0	0.0
70	0.0	1.0	0.0	0.0
71	0.0	4.1	0.0	0.0
72	0.0	0.0	0.0	0.0
73	0.0	0.0	0.0	0.0
74	0.0	0.0	0.0	0.0
75	0.0	0.0	0.0	0.0
76	0.0	0.0	0.0	0.0
77	0.0	0.0	0.0	0.0
78	0.0	0.0	0.0	0.0
79	0.0	0.0	0.0	0.0
80	0.0	0.0	0.0	0.0
81	0.0	0.0	0.0	0.0
82	0.0	0.0	0.0	0.0
83	0.0	6.5	0.0	1.2
84	0.0	0.0	0.0	0.0
85	0.0	0.0	0.0	0.0
86	0.0	0.0	0.0	0.0
87	0.0	0.0	0.0	0.0
88	1.6	200.0	91.0	5.1
89	0.0	1.1	0.0	0.0
90	0.0	0.0	0.0	0.0
91	0.0	0.0	0.0	0.0
92	0.0	0.0	0.0	0.0
93	0.0	0.0	0.0	0.0
94	0.0	0.0	0.0	0.0
95	0.0	0.0	0.0	0.0
96	0.0	0.0	0.0	0.0
97	0.0	0.0	0.0	0.0
98	0.0	0.0	0.0	0.0

PACKAGE C-PAK - RADIFLO Q VALUES
 RADIFLO REPEATABILITY EVALUATION
 ALL DATA X10-8 ATM-CC/SFC

UNIT NUM.	RUN 1	RUN 2	RUN 3	RUN 4
1	150.0	150.0	220.0	170.0
2	170.0	24.0	20.0	64.0
3	110.0	160.0	160.0	150.0
4	450.0	20.0	150.0	300.0
5	220.0	150.0	100.0	250.0
6	350.0	50.0	110.0	350.0
7	24.0	24.0	22.0	14.0
8	29.0	99.0	10.0	31.0
9	51.0	91.0	87.0	91.0
10	150.0	17.0	0.6	140.0
11	63.0	23.0	33.0	170.0
12	210.0	120.0	280.0	360.0
13	300.0	150.0	280.0	170.0
14	250.0	125.0	140.0	220.0
15	9.1	12.0	10.0	5.8
16	0.0	0.0	0.0	0.0
17	170.0	91.0	190.0	190.0
18	0.0	0.0	0.0	0.0
19	0.0	1.0	0.0	0.0
20	200.0	14.0	12.0	69.0
21	61.0	64.0	24.0	31.0
22	200.0	60.0	91.0	220.0
23	150.0	19.0	50.0	150.0
24	43.0	83.0	78.0	40.0
25	91.0	32.0	2.0	120.0
26	130.0	100.0	46.0	280.0
27	210.0	4.1	120.0	220.0
28	0.0	100.0	7.4	6.3
29	170.0	120.0	95.0	130.0
30	120.0	120.0	230.0	160.0
31	51.0	29.0	180.0	140.0
32	59.0	3.7	31.0	66.0
33	11.0	56.0	4.8	15.0
34	120.0	49.0	43.0	90.1
35	330.0	31.0	49.0	260.0
36	1.6	0.0	160.0	2.4
37	140.0	160.0	21.1	1.2
38	170.0	50.0	120.0	68.0
39	0.0	0.0	31.0	31.0
40	110.0	22.0	13.0	13.0
41	91.0	17.0	56.0	100.0
42	170.0	160.0	68.0	170.0
43	190.0	9.1	170.0	170.0
44	18.0	40.0	6.4	23.0
45	3.6	110.0	28.0	29.0
46	140.0	19.0	110.0	150.0
47	160.0	120.0	16.0	300.0
48	270.0	39.0	170.0	270.0
49	74.0	0.0	31.0	63.0
50	0.0	11.0	0.0	0.0

PACKAGE C-PAK - RACIFLO Q VALUES
 RACIFLO REPEATABILITY EVALUATION
 ALL DATA X10-3 ATM-CG/SEC

UNIT NUM.	RUN 1	RUN 2	RUN 3	RUN 4
51	7.8	6.0	9.9	6.1
52	0.0	120.0	0.0	0.0
53	66.C	56.0	120.0	71.0
54	18.0	0.0	48.0	16.0
55	0.0	83.0	0.0	0.0
56	41.C	1.1	87.0	24.0
57	150.0	140.0	0.0	1.3
58	180.0	120.0	99.0	120.0
59	180.0	2.9	120.0	180.0
60	4.2	210.0	4.4	4.5
61	59.C	45.0	220.0	87.0
62	28.0	83.0	51.0	39.0
63	220.0	3.7	91.0	190.0
64	51.C	61.0	3.4	2.0
65	170.0	83.0	66.C	180.0
66	28.C	0.0	66.0	53.0
67	0.0	34.0	0.0	0.0
68	10.0	100.0	49.0	45.0
69	29.C	41.0	29.0	29.0
70	140.0	1.0	59.C	210.0
71	0.0	2.9	0.0	0.0
72	15.C	6.0	5.4	14.0
73	0.0	0.0	0.0	0.0
74	0.C	1.0	0.0	0.0
75	20.C	0.0	21.0	19.0
76	0.0	0.0	0.0	0.0
77	0.C	35.0	0.0	0.0
78	53.0	83.0	29.0	33.0
79	46.0	100.0	160.0	120.0
80	130.C	0.0	210.C	150.0
81	0.0	28.0	0.0	0.0
82	71.C	6.0	26.0	83.0
83	0.0	9.1	0.0	0.0
84	33.0	83.0	11.0	19.0
85	160.C	160.0	95.0	170.0
86	48.0	8.3	220.C	190.0
87	8.1	1.7	12.0	11.0
88	2.C	6.0	2.0	2.2
89	0.0	1.5	0.0	0.0
90	1.2	3.3	1.2	1.2
91	2.4	0.0	2.3	2.2
92	0.0	0.0	0.0	0.0
93	0.C	140.0	0.0	0.0
94	150.0	0.0	140.0	160.0
95	0.0	0.0	0.0	0.0
96	0.0	91.0	0.0	0.0
97	210.0	0.0	81.C	200.0
98	0.0	0.0	0.0	0.0
99	0.C	0.0	0.0	0.0
100	0.0	0.0	0.0	0.0

34. C-PAK Radiflo Repeatability Q Values (Sheet 2 of 2)

PACKAGE CDIP - RADIFLO Q VALUES
 RADIFLO REPEATABILITY EVALUATION
 ALL DATA X10-8 ATM-CC/SEC

UNIT NUM.	RUN 1	RUN 2	RUN 3	RUN 4
1	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0
7	0.0	0.0	0.0	0.0
8	0.0	0.0	0.0	0.0
9	0.0	0.0	0.0	0.0
10	0.0	0.0	0.0	0.0
11	3.0	3.0	3.7	4.3
12	2.5	2.0	3.7	3.0
13	5.3	4.5	5.0	6.2
14	1.9	2.2	1.7	2.0
15	3.2	3.3	3.7	4.8
16	2.1	2.2	1.4	2.1
17	1.1	1.2	1.5	1.0
18	1.2	1.4	1.5	1.5
19	1.0	1.0	0.0	1.0
20	2.2	3.0	2.1	2.5
21	2.5	2.5	2.7	2.6
22	2.3	2.3	2.3	2.2
23	1.2	1.2	1.5	1.3
24	0.0	0.0	0.0	0.0
25	42.0	42.0	84.0	74.0
26	27.0	2.0	52.0	53.0
27	27.0	23.0	48.0	45.0
28	37.0	35.0	37.0	36.0
29	14.0	25.0	13.0	14.0
30	23.0	19.3	38.0	34
31	21.0	17.0	45.0	34.8
32	3.2	9.0	8.4	8.5
33	16.0	48.0	32.0	27.0
34	2.3	11.0	7.0	5.6
35	110.0	9.0	28.0	22.0
36	4.2	2.8	6.3	5.7
37	3.5	4.5	5.0	6.3
38	0.0	2.0	0.0	0.0
39	21.0	30.0	75.0	50.0
40	15.0	6.7	27.0	28.0
41	10.0	17.0	35.0	30.0
42	40.0	31.0	15.0	14.0
43	75.0	72.0	130.0	130.0
44	2.2	3.5	0.0	1.0
45	74.0	72.0	130.0	130.0
46	0.0	0.0	0.0	0.0
47	120.0	120.0	200.0	190.0
48	100.0	110.0	180.0	150.0
49	0.0	0.0	0.0	0.0
50	0.0	90.0	0.0	0.0

PACKAGE GDIP - RADIFLO Q VALUES
 RADIFLO REPEATABILITY EVALUATION
 ALL DATA X10-B ATM-CC/SEC

UNIT NUM.	RUN 1	RUN 2	RUN 3	RUN 4
51	32.0	12.0	18.0	35.0
52	42.0	30.0	110.0	100.0
53	0.0	0.0	0.0	0.0
54	0.0	0.0	0.0	0.0
55	0.0	0.0	0.0	0.0
56	0.0	0.0	0.0	0.0
57	0.0	0.0	0.0	0.0
58	150.0	140.0	200.0	280.0
59	270.0	5.9	160.0	320.0
60	180.0	180.0	210.0	280.0
61	83.0	85.0	160.0	150.0
62	0.0	0.0	0.0	0.0
63	7.0	15.0	13.0	7.5
64	93.0	83.0	140.0	150.0
65	170.0	150.0	190.0	270.0
66	130.0	110.0	190.0	210.0
67	0.0	0.0	0.0	0.0
68	320.0	280.0	170.0	210.0
69	100.0	76.0	140.0	130.0
70	320.0	240.0	140.0	240.0
71	0.0	0.0	0.0	0.0
72	0.0	0.0	0.0	0.0
73	2.8	2.4	3.5	3.2
74	0.0	0.0	0.0	0.0
75	0.0	0.0	0.0	0.0
76	0.0	0.0	0.0	0.0
77	290.0	260.0	190.0	250.0
78	0.0	0.0	0.0	0.0
79	340.0	260.0	200.0	340.0
80	0.0	0.0	1.0	0.0
81	280.0	230.0	220.0	0.0
82	340.0	260.0	160.0	330.0
83	110.0	98.0	180.0	190.0
84	0.0	0.0	0.0	180.0
85	0.0	0.0	0.0	0.0
86	0.0	0.0	0.0	0.0
87	0.0	0.0	0.0	0.0
88	0.0	0.0	0.0	0.0
89	0.0	0.0	0.0	0.0
90	1.4	1.4	0.0	0.0
91	6.7	5.0	3.0	3.3
92	0.0	0.0	0.0	0.0
93	1.6	1.5	0.0	0.0
94	4.3	9.3	4.2	4.7
95	0.0	0.0	0.0	0.0
96	12.0	26.0	3.5	5.5
97	210.0	150.0	180.0	270.0
98	370.0	300.0	220.0	270.0
99	1.3	1.0	1.0	1.0
100	5.3	7.6	7.1	6.0

35. C-DIP Radiflo Repeatability Q Values (Sheet 2 of 2)

PACKAGE MOSDIP - RADIOLO Q VALUES
 RADIFLO REPEATABILITY EVALUATION
 ALL DATA X10-8 ATM-CC/SEC

UNIT NUM.	RUN 1	RUN 2	RUN 3	RUN 4
1	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0
7	0.0	0.0	0.0	0.0
8	0.0	0.0	0.0	0.0
9	0.0	0.0	0.0	0.0
10	0.0	0.0	0.0	0.0
11	1.0	0.9	0.0	0.0
12	1.2	0.9	1.3	1.1
13	1.6	1.8	2.0	1.8
14	1.4	0.9	8.1	0.9
15	0.9	0.0	0.0	0.0
16	0.9	0.9	0.9	0.0
17	1.0	1.2	1.4	1.1
18	2.3	2.6	0.0	2.2
19	0.0	0.0	0.0	0.0
20	2.0	2.0	3.4	1.9
21	1.3	1.4	1.6	1.4
22	1.8	1.4	9.9	1.8
23	1.9	1.9	2.0	1.6
24	1.2	1.1	1.3	1.2
25	1.3	1.2	1.3	1.2
26	0.0	0.0	0.0	0.0
27	2.8	4.9	1.8	4.4
28	0.0	0.0	0.0	0.0
29	0.0	0.0	7.3	0.0
30	56.0	24.0	99.0	70.0
31	0.0	0.0	0.0	0.0
32	0.0	0.0	10.0	0.0
33	8.3	13.0	14.0	13.0
34	19.0	24.0	14.0	15.0
35	5.6	5.3	18.0	5.4
36	0.0	0.0	0.0	0.0
37	5.4	16.0	19.0	12.0
38	19.0	18.0	11.0	18.0
39	1.8	1.4	1.6	1.3
40	0.0	0.0	15.0	0.0
41	1.2	1.2	16.0	1.2
42	1.9	2.8	4.9	2.9
43	4.4	4.3	5.6	4.1
44	28.0	41.0	33.0	51.0
45	6.6	6.3	9.9	6.6
46	22.0	39.0	33.0	41.0
47	170.0	170.0	150.0	81.0
48	34.0	31.0	24.0	15.0
49	23.0	41.0	61.0	38.0
50	43.0	29.0	49.0	14.0

PACKARE MOSDIP - RADIFLO Q VALUES
 RADIFLO REPEATABILITY EVALUATION
 ALL DATA X10-8 ATM-CC/SEC

UNIT NUM.	RUN 1	RUN 2	RUN 3	RUN 4
51	0.0	0.0	0.0	0.0
52	0.0	0.0	0.0	0.0
53	0.0	0.0	6.3	0.0
54	0.0	0.0	2.8	0.0
55	0.0	0.0	0.0	0.0
56	180.0	180.0	160.0	83.0
57	0.0	0.0	13.0	0.0
58	160.0	140.0	99.0	71.0
59	0.0	0.0	0.0	0.0
60	83.0	87.0	81.0	76.0
61	0.0	0.0	0.0	0.0
62	0.0	0.0	0.0	0.0
63	4.9	4.6	3.6	5.3
64	0.0	0.0	0.0	0.0
65	0.0	0.0	0.0	0.0
66	0.0	0.0	0.0	0.0
67	0.0	0.0	0.0	0.0
68	0.0	0.0	0.0	0.0
69	1.1	0.0	0.0	0.0
70	0.0	0.0	0.0	0.0
71	0.0	0.0	0.0	0.0
72	480.0	580.0	500.0	330.0
73	0.0	0.0	0.0	0.0
74	410.0	530.0	600.0	580.0
75	470.0	500.0	3000.0	3000.0
76	63.0	63.0	160.0	28.0
77	51.0	56.0	120.0	44.0
78	280.0	250.0	180.0	110.0
79	340.0	410.0	3000.0	3000.0
80	0.0	0.0	0.0	0.0
81	0.5	0.0	1.4	0.0
82	0.0	0.0	0.0	0.0
83	2.3	0.0	3.4	0.9
84	340.0	340.0	3000.0	820.0
85	140.0	120.0	360.0	340.0
86	430.0	450.0	360.0	190.0
87	0.0	0.0	24.0	0.0
88	350.0	490.0	170.0	330.0
89	340.0	360.0	750.0	760.0
90	340.0	260.0	400.0	190.0
91	180.0	170.0	430.0	410.0
92	340.0	590.0	500.0	400.0
93	330.0	460.0	710.0	650.0
94	0.0	0.0	0.0	0.0
95	0.0	0.0	0.0	0.0
96	0.0	0.0	0.0	1.9
97	0.0	0.0	0.0	0.0
98	0.0	0.0	0.0	0.0
99	0.0	0.0	0.0	0.0
100	0.0	0.0	0.0	0.0

36. MOS DIP Radiflo Repeatability Q Values (Sheet 2 of 2)

PACKAGE TO100 - RADIFLO Q VALUES
 RADIFLO REPEATABILITY EVALUATION
 ALL DATA X10⁻⁸ ATM-CC/SEC

UNIT NUM.	RUN 1	RUN 2	RUN 3	RUN 4
1	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0
7	0.0	0.0	0.0	0.0
8	0.0	0.0	0.0	0.0
9	0.0	0.0	0.0	0.0
10	0.0	0.0	0.0	0.0
11	0.0	0.0	0.0	0.0
12	0.0	0.0	0.0	0.0
13	0.0	0.0	0.0	0.0
14	0.0	0.0	0.0	0.0
15	0.0	0.0	0.0	0.0
16	0.0	0.0	0.0	0.0
17	0.0	0.0	1.2	0.0
18	0.0	0.0	0.0	0.0
19	0.0	0.0	0.0	0.0
20	0.0	0.0	0.0	0.0
21	0.0	0.0	0.0	0.0
22	0.0	0.0	0.0	0.0
23	0.0	0.0	0.0	0.0
24	0.0	0.0	0.0	0.0
25	0.0	0.0	0.0	0.0
26	0.0	0.0	0.0	0.0
27	6.3	5.8	6.8	6.4
28	0.0	0.0	0.0	0.0
29	0.0	0.0	0.0	0.0
30	0.0	0.0	0.0	0.0
31	21.0	18.0	27.0	9.9
32	0.0	0.0	0.0	0.0
33	0.0	0.0	0.0	0.0
34	0.0	0.0	0.0	0.0
35	0.0	0.0	0.0	0.0
36	0.0	0.0	0.0	0.0
37	0.0	0.0	0.0	0.0
38	14.0	12.0	11.0	6.9
39	820.0	700.0	3000.0	3000.0
40	0.0	0.0	0.0	0.0
41	6.4	4.9	6.3	2.4
42	0.0	0.0	0.0	0.0
43	13.0	11.0	10.0	5.8
44	43.0	41.0	24.0	19.0
45	0.0	0.0	0.0	0.0
46	220.0	240.0	120.0	110.0
47	0.0	0.0	0.0	0.0
48	0.0	0.0	0.0	0.0
49	0.0	0.0	0.0	0.0
50	35.0	39.0	21.0	19.0

PACKAGE TO100 - RADIFLO Q VALUES
 RADIFLO REPEATABILITY EVALUATION
 ALL DATA X10-8 ATM-CC/SEC

UNIT NUM.	1	2	3	4
51	0.0	0.0	0.0	3.3
52	19.0	12.0	14.0	6.6
53	8.3	4.9	6.9	0.0
54	22.0	19.0	16.0	8.3
55	19.0	16.0	15.0	8.3
56	68.0	81.0	33.0	29.0
57	51.0	56.0	28.0	24.0
58	0.0	0.0	0.0	0.0
59	0.0	0.0	0.0	0.0
60	4.6	2.9	4.6	1.9
61	9.1	9.4	8.3	44.0
62	0.0	0.0	0.0	0.0
63	2.3	2.0	2.0	0.0
64	58.0	64.0	29.0	29.0
65	12.0	95.0	8.3	7.4
66	210.0	160.0	210.0	44.0
67	120.0	99.0	120.0	46.0
68	260.0	280.0	140.0	140.0
69	100.0	120.0	49.0	51.0
70	13.0	9.9	13.0	4.9
71	9.1	0.0	11.0	10.0
72	39.0	44.0	23.0	20.0
73	250.0	260.0	140.0	140.0
74	330.0	340.0	180.0	250.0
75	68.0	83.0	41.0	33.0
76	0.0	64.0	33.0	0.0
77	74.0	79.0	34.0	33.0
78	120.0	120.0	59.0	56.0
79	9.9	9.9	9.9	11.0
80	170.0	190.0	91.0	91.0
81	0.0	0.0	0.0	0.0
82	71.0	64.0	0.0	33.0
83	95.0	100.0	50.0	49.0
84	6.1	3.8	6.9	1.2
85	44.0	41.0	33.0	16.0
86	460.0	510.0	3000.0	3000.0
87	36.0	38.0	21.0	18.0
88	520.0	530.0	3000.0	750.0
89	480.0	530.0	500.0	29.0
90	810.0	720.0	3000.0	3000.0
91	690.0	650.0	3000.0	820.0
92	150.0	150.0	87.0	91.0
93	420.0	460.0	220.0	210.0
94	460.0	460.0	300.0	300.0
95	660.0	710.0	680.0	110.0
96	400.0	410.0	210.0	180.0
97	220.0	240.0	120.0	110.0
98	190.0	220.0	470.0	310.0

37. TO-100 Radiflo Repeatability Q Values (Sheet 2 of 2)

PACKAGE CERM RADIFLO Q VALUES
 RADIFLO REPEATABILITY EVALUATION
 ALL DATA X10-8 ATM-CC/SEC

UNIT NUM.	RUN 1	RUN 2	RUN 3	RUN 4
1	0.0	0.0	3000.0	500.0
2	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0
5	1.8	0.0	1.4	1.0
6	0.0	0.0	0.0	0.0
7	2.2	0.0	0.0	0.0
8	0.0	0.0	0.0	0.0
9	0.0	0.0	0.0	0.0
10	1.0	1.1	0.0	1.0
11	0.0	0.0	0.0	0.0
12	0.0	0.0	0.0	0.0
13	0.0	0.0	0.0	0.0
14	0.0	1.1	0.0	0.0
15	0.0	0.0	0.0	0.0
16	0.0	0.0	0.0	0.0
17	0.0	0.0	0.0	0.0
18	3000.0	3000.0	4.0	4.6
19	0.0	0.0	0.0	0.0
20	0.0	0.0	0.0	0.0
21	1.5	0.0	1.6	1.3
22	0.0	0.0	0.0	0.0
23	0.0	0.0	0.0	0.0
24	92.0	110.0	330.0	170.0
25	2.5	0.0	2.2	2.5
26	650.0	3000.0	33.0	22.0
27	470.0	500.0	520.0	3000.0
28	0.0	0.0	0.0	0.0
29	1.2	1.2	1.0	1.3
30	220.0	330.0	3000.0	3000.0
31	0.0	0.0	0.0	0.0
32	2.0	0.0	1.8	2.0
33	24.0	17.0	120.0	450.0
34	4.2	2.7	240.0	350.0
35	70.0	50.0	350.0	170.0
36	1.4	1.5	1.5	2.0
37	0.0	0.0	0.0	0.0
38	1.5	1.2	1.8	2.2
39	0.0	1.1	0.0	0.0
40	0.0	1.1	0.0	0.0
41	0.0	0.0	0.0	0.0
42	8.1	2.0	7.0	4.0
43	2.5	0.0	1.4	1.4
44	1.7	1.5	1.0	0.0
45	0.0	0.0	0.0	0.0
46	0.0	0.0	0.0	0.0
47	0.0	0.0	0.0	0.0
48	0.0	0.0	0.0	0.0
49	0.0	0.0	0.0	0.0
50	1.0	1.2	1.6	1.2

PACKAGE CERM - RADIFLO Q VALUES
 RADIFLO REPEATABILITY EVALUATION
 ALL DATA X10⁻⁶ ATN-CC/SEC

UNIT NUM.	RUN 1	RUN 2	RUN 3	RUN 4
51	1.7	1.2	0.0	1.9
52	0.0	0.0	0.0	0.0
53	0.0	0.0	0.0	0.0
54	0.0	0.0	0.0	0.0
55	2.4	0.0	1.3	1.3
56	0.0	0.0	0.0	0.0
57	0.0	0.0	3000.0	3000.0
58	1.2	1.2	0.0	0.0
59	1.4	0.0	0.0	1.0
60	1.0	0.0	0.0	1.4
61	0.0	0.0	0.0	0.0
62	1.0	0.0	0.0	0.0
63	1.4	1.5	0.0	1.0
64	0.0	0.0	0.0	0.0
65	0.0	0.0	0.0	0.0
66	0.0	0.0	0.0	0.0
67	0.0	0.0	0.0	0.0
68	0.0	0.0	0.0	0.0
69	0.0	0.0	0.0	0.0
70	0.0	0.0	0.0	0.0
71	0.0	0.0	0.0	0.0

38. Ceramic Radiflo Repeatability Q Values (Sheet 2 of 2)

PACKAGE TO-3 - RADIFLG. Q VALUES
 RADIFLO REPEATABILITY EVALUATION
 ALL DATA X10-8 ATM-CC/SEC

UNIT NUM.	RUN 1	RUN 2	RUN 3	RUN 4
1	3000.0	3000.0	3000.0	3000.0
2	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	7.0
4	3000.0	530.0	3000.0	470.0
5	330.0	340.0	500.0	430.0
6	1.7	8.3	0.0	10.0
7	4.2	5.9	4.2	4.5
8	3000.0	3000.0	3000.0	3000.0
9	0.0	0.0	0.0	0.0
10	3.5	5.0	5.7	4.3
11	0.0	0.0	0.0	0.0
12	1.0	7.5	1.0	8.2
13	0.0	0.0	0.0	0.0
14	3.0	1.0	1.0	1.0
15	6.8	5.9	5.8	9.3
16	3000.0	3000.0	3000.0	3000.0
17	3000.0	3000.0	630.0	3000.0
18	3000.0	3000.0	3000.0	3000.0
19	3000.0	3000.0	3000.0	3000.0
20	3000.0	3000.0	3000.0	3000.0
21	3000.0	3000.0	3000.0	3000.0
22	0.0	0.0	0.0	0.0
23	0.0	0.0	0.0	0.0
24	0.0	0.0	0.0	0.0
25	0.0	0.0	0.0	0.0
26	0.0	0.0	0.0	0.0
27	0.8	0.0	0.0	0.0
28	1.2	0.0	0.0	0.0
29	2.0	0.0	0.0	0.0
30	0.0	0.0	0.0	0.0
31	0.0	0.0	0.0	0.0
32	0.0	0.0	0.0	9.0
33	0.8	0.0	0.0	0.0
34	0.0	0.0	0.0	0.0
35	0.0	0.0	0.0	0.0
36	0.0	0.0	0.0	0.0
37	70.0	82.0	75.0	93.0
38	1.1	1.3	0.0	2.5
39	3000.0	3000.0	3000.0	3000.0
40	65.0	60.0	63.0	62.0
41	5.0	7.5	4.2	8.2
42	9.0	8.3	8.3	8.3
43	3000.0	3000.0	3000.0	3000.0
44	5.2	5.1	5.3	5.0
45	10.0	92.0	110.0	93.0
46	220.0	300.0	320.0	360.0
47	20.0	16.0	17.0	17.0
48	90.0	83.0	92.0	93.0
49	800.0	600.0	3000.0	720.0
50	3006.0	3000.0	3000.0	3000.0

PACKAGE TO 3 - RADIFLO Q VALUES
 RADIFLO REPEATABILITY EVALUATION
 ALL DATA X10-8 ATM-CC/SEC

UNIT NUM.	RUN 1	RUN 2	RUN 3	RUN 4
51	160.0	180.0	240.0	210.0
52	35.0	37.0	38.0	37.0
53	3000.0	3000.0	3000.0	3000.0
54	3000.0	3000.0	3000.0	3000.0
55	3000.0	3000.0	3000.0	3000.0
56	3000.0	3000.0	3000.0	3000.0
57	200.0	3000.0	320.0	3000.0
58	3000.0	3000.0	3000.0	3000.0
59	450.0	300.0	3000.0	3000.0
60	12.0	10.0	10.0	10.0
61	47.0	47.0	47.0	45.0
62	170.0	160.0	170.0	170.0
63	180.0	170.0	170.0	180.0
64	720.0	400.0	3000.0	3000.0
65	350.0	510.0	3000.0	550.0
66	240.0	220.0	370.0	270.0
67	120.0	130.0	150.0	130.0
68	320.0	270.0	300.0	290.0
69	300.0	230.0	470.0	370.0
70	500.0	570.0	3000.0	350.0
71	160.0	180.0	230.0	190.0
72	110.0	110.0	130.0	120.0
73	3000.0	3000.0	3000.0	3000.0
74	520.0	500.0	780.0	600.0
75	3000.0	3000.0	3000.0	3000.0
76	19.0	18.0	19.0	18.0
77	760.0	650.0	3000.0	740.0
78	470.0	250.0	480.0	380.0
79	3000.0	3000.0	3000.0	3000.0
80	3000.0	3000.0	3000.0	3000.0
81	3000.0	3000.0	3000.0	3000.0
82	3000.0	3000.0	3000.0	3000.0
83	3000.0	3000.0	3000.0	3000.0
84	280.0	130.0	240.0	140.0
85	380.0	330.0	370.0	370.0
86	3000.0	300.0	3000.0	3000.0
87	3000.0	300.0	3000.0	3000.0
88	3000.0	3000.0	3000.0	3000.0
89	420.0	350.0	740.0	470.0
90	1.7	6000.0	2.3	470.0
91	3.4	620.0	3.7	64.0
92	130.0	150.0	220.0	180.0
93	260.0	240.0	380.0	320.0
94	120.0	140.0	190.0	150.0
95	120.0	740.0	120.0	250.0
96	3000.0	650.0	3500.0	800.0
97	3000.0	3000.0	3000.0	3000.0
98	5.0	2.4	2.8	2.5
99	3000.0	3000.0	3000.0	3000.0
100	3000.0	3000.0	3000.0	3000.0

PACKAGE GLASS - RADIFLO Q VALUES
 RADIFLO REPEATABILITY EVALUATION
 ALL DATA X10-8 ATM-CC/SEC

UNIT NUM.	RUN 1	RUN 2	RUN 3	RUN 4
1	28.0	29.0	26.0	29.0
2	57.0	56.0	0.9	1.0
3	0.0	0.0	0.9	0.9
4	0.0	0.0	2.4	4.0
5	0.0	0.9	11.3	2.9
6	780.0	780.0	750.0	810.0
7	0.0	0.0	0.0	0.9
8	3000.0	3000.0	3000.0	3000.0
9	0.9	0.9	300.0	3.7
10	810.0	700.0	300.0	300.0
11	0.0	0.0	2.8	20.0
12	230.0	280.0	210.0	210.0
13	1.4	0.0	0.0	3.0
14	0.0	0.0	0.0	6.9
15	41.0	38.0	41.0	41.0
16	330.0	340.0	330.0	330.0
17	1.4	0.0	0.0	18.0
18	3000.0	3000.0	3000.0	3000.0
19	3000.0	3000.0	3000.0	3000.0
20	0.0	0.0	0.0	2.9
21	1.4	4.5	24.0	21.0
22	1.0	0.0	1.8	0.0
23	2.8	7.4	2.8	18.0
24	3000.0	3000.0	0.9	0.0
25	3000.0	3000.0	3000.0	3000.0
26	0.0	1.1	7.4	3.3
27	0.0	1.4	0.9	0.9
28	21.0	19.0	19.0	17.0
29	1.4	14.0	13.0	13.0
30	2.6	1.2	0.0	1.1
31	1.6	2.2	6.2	0.0
32	0.0	0.9	10.0	5.1
33	3000.0	3000.0	3000.0	3000.0
34	0.0	0.0	4.9	0.0
35	0.0	0.0	0.0	0.0
36	0.0	3.1	2.8	1.9
37	3000.0	4.1	1.0	19.0
38	0.0	7.4	0.0	1.1
39	0.0	0.9	1.4	1.1
40	0.0	0.9	10.0	10.0
41	11.0	81.0	81.0	81.0
42	19.0	41.0	110.0	41.0
43	0.0	0.0	3.6	23.0
44	8.2	19.0	67.0	62.0
45	0.9	7.3	7.8	2.8
46	0.9	1.2	9.9	6.8
47	0.9	0.0	14.0	28.0
48	0.0	0.0	1.2	0.0
49	0.0	0.0	6.4	43.0
50	0.0	0.0	6.4	43.0
51	1.2	2.0	5.4	3.9

40. Glass Standards Radiflo Repeatability Q Values

AVERAGE C-DIP - HELIUM R VALUES
 HELIUM TEMPERATURE CONDITION EVALUATION
 ALL DATA X10-9 ATM-CR/SFP

UNIT NUM.	50C MIN 1	75C MIN 2	100C MIN 3	125C MIN 4
1	1.5	1.7	0.2	0.1
2	0.4	0.4	0.2	0.5
3	0.2	0.4	0.2	0.5
4	0.2	0.9	0.0	1.0
5	1.7	2.1	0.6	0.4
6	2.0	0.5	0.3	0.4
7	0.7	1.0	0.4	0.8
8	1.1	2.4	0.5	0.3
9	5.7	3.9	2.7	0.5
10	0.4	1.1	0.2	0.5
11	4.5	4.8	3.5	4.5
12	11.0	10.0	7.2	10.0
13	3.0	7.2	6.9	10.0
14	3.0	1.4	0.6	0.4
15	0.6	0.5	0.6	0.3
16	1.2	3.5	5.0	3.0
17	0.4	1.9	0.2	0.1
18	0.7	0.8	0.2	0.4
19	3.5	1.9	0.3	0.4
20	5.2	1.9	1.0	2.0
21	1.3	4.0	0.4	0.4
22	0.7	2.5	0.3	0.3
23	0.7	3.0	0.6	1.6
24	1.8	0.6	0.2	0.3
25	3000.0	3000.0	3000.0	3000.0
26	1.2	0.7	0.3	1.0
27	290.0	250.0	1.1	0.8
28	1000.0	1.1	0.3	0.5
29	1.8	0.4	0.1	2.6
30	6.5	12.0	0.6	1.5
31	3000.0	270.0	120.0	230.0
32	1.2	1.9	0.2	0.2
33	1000.0	190.0	38.0	22.0
34	1.4	1.7	0.4	0.4
35	1.0	2.4	0.5	0.3
36	1.0	0.7	0.4	2.0
37	1.3	0.7	0.1	3.9
38	0.9	1.7	0.1	3.9
39	210.0	140.0	35.0	150.0
40	13.0	12.0	10.0	12.0
41	3000.0	3000.0	220.0	220.0
42	3000.0	3000.0	1.8	1.7
43	3000.0	3000.0	3000.0	3000.0
44	2.1	1.2	0.4	0.5
45	1.3	3.3	0.5	2.0
46	10.0	2.4	0.6	2.5
47	0.8	3000.0	3000.0	3000.0
48	3000.0	3000.0	3000.0	3000.0
49	0.9	3.2	0.1	0.1
50	0.5	3.9	0.5	1.0

41. C-DIP Helium R Values Temperature Conditions (Sheet 1 of 2)

PACKAGE GDIP - HELIUM R VALUES
 HELIUM TEMPERATURE CONDITION EVALUATION
 ALL DATA X10-8 ATM-CC/SEC

UNIT NO#.	50C RUN 1	75C RUN 2	100C RUN 3	125C RUN 4
51	1.6	3.5	4.5	2.4
52	120.0	0.7	0.7	0.6
53	0.8	0.6	1.3	0.3
54	0.1	0.3	1.0	0.1
55	0.4	3.0	0.1	0.1
56	0.2	0.7	0.5	1.3
57	0.6	0.4	1.3	2.0
58	3000.0	3000.0	3000.0	3000.0
59	150.0	1.8	0.7	3.0
60	3000.0	3000.0	3000.0	3000.0
61	3000.0	3000.0	3000.0	3000.0
62	0.3	2.2	0.2	0.1
63	1.0	0.6	0.1	2.9
64	3000.0	3000.0	3000.0	3000.0
65	0.5	0.6	0.7	0.2
66	1000.0	3000.0	3000.0	3000.0
67	1.1	1.3	1.2	1.4
68	3000.0	3000.0	3000.0	3000.0
69	3000.0	3000.0	3000.0	3000.0
70	3000.0	3000.0	3000.0	3000.0
71	4.8	1.0	0.0	0.1
72	1.0	0.5	0.4	2.0
73	0.9	6.2	1.2	0.3
74	1.0	10.0	0.7	1.3
75	1.4	0.4	0.3	0.4
76	0.5	1.5	0.1	0.3
77	3000.0	3000.0	3000.0	3000.0
78	0.8	0.7	0.4	0.3
79	3000.0	3000.0	3000.0	3000.0
80	0.3	1.5	0.2	1.1
81	3000.0	3000.0	3000.0	3000.0
82	3000.0	3000.0	3000.0	3000.0
83	3000.0	3000.0	3000.0	3000.0
84	5.0	3.5	0.5	2.5
85	1.1	2.1	0.5	0.5
86	3.0	1.4	0.1	0.3
87	1.2	0.5	0.2	0.5
88	0.4	0.6	1.3	0.6
89	1.3	1.1	0.2	0.2
90	1.5	3.8	0.5	1.4
91	1.7	1.8	1.0	1.0
92	10.0	2.0	0.3	1.0
93	4.8	5.2	0.8	110.0
94	14.0	22.0	140.0	250.0
95	1.1	0.7	0.4	4.0
96	3.5	3000.0	3000.0	62.0
97	3000.0	3000.0	3000.0	3000.0
98	3000.0	3000.0	3000.0	3000.0
99	5.8	2.5	12.0	1.2
100	150.0	270.0	3000.0	220.0

41. C-DIP Helium R Values Temperature Conditions (Sheet 2 of 2)

PACKAGE T0100 - HELIUM R VALUES
 HELIUM TEMPERATURE CONDITION EVALUATION
 ALL DATA X10⁻⁸ ATM-CC/SEC

UNIT NUM.	50C RUM 1	75C RUM 2	100C RUM 3	125C RUM 4
1	1.0	0.5	1.4	0.3
2	0.7	2.0	0.3	1.4
3	27.0	0.7	0.3	3.0
4	0.6	0.7	0.3	0.8
5	0.8	2.0	0.3	0.4
6	1.8	1.0	0.3	0.5
7	0.9	1.1	3.5	1.2
8	2.5	0.5	0.2	0.8
9	0.6	1.8	0.3	1.5
10	2.6	0.7	0.5	1.0
11	3.2	0.6	0.7	1.8
12	1.2	3.0	0.2	1.0
13	0.6	0.7	0.3	0.4
14	1.3	0.9	0.3	0.5
15	0.6	3.0	0.3	0.6
16	1.9	1.0	0.3	0.5
17	24.0	3000.0	3000.0	8.1
18	3.0	1.0	7.5	10.0
19	5.2	0.5	1.1	0.4
20	1.5	4.2	23.0	0.3
21	0.8	1.0	0.3	0.8
22	1.6	1.5	0.5	0.3
23	4.2	0.9	1.4	3.5
24	0.6	8.2	82.0	0.3
25	1.2	4.0	25.0	0.4
26	2.5	0.7	0.2	0.9
27	1.1	0.5	0.2	0.3
28	1.4	0.6	3.8	0.3
29	1.2	0.4	1.5	1.2
30	0.7	3.2	0.5	0.6
31	3000.0	3000.0	3000.0	6.5
32	1.4	0.7	2.8	7.2
33	0.7	0.5	1.9	1.3
34	3.5	0.5	50.0	11.0
35	0.7	0.6	0.8	3.2
36	2.0	0.6	250.0	75.0
37	5.0	80.0	15.0	5.5
38	80.0	3000.0	3000.0	3000.0
39	3000.0	3000.0	48.0	1.0
40	0.9	1.0	25.0	7.5
41	4.0	130.0	27.0	280.0
42	3.0	1.0	0.7	0.6
43	68.0	220.0	3000.0	0.6
44	3000.0	3000.0	3000.0	75.0
45	0.7	2.0	42.0	1.0
46	3000.0	3000.0	3000.0	3000.0
47	1.1	0.9	1.0	0.5
48	0.7	0.6	0.9	0.4
49	0.8	1.1	0.5	0.4
50	3000.0	3000.0	3000.0	3000.0

PACKAGE TO100 - HELIUM R VALUES
 HELIUM TEMPERATURE CONDITION EVALUATION
 ALL DATA X10⁻⁸ ATM-CC/SEC

UNIT NUM.	50C RUN 1	75C RUN 2	100C RUN 3	125C RUN 4
51	0.5	0.5	0.4	3.5
52	55.0	240.0	270.0	3000.0
53	0.7	82.0	75.0	0.4
54	55.0	120.0	170.0	280.0
55	3000.0	290.0	3000.0	3000.0
56	3000.0	3000.0	3000.0	3000.0
57	3000.0	0.5	0.4	12.0
58	0.6	0.5	0.4	0.4
59	0.6	1.5	0.6	0.3
60	53.0	3000.0	35.0	3.5
61	3000.0	3000.0	180.0	3000.0
62	1.0	1.2	0.6	0.4
63	1.5	3.0	32.0	3000.0
64	3000.0	3000.0	3000.0	4.2
65	45.0	3000.0	6.0	0.7
66	85.0	100.0	3000.0	3000.0
67	3000.0	3000.0	3000.0	3000.0
68	3090.0	3000.0	3000.0	3000.0
69	3000.0	3000.0	3000.0	3000.0
70	75.0	3000.0	3000.0	100.0
71	0.8	0.8	0.5	150.0
72	60.0	3000.0	62.0	32.0
73	3000.0	3000.0	3000.0	14.0
74	3000.0	3000.0	3000.0	3000.0
75	3030.0	3000.0	3000.0	3000.0
76	2.4	0.5	0.6	0.4
77	3000.0	3000.0	3000.0	3000.0
78	3000.0	3000.0	3000.0	3000.0
79	2.5	0.8	1.8	4.7
80	3000.0	5000.0	3000.0	100.0
81	24.0	1.0	3000.0	3000.0
82	3000.0	3000.0	3000.0	14.0
83	3000.0	3000.0	3000.0	3000.0
84	4.5	40.0	48.0	0.4
85	270.0	3000.0	3000.0	58.0
86	3090.0	3000.0	3000.0	3000.0
87	270.0	3000.0	3000.0	3000.0
88	3000.0	3000.0	3000.0	3000.0
89	3000.0	3000.0	3000.0	240.0
90	3000.0	3000.0	3000.0	3000.0
91	3000.0	3000.0	230.0	50.0
92	3000.0	3000.0	3000.0	3000.0
93	3000.0	3000.0	3000.0	3000.0
94	3000.0	3000.0	4.0	3000.0
95	0.6	3.0	0.4	1.0
96	3000.0	3000.0	3000.0	3000.0
97	3000.0	3000.0	3000.0	19.0
98	3000.0	180.0	3000.0	3000.0

42. TO-100 Helium R Values Temperature Conditions (Sheet 2 of 2)

PACKAGE CRIP - RADIFLO Q VALUES
 RADIFLO TEMPERATURE CONDITION EVALUATION
 ALL DATA X10-8 ATM-CC/SEC

UNIT NUM.	75C RUN 1	100C RUN 2	125C RUN 3	125CR RUN 4
1	0.0	0.0	0.0	0.3
2	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0
4	0.0	0.0	1.6	0.0
5	2.0	0.0	0.0	1.3
6	0.0	0.0	0.0	0.0
7	0.0	0.0	0.0	0.0
8	0.0	0.0	0.0	2.5
9	0.0	0.0	0.0	0.0
10	0.0	0.0	0.0	6.0
11	3.7	5.0	6.7	6.7
12	3.3	6.7	7.4	8.1
13	5.0	8.0	10.0	12.0
14	2.2	2.0	2.8	3.2
15	2.7	1.6	2.5	1.7
16	2.5	2.0	2.0	2.8
17	2.2	2.5	1.5	3.2
18	1.6	1.6	1.6	2.2
19	3.3	2.5	4.3	6.7
20	3.0	2.3	2.8	3.8
21	5.3	4.2	2.8	4.2
22	1.6	2.7	4.2	3.0
23	1.6	0.0	1.6	3.2
24	6.3	6.0	2.0	5.0
25	2.3	2.5	6.0	3.5
26	30.0	20.0	2.8	18.0
27	15.0	14.0	20.0	67.0
28	3.3	2.8	3.7	3.3
29	8.4	5.7	11.0	12.0
30	30.0	30.0	32.0	32.0
31	2.2	1.6	1.7	3.3
32	47.0	16.0	19.0	20.0
33	19.0	18.0	17.0	17.0
34	19.0	22.0	28.0	33.0
35	6.0	5.0	5.0	5.7
36	2.7	1.6	2.5	2.1
37	1.6	3.3	12.0	13.0
38	25.0	67.0	70.0	35.0
39	16.7	11.0	10.0	40.0
40	37.0	47.0	53.0	37.0
41	120.0	67.0	23.0	56.0
42	120.0	10.0	10.0	90.0
43	57.0	38.0	80.0	30.0
44	1.6	0.0	1.6	2.3
45	0.0	0.0	0.0	1.8
46	0.0	220.0	240.0	130.0
47	190.0	200.0	240.0	1.2
48	0.0	0.0	0.0	0.0
49	0.0	0.0	1.6	1.5
50	23.0	22.0	17.0	23.0

PACKAGE COIP - RADIFLO Q VALUES
 RADIFLO TEMPERATURE CONDITION EVALUATION
 ALL DATA X10-8 ATM-CC/SEC

UNIT NUM.	75C RUN 1	100C RUN 2	125C RUN 3	125CB RUN 4
51	0.0	0.0	4.0	3.2
52	0.0	0.0	0.0	0.0
53	0.0	0.0	0.0	0.0
54	0.0	0.0	0.0	0.0
55	0.0	0.0	0.0	0.0
56	0.0	0.0	2.5	1.3
57	290.0	250.0	200.0	180.0
58	0.0	0.0	0.0	0.0
59	370.0	370.0	350.0	270.0
60	150.0	140.0	130.0	130.0
61	0.0	0.0	0.0	0.0
62	1.6	0.0	2.5	1.7
63	140.0	160.0	100.0	42.0
64	0.0	0.0	1.6	1.3
65	220.0	230.0	200.0	97.0
66	0.0	0.0	1.6	1.3
67	780.0	620.0	700.0	530.0
68	120.0	130.0	180.0	120.0
69	630.0	970.0	850.0	670.0
70	0.0	0.0	0.0	0.0
71	0.0	0.0	0.0	1.3
72	6.7	6.0	4.7	6.3
73	0.0	0.0	1.6	1.2
74	0.0	0.0	0.0	1.3
75	0.0	0.0	0.0	0.0
76	580.0	600.0	630.0	320.0
77	2.2	0.0	0.0	1.5
78	810.0	470.0	420.0	370.0
79	0.0	0.0	1.6	1.3
80	570.0	500.0	520.0	430.0
81	320.0	430.0	330.0	23.0
82	130.0	130.0	130.0	92.0
83	0.0	2.0	1.6	2.2
84	0.0	0.0	0.0	0.0
85	2.5	0.0	0.0	0.0
86	3.4	0.0	0.0	0.0
87	1.6	0.0	0.0	0.0
88	1.6	0.0	0.0	1.7
89	2.2	6.0	2.0	1.7
90	5.0	2.0	12.0	2.8
91	0.0	0.0	0.0	1.7
92	8.2	0.7	6.0	3.8
93	20.0	16.0	37.0	5.0
94	0.0	0.0	0.0	0.0
95	160.0	200.0	130.0	400.0
96	250.0	240.0	200.0	170.0
97	660.0	760.0	680.0	500.0
98	3.7	5.0	2.0	4.0
99	15.0	20.0	30.0	22.0
100	1.6	0.0	0.0	0.0

PACKAGE TO100 - RADIO Q VALUES
 RADIFIELD TEMPERATURE CONDITION EVALUATION
 ALL DATA X10-9 ATM-CC/SEC

UNIT NUM.	25C RUN 1	75C RUN 2	100CB RUN 3	125CR RUN 4
1	1.7	0.0	0.0	1.8
2	2.5	0.0	0.0	0.0
3	1.7	0.0	1.5	0.0
4	0.0	0.0	0.0	1.5
5	2.1	0.0	1.5	1.5
6	4.6	0.0	1.7	0.0
7	1.7	1.0	2.0	0.0
8	2.3	0.0	1.3	1.7
9	0.0	1.0	0.0	1.5
10	0.0	0.0	0.0	0.0
11	0.0	0.0	0.0	0.0
12	3.3	0.0	1.7	0.0
13	1.5	0.0	6.7	80.0
14	0.0	0.0	1.7	0.0
15	9.2	0.0	3000.0	3000.0
16	3.2	0.0	3000.0	3000.0
17	6.3	1.0	3000.0	3000.0
18	9.2	0.0	28.0	27.0
19	2.0	1.0	15.0	15.0
20	1.6	0.0	570.0	3000.0
21	0.0	0.0	14.0	210.0
22	0.0	0.0	380.0	3000.0
23	0.0	0.0	55.0	1000.0
24	6.5	0.0	120.0	3000.0
25	3.8	0.0	730.0	3000.0
26	0.0	0.0	5.0	3000.0
27	14.0	13.0	13.0	18.0
28	1.1	0.0	20.0	1400.0
29	1.8	0.0	60.0	3000.0
30	0.0	2.0	270.0	3000.0
31	47.0	39.0	280.0	1400.0
32	1.9	0.0	30.0	30.0
33	2.3	0.0	630.0	3000.0
34	0.0	0.0	150.0	430.0
35	0.0	0.0	180.0	3000.0
36	0.0	0.0	83.0	3000.0
37	5.8	0.0	3000.0	3000.0
38	63.0	20.0	220.0	270.0
39	33.0	1200.0	920.0	3000.0
40	3.0	2.4	300.0	3000.0
41	27.0	6.6	1600.0	3000.0
42	3.2	0.0	2.5	2.0
43	45.0	13.0	1100.0	3000.0
44	75.0	46.0	120.0	1200.0
45	4.5	0.0	6.7	3.7
46	350.0	200.0	130.0	410.0
47	100.0	0.0	700.0	3500.0
48	0.0	0.0	430.0	1200.0
49	1.7	0.0	25.0	25.0
50	77.0	50.0	260.0	560.0

PACKAGE TO100 - RADIFLO Q VALUES
 RADIFLO TEMPERATURE CONDITION EVALUATION
 ALL DATA X10-8 ATM-CC/SEC

UNIT NUM.	25C RUN 1	75C RUN 2	100CB RUN 3	125CB RUN 4
51	0.0	0.0	200.0	220.0
52	33.0	10.8	42.0	150.0
53	7.4	3.4	630.0	3000.0
54	25.0	20.0	190.0	300.0
55	220.0	34.0	3000.0	3000.0
56	140.0	70.0	440.0	830.0
57	73.3	62.0	110.0	3000.0
58	1.7	0.3	22.0	25.0
59	6.7	0.0	0.0	0.0
60	630.0	20.0	3000.0	3000.0
61	170.0	34.0	3000.0	3000.0
62	2.0	0.0	3000.0	3000.0
63	2.0	0.0	8.3	7.7
64	0.0	0.0	76.0	220.0
65	120.0	15.0	1400.0	1500.0
66	28.0	6.0	45.0	38.0
67	170.0	120.0	770.0	3000.0
68	350.0	260.0	150.0	200.0
69	380.0	84.0	1300.0	3000.0
70	75.0	15.0	470.0	1500.0
71	35.0	0.0	63.0	63.0
72	17.0	15.0	550.0	3000.0
73	430.0	300.0	1500.0	3000.0
74	120.0	440.0	57.0	2.5
75	140.0	160.0	800.0	3000.0
76	0.0	3.0	3000.0	3000.0
77	150.0	74.0	280.0	1600.0
78	210.0	120.0	300.0	730.0
79	20.0	20.0	20.0	20.0
80	420.0	260.0	3000.0	3000.0
81	0.0	3.0	40.0	37.0
82	120.0	66.0	290.0	1200.0
83	170.0	130.0	470.0	3000.0
84	12.0	3.4	350.0	3000.0
85	77.0	60.0	200.0	1400.0
86	3000.0	3000.0	1700.0	3000.0
87	58.0	210.0	630.0	3000.0
88	3000.0	3000.0	1500.0	3000.0
89	3000.0	140.0	1100.0	1500.0
90	3000.0	3000.0	3000.0	3000.0
91	3000.0	3000.0	3000.0	3000.0
92	353.0	220.0	3000.0	3000.0
93	920.0	730.0	1300.0	3000.0
94	1200.0	740.0	3000.0	3000.0
95	3000.0	180.0	3000.0	3000.0
96	770.0	460.0	530.0	3000.0
97	380.0	270.0	820.0	3000.0
98	1300.0	1400.0	980.0	1100.0

HELIUM GETTER EVALUATION
ALL DATA X10-8 ATM-CC/SEC

UNIT NUM.	T084 FC48 RUN 1	CPAK FC48 RUN 2	CPAK POLY RUN 3	MDS PP9 RUN 4
1	0.1	0.3	0.1	1.0
2	0.0	0.6	0.2	0.5
3	0.0	0.6	0.5	0.9
4	0.0	1.4	0.4	0.5
5	0.0	1.0	0.2	1.7
6	0.0	1.2	0.1	0.9
7	0.0	0.6	0.4	0.4
8	0.0	2.5	0.4	0.4
9	0.0	0.3	0.1	2.4
10	0.0	1.4	0.5	0.1
11	0.4	0.4	1.5	0.3
12	0.0	1.5	2.4	0.9
13	0.1	1.1	0.4	0.0
14	0.0	1.1	0.0	0.3
15	0.1	0.7	0.3	0.2
16	3000.0	1.1	0.4	0.1
17	0.0	0.2	3.5	0.1
18	0.0	0.6	0.1	0.4
19	0.0	1.8	0.3	0.2
20	0.0	1.3	0.2	0.2
21	0.0	0.9	0.2	0.4
22	0.1	1.0	0.6	0.6
23	0.1	1.2	2.2	0.1
24	0.1	4.0	10.0	0.1
25	0.1	1.2	10.0	0.5
26	0.0	0.7	0.3	0.3
27	0.0	0.7	250.0	0.8
28	0.1	1.3	1.0	0.6
29	0.1	0.8	45.0	0.0
30	0.0	1.3	0.3	2.5
31	42.0	1.0	300.0	0.0
32	0.1	1.6	35.0	0.1
33	0.2	0.2	0.3	0.1
34	0.1	1.3	0.5	0.6
35	0.1	0.3	4.0	0.6
36	0.0	0.2	280.0	0.8
37	0.0	0.2	420.0	0.4
38	0.0	1.1	32.0	0.1
39	0.0	0.5	23.0	0.2
40	0.0	1.6	190.0	0.1
41	0.0	0.5	0.3	0.5
42	0.0	0.7	350.0	0.2
43	0.0	1.7	0.4	0.4
44	0.0	0.5	240.0	0.6
45	0.0	2.3	1400.0	0.7
46	0.0	0.7	900.0	0.2
47	0.0	0.5	52.0	0.5
48	0.0	1.2	700.0	0.1
49	0.0	0.1	40.0	1.1
50	0.0	0.3	55.0	0.2

45. Helium Getter Evaluation (Sheet 1 of 2)

HELIUM GETTER EVALUATION
ALL DATA X10-8 ATM-CC/SEC

UNIT NUM.	FC48 RUN 1	FC48 RUN 2	POLY RUN 3	PP9 RUN 4
51	0.0	0.3	45.0	0.0
52	0.0	0.3	230.0	0.0
53	0.0	0.1	500.0	0.0
54	0.0	0.3	1000.0	0.1
55	0.5	0.6	800.0	0.0
56	0.1	0.6	350.0	0.0
57	0.0	0.2	12.0	0.1
58	0.0	0.8	100.0	0.1
59	1.2	0.5	0.2	0.0
60	0.1	0.9	450.0	0.0
61	0.1	0.9	270.0	0.2
62	95.0	0.3	2200.0	0.0
63	0.1	1.4	2000.0	0.4
64	0.1	1.4	0.7	0.1
65	5.5	1.0	3.5	0.2
66	0.2	0.3	0.5	0.0
67	0.3	0.7	0.1	0.0
68	0.2	1.5	0.4	0.0
69	0.7	0.2	0.5	0.0
70	0.0	0.2	0.4	0.0
71	0.5	0.9	0.4	0.2
72	0.1	0.8	0.4	0.2
73	0.2	0.4	1.0	0.4
74	2.0	1.6	0.5	0.3
75	0.6	0.2	0.5	0.1
76	39.0	0.7	2.6	0.1
77	0.4	0.5	0.5	0.1
78	0.2	0.6	0.1	0.0
79	0.3	0.6	2.5	0.2
80	0.1	0.4	0.1	35.0
81	0.0	0.3	0.5	0.2
82	0.2	1.5	0.4	1.1
83	52.0	0.2	0.5	0.4
84	0.2	0.3	0.2	0.0
85	0.2	1.6	1.0	0.1
86	2.3	0.5	0.2	0.2
87	0.2	0.3	0.7	0.1
88	0.1	1.3	0.4	0.7
89	0.2	0.9	0.6	0.1
90	3000.0	0.4	0.5	0.1
91	1.6	0.8	0.2	0.0
92	25.0	1.2	7.5	0.0
93	0.6	0.6	0.5	3.0
94	0.1	0.4	0.2	2.6
95	2.6	0.6	0.4	0.5
96	0.2	0.2	0.1	7.2
97	0.2	0.2	0.1	1.7
98	0.1	0.3	0.1	0.6
99	0.0	0.3	0.4	7.5
100	0.0	0.6	0.0	3.0

RADIFLO GETTER EVALUATION
ALL DATA X10-8 AT4-CC/SEC

UNIT NUM.	T084 FC48 RUN		CPAK FC48 RUN		CPAK POLY RUN		MDS PP9 RUN	
	1	2	2	3	3	4		
1	2.0	20.0	0.0	0.0	0.0	0.0		
2	2.0	100.0	0.0	0.0	0.0	0.0		
3	7.0	0.0	0.4	1.0	1.0	1.0		
4	4.0	100.0	1.0	3.0	3.0	3.0		
5	0.0	300.0	0.1	0.0	0.0	0.0		
6	8.0	300.0	0.0	0.0	0.0	0.0		
7	4.0	500.0	0.2	0.0	0.0	0.0		
8	5.0	400.0	0.0	0.0	0.0	0.0		
9	5.0	100.0	0.0	0.0	0.0	0.0		
10	10.0	500.0	0.0	0.0	0.0	0.0		
11	40.0	400.0	0.0	0.0	0.0	0.0		
12	10.0	500.0	0.5	2.0	2.0	2.0		
13	0.0	200.0	1.9	4.0	4.0	4.0		
14	2.0	400.0	0.4	1.0	1.0	1.0		
15	2.0	0.0	1.6	3.0	3.0	3.0		
16	20.0	10.0	1.7	3.0	3.0	3.0		
17	20.0	300.0	1.0	3.0	3.0	3.0		
18	70.0	0.0	1.0	3.0	3.0	3.0		
19	60.0	0.0	0.6	1.0	1.0	1.0		
20	50.0	700.0	0.8	6.0	6.0	6.0		
21	40.0	100.0	1.9	3.0	3.0	3.0		
22	200.0	700.0	1.6	10.0	10.0	10.0		
23	0.0	600.0	0.7	6.0	6.0	6.0		
24	0.0	200.0	0.0	2.0	2.0	2.0		
25	0.0	0.0	0.3	3.0	3.0	3.0		
26	30.0	500.0	1.4	1.0	1.0	1.0		
27	0.0	600.0	1.3	5.0	5.0	5.0		
28	100.0	0.0	5.4	1.0	1.0	1.0		
29	4.0	600.0	2.0	2.0	2.0	2.0		
30	0.0	10.0	22.0	100.0	100.0	100.0		
31	6.0	20.0	0.4	1.0	1.0	1.0		
32	60.0	600.0	86.0	6.0	6.0	6.0		
33	0.0	300.0	45.0	0.0	0.0	0.0		
34	20.0	300.0	31.0	0.0	0.0	0.0		
35	6.0	300.0	1.4	0.0	0.0	0.0		
36	200.0	2.0	1.8	1.0	1.0	1.0		
37	50.0	0.0	51.0	1.0	1.0	1.0		
38	50.0	0.0	40.0	1.0	1.0	1.0		
39	100.0	0.0	25.0	4.0	4.0	4.0		
40	0.0	300.0	22.0	0.0	0.0	0.0		
41	0.0	600.0	40.0	6.0	6.0	6.0		
42	0.0	200.0	0.4	2.0	2.0	2.0		
43	100.0	400.0	37.0	9.0	9.0	9.0		
44	0.0	400.0	11.0	0.0	0.0	0.0		
45	0.0	7.0	150.0	0.0	0.0	0.0		
46	0.0	100.0	90.0	10.0	10.0	10.0		
47	200.0	400.0	130.0	270.0	270.0	270.0		
48	0.0	600.0	120.0	0.0	0.0	0.0		
49	0.0	400.0	120.0	0.0	0.0	0.0		
50	9.0	0.0	130.0	500.0	500.0	500.0		

RADIFLO GETTER EVALUATION
ALL DATA X10-8 ATM-CC/SEC

UNIT NUM.	T094 FC-38		CPAK FC48		CPAK POLY		MOS PP9	
	1 RUN	2 RUN	3 RUN	4 RUN	5 RUN	6 RUN	7 RUN	8 RUN
51	1.0	8.0	95.0	0.0	0.0	0.0	0.0	0.0
52	0.0	0.0	51.0	0.0	0.0	0.0	0.0	0.0
53	0.0	0.0	130.0	1.0	0.0	0.0	0.0	0.0
54	0.0	0.0	140.0	7.5	0.0	0.0	0.0	0.0
55	0.0	0.0	95.0	1.0	0.0	0.0	0.0	0.0
56	0.0	0.0	98.0	300.0	0.0	0.0	0.0	0.0
57	0.0	4.0	66.0	20.0	0.0	0.0	0.0	0.0
58	0.0	0.0	110.0	50.0	0.0	0.0	0.0	0.0
59	4.0	300.0	120.0	0.0	0.0	0.0	0.0	0.0
60	0.0	3.0	120.0	100.0	0.0	0.0	0.0	0.0
61	0.0	20.0	150.0	0.0	0.0	0.0	0.0	0.0
62	60.0	20.0	120.0	0.0	0.0	0.0	0.0	0.0
63	7.0	500.0	150.0	7.0	0.0	0.0	0.0	0.0
64	7.0	40.0	150.0	0.0	0.0	0.0	0.0	0.0
65	200.0	500.0	110.0	0.0	0.0	0.0	0.0	0.0
66	0.0	30.0	0.5	0.0	0.0	0.0	0.0	0.0
67	0.0	0.0	7.6	0.0	0.0	0.0	0.0	0.0
68	300.0	10.0	0.7	2.0	0.0	0.0	0.0	0.0
69	0.0	600.0	1.7	0.0	0.0	0.0	0.0	0.0
70	0.0	600.0	1.3	0.0	0.0	0.0	0.0	0.0
71	100.0	1.0	0.0	7.5	0.0	0.0	0.0	0.0
72	0.0	6.0	1.2	0.0	0.0	0.0	0.0	0.0
73	0.0	1.0	0.6	0.0	0.0	0.0	0.0	0.0
74	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0
75	0.0	0.0	0.7	5.0	0.0	0.0	0.0	0.0
76	0.0	0.0	0.5	650.0	0.0	0.0	0.0	0.0
77	0.0	0.0	0.7	100.0	0.0	0.0	0.0	0.0
78	0.0	300.0	0.7	0.0	0.0	0.0	0.0	0.0
79	0.0	1.0	0.0	1000.0	0.0	0.0	0.0	0.0
80	0.0	5.0	1.3	5.0	0.0	0.0	0.0	0.0
81	9.0	0.0	1.5	90.0	0.0	0.0	0.0	0.0
82	0.0	500.0	0.7	8.0	0.0	0.0	0.0	0.0
83	200.0	0.0	1.2	600.0	0.0	0.0	0.0	0.0
84	0.0	500.0	0.5	1000.0	0.0	0.0	0.0	0.0
85	0.0	300.0	0.6	1000.0	0.0	0.0	0.0	0.0
86	60.0	40.0	0.4	600.0	0.0	0.0	0.0	0.0
87	0.0	10.0	0.1	0.0	0.0	0.0	0.0	0.0
88	400.0	4.0	0.4	600.0	0.0	0.0	0.0	0.0
89	0.0	20.0	0.6	1000.0	0.0	0.0	0.0	0.0
90	0.0	2.0	1.2	350.0	0.0	0.0	0.0	0.0
91	9.0	4.0	0.4	1000.0	0.0	0.0	0.0	0.0
92	0.0	0.0	0.0	900.0	0.0	0.0	0.0	0.0
93	100.0	0.0	0.7	1000.0	0.0	0.0	0.0	0.0
94	0.0	400.0	0.4	10.0	0.0	0.0	0.0	0.0
95	10.0	0.0	1.3	90.0	0.0	0.0	0.0	0.0
96	9.0	0.0	0.7	1.0	0.0	0.0	0.0	0.0
97	0.0	200.0	0.4	32.0	0.0	0.0	0.0	0.0
98	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
99	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.0
100	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0

Surface Absorption Helium Data
All Data X 10⁻⁸ Atm cc/sec

Device Type and Number	Time to Read After Conditioning (Minutes)				
	1-5	30-35	60-65	90-95	120-125
C-DIP Lids (Sealant)					
1	3.0	0.4	0.2	0.05	0
2	2.5	0.3	0.1	0.05	0
3	2.6	0.3	0.1	0.05	0
4	2.0	0.2	0.1	0.05	0
5	1.9	0.2	0.1	0.05	0
Ceramic Lids (Sealant)					
20 A	190.0	120.0	62.0	45.0	25.0
21 A	130.0	38.0	16.0	7.0	3.0
22 A	210.0	89.0	45.0	20.0	10.0
23 D	28.0	3.2	2.0	2.0	1.5
24 D	35.0	6.2	3.5	2.5	1.5
25 D	17.0	4.0	2.7	2.1	1.0
C-DIP Lids					
1	2.8	0.3	0.2	0.05	0
2	2.0	0.3	0.1	0.05	0
3	1.8	0.3	0.1	0.05	0
4	1.6	0.3	0.1	0.05	0
5	1.2	0.3	0.3	0.05	0
Ceramic Lids					
1	8.0	2.4	2.2	1.5	0.8
2	5.0	2.3	2.1	1.4	0.6
3	3.2	2.7	2.0	1.4	0.6
4	1.3	1.2	1.2	1.0	0.5
5	5.5	2.4	2.1	1.4	0.5
Sealant Strips					
1 D	30.0	5.0	4.0	2.0	1.0
2 D	18.0	4.5	3.0	1.0	0.5
3 D	17.0	3.5	3.0	1.0	0.5
4 A	50.0	7.0	5.0	2.0	1.2
5 A	65.0	6.0	4.5	2.0	1.3
6 A	17.0	3.0	2.5	1.0	0.6

47. Surface Absorption Helium

Surface Absorption Radioisotope Data
 All Data X10-8 Atm cc/sec

Device Type and Number	Time to Read After Conditioning (Minutes)				
	1-5	30-35	60-65	90-95	120-125
C-DIP Lids (Sealant)					
1	7.8	7.0	5.8	5.5	5.1
2	2.0	1.3	0.6	0.3	0.1
3	2.5	2.1	2.0	1.8	1.6
4	1.1	1.0	0.8	0.5	0.2
5	0	0	0	0	0
Ceramic Lids (Sealant)					
20 A	40.0	20.0	10.0	4.0	2.0
21 A	40.0	19.0	9.0	3.0	1.0
22 A	39.0	19.0	9.0	3.0	1.0
23 D	38.0	18.0	9.0	3.0	1.4
24 D	40.0	20.0	9.0	2.5	1.0
25 D	41.0	20.0	9.0	3.0	1.2
C-DIP Lids					
1	0				
2	0				
3	0				
4	0				
5	0				
Ceramic Lids					
1	0				
2	0				
3	0				
4	0				
5	0				

48. Surface Absorption Radio

HELIUM CONTROLLED ORIFICE EVALUATION
ALL DATA X10-8 ATM-CC/SEC

UNIT NUM.	T084 50/2	T084 60/4	T084 60/4	T0130 60/1	T03 60/1
1	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	1.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0
7	0.0	0.0	0.0	0.0	0.0
8	0.0	0.0	1.0	0.0	0.0
9	0.0	0.0	0.0	0.0	0.0
10	0.0	0.0	0.0	0.0	0.0
11	1.0	0.0	0.0	0.0	0.0
12	0.0	0.0	1.0	0.0	0.0
13	0.0	0.0	0.0	0.0	0.0
14	0.0	0.0	1.0	0.0	0.0
15	0.0	0.0	0.0	0.0	0.0
16	1.0	3.0	1.0	0.0	0.0
17	0.0	0.0	0.0	0.0	0.0
18	0.0	0.0	1.0	0.0	0.0
19	0.0	0.0	0.0	0.0	0.0
20	0.0	0.0	0.0	0.0	0.0
21	0.0	0.0	0.0	0.0	0.0
22	0.0	0.0	0.0	0.0	0.0
23	0.0	0.0	0.0	0.0	0.0
24	0.0	0.0	0.0	0.0	0.0
25	1.0	2.5	0.0	0.0	0.0
26	0.0	0.0	0.0	0.0	0.0
27	0.0	0.0	0.0	0.0	0.0
28	0.0	0.0	0.0	0.0	0.0
29	0.0	0.0	0.0	0.0	0.0
30	0.0	0.0	0.0	0.0	0.0
31	0.0	1.5	1.0	0.0	0.0
32	0.0	0.0	0.0	0.0	0.0
33	0.0	0.0	0.0	0.0	0.0
34	0.0	0.0	0.0	0.0	0.0
35	0.0	0.0	1.0	0.0	0.0
36	0.0	0.0	0.0	0.0	0.0
37	0.0	0.0	0.0	0.0	0.0
38	0.0	0.0	0.0	0.0	0.0
39	0.0	0.0	1.0	0.0	0.0
40	0.0	0.0	0.0	0.0	0.0
41	0.0	0.0	0.0	0.0	0.0
42	0.0	0.0	0.0	0.0	0.0
43	0.0	0.0	0.0	0.0	0.0
44	0.0	0.0	0.0	0.0	0.0
45	0.0	0.0	0.0	0.0	0.0
46	0.0	0.0	1.0	0.0	0.0
47	0.0	0.0	0.0	0.0	0.0
48	0.0	0.0	0.0	0.0	0.0
49	0.0	0.0	0.0	0.0	0.0
50	0.0	0.0	1.0	0.0	0.0

49. Helium Controlled Orifice (Sheet 1 of 2)

HELIUM CONTROLLED ORIFICE EVALUATION
ALL DATA X10-8 ATM-CC/SEC

UNIT NUM.	T084 60/2	T084 60/4	T084 60/4	T0130 60/1	T03 60/1
51	0.0	0.0	0.0	3.0	0.0
52	1.0	0.0	1.0	3.0	0.0
53	0.0	3.0	0.0	3.0	2.0
54	0.0	0.0	0.0	2.0	1.0
55	0.0	0.0	0.0	0.0	1.0
56	0.0	0.0	2.0	3.0	1.0
57	1.0	0.0	1.0	2.0	5.0
58	0.0	0.0	0.0	2.0	8.0
59	0.0	0.0	0.0	3.0	14.0
60	0.0	0.0	2.0	3.0	0.0
61	0.0	0.0	0.0	0.0	0.0
62	1.0	0.0	0.0	3.0	0.0
63	0.0	0.0	0.0	3.0	0.0
64	0.0	0.0	2.0	5.0	1.0
65	0.0	0.0	3.0	3.0	1.0
66	0.0	0.0	0.0	10.0	0.0
67	0.0	0.0	0.0	3.0	0.0
68	2.0	4.0	3.0	9.0	0.0
69	0.0	0.0	0.0	5.0	0.0
70	0.0	0.0	0.0	2.0	0.0
71	2.0	21.0	10.0	3.0	0.0
72	0.0	0.0	0.0	3.0	0.0
73	0.0	0.0	1.0	3.0	1.0
74	0.0	0.0	1.0	10.0	0.0
75	2.0	45.0	10.0	15.0	1.0
76	1.0	0.0	1.0	4.0	0.0
77	0.0	0.0	0.0	5.0	0.0
78	0.0	0.0	0.0	3.0	1.0
79	0.0	0.0	1.0	6.0	0.0
80	0.0	0.0	0.0	3.0	37.0
81	1.0	0.0	2.0	3.0	1.0
82	1.0	3.0	0.0	0.0	9.0
83	2.0	45.0	7.0	5.0	0.0
84	0.0	0.0	1.0	5.0	0.0
85	0.0	0.0	0.0	0.0	0.0
86	2.0	30.0	13.0	13.0	0.0
87	1.0	0.0	0.0	0.0	0.0
88	0.0	6.0	10.0	50.0	1.0
89	0.0	0.0	0.0	5.0	11.4
90	0.0	0.0	0.0	15.0	0.0
91	2.0	20.0	8.0	50.0	0.0
92	2.0	22.0	11.0	4.0	0.0
93	4.0	30.0	7.0	12.0	0.0
94	0.0	21.0	0.0	25.0	0.0
95	2.0	3.0	15.0	0.0	0.0
96	1.0	0.0	1.0	10.0	1.0
97	0.0	0.0	0.0	3.5	3.0
98	1.0	22.0	7.0	103.0	0.0
99	0.0	0.0	0.0	3.0	9.0
100	0.0	0.0	0.0	3.0	0.0

49. Helium Controlled Orifice (Sheet 2 of 2)

WEIGHT GAIN DATA TO 84
 PACKAGE TYPE :

COLUMN HEADING = BOMB PRESSURE / INDICATOR FLUID
 WEIGHT RECORDED IN GRAMS

UNIT NUMBER	60/PP1 WT GAIN	60/PP2 WT GAIN	60/FC77 WT GAIN	60/FC78 WT GAIN	30/FC78 WT GAIN	90/FC78 WT GAIN	105/FC78 WT GAIN
1	0.0089	0.0173	0.0046	0.0067	0.0092	0.0194	0.0126
2	0.0	0.0	0.0	0.0002	0.0001	0.0	0.0003
3	0.0	0.0001	0.0	0.0	0.0	0.0003	0.0002
4	0.0	0.0	0.0	0.0001	0.0002	0.0	0.0006
5	0.0	0.0	0.0	0.0004	0.0	0.0	0.0001
6	0.0001	0.0001	0.0	0.0	0.0001	0.0	0.0004
7	0.0	0.0	0.0	0.0001	0.0001	0.0	0.0002
8	0.0001	0.0	0.0	0.0002	0.0001	0.0	0.0003
9	0.0001	0.0	0.0	0.0	0.0002	0.0	0.0006
10	0.0001	0.0	0.0001	0.0	0.0002	0.0	0.0006
11	0.0150	0.0162	0.0102	0.0153	0.0095	0.0152	0.0168
12	0.0	0.0	0.0005	0.0	0.0	0.0	0.0005
13	0.0	0.0	0.0	0.0	0.0002	0.0	0.0001
14	0.0001	0.0001	0.0	0.0008	0.0002	0.0005	0.0
15	0.0	0.0003	0.0002	0.0003	0.0002	0.0	0.0004
16	0.0119	0.0169	0.0065	0.0083	0.0063	0.0158	0.0170
17	0.0	0.0	0.0	0.0	0.0	0.0	0.0005
18	0.0001	0.0	0.0	0.0	0.0002	0.0002	0.0
19	0.0	0.0	0.0	0.0	0.0	0.0	0.0001
20	0.0	0.0001	0.0001	0.0	0.0001	0.0002	0.0007
21	0.0002	0.0	0.0	0.0	0.0001	0.0002	0.0005
22	0.0008	0.0015	0.0003	0.0005	0.0003	0.0008	0.0013
23	0.0006	0.0011	0.0004	0.0005	0.0006	0.0008	0.0018
24	0.0002	0.0005	0.0001	0.0	0.0002	0.0002	0.0010
25	0.0136	0.0218	0.0075	0.0012	0.0207	0.0201	0.0194
26	0.0	0.0	0.0	0.0	0.0	0.0	0.0002
27	0.0003	0.0	0.0004	0.0	0.0001	0.0	0.0012
28	0.0001	0.0	0.0001	0.0004	0.0	0.0	0.0
29	0.0004	0.0011	0.0003	0.0005	0.0006	0.0	0.0011
30	0.0022	0.0075	0.0013	0.0	0.0026	0.0083	0.0027
31	0.0188	0.0203	0.0197	0.0191	0.0194	0.0190	0.0189
32	0.0009	0.0021	0.0005	0.0005	0.0008	0.0023	0.0015
33	0.0001	0.0001	0.0	0.0	0.0	0.0002	0.0
34	0.0004	0.0001	0.0	0.0	0.0005	0.0009	0.0013
35	0.0003	0.0001	0.0001	0.0	0.0002	0.0007	0.0002
36	0.0004	0.0007	0.0001	0.0	0.0004	0.0006	0.0011
37	0.0	0.0	0.0	0.0	0.0001	0.0	0.0002
38	0.0	0.0005	0.0	0.0	0.0	0.0	0.0
39	0.0	0.0	0.0	0.0	0.0003	0.0007	0.0004
40	0.0	0.0	0.0	0.0002	0.0	0.0	0.0001
41	0.0	0.0	0.0	0.0002	0.0	0.0	0.0
42	0.0	0.0001	0.0	0.0	0.0002	0.0	0.0001
43	0.0	0.0	0.0	0.0001	0.0002	0.0	0.0
44	0.0	0.0	0.0	0.0001	0.0	0.0	0.0
45	0.0001	0.0	0.0011	0.0003	0.0	0.0	0.0
46	0.0	0.0	0.0	0.0	0.0	0.0	0.0002
47	0.0	0.0003	0.0003	0.0096	0.0	0.0006	0.0087
48	0.0	0.0	0.0	0.0003	0.0	0.0	0.0
49	0.0	0.0	0.0	0.0002	0.0	0.0	0.0
50	0.0005	0.0013	0.0003	0.0010	0.0004	0.0009	0.0012

WEIGHT GAIN DATA
PACKAGE TYPE : TO 84

COLUMN HEADING = RL78 PRESSURE / INDICATOR FLUID
WEIGHT RECORDED IN GRAMS

UNIT NUMBER	60/PP1 WT GAIN	60/PP2 WT GAIN	60/FC77 WT GAIN	60/FC78 WT GAIN	30/FC78 WT GAIN	90/FC78 WT GAIN	105/FC78 WT GAIN
51	0.0002	0.0004	0.0002	0.0003	0.0	0.0	0.0
52	0.0	0.0	0.0	0.0001	0.0	0.0	0.0
53	0.0	0.0001	0.0	0.0	0.0	0.0	0.0005
54	0.0001	0.0003	0.0022	0.0005	0.0003	0.0	0.0004
55	0.0002	0.0007	0.0005	0.0005	0.0004	0.0	0.0
56	0.0	0.0003	0.0002	0.0002	0.0	0.0	0.0003
57	0.0	0.0004	0.0	0.0001	0.0	0.0	0.0002
58	0.0	0.0003	0.0	0.0001	0.0	0.0002	0.0
59	0.0005	0.0009	0.0048	0.0007	0.0004	0.0004	0.0007
60	0.0003	0.0010	0.0004	0.0007	0.0	0.0008	0.0
61	0.0001	0.0007	0.0002	0.0004	0.0001	0.0007	0.0007
62	0.0	0.0001	0.0001	0.0013	0.0	0.0008	0.0020
63	0.0009	0.0019	0.0007	0.0011	0.0007	0.0008	0.0008
64	0.0123	0.0003	0.0001	0.0003	0.0	0.0	0.0008
65	0.0094	0.0105	0.0099	0.0098	0.0095	0.0062	0.0044
66	0.0001	0.0	0.0	0.0001	0.0	0.0302	0.0001
67	0.0070	0.0093	0.0096	0.0088	0.0052	0.0035	0.0062
68	0.0104	0.0117	0.0112	0.0111	0.0105	0.0109	0.0076
69	0.0064	0.0064	0.0063	0.0065	0.0046	0.0016	0.0001
70	0.0	0.0	0.0	0.0	0.0	0.0	0.0001
71	0.0104	0.0119	0.0112	0.0109	0.0	0.0107	0.0001
72	0.0155	0.0168	0.0166	0.0161	0.0145	0.0143	0.0047
73	0.0147	0.0170	0.0166	0.0144	0.0154	0.0148	0.0047
74	0.0152	0.0158	0.0162	0.0159	0.0142	0.0143	0.0113
75	0.0191	0.0205	0.0202	0.0196	0.0193	0.0193	0.0048
76	0.0151	0.0111	0.0160	0.0154	0.0150	0.0152	0.0044
77	0.0157	0.0171	0.0177	0.0174	0.0151	0.0151	0.0077
78	0.0157	0.0167	0.0163	0.0159	0.0149	0.0149	0.0074
79	0.0159	0.0167	0.0173	0.0162	0.0161	0.0144	0.0081
80	0.0147	0.0154	0.0158	0.0148	0.0140	0.0146	0.0078
81	0.0183	0.0193	0.0188	0.0179	0.0185	0.0186	0.0078
82	0.0150	0.0156	0.0161	0.0155	0.0142	0.0133	0.0082
83	0.0186	0.0202	0.0195	0.0194	0.0192	0.0192	0.0074
84	0.0029	0.0163	0.0159	0.0152	0.0150	0.0135	0.0074
85	0.0150	0.0164	0.0169	0.0156	0.0150	0.0100	0.0123
86	0.0147	0.0161	0.0158	0.0156	0.0151	0.0149	0.0004
87	0.0097	0.0109	0.0106	0.0102	0.0101	0.0146	0.0099
88	0.0103	0.0113	0.0110	0.0111	0.0108	0.0105	0.0060
89	0.0092	0.0095	0.0120	0.0059	0.0084	0.0094	0.0094
90	0.0149	0.0143	0.0164	0.0156	0.0142	0.0152	0.0065
91	0.0094	0.0103	0.0097	0.0096	0.0094	0.0094	0.0008
92	0.0102	0.0109	0.0108	0.0107	0.0103	0.0101	0.0
93	0.0102	0.0111	0.0109	0.0107	0.0003	0.0102	0.0
94	0.0111	0.0119	0.0117	0.0115	0.0099	0.0106	0.0215
95	0.0097	0.0107	0.0103	0.0097	0.0097	0.0098	0.0010
96	0.0098	0.0112	0.0106	0.0106	0.0104	0.0103	0.0006
97	0.0101	0.0111	0.0108	0.0103	0.0094	0.0094	0.0021
98	0.0094	0.0108	0.0116	0.0116	0.0074	0.0066	0.0

WEIGHT GAIN DATA
PACKAGE TYPE : CPAK

COLUMN HEADING = BOMB PRESSURE / INDICATOR FLUID
WEIGHT RECORDED IN GRAMS

UNIT NUMBER	60/PP1 WT GAIN	60/PP2 WT GAIN	60/FC77 WT GAIN	60/FC78 WT GAIN	30/FC78 WT GAIN	90/FC78 WT GAIN	105/FC78 WT GAIN
1	0.0264	0.0279	0.0277	0.0266	0.0209	0.0268	0.0263
2	0.0202	0.0064	0.0051	0.0028	0.0034	0.0207	0.0205
3	0.0147	0.0036	0.0024	0.0056	0.0	0.0153	0.0143
4	0.0243	0.0258	0.0177	0.0244	0.0075	0.0246	0.0243
5	0.0215	0.0230	0.0003	0.0218	0.0218	0.0218	0.0217
6	0.0213	0.0226	0.0032	0.0212	0.0212	0.0215	0.0205
7	0.0203	0.0217	0.0218	0.0205	0.0052	0.0207	0.0189
8	0.0196	0.0201	0.0039	0.0199	0.0053	0.0201	0.0017
9	0.0	0.0	0.0002	0.0	0.0	0.0002	0.0004
10	0.0213	0.0226	0.0224	0.0215	0.0103	0.0218	0.0215
11	0.0135	0.0068	0.0009	0.0186	0.0159	0.0186	0.0182
12	0.0258	0.0274	0.0277	0.0262	0.0252	0.0268	0.0259
13	0.0249	0.0144	0.0195	0.0201	0.0200	0.0257	0.0288
14	0.0268	0.0152	0.0149	0.0266	0.0068	0.0269	0.0266
15	0.0041	0.0016	0.0	0.0002	0.0	0.0026	0.0026
16	0.0	0.0001	0.0	C.C	0.0001	0.0002	-0.0002
17	0.0210	0.0231	0.0215	0.0214	0.0205	0.0219	0.0214
18	0.0211	0.0225	0.0163	0.0213	0.0187	0.0217	0.0214
19	0.0	0.0002	0.0	0.0001	0.0	0.0004	0.0001
20	0.0003	0.0001	0.0001	0.0	0.0	0.0003	0.0003
21	0.0242	0.0250	0.0257	0.0245	0.0244	0.0251	0.0229
22	0.0211	0.0277	0.0277	0.0265	0.0010	0.0267	0.0280
23	0.0272	0.0288	0.0285	0.0279	0.0294	0.0281	0.0267
24	0.0256	0.0272	0.0267	0.0247	0.0060	0.0259	0.0253
25	0.0213	0.0191	0.0197	0.0216	0.0178	0.0223	0.0210
26	0.0	0.0	0.0	0.0	0.0	0.0002	0.0002
27	0.0042	0.0009	0.0038	0.0088	0.0038	0.0021	0.0012
28	0.0219	0.0229	0.0	0.0223	0.0205	0.0223	0.0161
29	0.0253	0.0265	0.0263	0.0251	0.0180	0.0257	0.0249
30	0.0025	0.0004	0.0006	0.0	0.0004	0.0023	0.0033
31	0.0228	0.0203	0.0237	0.0189	0.0	0.0023	0.0033
32	0.0179	0.0038	0.0057	0.0080	0.0081	0.0165	0.0133
33	0.0268	0.0276	0.0	0.0270	0.0110	0.0276	0.0267
34	0.0193	0.0205	0.0204	0.0205	0.0191	0.0195	0.0182
35	0.0201	0.0217	0.0157	0.0203	0.0203	0.0204	0.0171
36	0.0195	0.0208	0.0205	0.0196	0.0199	0.0209	0.0169
37	0.0184	0.0078	0.0135	0.0176	0.0045	0.0184	0.0183
38	0.0203	0.0102	0.0030	0.0003	0.0101	0.0242	0.0239
39	0.0196	0.0054	0.0041	0.0020	0.0097	0.0169	0.0198
40	0.0188	0.0133	0.0010	0.0183	0.0121	0.0193	0.0193
41	0.0006	0.0001	0.0005	0.0002	0.0002	0.0006	0.0149
42	0.0169	0.0046	0.0046	0.0191	0.0001	0.0149	0.0152
43	0.0214	0.0222	0.0228	0.0216	0.0069	0.0219	0.0170
44	0.0	0.0	0.0002	C.C	0.0	0.0004	0.0003
45	0.0203	0.0220	0.0089	0.0205	0.0154	0.0206	0.0197
46	0.0192	0.0205	0.0201	0.0195	0.0019	0.0198	0.0023
47	0.0190	0.0202	0.0008	0.0192	0.0001	0.0195	0.0187
48	0.0218	0.0086	0.0086	0.0089	0.0	0.0219	0.0041
49	0.0187	0.0200	0.0200	0.0191	0.0075	0.0186	0.0173
50	0.0209	0.0224	0.0129	0.0310	0.0182	0.0214	0.0211

WEIGHT GAIN DATA
PACKAGE TYPE : CPAK

COLUMN HEADING = BOMB PRESSURE / INDICATOR FLUID
WEIGHT RECORDED IN GRAMS

UNIT NUMBER	60/PP1 WT GAIN	60/PP2 WT GAIN	60/FC77 WT GAIN	60/FC78 WT GAIN	30/FC78 WT GAIN	90/FC78 WT GAIN	105/FC78 WT GAIN
51	0.0216	0.0230	0.0225	0.0218	0.0028	0.0220	0.0044
52	0.0099	0.0031	0.0030	0.0	0.0065	0.0118	0.0121
53	0.0	0.0	0.0	0.0	0.0	0.0003	0.0002
54	0.0005	0.0157	0.0132	0.0136	0.0	0.0135	0.0043
55	0.0032	0.0007	0.0020	0.0012	0.0012	0.0028	0.0032
56	0.0022	0.0008	0.0005	0.0003	0.0005	0.0026	0.0034
57	0.0003	0.0004	0.0002	0.0	0.0001	0.0003	0.0020
58	0.0014	0.0004	0.0001	0.0005	0.0006	0.0012	0.0
59	0.0001	0.0001	0.0	0.0	0.0	0.0	0.0003
60	0.0191	0.0053	0.0054	0.0108	0.0075	0.0138	0.0072
61	0.0216	0.0049	0.0062	0.0050	0.0015	0.0160	0.0107
62	0.0015	0.0005	0.0001	0.0	0.0004	0.0014	0.0026
63	0.0258	0.0051	0.0031	0.0067	0.0087	0.0192	0.0177
64	0.0133	0.0027	0.0030	0.0030	0.0023	0.0091	0.0091
65	0.0208	0.0219	0.0209	0.0209	0.0053	0.0213	0.0213
66	0.0108	0.0022	0.0005	0.0020	0.0034	0.0088	0.0088
67	0.0207	0.0220	0.0214	0.0206	0.0	0.0212	0.0209
68	0.0191	0.0036	0.0028	0.0010	0.0072	0.0144	0.0
69	0.0001	0.0	0.0005	0.0	0.0	0.0	0.0005
70	0.0011	0.0003	0.0006	0.0003	0.0001	0.0007	0.0007
71	0.0196	0.0206	0.0205	0.0198	0.0110	0.0203	0.0192
72	0.0190	0.0201	0.0202	0.0189	0.0001	0.0194	0.0198
73	0.0004	0.0	0.0	0.0	0.0	0.0004	0.0006
74	0.0001	0.0001	0.0	0.0	0.0	0.0002	0.0
75	0.0004	0.0	0.0004	0.0	0.0003	0.0009	0.0020
76	0.0	0.0002	0.0003	0.0	0.0	0.0001	0.0003
77	0.0	0.0	0.0	0.0	0.0	0.0	0.0004
78	0.0193	0.0069	0.0054	0.0114	0.0081	0.0201	0.0195
79	0.0	0.0	0.0001	0.0	0.0	0.0002	0.0004
80	0.0228	0.0065	0.0066	0.0105	0.0120	0.0210	0.0154
81	0.0267	0.0188	0.0088	0.0184	0.0	0.0244	0.0242
82	0.0256	0.0061	0.0	0.0066	0.0123	0.0176	0.0207
83	0.0	0.0002	0.0004	0.0	0.0002	0.0001	0.0002
84	0.0200	0.0211	0.0034	0.0201	0.0200	0.0204	0.0169
85	0.0	0.0002	0.0001	0.0	0.0	0.0004	0.0001
86	0.0223	0.0287	0.0290	0.0274	0.0001	0.0275	0.0253
87	0.0211	0.0224	0.0221	0.0214	0.0209	0.0217	0.0210
88	0.0255	0.0095	0.0008	0.0040	0.0075	0.0244	0.0256
89	0.0001	0.0	0.0001	0.0	0.0001	0.0002	0.0007
90	0.0001	0.0002	0.0001	0.0	0.0	0.0	0.0001
91	0.0210	0.0226	0.0223	0.0022	0.0211	0.0216	0.0033
92	0.0	0.0002	0.0	0.0009	0.0	0.0003	0.0032
93	0.0	0.0002	0.0	0.0	0.0	0.0003	0.0003
94	0.0	0.0001	0.0004	0.0191	0.0002	0.0004	0.0001
95	0.0	0.0001	0.0	0.0	0.0	0.0003	0.0003
96	0.0207	0.0219	0.0219	0.0208	0.0038	0.0210	0.0207
97	0.0001	0.0	0.0143	0.0	0.0	0.1000	0.0003
98	0.0001	0.0	0.0005	0.0	0.0	0.0003	0.0003
99	0.0210	0.0224	0.0138	0.0149	0.0009	0.0214	0.0203
100	0.0	0.0	0.0011	0.0	0.0	0.0	0.0004

WEIGHT GAIN DATA
PACKAGE TYPE : CDIP

COLUMN HEADING = 80MB PRESSURE / INDICATOR FLUID
WEIGHT RECORDED IN GRAMS

UNIT NUMBER	60/PP1 WT GAIN	60/PP2 WT GAIN	60/FC77 WT GAIN	60/FC78 WT GAIN	30/FC78 WT GAIN	90/FC78 WT GAIN	105/FC78 WT GAIN
1	0.0	0.0002	0.0003	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0006	0.0001	0.0	0.0	0.0
3	0.0	0.0004	0.0	0.0003	0.0	0.0	0.0002
4	0.0	0.0	0.0	0.0001	0.0	0.0	0.0
5	0.0	0.0005	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0007	0.0001	0.0001	0.0	0.0
7	0.0	0.0	0.0	0.0006	0.0	0.0	0.0
8	0.0	0.0	0.0005	0.0001	0.0	0.0001	0.0
9	0.0	0.0	0.0	0.0	0.0	0.0002	0.0
10	0.0281	0.0302	0.0299	0.0285	0.0277	0.0284	0.0281
11	0.0001	0.0003	0.0	0.0002	0.0	0.0002	0.0
12	0.0	0.0	0.0	0.0001	0.0	0.0010	0.0
13	0.0	0.0	0.0	0.0001	0.0	0.0003	0.0
14	0.0	0.0002	0.0001	0.0	0.0	0.0001	0.0001
15	0.0	0.0	0.0001	0.0001	0.0	0.0001	0.0001
16	0.0	0.0	0.0	0.0	0.0	0.0	0.0
17	0.0	0.0	0.0	0.0	0.0	0.0	0.0
18	0.0	0.0	0.0	0.0	0.0	0.0	0.0
19	0.0	0.0	0.0009	0.0001	0.0	0.0	0.0
20	0.0	0.0001	0.0001	0.0001	0.0	0.0003	0.0
21	0.0	0.0	0.0	0.0	0.0	0.0	0.0
22	0.0	0.0	0.0	0.0001	0.0	0.0	0.0002
23	0.0	0.0001	0.0016	0.0003	0.0	0.0005	0.0002
24	0.0	0.0001	0.0	0.0	0.0003	0.0	0.0
25	0.0005	0.0026	0.0026	0.0014	0.0002	0.0000	0.0007
26	0.0	0.0002	0.0	0.0	0.0	0.0	0.0
27	0.0001	0.0002	0.0	0.0002	0.0002	0.0002	0.0001
28	0.0011	0.0021	0.0006	0.0012	0.0005	0.0020	0.0019
29	0.0002	0.0	0.0	0.0	0.0	0.0	0.0
30	0.0	0.0	0.0	0.0	0.0	0.0	0.0
31	0.0006	0.0007	0.0005	0.0004	0.0001	0.0005	0.0004
32	0.0	0.0003	0.0	0.0	0.0001	0.0004	0.0
33	0.0005	0.0010	0.0005	0.0012	0.0	0.0005	0.0006
34	0.0	0.0	0.0	0.0	0.0	0.0	0.0
35	0.0	0.0	0.0	0.0	0.0	0.0	0.0
36	0.0	0.0007	0.0	0.0001	0.0	0.0001	0.0001
37	0.0	0.0001	0.0001	0.0003	0.0001	0.0001	0.0001
38	0.0	0.0	0.0	0.0	0.0	0.0	0.0
39	0.0008	0.0011	0.0011	0.0015	0.0009	0.0010	0.0019
40	0.0002	0.0010	0.0009	0.0004	0.0001	0.0005	0.0004
41	0.0009	0.0005	0.0007	0.0005	0.0005	0.0009	0.0011
42	0.0362	0.0379	0.0387	0.0355	0.0312	0.0322	0.0339
43	0.0001	0.0032	0.0	0.0005	0.0005	0.0024	0.0017
44	0.0334	0.0360	0.0392	0.0344	0.0340	0.0339	0.0204
45	0.0004	0.0014	0.0	0.0003	0.0004	0.0013	0.0016
46	0.0001	0.0	0.0	0.0002	0.0	0.0004	0.0
47	0.0019	0.0045	0.0021	0.0022	0.0020	0.0037	0.0025
48	0.0	0.0	0.0	0.0	0.0	0.0	0.0
49	0.0	0.0	0.0005	0.0005	0.0001	0.0	0.0
50	0.0003	0.0007	0.0001	0.0005	0.0010	0.0016	0.0019

WEIGHT GAIN DATA
PACKAGE TYPE : CDIP

COLUMN HEADING = BOMB PRESSURE / INDICATOR FLUID
WEIGHT RECORDED IN GRAMS

UNIT NUMBER	60/PP1 WT GAIN	60/PP2 WT GAIN	60/FC77 WT GAIN	60/FC78 WT GAIN	30/FC78 WT GAIN	90/FC78 WT GAIN	105/FC78 WT GAIN
51	0.0001	0.0010	0.0001	0.0004	0.0002	0.0011	0.0028
52	0.0	0.0	0.0	0.0	0.0	0.0	0.0
53	0.0	0.0002	0.0	0.0002	0.0	0.0	0.0
54	0.0	0.0001	0.0	0.0	0.0	0.0001	0.0001
55	0.0	0.0001	0.0	0.0	0.0	0.0003	0.0003
56	0.0025	0.0001	0.0	0.0001	0.0	0.0002	0.0003
57	0.0	0.0	0.0	0.0	0.0	0.0	0.0
58	0.0	0.0	0.0011	0.0018	0.0009	0.0126	0.0257
59	0.0025	0.0023	0.0	0.0	0.0	0.0	0.0
60	0.0	0.0	0.0007	0.0018	0.0001	0.0010	0.0009
61	0.0014	0.0032	0.0	0.0018	0.0001	0.0010	0.0002
62	0.0	0.0001	0.0	0.0001	0.0	0.0002	0.0002
63	0.0008	0.0014	0.0009	0.0009	0.0007	0.0017	0.0015
64	0.0017	0.0012	0.0011	0.0023	0.0021	0.0045	0.0032
65	0.0057	0.0028	0.0017	0.0035	0.0088	0.0129	0.0071
66	0.0014	0.0053	0.0014	0.0026	0.0022	0.0049	0.0036
67	0.0	0.0051	0.0	0.0002	0.0	0.0002	0.0003
68	0.0156	0.0379	0.0074	0.0278	0.0278	0.0365	0.0208
69	0.0031	0.0063	0.0021	0.0027	0.0029	0.0065	0.0046
70	0.0314	0.0421	0.0166	0.0270	0.0398	0.0400	0.0395
71	0.0	0.0001	0.0028	0.0	0.0	0.0002	0.0001
72	0.0	0.0	0.0	0.0	0.0	0.0	0.0
73	0.0	0.0002	0.0	0.0003	0.0	0.0002	0.0001
74	0.0	0.0001	0.0	0.0	0.0	0.0001	0.0
75	0.0	0.0001	0.0029	0.0002	0.0	0.0002	0.0
76	0.0	0.0001	0.0	0.0002	0.0	0.0002	0.0001
77	0.0	0.0	0.0	0.0	0.0	0.0002	0.0
78	0.0022	0.0031	0.0031	0.0029	0.0004	0.0021	0.0021
79	0.0	0.0	0.0	0.0	0.0	0.0	0.0
80	0.0031	0.0045	0.0042	0.0046	0.0023	0.0042	0.0047
81	0.0	0.0	0.0	0.0	0.0	0.0	0.0
82	0.0076	0.0035	0.0026	0.0066	0.0104	0.0158	0.0091
83	0.0018	0.0038	0.0013	0.0020	0.0019	0.0071	0.0043
84	0.0024	0.0027	0.0036	0.0034	0.0020	0.0021	0.0028
85	0.0105	0.0191	0.0251	0.0328	0.0069	0.0182	0.0002
86	0.0279	0.0303	0.0314	0.0287	0.0268	0.0282	0.0157
87	0.0277	0.0296	0.0292	0.0285	0.0268	0.0270	0.0284
88	0.0	0.0	0.0	0.0001	0.0	0.0	0.0001
89	0.0212	0.0265	0.0278	0.0257	0.0008	0.0254	0.0142
90	0.0247	0.0289	0.0276	0.0283	0.0111	0.0228	0.0230
91	0.0273	0.0292	0.0282	0.0303	0.0281	0.0260	0.0255
92	0.0265	0.0276	0.0285	0.0269	0.0258	0.0263	0.0077
93	0.0260	0.0288	0.0386	0.0284	0.0253	0.0280	0.0036
94	0.0273	0.0300	0.0289	0.0273	0.0265	0.0289	0.0074
95	0.0246	0.0280	0.0286	0.0260	0.0244	0.0227	0.0188
96	0.0	0.0	0.0	0.0	0.0	0.0	0.0
97	0.0	0.0	0.0	0.0	0.0	0.0	0.0
98	0.0	0.0	0.0	0.0	0.0	0.0	0.0
99	0.0358	0.0465	0.0484	0.0461	0.0357	0.0328	0.0313
100	0.0453	0.0490	0.0484	0.0473	0.0461	0.0447	0.0452

52. C-DIP Weight Gain Data (Sheet 2 of 2)

WEIGHT GAIN DATA
PACKAGE TYPE : MOSDIP

COLUMN HEADING = BOARD PRESSURE / INDICATOR FLUID
WEIGHT RECORDED IN GRAMS

UNIT NUMBER	60/PP1 WT GAIN	60/PP2 WT GAIN	60/FC77 WT GAIN	60/FC78 WT GAIN	30/FC78 WT GAIN	90/FC78 WT GAIN	105/FC78 WT GAIN
1	0.0002	0.0002	0.0082	0.0005	0.0005	0.0002	0.0001
2	0.0001	0.0002	0.0015	0.0003	0.0002	0.0002	0.0002
3	0.0004	0.0003	0.0030	0.0	0.0003	0.0002	0.0
4	0.0003	0.0002	0.0031	C-C	0.0004	0.0004	0.0
5	0.0001	0.0003	0.0023	C-C	0.0004	0.0	0.0
6	0.0002	C.0003	0.0159	0.0	0.0054	0.0001	0.0002
7	0.0002	C.0002	0.0426	C.0004	0.0	0.0003	0.0002
8	0.0001	0.0003	0.0163	0.0007	0.0	0.0003	0.0
9	0.0002	C.0001	0.0026	C.0001	0.0001	0.0003	0.0
10	0.0001	0.0002	0.0175	C.0004	0.0003	0.0001	0.0002
11	0.0003	0.0002	0.0026	C.0008	0.0054	0.0001	0.0001
12	0.0015	0.0004	0.0013	C.0007	0.0006	0.0008	0.0006
13	0.0011	0.0003	0.0006	C.0	0.0902	0.0016	0.0001
14	0.0016	0.0005	0.0009	0.0	0.0005	0.0022	0.0012
15	0.0001	C.0005	0.0025	C-C	C.0003	0.0003	0.0
16	0.0004	0.0002	0.0055	0.0001	0.0004	0.0	0.0001
17	0.0003	C.0002	0.0002	C-C	0.0001	0.0	0.0
18	0.0001	0.0001	0.0019	C.C002	C.0004	0.0002	0.0003
19	0.0020	0.0007	0.0007	C.0	0.0	0.0018	0.0009
20	0.0006	0.0005	0.0016	C-C	0.0003	0.0006	0.0
21	0.0010	0.0003	0.0003	0.0	C.0001	0.0006	0.0003
22	0.0020	0.0007	0.0006	C.0004	0.0006	0.0017	0.0001
23	0.0001	0.0006	0.0006	C.0001	0.0003	0.0001	0.0
24	0.0005	0.0001	0.0002	0.0630	0.0002	0.0002	0.0
25	0.0001	0.0009	0.0009	C.0013	C.0002	0.0003	0.0
26	0.0010	0.0004	0.0014	C-C	C.0005	0.0008	0.0003
27	0.0011	0.0003	0.0012	0.0013	0.0005	0.0007	0.0006
28	0.0006	0.0002	0.0018	0.0005	0.0004	0.0006	0.0001
29	0.0009	0.0003	0.0001	C-C	0.0001	0.0004	0.0001
30	0.0090	0.0035	0.0027	C-C	0.0001	0.0004	0.0001
31	0.0018	0.0007	0.0014	0.0679	0.0008	0.0007	0.0038
32	0.0016	0.0003	0.0008	0.0	C.0007	0.0023	0.0013
33	0.0032	C.0008	0.0004	0.0	C.0007	0.0016	0.0008
34	0.0012	0.0005	0.0033	C.0017	0.0011	0.0047	0.0023
35	0.0126	0.0008	0.0015	0.0011	0.0008	0.0009	0.0009
36	0.0003	0.0003	0.0050	C-C	0.0008	0.0	0.0012
37	0.0018	0.0006	0.0010	C.0003	C.0004	0.0016	0.0002
38	0.0018	0.0004	0.0004	0.0	C.0006	0.0010	0.0006
39	0.0002	C.0005	0.0010	C-C	0.0006	0.0002	0.0
40	0.0035	0.0006	0.0003	0.0	0.0013	0.0050	0.0023
41	0.0013	C.0006	0.0037	C.0	C.0007	0.0018	0.0005
42	0.0006	0.0004	0.0047	C.C004	C.0006	0.0009	0.0003
43	0.0010	C.0003	0.0029	C.0006	0.0006	0.0005	0.0006
44	0.0034	C.0009	0.0031	C.0012	0.0012	0.0	0.0023
45	0.0008	0.0004	0.0015	C.0006	C.0007	0.0008	0.0005
46	0.0023	C.0009	0.0020	C.0006	C.0009	0.0025	0.0005
47	0.0003	0.0002	0.0008	C.0003	C.0003	0.0	0.0001
48	0.0011	0.0007	0.0016	C.0	0.0500	0.0028	0.0004
49	0.0074	0.0014	0.0053	C.0011	0.0	0.0076	0.0041
50	0.0101	0.0011	0.0010	0.0010	0.0025	0.0118	0.0044

WEIGHT GAIN DATA
PACKAGE TYPE : MOSDIP

COLUMN HEAVINC = BUMB PRESSURE / INDICATOR FLUID
WEIGHT RECORDED IN GRAMS

UNIT NUMBER	60/PP1 WT GAIN	60/PP2 WT GAIN	60/FC77 WT GAIN	60/FC78 WT GAIN	30/FC78 WT GAIN	90/FC78 WT GAIN	105/FC78 WT GAIN
51	0.0001	0.0005	0.0004	0.0	0.0015	0.0001	0.0
52	0.0	0.0004	0.0004	C.0	0.002	0.0	0.0
53	0.0064	0.0017	0.0030	C.0009	0.0058	0.0070	0.0032
54	0.0024	0.0009	0.0047	0.0	0.0008	0.0025	0.0011
55	0.0	0.0003	0.0003	C.C	C.0002	0.0	0.0
56	0.0171	0.0043	0.0041	0.0052	0.0036	0.0172	0.0
57	0.0020	C.0006	0.0006	0.0	0.0008	0.0015	0.0003
58	0.0075	0.0013	0.0016	C.0014	0.0014	0.0071	0.0038
59	0.0	0.0003	0.0003	0.0	0.0003	0.0	0.0
60	0.0002	0.0003	0.0004	C.C	0.0006	0.0010	0.0
61	0.0014	0.0002	0.0017	0.0	0.0007	0.0012	0.0005
62	0.0002	C.0005	0.0006	0.0	0.0002	0.0	0.0
63	0.0104	0.0022	0.0015	C.0004	0.0047	0.0218	0.0064
64	0.0002	0.0002	0.0005	0.0	0.0003	0.0	0.0001
65	0.0991	0.1054	0.1052	C.0498	0.1004	0.0992	0.0660
66	0.0001	0.0003	0.0016	C.C	C.0004	0.0001	0.0
67	0.0	0.0002	0.0010	0.0	0.0	0.0	0.0
68	0.0001	0.0002	0.1006	C.0001	0.0011	0.0009	0.0
69	0.0001	0.0	0.0002	0.0	0.0001	0.0	0.0
70	0.0	0.0001	0.0002	0.0	0.0001	0.0	0.0
71	0.0994	0.1058	0.1044	C.0761	0.1003	0.1012	0.0771
72	0.0759	0.0116	0.0139	C.0175	0.0159	0.1016	0.0243
73	0.0022	0.0005	0.0011	0.0	C.0007	0.0013	0.0005
74	0.0916	0.0240	0.0321	0.0383	0.0251	0.0950	0.0501
75	0.1002	0.0334	0.0494	0.0389	0.0680	0.1017	0.0769
76	0.0183	0.0022	0.0009	C.0007	0.0033	0.0181	0.0005
77	0.0251	0.0030	0.0032	0.0021	0.0053	0.0275	0.0086
78	0.0418	0.0066	0.0083	0.0065	0.0080	0.0438	0.0143
79	0.1046	0.1054	0.1090	0.1047	0.0961	0.1005	0.1031
80	0.0978	0.1042	0.1072	0.0684	0.0989	0.0990	0.0753
81	0.0974	0.1036	0.1099	0.0718	0.0985	0.0986	0.0522
82	0.1053	0.1128	0.1107	0.0596	0.1067	0.1067	0.0322
83	0.0978	0.1035	0.1145	0.0327	0.0979	0.0983	0.0674
84	0.0907	0.0966	0.0972	C.0997	0.0918	0.0917	0.0
85	0.0997	0.1056	0.1041	0.1048	0.1006	0.1009	0.0352
86	0.0505	0.0054	0.0056	0.0057	0.0093	0.0451	0.0117
87	0.0013	0.0004	0.0007	0.0002	0.0002	0.0005	0.0002
88	0.0279	0.0049	0.0079	0.0067	0.0057	0.0345	0.0047
89	0.0779	0.0590	0.0734	0.0597	0.0350	0.0786	0.0579
90	0.0043	0.0023	0.0028	0.0070	0.0031	0.0177	0.0055
91	0.0771	0.0821	0.0804	0.0769	0.0780	0.0782	0.0298
92	0.0741	0.0275	0.0292	0.0330	0.0352	0.0749	0.0542
93	0.0814	0.0453	0.0472	0.0445	0.0484	0.0820	0.0684
94	0.0833	0.0893	0.0888	0.0692	0.0855	0.0853	0.0504
95	0.0894	0.0955	0.1032	C.0553	C.0970	0.0917	0.0588
96	0.0893	0.0981	0.0940	0.0503	0.0699	0.0848	0.0
97	0.0910	0.0975	0.1035	C.0800	0.0939	0.0926	0.0577
98	0.0945	0.1017	0.1039	0.0710	0.0967	0.0958	0.0558
99	0.0879	0.0941	0.0978	0.0751	0.0892	0.0892	0.0514
100	0.0908	0.0956	0.0954	C.0756	0.0901	0.0803	0.0670

53. MOS DIP Weight Gain Data (Sheet 2 of 2)

WEIGHT GAIN DATA
PACKAGE TYPE : 10100

UNIT NUMBER	COLUMN HEADING = BOMB PRESSURE / INDICATOR FLUID WEIGHT RECORDED IN GRAMS					60/FC77 WT GAIN	60/FC78 WT GAIN	30/FC78 WT GAIN	90/FC78 WT GAIN	105/FC78 WT GAIN
	60/PP1 WT GAIN	60/PP2 WT GAIN	60/PP3 WT GAIN	60/PP4 WT GAIN	60/PP5 WT GAIN					
1	0.0	0.0	0.0	0.0	0.0	0.0001	0.0002	0.0001	0.0001	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0001	0.0001	0.0001	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0102	0.0001	0.0001	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0001	0.0001	0.0004	0.0002
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0001	0.0001	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	0.0002	0.0	0.0	0.0	0.0	0.0003	0.0	0.0	0.0002	0.0001
8	0.0	0.0	0.0	0.0	0.0	0.0001	0.0001	0.0001	0.0001	0.0003
9	0.0	0.0	0.0	0.0	0.0	0.0005	0.0003	0.0003	0.0004	0.0059
10	0.0	0.0	0.0	0.0	0.0	0.0053	0.0002	0.0002	0.0001	0.0
11	0.0	0.0	0.0	0.0	0.0	0.0001	0.0001	0.0001	0.0003	0.0003
12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13	0.0	0.0	0.0	0.0	0.0	0.0002	0.0	0.0	0.0006	0.0003
14	0.0	0.0	0.0	0.0	0.0	0.0001	0.0002	0.0001	0.0002	0.0002
15	0.0	0.0	0.0	0.0	0.0	0.0002	0.0001	0.0001	0.0001	0.0001
16	0.0	0.0	0.0	0.0	0.0	0.0002	0.0002	0.0002	0.0001	0.0
17	0.0	0.0	0.0	0.0	0.0	0.0001	0.0002	0.0002	0.0005	0.0
18	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
19	0.0	0.0	0.0	0.0	0.0	0.0001	0.0002	0.0002	0.0006	0.0006
20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0003	0.0
21	0.0	0.0	0.0	0.0	0.0	0.0011	0.0012	0.0012	0.0001	0.0
22	0.0	0.0	0.0	0.0	0.0	0.0011	0.0002	0.0001	0.0002	0.0
23	0.0001	0.0	0.0	0.0	0.0	0.0003	0.0001	0.0001	0.0003	0.0
24	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
25	0.0001	0.0002	0.0002	0.0002	0.0002	0.0	0.0001	0.0001	0.0002	0.0002
26	0.0003	0.0001	0.0003	0.0003	0.0003	0.0004	0.0004	0.0004	0.0005	0.0006
27	0.0	0.0002	0.0001	0.0001	0.0001	0.0003	0.0003	0.0003	0.0102	0.0
28	0.0	0.0002	0.0	0.0	0.0	0.0	0.0002	0.0002	0.0006	0.0218
29	0.0	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0001	0.0
30	0.0001	0.0	0.0001	0.0001	0.0001	0.0003	0.0	0.0	0.0001	0.0
31	0.0002	0.0001	0.0001	0.0001	0.0001	0.0002	0.0001	0.0001	0.0	0.0001
32	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
33	0.0	0.0002	0.0002	0.0002	0.0002	0.0006	0.0006	0.0006	0.0001	0.0006
34	0.0	0.0002	0.0002	0.0002	0.0002	0.0004	0.0002	0.0002	0.0007	0.0006
35	0.0	0.0	0.0	0.0	0.0	0.0002	0.0003	0.0003	0.0001	0.0
36	0.0	0.0001	0.0001	0.0001	0.0001	0.0002	0.0003	0.0003	0.0	0.0
37	0.0	0.0004	0.0004	0.0004	0.0004	0.0005	0.0003	0.0003	0.0006	0.0
38	0.0	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0005	0.0002
39	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40	0.0114	0.0306	0.0159	0.0159	0.0159	0.0231	0.0257	0.0257	0.0534	0.0245
41	0.0	0.0002	0.0002	0.0002	0.0002	0.0002	0.0001	0.0001	0.0003	0.0
42	0.0	0.0001	0.0001	0.0001	0.0001	0.0006	0.0002	0.0002	0.0006	0.0003
43	0.0	0.0	0.0	0.0	0.0	0.0001	0.0001	0.0001	0.0001	0.0
44	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
45	0.0001	0.0004	0.0004	0.0004	0.0004	0.0007	0.0004	0.0004	0.0008	0.0009
46	0.0004	0.0002	0.0002	0.0002	0.0002	0.0003	0.0001	0.0001	0.0005	0.0004
47	0.0048	0.0049	0.0042	0.0042	0.0042	0.0084	0.0040	0.0040	0.0113	0.0027
48	0.0	0.0003	0.0003	0.0003	0.0003	0.0003	0.0004	0.0004	0.0005	0.0
49	0.0	0.0002	0.0002	0.0002	0.0002	0.0002	0.0	0.0	0.0002	0.0
50	0.0001	0.0001	0.0005	0.0005	0.0005	0.0001	0.0	0.0	0.0	0.0001

54. TO-100 Weight Gain Data (Sheet 1 of 2)

WEIGHT GAIN DATA
PACKAGE TYPE : TO100

COLUMN HEADING = BOMB PRESSURE / INDICATOR FLUID
WEIGHT RECORDED IN GRAHS

UNIT NUMBER	60/PP1 WT GAIN	60/PP2 WT GAIN	60/FC77 WT GAIN	60/FC78 WT GAIN	30/FC78 WT GAIN	90/FC78 WT GAIN	105/FC78 WT GAIN
51	0.0	0.0	0.0	0.0	0.0	0.0	0.0
52	0.0	0.0	0.0	0.0	0.0	0.0	0.0
53	0.0001	0.0003	0.0	0.0005	0.0	0.0005	0.0003
54	0.0001	0.0004	0.0001	0.0006	0.0005	0.0006	0.0007
55	0.0	0.0	0.0001	0.0004	0.0	0.0008	0.0003
56	0.0002	0.0004	0.0001	0.0007	0.0004	0.0009	0.0007
57	0.0002	0.0003	0.0002	0.0003	0.0005	0.0004	0.0006
58	0.0	0.0	0.0	0.0	0.0	0.0	0.0
59	0.0	0.0	0.0	0.0	0.0	0.0	0.0
60	0.0	0.0	0.0	0.0	0.0	0.0	0.0
61	0.0	0.0001	0.0	0.0003	0.0	0.0001	0.0
62	0.0	0.0001	0.0	0.0004	0.0003	0.0003	0.0004
63	0.0001	0.0002	0.0010	0.0004	0.0005	0.0009	0.0004
64	0.0	0.0	0.0	0.0	0.0	0.0	0.0
65	0.0	0.0004	0.0001	0.0001	0.0003	0.0007	0.0005
66	0.0	0.0001	0.0002	0.0001	0.0003	0.0001	0.0
67	0.0	0.0	0.0	0.0	0.0	0.0	0.0
68	0.0001	0.0004	0.0004	0.0011	0.0005	0.0009	0.0020
69	0.0001	0.0003	0.0030	0.0009	0.0004	0.0007	0.0008
70	0.0	0.0	0.0	0.0	0.0	0.0	0.0
71	0.0009	0.0008	0.0008	0.0017	0.0012	0.0020	0.0028
72	0.0	0.0	0.0	0.0038	0.0	0.0	0.0
73	0.0017	0.0016	0.0014	0.0031	0.0015	0.0039	0.0037
74	0.0002	0.0001	0.0003	0.0005	0.0004	0.0006	0.0005
75	0.0002	0.0003	0.0	0.0007	0.0004	0.0009	0.0005
76	0.0	0.0003	0.0001	0.0004	0.0001	0.0007	0.0005
77	0.0024	0.0026	0.0018	0.0	0.0024	0.0072	0.0038
78	0.0074	0.0039	0.0115	0.0	0.0012	0.0088	0.0112
79	0.0	0.0	0.0	0.0	0.0	0.0	0.0
80	0.0001	0.0001	0.0	0.0006	0.0005	0.0010	0.0003
81	0.0007	0.0008	0.0007	0.0017	0.0011	0.0013	0.0025
82	0.0	0.0	0.0	0.0	0.0	0.0	0.0
83	0.0	0.0	0.0001	0.0001	0.0002	0.0002	0.0001
84	0.0	0.0	0.0	0.0	0.0	0.0	0.0
85	0.0009	0.0012	0.0010	0.0012	0.0009	0.0019	0.0024
86	0.0007	0.0007	0.0009	0.0013	0.0012	0.0013	0.0026
87	0.0010	0.0008	0.0007	0.0017	0.0010	0.0018	0.0028
88	0.0001	0.0002	0.0002	0.0006	0.0002	0.0004	0.0004
89	0.0001	0.0003	0.0	0.0006	0.0004	0.0029	0.0006
90	0.1301	0.1392	0.1371	0.1321	0.0628	0.1324	0.1260
91	0.0005	0.0004	0.0004	0.0010	0.0004	0.0009	0.0007
92	0.0764	0.0809	0.0695	0.1218	0.0620	0.1374	0.0461
93	0.0144	0.0317	0.0114	0.0297	0.0101	0.0385	0.0305
94	0.0480	0.0462	0.0335	0.0775	0.0420	0.1748	0.0408
95	0.1783	0.1704	0.1283	0.1793	0.1646	0.1795	0.1770
96	0.0012	0.0015	0.0012	0.0021	0.0002	0.0021	0.0033
97	0.0058	0.0053	0.0045	0.0104	0.0046	0.0171	0.0107
98	0.0062	0.0073	0.0160	0.0115	0.0171	0.0243	0.0191
99	0.0313	0.0282	0.0747	0.0391	0.0442	0.1424	0.0278

54. TO-100 Weight Gain Data (Sheet 2 of 2)

WEIGHT GAIN DATA
 PACKAGE TYPE 1 CERAMIC
 COLUMN HEADING = BOMB PRESSURE / INDICATOR FLUID
 WEIGHT RECORDED IN GRAMS

UNIT NUMBER	60/PPI WT GAIN	60/PP2 WT GAIN	60/FC77 WT GAIN	60/FC78 WT GAIN	30/FC78 WT GAIN	90/FC78 WT GAIN	105/FC78 WT GAIN
1	0.0001	0.0002	0.0013	0.0007	0.0	0.4796	0.0483
2	0.0006	0.0006	0.0	0.0005	0.0001	0.0	0.0
3	0.0001	0.0006	0.0008	0.0004	0.0003	0.0	0.0004
4	0.0	0.0003	0.0	0.0003	0.0	0.0	0.0001
5	0.0003	0.0005	0.0027	0.0007	0.0001	0.1772	0.0544
6	0.0003	0.0001	0.0	0.0007	0.0001	0.2991	0.0642
7	0.0001	0.0002	0.0	0.0003	0.2003	0.0007	0.0
8	0.0004	0.0003	0.0039	0.1173	0.0	0.0001	0.0
9	0.0	0.0001	0.0	0.0005	0.0004	0.0213	0.0
10	0.5572	0.5948	0.5057	0.5673	3.5054	0.5633	0.2229
11	0.0544	0.1668	0.4505	0.4691	3.0742	0.4619	0.2443
12	0.0	0.0	0.0	0.6199	0.0	0.0003	0.3301
13	0.0001	0.0001	0.0	0.0002	0.0003	0.0008	0.0
14	0.0	0.0003	0.0	0.0004	0.0002	0.0010	0.0
15	0.0	0.0001	0.0023	0.0	0.0	0.0307	0.0
16	0.0	0.0	0.0	0.0007	0.0002	0.0011	0.0
17	0.0	0.0001	0.0	0.0004	0.0	0.0025	0.0002
18	0.7913	0.0	0.8272	0.7968	0.8016	0.8011	0.0802
19	0.7202	0.7609	0.7553	0.7234	0.7340	0.7335	0.1838
20	0.0	0.0001	0.0002	0.0006	0.0	0.0304	0.0
21	0.7424	0.7726	0.7798	0.7518	0.7528	0.7524	0.3926
22	0.1412	0.1536	0.1512	0.1726	0.2474	0.1756	0.6156
23	0.5085	0.0707	0.0	0.0003	0.6539	0.1963	0.2552
24	0.0003	0.0	0.0	0.0078	0.0001	0.4346	0.0310
25	0.6984	0.7469	0.0119	0.1199	0.7130	0.0	0.2244
26	0.5695	0.3110	0.5885	0.7485	0.7472	0.0	0.0899
27	0.8092	0.3890	0.9168	0.7485	0.8833	0.7467	0.6255
28	0.8874	0.9379	0.9272	0.8999	0.8979	0.8954	0.7729
29	0.8316	0.8858	0.8719	0.8398	0.8453	0.8421	0.2838
30	0.8270	0.8462	0.8656	0.8416	0.8433	0.8417	0.6417
31	0.8367	0.8881	0.8763	0.8449	0.8446	0.8478	0.2138
32	0.8000	0.8501	0.8774	0.8102	0.8123	0.8140	0.1557
33	0.7206	0.7683	0.7555	0.7295	0.7325	0.7311	0.4713
34	0.0100	0.0035	0.8452	0.2837	0.0077	0.0161	0.0826
35	0.0004	0.0005	0.8150	0.7877	0.0602	0.0008	0.0
36	0.9033	0.9615	0.9458	0.9156	0.0	0.0	0.3358
37	0.0001	0.0442	0.8451	0.0499	0.7015	0.6953	0.0881
38	0.6900	0.7319	0.6939	0.7005	0.7015	0.6933	0.0843
39	0.0	0.0004	0.0	0.0004	0.0002	0.0010	0.0
40	0.0	0.0003	0.0001	0.0006	0.0	0.0010	0.0
41	0.0005	0.0	0.0	0.0009	0.0004	0.0010	0.0
42	0.7425	0.7920	0.7765	0.7517	0.7594	0.7578	0.4117
43	0.7642	0.8134	0.7946	0.7792	0.7794	0.7794	0.3732
44	0.6931	0.7371	0.7261	0.7043	0.7029	0.7020	0.4234
45	0.0003	0.0	0.0	0.0004	0.0	0.0003	0.0801
46	0.6794	0.7231	0.7374	0.7108	3.7092	0.7139	0.3197
47	0.0	0.0002	0.0001	0.0004	0.0002	0.0012	0.0802
48	0.6370	0.6783	0.6691	0.6407	0.6671	0.6651	0.4950
49	0.0	0.0004	0.0	0.0010	0.0	0.0004	0.0802
50	0.9173	0.9767	0.9611	0.9293	0.9344	0.9361	0.3735

WEIGHT GAIN DATA
 PACKAGE TYPE 1 CERAMIC
 COLUMN HEADING = BOMH PNESSURE / INDICATOR FLUID
 WEIGHT RECORDED IN GRAMS

UNIT NUMBER	60/PP1 WT GAIN	60/PP2 WT GAIN	60/FC77 WT GAIN	60/FC78 WT GAIN	30/FC70 WT GAIN	90/FC78 WT GAIN	155/FC78 WT GAIN
51	0.8999	0.9474	0.9327	0.9039	0.9049	0.9075	0.6934
52	0.0	0.0001	0.0000	0.0002	0.0003	0.0001	0.0001
53	0.0011	0.0009	0.0013	0.0020	0.0003	0.0	0.0007
54	0.7389	0.7872	0.7122	0.2466	0.7524	0.7501	0.0395
55	0.6800	0.7256	0.7131	0.6897	0.6947	0.6901	0.1011
56	0.8242	0.8798	0.8655	1.2899	0.8902	0.8361	0.5920
57	0.7042	0.7519	0.7390	0.7103	0.7186	0.7159	0.2533
58	0.8001	0.8660	0.8079	0.8386	0.8340	0.8272	0.7147
59	0.7488	0.7867	0.7802	0.7546	0.6841	0.6813	0.2291
60	0.0003	0.0	0.0003	0.0003	0.0001	0.0	0.0
61	0.0005	0.0001	0.0004	0.0	0.0003	0.0	0.0001
62	0.0001	0.0008	0.0005	0.0034	0.0001	0.8497	0.3302
63	0.8705	0.9293	0.9268	0.8924	0.8772	0.8914	0.3018
64	0.0003	0.0	0.0	0.0003	0.0001	0.0	0.0001
65	0.0002	0.0	0.0002	0.0005	0.0001	0.0	0.0002
66	0.0009	0.0002	0.0006	0.0006	0.0004	0.0	0.0007
67	0.0	0.0	0.0002	0.0004	0.0	0.0	0.3503
68	0.0	0.0	0.0	0.0005	0.0001	0.0	0.0
69	0.0003	0.0009	0.0013	0.0006	0.0003	0.0	0.0001
70	0.0001	0.0	0.0	0.0005	0.0	0.0	0.0
71	0.0001	0.0003	0.0020	0.0004	0.0	0.0	0.0002

WEIGHT GAIN DATA TO 3
PACKAGE TYPE 1 INDICATOR FLUID

COLUMN HEADING = BOMB PRESSURE / WEIGHT RECORDED IN GRAMS

UNIT NUMBER	60/PPI WT GAIN	60/PP2 WT GAIN	60/FC77 WT GAIN	60/FC78 WT GAIN	30/FC70 WT GAIN	90/FC78 WT GAIN	105/FC78 WT GAIN
1	1.7560	0.7115	0.6373	1.4694	0.0014	1.7815	1.5185
2	0.0602	0.0007	0.0056	0.0015	0.0	0.0009	0.0011
3	1.7345	1.8465	1.8315	1.7591	1.7595	1.7500	0.7980
4	0.1474	0.0545	0.0658	0.1358	0.0630	0.2428	0.2113
5	0.0059	0.0025	0.0041	0.0040	0.0022	0.0080	0.0115
6	0.0008	0.0010	0.0007	0.0010	0.0004	0.0009	0.0340
7	0.0005	0.0005	0.0039	0.0002	0.0	0.0	0.0023
8	0.7711	0.2186	0.2975	0.4297	0.2323	1.0660	1.6660
9	0.0001	0.0002	0.0032	0.0002	0.0	0.0352	0.0029
10	0.0005	0.0003	0.0030	0.0005	0.0	0.0002	0.0019
11	0.0007	0.0007	0.0055	0.0005	0.0003	0.0008	0.0030
12	0.0012	0.0012	0.0049	0.0014	0.0006	0.0011	0.0026
13	0.0001	0.0002	0.0016	0.0003	0.0	0.0004	0.0024
14	0.0	0.0003	0.0008	0.0	0.0	0.0003	0.0004
15	0.0015	0.0010	0.0054	0.0024	0.0002	0.0012	0.0034
16	1.1081	0.3419	0.4176	0.8093	0.2332	0.8416	0.8075
17	2.1036	2.2422	1.8978	2.0335	2.1360	2.1360	1.6885
18	1.7841	1.9026	1.6728	1.8089	1.8114	1.8110	1.3067
19	1.7146	0.5794	0.6746	0.9341	1.0571	0.2956	0.1091
20	1.7364	0.8557	0.4541	1.7621	1.3073	1.7647	1.1908
21	1.7904	1.9082	1.4786	1.8158	1.8166	1.8190	1.2248
22	0.0	0.0002	0.0072	0.0002	0.0	0.0001	0.0000
23	0.0	0.0010	0.0008	0.0001	0.0008	0.0008	0.0025
24	0.0	0.0004	0.0008	0.0009	0.0	0.0002	0.0026
25	0.0	0.0005	0.0048	0.0002	0.0	0.0003	0.0026
26	0.0	0.0004	0.0043	0.0	0.0	0.0007	0.0010
27	0.0	0.0001	0.0034	0.0	0.0	0.0004	0.0026
28	0.0	0.0	0.0145	0.0003	0.0	0.0	0.0002
29	0.0	0.0056	0.0016	0.0001	0.0	0.0	0.0023
30	0.0	0.0	0.0014	0.0001	0.0	0.0	0.0030
31	0.0	0.0031	0.0026	0.0001	0.0	0.0004	0.0024
32	0.0331	0.0116	.0111	0.0271	0.0094	0.0395	0.0478
33	0.0	0.0	.0003	0.0002	0.0005	0.0001	0.0003
34	0.0	0.0	0.0059	0.0002	0.0	0.0007	0.0024
35	0.0002	0.0002	0.0011	0.0	0.0	0.0001	0.0005
36	0.0001	0.0004	0.0070	0.0	0.0	0.0001	0.0034
37	0.0011	0.0007	0.0037	0.0009	0.0	0.0009	0.0038
38	0.0025	0.0013	0.0052	0.0011	0.0002	0.0019	0.0015
39	1.7353	1.8494	1.8212	1.7596	1.7623	1.7600	0.5108
40	0.0	0.0001	0.0056	0.0002	0.0003	0.0016	0.0009
41	0.0020	0.0048	0.0005	0.0	0.0006	0.0024	0.0022
42	0.1216	0.0492	0.0494	0.1235	0.0473	0.1833	0.1637
43	1.7373	1.6248	1.0194	1.7603	1.7635	1.7627	1.0530
44	0.0	0.0002	0.0013	0.0	0.0050	0.0003	0.0004
45	0.0005	0.0008	0.0001	0.0003	0.0	0.0003	0.0061
46	0.0063	0.0019	0.0236	0.0040	0.0023	0.0053	0.0110
47	0.0	0.0001	0.0051	0.0	0.0002	0.0009	0.0010
48	0.0015	0.0007	0.0091	0.0006	0.0	0.0022	0.0028
49	0.0291	0.0109	0.0177	0.0226	0.0145	0.0919	0.1075
50	0.0400	0.0145	0.0151	0.0330	0.0120	0.0735	0.1390

WEIGHT GAIN DATA
PACKAGE TYPE : TO 3

COLUMN HEADING = 80MB PRESSURE / INDICATOR FLUID
WEIGHT RECORDED IN GRAMS

UNIT NUMBER	60/PPI WT GAIN	60/PP2 WT GAIN	60/FC77 WT GAIN	60/FC78 WT GAIN	30/FC78 WT GAIN	90/FC78 WT GAIN	105/FC78 WT GAIN
51	0.0039	0.0023	0.0077	0.0027	0.0015	0.0039	0.0039
52	0.0	0.0001	0.0003	0.0001	0.0	0.0001	0.0004
53	0.0235	0.0085	0.0168	0.0191	0.0076	0.0428	0.0495
54	1.7310	1.8448	1.6943	1.7569	1.7584	1.7569	1.2142
55	0.8183	0.2072	0.2273	0.4648	0.2311	0.8155	0.6249
56	1.7711	1.8841	1.4569	1.7924	1.7925	1.7954	1.1915
57	2.0137	2.1878	2.1496	3.3034	2.0859	2.0825	0.6520
58	0.4581	0.1223	0.1499	0.3584	0.1327	0.4834	0.3572
59	0.0	0.0004	0.0119	0.0115	0.0	0.0017	0.0024
60	0.0001	0.0002	0.0	0.0001	0.3869	0.0015	0.0018
61	0.0	0.0003	0.0053	0.0003	0.0	0.0006	0.0008
62	0.0014	0.0007	0.0164	0.0008	0.0	0.0012	0.0019
63	0.0	0.0026	0.0012	0.0002	0.0	0.0001	0.0006
64	0.0668	0.0216	0.0242	0.0340	0.0184	0.1065	0.1650
65	0.0434	0.0102	0.0175	0.6415	0.0138	0.0836	0.1027
66	0.0075	0.0028	0.0041	0.0061	0.0020	0.0035	0.0040
67	0.0008	0.0012	0.0079	0.0009	0.0003	0.0015	0.0014
68	0.0023	0.0032	0.0045	0.0026	0.0016	0.0025	0.0007
69	0.0281	0.0052	0.0042	0.0087	0.0054	0.0141	0.0204
70	0.0229	0.0092	0.0098	0.0144	0.0097	0.0307	0.0645
71	0.0015	0.0006	0.0032	0.0007	0.0	0.0010	0.0014
72	0.0015	0.0011	0.0012	0.0012	0.0001	0.0012	0.0014
73	0.1175	0.0279	0.0323	0.0546	0.0239	0.1265	0.1238
74	0.0116	0.0040	0.0043	0.0055	0.0031	0.0121	0.0132
75	0.5255	0.1482	0.1863	0.3893	0.2297	0.5833	0.7734
76	0.0028	0.0018	0.0086	0.0043	0.0024	0.0047	0.0042
77	0.0199	0.0065	0.0085	0.0138	0.0021	0.0201	0.0341
78	0.0411	0.0108	0.0097	0.0144	0.0117	0.0414	0.0704
79	0.0609	0.0170	0.0479	0.0743	0.0133	0.0533	0.0724
80	0.4144	0.1582	0.1608	0.3105	0.0344	0.4776	0.5911
81	0.1025	0.0370	0.0428	0.0590	0.0328	0.1539	0.1630
82	0.2275	0.0938	0.0922	0.2593	0.8363	1.1531	0.8917
83	0.0849	0.0140	0.0227	0.0362	0.0136	0.0653	0.0910
84	0.0681	0.0111	0.0240	0.0311	0.0135	0.0463	0.0517
85	0.0	0.0004	0.0002	0.0	0.0	0.0001	0.0006
86	0.0252	0.0098	0.0114	0.0183	0.0095	0.0280	0.0066
87	0.0193	0.0067	0.0137	0.0091	0.0066	0.0176	0.0270
88	0.6583	0.2031	0.1753	0.2286	0.3117	0.8582	0.6622
89	0.0040	0.0019	0.0026	0.0024	0.0013	0.0045	0.0086
90	0.0654	0.0188	0.0136	0.0202	0.0238	0.0764	0.0764
91	0.0121	0.0048	0.0113	0.0047	0.0035	0.0233	0.0119
92	0.0040	0.0021	0.0086	0.0024	0.0032	0.0073	0.0114
93	0.0079	0.0026	0.0058	0.0054	0.0030	0.0047	0.0052
94	0.0012	0.0010	0.0015	0.0012	0.0014	0.0009	0.0015
95	0.0518	0.0104	0.0144	0.0104	0.0105	0.0516	0.0585
96	0.0647	0.0083	0.0191	0.0247	0.0148	0.0528	0.1030
97	0.2093	0.0528	0.0734	0.1363	0.0573	0.2956	0.3124
98	0.0	0.0001	0.0011	0.0	0.0002	0.0003	0.0005
99	0.7775	0.2005	0.2906	0.4917	0.2146	0.6879	0.6112
100	0.0563	0.0229	0.0186	0.0194	0.0233	0.0650	0.1130

56. TO-3 Weight Gain Data (Sheet 2 of 2)

WEIGHT GAIN DATA
PACKAGE TYPE : GLASS

COLUMN HEADING = BOMB PRESSURE / INDICATOR FLUID

UNIT NUMBER	60/PP1 WT GAIN	60/PP2 WT GAIN	60/FC77 WT GAIN	60/FC78 WT GAIN	30/FC78 WT GAIN	90/FC78 WT GAIN	105/FC78 WT GAIN
1	0.0720	0.0762	0.0752	0.0732	0.0727	0.0724	0.0727
2	0.0412	0.0435	0.0439	0.0417	0.0415	0.0419	0.0419
3	0.0001	0.0	0.0	0.0011	0.0	0.0	0.0002
4	0.0550	0.0580	0.0572	0.0559	0.0553	0.0555	0.0552
5	0.5410	1.0310	1.0217	0.9877	0.9644	0.9301	0.8325
6	0.0002	0.0	0.0	0.0001	0.0001	0.0003	0.0
7	0.0	0.0	0.0	0.0003	0.0	0.0	0.0001
8	0.0001	0.0	0.0	0.0001	0.0	0.0301	0.0
9	0.5028	1.3728	1.3162	0.5393	1.2672	1.2679	1.1150
10	0.0001	0.0	0.0	0.0010	0.0002	0.0303	0.0
11	0.0002	0.0	0.0	0.0003	0.0	0.0	0.0
12	0.0682	0.0533	0.0212	0.0337	0.0601	0.0665	0.0334
13	0.5631	0.0201	0.0275	0.2462	0.2462	0.0275	0.0267
14	0.0587	0.0621	0.0608	0.0587	0.0587	0.0578	0.0218
15	0.0601	0.1122	0.0713	0.0697	0.0688	0.0686	0.0207
16	0.0	0.0	0.0	0.0	0.0001	0.0002	0.0
17	0.0002	0.0	0.0003	0.0001	0.0	0.0002	0.0
18	0.0	0.0	0.0	0.0001	0.0	0.0303	0.0
19	0.0	0.0	0.0	0.0009	0.0	0.0003	0.0
20	0.0	0.0	0.0001	0.0016	0.0	0.0003	0.0002
21	1.1311	1.1968	1.1815	1.1943	0.1395	1.1388	0.0870
22	1.5560	1.7705	1.7470	1.6927	1.6797	1.6826	0.8428
23	0.0002	0.0	0.0	0.0020	0.0	0.0002	0.0301
24	0.5593	1.3788	1.5072	1.4575	1.1752	1.2326	1.2326
25	1.3887	1.4860	1.4886	1.4234	1.4152	1.4149	0.9261
26	0.6445	0.8176	0.8081	0.7824	0.7777	0.7784	0.5599
27	0.0541	0.0569	0.0564	0.0549	0.0541	0.0537	0.0098
28	0.0589	0.0626	0.0646	0.0623	0.0622	0.0618	0.0196
29	0.0409	0.0451	0.0446	0.0446	0.0441	0.0430	0.0078
30	0.0519	0.0548	0.0539	0.0528	0.0521	0.0522	0.0111
31	1.2935	1.3708	1.3536	1.3132	1.3039	1.3058	0.1467
32	1.2065	1.2771	1.2600	1.2212	1.2146	1.2160	0.1315
33	0.0	0.0	0.0014	0.0005	0.0	0.0002	0.0
34	0.0903	0.0963	0.0949	0.0923	0.0915	0.0915	0.0560
35	0.0002	0.0	0.0	0.0	0.0001	0.0005	0.0
36	0.0690	0.0731	0.0720	0.0697	0.0694	0.0695	0.0159
37	0.9409	1.0799	0.7386	0.8547	0.7980	1.1525	0.7534
38	0.0550	0.0585	0.0579	0.0563	0.0557	0.0550	0.0550
39	0.0474	0.0342	0.0138	0.8986	0.0007	0.0368	0.0311
40	0.0414	0.0436	0.0430	0.0419	0.0416	0.0416	0.0416
41	1.0170	1.0769	1.0639	0.7941	1.0238	1.0248	0.0857
42	1.2477	1.3216	1.3042	1.2664	1.2565	1.2577	0.8041
43	1.0762	1.1405	1.1247	1.0904	1.0825	1.0845	0.0315
44	0.9144	1.1707	1.1556	0.5197	1.1120	1.1111	0.2048
45	1.3015	1.3815	1.3621	1.3131	1.3142	1.3142	0.1802
46	0.4033	1.0920	1.0768	1.0434	1.0375	1.0391	0.1576
47	0.4003	0.9998	0.9877	0.9575	0.9507	0.9520	0.1576
48	0.4798	1.0903	1.0767	1.0427	1.0358	1.0372	1.0338
49	0.4364	1.1193	1.1066	0.0384	1.0652	1.0659	0.3418
50	0.0	0.0	0.0	0.0	0.0	0.0	0.0
51	0.3264	0.8443	0.8329	0.0515	0.8023	0.8022	0.6597

WEIGHT GAIN DATA
PACKAGE TYPE : GLASS

UNIT NUMBER	COLUMN HEADING = BOMB PRESSURE / INDICATOR FLUID									
	60/PT1 WT GAIN	60/PP2 WT GAIN	60/FC77 WT GAIN	60/FC78 WT GAIN	30/FC78 WT GAIN	90/FC78 WT GAIN	105/FC78 WT GAIN			
52	0.0001	0.0	0.0004	0.0035	0.0	0.0002	0.0			
53	0.0005	0.0	0.0	0.0001	0.0003	0.0002	0.0002			
54	0.0	0.0	0.0	0.0006	0.0001	0.0002	0.0002			
55	0.0001	0.0	0.0	0.0002	0.0001	0.0	0.0			
56	0.0001	0.0	0.0006	0.0003	0.0002	0.0	0.0002			
57	0.0003	0.0	0.0	0.0002	0.0	0.0	0.0			
58	0.0004	0.0	0.0	0.0	0.0	0.0001	0.0001			
59	0.0001	0.0	0.0001	0.0005	0.0003	0.0	0.0			
60	0.0608	0.0630	0.0615	0.0616	0.0241	0.0315	0.0213			
61	0.0521	0.0510	0.0620	0.0605	0.0398	0.0314	0.0233			
62	0.0613	0.0648	0.0642	0.0634	0.0614	0.0614	0.0605			
63	0.0576	0.0605	0.0599	0.0584	0.0587	0.0579	0.0442			
64	0.0693	0.0732	0.0724	0.0700	0.0597	0.0696	0.0001			
65	0.0657	0.0659	0.0691	0.0670	0.0655	0.0653	0.0270			
66	0.0639	0.0673	0.0670	0.0657	0.0645	0.0644	0.0439			

57. Glass Standard Weight Gain Data (Sheet 2 of 2)



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