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# Radiation Induced Stress Relaxation in Silicone and Polyurethane Elastomers

Gordon Spellman, William Gourdin, Wayne  
Jensen, Mark Pearson, Inge Fine

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# Radiation Induced Stress Relaxation in Silicone and Polyurethane Elastomers

Gordon Spellman, William Gourdin, Wayne Jensen, Mark Pearson, Inge Fine  
31 March 2005

## **Introduction**

Many different materials are used in the National Ignition Facility, NIF, located at Lawrence Livermore National Laboratory, LLNL. Some of these are exposed to significant doses of ionizing radiation. Two elastomers are of special interest because they are used in sealing applications with long expected lifetimes. These are LPU4, a polyurethane formulated at LLNL, and Dow Corning DC93-500, a silicone RTV elastomer. In 2004 a program to determine the impact of ionizing radiation on the stress relaxation and compression set characteristics of these two elastomers was undertaken.

Since the materials are used in continuous compression and must reliably seal, the primary test utilized was a stress relaxation test. This test provides insight into the ability of a seal to remain functional in a static seal. The test determines how much residual force remains after a certain period of time under compression. The temperature and absorbed radiation dose can dramatically impact this property. In this study the only independent environmental variable studied is the effect of radiation at ambient temperatures. Two levels of radiation exposure were studied, 1 MRad, and 10 MRad. One of the independent test parameters is the compression deflection during storage and in this test the value used was 25%. The need for a compression retention mechanism ruled out radiation exposure in the compressed direction since the high atomic number materials for that device would block the radiation. Therefore, an annular ring was chosen for the specimen shape. The procedures are, as closely as possible, based on ASTM D 6147-97.

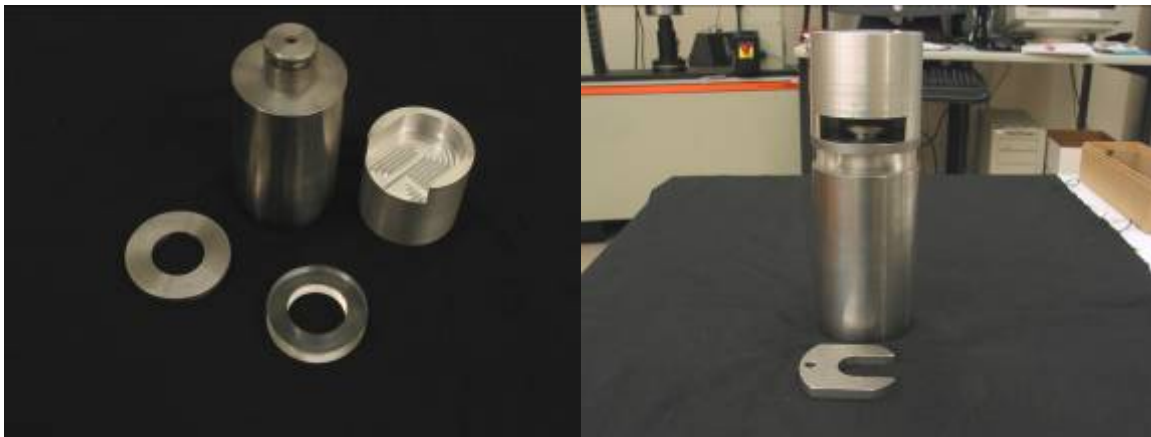
Since the data is readily obtained at the end of the stress relaxation test, the samples were also evaluated for compression set. Compression set is the essentially permanent deformation incurred in a seal after the seal is compressed for some period of time and then unloaded. Though this is indicative of potential sealing reliability, it is not as direct an indicator of seal performance as is stress relaxation. Compression set does not yield any useable, quantified information but is an indicator of viscoelastic deformation with time. The needed thickness measurements were obtained both from the unloading curves and direct measurement in general accordance with ASTM D395-03.

The radiation source for this testing was the Co60 gamma source located at Lawrence Livermore National Laboratory (LLNL). This source has an exposure vessel approximately 29.2cm (11.5") tall with an inside diameter of 7.44cm (2.93"). Because of the geometry limits, cylindrical symmetry and limited volume, a standard stress relaxation test such as ASTM D 6147-97 could not be utilized and a modified test was developed. An additional constraint imposed by the vertical asymmetry of the radiation dose in the exposure chamber was a limited height with reasonably uniform radiation exposure. The specific dimensions and radiation characteristics of the test cell are in *Appendix A*.

## **Details of test**

The testing geometry chosen was a 1.27cm (½ inch) thick annular ring with an inside diameter of 3.81cm (1 ½ inches) and an outside diameter of 6.35cm (2 ½ inches), (Fig 1.) This fixture could be placed in a container and lowered into the exposure chamber of the Co60 source.

An Instron mechanical test machine was used to compress the samples in the fixture. The sample was compressed to just past 25% compression %, 0.318cm (1/8”), and a lock plate was installed to hold this compression during radiation exposure. The load on the fixture was then released and the sample was promptly sent to the exposure chamber, exposed for a time to yield one of the accumulated doses, 1 or 10 MRad, and then returned and unloaded in the same mechanical test machine. During unloading the sample was compressed again to just past 25% of original thickness and the lock removed. The sample was then unloaded in a controlled fashion. The load at the point where motion of the fixture top first occurred during the unloading operation, the “liftoff point” was taken as the final load. In all cases, there was a small amount of deflection of the component past 25% during the loading and unloading, but this is not thought to have any significant impact on the test results. The stress relaxation is calculated as the drop in load as a quotient of the original load. All loading and unloading deflection and load data was collected electronically. Because of the cost of fixtures, the testing was limited to three samples for each condition, the minimum recommended in both referenced ASTM procedures.



*Figure 1*

Test Specimen and Test Fixture

The initial load to compress the samples to 25% was taken as the baseline. The deterioration of the load owing to normal stress relaxation control samples with no radiation exposure was used. Since time is an independent parameter in this testing, the controls were left loaded for approximately the same amount of time as the irradiated specimens.

During initial loading, the total deflection is 0.318cm (1/8”), which is 25% of the ring’s original thickness of 1/2”. During the unloading, after irradiation, the displacement from first contact point to where the sample just becomes completely unloaded is no longer 0.318cm (1/8”) since there is some compression set. This reduced deflection measured during unloading was used as one means to calculate compression set. The calculation is the original deflection, 0.318cm (1/8”), less the reduced deflection after exposure as a quotient of the original compression deflection, *not* the total thickness of the part. Compression set was estimated by direct measurement of the thickness of the specimens after being removed from the test fixture. The time between removal and measurement should be controlled and was targeted to be 30 minutes. That was not the case for all data collected. Details of these measurements are in *Appendix B*.

Details of the operational procedure for the compression testing aspects are included in *Appendix C*. The test sample designations are shown below in *Table 1*. Samples 1a, 1b, 1c, 2a, and 2b are considered developmental samples and are not included in results though the data is contained in the spreadsheets imbedded in this report.

## Results

The nomenclature used to track specific test specimens consisted of a serial number and a suffix letter. The specific tests are shown in the matrix, *Table 1*. Tests numbered 1 or 2 were preliminary and are excluded from final results. The details of test dates and times are included in:



Test ID and  
Times.xls

*Table 1*  
Test Sample Designation

Radiation Dose	NONE	1MRad	10MRad
LPU4 specimens	2a, 2b, 4b, 8a, 8b	10a, 10b, 11	4a, 9a, 9b
DC 93-500 specimens	1a, 1b, 1c, 3b, 5a, 6b	7a, 7b, 12, 13	3a, 5b, 6a

There was little change in the compressive stress relaxation properties of either material when exposed to 1Mrad of gamma radiation, *Table 2*. At 10 Mrad exposure there were significant changes for both materials. The LPU4 control exhibited a drop in load of 10%. With 1 MRad exposure, the 11% load loss was equivalent to that of the control. However at 10MRad exposure there was a significant difference and the load dropped 26%. The DC 93-500 exhibited similar drops in load of 8%, 5%, and 10% for exposures of none, 1MRad, and 10 MRad respectively. These results are detailed in Table 2 and Figures 2 and 3.

As discussed earlier, compression set was evaluated from both the load release curve of the compression testing as well as the direct measurement of sample thickness in the unloaded state before and after loading and radiation exposure. The results from the load release are included in Table 3 and are also described in *Figure 2*.

Table 2  
Radiation exposure (gamma) of LPU4 and DC 93-500  
Stress Relaxation

Table of stress relaxation, %					
Material	Radiation Dose	Test 1	Test 2	Test 3	Avg
LPU4	None	11	8	10	10
LPU4	1 MRad	Bad data	Bad data	9.5	9.5
LPU4	10 MRad	27	26	25	26
DC 93-500	None	Bad data	Bad data	8	8
DC 93-500	1 MRad	4	6	4	5
DC 93-500	10 MRad	14	6	11	10

Table 3  
Radiation exposure (gamma) of LPU4 and DC 93-500  
Compression Set

Table of Compression Set Measured by Compression Initial Loading Point, %*					
Material	Radiation	Test 1	Test 2	Test 3	Avg
LPU4	None	6	6	10	7
LPU4	1 MRad	13	10	15	13
LPU4	10 MRad	34	34	35	35
DC 93-500	None	6	11	11	9
DC 93-500	1 MRad	14	13	7	11
DC 93-500	10 MRad	31	46	44	41

\*Based on un-recovered thickness as a percent of original compressed deflection  
Or  $[(t_{\text{original}} - t_{\text{final}}) / (\text{amount of compression})]$ ; compression in this case was .125”  
These measurements are from the instantaneous unloading point. Measured thicknesses  
were also done after some relaxation time and are reported in Table 4 and Figure 4.

Below is all of the compression test data in graphical format. The first two graphs, *Figure 2*, are summaries in which replicate runs are combined into one set of data. These are useful to assess general effects. The graphs following those, *Figure 3*, include the data for each separate test. These give a good representation of repeatability. **These graphs and the details used to generate them are contained in both:**

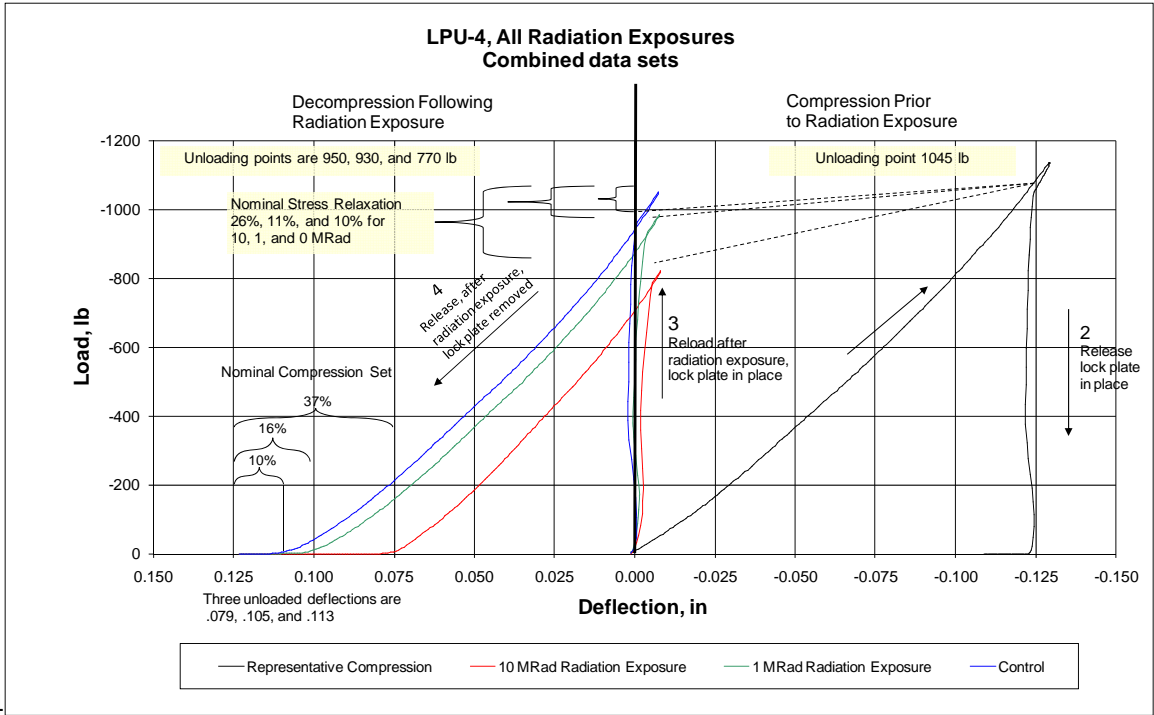


DC 93-500  
Summary.xls



LPU4 Summary.xls

**Figure 2**  
Summary Graphs, Load Retention



LPU4

**Dow Corning 93-500**

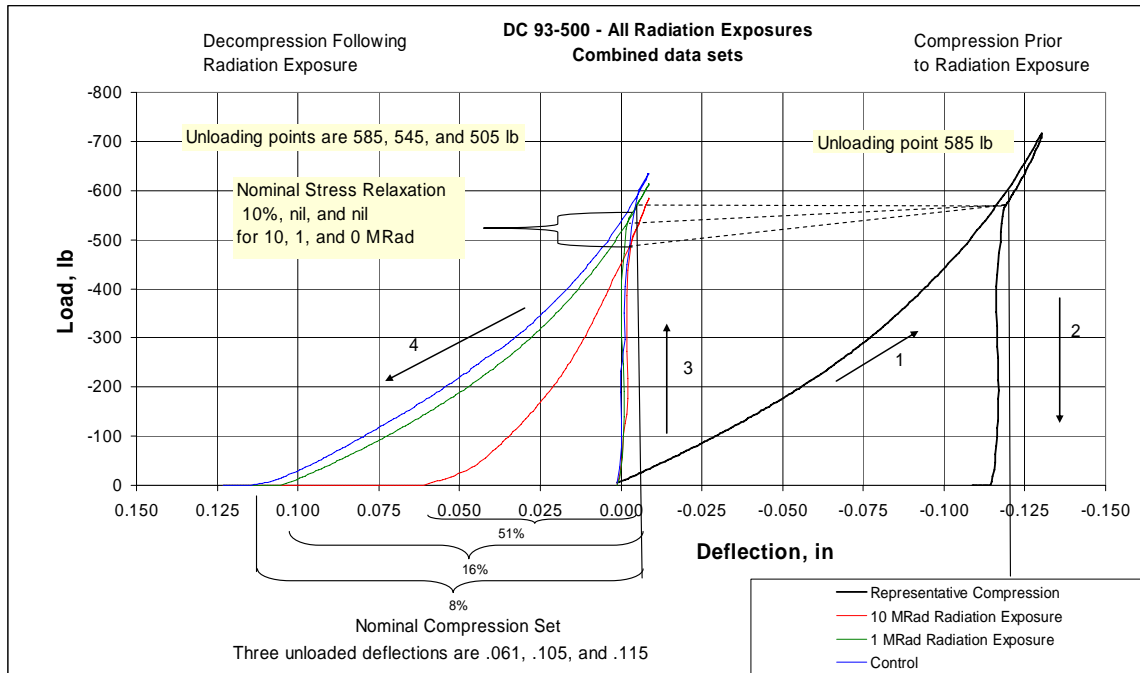
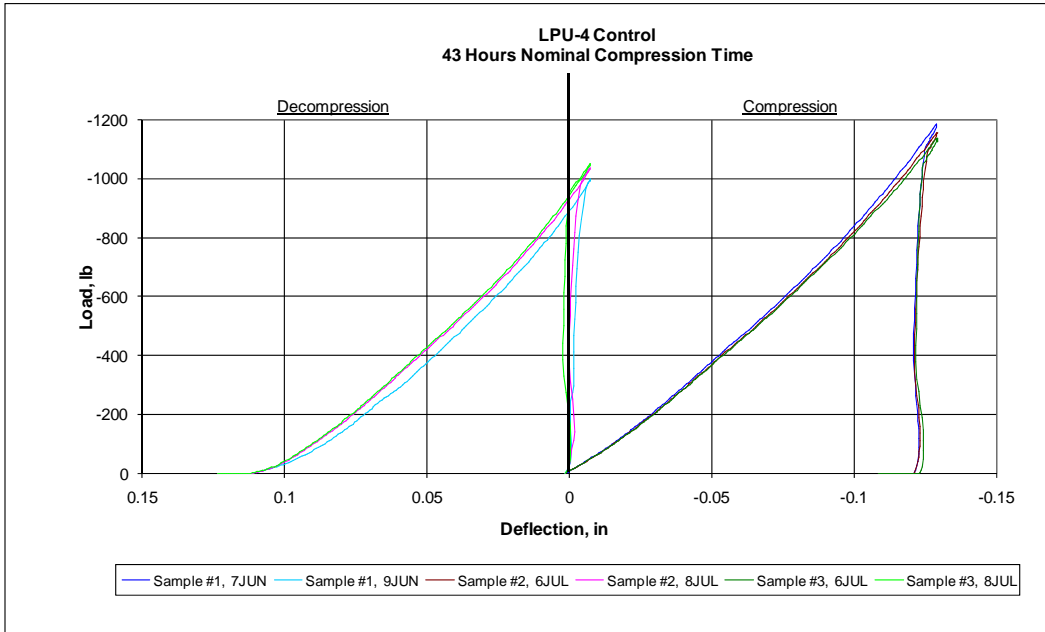
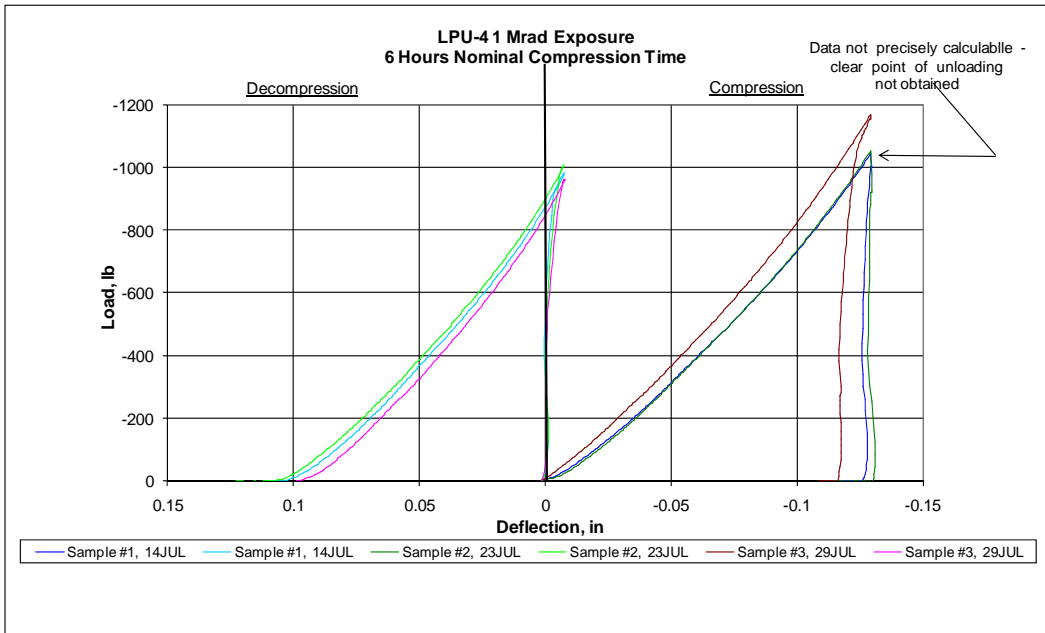


Figure 3  
Detailed Graphs for Load Retention

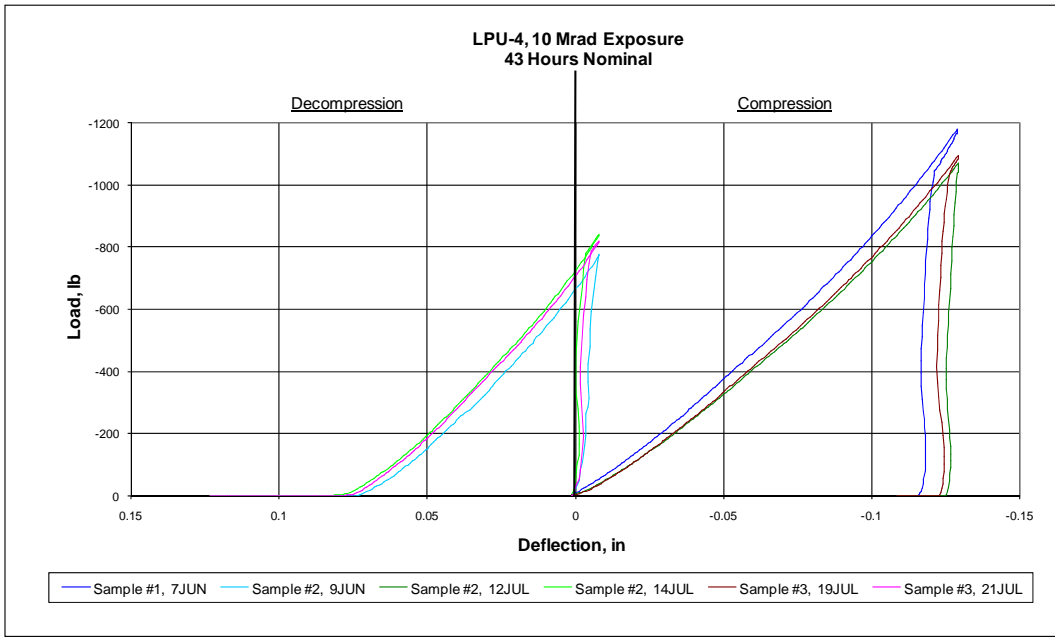


LPU4 Controls with nominal 43 hours of loaded condition. Range of stress relaxation is 8, 10, and 11%. Compression set values are 10, 10, and 16%.

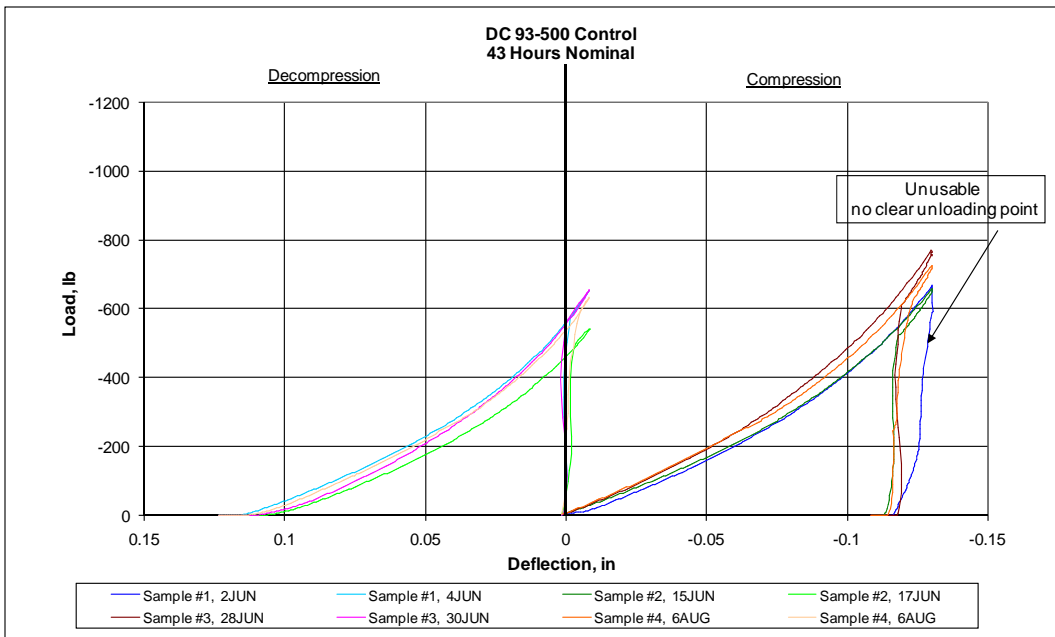


LPU4 1 MRad exposure with nominal 8 hours of loaded condition. Stress relaxation of single valid point is 9.5%. Compression set values are 14, 17, and 20%.

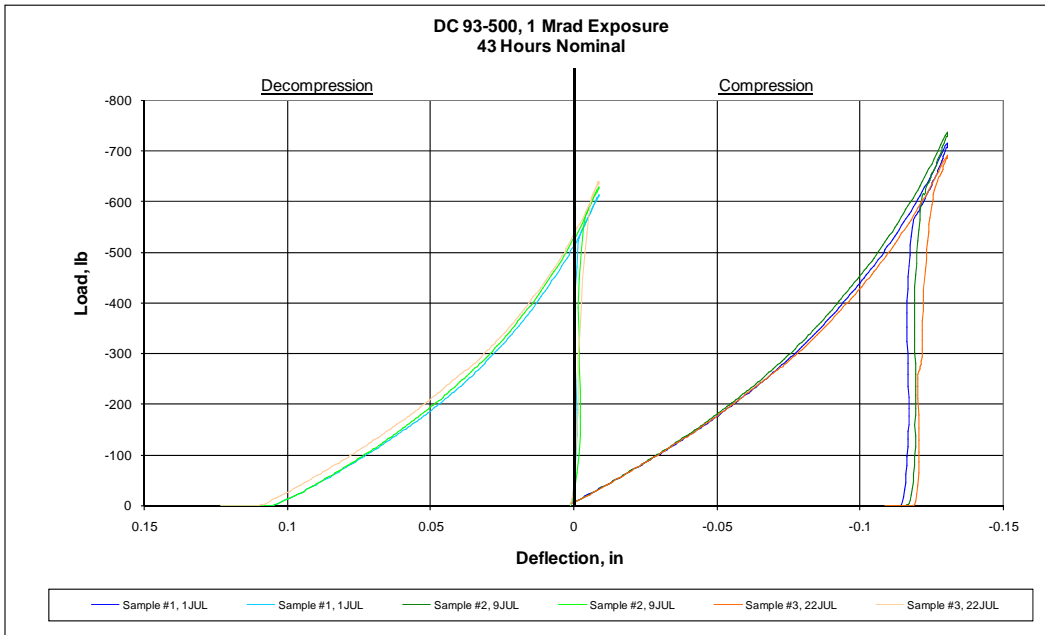




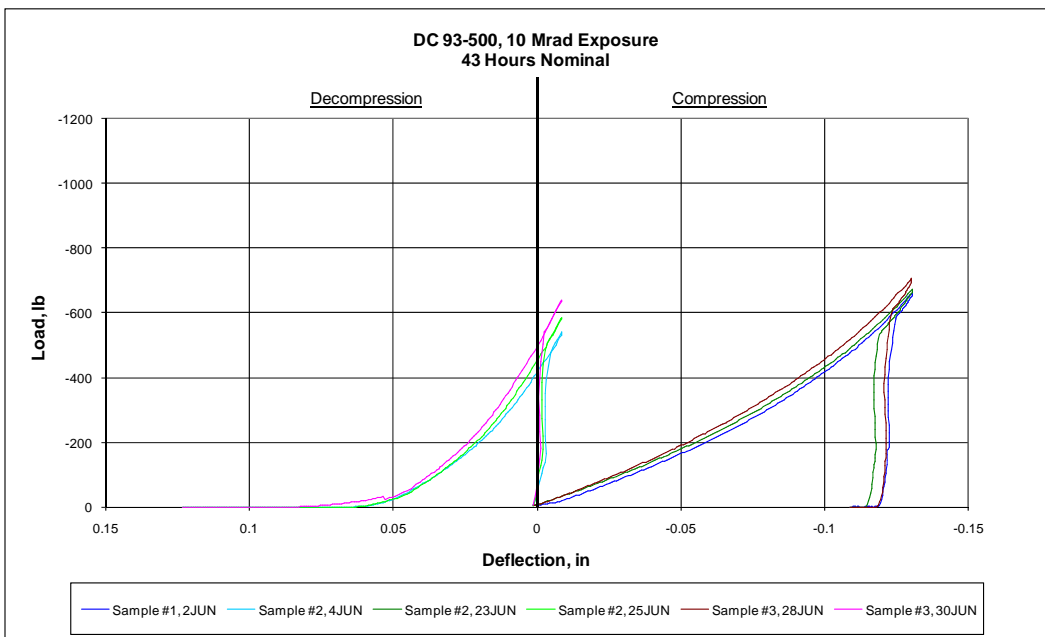
LPU4 10 MRad exposure with nominal 43 hours of loaded condition. Range of stress relaxation is 25, 26, and 27%. Compression set values are 32, 36, and 40%.



DC 93-500 control with nominal 43 hours of loaded condition. Range of stress relaxation is 4, 6, and 9%. Compression set values are 8, 11, and 14%.



DC 93-500 1 MRad exposure with nominal 8 hours of loaded condition. Range of stress relaxation is 4, 6, and 6%. Compression set values are 12, 16, and 16%.



DC 93-500 10 MRad exposure with nominal 43 hours of loaded condition. Range of stress relaxation is 6, 11, and 14%. Compression set values are 49, 50, 50%.

The compression set results based on direct measurement of thickness are presented in summary form in the table below and in the graphs following the table. In some cases there was noticeable dishing of the specimen with the inside and outside edges of the ring being thicker than the center of the annulus. Therefore measurements were taken at these three radial positions. **The details of all measurements as well as supplementary analytical graphs are in:**

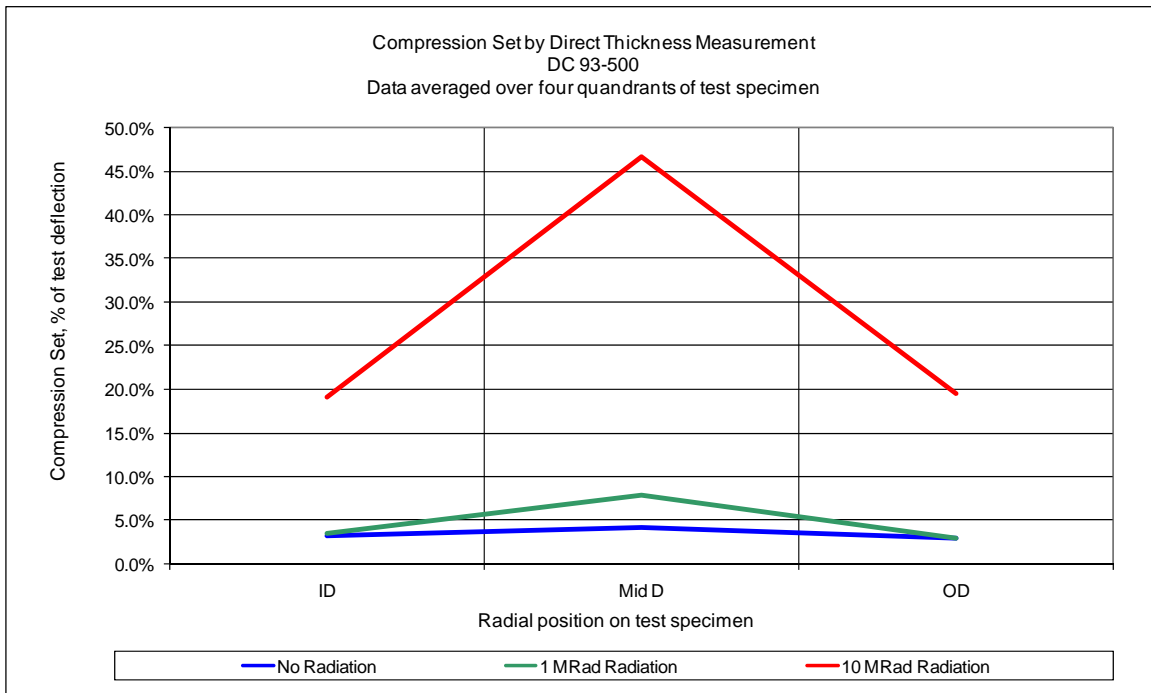
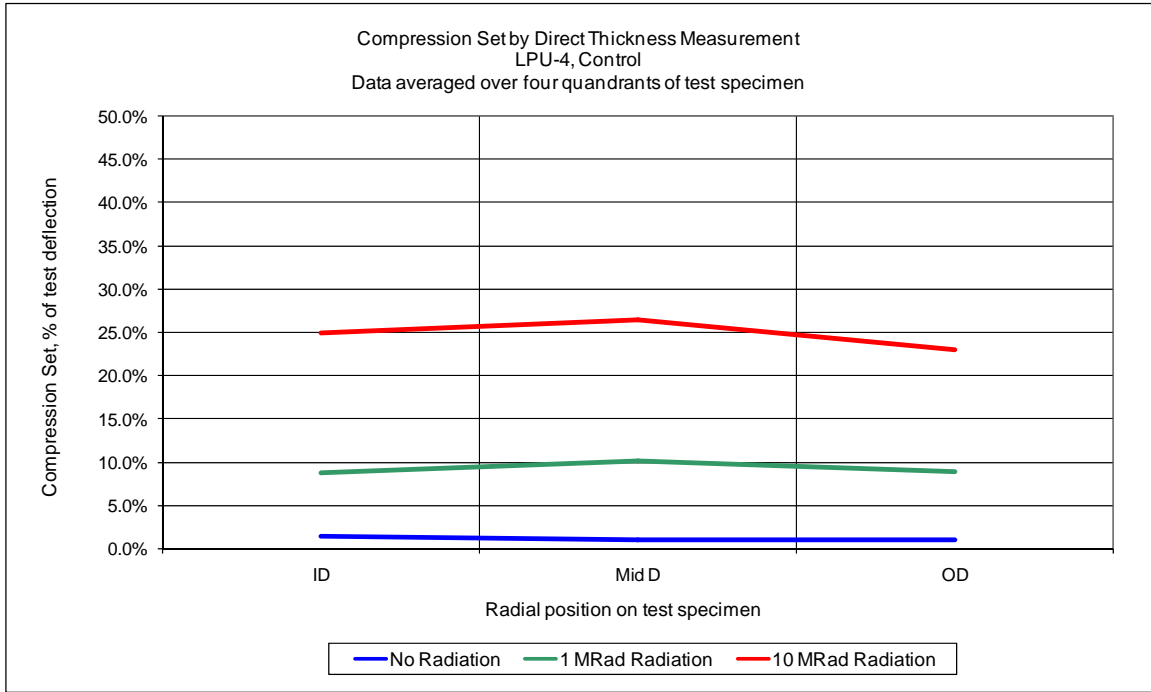


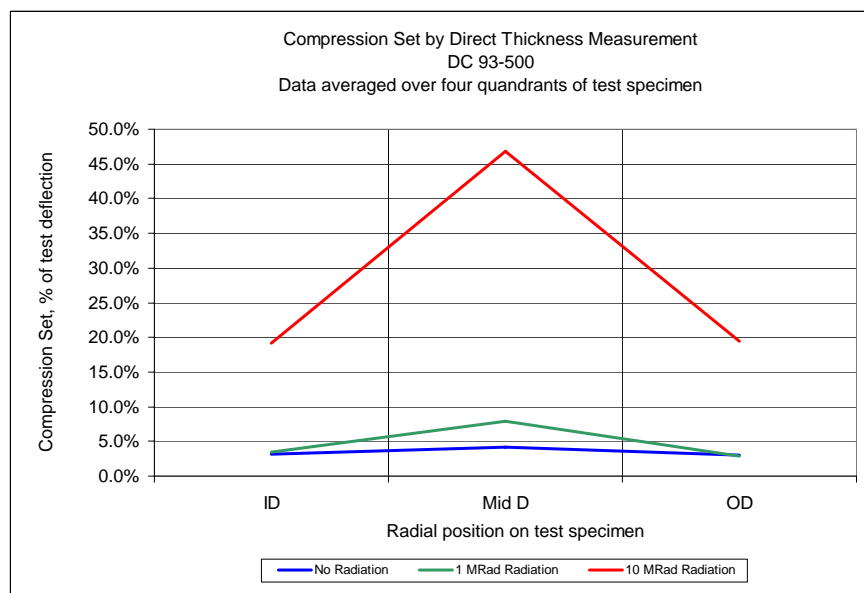
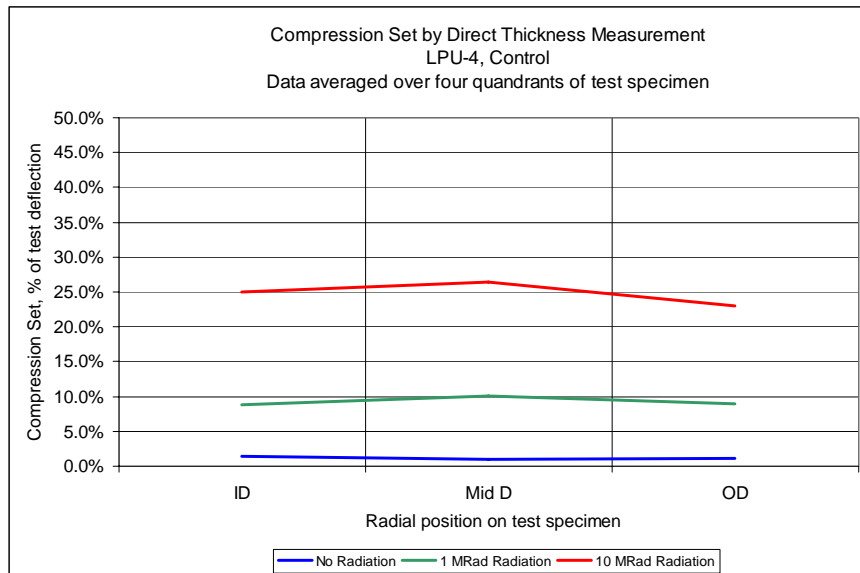
Compression Set by  
Thickness.xls

Table 4  
Compression Set by Direct Thickness Measurement

	Compression Set by Thickness Measurements (Percent of deflection)		
Polymer	Radiation Dose		
	None	1 Mrad	10 Mrad
DC 93-500	3.5%	4.8%	28.5%
LPU4	1.2%	9.3%	24.8%

*Figure 4*  
**Compression Set by Thickness**





During the test program a very anomalous sample was discovered. The data from that sample has been excluded from any summary information. An effort was made to discover the cause of the anomalous behavior and the details of that investigation are included in *Appendix D*.

### Conclusions

The urethane elastomer LPU4 shows substantially more stress relaxation after receiving an accumulated dose of 10 Mrad than does the RTV silicone DC 93-500. In contrast, DC 93-500 has somewhat higher compression set than LUP4 under the same conditions. At 1 Mrad exposure changes in these parameters appear to be negligible in comparison to control samples, although there may be a slight increase in compression set for both materials at 1Mrad exposure.

## Appendix A Details of Radiation Test Environment

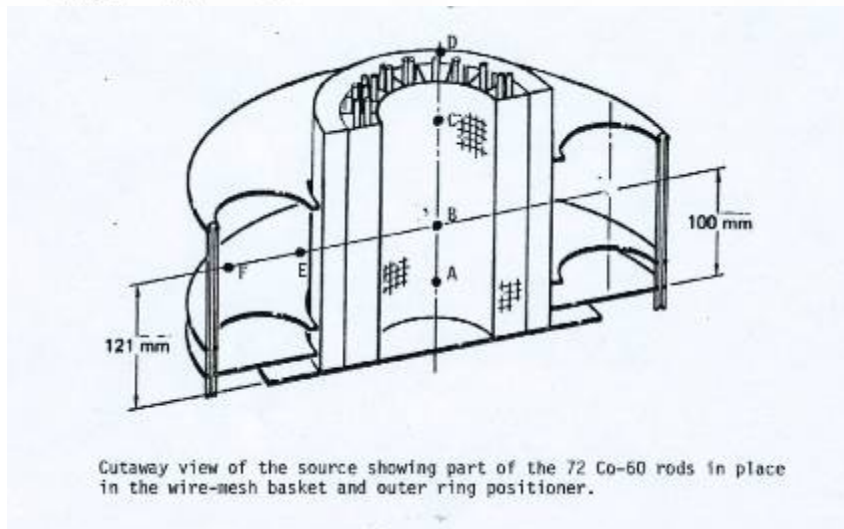
The dimensions, in inches, of the canister which is inserted into the radiation exposure vessel are:

<u>Dimension</u>	<u>Centimeters</u>	<u>Inches</u>
Inside height	29.2	11.5
Inside diameter	7.44	2.93
Outside diameter of tubing	7.83	3.08
Outside diameter of flange & lid	11.2	4.4
Thickness of flange and lid (each)	1.75	0.69

Below is information on height from the bottom of the canister to the area of maximum radiation flux. The canister rests on the flat bottom surface so that maximum flux is at a height of 121mm.

### Co-60 Pool Dose Rates

Position	Distance (cm) from floor	Calib date								
		1/18/83 krad/min	Mar-2003 krad/min	May-2003 krad/min	Jul-2003 krad/min	Sep-2003 krad/min	Nov-2003 krad/min	Jan-2004 krad/min	Mar-2004 krad/min	May-2004 krad/min
A	5.5	64	4.50	4.40	4.31	4.21	4.12	4.03	3.95	3.86
B	12	71	4.99	4.88	4.78	4.67	4.57	4.48	4.38	4.29
C	19	57	4.00	3.92	3.83	3.75	3.67	3.59	3.52	3.44
D	23	36	2.46	2.41	2.35	2.30	2.25	2.21	2.16	2.11
E	12	15	1.05	1.03	1.01	0.99	0.97	0.95	0.93	0.91
F	12	9.1	0.64	0.63	0.61	0.60	0.59	0.57	0.56	0.55
	Time (yrs)		39.2	38.1	36.9	35.7	34.8	33.0	31.1	29.3
	date	1/1/69	Mar-2003							
	activity (Ci)	100,000	1103							



*Appendix B*  
**IOM Compression Set Testing Using Measured Thicknesses**

The following setup was used to measure the thickness of silicone rings prior to Instron testing.



B&S .0001" indicator model 7028-4. No s/n  
Cadillac gage Model HG-6, ser# 9711G  
SPI Height gage Model N31-527-5, no s/n  
Mannix Temp/Hygro gage Mod CMM880 s/n 827984

The silicone rings are arbitrarily numbered, the ID is marked on the bore of the ring and this serves as the "12 o'clock" position for measurement. Heights above surface table measurements are taken in the approximate locations shown. These measurements shall be treated as approximations of thickness.



*Appendix C*  
**Details of Compression Testing Methods**

- Calibrate the load cell- This is done automatically by selecting the load cell icon located in the upper most right portion of the screen; it will be the third icon from the right. Choose calibrate from the load window, verify that there is no load on the load cell. The spherical seat platen is not considered a load. Choose OK. This will take a few seconds. Choose Done.
- Balance Load- This is done automatically. **Located in the upper most left corner**
- Align lower spherical seat platen (NEW)- Without test fixture close the platens together, **as you become close to touching use the fine position knob to apply a load of approximately -500 to -1000 lbf.** This will align the lower spherical seat platen with the upper platen. Open the platen until the gap is wide enough to easily insert the entire test fixture. **The crosshead and column is marked with red tape to indicate proper positioning for easy fixture placement.**
- Assemble the fixture with test seal



IOM fixture parts and seal (NO locking key)



A

B

C

- A) Place the seal over the top and centered on the steel fixture base.
- B) Place the steel compression ring over the seal
- C) Place the aluminum compression cap over the steel compression ring

Note: "Compression lock key" in front of the fixture base in photo C. This key will be needed during this test.



- Mount parts in Instron- Insert the FULLY assembled IOM fixture between the platens. When doing so try to place the assembled fixture as close to the center of the lower spherical seat platen as possible without touching the outer edge of the platen. Once this is accomplished you can now carefully fine position the fixture to the center using the circular markings on the lower platen. \*Note: Applying even a low force to the outer edge of the spherical seat platen will cause it to tilt, thus become misaligned with the upper platen. Misalignment may lead to an inappropriate starting point and cause problems during key insertion and removal.
- Balance the load cell
- Adjust the starting load- This step is important; it will help achieve a reproducible starting point for each test. With the assembly in place, carefully close the platens until a slight compressive force (negative) is applied. As you get close to touching the test fixture use the fine adjustment knob. Continue to close the platens one increment at a time until you go just beyond -5.0 lbs of compressive force. Now in the opposite direction and still using the fine adjustment knob open one increment. You should be at the starting point, which is with a compressive force applied but less than -5.0 lbs (**DO NOT Balance Load**).
- RESET Gauge Length (important) - **Resetting** the gauge length to zero is critical. **The method cannot perform correctly unless it starts at .000”**.



- Ready to start first phase of testing

## PHASE I TESTING

- 1) Start Test- This test will essentially compress the part, closing the platens @ .050” per minute until the crosshead displacement reaches .138”. At this point the crosshead will hold its position for ten seconds. This ten-second stop is the time the compression lock key is inserted in the slot above the steel compression ring. After the ten second hold the crosshead will start opening. After .028” of travel the crosshead will stop. The extension read out should be .110”. The lock key keeps the seal in compression so the entire assembly can be removed after the test.

2) Part compressed, locked and ready to be removed



3) End and Save Data

At this point it's time to save the data, but before doing so open the dog bone Icon (located just below the traffic light) and label the pertinent data fields available.

Examples:

DEFINE	Name:	Compression Lock
SPECIMEN	Specimen Name:	93-500 (3a)
NOTE	Operator:	Enter your name
	Company:	LLNL
	Lab Name:	Plastics
	Humidity:	40%
	Temperature:	73F
	Note1:	MP2-61A (the log book entry ID)
	Note2:	IOMSEAL1 (The Method name)

*You can add more than one note by scrolling up in the box next to note.*

Go to the file menu and select data end and save. Under the File Name: Label the data file using the logbook entry then Save. (Note: there may be more than one window open containing a file menu, but only one has the Data – End and Save option)

## **PHASE II TESTING**

- 1) Equipment start- Use the same guidelines as in Phase I testing
- 2) Enter the Software
  - a) Double click the Merlin button to the left of the series IX button.
  - b) In test type, select (scroll down) compression-Test profiler.
  - c) Select IOMSEAL2
  - d) Select test control (the traffic light icon)
  - e) Select Test (two down on left)
  - f) Select Profile: Be sure that IOMSEAL2 is displayed; if not select browse and scroll down to select it (double click). Close the test control window
- 3) Calibrate the load cell- Use the same procedure described in Phase 1 Testing.
- 4) Balance Load
- 5) Align lower spherical seat platen- Without test fixture close the platen together and apply a load of ~ -500 to -1000 lbf. This will align the spherical seat platen with the upper platen. Open the platen until the gap is wide enough to easily insert the entire test fixture. **The crosshead and column is marked with tape to indicate proper positioning for fixture placement.**
- 6) Mount parts in Instron- Insert the FULLY assembled IOM fixture between the platens. When doing so try to place the assembled fixture as close to the center of the lower spherical seat platen as possible without touching the outer edge of the platen. Once this is accomplished you can know carefully fine position the fixture to the center using the circular markings on the lower platen. **\*Note:** Applying even a low force to the outer edge of the spherical seat platen will cause it to tilt, thus become misaligned with the upper platen. Misalignment may lead to an inappropriate starting point and cause problems during key insertion and removal.
- 7) Balance load cell- Carefully close the platens using the fine adjust knob until a compressive force of -5.0 lbs is applied. (No more than -5.0 lbf)
- 8) RESET gauge length (important)

- 9) Start Test-This test will compress the part @ .050” per minute until the displacement reaches .016” at which time the crosshead will stop for ten seconds. **It won’t take long to reach this point so be ready.** Remove the compression lock key from the slot above the steel compression ring **using a predetermined tool.** After the ten second hold the crosshead will start opening @ .050” per minute for .138” of travel or to zero load. The extension should be reading .122”at the end of the test.

**\*Repeat the labeling and end and save process used in Phase I testing.**

10) Cold Shut Down-

- Exit from Merlin software – Message 1867 say OK
- Shut Down PC with Start Menu in lower right corner
- Turn off power to Instron with switch behind black box

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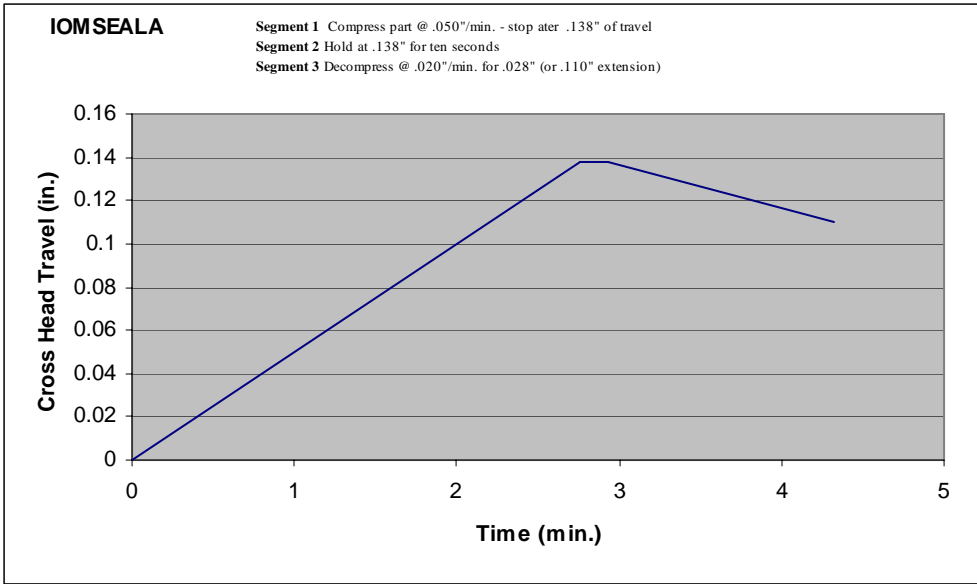
**Procedure for converting raw data into Excel files, then downloading to ZIP disk:**

1. Place ZIP disk into ZIP drive
2. Go to the Desk Top
3. Open Excel (short cut on desk top)
4. Using the file menu select open
  
5. In the Open window go to Files of Type:
6. Select All Files
7. Select Local disk (C:)
8. Double click Instron Folder
9. Double click User Folder
10. Double click Data Folder

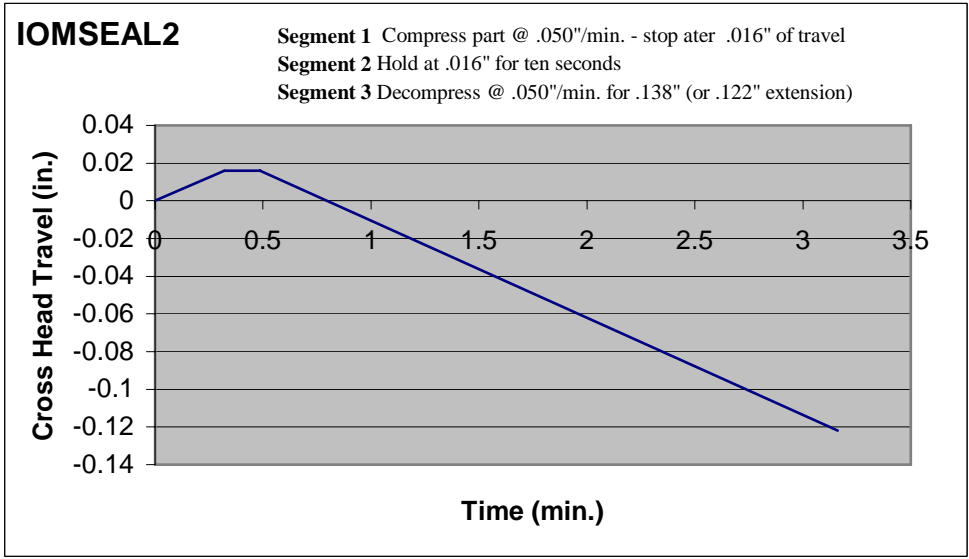
\*The Data folder is where most of the Merlin data files are kept. Some of the older Merlin files are in the Pearson folder, within the Data folder. You can also use search to find the raw data.

**Procedure to search for raw data:**

1. Scroll to the correct raw data file and double click
2. In Text Import Window the file type should have delimited selected; if not, select it.
3. Choose Next
4. Select comma delimiters
5. Choose Finish
6. In File Menu, select save as
7. In Save In, choose removable disk (D:) and Save
8. The Excel format window will pop up, select YES
9. Now close out Excel – It will ask if you want to save changes
10. Choose NO



Time	Ext	Speed
0	0	
2.76	0.138	.050"/min
2.93	0.138	Stop & Hold
4.32	0.11	.020" / min



Time	Ext	Speed
0	0	
0.32	0.016	.050" /min
0.4867	0.016	Stop & Hold
3.2467	-0.122	.050" /min

*Appendix D*  
**Study of Anomalous Specimen**  
**Contributed by Mark Pearson**

Observations during the IOM seal testing revealed a unusually high initial compressive load value on part 93-500 #12. I've summarized the average load achieved on initial testing for each of the LPU4 and 93-500 parts tested. The 93-500 part #12 was not included in the average for 93-500.

**Average maximum load of LPU4 and 93-500 in compression**

	<b>LPU4</b>	<b>93-500</b>		93-500 #12
Avg. of 11 parts	1114.7 lb	683.5 lb	Single part	1078.0

Because of this high compressive force obtained during IOM Seal test on part 93-500 #12 some quick comparisons with a known 93-500 (13) and LPU4 (10a) seals were made. Each of these three parts have been exposed to 1.0 mRad of radiation.

**Weight Comparison**

Ten IOM seal parts from each, the LPU4 and 93-500 were weighed (the part in question, 93-500 #12, was included in the 93-500 statistics). Table 1 contains a summary of the data of interest. Table 2 contains the values for each part measured.

**Table 1**

93-500 #12	<b>26.9512</b>
Avg.	27.0727
SD	0.1244
LPU4	
Avg.	27.85225
SD	0.2396579

**Table 2. Weight of IM Seal parts**

**IOM Seal Weight after testing**

Part ID	Weight (g)	Comments	Part ID	Weight (g.)	Comments
93-500 #1b	27.0109		LPU4 #2a	27.9736	Translucent appearance (Blooming?)
93-500 #1c	27.3159		LPU4#2b	27.8371	Translucent appearance (Blooming?)
93-500 # 3b	27.0775		LPU4 # 4b	28.2078	Translucent with surface irregularities (shrinkage?)
93-500 # 5a	26.9591		LPU4 #8a	28.0099	Clear
93-500 # 5b	27.0952	Noticeable compression set	LPU4 #8b	28.0419	Clear
93-500 # 6a	27.2388	Noticeable compression set	LPU4 #9a	27.8159	Amber clear with noticeable compression set
93-500 # 6b	27.0272		LPU4 # 9b	27.6316	Amber clear with noticeable compression set
93-500 #7a	26.9420		LPU4 # 10a	27.7830	Clear
93-500 #7b	27.1094		LPU4 # 10b	27.8786	Clear but not as clear as 5a/b
93-500 #12	<b>26.9512</b>		LPU4 # 11	27.3431	Clear
SUM	270.7272		SUM	278.5225	
Avg.	27.0727		Avg.	27.85225	
SD	0.1244		SD	0.239658	

Balance used: OHAUS Analytical Plus

Balance was calibration weight checked prior to measurements.

The balance was tarred between each measurement

7/29/2004 (MP2-83)

### Shore A Hardness

The Shore A hardness of Part #12 was measured at 54, and fell directly in the middle of the 93-500 and LPU4 parts that were measured (table 3)

Part	Shore A
LPU4 # 10a	61
93-500 #12	54
93-500 #13	47

Table 3

### TGA

TGA was conducted on small sections of each of the three parts. The temperature range covered between 25°C through 500°. The ramp rate was 10°C per minute. Argon was used as the purge gas. The TGA data indicates that part #12 is indeed 93-500, or at least is not LPU4. The LPU4 decomposition onset was ~ 300°C. (See figure 1.)

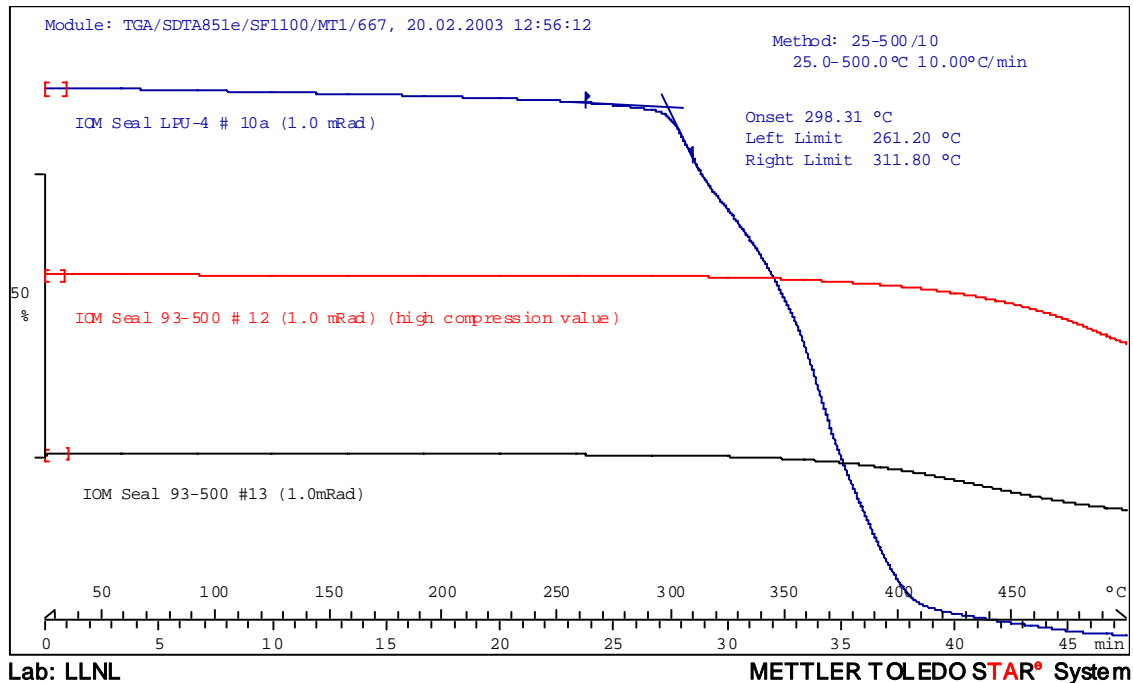


Figure 1. TGA curves for all three parts

### Thickness Measurements

Simple thickness measurements were taken on each of the three parts using the Onno Sokki Thickness Gauge (Model EG-233 No. 00020) with the Flat .318" diameter tip. The thickness measurements do indicate that the 93-500 # 12 part is slightly thicker than each of the other parts (Photo 1).

### Visual Observations

The part in question, 93-500 #12, appears to be darker than either the LPU4 #10a or the 93-500 #13 (Photo 1). In addition to the part thickness values, the shore-A hardness and Max load values achieved for each individual part is recorded on photo 1.



*Photo 1*



IOM Seal Starts

Log ID	Part ID	suffix	Method	Fixture	Test Description	Start Date	Time	Elapsed time	Max (lbf)	Thickness meas. Date/Time	Elapsed Time
DP1-25A	93-500 #1a	1a			Power Failure - no data	5/27/2004					
MP2-85A	93-500 #1a	1a	IOMSEALA	#1	Phase I - Compress & Lock	8/6/2004	830	NA	727.2		
MP2-85B	93-500 #1a	1a	IOMSEAL2	#1	Real Phase II Compress & Unlock	8/6/2004	915	45 min	634.0		
DP1-25A-1B	93-500 #1b	1b	IOMSEALA		Compression & Lock	5/27/2004	810	NA	642.6		
DP1-25A 1B-1	93-500 #1b	1b	IOMSEAL2		Unlock & Decompress	5/27/2004	1350	5 hr 40 min	555.2	6/27/2004	1445
DP1-25A 1C	93-500 #1c	1c	IOMSEALA		IOM Seal Trial Compress & Lock	5/27/2004	835	NA	590.4		
DP1-25A 1C-1	93-500 #1c	1c	IOMSEAL2		Unlock & Decompress	5/27/2004	1425	6 hr 50 min	521.9	7/10/2004	1245
DP1-25A 2A	LPU-4 #2a	2a	IOMSEALA		IOM Seal Trial Compress & Lock	5/28/2004	820	NA	1127.9		
DP1-25A 2A-1	LPU-4 #2a	2a	IOMSEAL2		Unlock & Decompress	5/28/2004	1455	6 hr 25 min	989	6/1/2004	700
DP1-25A 2B	LPU-4#2b	2b	IOMSEALA		IOM Seal Trial Compress & Lock	5/28/2004	830	NA	1141.1		
DP1-25A 2B-1	LPU-4#2b	2b	IOMSEAL2		Unlock & Decompress	5/28/2004	1600	7 30 min	925.2	6/10/2004	1115
MP2-60A	93-500 # 3a	3a	IOMSEALA	#1	Phase I - Compress & Lock For Red exposure	6/2/2004	1405	NA	660.2		
MP2-61C	93-500 # 3a	3a	IOMSEAL2	#1	Real Phase II Compress & Unlock (10 mRad exposure)	6/4/2004	915	43 hr 10 min	541.7	6/10/2004	1115 ~6 days
MP2-60B	93-500 # 3b	3b	IOMSEALA	#2	Phase I - Compress & Lock for Control	6/2/2004	1417	NA	669.5		
MP2-61D	93-500 # 3b	3b	IOMSEAL2	#2	Real Phase II Compress & Unlock Control	6/4/2004	940	43 hr 23 min	664.2	6/7/2004	700 ~3 days
MP2-63A	LPU-4 # 4a	4a	IOMSEALA	#1	Phase I - Compress & Lock For Rad exposure	6/7/2004	1410	NA	1181.4		
MP2-66A	LPU-4 # 4a	4a	IOMSEAL2	#1	Real Phase II Compress & Unlock (10 mRad exposure)	6/9/2004	935	43 hr 25 min	779.4	6/10/2004	915 1 Day
MP2-63B	LPU-4 # 4b	4b	IOMSEALA	#2	Phase I - Compress & Lock for Control	6/7/2004	1425	NA	1186.0		
MP2-66B	LPU-4 # 4b	4b	IOMSEAL2	#2	Real Phase II Compress & Unlock Control	6/9/2004	957	43 hr 32 min	997.0	6/9/2004	1320 1" 20"
MP2-71A	93-500 # 5a	5a	IOMSEALA	#1	Phase I - Compress & Lock for Control	6/15/2004	1045	NA	660.6		
MP2-71B	93-500 # 5a	5a	IOMSEAL2	#1	Real Phase II Compress & Unlock Control	6/17/2004	620	43 hr 35 min	542.9	7/21/2004	1530 ~ 34 days
MP2-72A	93-500 # 5b	5b	IOMSEALA	#1	Phase I - Compress & Lock For 10 mRad exposure	6/23/2004	1415	NA	671.5		
MP2-72B	93-500 # 5b	5b	IOMSEAL2	#1	Real Phase II Compress & Unlock (10 mRad exposure)	6/25/2004	945	43 hr 30 min	583.5	7/21/2004	1530 ~ 26 days
MP2-73A	93-500 # 6a	6a	IOMSEALA	#1	Phase I - Compress & Lock For Rad exposure	6/28/2004	1425	NA	706.5		
MP2-73C	93-500 # 6a	6a	IOMSEAL2	#1	Real Phase II Compress & Unlock (10 mRad exposure)	6/30/2004	945	43 hr 20 min	637.7	7/22/2004	630 ~ 22 days
MP2-73B	93-500 # 6b	6b	IOMSEALA	#2	Phase I - Compress & Lock for Control	6/28/2004	1440	NA	770.5		
MP2-73D	93-500 # 6b	6b	IOMSEAL2	#2	Real Phase II Compress & Unlock Control	6/30/2004	1005	43 hr 25 min	657.1	7/22/2004	630 ~ 22 days
MP2-74A	93-500 #7a	7a	IOMSEALA	#1	Phase I - Compress & Lock For Rad exposure	7/1/2004	825	NA	716.2		
MP2-74B	93-500 #7a	7a	IOMSEAL2	#1	Real Phase II Compress & Unlock (1.0 mRad exposure)	7/1/2004	1520	6 hr 55 min	613.0	7/22/2004	830 ~ 21 days
MP2-76A	93-500 #7b	7b	IOMSEALA	#1	Phase I - Compress & Lock For Rad exposure	7/9/2004	755	NA	738.1		
MP2-76B	93-500 #7b	7b	IOMSEAL2	#1	Real Phase II Compress & Unlock (1.0 mRad exposure)	7/9/2004	1445	6 hr 50 min	628.5	7/22/2004	830 ~13 days
MP2-75A	LPU-4 #8a	8a	IOMSEALA	#1	Phase I - Compress & Lock Control	7/6/2004	1441	NA	1154.1		
MP2-75C	LPU-4 #8a	8a	IOMSEAL2	#1	Real Phase II Compress & Unlock Control	7/8/2004	950	43 hr 10 min	1035.4	7/22/2004	900 ~14 days
MP2-75B	LPU-4 #8b	8b	IOMSEALA	#2	Phase I - Compress & Lock Control	7/6/2004	1505	NA	1136.3		
MP2-75D	LPU-4 #8b	8b	IOMSEAL2	#2	Real Phase II Compress & Unlock Control	7/8/2004	1005	43 hr 00 min	1050.7	7/22/2004	900 ~14 days
MP2-77A	LPU-4 #9a	9a	IOMSEALA	#1	Phase I - Compress & Lock For Rad exposure	7/12/2004	1405	NA	1070.5		
MP2-77B	LPU-4 #9a	9a	IOMSEAL2	#1	Real Phase II Compress & Unlock (10 mRad exposure)	7/14/2004	840	42 hr 35 min	842.4	7/22/2004	945 ~ 8 days
MP2-79A	LPU-4 #9b	9b	IOMSEALA	#1	Phase I - Compress & Lock For Rad exposure	7/19/2004	1400	NA	1094.5		
MP2-79B	LPU-4 #9b	9b	IOMSEAL2	#1	Real Phase II Compress & Unlock (10.0 mRad exposure)	7/21/2004	1140	45 hr 40 min	819.9	7/22/2004	945 ~ 22 hours
MP2-78A	LPU-4 # 10a	10a	IOMSEALA	#1	Phase I - Compress & Lock For Rad exposure	7/14/2004	855	NA	1046.4		
MP2-78B	LPU-4 # 10a	10a	IOMSEAL2	#1	Real Phase II Compress & Unlock (1.0 mRad exposure)	7/14/2004	1515	6 hr 20 min	983.5	7/22/2004	1040 ~ 8 days
MP2-81A	LPU-4 # 10b	10b	IOMSEALA	#1	Phase I - Compress & Lock For Rad exposure	7/23/2004	815	NA	1054.0		
MP2-81B	LPU-4 # 10b	10b	IOMSEAL2	#1	Real Phase II Compress & Unlock (1.0 mRad exposure)	7/23/2004	1400	5 hr 45 min	1009.0	7/23/2004	1425 ~25 minutes
MP2-82B	LPU-4 # 11	11	IOMSEAL2	#1	Real Phase II Compress & Unlock (1.0 mRad exposure)	7/29/2004	1510	7 hr 15 min	962.2	7/29/2004	1520 ~10 minutes
MP2-82A	LPU-4 # 11	11	IOMSEALA	#1	Phase I - Compress & Lock For Rad exposure	7/29/2004	755	NA	1170.9		
MP2-80A	93-500 #12	12	IOMSEALA	#1	Phase I - Compress & Lock For Rad exposure	7/22/2004	820	NA	1078.0		
MP2-80B	93-500 #12	12	IOMSEAL2	#1	Real Phase II Compress & Unlock (1.0 mRad exposure)	7/22/2004	1425	6 hr 5 min		7/22/2004	1445 ~ 20 minutes
MP2-87A	93-500 #12	12	IOMSEALA	#1	Phase I - Compress & Lock	8/24/2004	800	NA	984.1	To recheck high load needed during MP2-80A/B Note: key insertion tight	
MP2-87B	93-500 #12	12	IOMSEAL2	#1	Real Phase II Compress & Unlock	8/25/2004	720	NA	923.3	Note: Had to increase compressive travel in Phase II by .004" in order to remove key.	
MP2-84A	93-500 #13	13	IOMSEALA	#1	Phase I - Compress & Lock For Rad exposure	8/3/2004	815	NA	693.0		
MP2-84B	93-500 #13	13	IOMSEAL2	#1	Real Phase II Compress & Unlock (1.0 mRad exposure)	8/3/2004	1345	5 hr 30 min	639.4		
MP2-86A	93-500 #13	13	IOMSEALA	#1	Phase I - Compress & Lock For Rad exposure	8/17/2004	1500	NA		93-500 # 13 mistakenly reran to check higher than normal compressive loads. I meant to run #12	
MP2-86B	93-500 #13	13	IOMSEAL2	#1	Real Phase II Compress & Unlock (1.0 mRad exposure)	8/19/2004	1425				

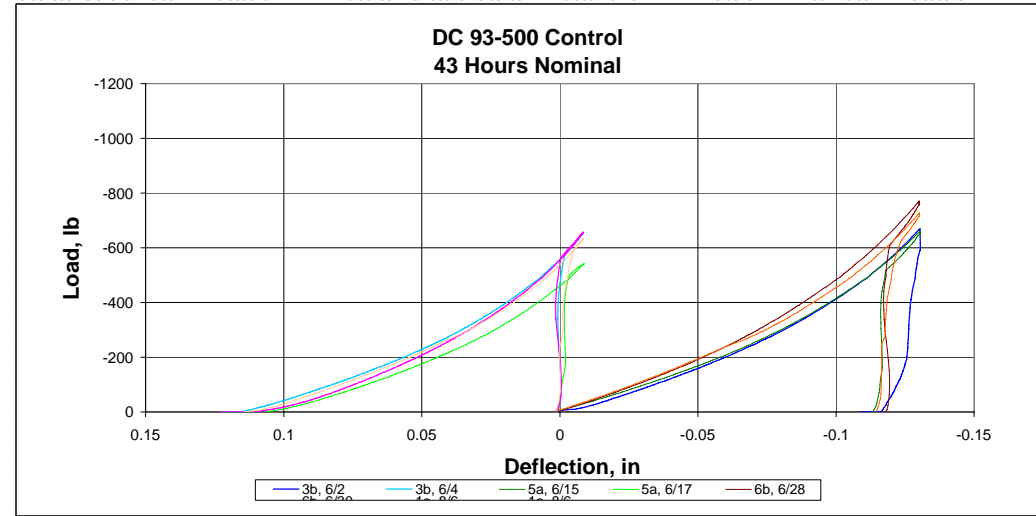
LPU-4 Parts		
LPU-4 control	# 4b	Completed
LPU-4 control	#8b	Completed
LPU-4 control	#8a	Completed
LPU-4 10 mRad	# 4a	Completed
LPU-4 10 mRad	# 9a	Completed
LPU-4 10 mRad	# 9b	Completed
LPU-4 1 mRad	# 10a	Completed
LPU-4 1 mRad	#10b	Completed
LPU-4 1 mRad	# 11	Completed
93-500 Parts		
93-500 control	# 3b	Completed
93-500 control	# 5a	Completed
93-500 control	# 6b	Completed
93-500 10 mRad	# 3a	Completed
93-500 10 mRad	# 5b	Completed
93-500 10 mRad	# 6a	Completed
93-500 10 mRad	# 7a	Completed
93-500 1 mRad	# 7b	Completed
93-500 1 mRad	# 12	Completed
93-500 1 mRad	#13	Monday August 2nd

10.0 mRad = 40 hrs exposure  
 1.0 mRad = 4 hrs exposure  
*Specimen looks like LPU-4 (high max load required)*

Has been down loaded for GPS

60B	61D	71A	71B	73B	73D	85A	85B	3b	>670	580	86.6%	13.4% <
cs	ce	cs	ce	cs	ce	cs	ce	5a	>660	500	75.8%	24.2% <
3b	3b	5a	5a	6b	6b	1a	1a	6b	610	560	91.8%	8.2%
								1a	620	590	95.2%	4.8%

60B				61D				71A				71B			
Extension i	Load lbf	corr	ext, corr	Extension i	Load lbf	corr	ext, corr	Extension i	Load lbf	corr	ext, corr	Extension i	Load lbf	corr	ext, corr
0	-4.57096	-0.001282	0.001282	0	-6.50274	-0.001299	0.001299232	0	-3.955602	-0.001284	0.001284	0	-4.844659	-0.001281	0.001281
-0.000786	-5.019398	-0.00128	0.000494	-0.000766	-10.56639	-0.001261	0.000495598	-0.000726	-4.863245	-0.001281	0.000555	-0.000758	-21.7272	-0.001242	0.000484
-0.001655	-5.949757	-0.001277	-0.000378	-0.001631	-61.69018	-0.001354	-0.000276716	-0.001647	-7.241007	-0.001272	-0.000375	-0.001683	-65.34372	-0.001377	-0.000305



-0.029187	-77.04268	-0.001465	-0.027721	-0.014353	-633.1455	-0.007538	-0.006815323	-0.029139	-89.25056	-0.001577	-0.027562	-0.013492	-517.3921	-0.007217	-0.006275
-0.029988	-79.56661	-0.001487	-0.028502	-0.013536	-623.7914	-0.007512	-0.006023665	-0.030008	-92.1905	-0.001607	-0.028401	-0.012655	-509.3403	-0.007195	-0.005466
-0.030845	-82.56942	-0.001513	-0.029332	-0.01271	-614.184	-0.007486	-0.005224759	-0.030861	-94.95473	-0.001636	-0.029225	-0.011833	-501.6896	-0.007173	-0.004089
-0.031675	-85.50296	-0.001541	-0.030134	-0.011869	-604.5943	-0.007459	-0.004409973	-0.031659	-97.14009	-0.001666	-0.029999	-0.01102	-494.2064	-0.006931	-0.00321
-0.03252	-88.38995	-0.001569	-0.030951	-0.011036	-595.6695	-0.007434	-0.003601303	-0.032476	-100.0578	-0.001692	-0.030784	-0.010183	-486.9626	-0.006972	-0.00231
-0.033329	-91.16807	-0.001596	-0.031733	-0.010183	-586.6323	-0.007409	-0.002773134	-0.033302	-102.557	-0.001721	-0.031581	-0.009345	-479.8708	-0.007003	-0.002342
-0.034147	-94.15126	-0.001627	-0.032519	-0.009345	-578.0922	-0.007386	-0.001959469	-0.034131	-105.4341	-0.001755	-0.032376	-0.008488	-472.7217	-0.007024	-0.001465
-0.034964	-96.97025	-0.001658	-0.033307	-0.008516	-569.5418	-0.007362	-0.001153796	-0.034984	-108.0334	-0.001786	-0.033198	-0.007651	-465.9249	-0.007034	-0.000617
-0.035822	-99.90154	-0.001689	-0.034131	-0.007698	-561.6655	-0.00734	-0.000358174	-0.035869	-111.0293	-0.001824	-0.034046	-0.00681	-459.2578	-0.007036	0.000226
-0.036687	-103.0958	-0.001727	-0.034959	-0.006897	-553.7339	-0.007318	0.000421405	-0.036695	-113.8436	-0.001866	-0.034835	-0.005976	-452.8943	-0.00703	0.001054
-0.037548	-106.0873	-0.001763	-0.035788	-0.006036	-545.8035	-0.007296	0.001259938	-0.037548	-116.6127	-0.001896	-0.035652	-0.005183	-446.6734	-0.007018	0.001835
-0.038373	-108.7546	-0.001795	-0.036578	-0.005222	-537.881	-0.007274	0.002051969	-0.038341	-119.1589	-0.00193	-0.036412	-0.004361	-440.3789	-0.006998	0.002637
-0.039179	-111.3938	-0.001828	-0.03735	-0.004341	-529.7302	-0.007252	0.002910253	-0.039135	-121.5914	-0.001963	-0.037172	-0.003528	-433.8076	-0.006971	0.003443
-0.039988	-113.9426	-0.001861	-0.038127	-0.003508	-522.3634	-0.007231	0.003723085	-0.039964	-124.3828	-0.002001	-0.037963	-0.002687	-427.5555	-0.006938	0.004252
-0.040818	-116.5995	-0.001895	-0.038922	-0.002698	-514.9412	-0.00721	0.004519873	-0.040833	-127.238	-0.002042	-0.038792	-0.001849	-421.7386	-0.006903	0.005054
-0.041659	-119.6374	-0.001936	-0.039723	-0.001885	-507.7874	-0.00719	0.005305492	-0.041655	-130.0284	-0.002082	-0.039573	-0.000992	-415.2828	-0.006857	0.005865
-0.042492	-122.4422	-0.001974	-0.040518	-0.001044	-500.7701	-0.007171	0.006127192	-0.042516	-133.2493	-0.002129	-0.040387	-0.000155	-409.2119	-0.006809	0.006654
-0.043349	-126.1278	-0.002026	-0.041323	-0.000194	-493.7871	-0.006933	0.006738922	-0.04333	-136.0691	-0.002172	-0.041158	0.000659	-403.8944	-0.006763	0.007421
-0.044171	-129.1001	-0.002069	-0.042102	0.000643	-486.8407	-0.006973	0.007615928	-0.044143	-138.7072	-0.002212	-0.041931	0.001484	-398.2845	-0.00671	0.008194
-0.044984	-131.6634	-0.002106	-0.042878	0.001524	-479.637	-0.007004	0.008527618	-0.044968	-141.7048	-0.002258	-0.04271	0.002325	-392.906	-0.006655	0.00898
-0.045786	-134.6366	-0.00215	-0.043636	0.002302	-473.5937	-0.007022	0.009323209	-0.045814	-144.608	-0.002304	-0.04351	0.003163	-387.1837	-0.006592	0.009755
-0.046647	-138.0213	-0.002201	-0.044446	0.003151	-466.9415	-0.007033	0.010183849	-0.04671	-147.6012	-0.002352	-0.044359	0.004012	-382.3998	-0.006537	0.010549
-0.047492	-141.1402	-0.00225	-0.045243	0.003952	-460.986	-0.007036	0.010988601	-0.047524	-150.3967	-0.002397	-0.045127	0.004861	-376.2412	-0.006462	0.011323
-0.048373	-144.2324	-0.002298	-0.046075	0.00479	-454.7876	-0.007033	0.011822301	-0.048381	-153.4554	-0.002448	-0.045934	0.005651	-371.1199	-0.006397	0.012047
-0.049191	-147.3266	-0.002348	-0.046843	0.005623	-448.4507	-0.007022	0.012644886	-0.049199	-156.29	-0.002495	-0.046704	0.006476	-366.4221	-0.006334	0.01281
-0.050016	-150.2091	-0.002394	-0.047622	0.006472	-442.076	-0.007004	0.013476288	-0.049992	-158.9416	-0.00254	-0.047453	0.007321	-360.9483	-0.006258	0.01358
-0.05083	-153.1046	-0.002442	-0.048388	0.007314	-435.8387	-0.00698	0.014293557	-0.05079	-161.4028	-0.002582	-0.048208	0.008147	-355.4575	-0.006179	0.014326
-0.051635	-155.8335	-0.002487	-0.049148	0.008163	-429.4233	-0.006949	0.015111505	-0.051635	-164.4162	-0.002633	-0.049002	0.008988	-350.4851	-0.006105	0.015093
-0.052472	-158.9443	-0.00254	-0.049933	0.008972	-423.9255	-0.006917	0.015889105	-0.052476	-167.3189	-0.002684	-0.049792	0.009869	-346.3074	-0.006041	0.015891
-0.05331	-161.9289	-0.002591	-0.050719	0.009786	-418.2324	-0.006879	0.016664698	-0.053334	-170.6395	-0.002743	-0.050591	0.010706	-341.0342	-0.005958	0.016665
-0.054171	-165.2265	-0.002648	-0.051523	0.010623	-412.8841	-0.006839	0.017462049	-0.054171	-173.6464	-0.002796	-0.051375	0.011512	-336.308	-0.005882	0.017394
-0.05502	-168.6173	-0.002707	-0.052313	0.011472	-407.3101	-0.006793	0.018265278	-0.055004	-176.5817	-0.002849	-0.052155	0.012325	-332.0259	-0.005811	0.018137
-0.055826	-171.7834	-0.002763	-0.053063	0.012306	-401.7029	-0.006742	0.019048038	-0.055834	-179.852	-0.002908	-0.052925	0.013202	-327.0943	-0.005729	0.018931
-0.056643	-174.4496	-0.002811	-0.053832	0.013147	-396.2064	-0.006689	0.019835658	-0.056647	-182.5846	-0.002959	-0.053688	0.013984	-323.7154	-0.005671	0.019655
-0.057484	-177.6933	-0.002869	-0.054615	0.013992	-390.7182	-0.006631	0.020623451	-0.057476	-185.6203	-0.003015	-0.054462	0.014829	-317.809	-0.005568	0.020397
-0.058314	-180.8772	-0.002927	-0.055386	0.01479	-385.8869	-0.006578	0.021367404	-0.058349	-189.0055	-0.003078	-0.055272	0.015671	-313.681	-0.005494	0.021165

0.961538 3.8%  
0.944 5.6%  
0.910569 8.9%  
0.938703 6.1%





60B	61D	71A	71B	73B	73D	85A	85B	3b	>670	580	86.6%	13.4% <
cs	ce	cs	ce	cs	ce	cs	ce	5a	>660	500	75.8%	24.2% <
3b	3b	5a	5a	6b	6b	1a	1a	6b	610	560	91.8%	8.2%
								1a	620	590	95.2%	4.8%

60B			
Extension i	Load lbf	corr	ext, corr
-0.126326	-143.6376	-0.002289	-0.124037
-0.125997	-137.4702	-0.002193	-0.123803
-0.125675	-131.2135	-0.002099	-0.123576
-0.125342	-124.8901	-0.002009	-0.123333
-0.124997	-119.212	-0.00193	-0.123066
-0.124663	-113.685	-0.001857	-0.122806
-0.124318	-108.4407	-0.001791	-0.122527
-0.123981	-102.4591	-0.00172	-0.122261
-0.123647	-96.79234	-0.001656	-0.121991
-0.123342	-91.97402	-0.001605	-0.121737
-0.122993	-86.02957	-0.001546	-0.121447
-0.122659	-79.73084	-0.001488	-0.121171
-0.122302	-73.76883	-0.001439	-0.120863
-0.121989	-68.88011	-0.001402	-0.120587
-0.121647	-63.55741	-0.001366	-0.120281
-0.121326	-58.53482	-0.001336	-0.119999
-0.121012	-53.83205	-0.001311	-0.119701
-0.120675	-49.34032	-0.001291	-0.119384
-0.120326	-43.36	-0.001269	-0.119057
-0.119969	-37.90735	-0.001255	-0.118714
-0.119663	-33.37954	-0.001246	-0.118417
-0.119318	-26.23491	-0.001241	-0.118077
-0.119004	-21.02243	-0.001242	-0.117762
-0.118671	-15.88897	-0.001249	-0.117422
-0.11833	-10.21589	-0.001262	-0.117067
-0.117996	-4.723695	-0.001281	-0.116715
-0.117659	-2.175088	-0.001292	-0.116367
-0.117322	-0.965596	-0.001298	-0.116024
-0.116977	-1.379066	-0.001296	-0.115681
-0.116667	-0.330655	-0.001301	-0.115366
-0.116354	-0.240272	-0.001301	-0.115052
-0.11602	-0.125313	-0.001302	-0.114718
-0.115651	-0.048803	-0.001302	-0.114349
-0.115326	-0.203662	-0.001301	-0.114024
-0.114961	-0.334762	-0.001301	-0.113666
-0.114671	-0.137788	-0.001302	-0.113369
-0.11431	-0.521375	-0.0013	-0.11301
-0.114	0.1062	-0.001303	-0.112697
-0.113679	0.130731	-0.001303	-0.112376
-0.113334	0.252604	-0.001304	-0.112003
-0.112977	0.343208	-0.001304	-0.111672
-0.112647	0.145012	-0.001303	-0.111344
-0.112326	0.064284	-0.001303	-0.111023
-0.112	-0.441606	-0.0013	-0.1107
-0.111671	0.589651	-0.001305	-0.110366
-0.111338	-0.011588	-0.001302	-0.110035
-0.110996	0.229824	-0.001304	-0.109693
-0.110647	-0.398082	-0.0013	-0.109347
-0.110314	-0.376909	-0.001301	-0.109013
-0.109981	0.207561	-0.001303	-0.108677

61D			
Extension i	Load lbf	corr	ext, corr

71A			
Extension i	Load lbf	corr	ext, corr
-0.12631	-527.3108	-0.007245	-0.119065
-0.125997	-524.3079	-0.007236	-0.11876
-0.125659	-521.6817	-0.007229	-0.11843
-0.125302	-518.0021	-0.007219	-0.118083
-0.124945	-505.7622	-0.007185	-0.11776
-0.124616	-488.9773	-0.006962	-0.117654
-0.12431	-474.774	-0.007019	-0.117291
-0.123961	-456.7024	-0.007034	-0.116926
-0.123651	-439.7761	-0.006996	-0.116655
-0.123322	-419.9913	-0.006891	-0.116431
-0.122977	-396.8064	-0.006695	-0.116282
-0.122635	-372.4167	-0.006414	-0.116222
-0.122278	-347.3468	-0.006057	-0.116221
-0.121957	-325.6946	-0.005705	-0.116252
-0.121635	-303.7607	-0.005314	-0.116321
-0.121318	-282.7028	-0.004917	-0.116401
-0.120989	-259.8942	-0.004469	-0.116519
-0.120639	-237.3005	-0.004019	-0.11662
-0.120298	-218.3809	-0.003644	-0.116654
-0.119977	-199.0786	-0.003269	-0.116708
-0.119631	-178.1349	-0.002877	-0.116754
-0.11931	-163.5494	-0.002618	-0.116691
-0.118989	-151.1997	-0.00241	-0.116578
-0.118659	-138.8063	-0.002213	-0.116446
-0.11831	-127.2661	-0.002042	-0.116268
-0.117965	-113.7494	-0.001858	-0.116106
-0.117627	-98.90114	-0.001679	-0.115948
-0.117322	-84.69209	-0.001533	-0.115789
-0.116977	-70.1232	-0.001411	-0.115566
-0.116635	-57.01588	-0.001327	-0.115308
-0.116322	-44.35823	-0.001272	-0.115049
-0.115989	-31.84852	-0.001244	-0.114744
-0.115639	-20.35651	-0.001243	-0.114396
-0.115278	-11.73304	-0.001258	-0.11402
-0.114941	-5.636152	-0.001278	-0.113663
-0.114635	-0.606239	-0.001299	-0.113336
-0.114322	-0.180246	-0.001302	-0.11302
-0.113989	0.179144	-0.001303	-0.112685
-0.113639	0.016014	-0.001302	-0.112337
-0.113294	-0.087087	-0.001302	-0.111992
-0.112965	-0.052944	-0.001302	-0.111663
-0.112627	-0.208345	-0.001301	-0.111326
-0.112282	0.235627	-0.001304	-0.110979
-0.111973	-0.023943	-0.001302	-0.11067
-0.111659	-0.244921	-0.001301	-0.110358
-0.111322	-0.115957	-0.001302	-0.11002
-0.110961	-0.001371	-0.001302	-0.109658
-0.1106	0.026485	-0.001303	-0.109297
-0.110306	-0.215579	-0.001301	-0.109005
-0.110008	-0.402701	-0.0013	-0.108708

71B			
Extension i	Load lbf	corr	ext, corr





73B

Table with 4 columns: Extension i, Load lbf, corr, ext, corr. Contains 39 data rows.

73D

Table with 4 columns: Extension i, Load lbf, corr, ext, corr. Contains 39 data rows.

85A

Table with 4 columns: Extension i, Load lbf, corr, ext, corr. Contains 39 data rows.

85B

Table with 4 columns: Extension in, Load lbf, corr, ext, corr. Contains 39 data rows.



## 73B

Extension	iLoad	lbf	corr	ext,	corr
-0.12636	-584.543	-0.0074	-0.11895		
-0.12602	-563.283	-0.00734	-0.11868		
-0.12568	-538.652	-0.00728	-0.1184		
-0.12536	-517.568	-0.00722	-0.11814		
-0.12504	-497.028	-0.00691	-0.11813		
-0.12471	-470.966	-0.00703	-0.11768		
-0.12437	-440.836	-0.007	-0.11737		
-0.12402	-407.161	-0.00679	-0.11723		
-0.12369	-372.539	-0.00642	-0.11728		
-0.12337	-337.222	-0.0059	-0.11747		
-0.12301	-296.345	-0.00518	-0.11783		
-0.12264	-255.863	-0.00439	-0.11825		
-0.12239	-225.331	-0.00378	-0.11861		
-0.12206	-189.302	-0.00308	-0.11897		
-0.12168	-150.637	-0.0024	-0.11928		
-0.12133	-118.361	-0.00192	-0.11941		
-0.12101	-89.8794	-0.00158	-0.11943		
-0.1207	-65.7478	-0.00138	-0.11932		
-0.12036	-42.6223	-0.00127	-0.11909		
-0.12003	-22.888	-0.00124	-0.11879		
-0.1197	-7.67517	-0.00127	-0.11843		
-0.11932	-0.60363	-0.0013	-0.11802		
-0.11902	-0.41897	-0.0013	-0.11772		
-0.11869	-0.12993	-0.0013	-0.11739		
-0.11836	0.271843	-0.0013	-0.11705		
-0.11802	-0.03135	-0.0013	-0.11672		
-0.1177	0.018244	-0.0013	-0.1164		
-0.11736	0.07126	-0.0013	-0.11606		
-0.11702	0.093271	-0.0013	-0.11572		
-0.11668	0.108168	-0.0013	-0.11537		
-0.11633	0.06396	-0.0013	-0.11503		
-0.11602	0.071327	-0.0013	-0.11472		
-0.11568	0.105966	-0.0013	-0.11438		
-0.11537	0.007861	-0.0013	-0.11407		
-0.11504	0.146849	-0.0013	-0.11374		
-0.1147	0.190716	-0.0013	-0.1134		
-0.11434	0.13085	-0.0013	-0.11304		
-0.114	0.123484	-0.0013	-0.1127		
-0.11369	0.038206	-0.0013	-0.11239		
-0.11336	0.061593	-0.0013	-0.11206		
-0.11303	0.165765	-0.0013	-0.11173		
-0.11271	0.108433	-0.0013	-0.11141		
-0.11235	0.073507	-0.0013	-0.11105		
-0.11203	0.035751	-0.0013	-0.11073		
-0.11166	0.315335	-0.0013	-0.11036		
-0.11135	0.083361	-0.0013	-0.11005		
-0.11103	0.25329	-0.0013	-0.10972		
-0.11071	0.290043	-0.0013	-0.1094		
-0.11036	0.01526	-0.0013	-0.10906		
-0.11002	0.027889	-0.0013	-0.10872		
-0.11	-0.04026	-0.0013	-0.1087		

## 73D

Extension	iLoad	lbf	corr	ext,	corr
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## 85A

Extension	iLoad	lbf	corr	ext,	corr
-0.12631	-452.678	-0.00703	-0.11928		
-0.12599	-437.945	-0.00699	-0.119		
-0.12567	-422.439	-0.00691	-0.11876		
-0.12531	-406.009	-0.00678	-0.11852		
-0.12498	-391.066	-0.00664	-0.11835		
-0.12462	-373.581	-0.00643	-0.11819		
-0.12431	-358.649	-0.00623	-0.11808		
-0.12396	-341.9	-0.00597	-0.11799		
-0.12363	-325.935	-0.00571	-0.11792		
-0.12332	-311.933	-0.00546	-0.11785		
-0.123	-295.263	-0.00516	-0.11784		
-0.12264	-279.239	-0.00485	-0.11779		
-0.12229	-271.92	-0.00471	-0.11759		
-0.12195	-266.255	-0.0046	-0.11735		
-0.12165	-261.264	-0.0045	-0.11715		
-0.12131	-256.484	-0.0044	-0.11691		
-0.12096	-250.417	-0.00428	-0.11668		
-0.12066	-245.793	-0.00419	-0.11647		
-0.12031	-226.213	-0.0038	-0.11652		
-0.11998	-209.987	-0.00348	-0.1165		
-0.11963	-191.839	-0.00313	-0.1165		
-0.11929	-173.617	-0.0028	-0.11649		
-0.11899	-156.146	-0.00249	-0.1165		
-0.11866	-136.975	-0.00219	-0.11648		
-0.11833	-116.171	-0.00189	-0.11644		
-0.11798	-89.5818	-0.00158	-0.1164		
-0.11764	-67.4097	-0.00139	-0.11625		
-0.11731	-48.5905	-0.00129	-0.11603		
-0.11698	-34.264	-0.00125	-0.11573		
-0.11664	-21.2555	-0.00124	-0.1154		
-0.11631	-11.953	-0.00126	-0.11506		
-0.11599	-3.78496	-0.00129	-0.11471		
-0.11566	-0.2999	-0.0013	-0.11435		
-0.11529	-0.13187	-0.0013	-0.11399		
-0.11496	0.059761	-0.0013	-0.11366		
-0.11459	0.256401	-0.0013	-0.11329		
-0.1143	0.160388	-0.0013	-0.11299		
-0.11398	0.168315	-0.0013	-0.11268		
-0.11366	0.033261	-0.0013	-0.11236		
-0.11332	0.338609	-0.0013	-0.11202		
-0.11297	0.074514	-0.0013	-0.11167		
-0.11261	-0.02768	-0.0013	-0.11131		
-0.1123	0.455639	-0.0013	-0.11099		
-0.11198	-0.19756	-0.0013	-0.11068		
-0.11166	0.670401	-0.00131	-0.11035		
-0.11133	-0.41786	-0.0013	-0.11003		
-0.11098	0.178928	-0.0013	-0.10968		
-0.11064	0.259539	-0.0013	-0.10934		
-0.11031	0.242364	-0.0013	-0.109		
-0.10998	0.210701	-0.0013	-0.10868		

## 85B

Extension	iLoad	lbf	corr	ext,	corr
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## 85B

ext, corr	Extension	i Load lbf	corr	ext, corr
-0.12827	0.110643	-2.97437	-0.00129	0.111932
-0.12796	0.111481	-2.0132	-0.00129	0.112773
-0.12765	0.112342	-1.28838	-0.0013	0.113638
-0.12733	0.113187	-0.34994	-0.0013	0.114488
-0.12701	0.114008	0.05811	-0.0013	0.115311
-0.12668	0.114854	0.473177	-0.0013	0.116158
-0.12635	0.115671	0.216965	-0.0013	0.116974
-0.12602	0.116485	0.614748	-0.00131	0.11779
-0.12571	0.117322	0.662837	-0.00131	0.118628
-0.1254	0.118215	0.549935	-0.00131	0.11952
-0.12509	0.119008	0.384937	-0.0013	0.120313
-0.12476	0.119862	0.438553	-0.0013	0.121166
-0.12443	0.120675	0.261466	-0.0013	0.121979
-0.12409	0.121496	0.405877	-0.0013	0.122801
-0.12378	0.122004	0.764741	-0.00131	0.123311
-0.12345				
-0.12314				
-0.12285				
-0.12255				
-0.12223				
-0.12191				
-0.1216				
-0.12132				
-0.12102				
-0.12073				
-0.12043				
-0.12014				
-0.12				
-0.1196				
-0.11928				
-0.119				
-0.11876				
-0.11852				
-0.11835				
-0.11819				
-0.11808				
-0.11799				
-0.11792				
-0.11785				
-0.11784				
-0.11779				
-0.11759				
-0.11735				
-0.11715				
-0.11691				
-0.11668				
-0.11647				
-0.11652				
-0.1165				
-0.1165				
-0.11649				
-0.1165				
-0.11648				
-0.11644				
-0.1164				
-0.11625				
-0.11603				
-0.11573				
-0.1154				
-0.11506				
-0.11471				
-0.11435				
-0.11399				
-0.11366				
-0.11329				
-0.11299				
-0.11268				
-0.11236				
-0.11202				
-0.11167				
-0.11131				
-0.11099				
-0.11068				
-0.11035				
-0.11003				
-0.10968				
-0.10934				
-0.109				
-0.10868				

