MHSMP-64-1

TIME- TO- EXPLOSION
THERMAL INITATION TEST FOR EXPLOSIVES (U)

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Mason & Hanger- Silas Mason Co., Inc.

Pantex Plant

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ABSTRACT

A controlled series of experiments have been performed in an attempt to evaluate the Henkin time-to-explosion test as a reactivity test and a quality assurance tool. This was done by comparing the Henkin results with those obtained with the presently used gas chromatograph chemical reactivity test. Two explosives, PBX 9404 and LX-04-1, were tested with four "inerts": sodium chloride, lead powder, Silastic Q-300030 and epoxy 633111. The experimental data from the two tests are given; a method for mathematically reducing the Henkin data is considered.

The data from the two tests are not in complete agreement. Both predict that the epoxy is reactive with and that NaCl is unreactive with both explosives. However, the Henkin data indicated reactivity of lead powder and Silastic with LX-04-1; the gas chromatograph did not. For PBX 9404, the Henkin test indicated that the lead was borderline reactive and the Silastic unreactive, while the gas chromatograph predicted the opposite. DTA thermograms are included to help interpret the comparison test results.

A section in the appendix is devoted to the experimental problems encountered in getting the Henkin test operational. All raw data generated during that time are included in the appendix. In addition, data obtained subsequently with a fairly wide variety of explosives (and propellants) are given; these indicate the present quality of data.

INTRODUCTION

In the determination of the thermal sensitivity of explosives, the time-to-explosion investigation has proven to be of value. Henkin and McGill[1] investigated the time-temperature relationship at which decomposition becomes explosive in character within short time intervals. It was apparent to them that the time-temperature relation was not constant, but depended on several variables. This test had been used for many years, but was abandoned when it failed to give the correct activation energy of pure explosives. The theoretical work of Zinn[2], which introduced a chemical depletion term, explained the shortcomings in the previous treatments. Mader's[2] experimental work with a scaled-up test verified the theoretical work. R. N. Rogers[3] has recently modified the experimental arrangement; this has resulted in a lower energy input rate, operation at lower temperatures and expansion of the time range. In general, this reduces considerably the perturbation of thermal lags, simplifies the measurement of the time-to-explosion, allows one to work in a region where a lesser accuracy in time measurement is acceptable, and makes the test a better mock-up of some important practical situations (safety and chemical reactivity).

The test has been proposed as a means of detecting incompatibility; the purpose of the present work was to evaluate the test to that end and to determine the possibility of its use as a quality assurance tool. In short, the approach was to compare the results from the Henkin and gas chromatographic chemical reactivity tests in a controlled, statistical manner.

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[1]Henkin, H., McGill, R., I. & E.C. 44, 1391 (1952)
[2]Zinn, J., Mader, C.L., Journal of Applied Physics 31, 323 (1960)
[3]Rogers, R.N., I. & E.C. Production Research & Development, Vol. I, No. 3, (1962)

Additional modifications, generally in the methods of loading and timing, were adopted in the course of the work at Pantex. The various problems encountered along the way (appendix) and the test results are presented and discussed in this report.

Apparatus and Experimental Procedure Used in Comparison Test

In this section, the procedure and technique used in performing the Henkin and gas chromatographic comparison experiment will be described. The latter test was used as a "yard stick" because it is presently accepted and used as a means of measuring chemical reactivity. The problems encountered in the development of the procedure (and subsequent development) will constitute a separate section (the appendix of this report). It is believed that this separation will permit a minimum of confusion for the various readers.

The basic apparatus used for the Henkin portion of the test was similar to that described by Rogers. The reaction chamber was identical; the metal bath temperature was controlled via a Fenwal Electronics, Inc. probe thermistor (in series with a 42 Ω resistor) by a Fisher Temperature Controller Model 44. The reaction temperature was measured by a chromel-alumel thermocouple placed in the bath liquid and monitored with a Leeds and Northrup K-3 Potentiometer. Major modifications to Rogers' apparatus resulted from changes in the loading and sealing of the blasting cap sample containers. The technique settled upon after numerous other systems had failed was as follows. The blasting cap (#8 brass made by du Pont) was loaded with the desired sample and followed by two 6.5 mm diameter gas checks (obtained from Hornady) which were also brass and were resized to slide easily but snuggly into the 0.260 inch I.D. blasting caps. The first gas check had the concave side turned toward the sample and the second had the concave side turned away from the sample. This was followed by a lead plug, 9/16 inch long and 1/4 inch in diameter. A punch and die was used to press the assembly at 350 pounds

(7000 psi). The cap was then crimped around the lead plug (about 1/4 inch from top of plug) with a Magneformer. Caps loaded in this way often blew the bottom out of the cap rather than forcing the gas check-plug assembly out the top. The timing system originally used had to be changed. A carbon-type earphone used in conjunction with a digital counter (Computer Measurements Co., Model 727B Universal Counter-Timer) proved to be satisfactory.

Four "inerts" with varying degrees of reactivity with the explosives PBX 9404 (Blend 1 of Lot 524-61) and LX-04-1 (Blend 2 of Lot 673-62) were chosen, ground, and sent to Pantex by LRL. These were sodium chloride (Baker & Adams Co.), lead powder (Fisher Scientific Co.), Silastic Q-30030, and epoxy 633111. The H.E. samples were ground with a Wiley Intermediate Model Mill; total (i.e., no sieving or other segregation) H.E. samples were used. The explosives, epoxy and Silastic were then dried in a vacuum oven at 60°C. for two hours. All of the samples were kept in a desiccator cabinet (calcium sulfate was the desiccant) with the exception of the sodium chloride which was kept in a sealed container. The pure H.E. sample size was 50 mg; the H.E.-inert mixtures were made by placing 50 mg of inert and 50 mg of explosives into the blasting cap and then rolling and shaking to achieve some degree of homogeneity.

The first step in the procedure was to experimentally obtain the time-temperature curves for the pure explosives. When these curves were determined, two temperatures, T_1 and T_2, were chosen for each H.E. such that the time-to-explosion would be on the order of 50 and 200 seconds. Fifteen replicate runs (in subgroups of five) were then made for each combination of temperature, "inert" and explosive; these subgroups of five were "randomly" sequenced within a given temperature and explosive. Pure explosive control runs were made each time a group of mixtures was tested. A typical day's run consisted of five pure H.E., five H.E. + NaCl, five H.E. + Pb, five H.E. + Silastic, and five H.E. + epoxy, all at T_1.

The gas chromatograph reactivity experiment was performed in a two-column chromatograph designed by LRL and manufactured by the Royal Research Corporation, Hayward, California. The experimental conditions were those of USAEC Specification RM-251808 with the exception that modified sample tubes and Pyrex glass sample crucibles were used. The inert materials and H.E. samples were the same as those used in the Henkin portion of the test. The H.E. samples were given a different treatment however; they were ground and the fractions passing U.S. Sieve #100 (149μ) and retained on U.S. Sieve #270 (53μ) were used. All samples were dried for two hours in vacuo at 60°C. The sample weight taken was 250 mg or 250 mg of each material in the case of mixtures. After placing the sample crucibles in the sample holder, the holders were evacuated, purged, filled with helium (15 psig), and immersed in a 120 ± 0.5°C. oil bath for 22 hours (experimentally, this varied from 22 to $\sim$ 23 hours). The evolved fixed gases (N_2, O_2, NO, CO, N_2O, CO_2) were then analyzed in the chromatograph; the organics and other products were not analyzed. Instrument parameters were:

1.	Column 1	Polypropylene glycol on firebrick, furnace 50°C., Filament current 350 ma., 15 psig He.
2.	Column 2	Silica gel, furnace 45°C., Filament current 350 ma., 13 psig He.
3.	Thermal Conductivity Cell	Furnace 50°C.
4.	He flow rate	100 cc/minute

Results

The Henkin raw data plotted as the time-to-explosion versus the reciprocal of the absolute temperature for the pure explosives are given in Figures 1 and 2. The solid lines were drawn for clarification and to indicate our choices of T_1 and T_2. It should be noted that the lines are drawn along the locus of concentrated short time points in compliance with the principle that the worst conditions should be given the most weight in safety or compatibility considerations. During the course of checking out the loading technique, the PBX 9404 + lead powder Henkin curve was also generated; it is included here as Figure 3 because it introduces an interesting point to be discussed later.

The Henkin data for the comparison tests are given in Table I; the gas chromatograph reactivity data are reported in Table II.

DTA thermograms of the pure explosives and the mixtures are shown in Figures 4 through 13. These are included for comparison with chromatography and Henkin data.

The harmonic mean is offered as a possibility for the analysis of the Henkin data. The harmonic mean, M_h, is defined as

$$M_h = \frac{N}{\sum_{i=1}^{N} \frac{1}{X_i}}$$

where N is the number of trials in a subgroup; i.e., five for this experiment and X_i is the explosion times of the ith trial. For a reactivity coefficient

RC, the following relationship is used:

$$RC = \sum_{j=1}^{S} \frac{\left[\frac{M_h \text{ (H.E.)}}{M_h \text{ (mix)}} \right]_j}{S}$$

where M_h (H.E.) is the harmonic mean for the pure explosive, M_h (mix) is the harmonic mean for a mixture (of the explosive and the inert for a particular subgroup) and S is the number of subgroups; i.e., three for this test.

The numbers that result from this calculation are shown in Table III. It should be noted that those trials which did not produce an explosion (these were mixtures that were stopped after a reasonable length of time) were not used in the calculations; since the times would be large, their contribution to the mean reactivity coefficient would be very small.

Discussion

The Henkin curves of LX-04-1 and PBX 9404 in Figures 1 and 2 show that at a given temperature, the PBX 9404 explosion times are shorter than those for LX-04-1; this agrees with data from other thermal tests. The curves are of the general shape expected for explosives. They qualitatively agree with the Henkin data generated by Rogers of LASL; quantitatively, they would not be expected to agree since the cap loading techniques (ours being contained and sealed more tightly) are different. We feel the change in cap loading makes the data in this report considerably more representative and reproducible than was previously possible.

The data taken on September 16, 1963 (Table I) show that no explosions occurred with the PBX 9404 + NaCL; indeed, this happened a few other times. Since NaCl is hygroscopic, it is possible that the NaCl picked up some moisture and caused this difference in times. In the comparison test, certain mixtures consistently blew the plug and seal out the top; more recent data, using more refined cap loading techniques, have been generated in which these same mixtures blew the bottom out of the caps. There was no appreciable change in the explosion times so the comparison test data are considered as giving a true picture. It is felt that the most desirable loading system is one that ruptures the cap; experience has shown that this is more reproducible from day to day.

In analyzing the Henkin data the shortest explosion time at a given temperature represents the worst condition that exists. However, experience has shown that pressure blows can result from systems improperly sealed; these can give times that are anomalously short. Therefore, a method is needed that will mathematically weigh the shorter times more heavily than the longer times but not overdo it. The harmonic mean does this rather well. It weighs the shorter times heavier than either the arithmetic or geometric mean. Also, the harmonic mean seems to be more promising for it can better handle data with a greater spread of values. Regardless of the choice, one must still make a reasonable selection of the critical value(s) of the reactivity coefficient, RC. On the basis of this one comparison test, the following ratio is considered a possibility. Samples having an RC value less than 1.5 are unreactive or indeterminant while those with RC greater than 1.5 but less than3 are borderline reactive. Those with RC greater than 3 are reactive. The low critical ratios are dictated by safety criteria. The proper value would, of course, depend on the use to which the data are to be put.

No attempt was made here to subject the chromatograph data to a rigorous mathematical treatment. For our purposes, the reactivity coefficient, RC, taken as the ratio of the total volume of gas evolved by the mixture to the sum of the volumes from the individual components, was considered to be adequate (although very naive). Somewhat arbitrarily, critical values were assigned; namely, the system is considered unreactive or indeterminant for $RC < 2$, borderline reactive for $2 < RC < 3$ and reactive for $RC > 3$.

Using these ground rules, the comparison of the two tests is as follows:

1. Henkin test LX-04-1 + "inerts"

   a. LX-04-1 + epoxy 633111: Reactive; $RC \approx 23$
   b. LX-04-1 + lead powder: Reactive; $RC \approx 6.2$
   c. LX-04-1 + Silastic Q-30030: Reactive; $RC \approx 3.6$
   d. LX-04-1 + NaCl: Unreactive; $RC \approx 1.1$

2. Reactivity test LX-04-1 + "inerts"

   a. LX-04-1 + epoxy 633111: Reactive; RR $\approx$ 4.2
   b. LX-04-1 + lead powder: Unreactive; RR $\approx$ 0.8
   c. LX-04-1 + Silastic Q-30030: Unreactive; RR $\approx$ 0.5
   d. LX-04-1 + NaCl: Unreactive; RR $\approx$ 0.4

3. Henkin test PBX 9404 + "inerts"

   a. PBX 9404 + epoxy 633111: Reactive; RC $\approx$ 6.4
   b. PBX 9404 + lead powder: Borderline reactive: RC $\approx$ 2.4
   c. PBX 9404 + Silastic Q-30030: Unreactive; RC $\approx$ 0.6
   d. PBX 9404 + NaCl: Unreactive; RC $\approx$ 0.7

4. Reactivity test PBX 9404 + "inerts"

   a. PBX 9404 + epoxy 633111: Reactive; RR $\approx$ 3.9
   b. PBX 9404 + lead powder: Unreactive; RR $\approx$ 1.0
   c. PBX 9404 + Silastic Q-30030: Borderline reactive; RR $\approx$ 1.7
   d. PBX 9404 + NaCl: Unreactive; RR $\approx$ 0.8

The data for the two tests are not in complete agreement. They do agree that epoxy reacts strongly and NaCl is very unreactive with both explosives. However, the Henkin test reflects reactivity of lead and Silastic with LX-04-1, while the gas chromatograph does not. Also, the Henkin test indicates some reactivity of lead, but no reactivity of Silastic, with PBX 9404; the gas chromatograph predicts the opposite situation. The discrepancies are not as clear cut in the PBX 9404 cases as for the LX-04-1's. The reasons for the discrepancies have not generally been investigated (except to some extent for lead + PBX 9404) and, therefore, only a priori explanations can be offered. These probably involve one or more of confinement, reaction temperature, geometry, area of contact and thermal conductivity. For the record, we will say here that the DTA results align themselves more closely with those from the Henkin than the gas chromatograph test. The one case for which some additional data are available is PBX 9404 + lead powder.[4] It will be noted from Figures 2 and 3 that at low temperatures, the curves of PBX 9404 and PBX 9404 + lead cross. The explosion times for the latter are considerably shorter for all temperatures above about 215°C. At 210°C. ($\frac{1000}{T°K}$ = 2.07); however, PBX 9404 times were on the order of 700 seconds while the mixture did not explode after 2000 seconds. The latter caps were opened; the black residue was run in the DTA. The differential thermogram was essentially that of lead; i.e., the material never would have exploded. A possible explanation is that the lead powder can conduct away (both locally and on the whole) the heat generated by the slowly decomposing explosive, thus preventing it from reaching the explosion threshhold temperature.

More important than any explanation of this activity is the lesson which can be learned and the warning sounded by these particular data. Great care must be exercised in choosing reaction temperatures in future Henkin work in order to minimize misinterpretation of hazardous or reactive mixtures. Obviously, choices of reaction temperatures corresponding to $\frac{1000}{T°K}$ values of about 2.05 and 1.89 would present a much different picture than the temperatures chosen in this work. It would appear that considerable knowledge about a system is needed; i.e., fairly complete time-temperature curves, before one could "rely" on Henkin data; in critical situations, use of the two-temperature method alone would be

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[4] The lead sample used for the generation of the PBX9404 + lead Henkin curve was supplied by Rogers, LASL, and was known to be reactive with PBX 9404. A different sample was used for the comparison test; the comparison test sample was bluish in color while the other was brown, indicating that some oxidation had probably taken place in the latter. The two samples gave essentially the same explosion times when mixed with PBX 9404.

unacceptable. It sort of boils down to the fact (and we are speaking from past experience) that new explosive systems will come equipped with their own eccentricities which may require variations in loading techniques, data interpretation, etc. For proposed routine testing programs or specification requirements, these problems could, of course, be worked out (and indeed must be for each specific system) in advance.

Building of workable Henkin equipment and mastering of loading techniques at other contractor installations could now surely be done with relative ease if the personnel are acquainted with basic thermal techniques and if the explosive systems are not too greatly different from those used in this work.

We feel the greatest problem with the Henkin test (and the gas chromatograph reactivity test for that matter) is in determining and quantitating what it is trying to tell. It would appear to be able to diagnose hazardous or unsafe situations, but not be directly or immediately relatable to long term surveillance problems. Therefore, it is thought that the test is not ready for use as a routine quality assurance tool. However, the Henkin test shows possibilities and should be allowed to take a place along side and be coupled with the DTA, pyrolyis, gas chromatograph, hot stage microscopy, etc., in diagnosing potentially hazardous materials and in investigating the thermal decomposition mechanisms, etc. of explosives and explosive systems.

TABLE I

HENKIN REACTIVITY TEST COMPARISON

Sample	9-12-63 Run No.	9-12-63 Time (sec)@ 243°C	9-24-63 Run No.	9-24-63 Time (sec)@ 242°C	9-11-63 Run No.	9-11-63 Time (sec)@ 242.5°C	9-13-63 Run No.	9-13-63 Time (sec)@ 264°C	9-18-63 Run No.	9-18-63 Time (sec)@ 264°C	9-20-63 Run No.	9-20-63 Time (sec) @264°C
LX-04-1	1	594.4	5	1014.7	1	767.9	8	243.4	5	75.0	1	56.9
	10	539.8	10	1130.7	6	733.6	11	121.8	10	270.4	6	218.7
	15	481.3	15	1093.8	11	704.1	13	69.7	15	71.4	11	85.2
	20	709.5	23	702.2	20	724.8	18	53.4	20	117.2	16	78.5
	28	735.9	25	616.7	25	737.0	20	88.2	25	62.5	25	62.5
LX-04-1 + Pb	2	81.1†	4	92.7†	2	127.4†	2	22.3†	4	21.8†	2	9.4
	9	55.2†	9	87.4†	7	106.3†	4	15.8†	9	18.3†	7	17.4†
	11	81.2†	14	84.3†	12	149.9†	15	19.7†	14	21.0†	12	17.2†
	21	100.6†	18	142.8†	17	149.4†	17	12.7†	19	25.8†	17	17.4†
	25	59.1†	21	111.1†	22	126.8†	22	22.4†	24	14.8†	22	17.1†
LX-04-1 + NaCl	3	536.7	3	849.6	3	497.0	5	112.9	3	58.1	3	37.2
	8	576.4†	8	1008.5	8	477.1	10	196.3	8	42.5	8	103.3
	16	538.1	13	848.8	13	483.3	12	374.3	13	144.1	13	125.8
	24	495.4	22	447.7	19	586.2	19	288.2	18	204.4	18	273.8
	26	402.3	24	767.1	24	609.2	23	98.6	23	42.8†	23	36.7
LX-04-1+ Silastic	4	175.6†	2	195.6†	4	149.8†	1	44.1†	2	37.4†	5	32.6†
	7	218.5†	7	196.2†	9	191.4†	6	17.3†	7	40.2†	9	21.2†
	13	98.1†	12	228.3†	14	252.1†	14	22.2†	12	55.1†	14	25.6†
	18	312.8†	17	159.9†	18	119.7†	16	38.8†	17	50.8†	19	24.8†
	23	160.7†	20	110.7	23	151.0†	25	37.7†	22	36.8†	24	22.6†
LX-04-1 + Epoxy	5	17.5†	1	19.6†	5	18.7†	3	10.0†	1	10.5†	4	8.6†
	6	17.1†	6	17.9†	10	21.7†	7	10.9†	6	11.8†	10	9.0†
	14	18.5†	11	18.9†	15	21.4†	9	8.5†	11	18.4†	15	8.4†
	19	16.4†	16	18.4†	16	18.2†	21	9.9†	16	16.8†	20	10.2†
	27	19.3†	19	19.4†	21	30.9†	24	11.2†	21	11.7†	25	9.0†

† - Blew seal out of top.

TABLE I (Con't.)

Sample	9-23-63 Run No.	9-23-63 Time (sec)@ 220°C	9-25-63 Run No.	9-25-63 Time (sec)@ 219.5°C	9-16-63 Run No.	9-16-63 Time (sec)@ 220°C	9-17-63 Run No.	9-17-63 Time (sec)@ 242°C	9-10-63 Run No.	9-10-63 Time (sec)@ 242.5°C	9-19-63 Run No.	9-19-63 Time (sec)@ 242°C
9404	1	299.4	1	269.5	5	539.0	1	63.1	1	55.5	3	20.6†
	6	275.5	10	216.1	10	281.1	6	64.4	6	39.8	8	25.7
	11	299.2	15	143.4†	15	293.9	11	27.8	11	48.8	13	61.4
	16	700.0‡	20	184.8	20	241.8	16	62.0	16	39.2	18	51.4
	21	234.0	25	241.2	24	306.0	21	32.2†	21	52.1	23	25.2
9404 + Pb	2	586.7	2	111.8	4	169.8†	4	13.5	2	11.7	1	16.2†
	7	106.2†	9	148.4	9	209.3†	9	13.7	7	12.3	6	12.9
	12	112.2	14	270.5	14	143.4	14	13.9	12	14.6	11	14.6†
	17	114.9†	19	150.8	19	157.5	19	15.1	17	16.0	16	14.5†
	22	102.6†	24	111.6	23	143.5†	24	13.3	22	17.2	21	11.8†
9404 + NaCl	3	467.5	3	277.2†	3	1500.0‡	2	73.2	3	81.5	4	118.7
	8	226.2	8	261.0†	8	1000.0‡	7	69.0	8	85.5	9	74.0
	13	232.8	13	1000.0‡	13	1000.0‡	12	69.9	13	102.1	14	74.2
	18	421.8	18	296.2†	18	1000.0‡	17	76.0	18	60.0	19	71.4
	23	720.0‡	23	700.0‡	25	1800.0‡	22	63.5	23	68.8	24	76.5
9404 + Silastic	4	1000.0‡	4	397.8†	2	428.8†	5	103.0†	4	172.8†	2	70.5†
	9	403.7†	7	475.0†	7	418.0†	10	72.5	9	101.1†	7	81.2†
	14	338.0†	12	374.0†	12	1000.0‡	15	58.4†	14	95.2	12	82.2
	19	215.3	17	557.8†	17	664.4†	20	59.5†	19	61.2†	17	82.0†
	24	246.3†	22	272.2†	22	477.0†	25	76.4†	24	51.8†	22	94.3†
9404 + Epoxy	5	23.7	5	26.0†	1	328.9	3	16.4†	5	14.2†	5	15.1†
	10	22.8†	6	23.2†	6	22.0†	8	16.0†	10	14.6†	10	15.2†
	15	22.5†	11	25.8†	11	26.0†	13	14.8†	15	13.5†	15	14.4†
	20	21.9†	16	25.0†	16	24.8†	18	15.5†	20	17.6†	20	13.8†
	25	21.8†	21	25.1†	21	24.6†	23	16.2†	25	17.3†	25	15.8†

† Blew seal out of top.
‡ No explosion

Table II

Gas Chromatographic Reactivity Results[1,2,3]
(Gas Evolved in μliter @ STP)

Sample	Run No.	Date (1963)	Time (hrs.) @120°C.±0.5	$N_2 + O_2$	NO + CO	N_2O	CO_2	TOTAL
NaCl	471	6-4	22:15	27.3	0	2.5	16.4	46.2
NaCl	472	6-4	22:00	19.5	0	0.6	16.1	36.2
Pb	473	6-4	22:00	21.1	0	1.0	17.9	40.0
Pb	474	6-4	21:45	20.1	0	0.8	5.0	25.9
Epoxy	475	6-4	22:00	16.7	0	1.5	16.1	34.4
Epoxy	476	6-4	22:00	17.3	0	2.5	17.4	37.2
Silastic	477	6-4	22:00	3.3	32.0	3.2	27.9	66.4
Silastic	478	6-4	22:15	6.3	15.2	1.8	30.5	53.9
9404	480	6-5	21:45	30.4	185.	31.0	114.	360.
9404	481	6-5	22:00	17.4	190.	25.5	114.	347.
NaCl + 9404	482	6-5	22:00	29.2	170.	18.9	99.3	317.
NaCl + 9404	483	6-5	21:45	32.7	154.	26.1	113.	326.
Epoxy + 9404	484	6-5	22:00	242.	272.	924.	327.	1760.
Epoxy + 9404	485	6-5	22:00	238.	322.	1050.	445.	2050.
Silastic + 9404	486	6-5	22:00	61.1	415.	194.	168.	839.
Silastic + 9404	487	6-5	22:15	69.4	445.	218.	204.	936.
9404	488	6-6	22:45	32.2	178.	23.4	115.	349.
9404	489	6-6	22:00	25.8	172.	25.0	115.	338.
Pb + 9404	490	6-6	22:00	36.4	172.	35.2	85.0	329.
Pb + 9404	491	6-6	22:15	39.5	174.	53.5	93.8	361.
NaCl + 9404	492	6-6	22:30	25.8	201.	28.8	124.	380.
NaCl + 9404	493	6-6	22:00	29.6	206.	29.6	138.	394.
Epoxy + 9404	494	6-6	22:15	240.	309.	1040.	391.	1980.
Epoxy + 9404	495	6-6	22:00	236.	326.	1020.	388.	1970.
Silastic + 9404	515	6-12	22:00	124.	195.	353.	204.	876.
Silastic + 9404	516	6-12	22:15	55.0	317.	125.	138.	635.
Epoxy + 9404	517	6-12	23:15	83.0	221.	228.	186.	718.
Epoxy + 9404	518	6-12	22:00	237.	289.	921.	374.	1821.
NaCl + 9404	519	6-12	22:30	26.3	206.	29.0	113.	374.
NaCl + 9404	520	6-12	22:45	34.3	226.	35.8	143.	439.
9404	521	6-12	23:15	30.2	211.	27.2	141.	409.
9404	522	6-12	23:00	32.6	206.	28.8	154.	421.
Pb + 9404	523	6-13	22:00	87.3	227.	145.	143.	602.
Pb + 9404	524	6-13	22:15	73.3	248.	93.6	133.	548.

[1] Runs made from 6-4 to 6-19 were calculated using the calibration of 6-19.
[2] Volumes are not corrected to 22:00 hours.
[3] There is some uncertainty as to the reliability of the third significant figure.

Table II (Con't)

Gas Chromatographic Reactivity Results[1,2,3]
(Gas Evolved in μliter @ STP)

Sample	Run No.	Date (1963)	Time (hrs.) @120°C.±0.5	$N_2 + O_2$	NO + CO	N_2O	CO_2	TOTAL
9404	525	6-13	22:15	430.	0	21.8	127.	579.
9404	526	6-13	22:15	32.8	224.	27.3	128.	412.
Pb + 9404	527	6-13	23:00	43.4	175.	44.3	88.8	352.
Pb + 9404	528	6-13	22:30	53.4	242.	54.1	99.5	449.
Silastic + 9404	529	6-13	22:30	61.6	376.	145.	132.	715.
Silastic + 9404	530	6-13	22:75	52.5	380.	115.	141.	728.
Pb	532	6-17	22:15	37.4	0	3.2	7.0	47.6
Pb	533	6-17	22:15	66.8	0	2.4	4.1	73.3
Silastic	534	6-17	22:00	6.2	28.4	20.8	13.4	68.8
Silastic	535	6-17	22:00	2.9	58.0	4.0	27.6	92.4
NaCl	536	6-17	23:00	24.7	0	5.3	4.4	34.4
NaCl	537	6-17	23:15	34.0	0	2.3	4.9	41.2
Epoxy	538	6-17	23:30	21.0	0	2.3	5.8	29.0
Epoxy	539	6-17	23:30	27.8	0	0.8	4.0	32.6
NaCl + LX-04-1	540	6-18	22:30	32.3	0	3.2	3.5	39.0
NaCl + LX-04-1	612	7-2	22:30	17.5	0	7.5	10.0	35.0
LX-04-1	544	6-18	22:00	133.	0	6.5	3.6	143.
LX-04-1	545	6-18	22:30	61.6	0	5.1	5.2	71.9
Pb + LX-04-1	546	6-18	22:45	31.2	0	20.4	3.6	55.2
Calibration Run 6-19-63								
Pb + LX-04-1	627	7-9	23:00	33.6	0	38.9	8.5	81.
Epoxy + LX-04-1	564	6-24	23:00	77.9	85.5	290.	34.7	488.
Epoxy + LX-04-1	565	6-24	22:30	62.8	58.0	256.	40.2	417.
Pb + LX-04-1	566	6-24	22:30	80.8	0	29.4	4.3	114.
Pb + LX-04-1	567	6-24	22:45	40.3	0	35.7	3.8	79.8
NaCl + LX-04-1	568	6-24	23:00	48.9	0	4.5	5.0	58.4
NaCl + LX-04-1	569	6-24	23:00	11.4	0	4.8	3.6	19.8
LX-04-1	570	6-24	23:15	37.9	0	8.7	3.3	49.9
LX-04-1	571	6-24	23:15	33.2	0	3.8	3.6	40.6
Pb + LX-04-1	572	6-25	22:15	97.0	0	25.0	4.9	127.
Pb + LX-04-1	609	7-2	23:00	30.0	0	37.4	7.4	74.8
NaCl + LX-04-1	574	6-25	22:30	41.7	0	3.4	4.4	49.5
NaCl + LX-04-1	575	6-25	22:30	13.9	0	5.5	4.2	23.6

[1] Runs made from 6-4 to 6-19 were calculated using the calculation of 6-19.
[2] Volumes are not corrected to 22:00 hours.
[3] There is some uncertainty as to the reliability of the third significant figure.

Table II (Con't)

Gas Chromatographic Reactivity Results[1,2]
(Gas Evolved in μliter @ STP)

Sample	Run No.	Date (1963)	Time (hrs.) @120°C.±0.5	$N_2 + O_2$	NO + CO	N_2O	CO_2	TOTAL
Silastic + LX-04-1	576	6-25	23:30	37.2	0	16.6	5.9	59.7
Silastic + LX-04-1	577	6-25	23:30	38.4	0	14.2	7.4	60.0
LX-04-1	578	6-25	23:15	51.6	0	4.4	1.7	57.7
LX-04-1	579	6-25	23:15	28.6	0	3.6	2.7	34.9
			Calibration	Run 6-26-63				
LX-04-1	607	7-2	22:00	15.8	0	4.8	31.4	52.0
LX-04-1	608	7-2	22:00	17.7	0	20.4	17.6	55.7
			Calibration	Run 7-8-63				
Epoxy + LX-04-1	613	7-8	22:15	39.0	54.4	168.	97.0	358.
Epoxy + LX-04-1	614	7-8	22:30	36.0	60.4	181.	30.3	308.
LX-04-1	615	7-8	22:45	25.6	0	2.1	58.0	85.7
LX-04-1	616	7-8	22:30	19.0	0	3.0	27.6	49.6
Silastic + LX-04-1	618	7-8	22:15	29.8	0	6.5	9.7	46.0
Silastic + LX-04-1	622	7-9	22:30	35.6	0	12.4	18.9	66.9
Epoxy + LX-04-1	623	7-9	22:00	53.5	64.2	158.	162.	438.
Epoxy + LX-04-1	624	7-9	22:00	39.2	59.6	168.	60.5	327.
LX-04-1	626	7-9	22:30	17.8	0	5.0	16.9	39.7
Silastic + LX-04-1	621	7-9	22:15	35.5	0	9.8	58.5	104.
Silastic + LX-04-1	604	7-1	23:00	74.7	9.9	14.1	18.5	117.
Pb	628	7-10	22:45	22.0	0	0.9	29.2	52.1
Pb	629	7-10	23:00	21.4	0	3.2	15.6	40.2
Epoxy	630	7-10	22:45	18.0	0	2.0	12.2	32.2
Epoxy	644	7-12	22:45	31.0	0	1.8	5.1	37.9
NaCl	632	7-10	22:45	16.3	0	1.5	28.8	46.6
NaCl	643	7-12	21:45	31.1	0	0.2	2.9	34.2
Silastic	638	7-11	22:15	1.8	14.5	2.1	16.6	35.0
Silastic	637	7-11	22:15	1.7	18.4	1.4	18.5	40.0
LX-04-1	601	7-1	23:00	19.6	0	4.0	17.8	41.4
LX-04-1	602	7-1	23:00	44.4	0	2.0	8.9	55.3

[1] Volumes are not corrected to 22:00 hours.
[2] There is some uncertainty as to the reliability of the third significant figure.

Table III

Material	Date	Temp. (°C).	Harmonic Mean (sec.)	Ratio, RC	Average Ratio
LX-04-1	9-12	243	596.6		
	9-24	242	857.7		
	9-11	243	733.0		
	9-13	264	88.1		
	9-18	264	90.0		
	9-20	264	79.8		
LX-04-1 + Pb	9-12	243	71.8	8.31	
	9-24	242	99.8	8.59	7.52
	9-11	242	129.8	5.65	
	9-13	264	17.7	4.98	
	9-18	264	19.6	4.59	4.98
	9-20	264	14.8	5.39	
LX-04-1 + NaCl	9-12	243	502.0	1.19	
	9-24	242	726.3	1.18	1.26
	9-11	242	525.0	1.40	
	9-13	264	165.4	0.53	
	9-18	264	65.8	1.37	1.03
	9-20	264	66.3	1.20	
LX-04-1 + Silastic	9-12	243	167.3	3.57	
	9-24	242	167.4	5.12	4.40
	9-11	242.5	162.1	4.52	
	9-13	264	28.1	3.14	
	9-18	264	42.9	2.10	2.82
	9-20	264	24.8	3.22	
LX-04-1 + Epoxy	9-12	243	17.7	33.7	
	9-24	242	18.8	45.6	37.86
	9-11	242	21.4	34.3	
	9-13	264	10.0	8.8	
	9-18	264	13.2	6.82	8.17
	9-20	264	9.0	8.87	

Table III (Con't)

Material	Date	Temp. (°C)	Harmonic Mean (sec)	Ratio, RC	Average Ratio
PBX 9404	9-16	220	308.3		
	9-23	220	274.3		
	9-25	219.5	201.1		
	9-10	242.5	46.2		
	9-17	242	43.7		
	9-19	242	30.7		
PBX 9404 + Pb	9-16	220	161.5	1.91	
	9-23	220	129.9	2.11	1.81
	9-25	219.5	143.0	1.41	
	9-10	242.5	14.0	3.30	
	9-17	242	13.9	3.14	2.89
	9-19	242	13.8	2.22	
PBX 9404 + NaCl	9-16	220			
	9-23	220	302.5	.907	.816
	9-25	219.5	277.4	.725	
	9-10	242.5	77.0	.600	
	9-17	242	70.1	.623	.536
	9-19	242	80.0	.384	
PBX 9404 + Silastic	9-16	220	480.4	.642	
	9-23	220	282.9	.970	.708
	9-25	219.5	391.9	.513	
	9-10	242.5	80.9	.571	
	9-17	242	70.9	.616	.522
	9-19	242	81.3	.378	
PBX 9404 + Epoxy	9-16	220	29.8	10.35	
	9-23	220	22.5	12.19	10.19
	9-25	219.5	25.0	8.04	
	9-10	242.5	15.3	3.02	
	9-17	242	15.8	2.77	2.62
	9-19	242	14.8	2.07	

Figure 1

LX-04-1

TIME-TO-EXPLOSION VERSUS THE RECIPROCAL OF THE ABSOLUTE TEMPERATURE

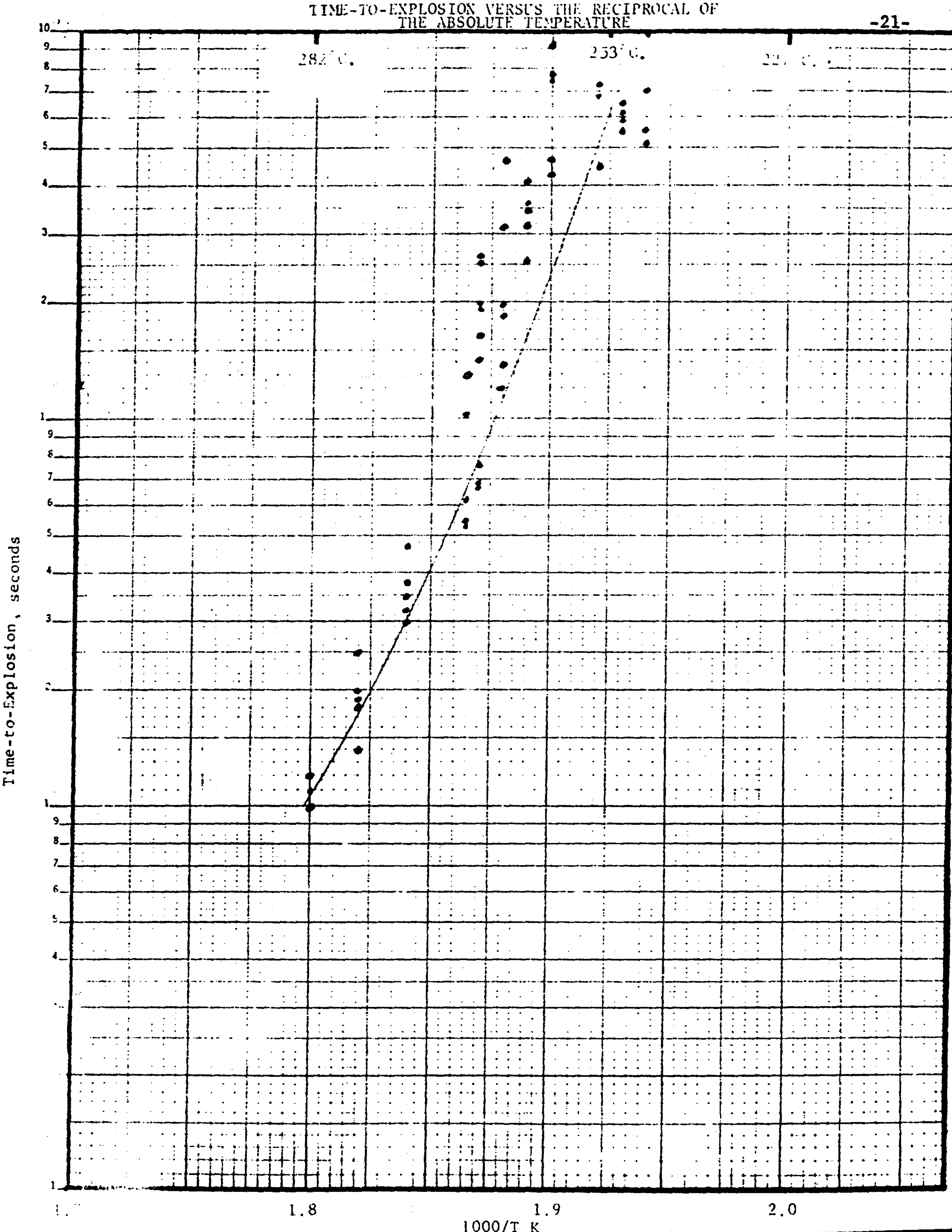


Figure 2
PBX 9404
TIME-TO-EXPLOSION VERSUS THE RECIPROCAL OF
THE ABSOLUTE TEMPERATURE

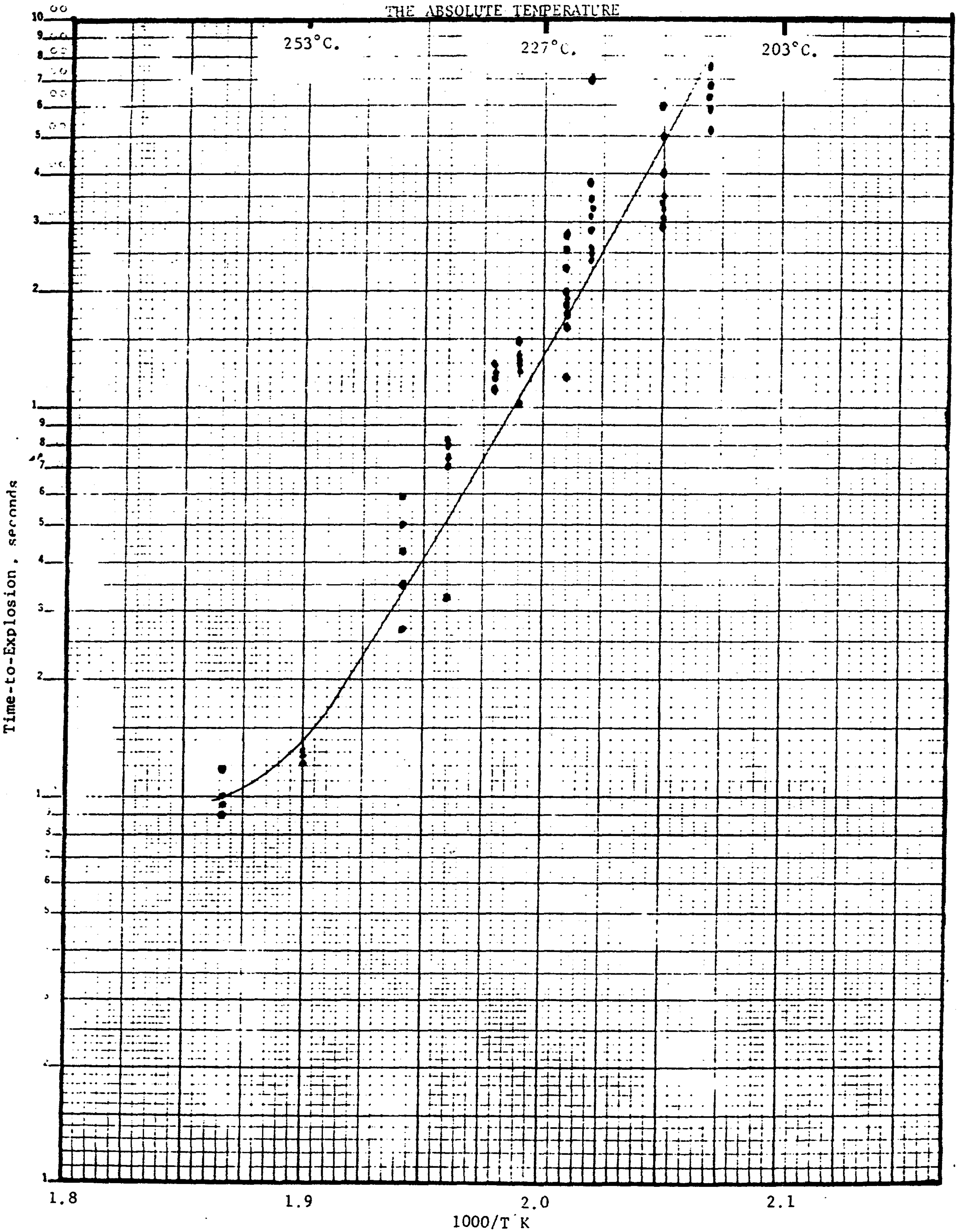


Figure 3

PBX 9404 + LEAD
TIME-TO-EXPLOSION VERSUS THE RECIPROCAL OF
THE ABSOLUTE TEMPERATURE

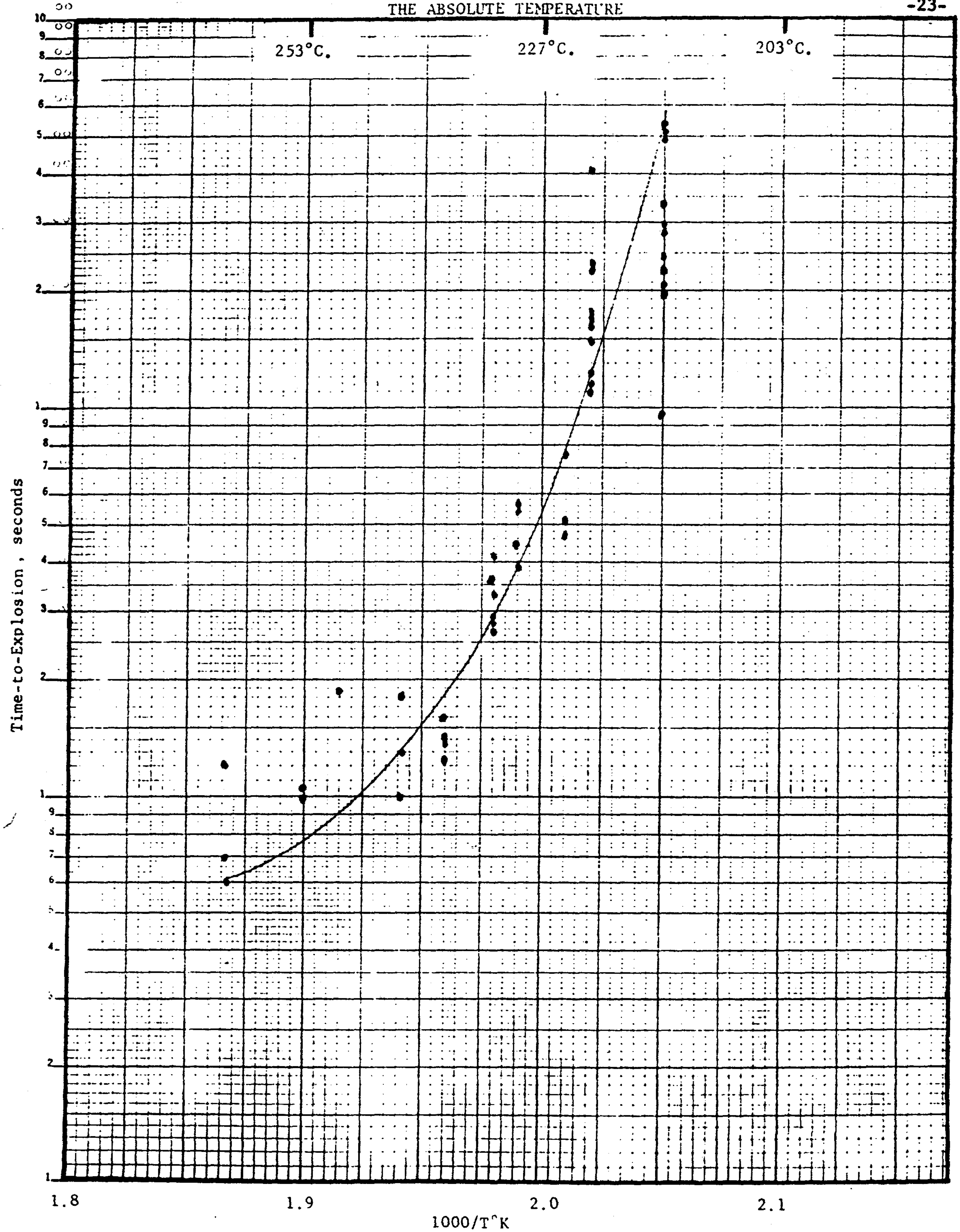


Figure 4

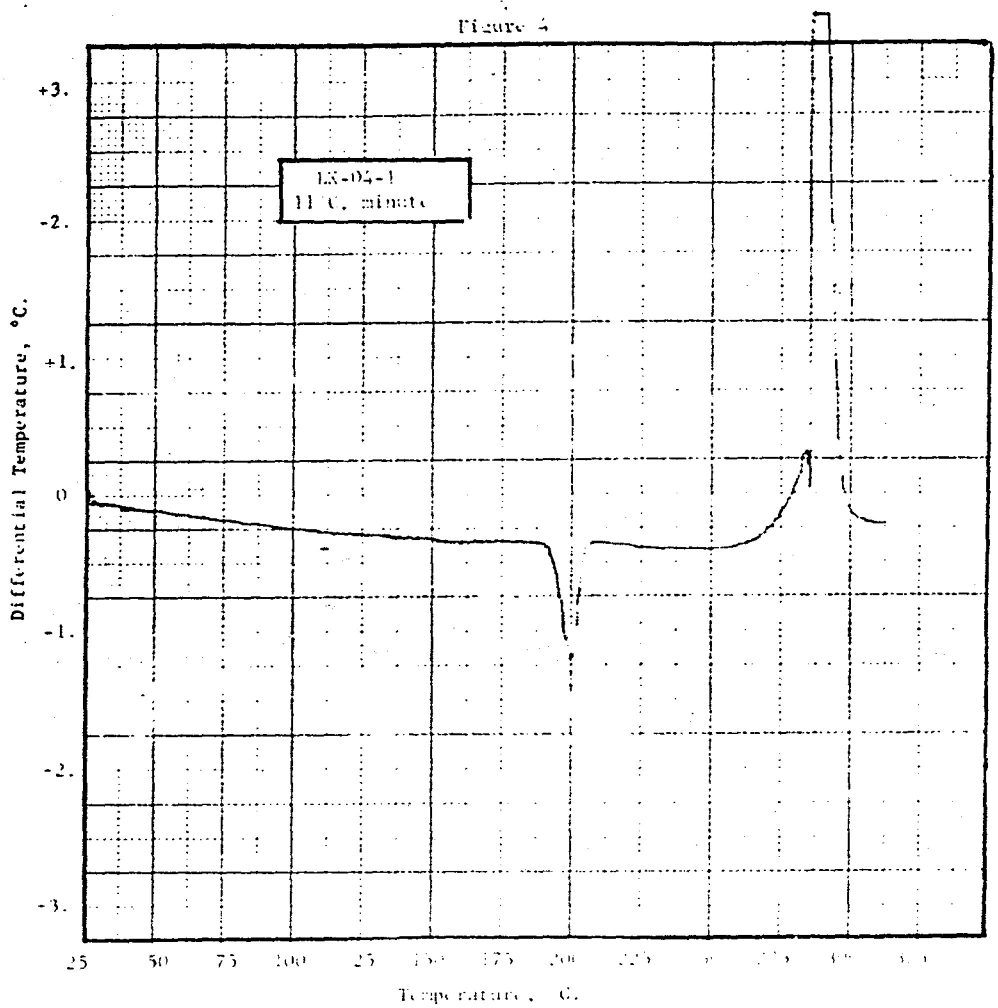


Figure 5

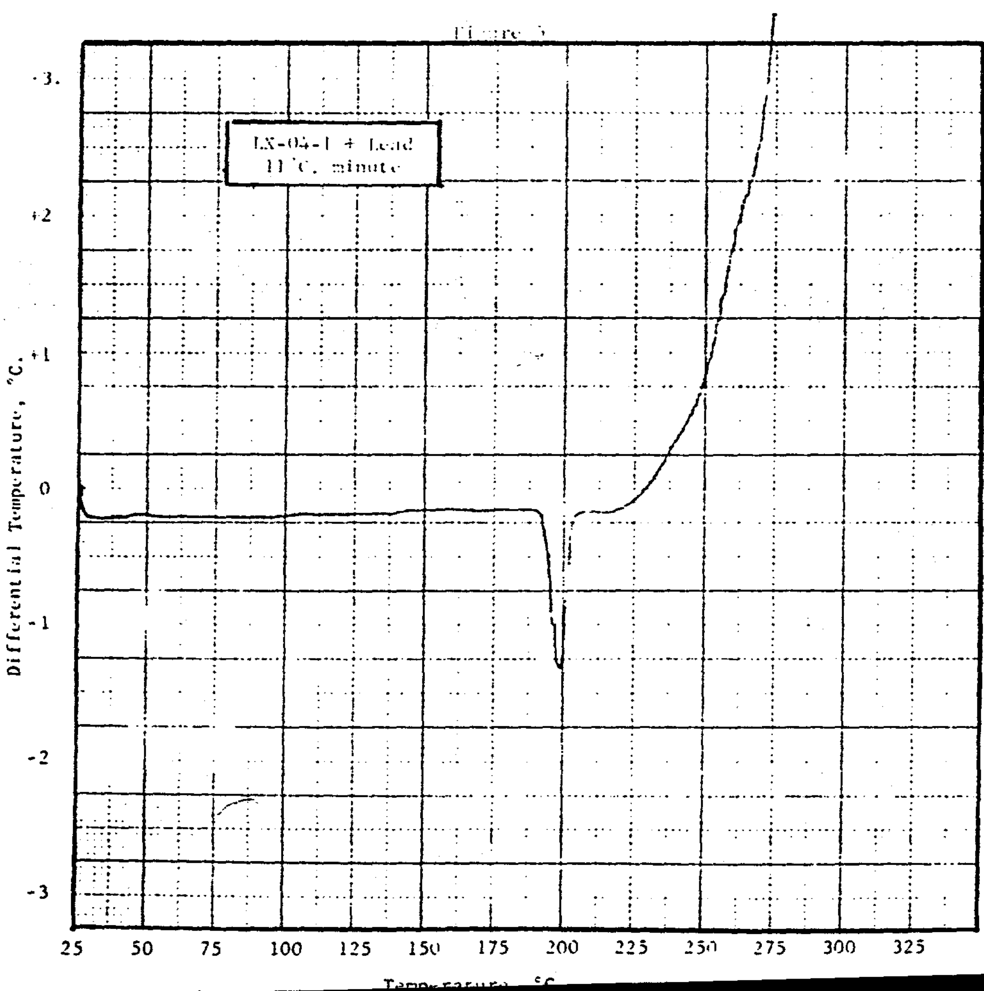


Figure 6

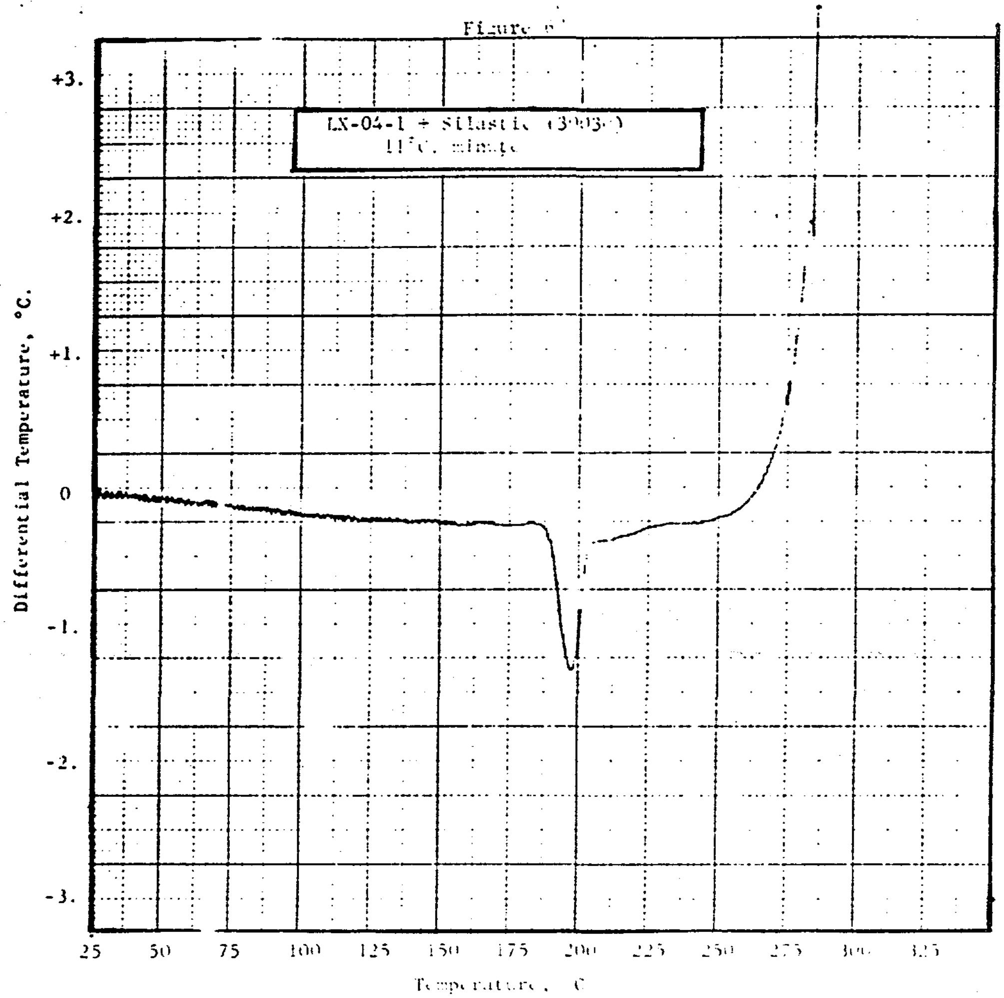


Figure [illegible]

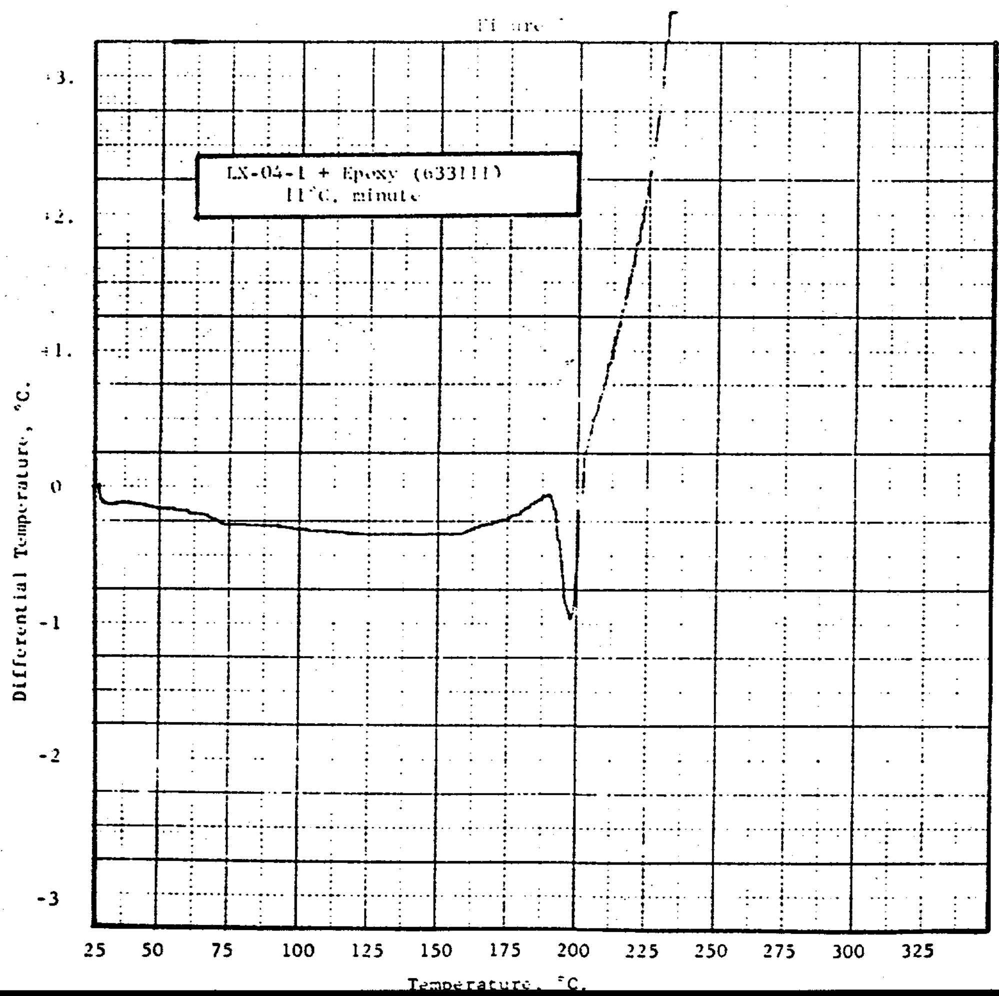


Figure 8

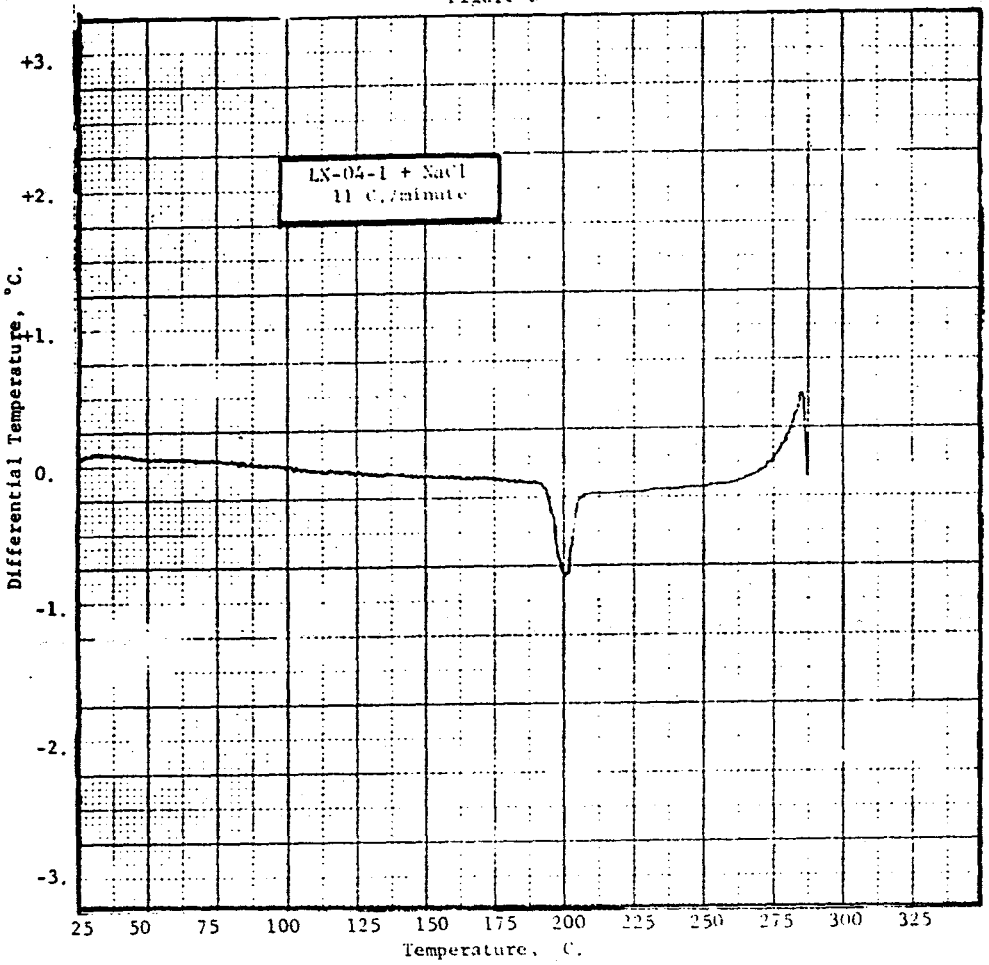


Figure 9

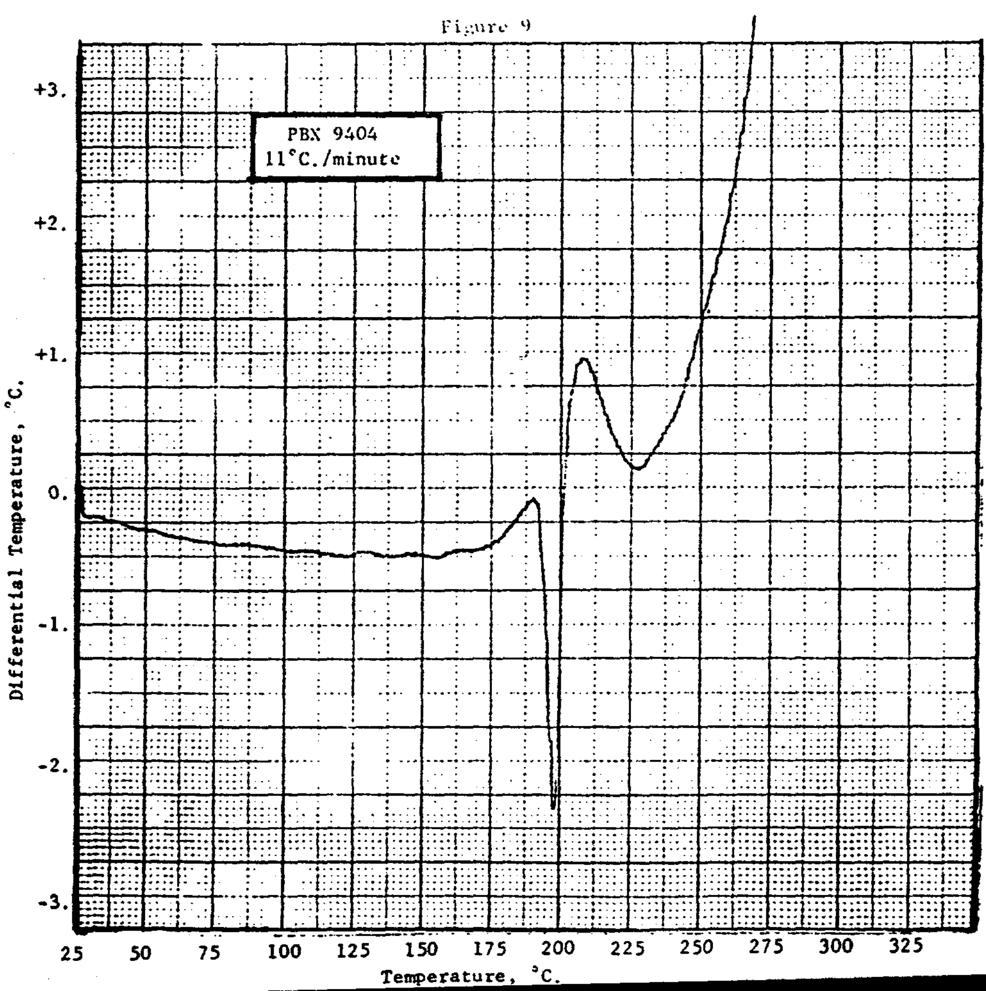


Figure 10

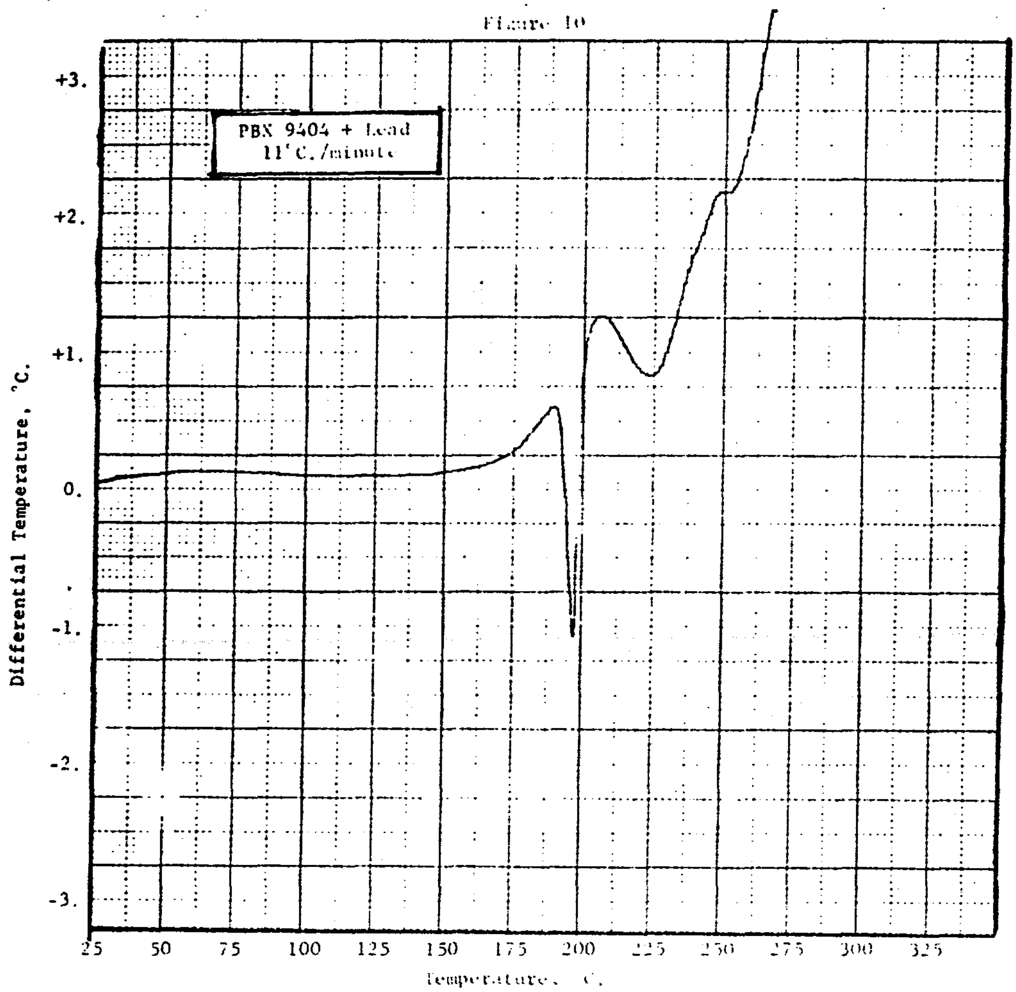


Figure 11

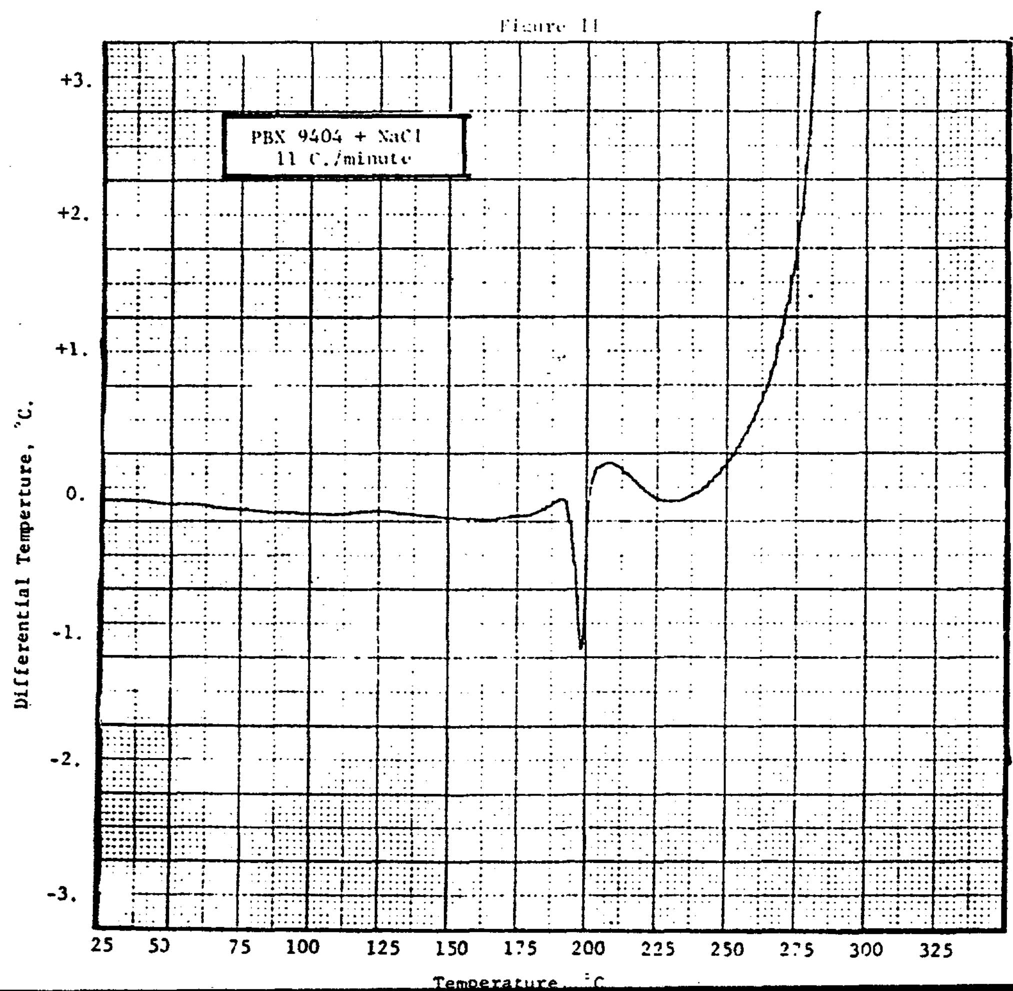


Figure 12

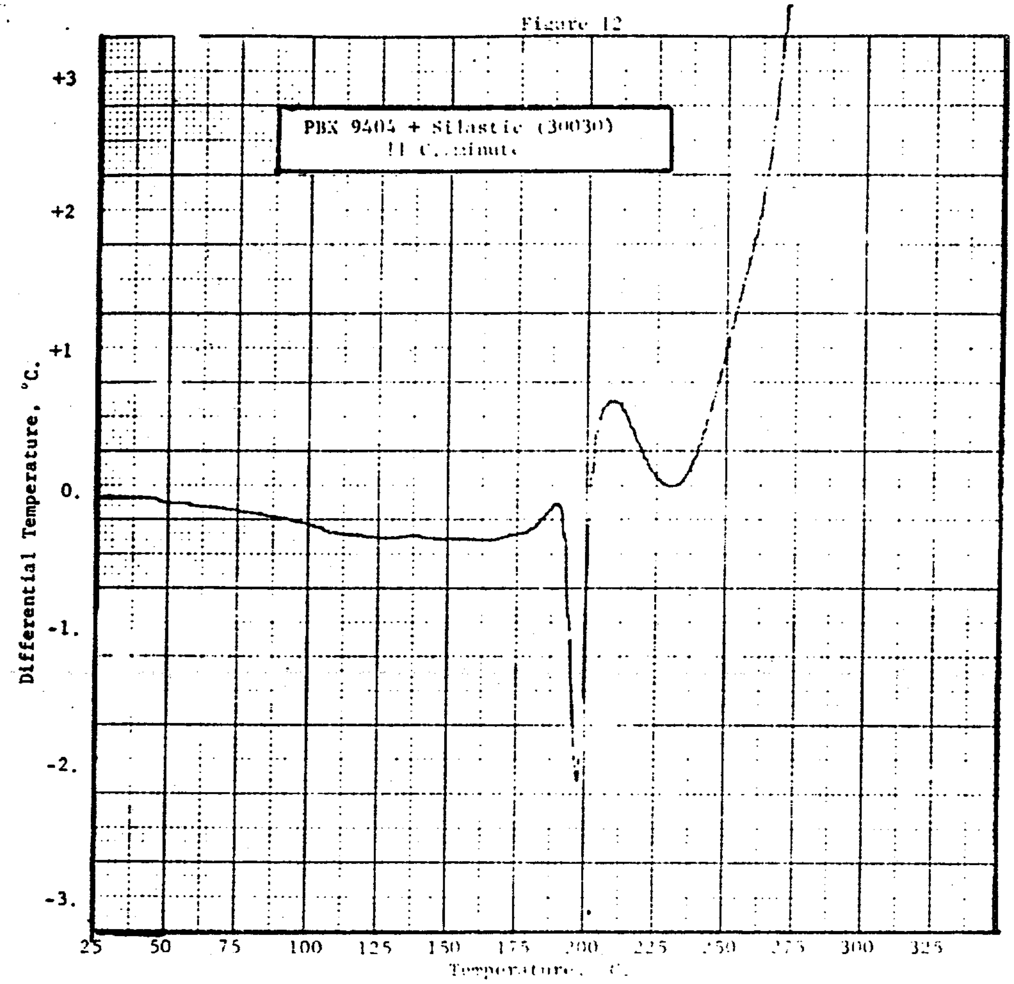
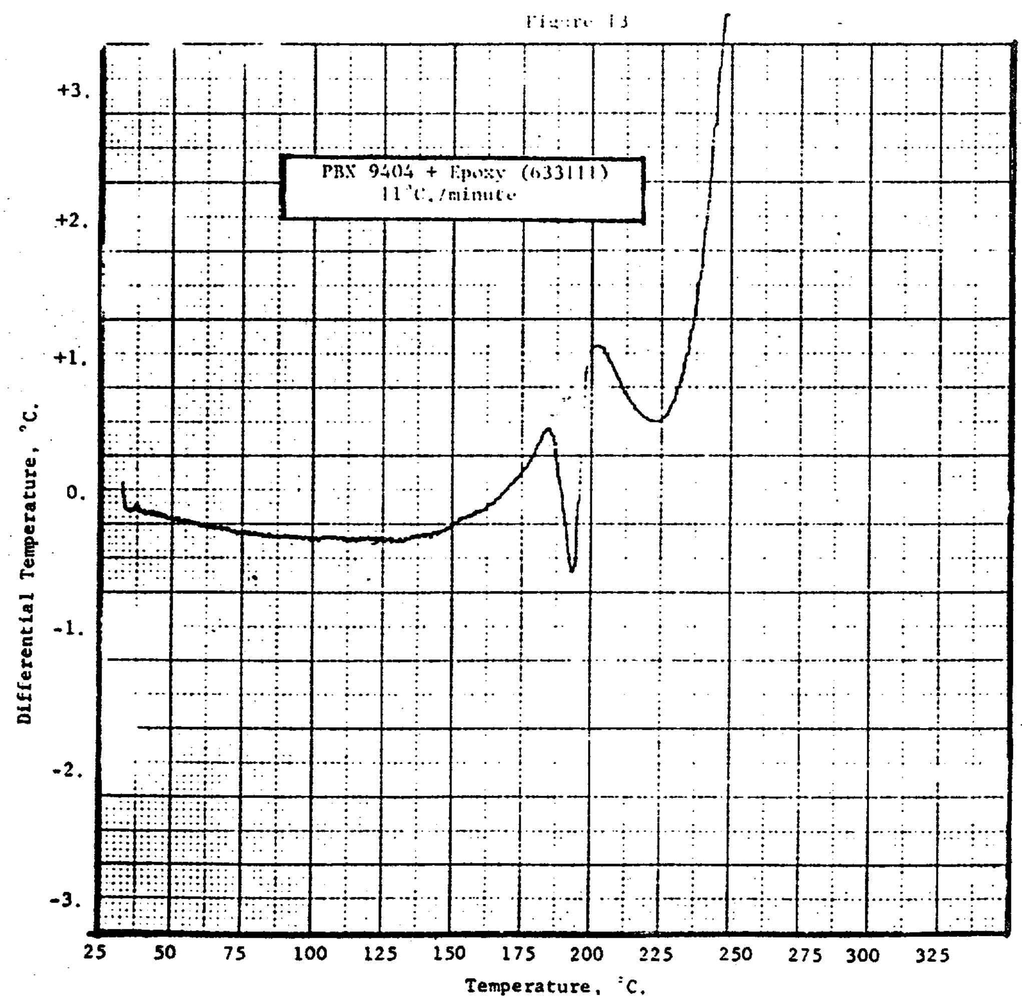


Figure 13



APPENDIX

EXPERIMENTAL DIFFICULTIES ENCOUNTERED WITH HENKIN TEST

Pages 1 through 7

DATA SHEETS FROM HENKIN EXPERIMENT

Appendix Data Sheets 1 - 74

Experimental Difficulties Encountered with Henkin Test

This section contains information to be considered in assessing the usability of the Henkin test as a routine quality assurance tool; it may also serve as a guide for future builders of Henkin test equipment (at least it will indicate some avenues not to pursue).

The major difficulty in getting the Henkin test in operation was the sample cap loading technique. Many different methods were tried at Pantex. The following is a chronological account of the major features of the evolution; it extends in time beyond the actual comparison experiment. The data sheets of all the Henkin work to date are reproduced in the appendix.

The initial plan was to adopt the method as reported by Rogers. His loading technique consisted of a #8 brass blasting cap (du Pont, 0.265 inch in diameter) loaded with a 40 mg sample; this was followed by a gas check (6.5 mm resized to 0.259 inch) with the convex side toward the sample, then a #00 cork and another gas check turned the same as the first. A punch and die was used to press the assembly to 300 pounds (6000 psi). The cap was then ejected from the die and crimped just above the first gas check with a dulled tubing cutter. A second cork was used at the top of the cap to hold a timing wire in place.

A variation in this loading method resulted from our ordering #8 blasting caps from Hercules; these turned out to be aluminum and were 0.22 inch in diameter. Twenty-two caliber (0.22 inch in diameter) gas checks and #000 corks were obtained for the aluminum caps. It was necessary to resize the gas checks so they could be easily pushed into the blasting cap; in systems where the gas check had to be forced into the blasting cap, a much larger percentage of the caps developed leaks and failed to explode. This technique was used with Grade II, 98% pure HMX. The data (see appendix data sheets 1 & 2) show that while some caps failed to explode, those that did gave reproducible times even when the sample size and loading pressure were varied. The failure to explode seemed to be associated with the corks. Just what happens to the cork when pressed was not determined; however, the cork could turn slightly causing the gas checks to tilt and not seal properly. The same technique was tried with PBX 9404; the results were horrendous (see data sheet 3).

To reduce the number of failures, another loading system was tried which used one gas check (convex side toward sample) and a 1/8 inch lead plug (data sheets 4 - 11). With HMX and LX-04-1, this system gave few failures and reproducible times-to-explosions. It would not give satisfactory results with PBX 9404. At 225°C., for example, two groups of times-to-explosion were obtained, one at approximately 25 seconds and the other at approximately 2000 seconds; intermediate times could not be obtained for PBX 9404 samples in the range 225 - 235°C. (this was thought to be where the time-temperature curve broke sharply). The brass gas checks were than aluminum plated and used with PBX 9404, but this did not change the results.

The samples of PBX 9404 that exploded in 25 seconds at 225°C. had a residue left in the cap. This residue was run in the DTA and gave a thermogram that compared to HMX suggesting that the nitrocellulose had caused the explosions.

Twenty unreacted samples were subjected to the normal nitrocellulose analysis; no abnormal amount or intersample variation of NC was observed. Other lots of PBX 9404 and different sampling techniques (total sample, sieve cuts, etc.) were tried, but they gave the same results. The short time (25 seconds at 225°C.) explosions were not as noisy as the longer times; this strengthened the pressure blow theory. To eliminate the pressure blows, different loading techniques were again tried. The first used a gas check, cork, gas check, and lead plug in that order. It was thought that the pressure buildup would compress the cork slightly, thereby increasing the volume and reducing the pressure sufficiently to maintain a seal. Some intermediate times, approximately 200 seconds at 231°C., were obtained which had not been obtained before, but the times ranged from 19 to 700 seconds (data sheets 20, 21). The next method consisted of pressing the H.E. in the cap, placing washers next to the H.E. and then sealing with a gas check and lead plug. This was to provide an air space so the pressure buildup would not be as great. This system gave short times, but no long times (appendix data sheets 23, 24). Then we decided to try more than one 1/8 inch lead plug to provide a better seal as well as some additional inertia and side wall friction. This gave no "extra long" times at 225 - 235°C.; the times were in two groups of approximately 20 and 200 seconds (appendix data sheet 26).

In an attempt to further strengthen the seals, the following was done: two gas checks were used; the first had the convex side turned away from the sample, the second had the convex side toward the sample. This was followed by two 1/8 inch lead plugs (see appendix data sheets 29 - 35). The results for the first ten samples were quite reproducible times of about 350 seconds at 230°C.

The first five were shot on Friday and the second five on the following Monday; the latter group all blew the side out of the cap. After these ten shots, the succeeding ones gave a large scattering of times at 230°C. While this turn of events was heart rending, we were able to maintain some feeling of progress.

At this time the construction of a Magneformer was completed. It permits crimping by sharply increasing a magnetic field around the caps and pressing the walls into the lead. A 1/4 inch long lead plug was substituted for the dual 1/8 inch plug arrangement; a crimp was made such that it would be on the lead plug. The various methods using lead plugs were re-evaluated by including magneforming (appendix data sheets 37 - 42). The results were generally improved, but a large deviation in time still persisted. At this point other parameters were varied in an attempt to define the problem, i.e., sample size and loading pressure, with very little improving effect noted (appendix data sheets 34, 35, 37). A few samples were tried in which an epoxy L933A was poured over the gas check-plug assembly. The adhesive was dried overnight and shot the following day. All these blew the side out of the cap; there was less deviation in the times than in previous loadings (appendix data sheets 36, 37). The approach was discontinued because of undeterminable side effects (CTE problems, heat evolution and/or heat sink problems, "thermal strength", etc.); it did indicate, however, that if the sealing assembly could be held in place, the explosions could be made to rupture the caps and give more reproducible times.

Following a discussion with R. Rogers, in which we discovered that our reproducibility goals were unrealistic (i.e., all previous work had been plagued by considerable scatter), it was decided that the experimental approach and philosphy should be changed as follows:

1. Accept the fact that scatter and odd times are inherent in the experiment.

2. Realize that just a few trials of any system are not sufficient to evaluate that system. This is especially true since loading is an art and the operator cannot duplicate seals except after considerable practice.

3. Choose one or two loading systems that appear to have the best chance of success and work with them extensively (with a minimum of modification). One desirable feature would be that the assembly be strong enough to cause explosions to rupture the cap rather than blow the seals out the top. It turns out that a shortage of aluminum caps occurred at this time; brass caps were amply available. We decided to load as follows:

    a. Load caps with H.E.

    b. Follow with two gas checks; the first with convex side away from H.E., the second with convex side toward H.E.

    c. Use a 1/2 inch long lead plug.

    d. Press at approximately 7000 psi.

    e. Magneform crimp the caps on the lead plug.

    f. Use both aluminum and brass caps.

4. Choose a known incompatible mixture of H.E. and "inert", compare its times with the pure H.E. (i.e., run the time-temperature curves) and use this to check out the loading techniques. The mixture chosen was PBX 9404 + lead powder; the latter was supplied by Rogers.

In generating these time-temperature curves, the brass cap assemblies quickly proved superior to the aluminum caps (appendix data sheets 38, 39). As a matter of fact, the brass system sealed in the manner described above was deemed sufficiently satisfactory (appendix data sheets 40 - 51) to be used in the comparison test. The comparison test data, which are quite good (in precision), are found in appendix data sheets 52 and 53. During the experiment, it was noted that mixtures containing lead, Silastic and epoxy consistently blew the seal out the top of the caps. The pure explosives and mixtures with NaCl ruptured the caps. By including a second 1/2 inch lead plug or a single 1 inch lead plug, all these systems could be made to rupture the caps (appendix data sheets 54, 55). In addition, these systems functioned as well (both in terms of reproducibility and absolute times) when the magneform crimp step was eliminated (appendix data sheets 54, 55, etc.). This latter is very desirable and helpful since magneforming is quite time consuming; all subsequent experiments have been performed without crimping (and the last described loading assembly).

A considerable number of experiments involving a wide variety of explosive systems have now been performed with satisfactory results (appendix data sheets 57 - 74). One one occasion, vendor supplied lead plugs would not seal well; this turned out to be caused by a surface lubricant (on the plugs). Cleaning in acetone eliminated the problem (appendix data sheets 58 - 60). Aluminum cap assemblies were tried again (appendix data sheets 57); these again gave poor results, probably because of their relative lack of strength. Some concern has arisen about the use of brass because of possible chemical reaction with the reactants. Experiments to date with gold plated caps and check have neither verified or rejected this concern (data sheets 68, 69).

The presently used cap assembly is as follows:

1. Load #8 brass blasting caps, 0.260 inch diameter with the desired explosive.

2. Resize 6.5 mm diameter brass gas checks to 0.259 inch diameter.

3. Slide a gas check into the cap with its convex side turned toward the sample.

4. Insert a 1 inch long by 1/4 inch diameter into the cap.

5. Press the assembly in a Carver Laboratory Press to 350 pounds; i.e., 7000 psi.

POP 419 [illegible] ✓ ✓ HMX ✓ ✓ (1)

		[illegible]	Pressure psi	HMX mg	temp °C	time sec	Ave time	Δ
1	125	230	6300	20	278	10.65		
2		230	"	20	278	10.55	9.70	2.75
3		230	"	20	278	7.90		
4	125	230	6300	60	278	9.90		
5		230	"	60	278	11.95	11.05	2.05
6		230	"	60	278	11.30		
7	125	230	6300	40	278	10.65		
8		230	"	40	278	11.05	10.28	1.80
9		230	"	40	278	10.15		
10			—	40	278	9.25		
11	100	165	4500	40	278	9.05		
12		165	"	40	278	10.60	9.52	1.70
13		165		40	278	8.90		
14	25	255	7000	40	278	10.00	9.05	1.35
15		255		40	278	8.50	(delayed (second try))	
16		255		40	278	8.65	" " "	
						$\boxed{9.94}$		

Data Sheet 1

POP 419

(2)

	230	237	247	252	263	269	274
HMX	8500	6000	431.8	477.2	88.8	19.1	13.0
			763.6	325.0	42.9	18.1	13.2
					42.8		
					40.4		

[illegible] with

gascheck cork & gascheck

Data Sheet 2

POP 419

3

Data Sheet 3

Temp on Programmer $V_{set}+0$	True Temp: Temp. TC inside bath	Temp. T.C. at bottom of bath		9404 time	
230°	256	258		18.0	did not ~~stop~~ Stop clock
230°	255	256		>1000	Reaction had occured
230°	252	254		>750	Reaction had occured
230°	252	254		22.05	Positive reaction
230°	252	254		>250	no positive reaction
230	252	254			Cap was not crimped
230	252	254		8.4	RDX - not crimped
230	252	254		7.3	RDX - not crimped
230	252	254		>350	no reaction noted
230	252	254		≈ 22	Reaction almost stopped Timer (Sample size was larger)

note added 3-12-64

The data for the next several day was not kept. It was very bad.

Data Sheet 4

HMX - 98% pure (4)

temp (°C)	time (sec.)	
266	35.9	
266	32.3	$\bar{x} = 32.3$
266	33.2	$\sigma = 2.80$
266	30.8	$\Delta = 6.3$
266	34.25	
266	29.75	
266	29.6	
263	49.7	
263	38.0	$\bar{x} = 43.75$
263	41.6	$\sigma = 4.75$
263	47.5	$\Delta = 11.7$
263	41.95	
255	252.0	
255	298.4	$\bar{x} = 262.1$
255	248.4	$\sigma = 20.98$
255	262.0	$\Delta = 50.0$
255	249.9	
260	51.4	
260	47.15	$\bar{x} = 51.2$
260	56.7	$\sigma = 6.86$
260	41.9	$\Delta = 16.75$
260	58.65	

temp (°C)	time (sec)	
269	19.35	
269	23.35	$\bar{x} = 22.0$
269	23.70	$\sigma = 2.17$
269	19.95	$\Delta = 4.35$
269	23.70	
273	16.25	
273	24.20	$\bar{x} = 18.52$
273	18.15	$\sigma = 3.37$
273	15.70	$\Delta = 8.5$
273	18.3	
277	24.95	
277	16.55	$\bar{x} = 19.95$
277	20.70	$\sigma = 4.37$
277	23.05	$\Delta = 10.45$
277	14.50	

gas check & $\frac{1}{8}$" lead plug

POP 419

POP 419

6-10-63

5

Data Sheet 5

		2			°C			
temp on Programmer	190	200			225	235	250	260
temp at TC in bottom		217			24A	240	264	273
Temperature		224			247	259	275	283
		1048.7			10.5	8.5	6.1	5.6
		20.3			11.15	7.3	5.7	4.9
		612.6			7.4	8.0	6.7	5.0
					8.1	8.4		
					NE(1170)	459.9	25.2	8.1
					NE(1009)	492.4	22.5	7.7
					799.6	363.4	24.0	9.6
					1022.9	267.2	23.4	9.4
					1093.4	372.8		
					970.4	A		
					996.6	391.1	24.0	9.45

8.3
1.0

check

041

POP 419

6-17-63 (6)

Tween Programm	200	220	225	
TC	212	229	235	
Temp inside	225	238	245	
[illegible]	26.7	12.0	9.2	
	25.55	9.8	13.05	
	1144 NE 4		15.25	
	1700 NE		NE.	1-gascheck
	777.8		10.2	1-1/8" lead plug
			9.65	
			965.15	
[illegible]				

Data Sheet 6

POP 419

6-12-63

7

Pre.		200	225
TC		214	239
Inside		223	248
q_{40}^{Δ}		22.1	11.65
		19 NE	13.9
		30.8	12.0
		24.2	14.3
		N.E.	16.5
		31.06	15.2
	temp ~230	4082.4	1351.45
LX 041			1797.9
			1181.2
			1251.2
			1232.85
			1262.9

1 gas check
1/8" plug

Data Sheet 7

POP 419

6-13-63

8

Pro.	150	170	185	200
T.C.	162	183	196	210
Inside Temp	171	192	205	225
NE	22771.5	2850 NE	2105.4 NE	
	4000 NE	1800 NE	2000 NE	
[illegible]			-(4252)	
				415645

1 gas check

1/8" lead plug

Data Sheet 8

POP 419

6-14-63

9

Bar.	200	205	202.5	202.5	202.5	202.5	
T.C.	213	219	215	214.5	216.0	216.5	
Inside	223	229	224	223.5	224	224	
	33.5	20.3	33.25	1622.75	4500 (NE)	30.1	
	[illegible]	23.55		2891.7		22.1+	timer fault
		28.9				29.1	
						12.8+	timer fault
9404							

1" gas check

1/8" lead plug

AVCH

Data Sheet 9

POP 419

LX 41 6-15 (10)

		230	234	238	245	250	255	260	265		240
		241		249	257	262	266	270	273		250
Table*		252		260	268	273.5	277.5	282	285		261
		1011.2		390.2	53.5	29.1	12.3	8.9	8.7		315.2
		888.1		~~*~~	64.8	21.7	14.3	10.5	8.0		310.2
		787.2		242.6	65.5	30.5	14.9	10.4	8.8		330.1
		1086.5		415.0	64.9	25.4	16.9	10.6	8.4		250.0
		883.3		283.4	66.2	26.7	13.2	10.4	8.0		327.4
				222.2				10.4			339.9
				252.8							338.5
Average		931.3		301.0	63.0	27.7	15.3	10.2	8.4		277.2

1 gas check
1/8" lead plug

Data Sheet 10

* [illegible]

POP 419

(11)

Prog. T/C in bottom	234	240	
Inside Temp	244	251	
	255	263	
1 X-041	670.2	481.8	
	655.45	128.8	
	636.85	234.8	296.8
	633.1	143.7	
	813.3	89.55	
		[illegible]	
		296.8	
$\bar{x}=$ 679.8			
		396.4	
		339.0	
		297.5	2
		150.7	
		223.25	
		174.85	
		84.6	
		94.6	

1 gas check
1/4 lead plug

Data Sheet 11

POP 419

6-10-63

(12)

Temp.		
Prog.	230	
Bottom	239.5	
Inside	250	
9404	1542.2	NE
(B1-524-61	17.3	?
Mach. [illegible])	11.0	
	10.2	?
	10.05	
9400	17.8	
O2' Samples	13.0	
(from Gas		
Chromatographic		
sample)		

1 g[illegible]
1/4 [illegible]

Data Sheet 12

POP 419

6-14-63

13

Temp.				
Prog.	205	210		
Bottom	217	222		
Inside	227	232.5		
				1 gas check
9404	7999.5 NE	~4100 NE		1/4 lead plug
(Dried, Mach. Powder)	~ 4000 NE	13.7		
		25.0		
		1700.0 NE		

Data Sheet 13

POP 419

6-20-6?

(14)

Temp.							
Dry.	210	225		220		215	
Cartridge	220	236.5		233		224.5	
Inside	230	249.5		242		233.5	
[illegible]	*3443.7	1063.1		17.7	not crimped	13.8	NC
(Dried Mach.		14.75	②	21.5		14.45	C
[illegible])		18.5		16.8		15.8	C
		15.5	①	15.2	crimped	19.8	NC
		18.2	②	22.5			
		~300	① NE	~20			
		~20	①	~17	C		
		25.6		14.6	NC		
		18.5		25.25	C		
						NE	Same lot
						1700	
						29.5	Same lot
						1105.5	
						29.3	

NC — not crimped

① old loading method 2 [illegible]C + Cork
② new loading method
* [illegible] 1 to 247

Data Sheet 14

6-21-63

(15)

Temp					[illegible] perhaps temperature not correct		
Parr.		215					
Bottel.		226					
[illegible]		238.5	228	229	222	221.5	226
			17.6	19.2	23.1	>550 I.E	22.9
Glued [illegible]	w/		14.1 ①	19.2	23.0	26.3 II	>400
[illegible]	Caps			24.7	24.9	65.7 ②	>400
+ Grinding of					19.7 ②	21.8	
Sample					61.3	24.6	
						22.8	
						>550	
				20.2	did not blow		
			32.2				
			18.- *				
			16.7				
Brass			15.5				
Caps							

② [illegible] (cut in chem. lab, sieved)

① Machined [illegible] only

* [illegible]

POP 419

-22 6-22-6[illegible]

16

Pro.							
TC							
Inside Temp	224	226	228	230	221	220	215
9404	>350						
	28.9	>500	21.7	22.5	27.5	30.4	>300
	34.0	23.2	>350	20.5	26.6		>300
	>350	21.7	21.1	19.8*	31.0		37.6
	26.9	>300	24.7	>850	>300		>300
	23.9	>400	19.2				40.2
	>350	17.2					
	29.5	20.8					
		18.9					
		>200					
		>300					
		>200					
		23.2①					
		4.3					
		23.8					
		>200					
Average	28.6	19.6	19.2	20.9	28.4		38.9
		21.3					

1 al plated gas check
1/8 lead plug

① [illegible]

* [illegible] 6-21

Data Sheet

POP 419

6-24-63

17

Temp.									
[illegible]		190		215		235			
[illegible]		202		222		248			
[illegible]		211		230		259			221 — 262
[illegible]		501.3	NE	1000	NE	14.0	200#	10.1	
		507.5	NE			13.0	200#	14.3	[illegible] 5¼ mg
		1004.0	NE			13.9	150#	13.9	150# 25 mg
		2200	NE			17.2	150#	12.85	[illegible]
						12.35	260#	13.5	2 gas checks + crimped
						196.0	(HMX)		
						15.1	150#		
						14.2	100#		
[illegible]		253							
									al gas checks
		9.6							1/8" lead plug
			241°C						
9404									
			19.1						

Data Sheet 17

Data Sheet 18

POP 419

6-25-63

18

	230°C	
NC	4.8	
	4.7	
	4.7	
[illegible] + H_2O	339.4	NE
(1 drop)	220.3	NE
	111.8	NE
NC + [illegible]	6.0	
([illegible] drops)	~6+	PFFT
	7.8	
	5.8	PFFT
NC + H_2O	5.1	
(1 drop)	7.1	
	3.8	
[illegible] ([illegible])	19.2	
94[illegible] + H_2O	692.4	NE
([illegible]) (1 drop)		

6-26-63

(19)

Sample		°C. 232		Sample	°C. 232	
9404 (ground)		15.2		NC + CEF	2.5	PFFT
		21.4		(50-50)	$\sim$5+	PFFT
		22.1			$\sim$8+	PFFT
9404 + H_2O	Plugs had [illegible] in &	203.8	NE	NC + CEF	7.2	PFFT
(old) [illegible]		208.3	NE	(75-25)	5.4	PFFT
		203.5	NE		6.1	PFFT
9404 (old samples)		19.5		9404	12.1	
		17.1		(ground)	17.5	
		18.5			16.5	
[illegible] + CEF	Plugs pushed up	301.9	NE	9404 + H_2O	115.0	NE
(50-50)		201.8	NE	(1/4 drop)	106.8	NE
		213.0	NE		98.2	
[illegible] + NC		4.9	PFFT!			
(50-50)		4.4				
		4.9				
NC + CEF + H_2O		203.1	NE			
(50-50 + 1 drop)		206.2	NE			
		202.4	NE			

Data Sheet 19

POP 419

POP 419

6-28-63

20

	230.5			232		~230°C		231°C	
910[4]	19.7							537.9	
left open	>400	NE						681.9	
	>900	NE						106.25	
to room atm.	16.7							19.3	
	25.4							<1100 NE	loaded with gas check cock, gas check, + lead plug.
	>1000	Temp 232						<700	
	13.5							~30	
								22.7	
load with gas check cock, gas check + PL plug	→			237.8			residue →	357.1	
								560.5	
				3230					
				17.1					
				21.0					
	>400	260 lb		235.5					
				16.1					
				17.1					
[illegible]	229								
						420.9			
						397.6			
						554.1			
						199.7			
			regular loading but 150 lbs			>600			
						>900			

Data Sheet 20

POP 419

11

1-2-63

21

	3.5					
	~~9.165 → 225.5~~					
	9.453 →	233.	233	233	236	236
		23.7 ①	162.6	>900 NE	15.9	367.5
		797.5	431.8			>600 NE
		22.5	>830 NE			
		322.4	>900 NE			
		288.4				
		21.8				
		19.8				
Reduce in cup →		>900 NE				
		>1000				
		① Samples were loaded with 2 packets cash & loading. 1 in E were exposed to room atm. over weekend loaded at 150 lbs	Samples were dried over night loaded at 150 lbs	Samples were dried over night loaded at 120 lbs	dried over night loaded at 150 lb	dried over night loaded at 120 lbs

Data Sheet 21

POP 419

7-3-83

22

Data Sheet 22

	260		°C 265
LX041	429.3		68.5
	605.1		333.5
	534.7		465.4
	686.7		
	648.8		
	500.7		400.1
	374.7	Imp changing.	804.5
	509.2		

POP 419

LX04-1

7-10

25

245°

LX041 10.372

10.770 265

134.0

703.9

440.8

318.8

7-10-63
Hert Carroll
Specimen

NE 1081.0

49.6

NE 1007.3

17.8

14.9

18.5

aver 17.1

2 [illegible] 260/200

Data Sheet 25

POP 419

7-10-63

245 R-6, C-9, F-8

(26)

	245°			231.5°	
9404	10.7	1st plug HE-260	NE	205.2	
	17.4	2nd plug 300		25.5	orig matl
	11.1	old sample(s)	NE	220.3	two plugs
2 plug aver: 12.1	12.9			151.2	260/300
1 plug aver: 16.05	16.5	one plug old sample		19.5	
	17.9		NE	301.6	ground matl
NE	[illegible]	orig matl		19.0	3 plugs 260/300 grd matl
	16.9	one plug 260		~90	3 plugs 260/300 orig matl
	13.4	orig matl	NE	238.7	2 plugs 100/200 orig matl
	13.3	two plugs		19.6	1 plug 260 grd matl
	12.6	orig matl 2 plugs			
	11.4	washed 260/300			
NE	124.5				
	106.0	2 gas checks			
NE	208.3	Coile-125			
recalc	20.9	orig matl			
	22.1				

Data Sheet 26

POP 419

7-11-63

27

	235°		230°		233°		239°		250°		257°		245°
Herb Carroll	545.3	NE					533.3	NE	13.3	12.1 aver	9.5	10.2 aver	17.8
material	401.8	NE					30.0	31.3 aver.	11.6		10.4		14.9
	400.9	NE					34.6		11.4		10.7		18.5
	~210	NE					29.5						NE 1081.0
	4405.7	NE											49.6
													NE 1007.
												temp	aver. time
												235	none
												239	31.3
												245	17.1
												250	12.1
												257	10.2
9404	20.9	16.9 aver.	501.0	NE	201.1	NE							
	14.9		178.1	18.5 aver	13.4	17.0 aver							
	15.9		23.8		19.0								
	16.8		16.1		14.5								
	16.1		15.6		21.2								

Data Sheet 27

POP 419

7-12-63

28

	237°		230/229				225°	
Herb Carroll	409.9	NE						
material	122.9							
	302.4	NE						
	101.4							
	209.7	NE						
9404		✓	305.1	NE			203.0	NE
		✓	319.9				22.2	
			26.5		orig		104.1	NE
	21.5 aver.	✓	401.4	NE	matl 230		106.5	NE
		crimped	676.6	NE			109.4	NE
			30.1					
			25.4					
			12.1	?				
			27.2		mach. dried,			
			18.2		not grd.			
			14.0		224			
			18.7					

Data Sheet 28

POP 419

8-2-63

29

	228°+	
9404 weak	321.6	one gas check, two plugs 260-308
	22.9	
weak	171.2	
	16.9	
	17.6	
aver 325.6	390.1	(one up-side down) two gas checks, two plugs 260-300
	405.1	
	261.7	
	298.2	
	273.1	

Data Sheet 29

POP 419

8-5-63

30

			230-231		243-244			
9404	374.7	s	433.7	2 gas checks		15.2		
		w	525.0	(one up-side down)		17.5		
		s	220.2	2 plugs		19.2		
		s	372.5	260-300		~205	s	
		s	323.3			715.7	NE	
		NE	810.5	2 gc 1 plug 260				
		NE	980—	" " "		16.9	1 GC. rev.	Plug 200#
		NE	1200—	2 GC 2 plug 260-300				
		NE	390—	1 gc 1 plug 260				
		s	285.8	2 GC 2 Plug 260-300				
		NE	601.8	2 gc 1p. 200				
	23.3		18.8		15.3	11.2		
			19.7	1 gc 2 plugs		22.7		
			42.9	260-300		13.9		
			13.5			11.3		
			21.4			17.2		
		NE	613.7					
		NE	601.1	2 gc 2p				
		NE	637.0	100-150.				
		NE	603.1					
				2 gc 2p				
				150-200				
		~	1412	2 gc 2p				
Clock did not stop			?	200-250				
		~	340					

Data Sheet 30

POP 419

8-6-63

31

Data Sheet 31

	235.5	
	23.0	2 GC + 2 Plug 260 - 300
	12.8	
S ~	245	
	213.4	
	23.5	1-RGC + 1 Plug 200#
NE	315	1 - GC + 1 Plug 200#
S	460~	2 GC - 2 P 150 - 200
	42.6	
T R	236.5	
NE	1002	GC failed Norm. — 2 gc-2p 200-250
	21.1	
	234.1	
NE	3372	25 mg
NE	1502	
NE	1001	
	18.7	75 mg
S	251.3	
	19.8	

	236	
	178.0	2 gc - 2p 200 - 250
	397.6	
	409.4	
S	226.2	LES Lovell Up ! Hope — 2 gc - 2p 260 - 300
	39.7	LES
~	42.	LES
NE	609.2	2 gc - 2p 200 - 250
S ~	235	
	411.7	
~	170	
	26.5	2 gc - 2p 200 - 250
~	230	

POP 419

8-7-63

32

Data Sheet 32

		235	
		320.4	
9404	(leak) NE	820.1	2gc-2p
	S timer did not stop	?	260-300
		44.1	
		21.5	
		536.9	
		15.5	1gc rev-2p
		14.3	260-300
		186.9	
	S	289-	2gc (new)
	S	217.4	2p 260-300
	S	282.0	
		16.6	same-crimped
		17.7	2gc 2P 260-300
		41.6	2gc-3p
		16.3	

Data Sheet 33

POP 419

8-8-63 (all crimped) 33

		234.5	
9404	S	?	2qc-1p, 300
	S	~155	1qcrw-1p 200
	S	~390	2qc-1p 300
	S	~155	
		27.9	
	S	?	copper cap 1qc-rw-1p 300
	S	~67	" "
		17.4	—

POP 419

8-9-63

34

Data Sheet 34

		233					
9404		~25					
	NE	700.	1gcr-1plug 300 2 crimps				
		231 [illegible]					
	SN	62.	1gcr-1p-300-				
	S	19.4	"	"			
		19.3	"	"			
		21.5	gc-cork-gc-p-300				
Brass		19.3	1gc-2P				
		18.8	"	"			
	S	~165	2gc-2p-260/300				
		238.6					
	S	235.8					
Alum.		429.4	2gc-1plug	260/ar@ 11,000v			
		207.5	2gc-1plug	260	25mg	no crimp	
		295.2	"	"	"	"	
	NE	400+	"	"	"	"	
	NE	400+	"	"	"	"	
	NE	400+	"	"	"	"	
		346	"	"	"	"	

POP 419

8-12-63

35

		238			
9404	weak	277.4	25mg		
	SN	142.			
	S	212.0			
	SN	138.	35mg		
	S	129.4			2gc-2p
	S	98.1			260-300
			55mg		
			65mg		
	NE	325	15mg		

Data Sheet 35

7-8-63

[illegible] temp cont.: R-6, C-10, [illegible]-5

23

	265.5 263.5	263.5	263.5 261.	267	266 267	266 262		265	
LX-041	219.5								
260#	159.2	(285#)							
	268.9								
	306.4								
	415.6								
150#		651.6	(weak)						
		563.8							
			747.0						
				624.6					
					438.9				
9404 260#					12.0				
HE 260-Lead 200-3 washers					~20	very weak			
200					9.3				
120 cork					9.3				
HE 260-Lead 200-1 washer					17.3				
same					10.0	very weak			
LX-041 300					372.2			403.1	200# 25 mg.
					72.0			596.9	
					528.3	Temp 262			
300						115.4			
						57.1			
						396.3	temp 258		

Data Sheet 23

POP 419

7-9-63

230 Temp. cont.
R-6, C-9, r-6.7
24

Data Sheet 24

		230°			245°	
9404	NE	655	200# 1 washer	orig. matl.	29.0	2 gas checks & cork 125#
	NE	803	HE-260, Plug 200, 1 washer	orig. matl.	33.3	same 260#
	NE	4315	HE-260, Plug 200, 2 washers	orig. matl.	24.8	same 125#
		19.6	260	orig. matl.	17.5	2 washers HE 260 - Plug 200
	NE	364	200	orig. matl.	16.9	2 washers HE-150 - Plug 200
	NE	455	300	orig. matl.	10.8	HE-260 1st Plug 260, 2nd Plug 200
	NE	1035	200	ground and dried matl.	24.7	HE 260 1st Plug 200, 2nd Plug 260, 1 washer
		11.6	260	ground and dried matl.	11.3	same
		13.3	300	ground and dried matl.		
		13.0	HE-300 Plug 260 - 1 washer - ground and dried matl.			
		43.1				
		19.6				
	NE	208	old sample @ 260#			
	NE	300	old sample @ 260#			
				NE	237	260# ground and dried matl.
				NE	264	260# ground and dried matl.
					17.1	2 plugs - 2 gas checks
					12.4	[illegible] unground
					9.0	[illegible] unground
					9.7	2 plugs - 2 gas checks
				old samples	12.1	2 plugs - 1 gas check
				old samples	9.7	
				old samples	13.9	
				old samples	16.9	same as above
				old samples	8.1	same as above
				old samples	9.4	same as above
					7.7	3 [illegible] plugs
					[illegible]	" " " "

POP 419

LX04-1 7-10 25

245°

LX041	10.372		
	10.770	265	
		134.0	
		703.9	
		440.8	
		318.8	
			NE 1081.0
			49.6
			NE 1007.3
			17.8
		aver 17.1	14.9
			18.5

~~7-10-63 Hart Carroll Spraine~~

2,[illegible] 260/300

Data Sheet 25

POP 419

7-10-63

245 R-6, C-9, F-8

26

	245°			231.5°	
9404	10.7	1st plug HE-260	NE	205.2	
	12.4	2nd plug 300		25.5	orig matl
	11.1	old sample	NE	220.3	two plugs
2 plugs ave: 12.1	12.9			151.2	260/300°
1 plug ave: 16.05	16.5	one plug old sample		19.5	
	17.9		NE	361.6	ground matl
NE	[illegible]	orig matl		19.0	2 plugs 260/300 grd matl
	16.9	one plug 260		~90	3 plugs 260/300 grd matl
	13.4	orig matl	NE	238.7	2 plugs 100/200 grd matl
	13.3	two plugs		19.6	1 plug 260 grd matl
	12.6	orig matl			
	11.4	2 plugs [illegible] 260/300			
NE	124.5				
	106.0	2 gas checks			
NE	208.3	coil-125			
[illegible]	20.9	orig matl			
	22.1				

Data Sheet 26

POP 419

7-11-63

27

	235°		230°		233°		239°		250°		257°		245°
Herb Carroll	545.3	NE					533.3	NE	13.3	12.1 aver.	9.5	10.2 aver.	17.8
material	401.8	NE					30.0	31.3 aver.	11.6		10.4		14.9
	400.9	NE					34.6		11.4		10.7		18.5 !
	~210	NE					29.5						NE 1081.0
	44057	NE											49.6
													NE 1007.
												temp	aver. time
												235	none
												239	31.3
												245	17.1
												250	12.1
												257	10.2
9404	20.9	16.9 aver.	501.0	NE	201.1	NE							
	14.9		178.1	18.5 aver.	13.4	17.0 aver.							
	15.9		23.8		19.0								
	16.8		16.1		14.5								
	16.1		15.6		21.2								

Data Sheet 27

POP 419

7-12-63

28

	237°			230/229			225°	
Herb Carroll	409.9	NE						
material	122.9							
	302.4	NE						
	101.4							
	209.7	NE						
9404			✓	305.1	NE		203.0	NE
			✓	319.9			22.2	
				26.5		orig	104.1	NE
	21.5 aver.		✓	401.4	NE	matl 230	106.5	NE
		crimped	✓	676.6	NE		109.4	NE
				30.1				
				25.4				
				12.1	?			
				27.2		mach. dried,		
				18.2		not grd.		
				14.0		224		
				18.7				

Data Sheet 28

Data Sheet 29

POP 419

8-2-63

29

		228°+	
9404	weak	321.6	one gas check, two plugs 260-300
		22.9	
	weak	171.2	
		16.9	
		17.6	
	aver 325.6	390.1	(one up-side down) two gas checks, two plugs 260-300
		405.1	
		261.7	
		298.2	
		273.1	

POP 419

6-6-63

31

235.5

23.0
12.8
2 GC + 2 Plug
260 - 300
S ~ 245
213.4

23.5 1-RGC + 1 Plug 200#

NE 315 1 - GC + 1 Plug 200#

S 460~ 2 GC - 2 P
42.6 150 - 200
T 236.5
NE 1002 GC failed
21.1 Norm.
234.1
NE 3372
NE 1502 25 mg
NE 1001
18.7
S 251.3 75 mg
19.8
2 gc - 2 p
200 - 250

236

178.0
397.6
409.4
2 gc - 2 p
200 - 250

S 226.2 [illegible] Louver Up ! Hope
39.7 [illegible]
~42. [illegible]
2 gc - 2 p
260 - 300

NE 609.2
S~ 235
411.7
2 gc - 2 p
200 - 250

~ 170

26.5
~ 230
2 gc - 2 p
200 - 250

Data Sheet 31

Data Sheet 32

POP 419

8-7-63

32

		235	
		320.4	
9404	(leak) NE	820.1	2gc-2p
	S timer did not stop	?	260-300
		44.1	
		21.5	
		536.9	
		15.5	1gc rev-2p
		14.3	260-300
		186.9	
	S	289-	2gc (new)
	S	217.4	2p-260-300
	S	282.0	
		16.6	same-crimped
		17.7	2gc 2P 260-300
		41.6	2gc-3p
		16.3	

Data Sheet 33

POP 419

8-8-63 (all crimped) 33

		234.5	
9404	S	?	2qc-1p, 300
	S	~155	1qcrew 1p 200
	S	~390	2qc 1p 300
	S	~155	
		27.9	
	S	?	copper cap 1qc-rew 1p 300
	S	~67	" "
		17.4	—

8-9-63

34

		233				
9404		~25				
	NE	700.	1gcr-1plug 300 2 crimps			
		~~231 Time~~				
	SN	62.	1gcr-1p-300-			
Brass	S	19.4	"	"		
		19.3	"	"		
		21.5	gc-cork-gc-p-300			
		19.3	1gc-2P			
		18.8	"	"		
	S	~165	2gc-2p-260/300			
		238.6				
	S	235.8				
Alum.		429.4	2gc-1plug	260/ar@ 11,000V		
		207.5	2gc-1plug	260	25mg	no crimp
		295.2	"	"	"	"
	NE	400+	"	"	"	"
	NE	400+	"	"	"	"
	NE	400+	"	"	"	"
		346	"	"	"	"

Data Sheet 34

POP 419

8-12-63

35

		238		
9404	weak	277.4		
	SN	142.	25mg	
	S	212.0		
	SN	138.		
	S	129.4	35mg	2gc-2p
	S	98.1		260-300
			55mg	
			65mg	
	NE	325		
			15mg	

Data Sheet 35

POP 419

8-13-63

36

Data Sheet 36

9404

	239		
72.5 oz.	SN 81	2 gc-2 p 260-300 glue	epoxy A933A
	SN 68		
	SN 73		
	SN 51		
	SN 88.		
53.4 oz.	SN 82	2 gc-1 p 260 glue	
	SN 50		
	SN 55		
	SN 37		
	SN 43		
	SN 15	1 gc-no p. 200 glue	
	SN 20		
	S 15.6		
	28.9	2 gc-2 p 260-300 no glue	
NE	500		
	14.5		
	15.9		
NE	100	1 gc-no p 200 no glue	
NE	100		

PUP 4:9

8-13 63

37

235

S 95
S 95 glued
S 26

600 NE 15 mg

200 NE Small Sample 2gc 1 plug 200

24.0 1gc 1 plug 200#
400 NE Small Sample
145.8 2gc 1 plug 200 ~ 50 mg

237

NE 305,
NE 500 25 mg 2gc 1P - 200
leak NE 860 25 mg 2gc - 2p 260/300
NE 1040 " " "

NE 2600 20 mg 1gc 1P - 200
NE 600 20 mg 1gc - 1P - 260#
NE 1150

19.6 25 mg 1gc 1Plug 200

S ~ 20 65 mg 2GC 1P Crimp
NE 430 " " " "

15.4 65 mg + Pb
2GC 1P + Crimped

Data Sheet

(38)

	8-14-63		8-15-6		
	237		252.5		
	26.8	S	16.6	2gc-1p 260	Al caps
NE	560	S	~16		
	~23 -?	S	13		
	266.7	NE	405	defective glue check	
S	22.2	S	13.5		
S	123	S	14.4		
	279.7	S	~11		
NE	403	S	9.3	w/ lead	Al caps 2gc-1p 260
S	105	S	~11		
S	~14	S	~11		
	11.4	S	10.0		
	16.7		12.9		
	14.0	S	12.3	was not crimped 2GC 1Plug	
	18.3	S	~13	Brass caps	
		S	~13		
		S	~10	1gc-1p 260 w/lead	
			10.5		

Data Sheet 38

8-16-63 (39)

9404

225 229°C

652.7 same as below but not crimped

NE 4000 Plug had moved

(2gc-1p 260 Alum)

18.2
17.7 lead
16.5 alum
19.8 2gc-1p 260

NE 1000 plug moved
27.5
S 27.1 alum
28.4
23.4
S ~128
S 149.0
S ~135
NE 55 not crimped brass
S ~133
S ~133
S 103.1
S ~127
S ~125 2gc-1p 350
39.7 not crimped lead brass
S ~56.
54.9
44.1

Data Sheet 40

8-19-63

(40)

	225		220		
9404	SN198	crimped	SN249	Crimped	
	SS120	Brass	SN258	crimped	
	SS190	Crimped	SN242	Crimped	
	SS161				
	SN170				
	SN194	crimped			
	50.5	crimped	172.1	C	Pb
	SN75.-		N148	C	Pb
	46.6	C Brass	SN115	C	Pb
		9404 + Pb	75.1	not C	Pb
			110	C	Pb
			122.5	C	Pb

C - Crimped

S-57		
58.2	LRL-Pb sample	
37.0		

8-20-6 :

41

9404	215		215		
~322 aver.	S ~338		S~598.	crimped	
	S ~305		S~325	"	
	S~329	9404	S~497	"	9404
	S~345		S~399	"	
	S~293				
	S~298	crimped			
	506.1				
	96.1		N.E. 700	crimped	(cracked gas check)
	S~197		515		
	227.4	9404 + Pb	NE 700		
	247.6		NE 1150		
	284.1	crimped	NE 750		9404 + Pb
	~338	crimped			
	295.8	crimped			
	295.7	crimped			
	493.2	crimped			

Data Sheet 41

8-21-63 (42)

9404	210		
	S~670	crimped	
	S~519	"	
	S~582	"	
	N.E. 1355	"	
	S~759	"	
	S~566	not crimped	
	S~459	crimped	(30 sec. dwell)
	[illegible]	not crimped	
	N.E. 1200	crimped	(30 sec. dwell)
9404 + Pb			
	N.E. 1125	crimped	
	N.E. 1200	"	
	N.E. 1300	"	
	N.E. 2000	not crimped	
	430.3	" "	(10 [illegible] of Pb)
	395.	" "	(20 [illegible] of Pb)

Data Sheet 42

POP 419

8-23-63 (43)

9404	R-6 C-9 F-5.2	218°C		R=6 C=10 F=2.0		R-6 C-10 F-1.6	233		R-6 C-10 F-0.8	224
	S	~324		238°C			S 119			
	S	~692					S 111			
	S	~341		S~73			S 122			
	S	~312	N.E.	320			S 121			
	S	~286		S 71			S 128			
	S	~375		32.7						
				S 81						
				S 80						
	NE	750		S~16			26.8			96.9
		162.2		S~14			S 36		S	144
		165.5		12.5			S 33			
	S	407		S~14			S 29			
		175.3					S 41			
		227.9					S 28			
		231.3								
	N.F.	2800								

Data Sheet 43

POP 419

8-23-63

44

QMCH	R-6 C-10 F-0.5	225		R-6 C-10 F-2.5	242	R-6 C-10 F-4.0	262.5
		162	loaded 8-22	S	35	S	10
	S	279	pressed 8-22	S	59	S	9
	S	198	loaded 8-22	S	50.7	S	10
	S	181	pressed 8-22	S	42.2	S	9.7
	S	226			27.1	S	11.9
	S	253	loaded 8-22				
	S	172.3	pressed 8-22				
	N	400	loaded 8-22	S	10	S	12
		63.6	pressed 8-22	S	10	S	7
		62.1	loaded 8-22 pressed 8-22	S	18	S	6
Z + QMCH	11	500	loaded 8-22	S	13	S	6
≈1:1		46.3	pressed 8-22	S	13	S	7
	S	218					
		1137					
	S	34					
		53.3					
		46.1					
	S	57	3 gas checks				

Data Sheet 44

8-26-6

(45)

LX-04-1		(R6 C10 F3.5)	256°			(R6 C10 F3)	249°			(R6 C10 F4.2)	263°
		S	345	338 av.		S	725	738 av.		S	130	81 av.
		S	316			S	786			S	62	
	End crimp		238.4			S	443			S	55	
		S	414			S	1061			S	103	
		S	257			S	676			S	54	
		S	358									

Data Sheet 45

Data Sheet 46

POP 419

8-27-63

46

LX-04-1		RG C10 F4.6	270°		RG C10 F4.8	277°		RG C10 F5.3	284°		RG C10 F4.0	260°	
		S	30	36 av.	S	18	19 av.	S	10	11 av.	S	136	236 av
		S	35		S	25		S	11		S	120	
		S	32		S	14		S	10		S	183	
		S	38		S	19		S	12		S	312	
		S	47		S	20		S	12		S	468	
											S	198	

Data Sheet 47

POP 419

8-28-63

47

LX-04-1		(R6 C10 F3.3)	252.5°		(R6 C10 F4.1)	261.5°
		S	428	673 av.	S	253
		S	777		S	197
		S	466		S	262
		S	935		S	164
		S	758		S	192

214 av.

POP 419

8-29-63

48

LX-04-1	R6 C10 F4.1	262.5°	
	S	66	84 av.
	S	141	
	S	68	
	S	76	
	S	68	

Data Sheet 48

POP 419

8-30-63

49

LX-04-1	R6 C10 F2.7	246°		R6 C10 F2.2	242°	
	S	596	705 av.	S	518	941 av.
	S	821		S	1110	
	Top	558		S	1551.	
	S	656.		Top.	702	
	S	611.		S	972.	
	S	841.		S	552	

POP 419

9-3-63

50

LX-04-1	R6 C10 F3.8	260-261°				
	S	402	236 av.			
	S	123				
	S	225				
	S	247				
	S	183				
	S	101	92 av.	gfw		
	S	92				
	S	89				
	S	85				
	S	92				
		1.982			1.567	
9404		231.5°			235°	
		130	162 av.		141	96 av.
		190			91	
		167			83	
		130			86	
		173			81	

Data Sheet 50

POP 419

9-6-63

51

9404	R6 C10 F2.7	245.5°		246				
		36.2		18.5				
		14.7		11.9	not crimped			
		19.9	T	14.0	"	"		
	T	13.8	T	13.5	"	"		
	T	14.4						
	T	15.2						
			9-9-63					
			242					242
		T	15.3	not crimped				67.2
		T	19.3	"	"			16.0
		T	72.0	Crimped				15.8
		T	26.6	"				
		T	16.5	"			?	19.9
								~19
			~~242~~.5				T	16.0
								13.8
							T	14.6
								17.9

Data Sheet 5

POP 419

52

Date / Temp			9-12 243 °C			9-13 264°			9-18 264°			9-20 264			9-24 242			9-11 242.5
LX-04-1	1		594.4	8		243.4	5		75.0	1		56.9	5		1014.7	1		767.9
	10		539.8	11		131.8	10		270.4	6		218.7	10		1130.7	6		733.6
	15		481.2	13		69.7	15		71.4	11		85.2	15		1093.8	11		704.1
	20		709.5	18		53.4	20		117.2	16		78.5	23		702.2	20		724.8
	28		735.9	20		88.2	25		54.2	21		62.5	25		616.7	25	T	737.0
LX-04-1 + Pb	2	T	81.1	3	T	22.3	4	T	21.8	2		9.44	4	T	92.7	2	T	127.4
	9	T	55.2	4	T	15.8	9	T	18.3	7	T	17.49	9	T	87.4	7	T	106.3
	11	T	91.2	15	T	19.7	14	T	21.0	12	T	17.2	14	T	84.3	12	T	149.9
	21	T	100.6	17	T	12.7	19	T	25.8	17	T	17.4	18	T	142.8	17	T	149.4
	25	T	59.1	22	T	22.4	24	T	14.8	22	T	17.1	21	T	111.1	22	T	126.8
LX-04-1 + NaCl	3		536.7	5		112.9	3		58.1	3		37.2	3		849.6	3		497.0
	8	T	576.4	10		196.3	8		42.5	8		103.3	8		1008.5	8		477.1
	16		538.1	12		374.3	13		144.1	13		125.8	13		848.8	13		483.3
	24		495.4	19		288.2	18		204.4	18		273.8	22		447.7	19		586.2
	26		402.3	23		98.6	23	T	42.8	23		36.7	24		767.1	24		609.2
LX-04-1 + Silastic 3003 0	4	T	175.6	1	T	44.1	2	T	37.4	5	T	32.6	2	T	195.6	4	T	149.8
	7	T	218.5	6	T	17.3	7	T	40.2	9	T	21.2	7	T	196.2	9	T	191.4
	13	T	98.1	14	T	[illegible]	12	T	55.1	14	T	25.6	12	T	228.3	14	T	252.1
	18	T	312.8	16	T	38.8	17	T	50.8	19	T	24.8	17	T	159.9	18	T	189.7
	23	T	160.7	25	T	37.7	22	T	36.8	24	T	22.6	20	T	110.7	23	T	151.0
LX-04-1 + Epoxy 633111	5	T	17.5	3	T	10.0	1	T	10.5	4	T	8.6	1	T	19.6	5	T	18.7
	6	T	17.1	7	T	10.9	6	T	11.8	10	T	9.0	6	T	17.9	10	T	21.7
	14	T	18.5	9	T	8.5	11	T	18.4	16	T	8.4	11	T	18.9	15	T	21.4
	19	T	16.4	21	T	9.9	16	T	16.8	[illegible]	T	10.2	16	T	18.4	16	T	18.2
	27	T	19.2	24	T	11.2	21	T	11.7	[illegible]	T	9.0	19	T	19.4	21	T	30.9

Data Sheet 52

POP 419

242.5

[illegible] | [illegible]

(53)

LRL	Date		9-10		9-16		9-17		9-19		9-23		9-25
	Temp.		242.5		220		242		242		220		219.5
9404		1	55.5	5	539.0	1	63.1	3 T	20.6	1	299.4	1	269.5
		6	39.8	10	281.1	6	64.4	8	25.7	6	275.5	10	216.1
		11	48.8	15	239.9	11	27.8	13	61.4	11	299.2	15 T	143.4
		16	39.2	20	241.8	16	62.0	18	51.4	16 NE	700	20	184.8
		21	52.1	24	306.0	21 T	32.2	23	25.2	21	234.0	25	241.2
9404 + Pt		2	11.7	4 T	169.9	4	13.5	1 T	16.2	2	586.7	2	111.8
		7	12.3	9 T	209.3	9	13.7	6	12.9	7 T	106.2	9	142.5
		12	14.6	14	143.4	14	13.9	11 T	14.6	12	112.2	14	270.5
		17	16.0	19	157.6	19	15.1	16 T	14.5	17 T	114.9	19	150.8
		22	17.2	23 T	143.5	24	13.3	21 T	11.8	22 T	102.6	24	111.6
9404 + NaCl		3	81.5	3 NE	1500	2	73.2	4	118.7	3	467.5	3 T	277.2
		8	85.5	8 NE	1000	7	69.0	9	74.0	8	226.2	8 T	261.0
		13	102.1	13 NE	1000	12	69.9	14	74.2	13	232.8	13 NE	1000.
		18	60.0	18 NE	1000	17	76.0	19	71.4	18	421.8	18 T	296.2
		23	68.8	25 NE	1800	22	63.5	24	76.5	23 NE	720.	23 NE	700
9404 + SILASTIC		4 T	172.8	2 T	428.8	5 T	103.0	2 T	70.5	4 NE	1000	4 T	397.8
30030		9 T	101.1	7 T	418.0	10	72.5	7 T	81.2	9 T	403.7	7 T	475.0
		14 T	95.2	12 NE	1000	15 T	58.4	12	82.2	14 T	338	12 T	374.0
		19 T	61.2	17 T	664.4	20 T	59.5	17 T	82.0	19	215.3	17 T	557.8
		24 T	51.8	22 T	477	25 T	76.4	22 T	94.3	24 T	246.3	22 T	272.2
9404 + EPOXY		5 T	14.2	1	329.9	3 T	16.3	5 T	15.1	5	23.7	5 T	26.0
633111		10 T	14.6	6 T	22.0	8 T	16.0	10 T	15.2	10 T	22.8	6 T	23.2
		15 T	13.5	11 T	26.0	13 T	14.8	15 T	14.4	15 T	22.5	11 T	25.8
		20 T	17.6	16 T	24.8	18 T	15.5	20 T	13.8	20 T	21.9	16 T	25.0
		25 T	17.3	21 T	24.6	23 T	16.2	25 T	15.8	25 T	21.8	21 T	25.1

Comparison Test Data

Data Sheet 54

54

220°	
24.4	9404 + epoxy
25.0	
23.4	
124.8	9404 + lead
98.3	
112.2	
361.0	9404 + silastic
—	
336.8	

(55)

Data Sheet 5.

POP 419

244°C	
19.5 19.3 24.4	Loaded with 2 Gaschecks / Long Lead plug and filled with Sauereisen Cement. All out bottom
242°	
15.8 15.2 15.4	2 gc, 2 plugs 300/350 all out bottom 9404 + EPOXY (9-30)
245°	
25.0 44.3 34.0	2 gc, 2 plugs 300/350 all out bottom 9404 only (10-1)
242°	
69.0 87.1 47.1	9404 + SILASTIC (10-2) all out bottom
25.0 23.0 —	9404 + Pb (10-2) all out bottom

Date		11-11	11-12	11-13	11-14	11-18	
Temp.		220-2	221-2	221	221	220+	
9404	1	210.2					
	2	201.4					
	3	190.1					
	4	187.9					
	5	186.4					
	6		600	NE (LEAK)			
	7		213.4				
	8		211.1				
	9		210.8				
	10		186.2				
	11			239.9			
	12			207.1			
	13			~200	(timer stopped)		
	14			600	NE (cap failure)		
	15			221.5			
	16				214.3		
	17				~200	(timer stopped)	
	18				217.2		
	19				213.6		
	20				206.6		
	21					175.0	temp not accurate
	22					194.4	
	23					196.2	
	24					153.3	
	25					178.2	

POP 419

57

11-19-63			
	223°		
9404 + epoxy	29.0	aver. 30.4	
	28.4		
(brass caps)	32.2	2qc, 1"p @ 300 lb	6000 psi
	30.9		Brass caps
	31.5		
	28.4	aver. 30.2	
	28.7		
	30.6	1qc, 1"p @ 300 lb	
	30.5		
	33.0		
Alum caps			
9404 11-26-63	22.0	T	
	33.8		
	413.5		
	273.6		
	1000	NE	
9404 11-19-63	~30	1qc, 1"p ~225 lbs	
	500.2	Al caps 6000 psi	
	1000	NE	
11-20-63			
9404 + epoxy	30.6		
	27.2	T	
	28.0		

Data Sheet 57

POP 419

58

9010	12-6			12-6		12-6		12-6		12-9			12-9
	210°			224.5°		220°		215°		202.5°			204°
PROD. REJECT	500	NE											
(grey)				13.9									
				15.6									
Holstone						26.0							
						23.0							
						24.2							
						26.4							
						24.0							
Holstone								35.8					
								32.8					
								35.2					
								36.2					
								35.7					
Prod. Reject								29.6					
(grey)								30.4					
								31.8					
								31.0					
								37.5					
Holstone										118.6		IP	84.2
										650	NE	IP	83.8
										500	NE		
										113.0			
										115.1			
Prod. Reject										600	NE IP	IP	750
(grey)										500	NE IP		

Data Sheet 5

POP 419

* double wt.

(59)

9010	12-10 204°		12-10 208°		12-10 208°		12-11 208.5°		12-11 205°				
Holstein	360	NE	54.6				43.8	1P1g	660	1P1g NE			
	96.2		60.7				45.1	1P1g	82.5	1P1g			
	101.0		56.8				48.8	1P1g	360	1P1g NE			
			57.9										
			62.0										
Prod. Reject (gray) 1P	1380	NE	1020	NE 2g	420	NE*	72.8	1P1g *	330	1P1g* NE			
1P	500	NE	540	NE 2g	513	*	70.2	1P1g *	300	1P1g* NE			
		1P	420	NE 2g	420	NE*	67.8	1P1g *	360	400/28 1P1g* NE			
		1P	80	* 2g	525	*							
		1P	412	* 2g	300	NE*							
		1P	540	NE									
		2G 1P	59	*									
Production (white)													
Discolored													

plugs were not cleaned with acetone

Data Sheet 59

POP 419

(60)

Data Sheet 60

9010		12-13			12-13		
		205°			205°		
Holstine	NE	1200	glue	w	397.8		
	NE	300		w	309.0	2P2g	
	glue out top T	534.2		w	477.2		
		458.1	2P		84.8	2x wt	temperature fluctuating about 3° ! (cont. 202-205)
		464.1			89.2	2P2g	
	NE	660			104.7		
					97.8	2x wt	
					102.7	1P1g	
					88.2		

Discolored

POP 419

61

		317°		310.5°		323.5°
NH_4ClO_4	✓	83.0		192.0		40.5
	✓	95.4		163.9		47.1
(✓ = 75 mg)	✓	93.3		116.2		36.3
	✓	79.8		302.2		44.8
	✓	97.0		124.4		47.3
		106.2	✓	299.4		
		106.4	✓	142.4		
		500	NE			
		174.3				
		150.8				
		94.9				
		81.0				
		195.6				
		157.8				
NH_4ClO_4 + Al	✓	81.2		143.8		44.7
	300# ✓	220.3		142.4		53.0
(✓ = 100 mg)	✓	102.6		248.6		49.5
	✓	90.0		600	NE	48.7
	✓	123.4		297.9		30.0
		83.4		489.2		
		88.2		131.0		
		80.2	✓	186.2		
		126.4	✓	198.8		
		171.7				
		73.2				
		70.6				
		113.5				
		147.2				

Data Sheet 61

(62)

		165.5°			175°			154.5°		144.5°	
PETN		40.4			25.8			79.5		164.0	
	39.4	38.0		25.1	25.0		84.3	83.0	171.1	166.7	
		38.5			25.2			69.5		170.2	
		39.0			24.9			98.6		177.0	
		41.1			24.5			90.7		177.6	
		135°			141°					145°	
		716.9			825	NE				171.4	
	718.1	716.2			600	NE				174.5	
		779.8			1900	NE				182.6	
		656.4			327.8						
		721.1			4300	NE					
					1250	NE					
		170°							NE	500	w/ Pb
									NE	600	50-50
		29.6			144°				NE	300	by wt.
									NE	300	
								not mixed	NE	300	
					183.8			fresh	NE	4200	
		139.5°			178.4						
		850	NE		135.5°						
		477.5									
					688.6						
					620.1						

(63)

		249°C		258°		265°			259.5°			253°
3269 –			NE	650								
3270	w	560										
Baratol						60.6			79.0			113.0
						59.9			77.8			112.6
					62.6	63.8		78.2	78.7		114.1	114.6
						64.2			80.8			106.9
						65.6			74.6			123.4
						61.4						
3317						131.0	50 mg		159.5			255.0
TNT – Viton A –					omit	83.4	75 mg		164.5			229.8
$BaCO_3$ (50/10/40)					omit	90.0	100 mg	159.4	172.5		241.3	236.2
					136.1	111.4	50 mg		165.3			246.0
						141.6	50 mg		132.0			239.4
						135.0	50					
						131.6	50					
TNT						650	NE					
						1195.0?						
						1500.0	NE					

POP 419

Data Sheet 63

POP 419

64

		240°		220°
9404 (Doug. H.) Control		13.4		169.2
		15.1		186.6
	17.8	14.2	171.2	160.4
		37.0 ✓		178.6
		13.8		161.1
		14.2 ✓		
10275C3101		38.6		140.4
		23.2 ✓		152.6
	35.0	36.6	152.6	171.2
		37.7		167.5
		38.9		131.4
10281C3101		10.6		125.6
		10.9		135.4
	12.9	13.0	148.9	174.6
		14.0		143.2
		16.2		165.5

These were solvent pressed (9404)

Data Sheet 64

POP 419

t and ½t

(65)

		230°	
HMX	∞	225.8	T
	1.7	224.4	T
	2	203.2	T
in	100		
out	100		
in	148.5		
		248.5	T
in	120		
out	120		
in	175 N		
	N	295	T just a tick
in	100		
out	100		
in	124 N		
	N	224	T just a tick
in	100		
out	100		
in	129.2		
		229.2	

POP 419

66

		230°		225.5°
9404		62.5		97.4
			95.8 T	92.9
				83.8
				90.7
				119.0
				90.2
9404 (8% humid.)				89.1
			92.2 T	86.2
				96.1
				92.8
			T	97.0
9404 (60% humid.)				78.6
				92.5
			91.6	98.0
			T	96.9
			T	92.0

		230°		245°	
HMX	T	174.6		88.6	
			92.5	93.2	
		225°		91.7	
	T	256.1		88.3	
				100.6	
HMX (8% humid.)				200	NE [illegible]
				94.8	T
			88.8	86.0	
				82.0	T
				96.4	
				88.6	
HMX (60% humid.)				90.3	T
				200	NE
			96.1	90.9	
				98.4	
				89.5	T
				111.3	

POP 419

68

Data Sheet 68

9404 (B4-524-61, #325 SIEVE)		240°		220°		200°		210°		
Brass caps		16.0		127.0		559.2		289.7		9
	19.4	24.6	135.0	132.5	573.6	551.7	277.3	310.8	T	8
		19.8		146.6		534.7		265.7		7
		18.2		138.8		570.4		235.2		6
		18.4		130.2		651.8		284.9		5
[illegible] caps		16.0		152.2		840.8		307.2		9
	19.2	17.6	144.1	141.0	951.4	975.1	364.1	261.4		8
		19.8		161.5		847.2		319.0		7
		19.4		126.8		686.2		448.8		6
		23.0 T		139.0		1407.5		484.1		5

POP 419

(69)

1404 (84-524-61, #325 SIEVE)		230°		250°		195°		225°	191°
Brass caps		67.7		10.8		1133.6		107.8	2800 N
	35.1	30.0	13.6	14.6	953.0	862.3	93.6	87.2	(PLUG MOVED)
		27.2		13.3		893.6		91.4	
		24.8		12.8		938.5		93.0	
		26.0		16.2		937.2		88.6	
Gold caps		23.7		13.6		1069.3		102.6	
	29.0	29.6	15.2	14.4	1272.4	1904.9	87.2	38.5	
		27.7		15.6		1140.4		96.1	
		27.6		15.0		1079.8		97.1	
		36.2		16.4		1167.5		101.5	

245

70

HMX		255°		248°		240°
Holston		49.1		79.6		121.9
	47.9	47.8	82.7	80.9	127.1	137.8
		48.2		82.0		127.0
		43.7		90.0		126.8
		50.5		80.8		121.8
Milled Bridgewater		89.0		172.3		206.8
	96.7	114.9	155.4	143.8	217.3	227.2
		44.8		172.2		228.8
		85.4		134.9		211.9
		99.4		154.0		211.4
Unmilled Bridgewater		53.1		72.0		104.3
	54.6	55.3	79.1	79.7	107.9	107.4
		54.0		77.3		118.0
		53.3		79.6		100.1
		57.4		87.0		109.8

Data Sheet 70.

(72)

HMX (LRL)		230°			245°			260°
A-315		200.7	T		107.0			27.9
B Sc C	236.6	245.2	T	108.9	110.1	T	36.2	38.0
		229.8			110.8	T		33.0
		273.8			111.1			38.7
		233.6			105.5			43.5
A-316		254.0			139.7			28.6
3 Sc F	241.0	270.6		116.8	95.6		36.0	27.5
		256.2			121.6			29.7
		216.2			114.0			31.5
		208.2			113.2	T		35.6

T - [illegible]
N - [illegible]
NE - [illegible]

Data Sheet 72

POP 419

(73)

HMX (BRIDGEWATER)			230°				260°
Unmilled.	62μ	542.5	510	T	88μ	81.7	62.2
			586.7				87.0
			530.7				96.0
	125μ	452.9	404.1		125μ	87.4	85.8
			850	NE (plug moved)			88.2
			513.2				88.2
			441.4				
	350μ	360.6	357.3		350μ	69.0	62.8
			301.8	T			69.0
			422.6	T			75.2
Milled.	10μ	668.3	756.2	T	10μ	121.1	120.2
			609.4	T			120.5
			639.3				122.6
	44μ	697.1	723.4		44μ	131.9	124.8
			695.8				124.8
			672.2				146.0
	62μ	626.1	613.6		30μ	130.2	111.1
			626.6				128.2
			638.1				151.2

Data Sheet 73

POP 419

(74)

9404		240°							~~240°~~
						brass cups			
~25 mg		56.8							
~75 mg		14.2							
old plug		23.2							
300#		14.4							
24 mg	T	43.5							
48 mg		42.6							
73 mg		12.6							
58 mg		12.0							
53 mg		17.8							
55 mg		13.2	T 38.7	13.8					
51 mg		17.5	29.6						
65 mg		15.6	13.2						
49 mg		39.6	33.6						
50 mg		22.3	25.1						
75 mg			14.1						
99 mg			21.6						
		14.9							
B3-569-61 ~65 mg		14.4							
		14.8							
		17.2							
B1-531-61 ~60 mg		14.6							
		17.0							

Data Sheet 74

(72)

HMX (LRL)		230°			245°			260°
A-315		200.7	T		107.0			27.9
B Sc C	236.6	245.2	T	108.9	110.1	T	36.2	38.0
		229.8			110.8	T		33.0
		273.8			111.1			38.7
		233.6			105.5			43.5
A-316		254.0			139.7			28.6
B Sc F	241.0	270.6		116.8	95.6		36.0	27.5
		256.2			121.6			29.7
		216.2			114.0			31.5
		208.2			113.2	T		35.6

T - [illegible] out top
N - [illegible]
NE - no explosion

Data Sheet 72

FOP 419

8-5-63

30

		230-231		243-244	
9404	s	433.7	2 gas checks (one up-side down) 2 plugs 260-300	15.2	
374.7	w	525.0		17.5	
	s	220.2		19.2	
	s	372.5		~205	s
	s	323.3		715.7	NE
	NE	810.5	2 gc 1 plug 260		
	NE	940—	" " "	16.9	1 G.C. rev. 1 Plug 200#
	NE	1200—	2 GC 2 plug 260-300		
	NE	390—	1 gc - 1 plug 260		
	s	285.8	2 GC - 2 Plug 260-300		
	NE	601.8	2 gc 1p. 200		
23.3		18.8	1 gc 2 plugs 260-300	11.2	
		19.7		22.7	
		42.9		13.9	
		13.5		11.3	
		21.4		17.2	
	NE	613.7	2 gc 2p 100-150.	15.3	
	NE	601.1			
	NE	637.0			
	NE	603.1	2 gc 2p 150-200		
	~	1112	2 gc 2p 200-250		
Clock did not stop		?			
	~	340			

POP 419

Data Sheet 30

POP 419

8-13-63

36

9404

		239	
72.5 oz.	S	N81	
	S	N68	2gc-2p
	S	N73	260-300
	S	N51	glue
	S	N88.	
53.4 oz.	S	N82	
	S	N50	2gc-1p
	S	N55	260
	S	N37	glue
	S	N43	
	S	N15	1gc-no p.
	S	N20	200
	S	15.6	glue
		28.9	
	NE	500	2gc-2p
		14.5	260-300
		15.9	200 glue
	NE	100	1gc-no p
	NE	100	200 no glue

epoxy A933A

Data Sheet 36