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AUTHORITY
NSWC notice dtd 14 Aug 1975; NSWC notice dtd 14 Aug 1975

Armor Carburized by the Lithium Catalyst Process

PART A

SYNOPSIS

1. A series of 1.6" face hardened armor plates has been produced by the lithium catalyst process consisting of carburizing in a gas atmosphere containing lithium vapor. The asserted advantages of this process were that the depth and carbon content of the face could be closely controlled and that the time of processing was considerably less than that used in conventional carburizing. An investigation of 17 small samples and 74 test plates of various face depths and carbon contents has been completed.

2. It is concluded that:

a. Satisfactory face hardened armor can be carburized by the Lithium catalyst process.

b. Seventy (70) ballistic test plates were processed by this method with hardened faces ranging from 25 to 44% of the plate thickness. Of these 58.6% passed the ballistic requirements of specification JAN-A-84.

c. Maximum carbon contents in the face appeared to be controllable. However, the plates did not show the plus or minus .5 point carbon uniformity claimed by the manufacturer.

d. Decarburization of the surface was not excessive.

e. Some of the plates showed an excess of retained austenite which lowered ballistic quality and could not be decreased by more drastic hardening. This condition was caused by excessively high carbon in the face.

f. The contention that lithium carburizing would shorten the time required to carburize armor was not borne out. The average carburizing time employed on the subject 1/2" plates was not too different from that previously employed for 1/2" armor as pack carburized, but greatly exceeded the time required for liquid or gas carburizing as accomplished on armor submitted previously.

8. This investigation has shown that armor produced by the lithium carburizing process possesses no outstanding characteristics, but perhaps with better control and more experience the method could produce acceptable armor plate. However, the promise of better control, lower cost and higher quality which prompted this investigation has not been fulfilled.

3. It is recommended that no further experiments be conducted on carburization by the lithium catalyst process.

Armor Carburized by the Lithium Catalyst Process

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PART B

INTRODUCTION

1. AUTHORITY:

These tests were authorized by reference (a) and conducted under Task Assignments TED Project No. NPG-AR-8209 and NPG-41-Re3a-123-1.

2. REFERENCES:

a. BUAER ltr Aer-AR-82 Ser. 81239 of 2 Aug 1949
b. BUAER ltr Aer-AR-82 Ser. 99564 of 29 Nov 1949
c. NAVPROV ltr S13-1(3)(BPO 94353) of 25 Nov 1946 to BUORD

3. BACKGROUND:

The Lithium Company of Newark, N. J. has developed a gas carburizing process which is stated to produce a rapid and uniform rate of carburization of steel with the carbon concentration readily controllable to plus or minus five points of any desired analysis. In conventional carburizing a rich air-gas ratio is required which ordinarily gives a case up to 1.2% carbon. This high carbon concentration causes a matrix of iron carbide to form between the grains of the metal which is highly detrimental to the strength of the case. In an attempt to avoid this condition it is common practice to subject the carburized material to a diffusion cycle which is often several times longer than the carburizing cycle itself. This operation is expensive, requiring greatly increased heat-treating facilities. Moreover the extent of diffusion is uncertain, enlarged grain structures result from the prolonged heating, and maximum hardness is produced, not at the surface, but some distance beneath the surface due to the partial surface decarburization occurring during the diffusing cycle. The Lithium process, it was reported, by entirely eliminating water vapor, completely stops decarburization and the air-gas ratio may be adjusted to obtain carburization in the range desired directly without any diffusion cycles. The rapid rate of lithium carburization is said to be due to several factors all resulting from the presence of lithium in the carburizing atmosphere. First, the removal of water vapor eliminates decarburization; second, the surface of the steel remains clean and bright, scale-free and

soot-free throughout the carburizing cycle allowing maximum contact of the carburizing gas with the surface; and third, the lithium metallic vapor acts as a scavenger not only to clean the surface of the steel of oxides but to remove intergranular oxides, oxygen and sub-scale from the metal thus permitting rapid inward diffusion of the carbides. Lithium carburization is claimed to be three times faster than conventional commercial carburization. In view of the promise held by this process, it was felt than an experimental program to determine its merits was warranted.

Consequently a contract was entered into with the Lithium Company to obtain a heat of electric furnace steel of an analysis similar to that which is ordinarily used for 1/2" face hardened armor plate as a basis for comparison with conventional carburizing. The Lithium Co. was to carburize test samples (4"x6"x1/2") and test plates (24"x36"x1/2") of this material to specific depths and carbon levels as indicated. A minimum of 60 full size plates representing 15 different carbon gradients was to be furnished. To permit the selection of suitable plate treatments, the Lithium Co. was to supply a minimum of 15 and a maximum of 100 sample treatments. The samples and plates were to be oil quenched from the carburizing temperature (1700°F) and drawn at 600°-700°F by the Lithium Co. and hardened and drawn at the Naval Proving Ground. The contract covered carburizing of samples to .50, .60, .70 and .80% carbon maximums and, for each carbon maximum, samples representing at least three carbon depths in the range of 20% to 45% of the plate thickness, the depth of penetration being based on the depth at which 540 Knoop hardness is obtained. This depth is approximately equivalent to the .32% carbon level.

4. OBJECT OF TEST:

The object of this test was to determine the ballistic and metallurgical properties of 1/2" face hardened armor plate carburized by the lithium catalyst process.

5. PERIOD OF TEST:

a. Date of Project Letter 2 August 1949

b. Date Material Received
Samples 31 Jan 1950 to 24 Jun 1950
Plates 7 Jul 1950 to 16 Mar 1951

c. Date Commenced Test 31 January 1950

d. Date Completed Test 10 April 1951

6. REPRESENTATIVES PRESENT:

The following representatives were present to witness part of the tests:

Mr. Harold J. Ness, President	The Lithium Company
Mr. Vihe Asdikian, Sales Dept.	" " "
Mr. Kingsley, Engineer	" " "
Mr. R.G. Henry, Chief Metallurgist	" " "

PART C

DETAILS OF TEST

7. DESCRIPTION OF ITEM UNDER TEST:

a. The plates investigated consisted of 17 samples 1/2"x3"x5" and 74 plates 1/2"x24"x36" carburized on one surface in an atmosphere of gas containing lithium as a catalyst. The 1/2" plates used were obtained by The Lithium Company from The Allegheny Ludlum Steel Corporation and had the following analysis:

C	Mn	P	S	Si	Ni	Mo
.20/.24	.40/.60	.025 Max.	.025 Max.	.20/.30	3.30/3.70	.35/.45

8. PROCEDURE:

The Lithium Company carburized one side of a series of 1/2"x3"x5" plate samples to maximum carbon contents ranging from .51% to 1.20%, average carbon contents for the case in the range of .42% to .75% and percentages of face over 540 Knoop hardness from 13% to 62%. Carburizing data are shown in Appendix (A), pages 1 to 17 inclusive. A compilation of data obtained from these samples is shown in Table III, Appendix (B). Curves showing hardness distribution through cross-sections of the sample plates after oil quenching from 1550°F and drawing at 300°F are shown in Figures 1 to 17 inclusive, Appendix (C).

Armor Carburized by the Lithium Catelyst Process

After the results obtained on the small sample plates had been reviewed, the Lithium Co. carburized 37 pairs of 1/2"x24"x36" plates for ballistic testing. In this process two plates were welded together along all four edges, sealing off the inside surfaces and thereby carburizing one surface only of each plate. Carburizing data for these plates are included in Appendix (A), pages 20-42 inclusive and Table IV, Appendix (B).

After carburizing, The Lithium Company took millings every one-hundredth of an inch from the face of a plate from each heat to determine the carbon gradient in the carburized face. The results are shown in Tables I and II, Appendix (B).

The ballistic plates were all given a standard hardening treatment consisting of heating in a salt bath for one hour at 1550°F, quenching in oil and drawing for one hour at 300°F. Some of the plates were heat treated at the Lithium Company plant but since erratic ballistic results were obtained, they were all re-treated at the Naval Proving Ground.

After heat treatment, coupons were taken from a corner of each plate for Brinell hardness on face and back, Tukon hardness survey on the cross-section, and microscopic examination. The results of hardness testing are shown on the curves designated as Figures 18 to 87 inclusive, Appendix (C). Carbon content curves are also shown in the Figures representing the first plate in each carburizing heat.

All 24"x36" plates with the exception of four (4) plates received in a cracked condition, were ballistically tested versus Caliber .50AP M2 projectiles at 0° obliquity in accordance with existing specifications for face hardened armor and ballistic limits were evaluated. In addition representative plates were tested with 20mm HE projectiles at 20° obliquity; and 20mm APM95 projectiles at 0° obliquity.

9. RESULTS AND DISCUSSION.

a. Detailed ballistic results for each plate tested are given in Appendix (E), pages 1 to 87. Ballistic limits are also listed on the hardness curves, Appendix (C).

b. Table V, Appendix (B), is a summary of these ballistic results and Appendix (F) shows typical plates after ballistic test.

c. Table VI, Appendix (B) rates the plates from best to worst according to their Vp50 limits and shows the margin in feet per second by which the individual plates passed or failed JAN-A-784 specification. Seventy plates were rated, four plates, P-7-A, P-7-B, P-10-A and P-10-B, having been received from the Lithium Company in a badly cracked condition and not fit for testing. According to this Table, 41 of the 70 plates or 58.5% passed the ballistic test.

d. In an attempt to correlate the metallurgical characteristics with the plate ballistic ratings, curves have been drawn plotting plate ratings, best to worst, against:

Maximum carbon content in the face, Figure 88, Appendix (C).

Average carbon content in first .05" of face, Figure 89.

Average carbon content in first .10" of face, Figure 90.

Average carbon content in entire face, Figure 91.

Brinell hardness of face surface, Figure 92.

Percent of face above 540 Knoop hardness, Figure 93.

Total Carburizing time Figure 94.

Curves were also drawn plotting carbon contents (Figure 95) and total carburizing time (Figure 96) versus ballistic rating of carburizing heats, best to worst.

e. In Figures 88, 89, 90 and 91 showing the various stages of carbon content in the face there seems to be a slight tendency towards decreasing carbon content as the ballistic quality decreases. The average carbon content in the faces of the satisfactory plates is .539%, in the plates which failed .517%, with an average for all plates of .53%. However, considering the large spread in carbon contents of both "passed" and "failed" plates and the very small difference in average contents it is believed that the carbon contents are not significant in explaining the difference between passing and failing.

Armor Carburized by the Lithium Catalyst Process

f. Figure 92 showing Brinell hardness of the face versus ballistic rating shows a well dispersed scattering of values with a tendency for the best plates to have the higher hardness although many of the plates which failed had hardnesses comparable to the ones which passed. The satisfactory plates had an average B.H.N. of 648 (spread of 595 to 674), the failed plates an average of 637 B.H.N. (spread of 585 to 672) and the average of all plates was 644 (spread of 585 to 674). Here again, hardness values cannot be used to discern between passed and failed plates.

g. Figure 93 showing percentage of face versus ballistic quality reveals that the satisfactory plates had faces ranging from 28% to 42%, averaging 33.6%, while those which failed ranged from 25.2% to 44.3%, averaging 32.8%. The average face of all plates was 33.3%. The significant characteristic of this Figure is that there was a large number of failed plates which had either high or low percentages of face although approximately half of the "failed" plates had faces comparable to the "passed" plates.

h. Figure 94 indicates that the best plates had the shortest carburizing time but as in the other curves this is only a tendency. The average total carburizing time for the plates that passed the ballistic tests was 64.4 hours while the average for failed plates was 70.2 hours. Here again, many of the failed plates had short carburizing times and a few of the passed plates had long carburizing times. The average carburizing time for all the subject plates was approximately 67 hours and produced an average depth of face of 33%. In comparison with pack carburizing of 1/2" face hardened armor which requires approximately 75 hours to produce a 36% face, there does not appear to be a time saving worthy of note.

i. Figure 95 shows the carbon contents of various phases of the face plotted against the ballistic rating of plates grouped into carburizing batches or heats. The results here are variable and definite conclusions cannot be drawn.

j. Figure 96 depicts the total carburizing time plotted against ballistic rating of carburizing heats. There is considerable variation in carburizing time but there is a definite indication of better ballistics for the shorter carburizing cycles.

k. Figure 97, Appendix (D) shows the microstructure in the face of plate P-4-A which failed ballistic test by 60 foot-seconds. Perhaps the largest contributing factor to this plate's failure was the excess amount of retained austenite shown in the Figure. This retained austenite shows up in the hardness curve (Figure 24 as an

example) as a sharp dip near the surface. The photomicrograph was taken .020" from the surface of the plate while Figure 98 was taken .069" from the surface and is almost free from retained austenite and shows a knoop hardness of 690, 115 points harder than in the retained austenitic area. In Figure 24-A is shown the hardness curve of plate P-4-A after having been given a more drastic quench in cold water. The curve shows that the hardness has been increased overall but some retained austenite is still present. Figures 99 and 100 illustrate the microstructures in the best ballistic plate at depths of .020" and .041" respectively. Little retained austenite is evident.

l. By examining the hardness curves in relation to the carbon curves it is possible to see that for this hardening treatment any increase in carbon above .80% causes (with a few exceptions) a significant drop in hardness due to the retention of austenite, indicating that the maximum carbon content in the face should be kept under .80%. It is also evident that the lowest maximum should be approximately .55% to .60% C. since all four plates of Heat #69 (P-34-A and B and P-35-A and B) which had a maximum carbon content of .50% failed.

m. Table VII, Appendix (B) is a comparison of the subject plates with 1/2" face hardened armor produced by other methods. It shows that the Lithium carburized plates are about equal in overall ballistic performance to Diebold pack carburized acceptance test plates, on the basis of average VpMin limits versus Caliber 50 APM2 projectiles. In comparison with experimental Plurarelt and Lukens composite plates as heat treated by the Naval Proving Ground they appear to be inferior.

n. A total of ten (10) of the subject plates were tested against 20mm APM95 projectiles at 0° obliquity, and gave an average VpMin limit of 1717 ft/sec. The average VpMin limit for 1/2" face hardened armor reported in reference (c) was 1688 ft/sec. Thus, the performance of the subject plates against 20mm APM95 projectiles is considered equivalent to that exhibited by face hardened plates tested previously.

PART D

CONCLUSIONS

10. a. Satisfactory face hardened armor can be carburized by the Lithium catalyst process.

b. Seventy (70) ballistic test plates were processed by this method with hardened faces ranging from 25 to 44% of the plate thickness. Of these 58.6% passed the ballistic requirements of specification JAN-A-784.

c. Maximum carbon contents in the face appeared to be controllable. However, the plates did not show the plus or minus 5 point carbon uniformity claimed by the manufacturer.

d. Decarburization of the surface was not excessive.

e. Some of the plates showed an excess of retained austenite which lowered ballistic quality and could not be decreased by more drastic hardening. This condition was caused by excessively high carbon in the face.

f. The contention that lithium carburizing would shorten the time required to carburize armor was not borne out. The average carburizing time employed on the subject 1/2" plates was not too different from that previously employed for 1/2" armor as pack carburized, but greatly exceeded the time required for liquid or gas carburizing as accomplished on armor submitted previously.

g. This investigation has shown that armor produced by the lithium carburizing process possesses no outstanding characteristics, but perhaps with better control and more experience the method could produce acceptable armor plate. However, the promise of better control, lower cost and higher quality which prompted this investigation has not been fulfilled.

PART E

RECOMMENDATIONS

11. It is recommended that no further experiments be conducted on carburization by the lithium catalyst process.

Armor Carburized by the Lithium Catalyst Process

The tests upon which this report is based were conducted by:
W. H. HALL, Metallurgist,
Armor and Projectile Laboratory,
Terminal Ballistics Department
J. J. GLANCY, Ordnance Engineer,
Light Armor Battery Officer
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This report was reviewed by:
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Terminal Ballistics Department
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Terminal Ballistics Department
R. H. LYDDANE, Director of Research,
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APPROVED: IRVING T. DUKE
Rear Admiral, USN
Commander, Naval Proving Ground

C. T. MAJOR
Captain, USN
Ordnance Officer
By direction

CONFIDENTIAL

NPG REPORT NO. 952

U. S. NAVAL PROVING GROUND
DAHLGREN, VIRGINIA

Final Repo

on

Armor, Medium Ferrous

Final Repor*

on

Heat Treatment Bel[illegible] and

Metallurgical Te[illegible]

Hardened Armor Ce[illegible]ed [illegible]e

Lithium Catalys[illegible] rocess

NPG-41-Rege-123-1

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Copy No. 13
No. of Pages: 12

CONFIDENTIAL
SECURITY INFORMATION

NAVAL APPLIED PLANT CARBURIZING PROGRAM

DATE Jan. 16, 1950

HEAT NO.	3	FURNACE NO.	1700°F.
PLATE NO.	#1 A & #1 B	CARBURIZING TEMP.	1840°F.
START	5:00 PM 1/16/50	DIFFUSION TEMP.	1600°F.
FINISH	8:30 AM 1/18/50	GASOMETER TUBE NO.	1
TIME AT 1ST SETTING		ENRICHING } AIR.	70 c.f.h.
TIME AT 2ND SETTING		GAS.	8.5 c.f.h.
TOTAL TIME	39 1/2 hrs.	RATIO.	8.23 c.f.
		DILUTION.	None
		GAS PRESSURE.	2.2#
		TEMPERING TEMP.	1300°F.
		TEMPERING TIME.	2 hours
		NET PASS.	
		CARBON ANALYSIS	
		DIFFUSION TIME	
		FINAL ANALYSIS	.896

GAS ANALYSIS (FROM GRAPHS)

	TIME 5:00 PM	TIME	TIME	TIME	TIME	TIME
	1/17/50 .1					
	23.7					
	0					
	1.8					
	28.1					

GAS ANALYSIS (FROM PUMPS)

GENERAL NOTES: Carbon Analysis

1st .010" - .896

2nd .010" - .902

3rd - no analysis

Confidential Security Information

Appendix A

1 SIGNED

[redacted] Jan. 20, 1950

[redacted] No. 5 (Supplement)

[redacted] No. ALA & SEB

[redacted] 10:30 AM 1/20/50

[redacted] 9:00 AM 1/21/50

[redacted] ----

[redacted] ----

TOTAL TIME 22 1/2 hrs.

[redacted] 1700°F.

[redacted]

[redacted] 1600°F.

[redacted]

[redacted]) AIR. 70 c.f.h.

[redacted]) GAS. [redacted]

[redacted]

[redacted]

[redacted]

[redacted] 1300°F.

[redacted] 2 hrs.

[redacted] 43.5 [redacted] 4:30 PM 1/20/50

[redacted]

[redacted]

[redacted]

[redacted] ANALYSIS (FROM CRACKER)

	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	8:50AM		11:45AM			
[redacted]	1/20/50 .3	.3	.3			
[redacted]	23.4 10:35AM	23.7	23.6			
[redacted]						
[redacted]						
[redacted]						
[redacted]						

[redacted] ANALYSIS (FROM FURNACE)

[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted] - [redacted]
[redacted]					
[redacted]					
[redacted]					
[redacted]					
[redacted]					

[redacted] NOTES, CARBON ANALYSIS

4th .010" - .376

5th .010" - .422

6th .010" - .402

7th .010" - .408

8th .010" - .408

9th .010" - .372

10th .010" - .402

11th .010" - .402

12th .010" - .3460

13th .010" - .3460

14th .010" - [redacted]

15th .010" - .3620

16th .010" - .3480

17th .010" - .2980

[redacted] R. D. Hamm

APPENDIX A

NAVAL ARMOR PLATE CARBURIZING FURNACE

DATE Jan. 23, 1950

RUN NO. 9

PLATE NO. 48A & 52B

START 12:30 PM 1/23/50

FINISH 8:45 A.M. 1/25/50

TIME AT 1ST SETTING 14 3/4 hrs. (with addition)

TIME AT 2ND SETTING 30 hrs.

TOTAL TIME 44 3/4 hrs.

FURNACE TEMP.	1200°F.
QUENCH TEMP.	1840°F.
LIQUID VAPORIZER.	1600°F
CARBURIZING TUBE NO.	2
ROTAMETER) AIR.	70
READINGS) GAS.	73
RATIO	9.59:1
ADDITION.	2 C.F.H. Propane
GAS PRESSURE.	22"
TEMPERING TEMP.	1300°F.
TEMPERING TIME.	2 1/2 hrs.
DEW POINT.	
CARBON ANALYSIS 1st ANALYSIS TIME	
FINAL ANALYSIS	

GAS ANALYSIS (FROM QUENCH)

	TIME 1:30PM	TIME 8:10PM	TIME 12 M.	TIME 5:40AM	TIME 7:30AM	TIME 4:15 PM
CO_2	1/23/50 .3	.3	.3 1/24/50	.3	.4	.5
CO	25.5	23.8	23.7	23.3	22.9	22.9
ILL.						
CH_4						
H_2						

1/25/50 1:15 AM .5 8:45AM .5
22.8 22.9

GAS ANALYSIS (FROM FURNACE)

	TIME	TIME 9:40PM	TIME 12:30AM	TIME 5:55AM	TIME 9:40AM	TIME
CO_2		1/23/50 .3	1/24/50 .3	.2	.4	
CO		25.5	23.3		23.0	
ILL.						
CH_4						
H_2						

GENERAL NOTES: Carbon Analysis Ratios

1st .010" - .5380	10th .010" - .5260	1/23/50 5:00 PM Add 2 c.f.h. on
2nd .010" - .5840	11th .010" - .5000	1/24/50 8:45 AM Add. 2 c.f.h. off
3rd .010" - .5840	12th .010" - .4900	1/24/50 8:45 AM changed to ~~7.0~~ 10.0/7.0
4th .010" - .5520	13th .010" - .4600	1/24/50 continued at ~~7.0~~ 10.0/7.0 to
5th .010" - .5720	14th .010" - .4520	end of cycle.
6th .010" - .5620	15th .010" - .4480	
7th .010" - .5680	16th .010" - .4000	
8th .010" - .5460	17th .010" - .3860	
9th .010" - .5440	18th .010" - .3480	
	19th .010" - .3280	

The Lithium Company
111 Sylvan Ave., Newark, N.J.

APPENDIX A

NAVAL ARMOR PLATE CARBURIZING PROGRAM

DATE Jan. 23, 1950

HEAT NO. 10

PLATE NO. S 3A & S 3B

START 5:00 PM 1/23/50

FINISH 4:30 PM 1/25/50

TIME AT 1ST SETTING 14 3/4 hrs.

TIME AT 2ND SETTING 32 3/4 hrs.

TOTAL TIME 47 1/2 hrs.

FURNACE TEMP.	1700°F.
CRACKER TEMP.	1640°F.
LITHIUM VAPORIZER.	1600°F.
CRACKER TUBE NO.	2
ROTAMETER) AIR.	70
READINGS) GAS.	7.3
RATIO.	9.59-1
ADDITION.	2 c.f.h. Propane
GAS PRESSURE.	2.2"
TEMPERING TEMP.	1350°F.
TEMPERING TIME.	2 hrs.
DEW POINT.	
CARBON ANALYSIS.	
IST ANALYSIS TIME	
FINAL ANALYSIS	

GAS ANALYSIS (FROM CRACKER)

	TIME 9:10PM	TIME 12:00 MNTIME 5:45AM		TIME 9:30AM	TIME 4:.5 PM	TIME 1:15
CO_2	1/23/50 .3	.3	1/24 .5	.4	.5	1/25 .5
CO	23.8	23.7	23.3	22.9	22.9	22.8
ILL						
CH_4						
H_2						

1/25/50 8:45 AM .5
22.9

GAS ANALYSIS (FROM FURNACE)

	TIME 9:40PM	TIME 12:30AM	TIME 5:55AM	TIME 9:40AM	TIME	TIME
CO_2	1/23 .3	1/24 .3				
CO	23.5	23.3		21.0		
ILL						
CH_4						
H_2						

GENERAL NOTES:

CARBON ANALYSIS

1st .010" - .4780
2nd .010" - .4560
3rd .010" - .4720
4th .010" - .4620
5th .010" - .4660
6th .010" - .4840
7th .010" - .5040
8th .010" - .4960
9th .010" - .4860
10th .010" - .4600
11th .010" - .4300
12th .010" - .4280
13th .010" - .3940
14th .010" - .3880
15th .010" - .3560
16th .010" - .3520
17th .010" - .3440
18th .010" - .3180

RATIOS

1/23/50 5:00 PM Add 2 c.f.h. on
1/24/50 8:45 PM Add 2 c.f.h. off
1/24/50 8:45 AM Changed to 10.0/7.0
1/24/50 Continued at 10.0/7.0 to end of cycle.

CONFIDENTIAL SECURITY INFORMATION

SIGNED

APPENDIX A

NAVAL ARMOR PLATE CARBURIZING PROGRAM

DATE Jan. 11, 1950

HEAT NO. 1

PLATE NO. 54A and 54B

START 4:30 PM 1/11/50

FINISH 8:30 AM 1/13/50

TIME AT 1ST SETTING 24 hrs.

TIME AT 2ND SETTING 16 hrs.

TOTAL TIME 40 hrs.

FURNACE TEMP.	1700°F.
CRACKER TEMP.	1840°F.
LITHIUM VAPORIZER.	1600°F.
CRACKER TUBE NO.	2
ROTAMETER) AIR.	65 cfh (1st 24 hrs)
READINGS) GAS.	7 cfh (1st 24 hrs) (re 16 hours.)
RATIO.	9.28-1 9.23:1
ADDITION	None
GAS PRESSURE.	2.2"
TEMPERING TEMP.	1300°F.
TEMPERING TIME.	3 hrs.
CARBON ANALYSIS 1ST ANALYSIS TIME	
FINAL ANALYSIS	1st .010" - 726

GAS ANALYSIS (FROM CRACKER)

	TIME 2:20PM	TIME 4:45PM	TIME 5:05PM	TIME 8:30AM	TIME 4:30PM	TIME 8:30 PM
CO2	1/11 - .2	1/11 - .2	1/11 - .2	1/12 - .3	.1	.1
CO						
ILL						
CH4						
H2						

CO_2 (8:30AM) 1/13/50
.2

GAS ANALYSIS (FROM FURNACE)

	TIME	TIME	TIME	TIME	TIME	TIME
CO_2						
CO						
ILL						
CH_4						
H_2						

GENERAL NOTES:

Carbon Analysis - 1st .010" - .726 7th .010" - .382

2nd .010" - .586 8th .010" - .390

3rd .010" - .569 9th .010" - .356

4th .010" - .566 10th .010" - .324

5th .010" .566 11th .010" - .282

6th .010" - .490 12th .010" - .240

[redacted] March 31, 1950

[redacted] 7

[redacted] S-5-B

[redacted] 11:00AM 1/21/50

[redacted] 5:00 PM 1/23/50

[redacted] 24 hrs. - 24 hrs.

[redacted] 48 hrs.

[redacted] 54 hrs.

[redacted]	1700°F.
[redacted]	1850°F.
[redacted]	1600°F.
[redacted]	2
[redacted] AIR.	20 cfh
[redacted] GAS.	7.4 cfh
[redacted]	9.49-1
[redacted]	1 cfh
[redacted]	24#
[redacted]	1300°F.
[redacted]	2 hrs.
[redacted]	440°F.

[redacted] ANALYSIS
[redacted] ANALYSIS [redacted]
FINAL ANALYSIS

[redacted] ANALYSIS ([redacted])

	[redacted] 11:15AM	[redacted] 3:00PM	[redacted] 6:00PM	[redacted] 9:00AM	[redacted] 3:00PM	[redacted] 8:30AM
[redacted]	1/21/50 .3	.3	15	1/22/50 .2	.3	1/23/50 .3
[redacted]	23.4	23.7		23.5	23.5	23.6
[redacted]						
[redacted]						
[redacted]						
[redacted]						

[redacted] ANALYSIS ([redacted])

	[redacted]	[redacted]	[redacted]	[redacted] 9:20AM	[redacted] 10:20AM	[redacted]
[redacted]				1/22/50 .3	.25	
[redacted]				23.7	23.6	
[redacted]						
[redacted]						
[redacted]						
[redacted]						

[redacted]: Carbon Analysis

1st .010" - 1.040

2nd .010" - 1.162

3rd .010" - .960

4th .010" - .962

Ratios

1/21/50 11:15 AM - 7.4/7.0

5:45 PM - changed to 9/70

1/21/50 11:00 AM Add 1 cfh on

1/22/50 8:30 AM Add 1 cfh off

1/22/50 2:00 PM changed to 7/3/70

Note: changed to cracker tube #2 at 10:15 AM 1/21/50

NAVAL ARMOR PLATE CARBURIZING PROGRAM

DATE Jan. 25, 1950

HEAT NO. 7 (Supplement)

PLATE NO. S 5 A & S 5 B

START 5:00 PM 1/25/50

FINISH 8:45 AM 1/26/50

TIME AT 1ST SETTING

TIME AT 2ND SETTING

TOTAL TIME 15 3/4 hours

FURNACE TEMP.	1700°F.
CRACKER TEMP.	1800°F.
LITHIUM VAPORIZER.	1600°F.
CRACKER TUBE NO.	1
ROTAMETER) AIR.	70
READINGS) GAS.	7.1
RATIO.	10-1
ADDITION.	None
GAS PRESSURE.	2.2"
TEMPERING TEMP.	1300°F.
TEMPERING TIME.	2 hours
DEW POINT.	
CARBON ANALYSIS.	
1ST ANALYSIS TIME	
FINAL ANALYSIS	

GAS ANALYSIS (FROM CRACKER)

	TIME 5:15PM	TIME 5:35 PM	TIME 1:15 AM	TIME	TIME	TIME
CO_2	1/25 - .5	.4	1/26 - .5			
CO	22.9	23.0	23.0			
ILL						
CH_4						
H_2						

GAS ANALYSIS (FROM FURNACE)

	TIME	TIME	TIME	TIME	TIME	TIME
CO_2						
CO						
ILL						
CH_4						
H_2						

GENERAL NOTES: Carbon Analysis Ratios

5th .010" - .5600	13th .010" - .5240	1/25/50 5:30 PM changed 7/1/70 ar
6th .010" - .5540	14th .010" - .5420	21st .010" - .4140
7th .010" - .5340	15th .010" - .5040	22nd .010" - .4080
8th .010" - .5440	16th .010" - .5080	23rd .010" - .4060
9th .010" - .5400	17th .010" - .4760	24th .010" - .3620
10th .010" - .5540	18th .010" - .4740	25th .010" - .3620
11th .010" - .5380	19th .010" - .4240	26th .010" - .3120
12th .010" - .5340	20th .010" - .4200	

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APPENDIX A

NAVAL ARMOR PLATE CARBURIZING PROGRAM

DATE Feb. 2. 1950

HEAT NO.	16	FURNACE TEMP.	1700°F.
PLATE NO.	S 6 A and S 6 B	CRACKER TEMP.	1840°F.
START	4:30 PM 2/2/50	LITHIUM VAPORIZER.	1600°F.
FINISH	10:00 AM 2/4/50	CRACKER TUBE NO.	2
TIME AT 1ST SETTING	16 hours	ROTAMETER READINGS) AIR.	70 c.f.h.
TIME AT 2ND SETTING	25 ½ hours	ROTAMETER READINGS) GAS.	7.4 c.f.h.
TOTAL TIME	41 1/2 hours	RATIO.	9.46-1
		ADDITION	2 c.f.h.
		GAS PRESSURE.	2.2"
		TEMPERING TEMP.	1305°F.
		TEMPERING TIME.	3 hours
		DEW POINT	
		CARBON ANALYSIS 1ST ANALYSIS TIME	
		FINAL ANALYSIS	

GAS ANALYSIS (FROM CRACKER)

	TIME 4:35PM	TIME 8:35AM	TIME 4:35 PM	TIME 8:50 AM	TIME	TIME
CO_2	2/2 - .3	2/3 - .3	.3	2/4 - .3		
CO	22.6	22.8	22.8	22.9		
H_2						
CH_4						
H_2						

GAS ANALYSIS (FROM FURNACE)

	TIME 4:40 PM	TIME 8:50AM	TIME 8:55AM	TIME	TIME	TIME
CO_2	2/2 - .4	.2	2/4 - .2			
CO	24.6	23.6	23.6			
H_2						
CH_4						
H_2						

GENERAL NOTES: Carbon Analysis

1st .010" - .9220 9th .010" - .6230 2/2/50 4:30 PM 2 cfh add on

2nd .010" - .8860 10th .010" - .5460 2/3/50 8:30 AM 2 cfh add off

3rd .010" - .8140 11th .010" - .5020 17th .010" - .3560

4th .010" - .7660 12th .010" - .5000 18th .010" - .3360

5th .010" - .7200 13th .010" - .4200 19th .010" - .2920

6th .010" - .6660 14th .010" - .4000

7th .010" - .6460 15th .010" - .3000

8th .010" - .6040 16th .010" - .2800

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APPENDIX A

NAVAL ARMOR PLATE CARBURIZING PROGRAM

DATE Feb. 15, 1950

HEAT NO. 24

PLATE NO. S 7 A - S 7 B

START 4:45PM 2/15/50

FINISH 9:30AM 2/17/50

TIME AT 1ST SETTING 16½ hr.

TIME AT 2ND SETTING 24¼ hr.

TOTAL TIME 40 3/4 hrs.

FURNACE TEMP.	1700°F.
CRACKER TEMP.	1840°F.
LITHIUM VAPORIZER.	1800°F.
CRACKER TUBE NO.	2
ROTAMETER (AIR.	70 c f h
READINGS (GAS.	7.3 c f h
RATIO .	9.59-1
ADDITION.	1.5 c f h
GAS PRESSURE.	2.2"
TEMPERING TEMP.	1300°F.
TEMPERING TIME.	3 hours.
DEW POINT.	
CARBON ANALYSIS 1ST ANALYSIS TIME	
FINAL ANALYSIS	

GAS ANALYSIS (FROM CRACKER)

	TIME 9:00AM	TIME 11:00AM	TIME 2:00PM	TIME 4:30PM	TIME 8:30AM	TIME
CO2	2/16 .3	2/16 .3	2/16 .3	2/16 .3	2/17 .3	
CO	23.4	23.6	22.3	22.7	23.3	
ILL						
CH4						
H2						

GAS ANALYSIS (FROM FURNACE)

	TIME 9:00AM	TIME 11:00AM	TIME 2:00PM	TIME 4:30PM	TIME 8:30AM	TIME
CO2	2/16 .35	2/16 .3	2/16 .4	2/16 .4	2/17 .3	
CO	24.4	23.3	23.4	23.2	23.5	
ILL						
CH4						
H2						

GENERAL NOTES: Carbon Analysis

1st .010" - .8440
2nd .010" - .8400
3rd .010" - .8000
4th .010" - .8340
5th .010" - .7700
6th .010" - .7520
7th .010" - .7160
8th .010" - .7200
9th .010" - .6240
10th .010" - .5680
11th .010" - .5200
12th .010" - .4760
13th .010" - .4280
14th .010" - .4040
15th .010" - .3840
16th .010" - .3720
17th .010" - .3480
18th .010" - .3160

Sample was tranferred Directly from carburizing Furnace to tempering Furnace, tempered for 2 hours, and later had to be retempered 1 hour

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SIGNED Robert H. Heuer

APPENDIX A

[redacted] 3/24/50

[redacted]

[redacted] March 21, 1950

[redacted] 41

[redacted]

[redacted] 5:00 PM 3/21/50

[redacted] 9:00 AM 3/23/50

[redacted] 16 hrs.

[redacted] 24 hrs.

[redacted] 40 hrs.

[redacted] 1700°F.
[redacted] 1820°F
[redacted] 1720°F
[redacted] 70
[redacted] 71
[redacted]
[redacted] 4.5 CFM
[redacted] 2.2"
[redacted] 1300°
[redacted] 2 hrs.
[redacted]
[redacted]
[redacted]

[redacted]

[redacted]

[redacted]

[redacted] Carbon Analysis — 1:30 PM 3/22/50 changed to cracker tube #2

✓ 1st .010" - .6640	8th .010" - .6120	
2nd .010" = .6900	✓ 9th .010" = .5980	
3rd .010" - .7180	10th .010" - .6000	15th .010" - .5080
4th .010" = .6840	11th .010" = .5920	16th .010" = .4900
✓ 5th .010" - .6460	12th .010" - .5980	✓ 17th .010" = .4040
6th .010" - .6480	✓ 13th .010" = .5400	18th .010" = .3950
7th .010" - .6480	14th .010" - .5200	20th .010" = .3740
		✓ 21st .010" - .3200

Analysis for cut #16 is questionably due to the small amount of [redacted] sample. We found it impossible to check this result. Robert H. Herman

APPENDIX A
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NAVAL AIRCRAFT GAS CARBURIZING PROGRAM

DATE February 5, 1950

HEAT NO. 18

PLATE NO. S 9 B

START 6:00 PM 2/5/50

FINISH 12:00 Noon 2/7/50

TIME AT 1ST SETTING 15 ½ hrs.

TIME AT 2ND SETTING 27 hrs.

TOTAL TIME 42 hrs.

FURNACE TEMP.	1700°F.
CRACKER TEMP.	1840°F.
LINDBERG WATTMETER	1500°F.
CRACKER TUBE NO.	2
ROTAMETER } AIR	70 c f h
READINGS } GAS	7.4 cfh
RATIO	9.45-1
ADDITION	2 cfh
GAS PRESSURE	2.2"
TEMPERING TEMP.	1300°F.
TEMPERING TIME	2 hrs.
DEWPOINT	
CARBON ANALYSIS	
1ST ANALYSIS	
FINAL ANALYSIS	

GAS ANALYSIS (FROM CRACKER)

	TIME 8:30AM	TIME 10:35AM	TIME 8:45AM	TIME 11:30AM	TIME	TIME
	2/6/50		2/7/50			
CO_2	.4	.4	.4	.4		
CO	23.1	23.4	22.8	23.0		
H_2		0				
CH_4		.3				
N_2		30.3				

GAS ANALYSIS (FROM FURNACE)

	TIME 9:00AM	TIME 10:30AM	TIME	TIME	TIME	TIME
	2/6/50	2/7/50				
CO_2	.2	.3				
CO	23.8	24.6				
H_2	0	0				
CH_4	3.9	.5				
N_2	31.4	29.4				

GENERAL NOTES: CARBON ANALYSIS

1st .010" - .5260	11th .010" - .4860	2/5/50 6:00PM 2 cfh add on
2nd .010" - .5340	12th .010" - .4846	2/6/50 9:30 AM 2 cfh add off
3rd .010" - .5540	13th .010" - .4460	2/6/50 9:30 AM changed ratio to 7.2/70 9.73-1
4th .010" - .5540	14th .010" - .4000	
5th .010" - .5200	15th .010" - .3700	
6th .010" - .5320	16th .010" - .3560	
7th .010" - .5200	17th .010" - .3120	
8th .010" - .5240	Note: Changed to cracker tube #1 @ 9:30 AM 2/6/50	
9th .010" - .5080		
10th .010" - .5020		

NAVAL ARMOR PLATE CARBURIZING PROGRAM

DATE June 22, 1950

HEAT NO. 28

PLATE NO. 810A & 810B

START 5:00 PM Febr. 21, 1950

FINISH 5:00 PM Febr. 23, 1950

TIME AT 1ST SETTING 15½ hours

TIME AT 2ND SETTING 32½ hours

TOTAL TIME 48 hours

FURNACE TEMP.	1700°F.
CRACKER TEMP.	1810°F.
LITHIUM VAPORIZER.	1600°F.
CRACKER TUBE NO.	2
ROTAMETER) AIR.	70
READINGS) GAS.	7.25
RATIO.	9.65-1
ADDITION	1.5 cfh
GAS PRESSURE	
TEMPERING TEMP.	1300°F.
TEMPERING TIME.	1 hour
DEWPOINT.	
CARBON ANALYSIS.	
1ST ANALYSIS TIME	
FINAL ANALYSIS	

GAS ANALYSIS (FROM CRACKER)

	TIME 9:00AM	TIME 11:00AM	TIME 3:30PM	TIME 4:00PM	TIME	TIME
CO2	2/22 .4	2/22 .35	2/22 .4	2/22 .45		
CO	22.8	22.7				
ILL						
CH4						
H2						

GAS ANALYSIS (FROM FURNACE) R-2100

	TIME 9:00AM	TIME 1:00 PM	TIME	TIME	TIME	TIME
CO2	2/22 .3	2/22 .3				
CO	23.2	21.8				
ILL						
CH4						
H2						

GENERAL NOTES: CARBON ANALYSIS

1st .010" - .5040	11th .010" - .4960
2nd .010" - .5160	12th .010" - .4760
3rd .010" - .5320	13th .010" .4320
4th .010" - .5720	14th .010" - .4080
5th .010" - .5720	15th .010" - .3940
6th .010" - .5680	
7th .010" - .5720	
8th .010" - .5520	
9th .010" - .5640	
10th .010" - .5280	

4:00 PM 2/22 - Gas to 7.3
12:20 PM 2/23 - Gas to 7.25
12:00 M 2/23 - Changed to cracker tube #1
Addition off 8:30 AM 2/22.

SIGNED R. E. Hess

NAVAL ARMOR PLATE CARBURIZING PROGRAM

DATE June 22, 1950

HEAT NO. 29

PLATE NO. S11A & S11B

START 7:45 PM 2/23

FINISH 12:30 Noon 2/25

TIME AT 1ST SETTING 16½ hours

TIME AT 2ND SETTING 24¼ hours

TOTAL TIME 40 3/4 hours

FURNACE TEMP. 1700°F
GRAPHITE TEMP. 1840°F
LITHIUM VAPORIZER. 1600°F
GRAPHITE TUBE NO. 1
ROTAMETER READINGS) AIR. 70
) GAS. 7.25
RATIO. [illegible]
ADDITIONS [illegible]
GAS PRESSURE
TEMPERING TEMP. 1300°F
TEMPERING TIME. 1 hour
DEWPOINT.
CARBON ANALYSIS.
1ST ANALYSIS TIME
FINAL ANALYSIS

GAS ANALYSIS (FROM GRAPHITE)

	TIME	TIME	TIME	TIME	TIME	TIME
CO2						
CO						
ILL						
CH4						
H2						

GAS ANALYSIS (FROM FURNACE)

	TIME	TIME	TIME	TIME	TIME	TIME
CO2						
CO						
ILL						
CH4						
H2						

GENERAL NOTES: CARBON ANALYSIS:

1st .010" - .5520
2nd .010" - .6920
3rd .010" - .7520
4th .010" - .7320
5th .010" - .6680
6th .010" - .5960
7th .010" - .6600
8th .010" - .5160
9th .010" - .6080
10th .010" - .5520
11th .010" - .5160
12th .010" - .5040
13th .010" - .4760
14th .010" - .4680
15th .010" - .4320
[illegible] = [illegible]

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F3

SIGNED R. J. Henry

APPENDIX A

[redacted] HEAT NO. 35

[redacted] PLATE NO. 812A & 812B

[redacted] START 5:00 PM 3/9/50

[redacted] FINISH 9:00 AM 3/11/50

[redacted] TIME AT 1ST SYSTEM 16 hours

[redacted] TIME AT 2ND SYSTEM 24 hours

[redacted] TOTAL TIME 40 hours

[redacted] DATE June 22, 1950

[redacted] STEAM TEMP. 1700°F.

[redacted] CRACKER TEMP. 1540°F.

[redacted] LIQUID VAPORIZER. 1600°F.

[redacted] CRACKER TUBE NO. 1

[redacted] RESISTOR AIR. 70

[redacted] READING GAS. 7.25

[redacted] RATIO. 9.66-1

[redacted] ADDITIVE. 1.5 5th

[redacted] GAS PRESSURE. 2.2#

[redacted] TEMPERING TEMP. 1300°F

[redacted] TEMPERING TIME. 3 hours

[redacted] DEW POINT.

[redacted] CARBON ANALYSIS

[redacted] 1ST ANALYSIS TIME

[redacted] FINAL ANALYSIS

[redacted] GAS ANALYSIS (FROM CRACKER)

[redacted]	[redacted] 10:00 AM	[redacted] 11:30 AM	[redacted] 2:00 PM	[redacted] 3:30 PM	[redacted] 5:00 PM	[redacted]
[redacted]	3/10 .3	3/10 .35	3/10 .8	3/10 .4	3/10 .4	
[redacted]	23.7	24.8	22.9	24.0	23.0	
[redacted]						
[redacted]						
[redacted]						

[redacted] GAS ANALYSIS (FROM [redacted]) R-2100

[redacted]	[redacted] 10:00 AM	[redacted] 11:30 AM	[redacted] 2:00 PM	[redacted]	[redacted] 5:00 PM	[redacted]
[redacted]	3/10 .3	3/10 .2	3/10 .4		3/10 .3	
[redacted]	24.8	23.8	23.8		22.6	
[redacted]						
[redacted]						
[redacted]						

[redacted] General notes: CARBON ANALYSIS

1st .010" - .8020	15th .010" - .3480	2:00 PM 3/10/50
2nd .010" - .7300	16th = .288 ~ .296	changed to cracker tube #2
3rd .010" - .6780		
4th .010" - .6640		Add. off 9:00 AM 3/10/50
5th .010" - .6560		
6th .010" - .6520		3/10 9:30AM - Air to Gas to 7.2
7th .010" - .6040		
8th .010" - .5280		
9th .010" - .5040		
10th .010" - .4520		
11th .010" - .4480		
12th .010" - .4140		
13th .010" - .4040		
14th .010" - .3520		

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SECURITY INFORMATION

[redacted] SIGNED [redacted]

APPENDIX A

NAVY ARMOR PLATE CARBURIZING [illegible]

HEAT NO. 59

PLATE NO. S13A and S13B

START 5:00 PM 3/17/50

FINISH 9:00AM 3/19/50

TIME AT 1ST SETTING 16 hours

TIME AT 2ND SETTING 24 hours

TOTAL TIME 40 hours

DATE	June 22, 1950
FURNACE TEMP.	1700°F
CASE TEMP.	1650°F.
LIQUID VAPORIZER	1600°F
CRACKER TUBE NO.	1
ROTAMETER READINGS / AIR.	70
GAS.	7.1
RATIO.	9.85-1
ADDITION.	1.5 c/m
GAS PRESSURE.	
TEMPERING TEMP.	1300°F.
TEMPERING TIME.	3 hours
DEW POINT.	
CARBON ANALYSIS	
1ST ANALYSIS TAKE	
FINAL ANALYSIS	

GAS ANALYSIS (FROM CRACKER)

	TIME	TIME	TIME	TIME	TIME	TIME
CO2						
CO						
H2						
CH4						
N2						

GAS ANALYSIS (FROM FURNACE) 2100

	TIME	TIME	TIME	TIME	TIME	TIME
CO2						
CO						
H2						
CH4						
N2						

General Notes: CARBON ANALYSIS

1st .010"	- .8760	13th .010"	- .6080
2nd .010"	- .8700	14th .010"	- .5240
3rd .010"	- .8740	17th	- .378 + .387
4th .010"	- .8720	20 " "	- .301 + .296
5th .010"	- .8000		
6th .010"	- .8120		
7th .010"	- .7600		
8th .010"	- .7440		
9th .010"	- .6820		
10th .010"	- .7140		
11th .010"	- .6800		
12th .010"	- .6120		

Add. off 9:00 AM 3/18/50

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SIGNED R. J. Lewis

NAVAL ARMOR PLATE CARBURIZING PROGRAM

HEAT NO. 55

PLATE NO. S14 A & S14 B

START 4:45 PM 5/1/50

FINISH 1:30 PM 5/3/50

TIME AT 1ST SETTING 16 hours

TIME AT 2ND SETTING 28 3/4 hours

TOTAL TIME 44 3/4 hours

DATE June 22, 1950

FURNACE TEMP.	1700°F.
CRACKER TEMP.	1640°F.
LITHIUM VAPORIZER.	
CRACKER TUBE NO.	1
ROTAMETER { AIR.	100 cfh
READINGS { GAS.	13 cfh
RATIO.	7.7-1
ADDITION	3 cfh
GAS PRESSURE.	
TEMPERING TEMP.	1300°F
TEMPERING TIME	3 hours
DEWPOINT	

CARBON ANALYSIS
1ST ANALYSIS TIME
FINAL ANALYSIS

GAS ANALYSIS (FROM CRACKER)

	TIME	TIME	TIME	TIME	TIME	TIME
CO2						
CO						
ILL						
CH4						
H2						

GAS ANALYSIS (FROM FURNACE) Pit Furnace

	TIME	TIME	TIME	TIME	TIME	TIME
CO2						
CO						
ILL						
CH4						
H2						

GENERAL NOTES:

CARBON ANALYSIS

1st .010" - .8120
2nd .010" - .7680
3rd .010" - .7140
4th .010" - .6800
6th .010" - .6480
5th .010" - .6260
7th .010" - .5760
8th .010" - .5240

10th - .487 + .487
14th - .353 + .349

Add. off 8:45 Am 5/2/50
Changed to cracker tube #2
4:00 PM 5/2/50

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SECURITY INFORMATION

SIGNED R. J. Henry

[redacted] PLANT CARBURIZING PROGRAM

[redacted] No. 56

[redacted] No. 515 A & 515 B

[redacted] 4:30 PM 5/3/50

[redacted] 8:15 AM 5/5/50

[redacted] AT 1ST SETTING 16 hrs.

[redacted] AT 2ND SETTING 24 3/4 hrs.

TOTAL TIME 40 3/4 hours

[redacted] DATE June 22, 1950

[redacted] 1700°F.

[redacted] 2

[redacted] 100

[redacted] 8.81-1

[redacted] 3 cfh

[redacted] 1300°F.

[redacted] 3 hrs.

CARBON ANALYSIS
1ST ANALYSIS [redacted]
FINAL ANALYSIS

GAS ANALYSIS (FROM GREATER)

[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
CO2						
CO						
H2						
CH4						
N2						

[redacted] ANALYSIS (FROM FURNACE A Pit Furnace

[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
CO2						
CO						
H2						
CH4						
N2						

GENERAL NOTES: CARBON ANALYSIS

1st .010"	- .8420	9th .010"	- .4240
2nd .010"	- .7920	10th .010"	- .3720
3rd .010"	- .7480		
4th .010"	- .7240		
5th .010"	- .6560		
6th .010"	- .6160		
7th .010"	- .5320		
8th .010"	- .4880		
12th .	- .311 4311		

Ratio changed at 4:00 PM 5/4 Air 100
Gas 11.4

Addition off 8:30 AM 5/4/50

CONFIDENTIAL
SECURITY INFORMATION

17 [redacted] C. D. Hengst APPENDIX A

[illegible] ARMOR PLATE CARBURIZING PROGRAM

DATE June 22, 1950

HEAT NO. 58 (Plate)

PLATE NO. 816A & 816B

START 5:00 PM 5/22/50

FINISH 5:00 PM 5/24/50

TIME AT 1ST SETTING 16 hrs.

TIME AT 2ND SETTING 32 hrs.

TOTAL TIME 48 hrs.

FURNACE TEMP.	1700°F
CRACKER TEMP.	1840°F
LITHIUM VAPORIZER	
CRACKER TUBE NO.	2
ROTAMETER) AIR.	100
READINGS) GAS.	11.75
RATIO.	8.51-1
ADDITION.	3 cfh
GAS PRESSURE.	
TEMPERING TIME.	2 hrs.
TEMPERING TEMP.	1300°F
DEW POINT.	
CARBON ANALYSIS	
1ST ANALYSIS TIME	
FINAL ANALYSIS	

GAS ANALYSIS (FROM CRACKER)

	TIME	TIME 2:20 PM	TIME 3:30 PM	TIME	TIME	TIME
CO2		5/24 .5	.7			
CO		22.1	21.9			
H2						
CH4						
N2						

GAS ANALYSIS (FROM FURNACE)

Pit Furnace

	TIME	TIME 2:00PM	TIME 3:00PM	TIME	TIME	TIME
CO2		5/24 .3	.3			
CO		23.4	23.2			
H2						
CH4						
N2						

GENERAL NOTES: CARBON ANALYSIS

1st .010" - .6080	9th .010" - .4420	5:00 PM 5/23
2nd .010" - .5800	10th .010" - .4200	Air - 100 cfh
3rd .010" - .5560	11th .010" - .3800	Gas - 11 cfh
4th .010" - .5420	12th .010" - .3480	
5th .010" - .5120	13th . . - .36 & 37	Add. off 9:00 AM 5/23
6th .010" - .5060		
7th .010" - .4900		Changed to cracker tube
8th .010" - .4820		#1 5/23 @ 10:30AM.

CONFIDENTIAL
SECURITY INFORMATION

[redacted] PLANT CARBURIZING PROGRAM

JOB NO. 62

FURN. NO. S17A & S17B

START 5:00 PM 6/5/50

FINISH 5:00 PM 6/7/50

TIME AT 1ST SETTING [redacted]

TIME AT 2ND SETTING [redacted]

TOTAL TIME 48 hours

DATE June 22, 1950

FURNACE TEMP.	1700°F.
CHARGE TEMP.	1540°F.
[redacted]	[redacted]
CHARGE TIME IN.	[redacted]
NATURAL) AIR.	100 cfh
HEATING) GAS.	15 cfh
RATIO.	7.7:1
ADDITIVE	5 cfh
GAS PRESSURE.	[redacted]
TEMPERING TEMP.	1350°F
TEMPERING TIME	2 hrs.
REMARKS	[redacted]

CARBON ANALYSIS
1ST ANALYSIS TIME [redacted]
FINAL ANALYSIS [redacted]

GAS ANALYSIS (FROM CHARTS)

	TIME 1:30 AM 6/6	TIME	TIME	TIME	TIME	TIME
CO2	2					
CO	[redacted]					
H2						
CH4						
N2						

[redacted] ANALYSIS (FROM CHARTS) Pit Furnace

	TIME	TIME	TIME	TIME	TIME	TIME
CO2						
CO						
H2						
CH4						
N2						

GENERAL NOTES:

CARBON ANSLYSIS

1st .010"	.7080
2nd .010"	.7120
3rd .010"	.6700
4th .010"	.5280
5th .010"	.5120
6th .010"	.4480
7th .010"	.4120
8th .010"	.3740
9th .010"	.3400
10th .010"	.3080

BY [redacted] R. J. Lenz

NA[illegible] ARMOR PLATE CARBURIZING [illegible]GRAM

HEAT NO. 64

PLATE NO. P1A & P1B - P2A & P2B

START 4:00 PM 6/21/50

FINISH 4:00 PM 6/22/50

TIME AT 1ST SETTING 24 hrs.

TIME AT 2ND SETTING ____

TOTAL TIME 24 hrs.

DATE July 7, 1950

FURNACE TEMP.	1700°F.
CRACKER TEMP.	1840°F.
LITHIUM VAPORIZER.	
CRACKER TUBE NO.	1
ROTAMETER) AIR.	100 cfh
READINGS) GAS.	13 cfh
RATIO .	7.7-1
ADDITION.	3 cfh
GAS PRESSURE.	
TEMPERING TEMP.	
TEMPERING TIME.	
DEW POINT.	
CARBON ANALYSIS	
1ST ANALYSIS TIME	
FINAL ANALYSIS	

GAS ANALYSIS (FROM CRACKER)

	TIME 5:00PM 6/21	TIME	TIME	TIME	TIME
CO2	.2				
CO	23.4				
ILL					
CH4					
H2					

GAS ANALYSIS (FROM FURNACE)

	TIME	TIME	TIME	TIME	TIME
CO2					
CO					
ILL					
CH4					
H2					

GENERAL NOTES:

Both plates removed from furnace and air cooled to room temperature.

20 SIGNED R. Kenney

NAVAL [illegible] PLANT [illegible]

DATE July 7, 1950

HEAT NO. 64

PLATE NO. F1A & F1B - F2A & F2b

START 8:30 AM 6/22/50

FINISH 8:30 AM 6/23/50

TIME AT 1ST SETTING

TIME AT 2ND SETTING 24 hrs.

TOTAL TIME 24 hrs.

FURNACE TEMP.	1700°F.
QUENCH TEMP.	1540°F.
CARBURIZING VAPORIZER.	
CRACKER TUBE NO.	2
ROTAMETER) AIR.	100 cfh
READINGS) GAS.	13 cfh
RATIO.	7.7=1
ADDITION.	None
GAS TEMP.	600°F
TIME.	2 hrs.
1ST.	
LAST.	
1ST ANALYSIS TIME	
FINAL ANALYSIS	

GAS ANALYSIS (FROM CRACKER)

	TIME 10:30AM	TIME	TIME	TIME	TIME	TIME
Sec	6/22/50 .2					
CO	23.1					
H_2						
CH_4						
N_2						

GAS ANALYSIS (FROM FURNACE)

	TIME	TIME	TIME	TIME	TIME	TIME
Sec						
CO						
H_2						
CH_4						
N_2						

GENERAL NOTES:

CARBON ANALYSIS:

1st .010" - .8240	9th .010" - .5820
2nd .010" - .7080	10th .010" - .5840
3rd .010" - .6840	11th .010" - .5520
4th .010" - .6800	12th .010" - .5240
5th .010" - .6560	13th .010" - .3980
6th .010" - .6640	14th .010" - .3380
7th .010" - .5980	15th .010" - .2460
8th .010" - .5760	

Both plates oil quenched from carburizing temp. and then tempered.

SIGNED [signature]

ATTENDANT

NAVAL ARMOR PLATE QUENCHING PROGRAM

July 17, 1950

HEAT NO. 65 (1 plate)

PLATE NO. P3A & P3B

START 4:30 PM 6/22/50

FINISH 4:30 PM 6/23/50

TIME AT 1ST SETTING 24 hrs.

TIME AT 2ND SETTING ____

TOTAL TIME 24 hrs.

FURNACE TEMP. 1700°F

QUENCH TEMP. 1640°F.

LITHIUM VAPORIZER.

CRACKER UNIT NO. 2

Rotameter } AIR. 100 cfh

READINGS } GAS. 13 cfh

RATIO. 7.7-1

ADDITION. 3 cfh

GAS PRESSURE.

TEMPERING TEMP.

TEMPERING TIME.

DEW POINT.

CARBON ANALYSIS

1ST ANALYSIS TIME

FINAL ANALYSIS

GAS ANALYSIS (FROM CRACKER)

	TIME 5:15PM 6/22/50	TIME 3:35 PM 6/23/50	TIME	TIME	TIME	TIME
CO_2	.2	.2				
CO	23.2	23.0				
H_2						
CH_4						
N_2						

GAS ANALYSIS (FROM FURNACE)

	TIME	TIME	TIME	TIME	TIME	TIME
CO_2						
CO						
H_2						
CH_4						
N_2						

GENERAL NOTES;

Removed from furnace and air cooled to room temperature.

SIGNED R. Hauser Jr.

NAVAL ARMOR PLATE CARBURIZING PROGRAM

DATE July 17, 1950

HEAT NO. 65 (1 plate)

PLATE NO. P3A & P3B

START 8:30AM 6/24/50

FINISH 8:30AM 6/25/50

TIME AT 1ST SETTING ____

TIME AT 2ND SETTING 24 hrs.

TOTAL TIME 24 hrs.

FURNACE TEMP.	1700°F.
CRACKER TEMP.	1640°F.
LITHIUM VAPORIZER.	
CRACKER TUBE NO.	2
rotameter readings AIR.	100 cfh
rotameter readings GAS.	15 cfh
RATIO.	7.7-1
ADDITION.	
GAS PRESSURE.	
TEMPERING TEMP.	650°F.
TEMPERING TIME.	2 hrs.
DEW POINT .	
CARBON ANALYSIS	
1ST ANALYSIS TIME	
FINAL ANALYSIS	

GAS ANALYSIS (FROM CRACKER)

	TIME 10:10AM	TIME 4:15PM	TIME	TIME	TIME	TIME
CO2	6/24/50 .2	6/24/50 .2				
CO	23.1	23.0				
ILL						
CH4						
H2						

GAS ANAYLSIS (FROM FURNACE) (Pit)

	TIME	TIME	TIME	TIME	TIME	TIME
CO2						
CO						
ILL						
CH4						
H2						

GENERAL NOTES:

CARBON ANALYSIS

1st .010" - .8320	9th .010" - .5280
2nd .010" - .8040	10th .010" - .5100
3rd .010" - .7800	11th .010" - .4520
4th .010" - .7380	12th .010" - .4160
5th .010" - .6980	13th .010" .3900
6th .010" - .6880	14th .010" - .3240
7th .010" - .6400	
8th .010" - .5940	

SIGNED [signature]

NAVAL ARMOR PLATE CARBURIZING PROGRAM

HEAT NO. 64 & 65 (Retreatment)

PLATE NO. P2A & P2B
P3A & P3B

START 9:30 AM 11/7/50

FINISH 9:30 AM 11/9/50

TIME AT 1ST SETTING 24 hr. (7.7-1)

TIME AT 2ND SETTING 24 hrs. (8.0-1)

TOTAL TIME 48 hrs.

DATE DECEMBER 28, 1950

FURNACE TEMP. 1700°F

CRACKER TEMP. 1940°F.

LITHIUM VAPORIZER. ———

CRACKER TUBE NO. 2

ROTAMETER READINGS } AIR. 100 cfh 100 cfh
GAS. 13 cfh 12.5 cfh

RATIO. 7.7-1

ADDITION. 3 6 7 h

GAS PRESSURE.

TEMPERING TEMP. ———

TEMPERING TIME. ———

DEW POINT.

CARBON ANALYSIS

1ST ANALYSIS TIME

FINAL ANALYSIS

GAS ANALYSIS (FROM CRACKER)

	TIME 8:55AM 11/7	TIME 4:25PM 11/7	TIME 10:15AM 11/8	TIME 4:20PM 11/8	TIME 8:35AM 11/9	TIME
CO_2	.1	.1	.3	.3	.3	
CO						
ILL						
CH_4						
H_2						

GAS ANALYSIS (FROM FURNACE)

	TIME 10:15A 11/7	TIME	TIME	TIME	TIME	TIME
CO_2	0					
CO						
ILL						
CH_4						
H_2						

GENERAL NOTES:

1st .010"	.8080	9th .010"	.5480
2nd .010"	.7980	10th .010"	.5320
3rd .010"	.7780	11th .010"	.5120
4th .010"	.7340	12th .010"	.4960
5th .010"	.6620	13th .010"	.3870
6th .010"	.6240	14th .010"	.3320
7th .010"	.5840	15th .010"	.2680
8th .010"	.5760		

Burnt out for 1½ hours after 1st 24 hrs.
Both plates oil quenched from carburizing cycle.

CONFIDENTIAL
SECURITY INFORMATION

SIGNED Robert E. Kinney

APPENDIX A

NAVAL ARMOR PLATE CARBURIZING PROGRAM

DATE DECEMBER 26, 1950

HEAT NO. 64 & 65 (Reireatment)
PLATE NO. P2A & P2B / P3A & P3B

START 8:30 AM 11/7/50

FINISH 8:30 AM 11/9/50

TIME AT 1ST SETTING 24 hr. (7.7-1)

TIME AT 2ND SETTING 24 hrs. (9.0-1)

TOTAL TIME 48 hrs.

FURNACE TEMP. 1750°F
CRACKER TEMP. 1840°F
LITHIUM VAPORIZER. ———
CRACKER TUBE NO. 2
ROTAMETER) AIR. 100 cfh 100 cfh
READINGS) GAS. 13 cfh 12.5 cfh
RATIO. 7.7-1
ADDITION. 3 c f h
GAS PRESSURE.
TEMPERING TEMP. ———
TEMPERING TIME. ———
DEW POINT.
CARBON ANALYSIS
1ST ANALYSIS TIME
FINAL ANALYSIS

GAS ANALYSIS (FROM CRACKER)

	TIME 9:55AM	TIME 4:25PM	TIME 10:15AM	TIME 4:20PM	TIME 8:35AM	TIME
	11/7	11/7	11/8	11/8	11/9	
CO_2	.1	.1	.3	.3	.3	
CO						
ILL						
CH_4						
H_2						

GAS ANALYSIS (FROM FURNACE)

	TIME 10:15A	TIME	TIME	TIME	TIME	TIME
	11/7					
CO_2	0					
CO						
ILL						
CH_4						
H_2						

GENERAL NOTES:

1st .010" - .8080	9th .010" - .5480	Burnt out for 1½ hours after 1st 24 hrs. Both plates oil quenched from carburizing cycle.
2nd .010" - .7990	10th .010" - .5320	
3rd .010" - .7780	11th .010" - .5120	
4th .010" - .7540	12th .010" - .4960	
5th .010" - .6620	13th .010" - .3870	
6th .010" - .6240	14th .010" - .3320	
7th .010" - .5740	15th .010" - .2680	
8th .010" - .5760		

CONFIDENTIAL
SECURITY INFORMATION

SIGNED Robert E. Wingo

APPENDIX A

MAY [illegible] ARMOR PLATE CARBURIZING [illegible] GRAM

DATE July 17, 1950

HEAT NO. 66

PLATE NO. P4A & P4B - P5A & P5B

START 11:30AM 7/8/50

FINISH 6:30PM 7/10/50

TIME AT 1ST SETTING 24 hrs.

TIME AT 2ND SETTING 30 hrs.

TOTAL TIME 54 hrs.

FURNACE TEMP.	1750°F.
CRACKER TEMP.	1640°F
LITHIUM VAPORIZER.	
CRACKER TUBE NO.	1
ROTAMETER) AIR.	100 cfh
READING) GAS	13 cfh
RATIO.	7.7:1
ADDITION.	3 cfh
GAS PRESSURE.	
TEMPERING TEMP.	650°F.
TEMPERING TIME.	2 hrs.
DEW POINT.	
CARBON ANALYSIS	
1ST ANALYSIS TIME	
FINAL ANALYSIS	

GAS ANALYSIS (FROM CRACKER)

	TIME 12:00 N.	TIME 9:30AM	TIME 11:05AM	TIME	TIME	TIME
	7/8/50	7/9/50	7/10/50			
CO2	.2	.2	.2			
CO	23.0	22.9	23.4			
HH						
CH4						
H2						

GAS ANALYSIS (FROM FURNACE)

	TIME	TIME	TIME	TIME	TIME	TIME
CO2						
CO						
HH						
CH4						
H2						

GENERAL NOTES:

1st .010" - .8580	7th .010" - .6440	Test Plate found on bottom of furnace because of broken weld.
2nd .010" - .7880	8th .010" - .4400	
3rd .010" - .7600	9th .010" - .372	
4th .010" - .7160	10th .010" - .3634	
5th .010" - .6900	11th .010" - .3500	
6th .010" - .7120	12th .010" - .3280	

SIGNED [signature]

NAVAL ARMOR PLATE CARBURIZING PROGRAM

DATE Nov. 14, 1950

HEAT NO. 66 Retreatment

PLATE NO. P-4-A & P-4-B

START 3:30 PM 11-14-50

FINISH 4:00 PM 11-16-50

TIME AT 1ST SETTING 24 hrs. (7.7-1)

TIME AT 2ND SETTING 24½ hrs. (8.0-1)

TOTAL TIME 48½ hrs.

FURNACE TEMP. 1700°F
CRACKER TEMP. 1840°F
LITHIUM VAPORIZER.
CRACKER TUBE NO. 1
ROTAMETER READINGS) AIR. 100 CFH 100 CFH
ROTAMETER READINGS) GAS. 13 CFH 12.5 CFH
RATIO. 7.7-1 8.0-1
ADDITION. 3 CFH
GAS PRESSURE.
TEMPERING TEMP.
TEMPERING TIME.
DEW POINT.
CARBON ANALYSIS
1ST ANALYSIS TIME
FINAL ANALYSIS

GAS ANALYSIS (FROM CRACKER)

	TIME 4:35 PM 11-14-50	TIME 8:40 AM 11-15-50	TIME 11:35 AM 11-15-50	TIME 4:15 PM 11-15-50	TIME 5:00 PM 11-15-50	TIME 9:25 AM 11-16-50
CO2	.1	.1	.1	.3	.3	.3
CO						
ILL						
CH4						
H2						

GAS ANALYSIS (FROM FURNACE)

	TIME	TIME	TIME	TIME	TIME	TIME
CO2						
CO						
ILL						
CH4						
H2						

GENERAL NOTES:

1st	.010"	-	.8240
2nd	"	-	.8300
3rd	"	-	.8240
4th	"	-	.7480
5th	"	-	.6970
6th	"	-	.6640
7th	"	-	.5760
8th	"	-	.5360
9th	"	-	.4220
10th	"	-	.3740
11th	"	-	.3520
12th	"	-	.3190

Burnt out for 1½ hrs. after 1st 24 hours

SIGNED R. L. Henry

HAT [redacted] PLATE CARBURIZING [redacted]RAM

DATE July 17, 1950

HEAT NO.	67 (3 plates)
PLATE NO.	P8A & P8B - P9A & P9B
START	7:00 PM 7/10/50
FINISH	8:30 PM 7/17/50
TIME AT 1ST SETTING	24 hrs (7.7-1)
TIME AT 2ND SETTING	37½ hrs (8.0-1)
TOTAL TIME	61½ hrs.

FURNACE TEMP.	1700°F.
CRACKER TEMP.	1830°F.
LITHIUM VAPORIZER.	
CRACKER TUBE NO.	2
ROTAMETER) AIR.	100 cfh 100 cfh
READING) GAS:	15 cfh 12.5 cfh
RATIO.	7.7-1 8.0-1
ADDITION.	3 cfh
GAS PRESSURE.	
TEMPERING TEMP.	650°F.
TEMPERING TIME.	2 hrs.
DEW POINT.	
CARBON ANALYSIS	
1ST ANALYSIS FOR	
FINAL ANALYSIS	

GAS ANALYSIS (FROM CRACKER)

	TIME 8:45AM 7/11/50	TIME 9:00 AM 7/12/50	TIME 5:00 7/12/50	TIME	TIME	TIME
CO2	.2	3	3			
CO	22.9	22.7	22.9			
XLL.						
CH4						
H2						

GAS ANALYSIS (FROM FURNACE)

	TIME	TIME	TIME 5:10PM 7/12/50	TIME	TIME	TIME
CO2			0			
CO			23.8			
XLL.						
CH4						
H2						

GENERAL NOTES:

CARBON ANALYSIS:

1st .010" - .7900	5th .010" - .6620	9th .010" - .4800
2nd .010" - .7600	6th .010" - .6360	10th .010" - .4360
3rd .010" - .7220	7th .010" - .5600	11th .010" - .4060
4th .010" - .6700	8th .010" - .5220	12th .010" - .3380
		13th .010" - .3000

CONFIDENTIAL
SECURITY INFORMATION

SIGNED [signature]

NAVAL ARMOR PLATE CARBURIZING PROGRAM

DATE Jan. 15, 1951

HEAT NO. 67 Retreatment

PLATE NO. P-7-A & P-7-B

START 9:00 AM 1-15-51

FINISH 3:00 PM 1-17-51

TIME AT 1ST SETTING 30 hrs. (7.7-1)

TIME AT 2ND SETTING 24 hrs. (8.0-1)

TOTAL TIME 54 hrs.

FURNACE TEMP. 1700°F
CRACKER TEMP. 1840°F
LITHIUM VAPORIZER.
CRACKER TUBE NO. 1
ROTAMETER) AIR. 100 CFH 100 CFH
READINGS) GAS. 13 CFH 12.5 CFH
RATIO. 7.7-1 8.0-1
ADDITION. 3 CFH
GAS PRESSURE.
TEMPERING TEMP.
TEMPERING TIME.
DEW POINT.
CARBON ANALYSIS
1ST ANALYSIS TIME
FINAL ANALYSIS

GAS ANALYSIS (FROM CRACKER)

	TIME AM 1-15-51	TIME PM 1-15-51 (10:15)	TIME AM 1-16-51 (3:30)	TIME AM 1-17-51 (8:35)	TIME AM 1-17-51 (9:30)	TIME (11:15)
CO2	.1	.1	.1	.3	.3	
CO						
ILL						
CH4						
H2						

GAS ANALYSIS (FROM FURNACE)

	TIME AM 1-15-51 (11:45)	TIME PM 1-15-51 (4:25)	TIME AM 1-16-51 (9:45)	TIME	TIME	TIME
CO2	.1	.1	.1			
CO						
ILL						
CH4						
H2						

GENERAL NOTES:

1st	.010"	- .8380	8th	.010"	- .5260	BURNT OUT FOR 1½hrs.
2nd	"	- .8320	9th	"	- .4640	3:00 PM - 4:30 PM
3rd	"	- .8320	10th	"	- .4080	
4rd	"	- .7680	11th	"	- .3860	
5th	"	- .7220	12th	"	- .3440	
6th	"	- .6540	13th	"	- .3120	
7th	"	- .5840				

CONFIDENTIAL
SECURITY INFORMATION

SIGNED R. L. Henry

APPENDIX A

NAVAL ARMOR PLATE CARBURIZING PROGRAM

DATE Feb. 5, 1951

HEAT NO. 67 (Retreatment)

PLATE NO. P-9-A & P-9-B

START 12:30 P.M. 2-5-51

FINISH 2:30 P.M. 2-7-51

TIME AT 1ST SETTING 24 hrs. (7.7-1)

TIME AT 2ND SETTING 26 hrs. (8.0-1)

TOTAL TIME 50 hrs.

FURNACE TEMP. 1700°F

CRACKER TEMP. 1840°F

LITHIUM VAPORIZER.

CRACKER TUBE NO. 2

ROTAMETER READINGS) AIR. 100 CFH 100 CFH

) GAS. 13 CFH 12.5 CFH

RATIO. 7.7-1 8.0-1

ADDITION. 3 CFH

GAS PRESSURE.

TEMPERING TEMP.

TEMPERING TIME.

DEW POINT.

CARBON ANALYSIS

1ST ANALYSIS TIME

FINAL ANALYSIS

GAS ANALYSIS (FROM CRACKER)

	TIME 1:40PM	TIME 8:55 AM	TIME 2:15 PM	TIME 4:10 PM	TIME 8:45AM	TIME
CO2	2-5-51 .1	2-6-51 .1	2-6-51 .3	2-6-51 .3	2-7-51 .3	
CO						
ILL						
CH4						
H2						

GAS ANALYSIS (FROM FURNACE)

	TIME 2:00PM	TIME 9:15 AM	TIME 4:25 PM	TIME 8:55 AM	TIME	TIME
CO2	2-5-51 .1	2-6-51 .1	2-6-51 .2	2-7-51 .3		
CO						
ILL						
CH4						
H2						

GENERAL NOTES:

Carbon Analysis

1st	.010"	- .8160
2nd	"	- .8040
3rd	"	- .7780
4th	"	- .6860
5th	"	- .6260
6th	"	- .5520
7th	"	- .5140
8th	"	- .4580
9th	"	- .4260
10th	"	- .3760
11th	.010"	- .3580
12th	"	- .3240

Burnt out for 1½ hrs. after 1st 24 hrs. 12:30 PM 2-6-51 2:00 PM

SIGNED R. L. Henry

NAVAL ARMOR PLATE CARBURIZING PROGRAM

DATE August 28, 1950

HEAT NO. 60
P10A & P10B

PLATE NO. P11A & P11B P12A & P12B

START 11:00 AM 7/13/50

FINISH 11:30 AM 7/15/50

TIME AT 1ST SETTING 24 hrs. (7.7-1)

TIME AT 2ND SETTING 24½ hrs. (8.33-1)

TOTAL TIME 48½ hours

FURNACE TEMP. 1700°F

CRACKER TEMP. 1840°F

LITHIUM VAPORIZER. -

CRACKER TUBE NO. 2

ROTAMETER) AIR. 100 cfh 100 cfh

READINGS) GAS. 13 cfh 12 cfh

RATIO. 7.7-1 8.33-1

ADDITION. 3 cfh

GAS PRESSURE. 22"

TEMPERING TEMP. 650°F

TEMPERING TIME. 2 hrs.

DEW POINT.

CARBON ANALYSIS

1ST ANALYSIS TIME

FINAL ANALYSIS

GAS ANALYSIS (FROM CRACKER)

	TIME 4:35P	TIME 8:45AM	TIME 11:15 A	TIME 3:46PM	TIME 11:05AM	TIME
CO_2	7/14 .2	7/14 .2	7/14 .4	7/14 .3	7/15 .3	
CO	23.2	23.0		22.8	22.9	
ILL						
CH_4						
H_2						

GAS ANALYSIS (FROM FURNACE) Pit

	TIME	TIME	TIME	TIME 3:55 PM	TIME	TIME
CO_2				7/15 0		
CO				23.6		
ILL						
CH_4						
H_2						

GENERAL NOTES: CARBON ANAYLSIS

1st .010"	- .8600	7th .010"	- .5360
2nd .010"	- .7820	8th .010"	- .4920
3rd .010"	- .7940	9th .010"	- .4120
4th .010"	- .7120	10th .010"	- .3960
5th .010"	- .6780	11th .010"	- .3720
6th .010"	- .6040	12th .010"	- .3280

CONFIDENTIAL
SECURITY INFORMATION

SIGNED Robert Hussey

APPENDIX A

NAVAL ARMOR PLATE CARBURIZING PROGRAM

DATE Jan. 30, 1951

HEAT NO. 68 Retreatment

PLATE NO. P-10-A & P-10-B

START 8:30 AM 1-30-51

FINISH 9:30 AM 2-2-51

TIME AT 1ST SETTING 30 hrs. (7.7-1)

TIME AT 2ND SETTING 42 hrs.

TOTAL TIME 72 hrs.

FURNACE TEMP. 1700°F
CRACKER TEMP. 1840°F
LITHIUM VAPORIZER.
CRACKER TUBE NO. 2
ROTAMETER READINGS: AIR 100 CFH 100 CFH; GAS 13 CFH 12.0 CFH
RATIO 7.7-1 8.34-1
ADDITION 3 CFH
GAS PRESSURE.
TEMPERING TEMP.
TEMPERING TIME.
DEW POINT.
CARBON ANALYSIS
1ST ANALYSIS TIME
FINAL ANALYSIS

GAS ANALYSIS (FROM CRACKER)

	TIME 10:30 AM 1-30-51	TIME 2:15 PM 1-30-51	TIME 4:35 PM 1-31-51	TIME 10:30 AM 2-1-51	TIME 8:35 AM 2-2-51	TIME
CO_2	.1	.2	.3	.3	.3	
CO						
ILL						
CH_4						
H_2						

GAS ANALYSIS (FROM FURNACE)

	TIME 11:30 AM 1-30-51	TIME 3:00 PM 1-30-51	TIME	TIME	TIME	TIME
CO_2	.1	.1				
CO						
ILL						
CH_4						
H_2						

GENERAL NOTES:

1st	.010"	- .7360	10th	.010"	- .4900	Burnt out for 1½ hrs. after 1st 30 hrs.
2nd	"	- .7600	11th	"	- .4460	
3rd	"	- .7200	12th	"	- .4020	
4th	"	- .6860	13th	"	- .3720	
5th	"	- .6620	14th	"	- .3600	
6th	"	- .6260	15th	"	- .3320	
7th	"	- .5760				
8th	"	- .5520				
9th	"	- .5160				

CONFIDENTIAL
SECURITY INFORMATION

SIGNED R. F. Hengst

APPENDIX A

NAVAL ARMOR PLATE CARBURIZING PROGRAM

DATE August 22, 1950

HEAT NO. 69 3 plates

PLATE NO. P13A & P13B P14A & P14B P15A & P15B

START 12:45 PM 7/15/50

FINISH 11:30 7/17/50

TIME AT 1ST SETTING 24 hrs. (7.7-1)

TIME AT 2ND SETTING 22½ hrs. (8.48-1)

TOTAL TIME 46 ½ hrs.

FURNACE TEMP.	1700°F.	
CRACKER TEMP.	1840°F.	
LITHIUM VAPORIZER.	--	
CRACKER TUBE NO.	2	
ROTAMETER READINGS AIR.	100 cfh	100 cfh
ROTAMETER READINGS GAS.	13 cfh	11.8 cf
RATIO.	7.7-1	8.48-1
ADDITION.	3 cfh	
GAS PRESSURE.	2.2"	
TEMPERING TEMP.	650°F.	
TEMPERING TIME.	2 hrs.	
DEW POINT.		

CARBON ANALYSIS

1ST ANALYSIS TIME

FINAL ANALYSIS

GAS ANALYSIS (FROM CRACKER)

	TIME 1:30PM 7/15	TIME 4:30PM 7/15	TIME 8:45AM 7/17	TIME	TIME	TIME
CO2	.2	.2	.4			
CO	23.1	23.0				
ILL						
CH4						
H2						

GAS ANALYSIS (FROM FURNACE)

	TIME	TIME	TIME	TIME	TIME	TIME
CO2						
CO						
ILL						
CH4						
H2						

GENERAL NOTES:

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SECURITY INFORMATION

SIGNED Robert Henry

APPENDIX A

NAVAL ARMOR PLATE CARBURIZING PROGRAM

(Supplement)

DATE August 28, 1950

HEAT NO. 69 3 full plates P13A & P13B

PLATE NO. P14A & P14B P15A & P15B

START 7:00 PM 8/13/50

FINISH 8:30 AM 8/14/50

TIME AT 1ST SETTING --

TIME AT 2ND SETTING --

TOTAL TIME 13 ½ hours

FURNACE TEMP. 1700°F.
CRACKER TEMP. 1940°F.
LITHIUM VAPORIZER. ---
CRACKER TUBE NO. 2
ROTAMETER) AIR. 100 c/h
READINGS) GAS. 11.5 c/h
RATIO. 8.7-1
ADDITION. None
GAS PRESSURE. 2.2
TEMPERING TEMP.
TEMPERING TIME.
DEW POINT.
CARBON ANALYSIS
1ST ANALYSIS TIME
FINAL ANALYSIS

GAS ANALYSIS (FROM CRACKER)

	TIME 7:05 PM 8/13	TIME	TIME	TIME	TIME	TIME
CO2	.6					
CO						
ILL						
CH4						
H2						

GAS ANALYSIS (FROM FURNACE)

	TIME	TIME	TIME	TIME	TIME	TIME
CO2						
CO						
ILL						
CH4						
H2						

GENERAL NOTES:

1st	.010" - .4900	6th	.010" - .5460
2nd	.010" - .4920	7th	.010" - .5420
3rd	.010" - .5000	8th	.010" - .5340
4th	.010" - .5380	9th	.010" - .5220
5th	.010" - .5600	10th	.010" - .5120
		11th	.010" - .4020
		12th	.010" - .3920
		13th	.010" - .3600
		14th	.010" - .3160

CONFIDENTIAL
SECURITY INFORMATION

SIGNED Robert Berry

APPENDIX A

NAVAL ARMOR PLATE CARBURIZING PROGRAM

DATE August 10, 1950

HEAT NO. 70 (3 plates)
P16A & P16B
PLATE NO. P17A & P17B P18A & P18B

START 3:15 PM 7/12/50

FINISH 3:15 PM 7/19/50

TIME AT 1ST SETTING 24 hrs (7.7-1)

TIME AT 2ND SETTING 24 hrs (8.62-1)

TOTAL TIME 48 hrs.

FURNACE TEMP. 1700°F
CRACKER TEMP. 1840°F
LITHIUM VAPORIZER.
CRACKER TUBE NO. 1
ROTAMETER) AIR. 100 cfh 100 cfh
READINGS) GAS. 13 cfh 11.6 cf
RATIO. 7.7-1 8.62-1
ADDITION. 3 cfh
GAS PRESSURE. 2.2#
TEMPERING TEMP. 650°F 212°F
TEMPERING TIME. 2 hrs. 2 hrs.
DEW POINT.
CARBON ANALYSIS
1ST ANALYSIS TIME
FINAL ANALYSIS

Hardened @ 1550°F for 1 hr oil quenched

GAS ANALYSIS (FROM CRACKER)

	TIME 8:45AM	TIME 3:25 PM	TIME 4:00PM	TIME	TIME	TIME
CO2	7/18 12	7/18 .5	7/18 .5			
CO	23.3	22.6	22.4			
ILL						
CH4						
H2						

GAS ANALYSIS (FROM FURNACE)

	TIME	TIME	TIME	TIME	TIME	TIME
CO2						
CO						
ILL						
CH4						
H2						

GENERAL NOTES:

1st .010" - .7720
2nd .010" - .7600
3rd .010" - .6000
4th .010" - .6400
5th .010" - .5640
6th .010" - .5140
7th .010" - .4400
8th .010" - .3800
9th .010" - .3540
10th .010" - .3200

SIGNED

NAVAL ARMOR PLATE CARBURIZING PROGRAM

DATE August 10, 1950

HEAT NO. 71 (3 plates)

PLATE NO. P 19 A P 20 A P 21 A
P 19 B P 20 B P 21 B

START 3:30 PM 7/19/50

FINISH 9:30 AM 7/22/50

TIME AT 1ST SETTING 24 hrs. (7.7-1)

TIME AT 2ND SETTING 42 hrs. (8.63-1)

TOTAL TIME 66 hrs.

FURNACE TEMP. 1700°F.
CRACKER TEMP. 1840°F.
LITHIUM VAPORIZER.
CRACKER TUBE NO. 2
ROTAMETER READINGS) AIR. 100 cfh 100 cfh
GAS. 13 cfh 11.6 cfh
RATIO. 7.7-1 8.63-1
ADDITION. 3 cfh
GAS PRESSURE. 2.2#
TEMPERING TEMP. 650°F 212°F
TEMPERING TIME. 2 hrs. 2 hrs.
DEW POINT.
CARBON ANALYSIS
1ST ANALYSIS TIME
FINAL ANALYSIS

Hardened @ 1550°F.
Oil quenched.

GAS ANALYSIS (FROM CRACKER)

	TIME 8:45 7/20 AM	TIME 2:55PM 7/20	TIME 5:05PM 7/20	TIME 8:45AM 7/21	TIME	TIME
CO2	.2	.15	.3	.45		
CO	23.1	23.4				
ILL						
CH4						
H2						

GAS ANALYSIS (FROM FURNACE) Pit

	TIME	TIME 3:05PM 7/20	TIME 5:15PM 7/20	TIME 9:00AM 7/21	TIME	TIME
CO2		0	.3	.2		
CO						
ILL						
CH4						
H2						

GENERAL NOTES:

1st .010" - .7000	10th .010" - .3800
2nd .010" - .7180	11th .010" - .3400
3rd .010" - .6660	12th .010" - .3080
4th .010" - .6360	
5th .010" - .6320	
6th .010" - .5560	
7th .010" - .5120	
8th .010" - .4980	
9th .010" - .4600	

At completion of 1st phase 24 hrs the gas was turned off for one hr and air (100 cfh) was passed into furnace for a burnt out.

SIGNED [signature]

NAVAL ARMOR PLATE CARBURIZING PROGRAM

DATE August 28, 1950

HEAT NO. 72 (3 plates)
P22A & P22B
PLATE NO. P23A & P23B P24A & P24B

START 11:30 AM 7/22/50

FINISH 4:30 PM 7/24/50

TIME AT 1ST SETTING 24 hrs. (7.7-1)

TIME AT 2ND SETTING 29 hrs. (8.48-1)

TOTAL TIME 53 hrs.

FURNACE TEMP. 1700°F.
CRACKER TEMP. 1840°F.
LITHIUM VAPORIZER. -
CRACKER TUBE NO. 1
ROTAMETER) AIR. 100 cfh 100 cfh
READINGS) GAS. 13 cfh 11.8 cfh
RATIO. 7.7-1 8.48-1
ADDITION. 3 cfh
GAS PRESSURE. 2.25
TEMPERING TEMP.
TEMPERING TIME.
DEW POINT.
CARBON ANALYSIS
1ST ANALYSIS TIME
FINAL ANALYSIS

GAS ANALYSIS (FROM CRACKER)

	TIME 1:15 PM 7/22	TIME 2:25PM 7/22	TIME 8:35 AM 7/24	TIME 10:30AM 7/24	TIME 4:00PM 7/24	TIME
CO_2	.1	.2	.4	.4	.4	
CO	27.4	23.2	28.8			
ILL						
CH_4						
H_2						

GAS ANALYSIS (FROM FURNACE) PIT

	TIME	TIME	TIME	TIME 10:45PM 7/24	TIME 4:15 PM 7/24	TIME
CO_2				.3	.3	
CO						
ILL						
CH_4						
H_2						

GENERAL NOTES:

1st .010" - .7100	6th .010" - .6160	11th .010" - .4130
2nd .010" - .7110	7th .010" - .5540	12th .010" - .3780
3rd .010" - .7020	8th .010" - .4980	13th .010" - .3180
4th .010" - .6740	9th .010" - .4960	
5th .010" - .6740	10th .010" - .4680	

At completion of 1st phase (25 hrs. the addition and gas to cracker were turned off and 100 cfh of air was allowed to furnace for one hr. burn out.

SIGNED Robert Henry

NAVAL ARMOR PLATE CARBURIZING PROGRAM

DATE August 10, 1950

HEAT NO. 73 (3 full plates)
P25 A & B
PLATE NO. P26 A & B P27A & B

START 5:30 PM 7/24/50

FINISH 5:00 PM 7/27/50

TIME AT 1ST SETTING 24 hrs (7.7-1)

TIME AT 2ND SETTING 47½ hrs.

TOTAL TIME 71 ½ hrs.

FURNACE TEMP. 1700°F
CRACKER TEMP. 1040°F
LITHIUM VAPORIZER.
CRACKER TUBE NO.
ROTAMETER READINGS } AIR. 100 cfh 100 cfh
GAS. 13 cfh 11.6 cfh
RATIO. 7.7-1 8.63-1
ADDITION. 3 cfh
GAS PRESSURE. 2.2#
TEMPERING TEMP. 212°F
TEMPERING TIME. 2 hrs.
DEW POINT.
CARBON ANALYSIS
1ST ANALYSIS TIME
FINAL ANALYSIS

GAS ANALYSIS (FROM CRACKER)

Hardened @ 1550°F for 1 hr oil quenched

	TIME 8:45AM	TIME 9:00AM	TIME 4:15PM	TIME 8:50AM	TIME 3:15PM	TIME
CO2	7/25 .2	7/26 .5	7/26 .5	7/27 .6	7/27 .5	
CO						
ILL						
CH4						
H2						

GAS ANALYSIS (FROM FURNACE)

	TIME	TIME	TIME 4:25PM	TIME	TIME	TIME
CO2			7/26 .4			
CO						
ILL						
CH4						
H2						

GENERAL NOTES:

1st .010" - .6400	.6210	10th .010" - .4740	
2nd .010" - .6020		11th .010" - .4140	
3rd .010" - .5980		12th .010" - .3400	
4th .010" - .5900		13th .010" - .3320	
5th .010" - .5980		14th .010" - .2960	
6th .010" - .5780			
7th .010" - .5400			
8th .010" - .5160			
9th .010" - .4920			

At the completion of the 1st phase of the cycle (24 hrs.) the addition gas and cracker gas was shut off and 100 cfh air allowed to burn out furnace for 1 hrs.

SIGNED [signature]

NAVAL ARMOR PLATE CARBURIZING PROGRAM

DATE August 23, 1950

HEAT NO. 74 (2 full plates)
PLATE NO. P28A & P28B
P29A & P29B

START 5:15 PM 7/27/50

FINISH 7:00 PM 7/30/50

TIME AT 1ST SETTING 24 hrs. (7.7-1)

TIME AT 2ND SETTING 50 hrs. (8.61-1)

TOTAL TIME 74 hrs.

FURNACE TEMP. 1700°F.
CRACKER TEMP. 1840°F.
LITHIUM VAPORIZER. =
CRACKER TUBE NO.
ROTAMETER READINGS) AIR. 100 cfh 100 cfh
) GAS. 13 cfh 11.6 cfh
RATIO. 7.7-1
ADDITION. 3 cfh
GAS PRESSURE. 272"
TEMPERING TEMP.
TEMPERING TIME.
DEW POINT.
CARBON ANALYSIS
1ST ANALYSIS TIME
FINAL ANALYSIS

GAS ANALYSIS (FROM CRACKER)

	TIME 7:40A 7/28	TIME 5:15PM 7/28	TIME 8:35AM 7/29	TIME 10:15AM 7/29	TIME	TIME
CO2	2	2	.5	.5		
CO						
ILL						
CH4						
H2						

GAS ANALYSIS (FROM FURNACE) Pit

	TIME	TIME	TIME	TIME	TIME	TIME
CO2						
CO						
ILL						
CH4						
H2						

GENERAL NOTES:

1st .010" - .7860	6th .010" - .5640	11th .010" - .4000
2nd .010" - .6860	7th .010" - .5200	12th .010" - .3820
3rd .010" - .6460	8th .010" - .5180	13th .010" - .3180
4th .010" - .6420	9th .010" - .4680	
5th .010" - .6180	10th .010" - . 4340	

Burnt out 1½ hrs. (100 cfh) after 1st 24 hrs.
Burnt out 1 hr (100 cfh) 1:00 PM 7/29/50
&
2:00 PM 7/29/50

SIGNED Robert Henry

NAVAL ARMOR PLATE CARBURIZING PROGRAM

DATE August 22, 1950

HEAT NO. 75 (2 plates)
P50A & P50B

PLATE NO. P51A & P51B

START 8:30 AM 7/31/50

FINISH 8:30 AM 8/3/50

TIME AT 1ST SETTING 24 hrs. (7.7-1)

TIME AT 2ND SETTING 48 hrs. (8.63-1)

TOTAL TIME 72 hrs.

FURNACE TEMP. 1700°F.
CRACKER TEMP. 1840°F.
LITHIUM VAPORIZER.
CRACKER TUBE NO. 2
ROTAMETER READINGS) AIR. 100 cfh 100 cfh
) GAS. 13 cfh 11.6 cfh
RATIO. 7.7-1 8.63-1
ADDITION. 3 cfh
GAS PRESSURE. 2.2#
TEMPERING TEMP.
TEMPERING TIME.
DEW POINT.
CARBON ANALYSIS
1ST ANALYSIS TIME
FINAL ANALYSIS

GAS ANALYSIS (FROM CRACKER)

	TIME 9:30 AM	TIME 4:25 PM	TIME 11:30 AM	TIME 9:45 AM	TIME 5:05 PM	TIME 8:30 AM
CO_2	7/31 .2	7/31 .2	8/1 .1	8/2 .5	8/2 .5	8/3 .5
CO						
ILL						
CH_4						
H_2						

GAS ANALYSIS (FROM FURNACE)

	TIME	TIME	TIME	TIME 10:00 AM	TIME	TIME
CO_2				8/2 .4		
CO						
ILL						
CH_4						
H_2						

GENERAL NOTES:

1st .010" - .6740	6th .010" - .5620	11th .010" - .4000
2nd .010" - .6700	7th .010" - .5580	12th .010" - .4000
3rd..010" - .6480	8th .010" - .5180	13th .010" - .3600
4th .010" - .6440	9th .010" - .4780	14th .010" - .3400
5th .010" - .6000	10th .010" - .4440	15th .010" - .3200

Burnt out 2 hrs. after 1st 24 hrs.
Burnt out 1½ hrs. at 12:00 Noon 8/2/50
1:30 PM 8/2/50

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SECURITY INFORMATION

SIGNED Robert Perry

APPENDIX A

NAVAL ARMOR PLATE CARBURIZING PROGRAM

DATE August 28, 1950

HEAT NO. 76 2 full plates P32A & P32B

PLATE NO. P33A & P33B

START 2:00 PM 8/12/50

FINISH 1:30 PM 8/15/50

TIME AT 1ST SETTING 24 hrs (7.7-1)

TIME AT 2ND SETTING 47.5 (8.7-1)

TOTAL TIME 71½ hrs.

FURNACE TEMP. 1750°F.

CRACKER TEMP. 1940°F.

LITHIUM VAPORIZER. —

CRACKER TUBE NO. 1

ROTAMETER READINGS) AIR. 100 cfh 100 cfh

) GAS. 13 cfh 11.5 cfh

RATIO. 7.7-1 8.7-1

ADDITION. 3 cfh

GAS PRESSURE. 2.2

TEMPERING TEMP.

TEMPERING TIME.

DEW POINT.

CARBON ANALYSIS

1ST ANALYSIS TIME

FINAL ANALYSIS

GAS ANALYSIS (FROM CRACKER)

	TIME 1:30 AM	TIME 8:35 AM	TIME 9:30 AM	TIME 8:45 AM	TIME 1:30 PM	TIME
	8/12	8/13	8/14	8/15	8/15	
CO_2	.2	.5	.6	.5	.5	
CO						
ILL						
CH_4						
H_2						

GAS ANALYSIS (FROM FURNACE)

	TIME	TIME	TIME	TIME	TIME	TIME
CO_2						
CO						
ILL						
CH_4						
H_2						

GENERAL NOTES:

1st .010" - .6540	6th .010" - .5120	11th .010" - .3840
2nd .010" - .6200	7th .010" - .4820	12th .010" - .3200
3rd .010" - .6000	8th .010" - .4400	
4th .010" - .5820	9th .010" - .4040	
5th .010" - .5420	10th .010" - .3980	

Burnt out 2 hrs. after 1st 24 hrs. with add.
Burnt out 1½ hrs. 2:30 PM - 4:00 PM 8/14/50.

NAVAL ARMOR PLATE CARBURIZING PROGRAM

DATE August 22, 1950

HEAT NO. 77 2 full plates
P34A & P34 B
PLATE NO. P36 A & P35B

START 2:00 PM 8/15/50

FINISH 2:00 PM 8/18/50

TIME AT 1ST SETTING 24 hrs. (7.7-1)

TIME AT 2ND SETTING 48 hrs. (8.7-1)

TOTAL TIME 72 hrs.

FURNACE TEMP. 1700°F
CRACKER TEMP. 1840°F.
LITHIUM VAPORIZER. -
CRACKER TUBE NO.
ROTAMETER READINGS } AIR. 100 cfh 100 cfh
GAS. 13 cfh 11.5 cfh
RATIO. 7.7-1 8.7-1
ADDITION.
GAS PRESSURE. 2.2"
TEMPERING TEMP.
TEMPERING TIME.
DEW POINT.
CARBON ANALYSIS
1ST ANALYSIS TIME
FINAL ANALYSIS

GAS ANALYSIS (FROM CRACKER)

	TIME 4:30 PM	TIME 9:00 AM	TIME 4:15PM	TIME 10:15AM	TIME 9:30 AM	TIME 1:15 PM
CO2	8/16 .2	8/16 .2	8/16 .6	8/17 .6	8/17 .5	8/18 .6
CO						
ILL						
CH4						
H2						

GAS ANALYSIS (FROM FURNACE)

	TIME	TIME	TIME	TIME	TIME	TIME
CO2						
CO						
ILL						
CH4						
H2						

GENERAL NOTES:

1st .010" - .5020	6th .010" - .3980
2nd .010" - .5000	7th .010" - .3800
3rd .010" - .4820	8th .010" - .3780
4th .010" - .4320	9th .010" - .3580
5th .010" - .4060	10th .010" - .3480
	11th .010" - .3180

CONFIDENTIAL
SECURITY INFORMATION

SIGNED Robert Henry

APPENDIX A

NAVAL ARMOR PLATE CARBURIZING PROGRAM

DATE September 6, 1950

HEAT NO. 78 2 full plates P36A & P36B

PLATE NO. P37A & P37B

START 9:00AM 8/21/50

FINISH 9:00AM 8/24/50

TIME AT 1ST SETTING 24 hrs. (7.7-1)

TIME AT 2ND SETTING 48 hrs. (8.7-1)

TOTAL TIME 72 hours

Plates carbonitrided

FURNACE TEMP. 1700°F.

CRACKER TEMP. 1840°F.

LITHIUM VAPORIZER. -

CRACKER TUBE NO. 1

ROTAMETER READINGS) AIR. 100 cfh 100 cfh

ROTAMETER READINGS) GAS. 13 cfh 11.5 cfh

RATIO. 7.7-1 8.7-1

ADDITION. 5 cfh

GAS PRESSURE. 2.2"

TEMPERING TEMP.

TEMPERING TIME.

DEW POINT.

CARBON ANALYSIS

1ST ANALYSIS TIME

FINAL ANALYSIS

Hardened @ 1550°F. - 1 hr. Oil quenched.

GAS ANALYSIS (FROM CRACKER)

	AM TIME 10:00	TIME 4:30PM	TIME 11 AM	TIME 5:05PM	TIME 11:16AM	TIME 8:35AM
CO_2	8/21 .2	8/21 .2	8/22 .6	8/22 .6	8/23 .6	8/24 .6
CO						
ILL						
CH_4						
H_2						

GAS ANALYSIS (FROM FURNACE)

	TIME	TIME	TIME	TIME	TIME	TIME
CO_2						
CO						
ILL						
CH_4						
H_2						

GENERAL NOTES:

1st .010" - .6000
2nd .010" - .5580
3rd .010" - .4920
4th .010" - .4960
5th .010" - .4640
6th .010" - .4920
7th .010" - .4600
8th .010" - .4400
9th .010" - .4210
10th .010" - .4000
11th .010" - .3400
12th .010" - .3100

Burnt out 2 hrs. after 1st 24 hrs. with C_3H_8 addition. Started adding NH_3 at this point 8%.
Burnt out 1½ hrs. 8/23/50 9:00 AM-10:30 AM.

Toughness when machining noted .040" deep.

CONFIDENTIAL SECURITY INFORMATION

SIGNED Robert Henry

APPENDIX A

Armor Galvanized by the Lithium Catalyst Process

Table 3

SAMPLES
CARBON CONTENTS OF FACE AT DEPTHS INDICATED

Heat and Plate Nos.	3 C-1-B	9 S-2-B	10 S-3-B	1 S-4-B	7 S-5-B	16 S-6-B	24 S-7-B	42 S-8-B	18 S-9-B	28 S-10-B
Depth of C. Sample										
.01"	.90	.54	.48	.73	1.04	.92	.84	.66	.53	.50
.02"	.90	.58	.48	.59	1.35	.89	.84	.68	.52	.52
.03"	.46	.58	.47	.59	.96	.81	.80	.72	.55	.53
.04"	.38	.55	.46	.57	.96	.88	.83	.68	.53	.57
.05"	.42	.57	.45	.57	.56	.73	.77	.65	.52	.57
.06"	.40	.54	.48	.49	.53	.69	.77	.64	.50	.59
.07"	.43	.57	.50	.30	.53	.64	.72	.62	.50	.57
.08"	.41	.55	.50	.39	.54	.60	.72	.61	.52	.55
.09"	.37	.54	.49	.36	.54	.63	.62	.59	.52	.56
.10"	.40	.53	.46	.30	.55	.55	.57	.60	.50	.53
.11"	.40	.50	.43	.28	.54	.50	.52	.59	.50	.50
.12"	.35	.49	.43	.24	.53	.50	.48	.59	.48	.48
.13"	.35	.46	.39		.52	.42	.43	.54	.45	.43
.14"	.40	.45	.40		.54	.40	.40	.52	.40	.41
.15"	.36	.45	.36		.50	.39	.39	.51	.37	.39
.16"	.35	.40	.35		.51	.39	.37	.49	.36	
.17"	.30	.39	.34		.48	.36	.35	.40	.31	
.18"	.35	.35	.32		.47	.34	.32	.39		
.19"	.32	.33	.33		.42	.29		.37		
.20"	.30	.34	.28		.42			.37		
.21"		.33	.27		.41			.32		
.22"					.41					
.23"					.41					
.24"					.36					
.25"					.36					
.26"					.37					
Max. C.	.90	.58	.50	.73	1.35	.92	.84	.72	.55	.59
Ave. .05"	.43	.56	.47	.60	.74	.73	.75	.65	.52	.55
Ave. .10"	.41	.56	.48	.50	.74	.73	.75	.65	.52	.55
Ave. Face	.43	.48	.43	.50	.56	.59	.60	.55	.46	<.51
Depth Face	.20"	.21"	.17"	.10"	.26"	.18"	.18"	.21"	.17"	-

Armor Carburized by the Lithium Catalyst Process

TABLE I (Continued)

Heat and Plate Nos.	29 S-11-B	35 S-12-B	39 S-13-B	57 S-14-B	56 S-15-B	58 S-16-B	62 S-17-B
Depth of C. Sample							
.01"	.55	.80	.88	.81	.84	.61	.71
.02"	.69	.73	.87	.77	.79	.58	.71
.03"	.75	.68	.87	.71	.75	.56	.67
.04"	.73	.66	.87	.68	.72	.54	.53
.05"	.67	.66	.80	.65	.66	.51	.51
.06"	.70	.65	.81	.63	.62	.51	.45
.07"	.66	.60	.78	.58	.53	.49	.41
.08"	.62	.53	.74	.52	.49	.48	.37
.09"	.61	.50	.68	-	.42	.44	.34
.10"	.55	.45	.71	.48	.37	.42	.31
.11"	.52	.45	.68	-	-	.38	
.12"	.50	.41	.61	-	.31	.35	
.13"	.48	.40	.61	-		.36	
.14"	.47	.35	.52	.35			
.15"	.43	.35	-				
.16"	-	.29	-				
.17"	-		.38				
.18"	.24		-				
.19"			-				
.20"			.30				
Max. C.	.75	.80	.88	.81	.84	.61	.71
Ave. .05"	.68	.71	.86	.72	.75	.56	.62
Ave. .10"	.65	.63	.80	.63	.62	.51	.50
Ave. Face	<.56	.55	(.84)	<.71	.57	-	.50
Depth Face	>.18"	.15"	.20"	.15"	.12"	>.13"	.10"

Armor Carburized by the Lithium Catalyst Process

TABLE II

1/2" X 36" X 36" PLATES
CARBON CONTENTS OF FACE AT DEPTHS INDICATED

Heat and Plate No.	64 P-1-A-B	64A-65A P-2-3	66A P-4	66 P-5-6	67A P-7	67 P-8	67B P-9	68A P-10	68 P-11-12	69 P-13-14-15
Depth of C. Sample										
.01"	.82	.81	.82	.86	.84	.78	.82	.74	.86	.49
.02"	.71	.80	.83	.79	.83	.76	.80	.76	.78	.49
.03"	.68	.78	.82	.76	.83	.72	.78	.72	.79	.50
.04"	.68	.75	.75	.72	.77	.67	.69	.69	.71	.54
.05"	.66	.63	.70	.69	.72	.66	.63	.66	.66	.56
.06"	.66	.62	.68	.71	.65	.64	.55	.63	.60	.55
.07"	.60	.57	.58	.60	.58	.56	.51	.59	.54	.54
.08"	.58	.58	.54	.44	.53	.52	.46	.56	.49	.53
.09"	.58	.55	.42	.37	.46	.48	.43	.52	.41	.52
.10"	.58	.58	.37	.36	.41	.44	.38	.49	.40	.51
.11"	.55	.51	.35	.35	.39	.41	.36	.45	.37	.40
.12"	.52	.50	.32	.33	.34	.34	.32	.40	.33	.39
.13"	.40	.39			.31	.30		.37		.36
.14"	.34	.33						.36		.32
.15"	.25	.27						.33		
Max. C	.82	.81	.83	.86	.84	.78	.82	.76	.86	.56
Ave. .05"	.71	.76	.78	.76	.80	.72	.74	.71	.76	.52
Ave. .10"	.66	.66	.65	.63	.66	.62	.61	.63	.63	.52
Ave. Face	.60	.60	.60	.59	.59	.56	.56	.56	.58	.48
Depth Face	.14"	.14"	.12"	.12"	.13"	.13"	.12"	.15"	.12"	.14"

Armor Carburized by the Lithium Catalyst Process

TABLE II (Continued)

Heat and Plate No.	70 P-16-17-18	71 P-19-20-21	72 P-22-23-24	73 P-25-26-27	74 P-28-29	75 P-30-31	76 P-32-33	77 P-34-35	78 P-36-37
Depth of C. Sample									
.01"	.77	.70	.71	.64	.79	.67	.65	.50	.60
.02"	.76	.72	.71	.60	.69	.67	.62	.50	.54
.03"	.66	.67	.70	.60	.65	.65	.60	.46	.49
.04"	.64	.64	.67	.59	.64	.64	.58	.43	.50
.05"	.56	.63	.67	.60	.62	.60	.54	.41	.48
.06"	.51	.56	.62	.56	.58	.56	.51	.40	.48
.07"	.44	.51	.55	.54	.52	.56	.58	.38	.46
.08"	.33	.50	.50	.52	.52	.52	.44	.38	.44
.09"	.36	.43	.50	.49	.47	.48	.40	.36	.42
.10"	.32	.38	.47	.47	.43	.44	.40	.35	.40
.11"		.34	.42	.41	.40	.40	.36	.32	.34
.12"		.31	.38	.34	.36	.40	.32		.31
.13"			.32	.33	.32	.35			
.14"				.30		.34			
.15"						.32			
Max. C.	.77	.72	.71	.64	.79	.67	.65	.50	.60
Ave. .05"	.66	.67	.69	.61	.68	.65	.60	.46	.52
Ave. .10"	.54	.58	.61	.56	.59	.58	.52	.42	.48
Ave. Face	.54	.54	.56	.50	.54	.51	.49	.41	.46
Depth Face	.10"	.12"	.13"	.14"	.13"	.15"	.12"	.11"	.12"

TABLE III

SAMPLES
TEST DATA

Piece No.	Run No.	Max. C.	Ave. C. 1st .05"	Ave. C. 1st .10"	Ave. C. in Face	Depth of Face	Max. Knoop	Percent of Face	B.H.N. Face	B.H.N. Back	Total Carburizing Time-Hrs.	Carb. Time Hrs.	Air to Gas at Ratio	Propane Addition c.f.h.	Propane Addition Hrs.	Additional Carburizing Hrs.	Additional Carburizing Ratio
S-1-B	5	.90	.61	.51	.43	.20"	697	40	618	467	62	39.5	8.25-1	None		22.5	9.72-1
S-4-B	9	.83	.60	.56	.48	.21"	738	40	682	475	44.75	14.75	9.59-1	2	14.25	30	9.59-1
S-7-B	10	.80	.48	.48	.43	.18"	683	36	674	464	47.5	15.75	9.59-1	2	15.25	31.25	9.59-1
S-8-B	1	.75	.61	.50	.50	.10"	675	13	578	460	40	24	9.28-1	None		16	9.28-1
S-11-B	1	.93	.91	.73	.56	.36"	638	45	652	477	69.75	6.75 27	9.42-1 9.6-1	1	21.0	35.75	9.72-1
S-12-B	34	.88	.83	.73	.59	.18"	729	37	653	489	41.5	10	9.46-1	2	10	20.5	9.50-1
S-13-B	36	.86	.83	.75	.60	.18"	725	30	688	474	40.75	16.25	9.59-1	1.5	16.25	24.5	9.50-1
S-5-B	41	.72	.68	.65	.55	.21"	702	40	648	492	40	16	9.85-1	1.5	16	24	9.85-1
S-9-B	18	.55	.53	.52	.48	.17"	662	26	648	474	42	15.5	9.46-1	2	15.5	26.5	9.75-1
S-10-B	26	.59	.54	.55			729	42	675	466	48	15.5	9.66-1	1.5	15.5	32.5	9.66-1
S-11-B	29	.75	.68	.65	<.56		764	35	704	462	40.75	16.25	9.65-1	1.5	16.25	24.5	9.65-1
S-12-B	35	.80	.71	.63	.55	.15"	697	62	637	489	40	16	9.66-1	1.5	16	24	9.72-1
S-15-B	39	.88	.85	.80	(.64)	.20"	744	46	643	475	40	16	9.86-1	1.5	16	24	9.86-1
S-14-B	55	.81	.72	.63	<.57	.15"	764	47	691	481	44.75	16	7.7-1	3	16	28.75	7.7-1
S-15-B	56	.84	.75	.62	.57	.12"	760	36	655	495	40.75	23.5	8.61-1	3	16	17.25	8.08-1
S-16-B	38	.61	.56	.51			744	43	678	484	48	24	8.51-1	3	16	24	9.09-1
S-17-B	62	.71	.62	.50	.50	.10"	764	32	643	467	46 45.5	48	7.7-1	.5	48	-	-

Data for the blank spaces are unavailable.

TABLE IV

PLATES
CARBURIZATION DATA

CARBURIZATION DATA FOR PLATES

Plate No.	Heat No.	Air to Gas Ratio	Time in Hours	Ratio	Time	Ratio	Time	Ratio	Time	Total	PROPANE ADDITIONS c.f.h. For:
1	70	7.7-1	24	7.7-1	24	-	-	-	-	48	3 " 1st 24 Hrs.
2	70A	"	"	"	"	7.7-1	24	8.0-1	24	96	" " " " and last 48 Hrs.
3	"	"	"	"	"	"	"	"	"	96	
4	"	"	"	"	30	"	"	"	24.5	102.5	" " 30 "
5	"	"	"	"	23	-	-	-	-	54	
6	"	"	"	"	"	-	-	-	-	54	
7	"	"	"	8.0-1	37.5	7.7-1	30	8.0-1	24	115.5	" " 61.5 Hrs. and last 54 Hrs.
8	"	"	"	"	"	-	-	-	-	61.5	
9	"	"	"	"	"	7.7-1	24	8.0-1	26	111.5	" " and last 50 Hrs.
10	66	"	"	8.35-1	24.5	"	30	8.34-1	42	120.5	" " 48.5 "
11	"	"	"	"	"	-	-	-	-	48.5	" " " "
12	"	"	"	"	"	-	-	-	-	48.5	" " " "
13	69	"	"	8.48-1	22.5	8.7-1	13.5	-	-	60	" " 46.5 "
14	"	"	"	"	"	"	"	-	-	60	" " " "
15	"	"	"	"	"	"	"	-	-	60	" " " "
16	70	"	"	8.62-1	24	-	-	-	-	48	" " 43 "
17	"	"	"	"	"	-	-	-	-	48	" " " "
18	"	"	"	"	"	-	-	-	-	48	" " " "
19	71	"	"	8.53-1	42	-	-	-	-	66	" " 66 "
20	"	"	"	"	"	-	-	-	-	66	" " " "
21	"	"	"	"	"	-	-	-	-	66	" " " "
22	72	"	"	8.45-1	29	-	-	-	-	53	" " 25 "
23	"	"	"	"	"	-	-	-	-	53	" " " "
24	"	"	"	"	"	-	-	-	-	53	" " " "

TABLE IV (Continued)

CARBURIZATION DATA FOR PLATES

Plate Nos.	Heat No.	Air to Gas Ratio	Time in Hours	Ratio	Time	Ratio	Time	Ratio	Time	Total	PROPANE ADDITIONS c.f.h. for: 3	1st 24 Hrs.
25 A-B	73	7.7-1	24	8.63-1	47.5	-	-	-	-	71.5		
						-	-	-	-	71.5		
						-	-	-	-	71.5		
28 "	74	"	"	8.61-1	50	-	-	-	-	74		74
						-	-	-	-	74		
				8.63-1	48	-	-	-	-	72		72
						-	-	-	-	72		
				8.7-1	47.5	-	-	-	-	71.5		71
						-	-	-	-	71.5		
					48	-	-	-	-	72		72
						-	-	-	-	72		
36 "	78	"	"	"	"	Carbo Nitrided				72	- .8% NH3 added last 48 Hrs.	
37 "	"	"	"	"	"	"				72		

TABLE V

RESULTS - TEST DATA PLATES

Plate No.	Heat	Max. Carbon	Ave. C 1st .05"	Ave. C 1st .10"	Ave. C 1st Case above .30C	Depth of Case above .30C	Max. Knoop	% Face Over 540 Knoop	B.H.N. Face Surface	B.H.N. Back Surface	Cal. .50 VpMin	Cal. .50 Vp50	Specification Failed or Passed	Specification JAN-A-784	F.S. Above or Below Spec.	20mm VpMin
P-1-A	64	.82	.71	.66	.60	.14"	697	30.5	642	457	2171	2183	F	2193	-10	>2730
B	"						702	28.6	663	463	2314	2337	P	2195	+119	>2733
2-A	" A	.81	.76	.66	.60	.14"	711	40.5	619	464	2187	2195	P	2195	-8	>2714
B	"						720	37.1	621	461	2205	2285	P	2198	+7	>2714
3-A	65A	.81	.76	.66	.60	.14"	715	37.7	625	466	2224	2262	P	2207	+17	>2725
B	" A	.81	.76	.66	.60	.14"	715	37.6	623	466	2234	2269	P	2211	+23	>2714
4-A	66A	.83	.78	.65	.60	.12"	692	40.0	597	453	2124	2140	F	2199	-60	>2739
B	" A	.83	.78	.65	.60	.12"	715	36.2	596	452	2130	2133	F	2198	-66	>2742
5-A	66	.86	.76	.63	.59	.12"	706	30.9	653	462	2302	2344	P	2207	+95	>2725
B	"						697	30.2	665	463	2315	2332	P	2198	+117	
6-A	"						688	29.6	649	460	2170	2190	F	2201	-19	
B	"						692	28.1	653	462	2330	2372	P	2202	+128	>2717
7-A	67A	.84	.80	.66	.59	.13"	Received in cracked condition - Not Tested.									
B	"						"	"	"	"	"	"				
8-A	67	.78	.72	.62	.56	.13"	675	29.3	653	463	2162	2212	F	2196	-27	>2722
B	"						692	29.2	651	462	2206	2212	P	2211	-1	>2720
9-A	" B	.82	.74	.61	.56	.12"	697	38.1	637	467	2181	2209	F	2214	-27	>2730
B	"						702	36.0	642	467	2209	2217	F	2217	-6	>2739
10-A	68A	.76	.71	.63	.55	.15"	Received in cracked condition - Not Tested.									
B	"						"	"	"	"	"	"				
11-A	68	.86	.76	.63	.58	.12"	729	35.2	670	465	2197	2289	P	2196	+1	>2733
B	"						671	29.1	666	463	2342	2355	P	2202	+140	>2739
12-A	"						725	36.4	667	464	2309	2316	P	2192	+117	
B	"						764	32.6	672	484	2243	2243	P	2196	+47	>2727

TABLE V (Continued)

Plate No.	Heat	Max. Carbon	Ave. C 1st .05"	Ave. C 1st .10"	Ave. C 1st Case above .30C	Depth of Case above .30C	Max. Knoop	% Face Over 540 Knoop	B.H.N. Face Surface	B.H.N. Back Surface	Cal. .50 Vp50	Cal. .50 Vp50	Specification Failed or Passed	Specification JAN-A-juz	F.S. Above or Below Spec.	20mm Vp50
P-13-A	69	.56	.52	.52	.48	.14"	680	32.4	604	461	2151	2265	F	2190	-43	>2735
B	"						662	25.2	608	481	2157	2271	F	2196	-37	>2735
14-A	"						697	32.3	595	456	2240	2281	F	2187	+53	
B	"						688	30.0	611	461	2218	2275	P	2205	+13	>2737
15-A	"						680	34.9	604	460	2247	2247	P	2193	+54	
B	"						692	35.4	599	454	2216	2262	P	2193	+23	
16-A	70	.77	.68	.54	.54	.10"	710	32.8	663	467	2151	2187	F	2177	-5	
B	"						743	29.4	657	466	2276	2276	P	2189	+87	>2746
17-A	"						739	34.1	657	465	2210	2210	P	2180	+30	
B	"						729	35.4	655	466	2222	2239	P	2181	+41	
18-A	"						744	34.7	672	465	2176	2236	F	2208	-18	
B	"						734	39.4	667	466	2204	2242	P	2184	+20	>2739
19-A	71	.72	.67	.58	.54	.12"	734	35.5	663	468	2184	2212	P	2177	+7	>2757
B	"						729	35.2	661	466	2164	2169	F	2187	-23	
20-A	"						714	32.6	674	465	2228	2236	P	2193	+35	
B	"						715	33.1	665	460	2209	2244	F	2216	-6	
21-A	"						711	33.0	666	464	2169	2231	F	2228	-49	
B	"						706	32.0	655	456	2226	2236	P	2198	+28	>2727
22-A	72	.71	.69	.61	.56	.13"	739	34.3	668	461	2281	2289	P	2216	+65	>2730
B	"						734	30.0	667	457	2245	2273	P	2208	+37	>2744
23-A	"						702	37.6	653	461	2195	2240	P	2193	+2	
B	"						811	32.1	660	464	2151	2273	F	2198	-43	
24-A	"						748	34.4	660	462	2161	2304	F	2181	+9	
B	"						729	32.8	658	464	2219	2259	P	2189	+30	>2746

TABLE V (Continued)

Plate No.	Heat	Max. Carbon	Ave. C 1st .05"	Ave. C 1st .10"	Ave. C 1st Case above .30C	Depth of Case above .30C	Max. Knoop	% Face Over 540 Knoop	B.H.N. Face Surface	B.H.N. Back Surface	Cal. .50 VpMin	Cal. .50 Vp50	Specification Failed or Passed	Specification JAN-A-784	F.S. Above or Below Spec.	20mm VpMin
P-25-A	73	.64	.61	.56	.50	.14"	702	31.0	653	460	2260	2260	P	2199	+61	
B	"						711	31.7	657	461	2281	2283	P	2217	+64	
26-A	"						710	29.8	653	465	2093	2228	F	2201	-103	>2765
B	"						710	31.4	653	467	2271	2277	P	2193	+78	>2737
27-A	"						715	31.0	657	466	2208	2206	P	2193	+15	
B	"						683	32.2	646	458	2241	2259	P	2201	+40	>2730
28-A	74	.79	.68	.59	.54	.13"	729	32.8	655	465	2255	2255	P	2213	+42	>2739
B	"						706	31.6	652	463	2207	2226	F	2211	-1	
29-A	"						744	42.1	662	471	2246	2266	P	2184	+62	>2735
B	"						692	33.5	659	465	2184	2258	P	2183	+1	
30-A	75	.67	.65	.58	.51	.15"	688	44.3	653	463	2146	2153	F	2186	-36	
B	"						683	36.0.	644	461	2197	2203	P	2187	+10	>2730
31-A	"						688	34.9	647	463	2212	2231	P	2190	+22	
B	"						692	34.1	648	464	2232	2249	P	2187	+45	>2730
32-A	76	.65	.60	.52	.49	.12"	654	26.7	642	462	2147	2147	F	2180	-32	
B	"						662	28.7	643	455	2142	2205	F	2170	-28	>2739
33-A	"						702	29.0	653	461	2222	2222	P	2213	+9	>2744
B	"						725	34.0	646	455	2168	2188	F	2216	-42	
34-A	77	.50	.46	.42	.41	.11"	658	28.7	587	461	2119	2147	F	2184	-13	
B	"						654	29.6	590	455	2124	2124	F	2170	-46	>2744
35-A	"						658	34.0	595	464	2109	2155	F	2184	-72	>2737
B	"						662	27.5	585	455	2173	2178	F	2189	-25	
36-A	78	.60	.52	.48	.46	.12"	725	32.7	658	475	2242	2242	P	2208	+34	
B	"						702	34.1	658	472	2197	2314	F	2205	-6	>2742
37-A	"						702	39.4	631	462	2157	2206	F	2190	-29	
B	"						683	35.6	614	467	2250	2261	P	2207	+43	>2725

Armor Carburized by the Lithium Catalyst Process

TABLE VI

BALLISTIC RATING OF ALL PLATES

PASSED

Ranking	Plate No.	+ or - F.S. Plus	Total Carburizing Time Hours	BHN Face	% Face over 540 Knoop
1	11-B	+140	48.5	668	29.1
2	6-B	+128	54	658	28.1
3	1-B	+119	45	663	28.6
4	5-B	+117	54	665	30.2
5	12-A	+117	48.5	667	36.4
6	5-A	+ 95	54	653	30.9
7	16-B	+ 87	48	657	29.4
8	26-B	+ 78	71.5	653	31.4
9	22-A	+ 65	53	668	34.3
10	25-B	+ 64	71.5	657	31.7
11	29-A	+ 62	74	662	42.1
12	25-A	+ 61	71.5	653	31.8
13	15-A	+ 54	60	604	34.9
14	14-A	+ 53	60	595	32.3
15	12-B	+ 47	48.5	672	32.6
16	31-B	+ 45	72	648	34.1
17	37-B	+ 43	72	614	35.6
18	26-A	+ 42	74	655	32.8
19	17-B	+ 41	48	655	35.4
20	27-B	+ 40	71.5	646	32.2
21	22-B	+ 37	53	667	30.0
22	20-A	+ 35	66	674	32.6
23	36-A	+ 34	72	658	32.7
24	24-B	+ 30	53	658	32.8
25	17-A	+ 30	48	657	34.1
26	21-B	+ 28	66	655	32.0
27	15-B	+ 23	60	599	35.4
28	3-B	+ 23	96	623	37.6
29	31-A	+ 22	72	647	34.9
30	18-B	+ 20	48	667	39.4
31	3-A	+ 17	96	625	37.7
32	27-A	+ 15	71.5	657	31.0
33	14-B	+ 13	60	611	30.0
34	30-B	+ 10	72	644	36.0
35	33-A	+ 9	71.5	653	29.0
36	2-B	+ 7	96	621	37.1
37	19-A	+ 7	66	663	35.5
38	23-A	+ 2	53	653	37.6
39	11-A	+ 1	48.5	670	35.2
40	29-B	+ 1	74	659	33.5

Armor Carburized by the Lithium Catalyst Process

TABLE VI (Continued)

FAILED (Except #2-A)

Ranking	Plate No.	+ or - f.s. Minus	Total Carburizing Time Hours	BHN Face	% Face over 540 Knoop
41	28-B	- 1	74	652	31.6
42	8-B	- 1	61.5	651	29.2
43	16-A	- 5	48	663	32.8
44	36-B	- 6	72	658	34.1
45	20-B	- 6	66	665	33.1
46	9-B	- 6	111.5	642	36.0
47	2-A	- 8 pass	96	619	40.5
48	24-A	- 9	53	660	34.4
49	1-A	- 10	48	642	30.5
50	34-A	- 13	72	587	28.7
51	18-A	- 18	48	672	34.7
52	6-A	- 19	54	649	29.6
53	19-B	- 23	66	661	35.2
54	35-B	- 25	72	585	27.5
55	8-A	- 27	61.5	653	29.3
56	9-A	- 27	111.5	637	38.1
57	32-B	- 28	71.5	643	28.7
58	37-A	- 29	72	631	39.4
59	32-A	- 32	71.5	642	26.7
60	30-A	- 36	72	653	44.3
61	13-B	- 37	60	608	25.2
62	33-B	- 42	71.5	646	34.0
63	23-B	- 43	53	650	32.1
64	13-A	- 43	60	604	32.4
65	34-B	- 46	72	590	29.8
66	21-A	- 49	66	666	33.0
67	4-A	- 60	102.5	597	40.0
68	4-B	- 66	102.5	596	36.2
69	35-A	- 72	72	595	34.0
70	26-A	-103	71.5	653	29.8

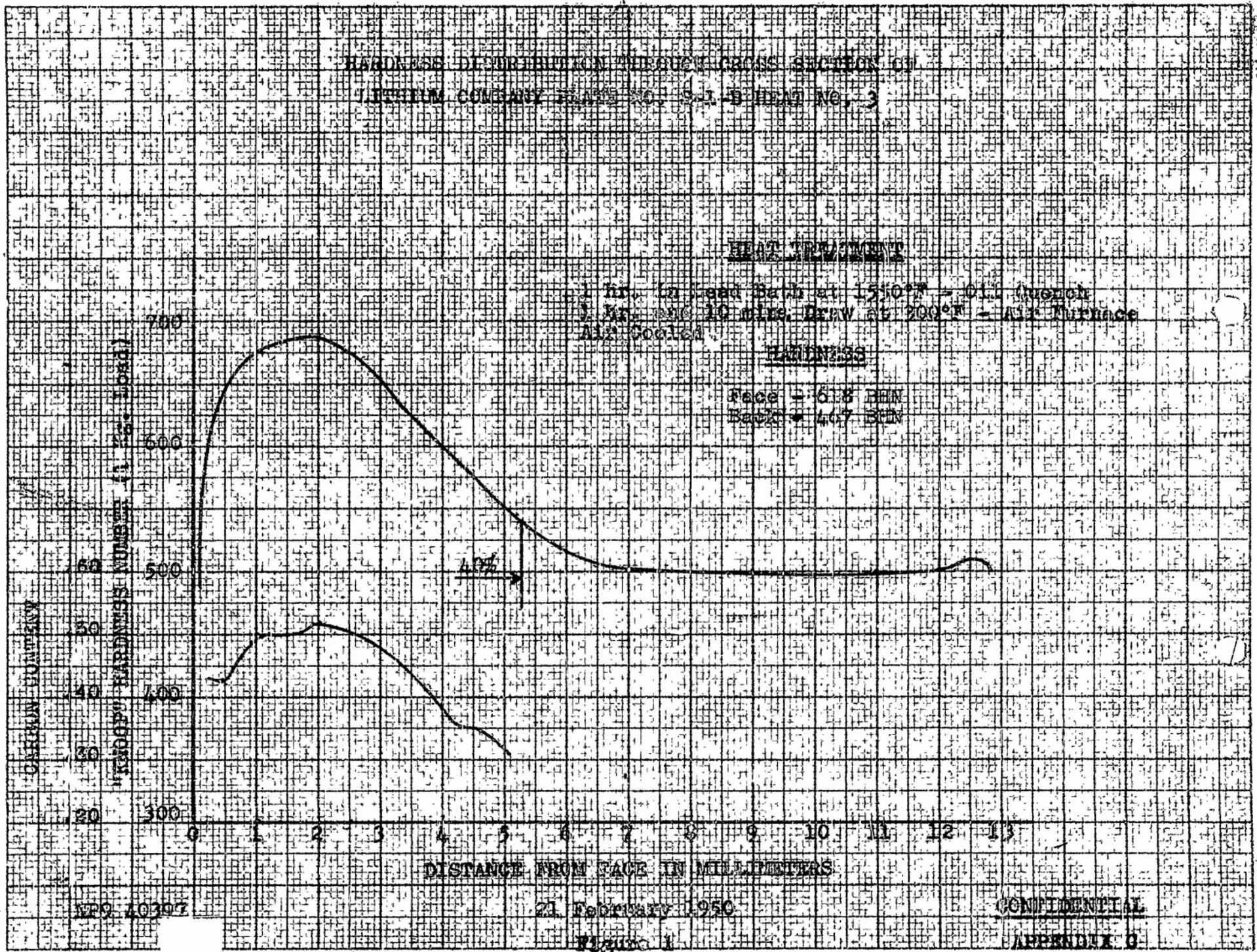
Spread of -103 to +140 243 f.s.
Average +14 f.s.
41 Plates passed by average of 45 f.s. over spec.
29 Plates failed by average of 30 f.s. under spec.

Armor Carburized by the Lithium Catalyst Process

TABLE VII

COMPARISON OF LITHIUM CARBURIZED 1/2" ARMOR
WITH OTHER TYPES OF FACE HARDENED ARMOR

Armor Source	No. of Plates	Ave. Gauge	Average Limits "V_{pMin}"	Average Limits "V_{p50}"	Corrected Limits V_{pMin} JAN-A-784	Corrected Limits "V_{p50}" "F"	Date Submitted
Lithium Carburized (NPG Treated)	70	0".514	2208	2240	2189	2209	1950-1951
Diebold Pack Carburized Republic E.F. (Production)	100	0".501	2202	--	2200	--	1944-1945
Diebold Pack Carburized Republic O.H. (Production)	100	0".498	2179	--	2182	--	1943-1944
Pluramelt .21C (NPG Treated)	--	--	--	--	--	2369	1945
Pluramelt .25C (NPG Treated)	--	--	--	--	--	2416	1945
Lukens Composite (NPG Treated) Rept 135	--	0".523	--	2373	--	2320	1949



NP2 40307

21 February 1950

Figure 1

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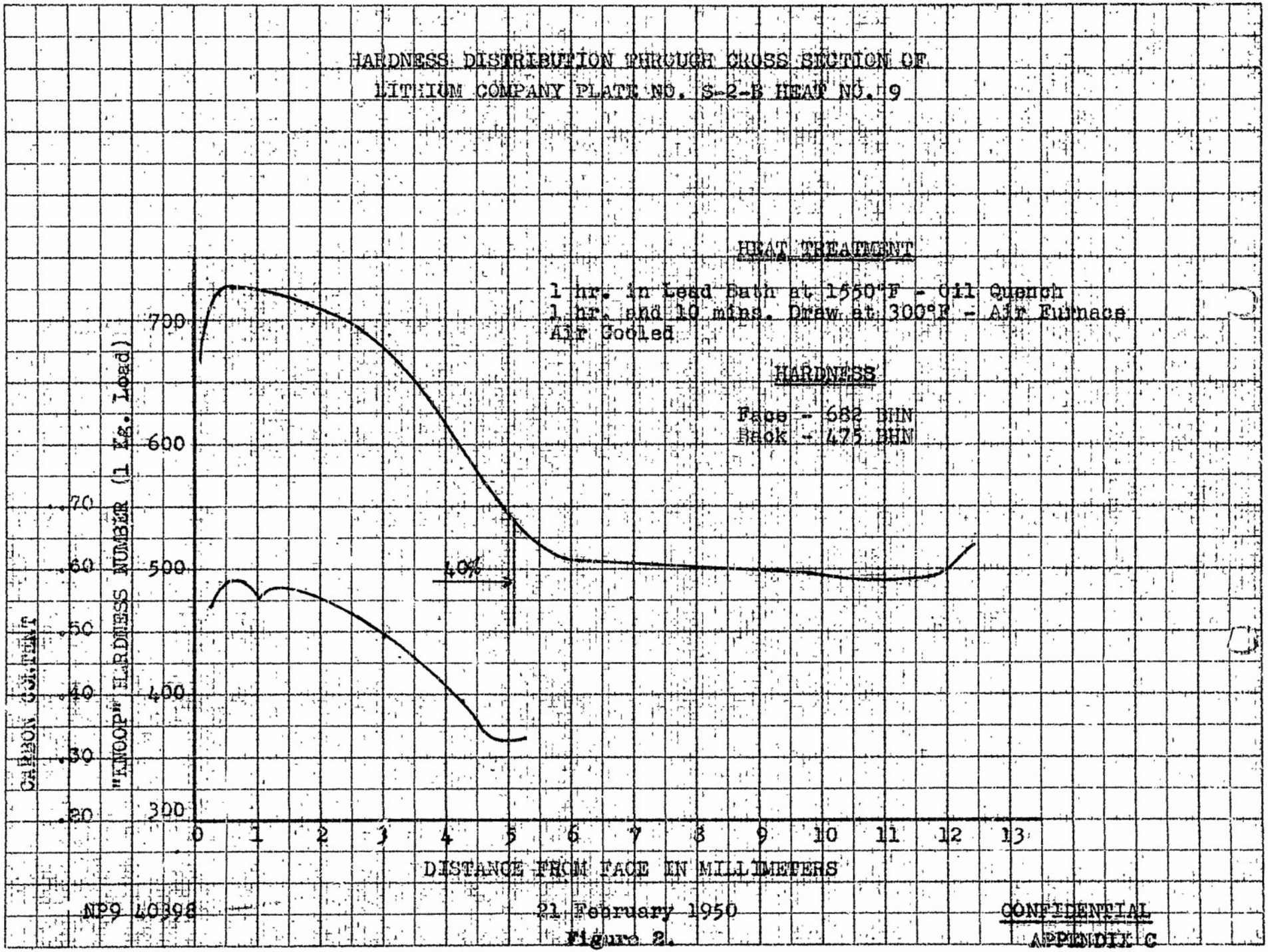

NP9 40398

21 February 1950

Figure 2.

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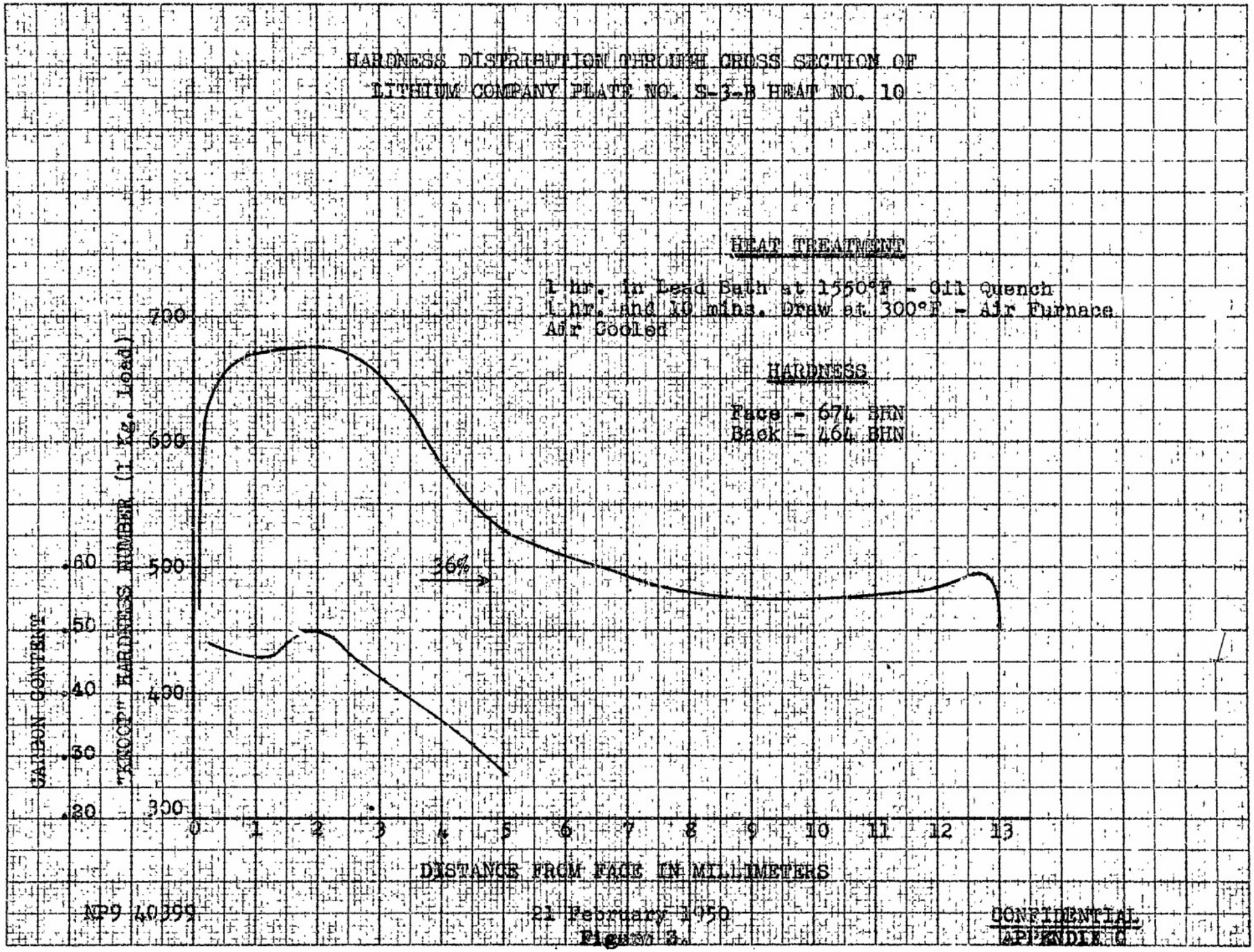

NP9 40399

21 February 1950

Figure 3.

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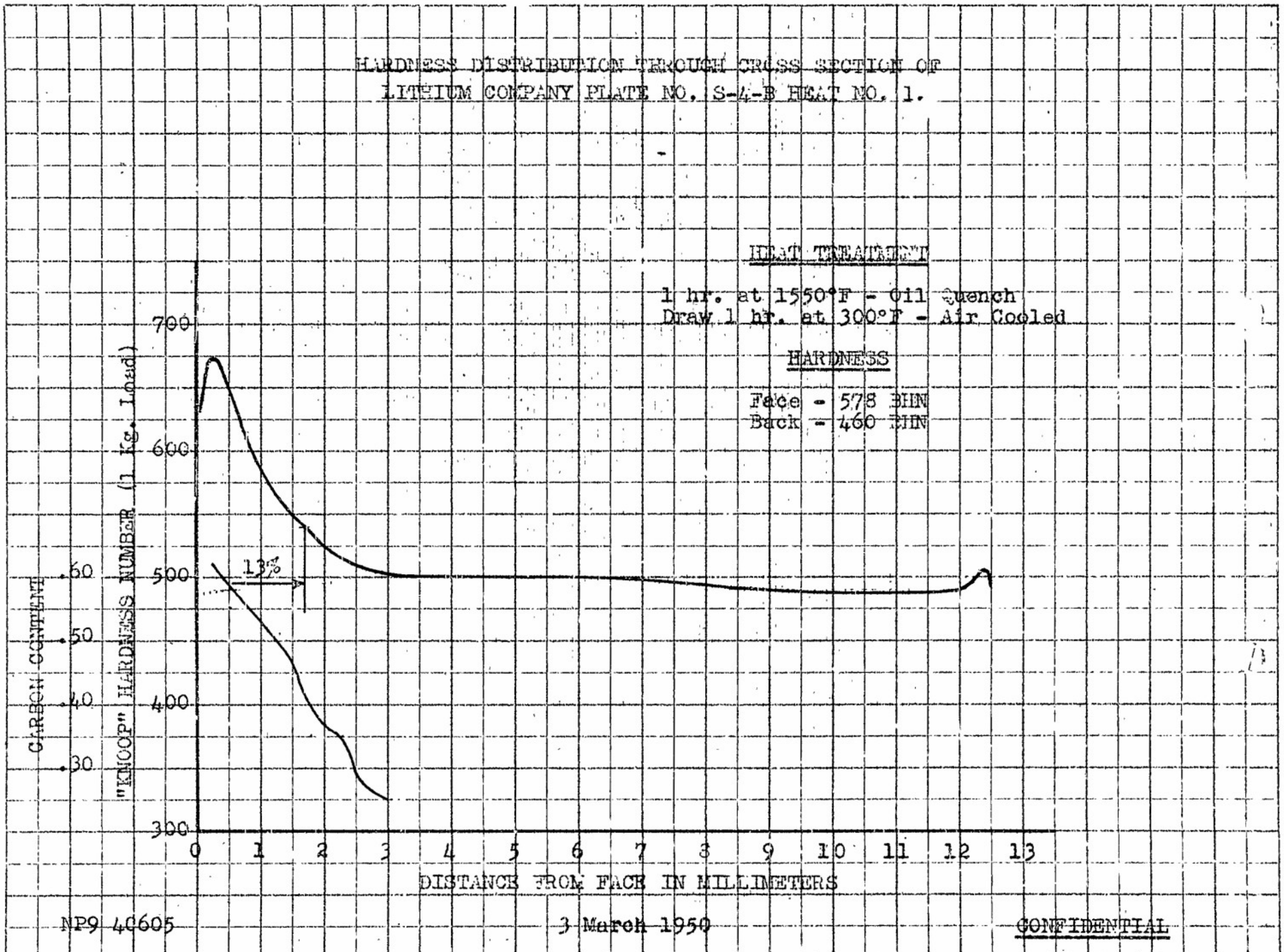

NP9 40605

3 March 1950

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Figure 4

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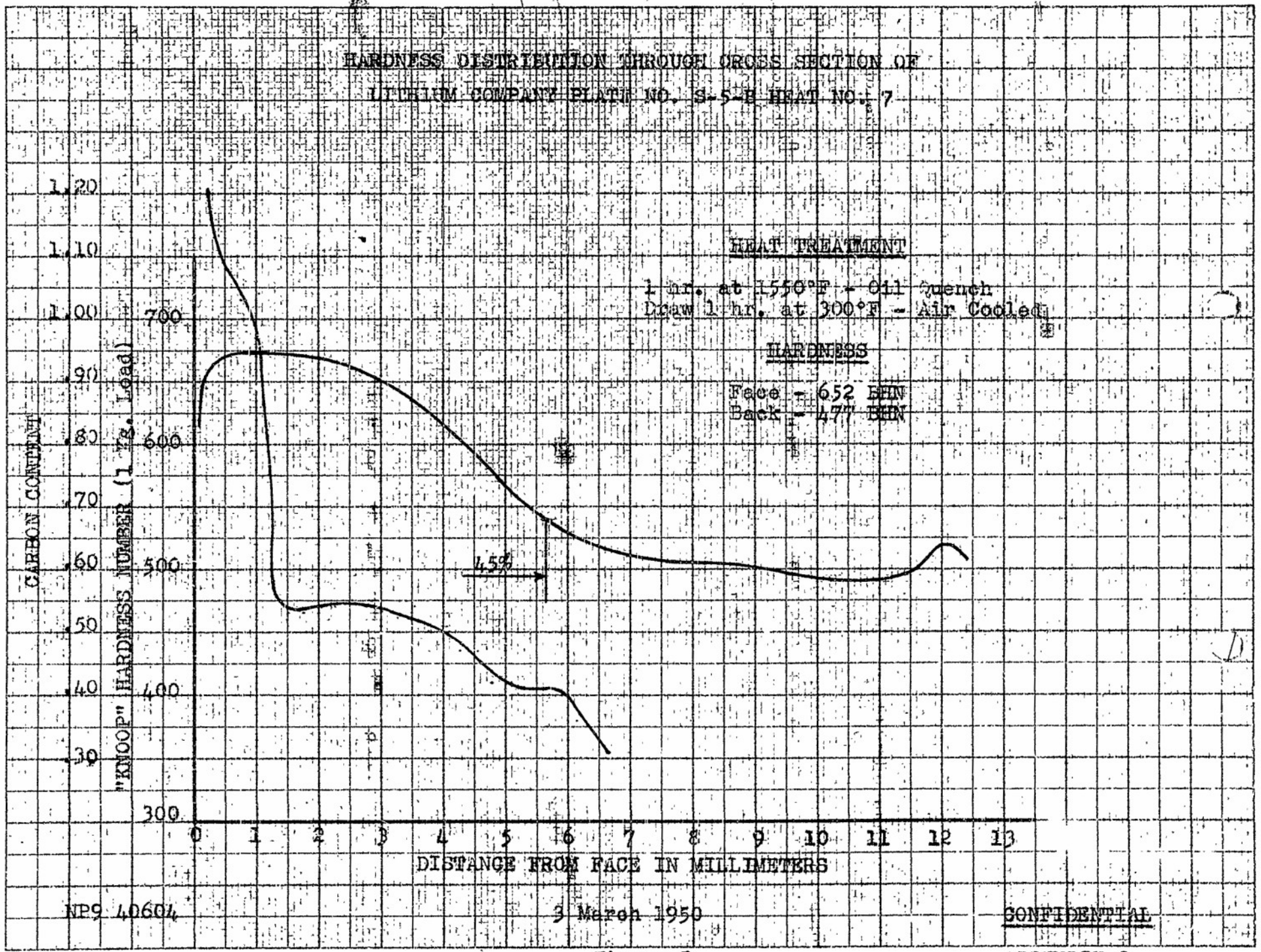


Figure 5

APPENDIX C

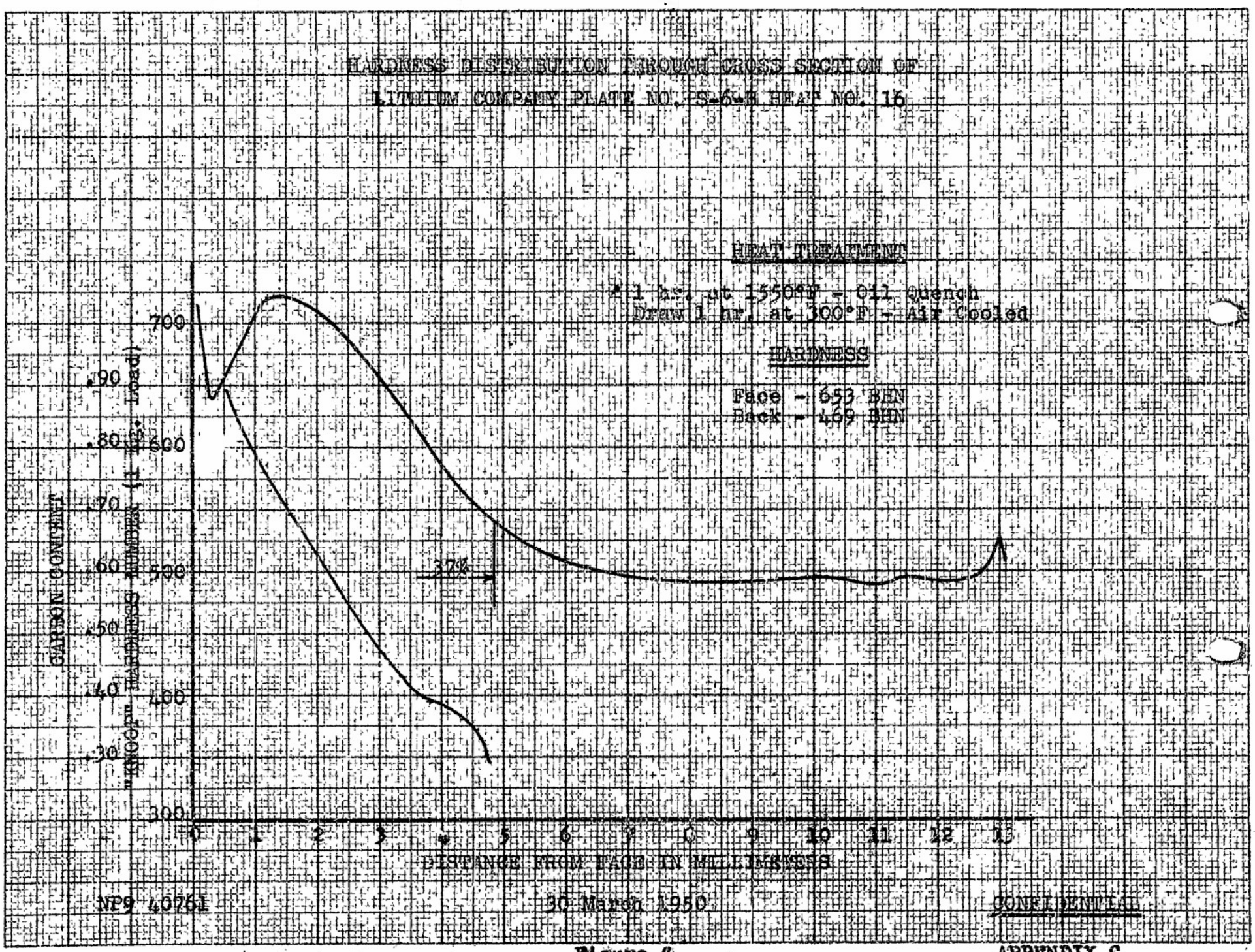


Figure 6

APPENDIX C

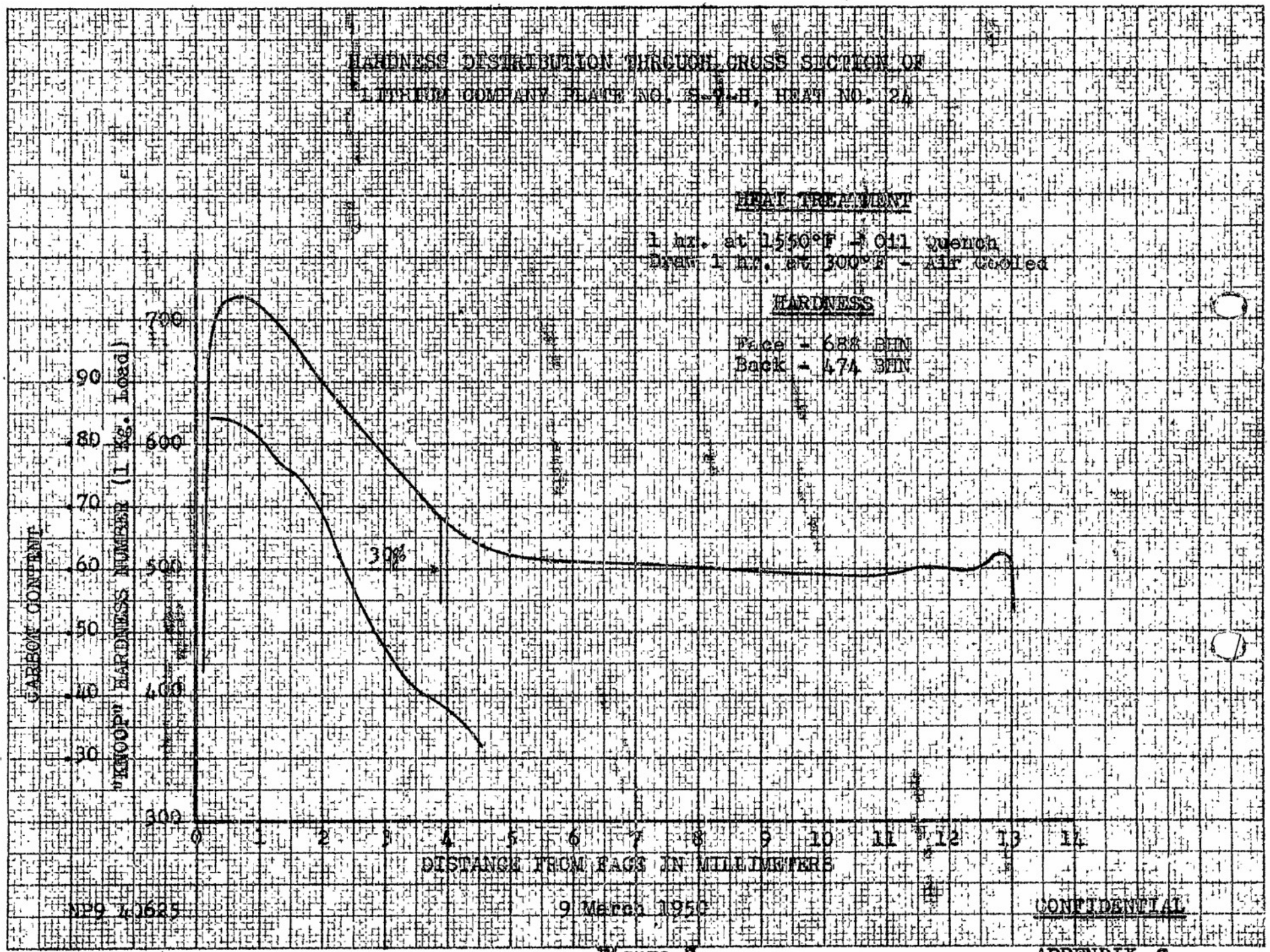


Figure 7.

APPENDIX C

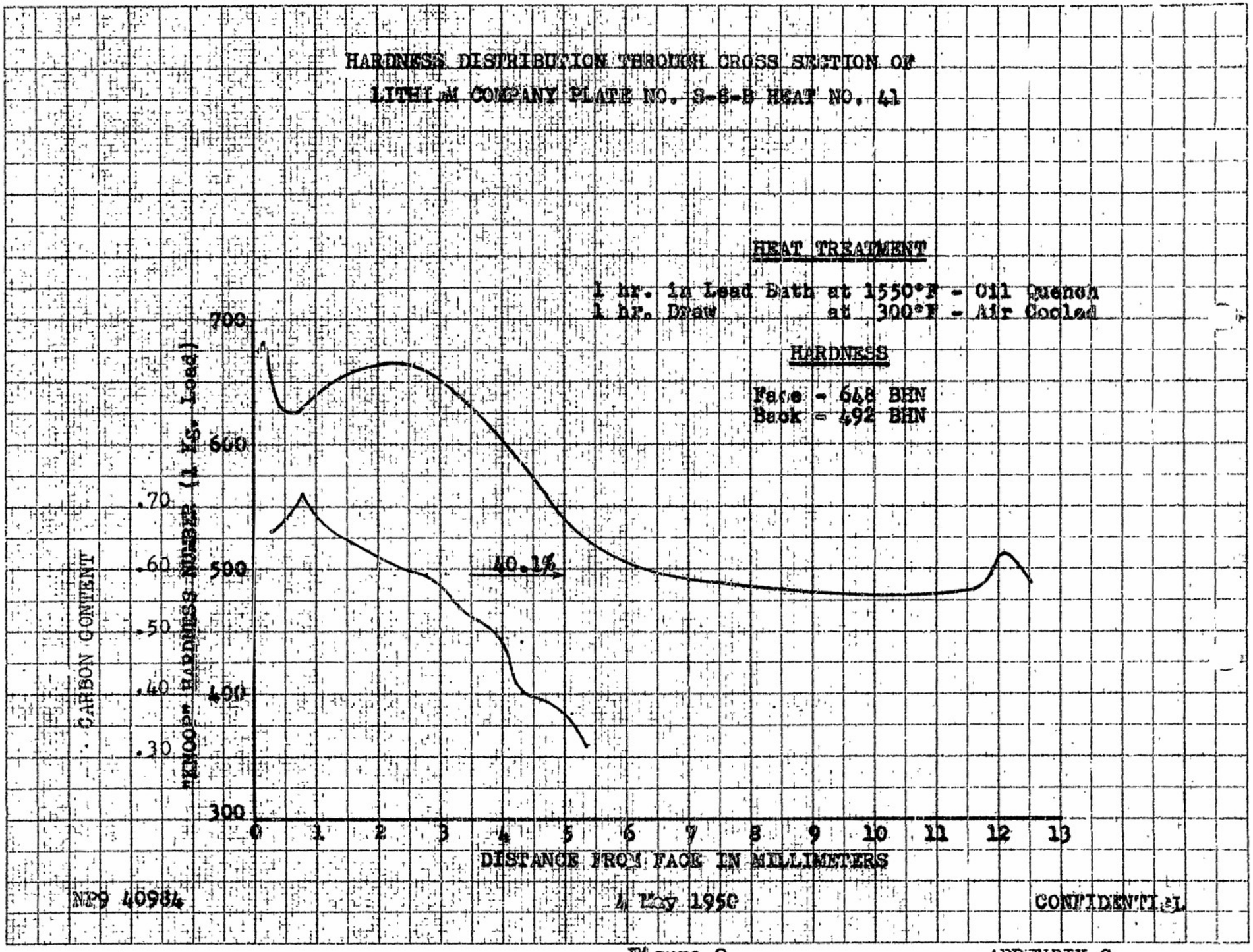


Figure 8.

APPENDIX C

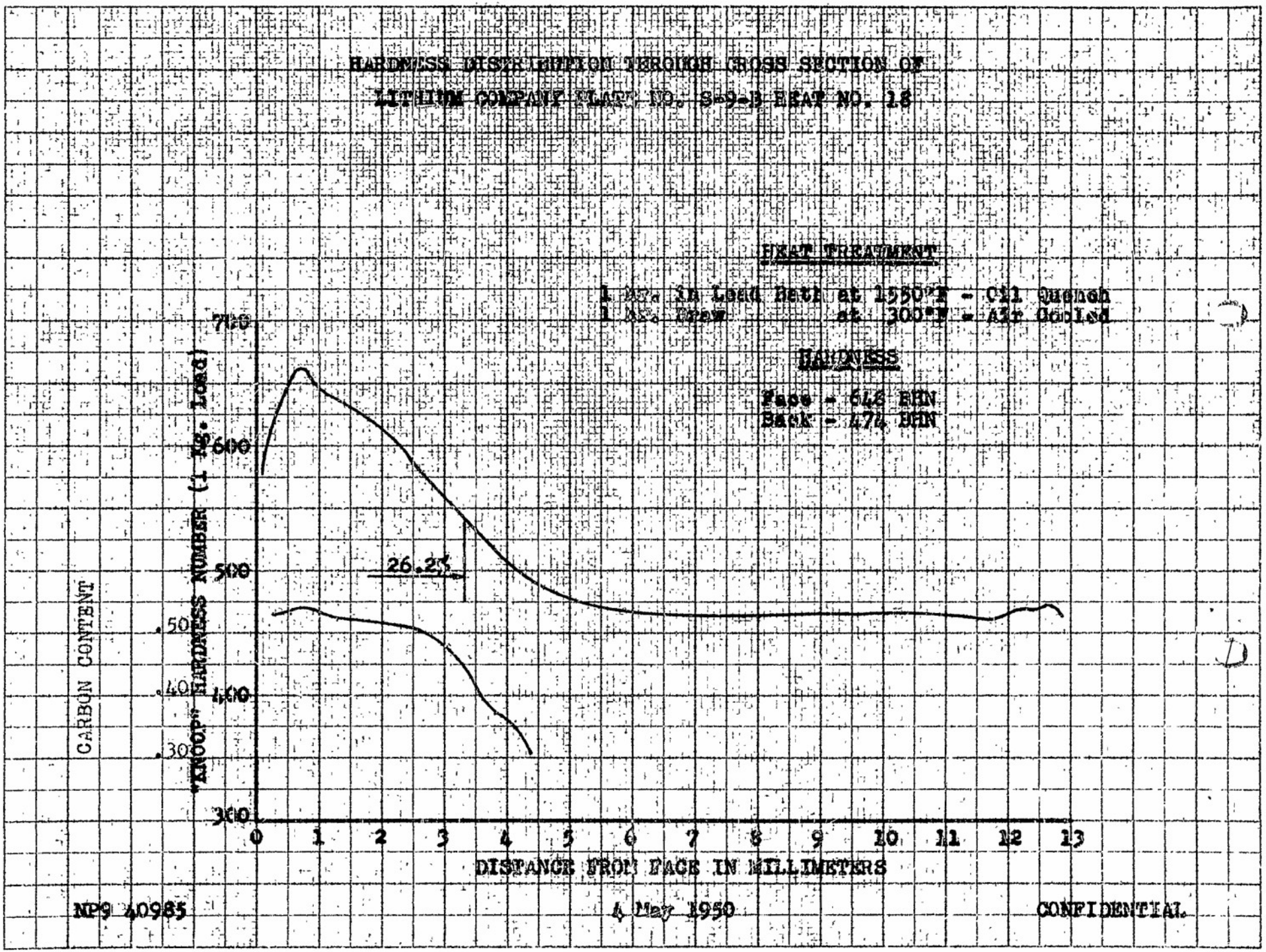


Figure 9.

APPENDIX C

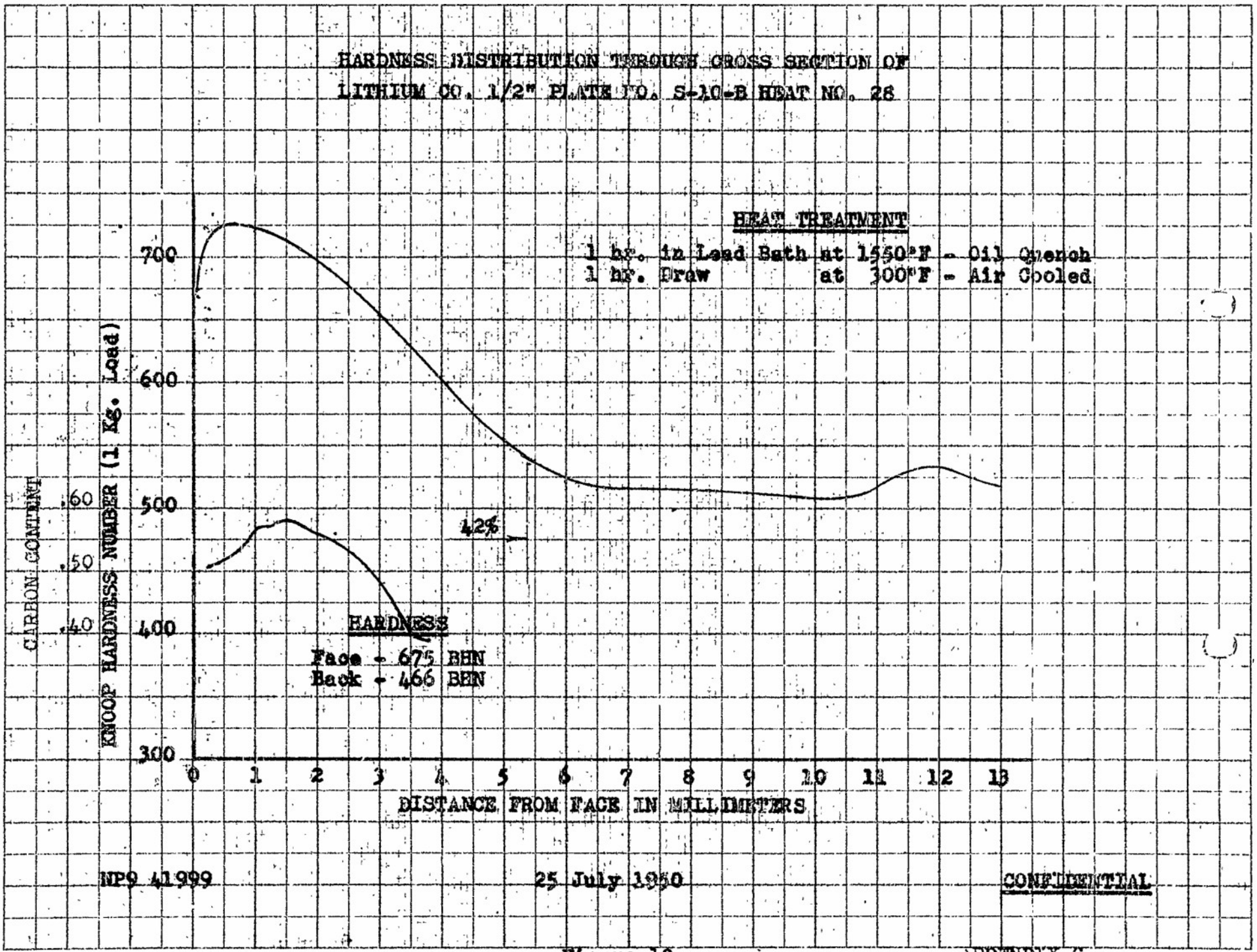


Figure 10.

APPENDIX C

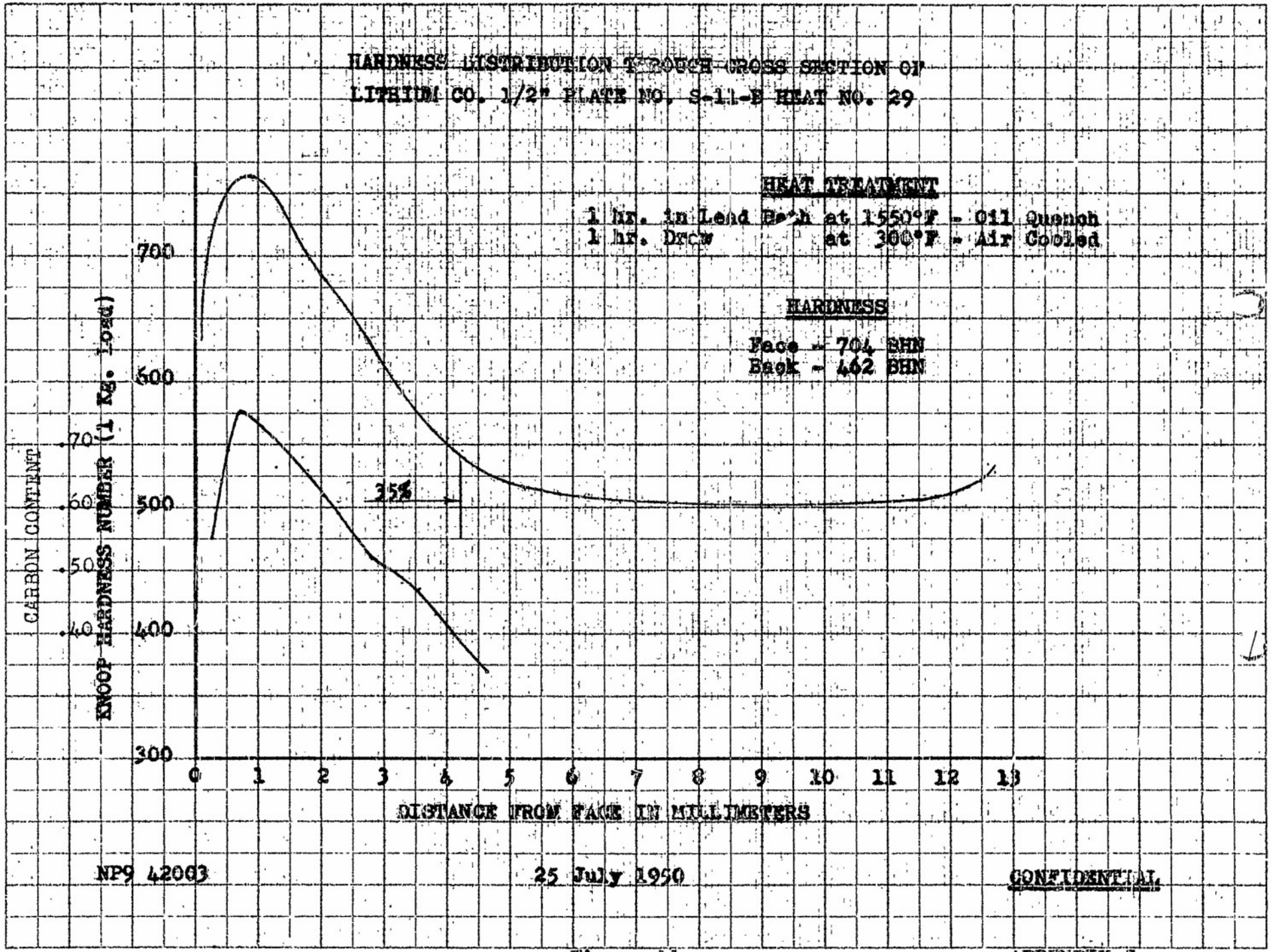
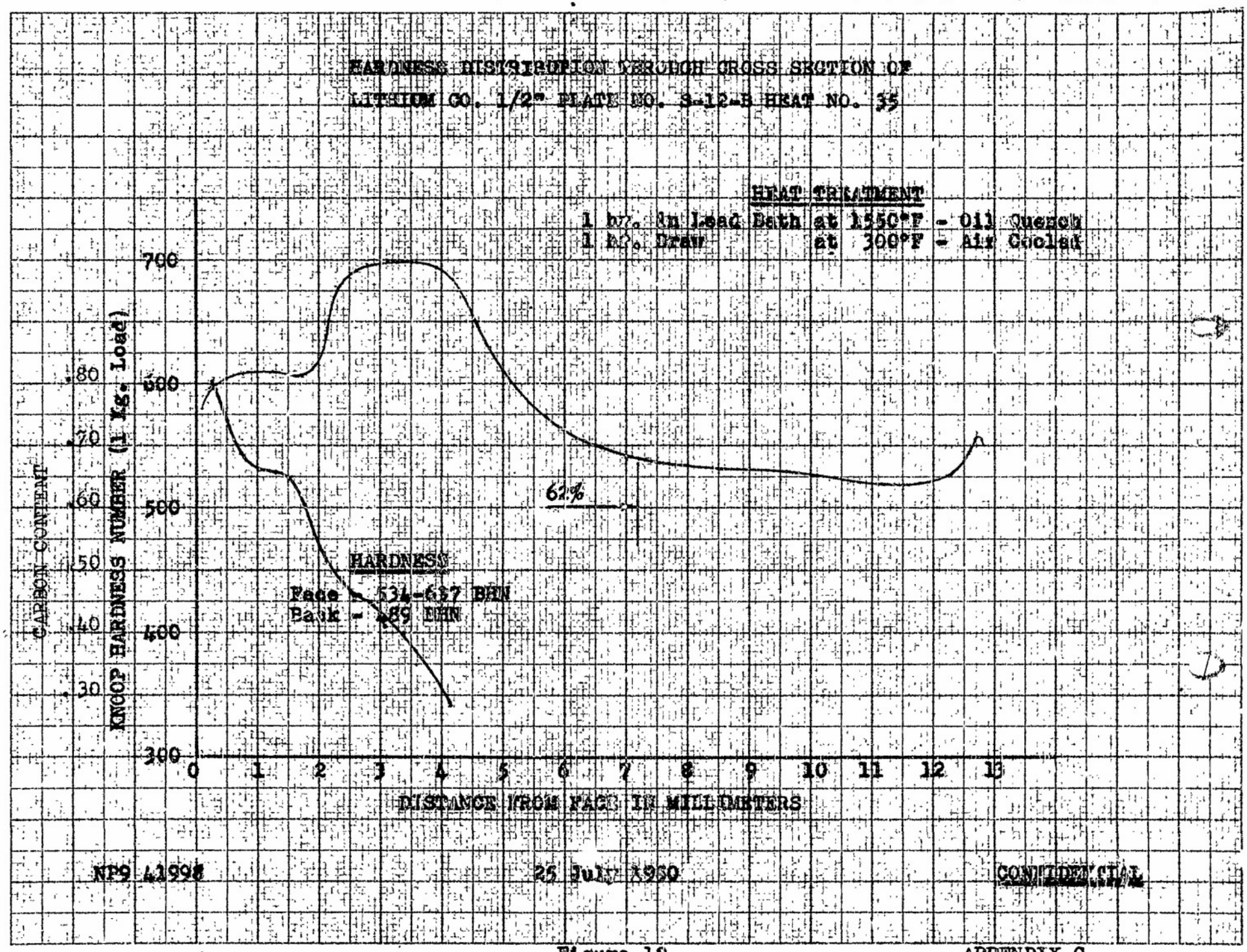


Figure 11.

APPENDIX C

HARDNESS DISTRIBUTION THROUGH CROSS SECTION OF
LITHIUM CO. 1/2" PLATE NO. 3-12-B HEAT NO. 35

HEAT TREATMENT
1 hr. @ Load Bath at 1550°F - Oil Quench
1 hr. Draw at 300°F - Air Cooled



NP9 41998 25 July 1950 CONFIDENTIAL

Figure 12.

APPENDIX C

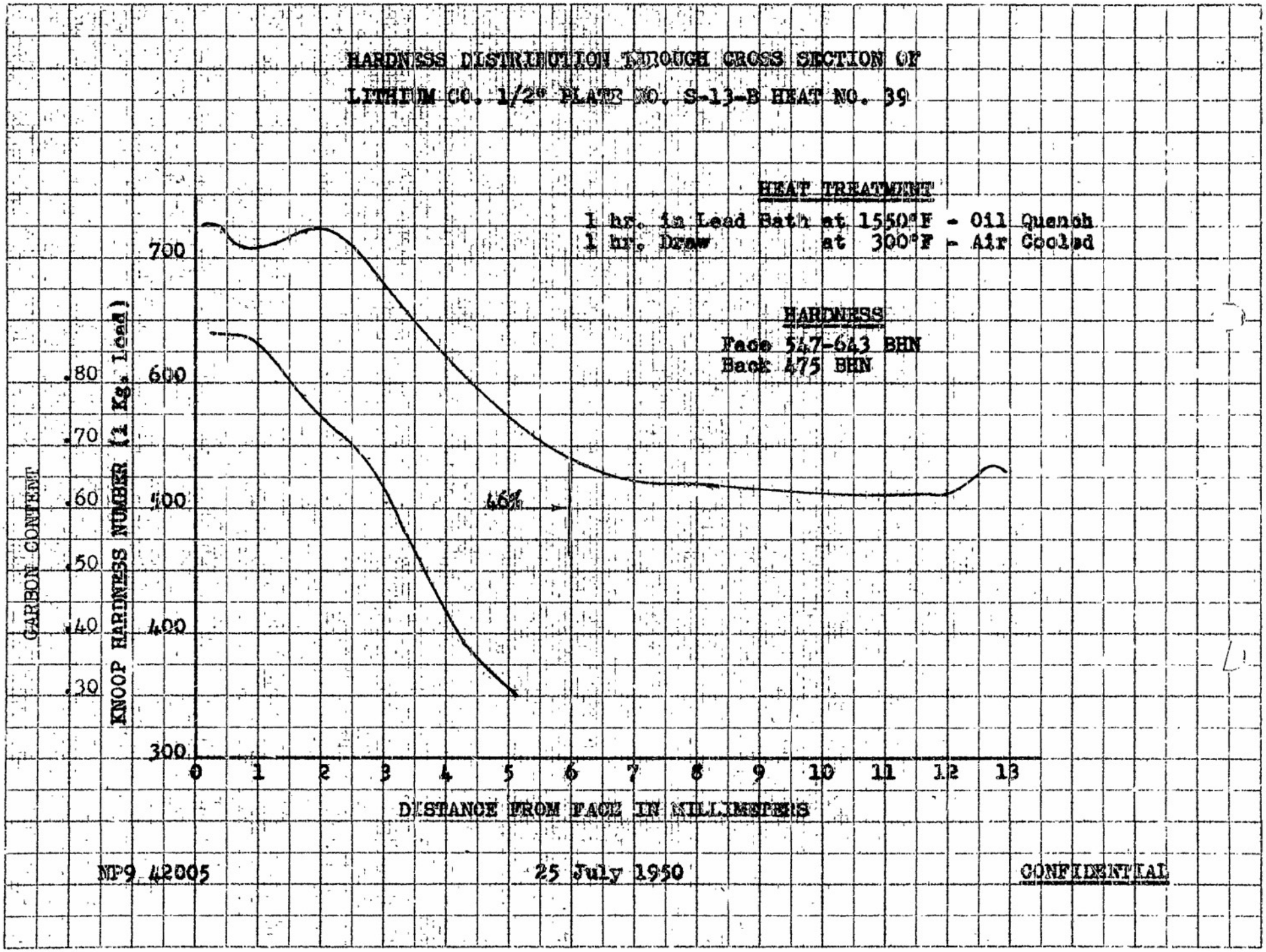

HARDNESS DISTRIBUTION THROUGH CROSS SECTION OF
LITHIUM CO. 1/2" PLATE NO. S-13-B HEAT NO. 39
HEAT TREATMENT
1 hr. in Lead Bath at 1550°F - Oil Quench
1 hr. Draw at 300°F - Air Cooled
HARDNESS
Face 547-643 BHN
Back 475 BHN
KNOOP HARDNESS NUMBER (1 Kg. Load)
CARBON CONTENT
700
600
500
400
300
.80
.70
.60
.50
.40
.30
46%
0 1 2 3 4 5 6 7 8 9 10 11 12 13
DISTANCE FROM FACE IN MILLIMETERS
NP9 42005
25 July 1950
CONFIDENTIAL

Figure 13.

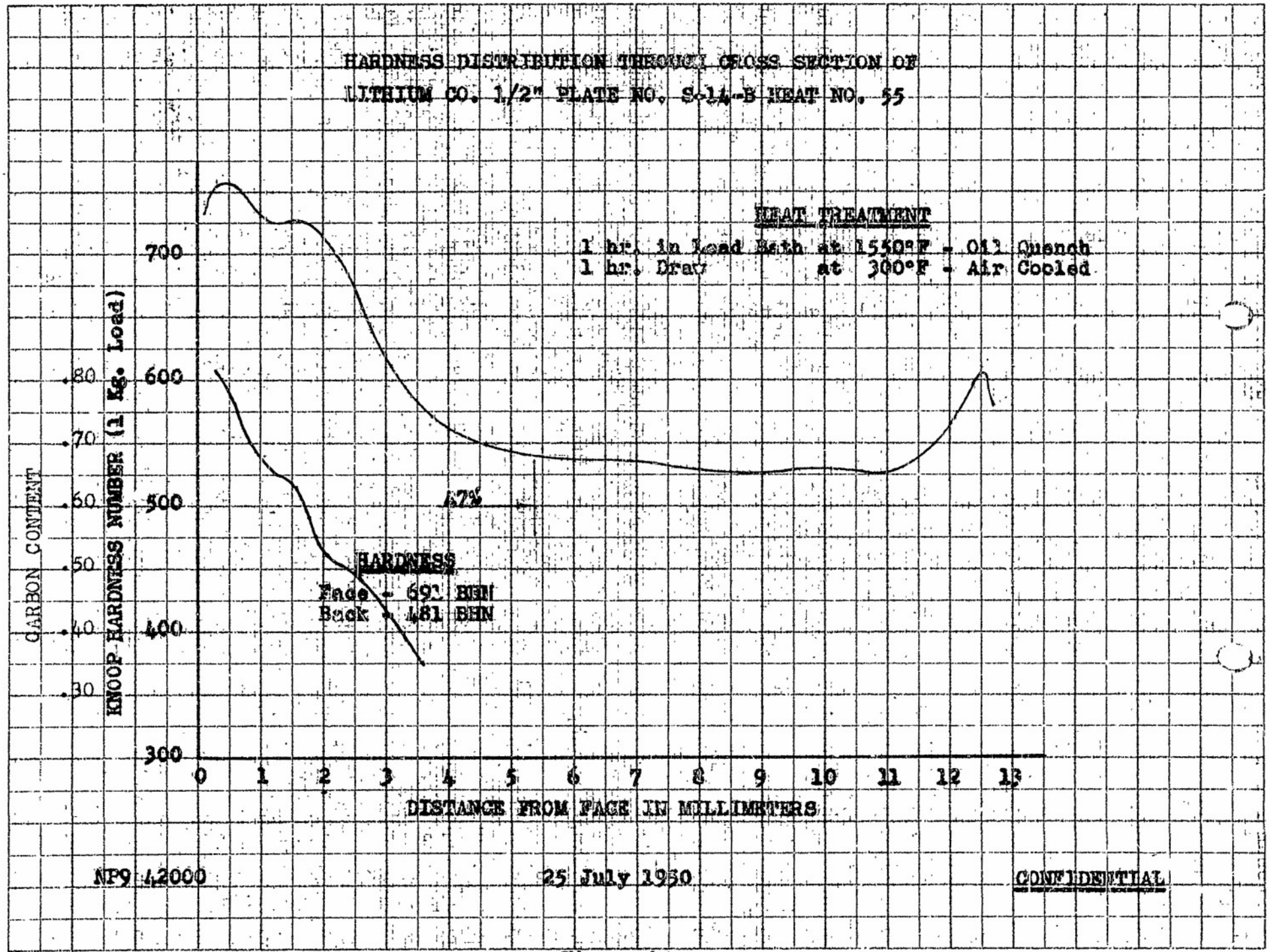

HARDNESS DISTRIBUTION THROUGH CROSS SECTION OF
LITHIUM CO. 1/2" PLATE NO. S-14-B HEAT NO. 55
HEAT TREATMENT
1 hr. in Lead Bath at 1550°F - Oil Quench
1 hr. Draw at 300°F - Air Cooled
KNOOP HARDNESS NUMBER (1 Kg. Load)
CARBON CONTENT
700
600
500
400
300
.80
.70
.60
.50
.40
.30
47%
HARDNESS
Face - 692 BHN
Back - 481 BHN
0 1 2 3 4 5 6 7 8 9 10 11 12 13
DISTANCE FROM FACE IN MILLIMETERS
NP9 42000
25 July 1950
CONFIDENTIAL

Figure 14.

HARDNESS DISTRIBUTION THROUGH CROSS SECTION OF
LITHIUM CO. 1/2" PLATE NO. S-15-B HEAT NO. 56

HEAT TREATMENT

1 hr. In Lead Bath at 1550°F - Oil Quench
1 hr. Draw at 300°F - Air Cooled

HARDNESS

Face - 655 BHN
Back - 495 BHN

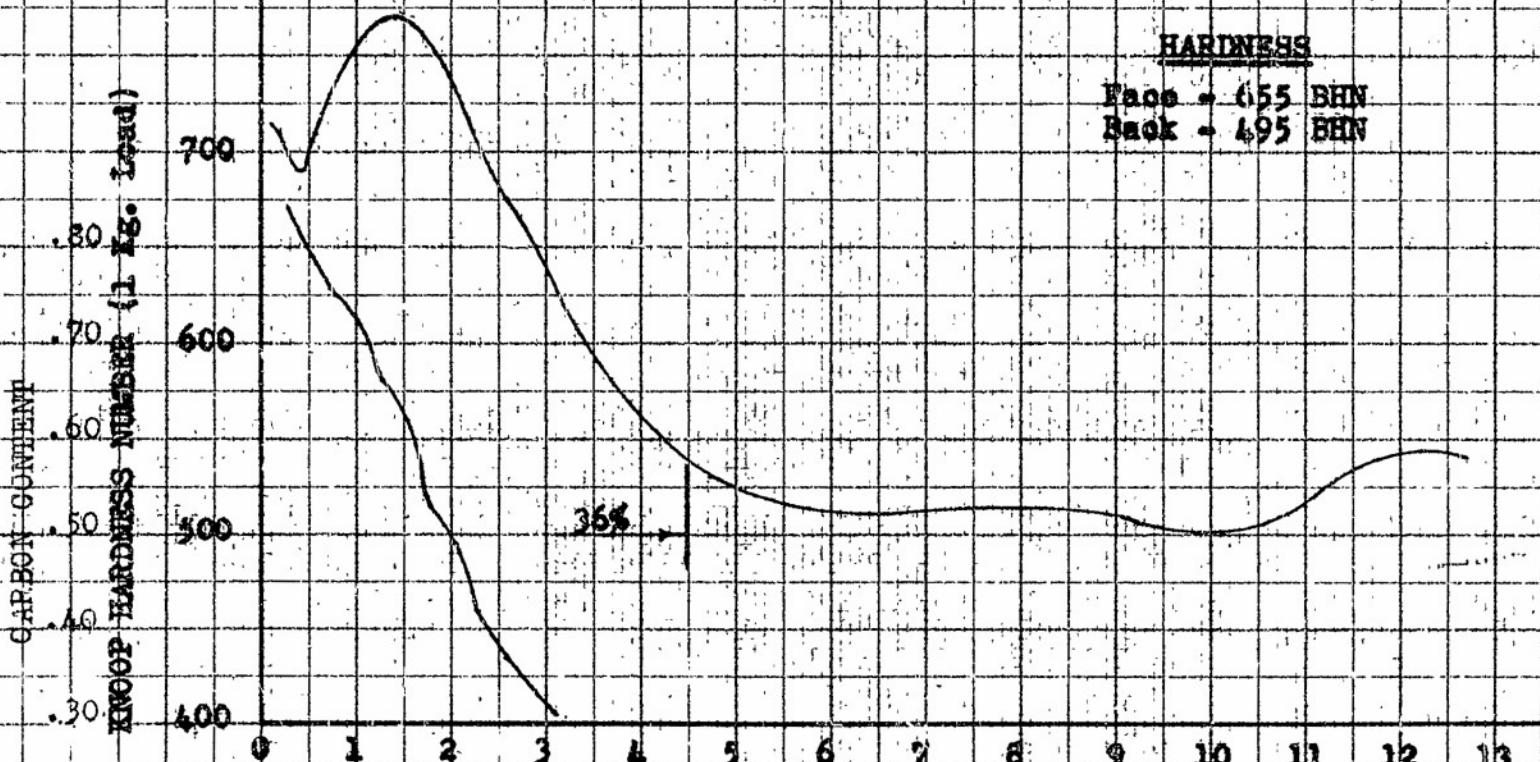


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Figure 15.

APPENDIX C

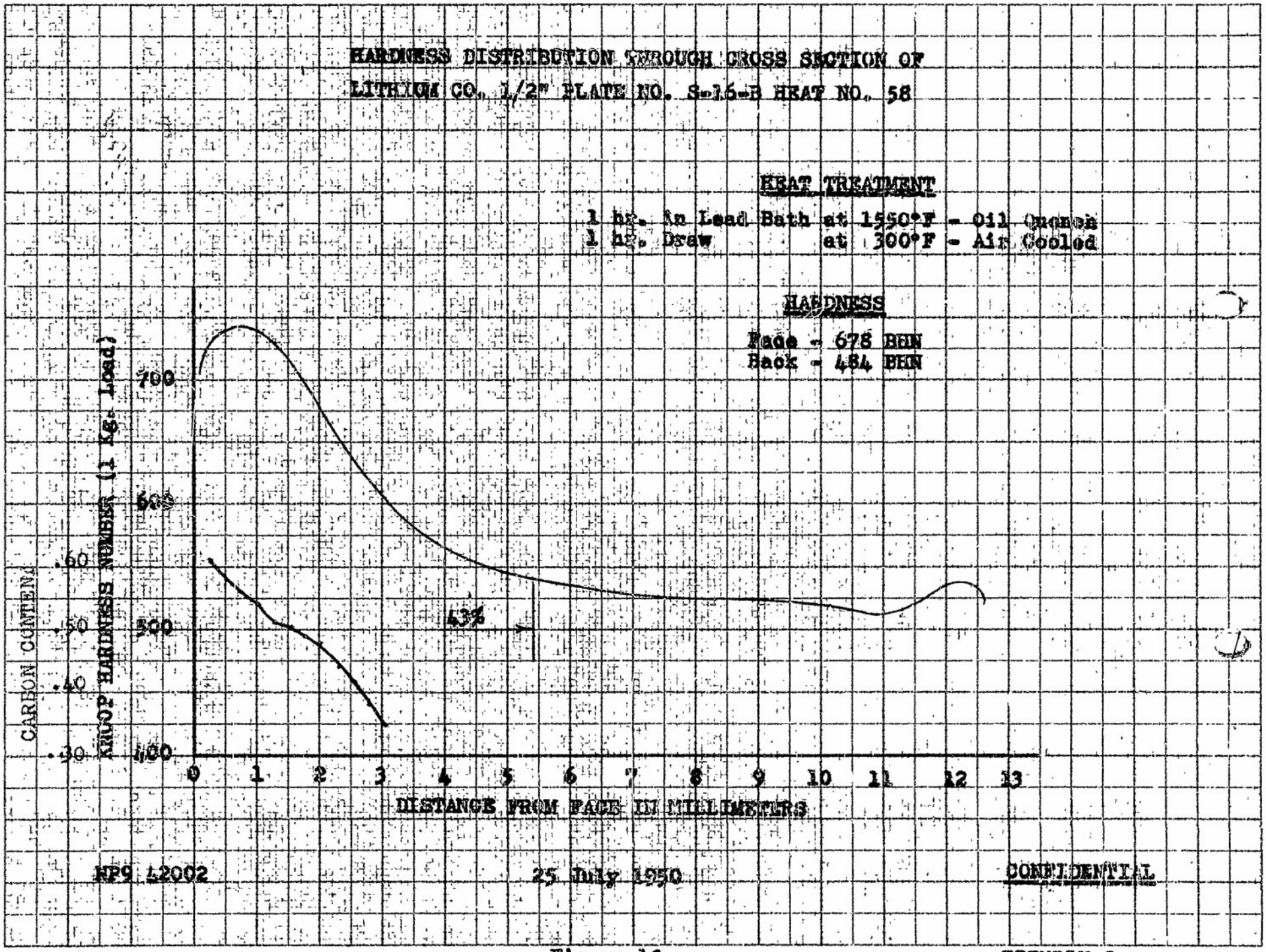


Figure 16.

APPENDIX C

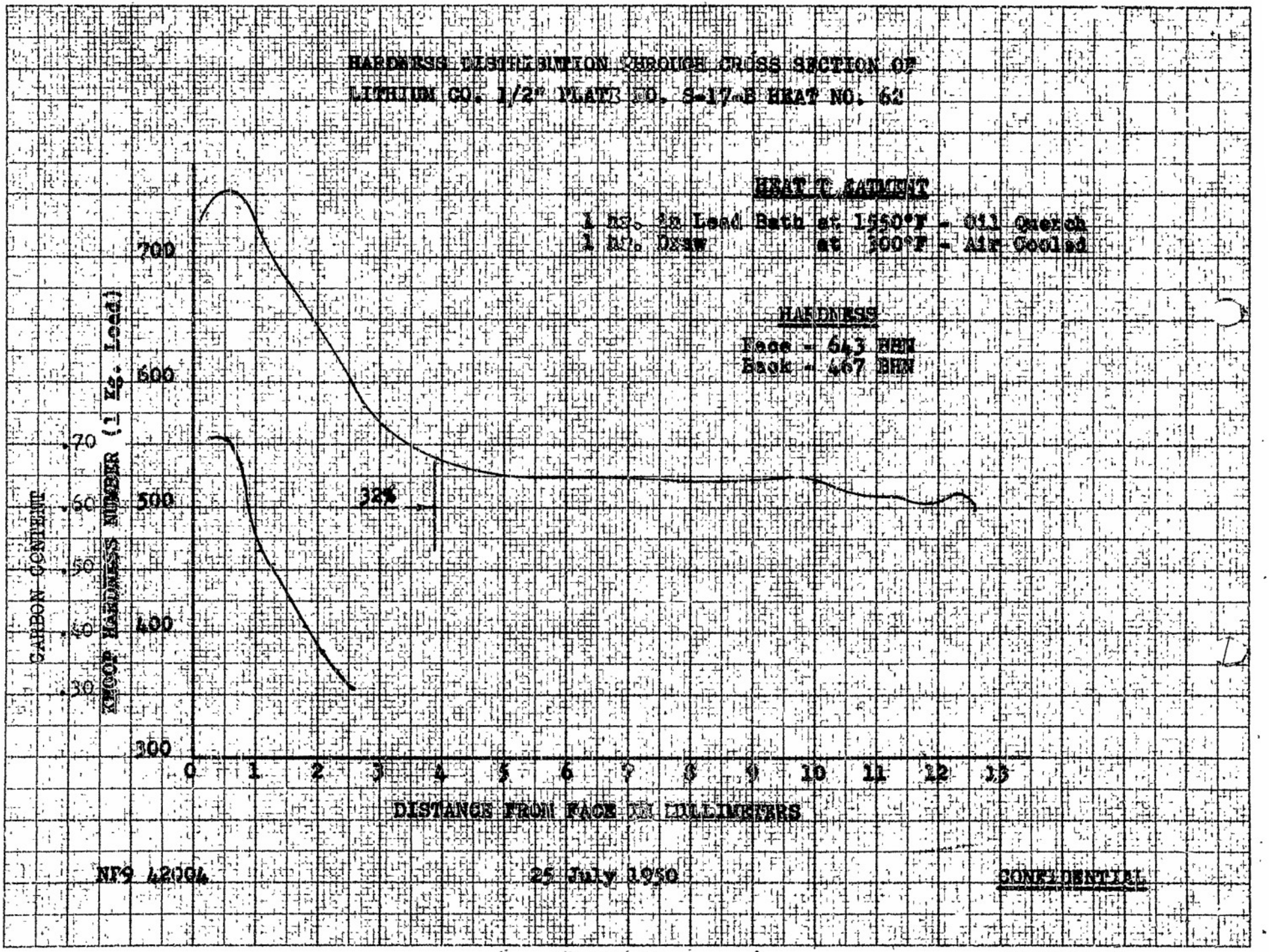


Figure 17.

APPENDIX C

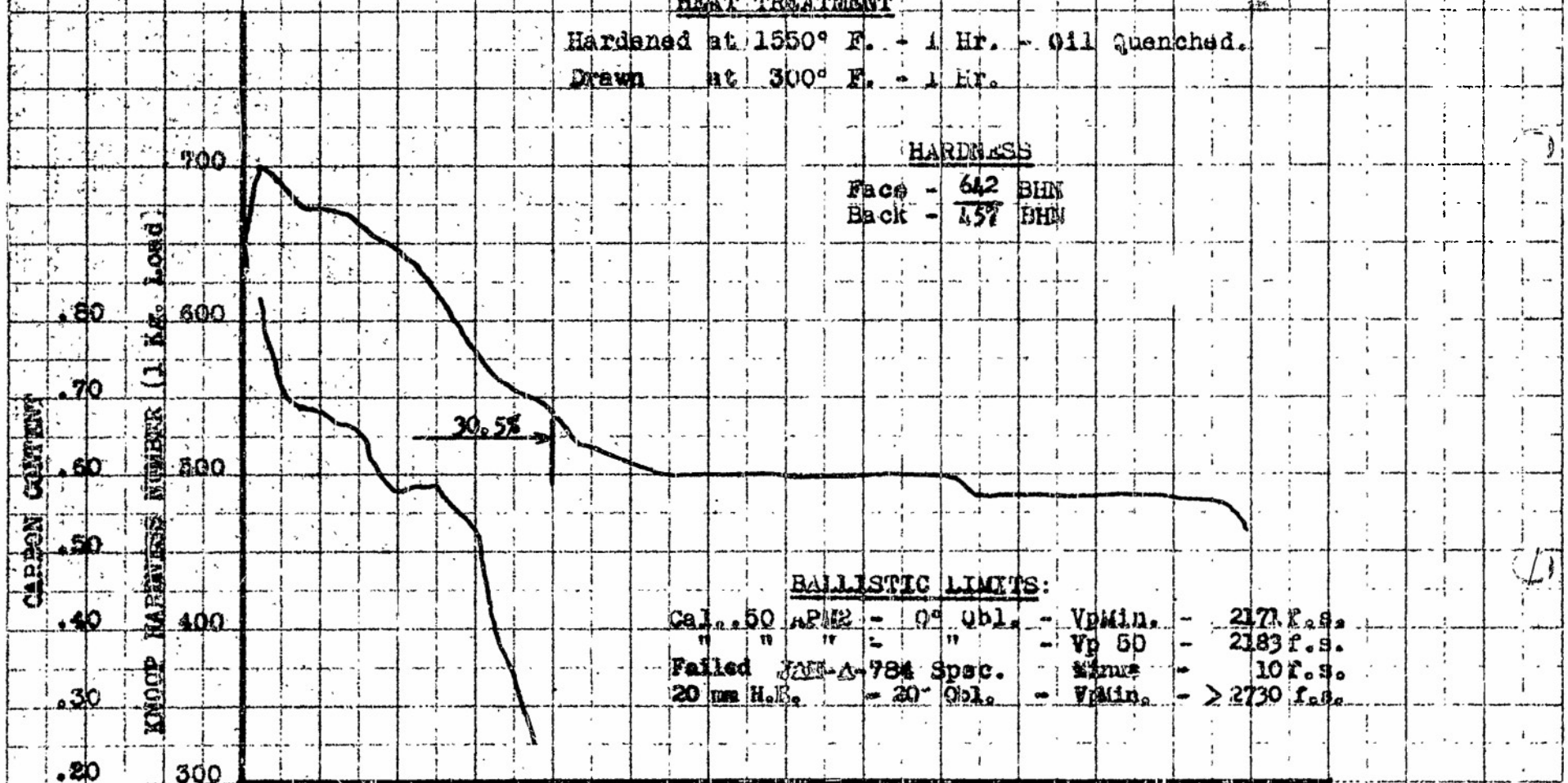
HARDNESS DISTRIBUTION THROUGH CROSS SECTION OF
LITHIUM CO. .512" PLATE NO. P-1-A HEAT NO. 64

HEAT TREATMENT

Hardened at 1550° F. - 1 Hr. - Oil Quenched.
Drawn at 300° F. - 1 Hr.

HARDNESS

Face - 642 BHN
Back - 457 BHN



BALLISTIC LIMITS:

Cal. .50 APHE - 0° Obl. - Vpmin. - 2171 f.s.
" " " - " - Vp 50 - 2183 f.s.
Failed MIL-A-46100 Spec. - Vmax - 10 f.s.
20 mm H.E. - 20° Obl. - Vpmin. - > 2730 f.s.

Figure 18

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APPENDIX C

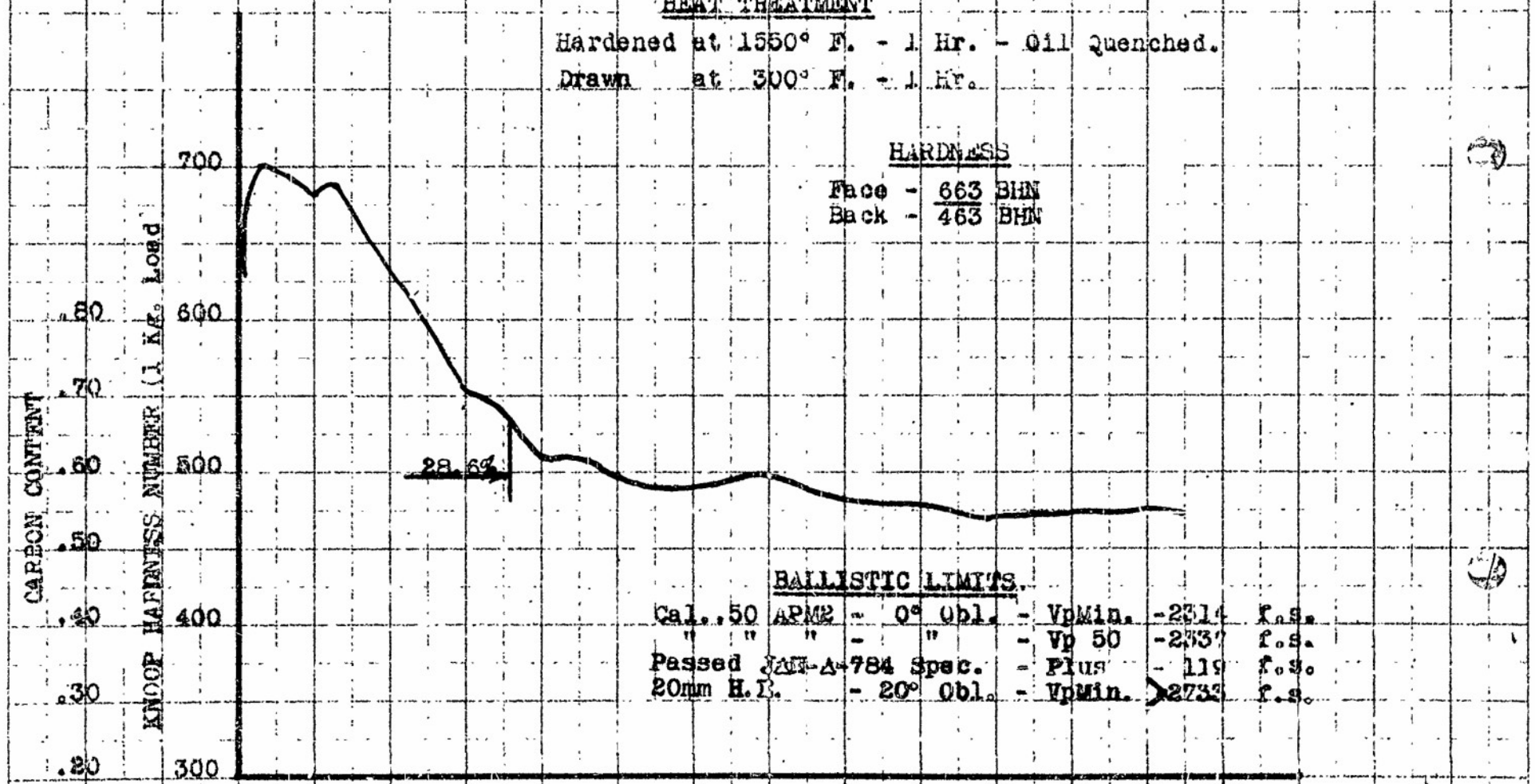
HARDNESS DISTRIBUTION THROUGH CROSS SECTION OF
LITHIUM CO. .513" PLATE NO. P-1-B HEAT NO. 64

HEAT TREATMENT

Hardened at 1550° F. - 1 Hr. - Oil Quenched.
Drawn at 300° F. - 1 Hr.

HARDNESS

Face - 663 BHN
Back - 463 BHN



BALLISTIC LIMITS.

Cal..50 APM2	- 0° Obl.	- VpMin.	-2314	f.s.
" " "	- "	- Vp 50	-2337	f.s.
Passed JAN-A-784 Spec.		- Plus	- 119	f.s.
20mm H.E.	- 20° Obl.	- VpMin.	>2733	f.s.

Figure 19.

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APPENDIX C

HARDNESS DISTRIBUTION THROUGH CROSS SECTION OF

LITHIUM CO. .513 " PLATE NO. 2-6-A HEAT NO. 61

HEAT TREATMENT

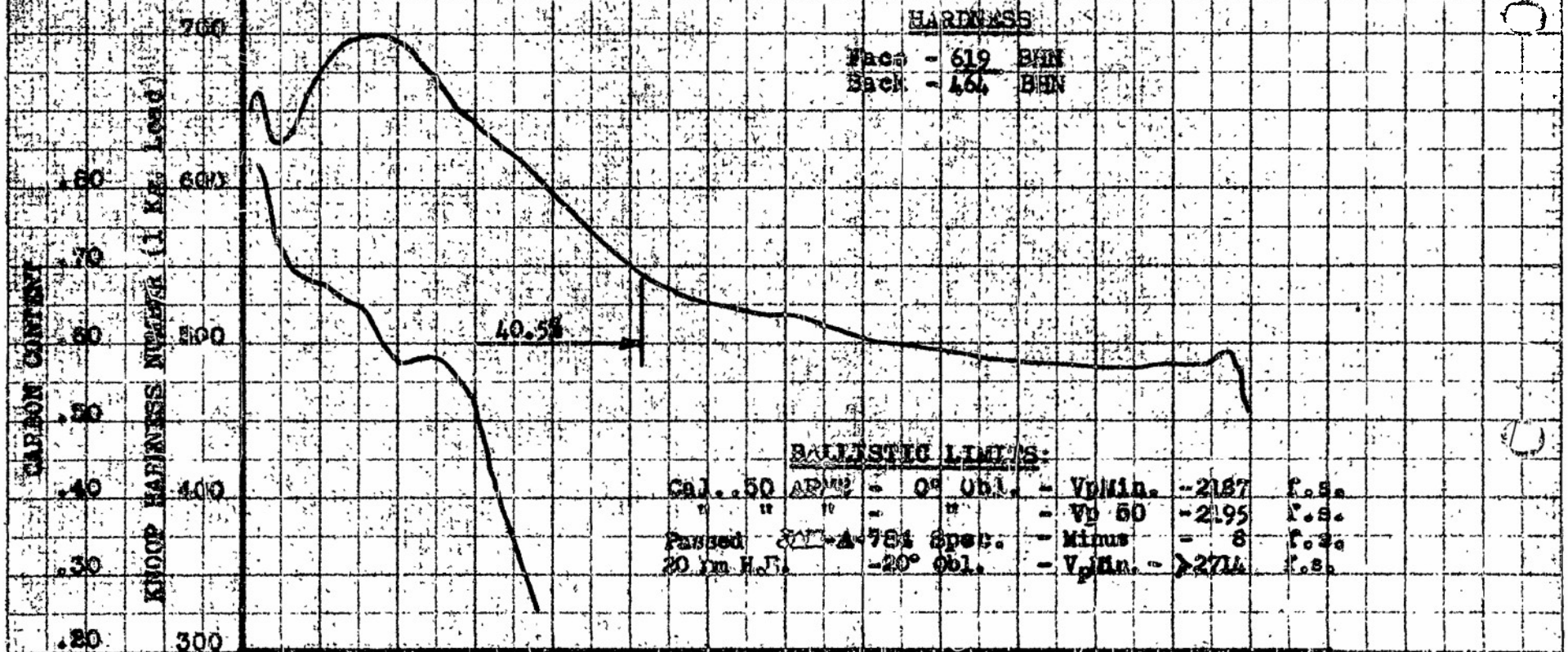
Hardened at 1550° F. - 1 Hr. - Oil Quenched.

Drawn at 800° F. - 1 Hr.

HARDNESS

Face - 619 BHN

Back - 464 BHN



BALLISTIC LIMITS:

Cal. .50 AP M2	- 0° Obl.	- V_p Min.	-2187	f.s.
" " "	- "	- V_p 50	-2195	f.s.
Passed 30-A-78A Spec.	- Minus	-	8	f.s.
20 mm H.E.	-20° Obl.	- V_p Min. -	>2714	f.s.

Figure 20

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APPENDIX C

HARDNESS DISTRIBUTION THROUGH CROSS SECTION OF

LITHIUM CO. .515" PLATE NO. P-2-S HEAT NO. 64

HEAT TREATMENT

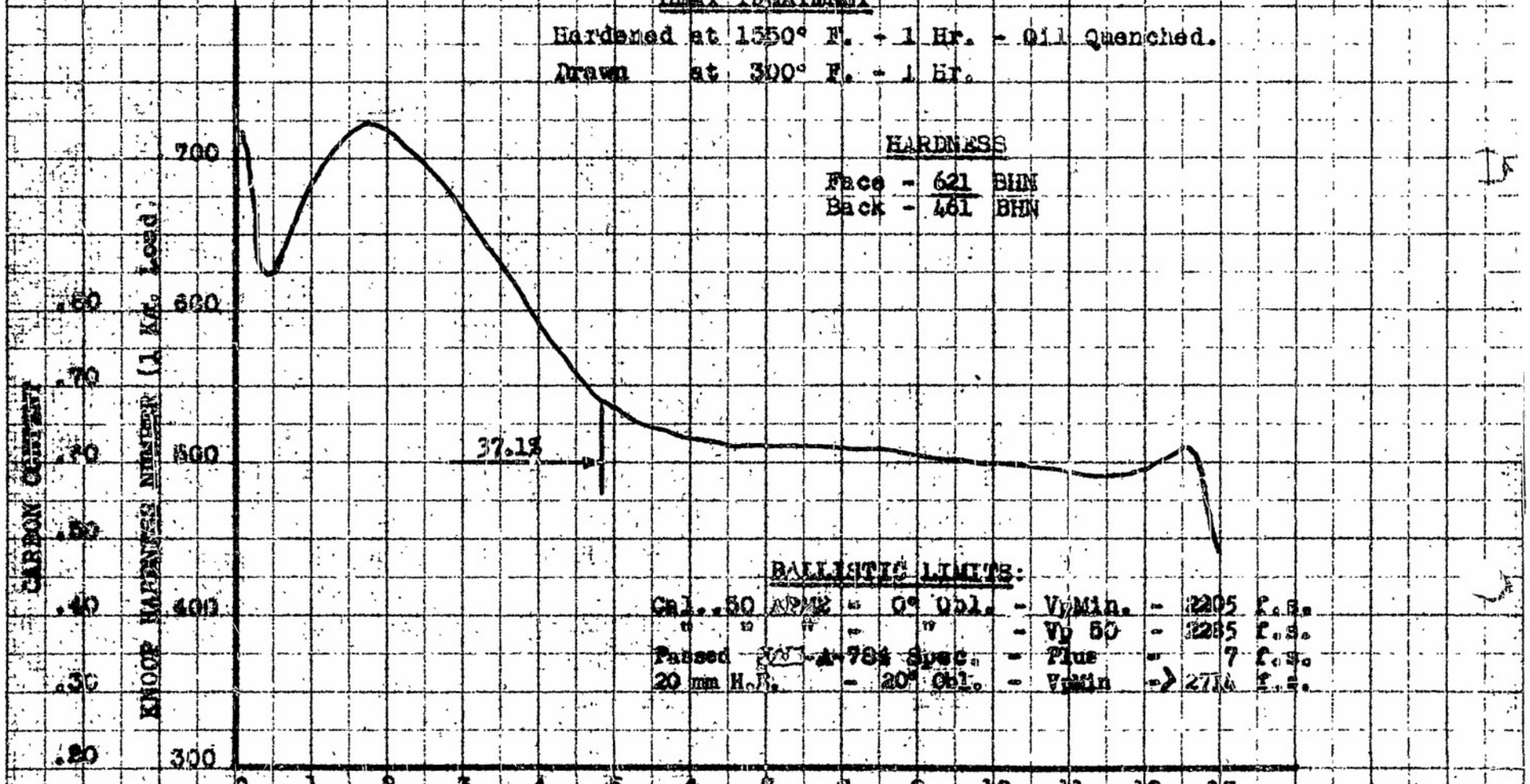
Hardened at 1550° F. + 1 Hr. - Oil Quenched.

Drawn at 300° F. + 1 Hr.

HARDNESS

Face - 621 BHN

Back - 461 BHN



BALLISTIC LIMITS:

Cal..50 APM2 @ 0° Obl. - V_p Min. - 2205 f.s.

" " " " - V_p 50 - 2285 f.s.

Passed MIL-A-46% Spec. - Plus - 7 f.s.

20 mm H.E. - 20° Obl. - V_p Min. -> 2710 f.s.

Figure 31

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APPENDIX C

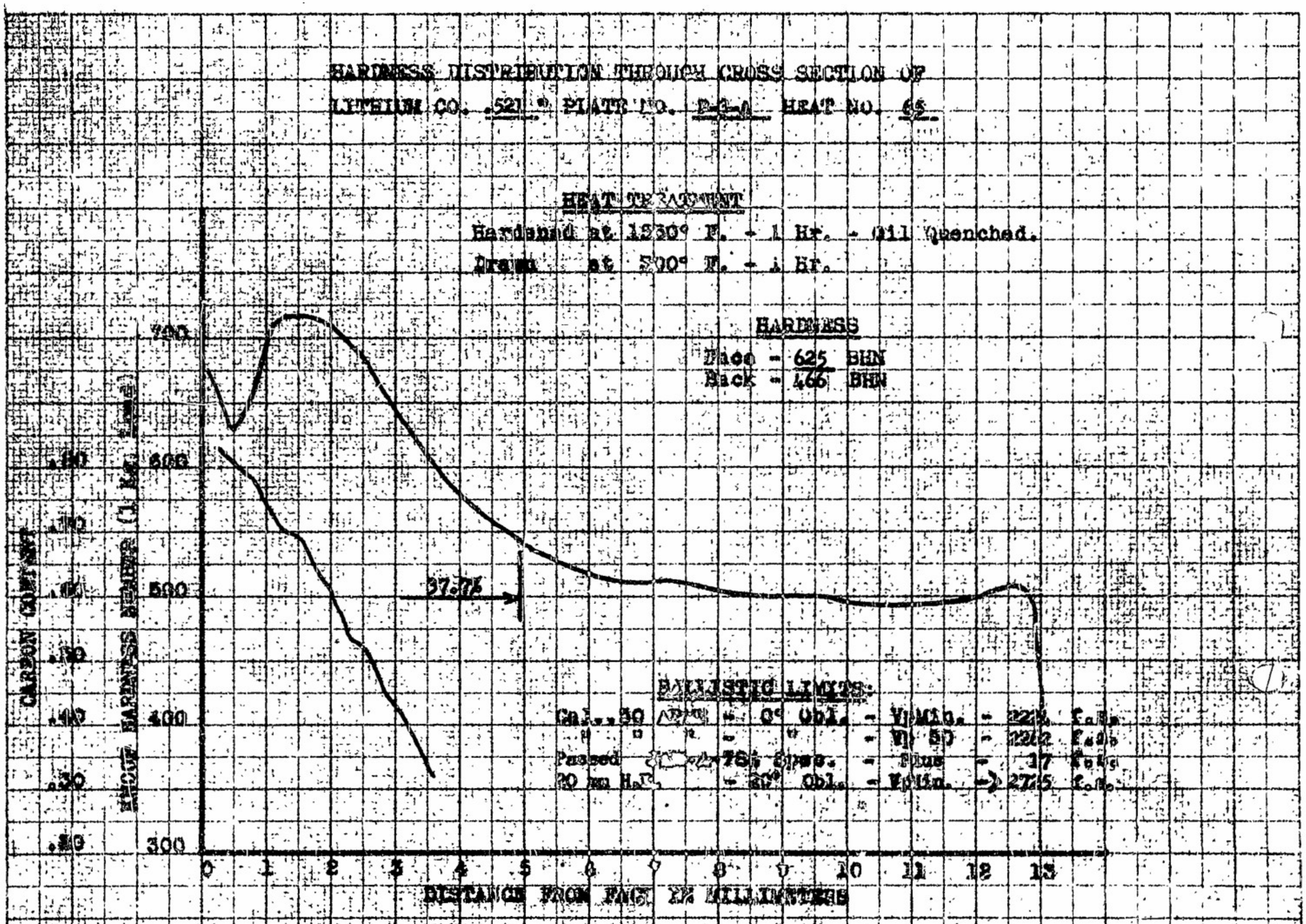

Figure 22

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APPENDIX C

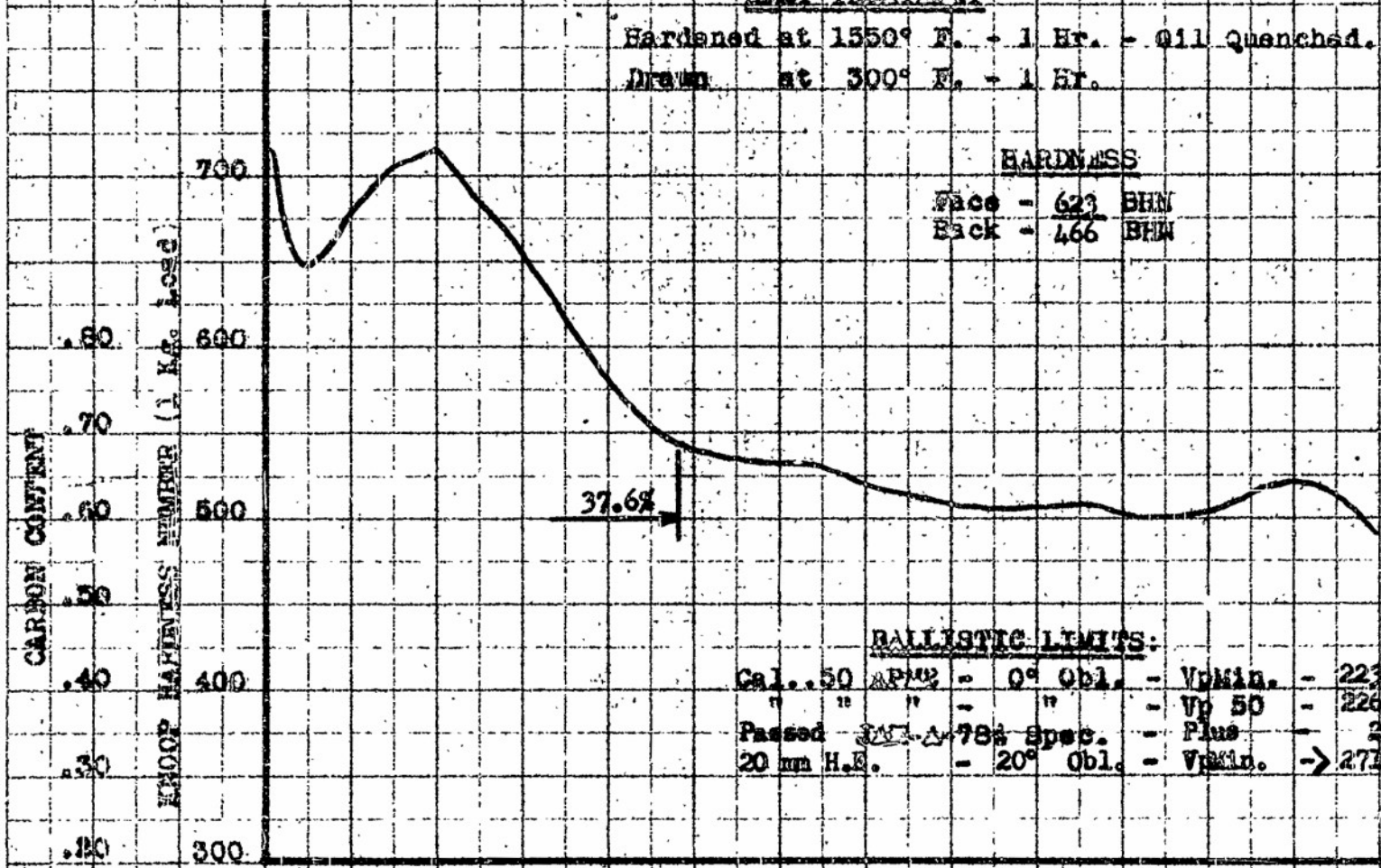
HARDNESS DISTRIBUTION THROUGH CROSS SECTION OF
LITHIUM CO. .524" PLATE NO. P-3-B HEAT NO. 65

HEAT TREATMENT

Hardened at 1550° F. + 1 Hr. - Oil Quenched.
Drawn at 300° F. + 1 Hr.

HARDNESS

Face - 623 BHN
Back - 466 BHN



BALLISTIC LIMITS:

Cal..50 AP	- 0° Obl.	- V50Min.	- 2234	f.s.
" " "	- "	- V50	- 2269	f.s.
Passed [illegible]	78% Spec.	- Plus	- 23	f.s.
20 mm H.E.	- 20° Obl.	- V50Min.	-> 2714	f.s.

Figure 23

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APPENDIX C

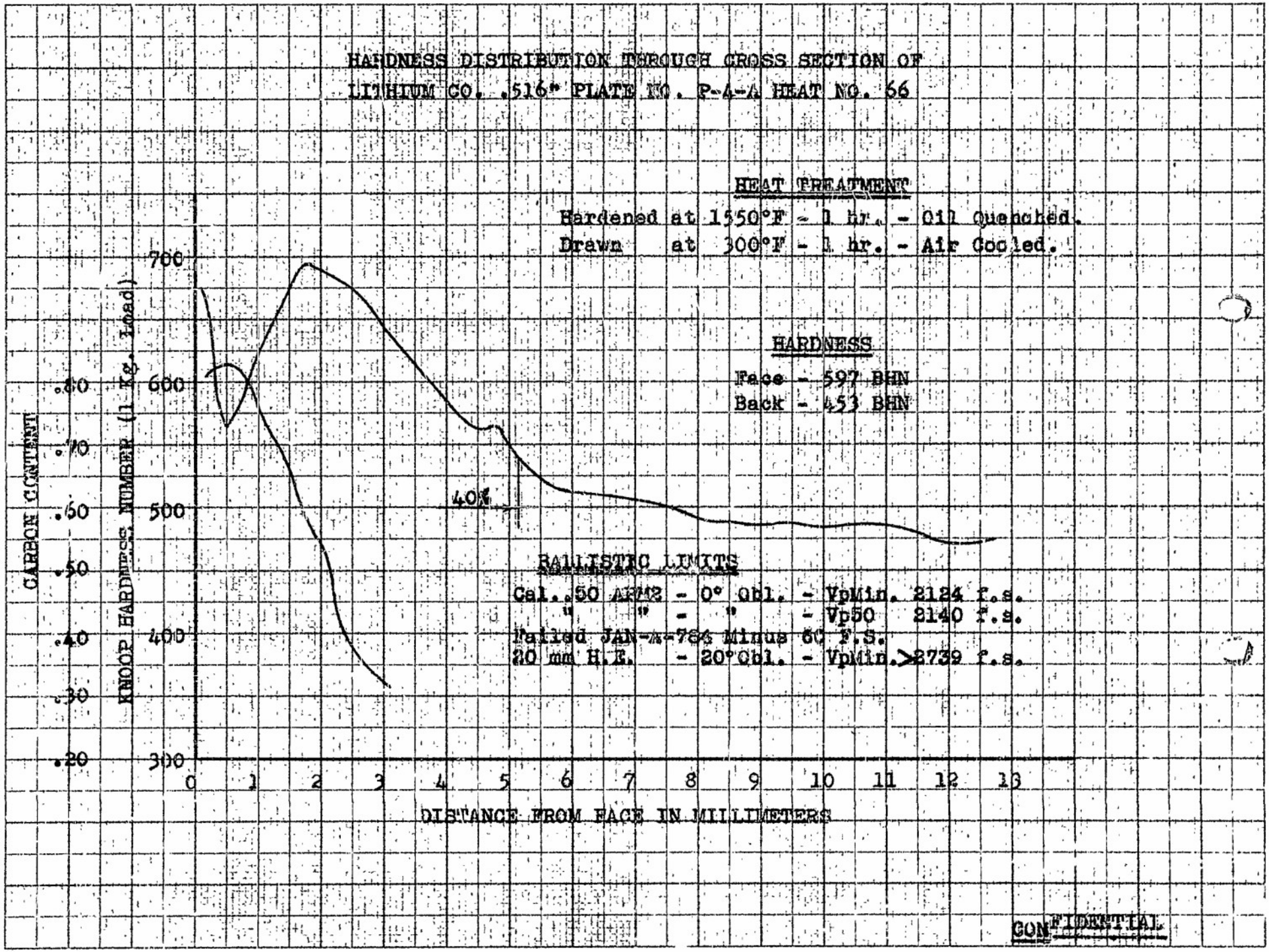

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Figure 24.

APPENDIX C

HARDNESS DISTRIBUTION THROUGH CROSS SECTION OF
LITHIUM CO. 1/2" (.516") PLATE NO. P-4-A HEAT NO. 66

HEAT TREATMENT

Hardened at 1550°F - 1 hr. - Water Quenched.
Drawn at 300°F - 1 hr. - Air Cooled.

HARDNESS

Face - 627 BHN
Back - 460 BHN

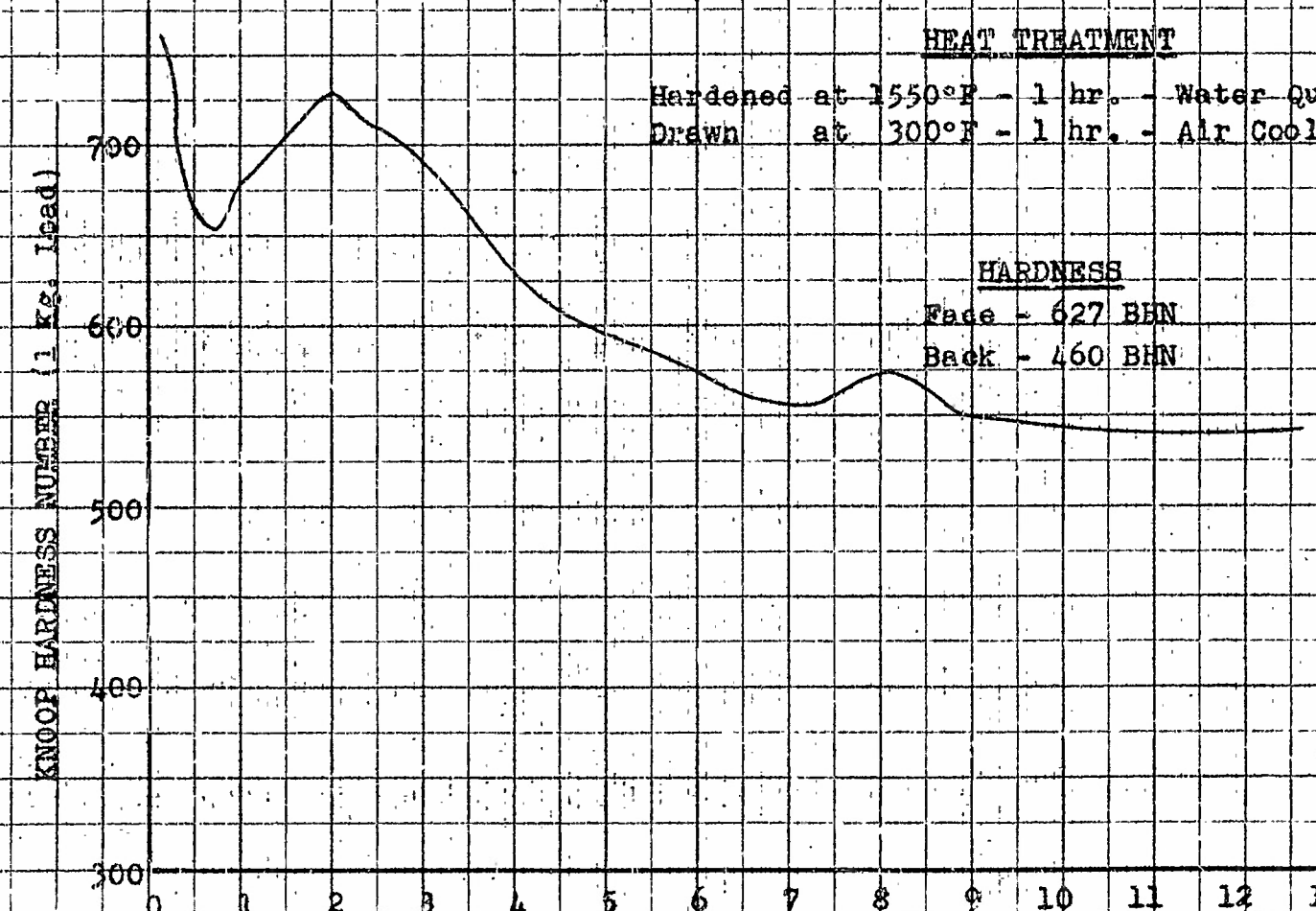

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Figure 24-A

APPENDIX C

HARDNESS DISTRIBUTION THROUGH CROSS SECTION OF

LITHIUM CO. .515" PLATE NO. P-4-H HEAT NO. 66

HEAT TREATMENT

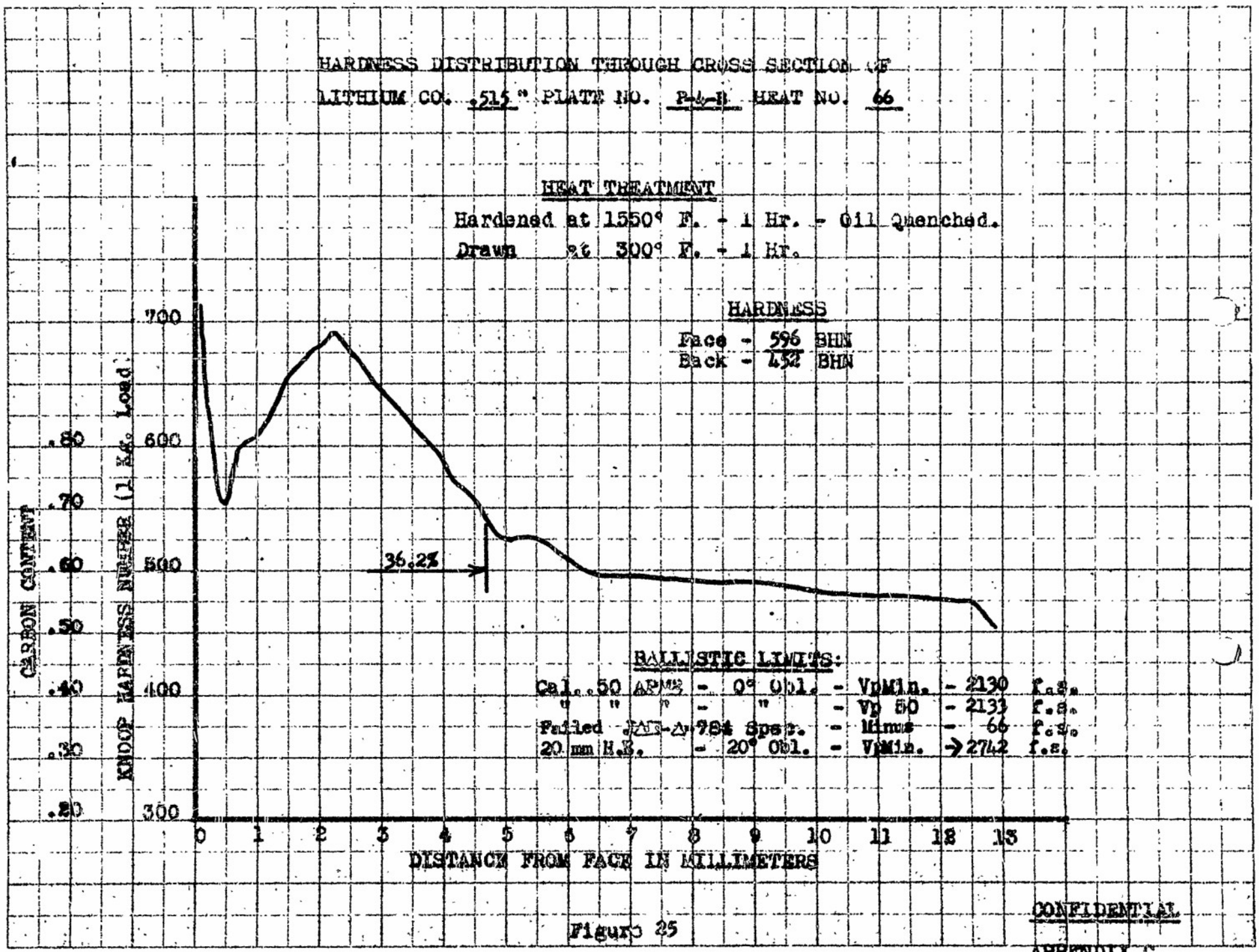
Hardened at 1550° F. - 1 Hr. - Oil Quenched.

Drawn at 300° F. - 1 Hr.

HARDNESS

Face - 596 BHN

Back - 452 BHN



BALLISTIC LIMITS:

Cal. .50 APM2	- 0° Obl.	- V50Min.	- 2130	f.s.
" " "	- "	- V50	- 2133	f.s.
Failed .45-A-784 Spec.	- Minus	-	66	f.s.
20 mm H.E.	- 20° Obl.	- V50Min.	→ 2742	f.s.

Figure 25

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APPENDIX C

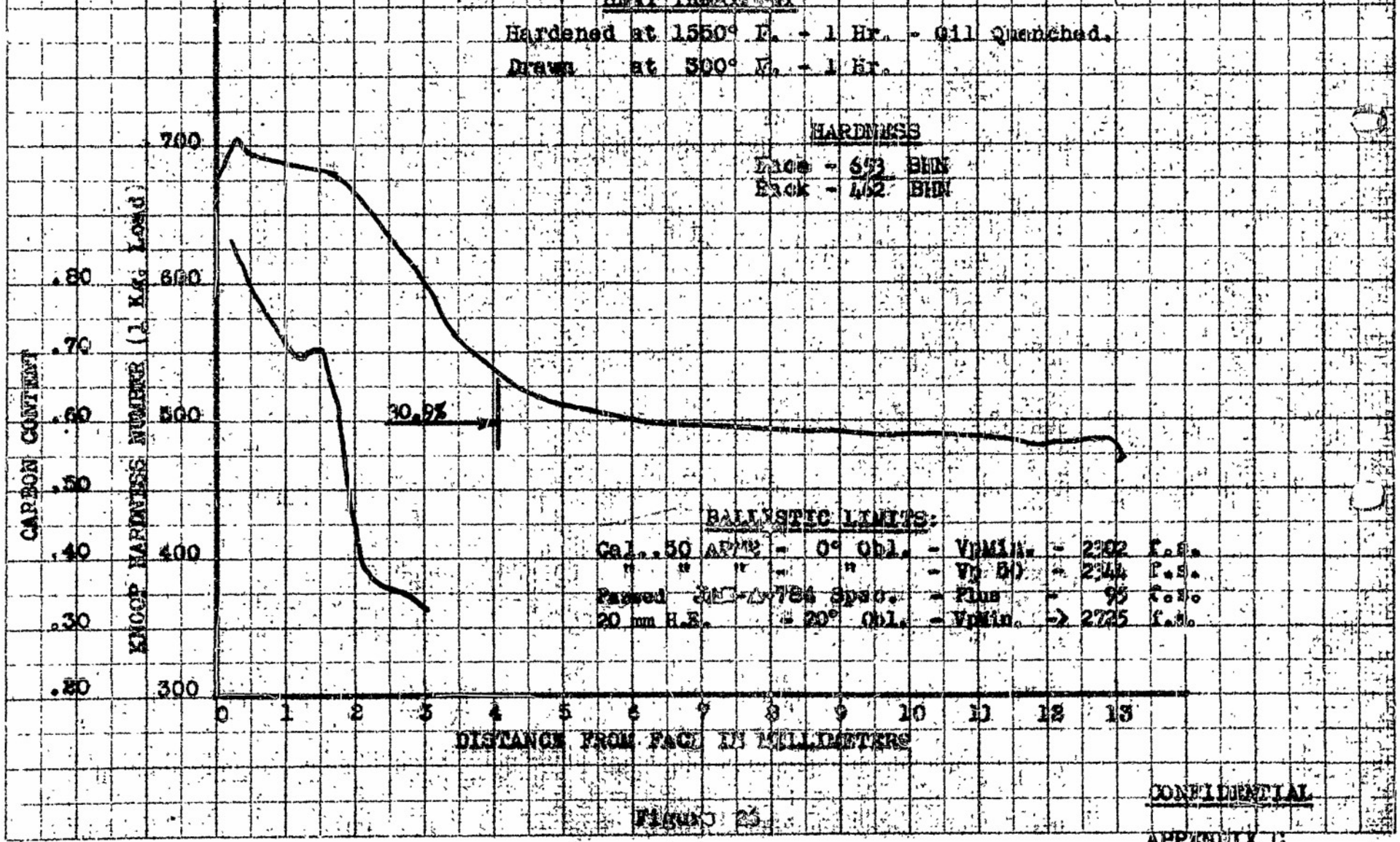
HARDNESS DISTRIBUTION THROUGH CROSS SECTION OF
LITHIUM CO. .50" PLATE NO. [illegible] HEAT NO. 66

HEAT TREATMENT

Hardened at 1550° F. - 1 Hr. - Oil Quenched.
Drawn at 500° F. - 1 Hr.

HARDNESS

Face - 653 BHN
Back - 402 BHN



BALLISTIC LIMITS:

Cal. .50 AP M2 - 0° Obl. - V50 Min. - 2302 f.s.
" " " " - " - V50 Max. - 2344 f.s.
Passed MIL-A-12484 Spec. - Plus - 9% f.s.
20 mm H.E. - 20° Obl. - V50 Min. -> 2725 f.s.

Figure 25

CONFIDENTIAL

APPENDIX C

HARDNESS DISTRIBUTION THROUGH CROSS SECTION OF

LITHIUM CO. .515 " PLATE NO. K-5-B HEAT NO. 66

HEAT TREATMENT

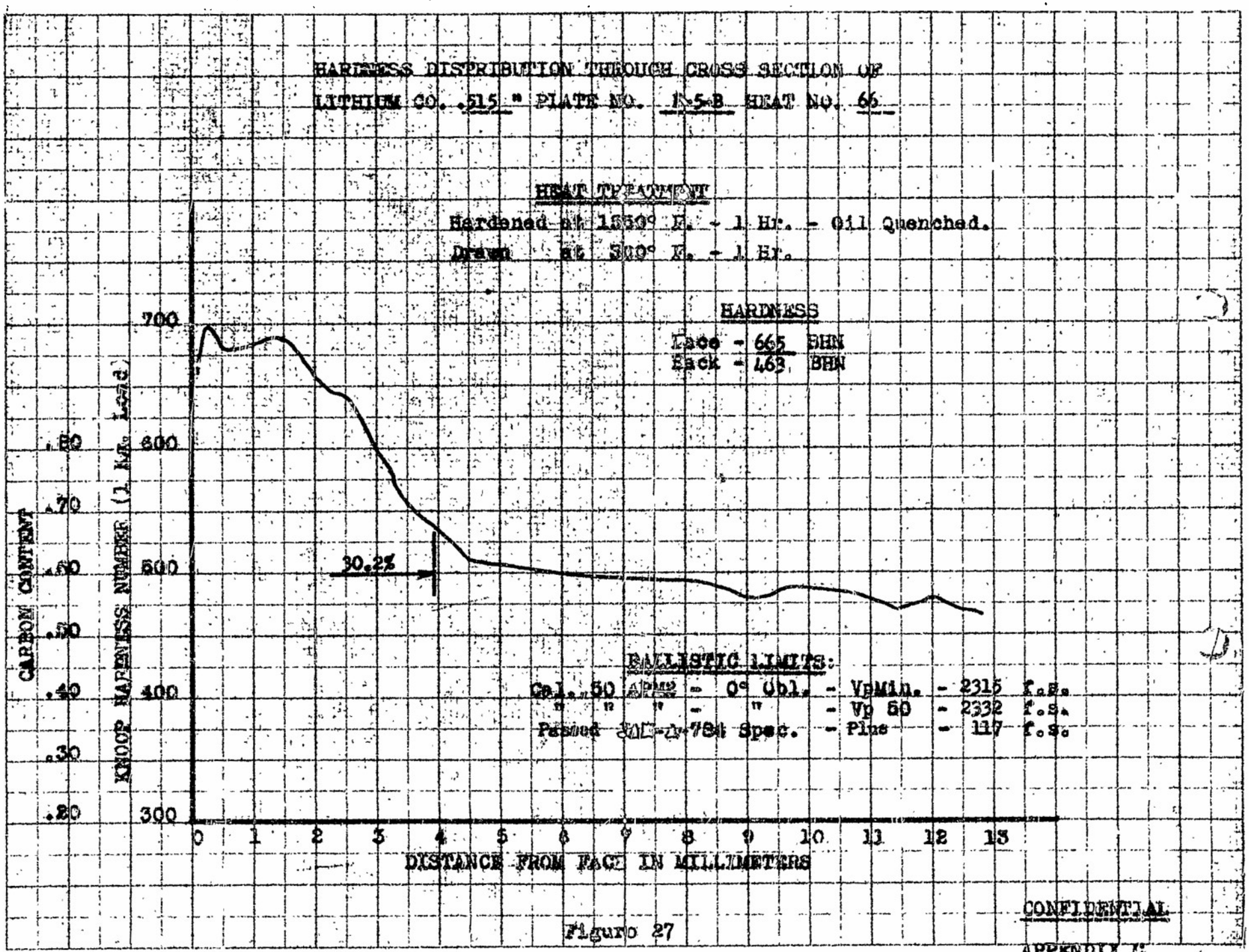
Hardened at 1550° F. - 1 Hr. - Oil Quenched.

Drawn at 300° F. - 1 Hr.

HARDNESS

Face - 665 BHN

Back - 463 BHN



BALLISTIC LIMITS:

Cal. .50 APHE - 0° Obl. - VpMin. - 2315 f.s.

" " " - " - Vp 50 - 2332 f.s.

Passed MIL-A-46100 Spec. - Plus - 117 f.s.

Figure 27

CONFIDENTIAL

APPENDIX C

HARDNESS DISTRIBUTION THROUGH CROSS SECTION OF

LITHIUM CO. .22" PLATE NO. 2 HEAT NO. 66

HEAT TREAT

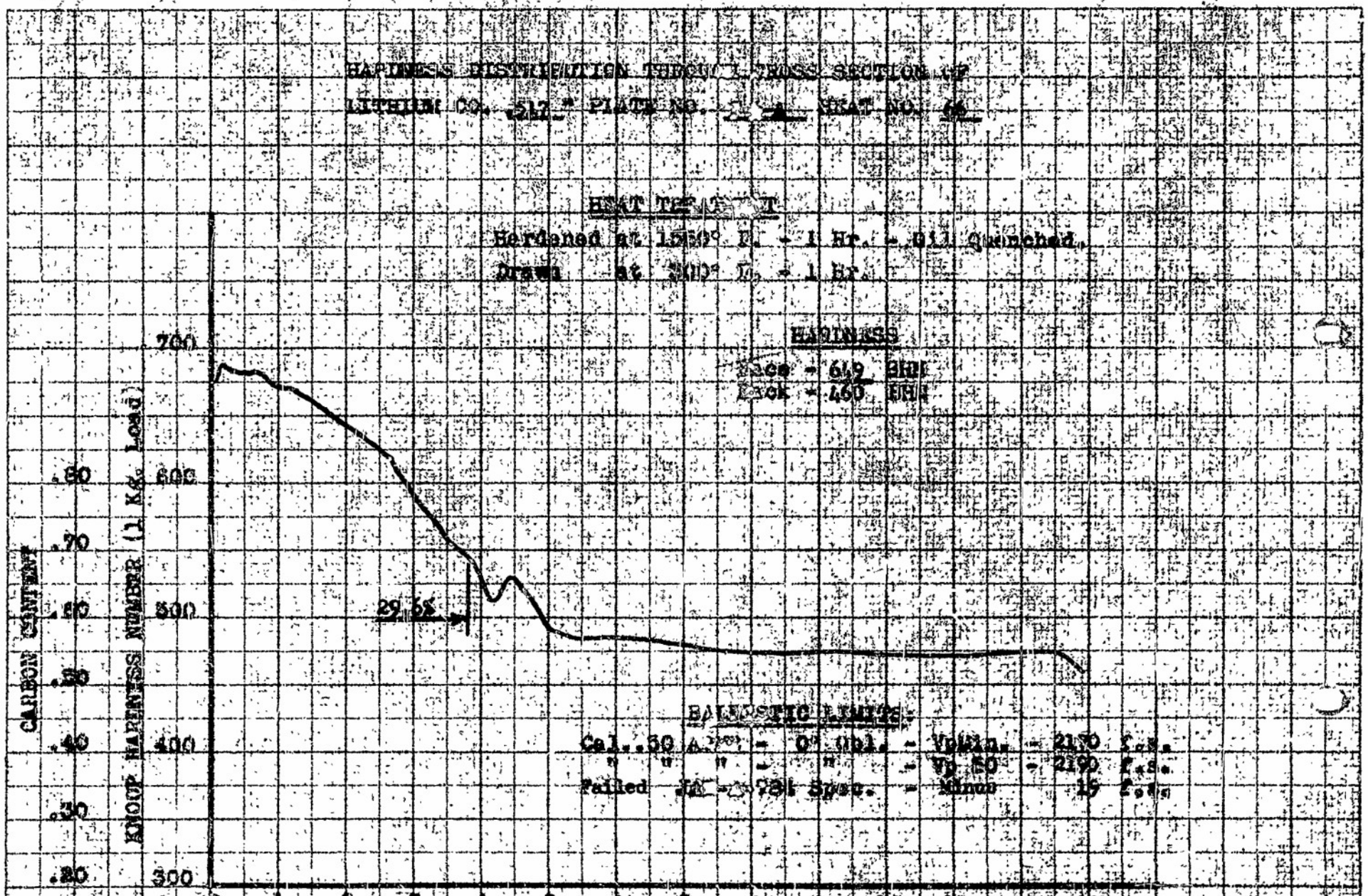
Hardened at 1550° F. - 1 Hr. - Oil Quenched.

Drawn at 300° F. - 1 Hr.

HARDNESS

Face - 649 BHN

Back - 460 BHN



BALLISTIC LIMITS:

Cal. .30 A.P. (WC) - 0° Obl. - V50 in. - 2170 f.s.

" " " - " - V50 - 2190 f.s.

Failed AT - 78% Spec. - Minus - 19 f.s.

Figure 20

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APPENDIX C

HARDNESS DISTRIBUTION THROUGH CROSS SECTION OF

LITHIUM CO. .16 " PLATE NO. C-6-B HEAT NO. 66

HEAT TREATMENT

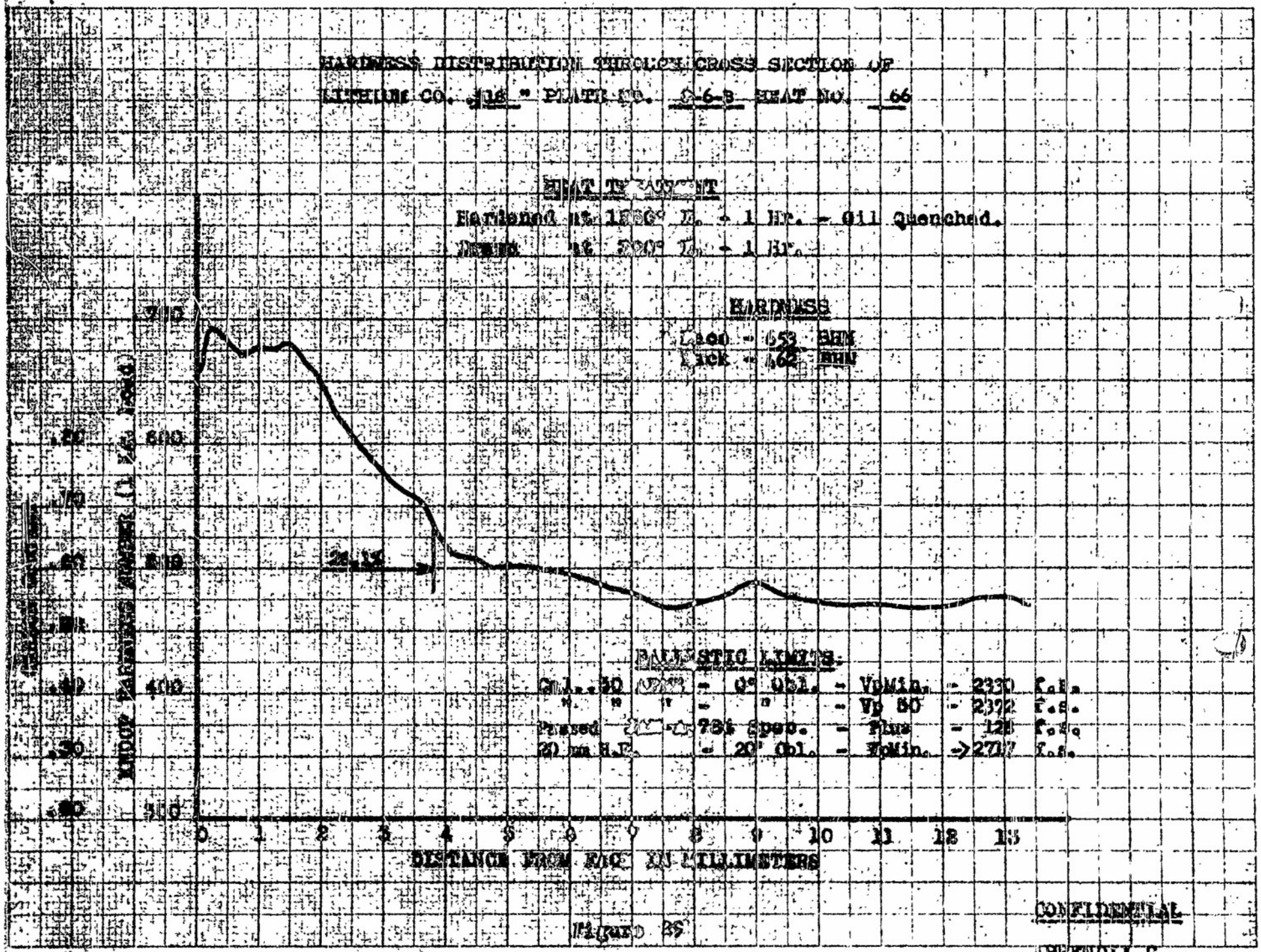
Hardened at 1550° F. + 1 Hr. - Oil Quenched.

[illegible] at 500° F. + 1 Hr.

HARDNESS

Face - 653 BHN

Back - 462 BHN



BALLISTIC LIMITS.

Cal..30 [illegible] - 0° Obl. - VpMin. - 2330 f.s.

" " " - " - Vp 80 - 2372 f.s.

Passed [illegible] - 73½ Spec. - Plus - 128 f.s.

20 mm H.E. - 20° Obl. - VpMin. -> 2717 f.s.

Figure 39

CONFIDENTIAL

APPENDIX C

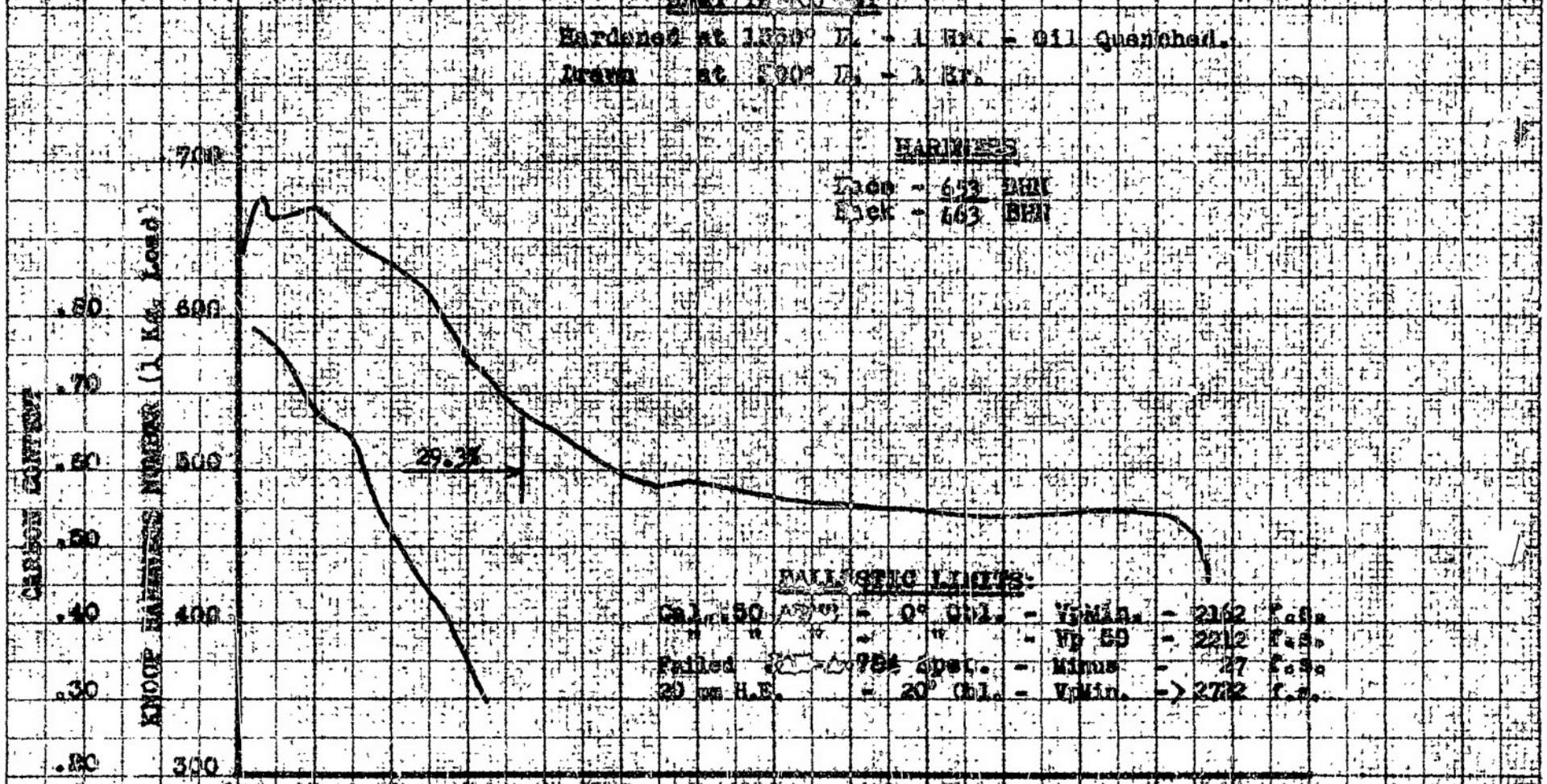
HARDNESS DISTRIBUTION THROUGH CROSS SECTION OF
LITHIUM CO. 5½" PLATE NO. S-6-A TEST NO. 67

HEAT TREATMENT

Hardened at 1550° F. - 1 Hr. - Oil Quenched.
Drawn at 520° F. - 1 Hr.

HARDNESS

Face - 653 BHN
Back - 663 BHN



BALLISTIC LIMITS:

Cal. .50 A.P. (M2) - 0° Obl. - V50 Min. - 2162 f.s.
" " " - " - V50 Max. - 2212 f.s.
Failed at -4.0° Obl. - Minus - 27 f.s.
20 mm H.E. - 20° Obl. - V50 Min. -> 2732 f.s.

Figure 39

CONFIDENTIAL

APPENDIX C

HARDNESS DISTRIBUTION THROUGH CROSS SECTION OF

LITHIUM CO. .52" PLATE NO. F-S-B HEAT NO. 67

HEAT TREATMENT

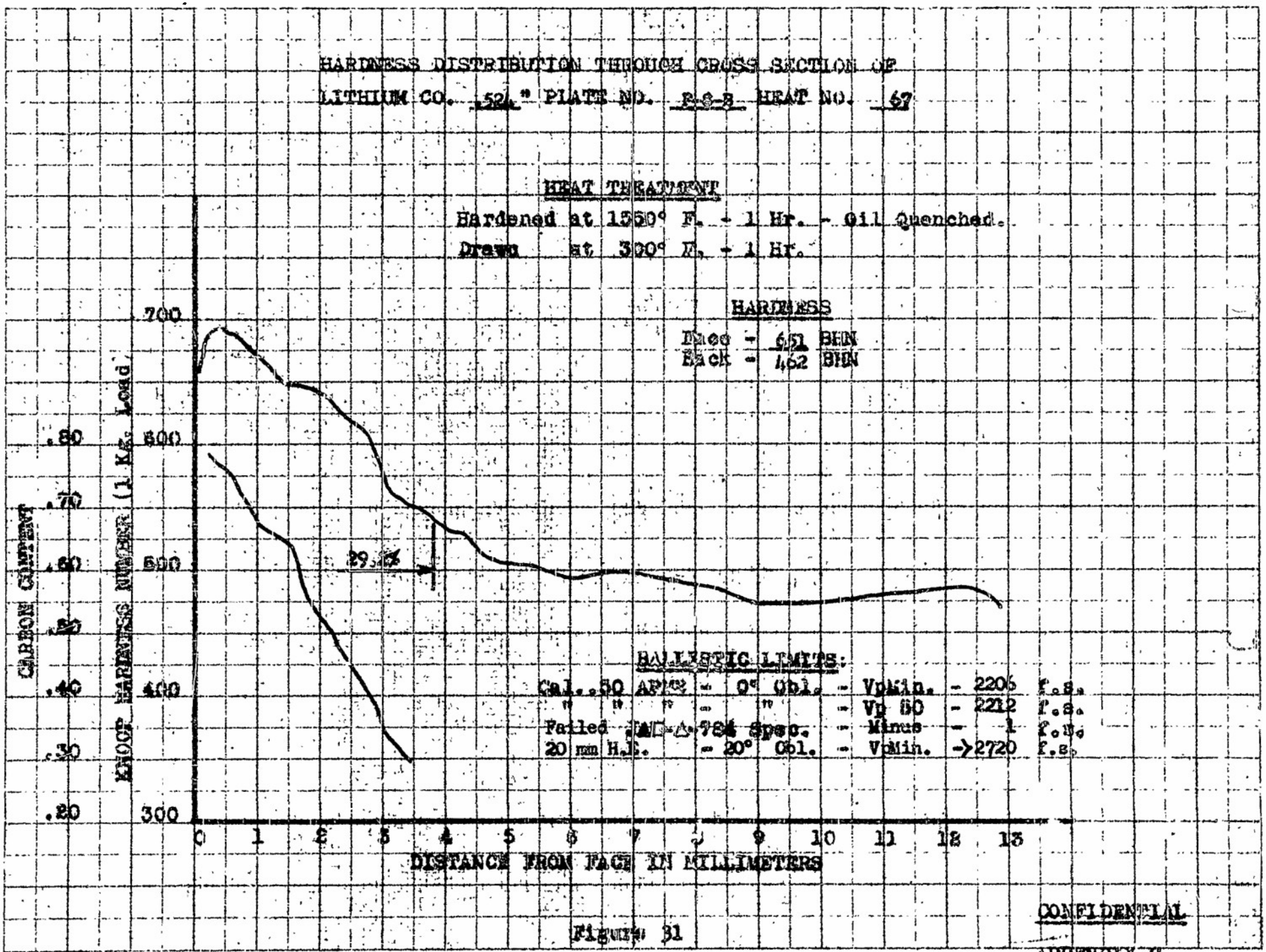
Hardened at 1550° F. - 1 Hr. - Oil Quenched.

Drawn at 300° F. - 1 Hr.

HARDNESS

Face - 651 BHN

Back - 462 BHN



BALLISTIC LIMITS:

Cal. .50 AP M2	- 0° Obl.	- V50 Min.	- 2206	f.s.
" " "	- " "	- V50	- 2212	f.s.
Failed MIL-A-46100 Spec.		- Minus	- 1	f.s.
20 mm H.E.	- 20° Obl.	- V50 Min.	->2720	f.s.

Figure 31

CONFIDENTIAL

APPENDIX C

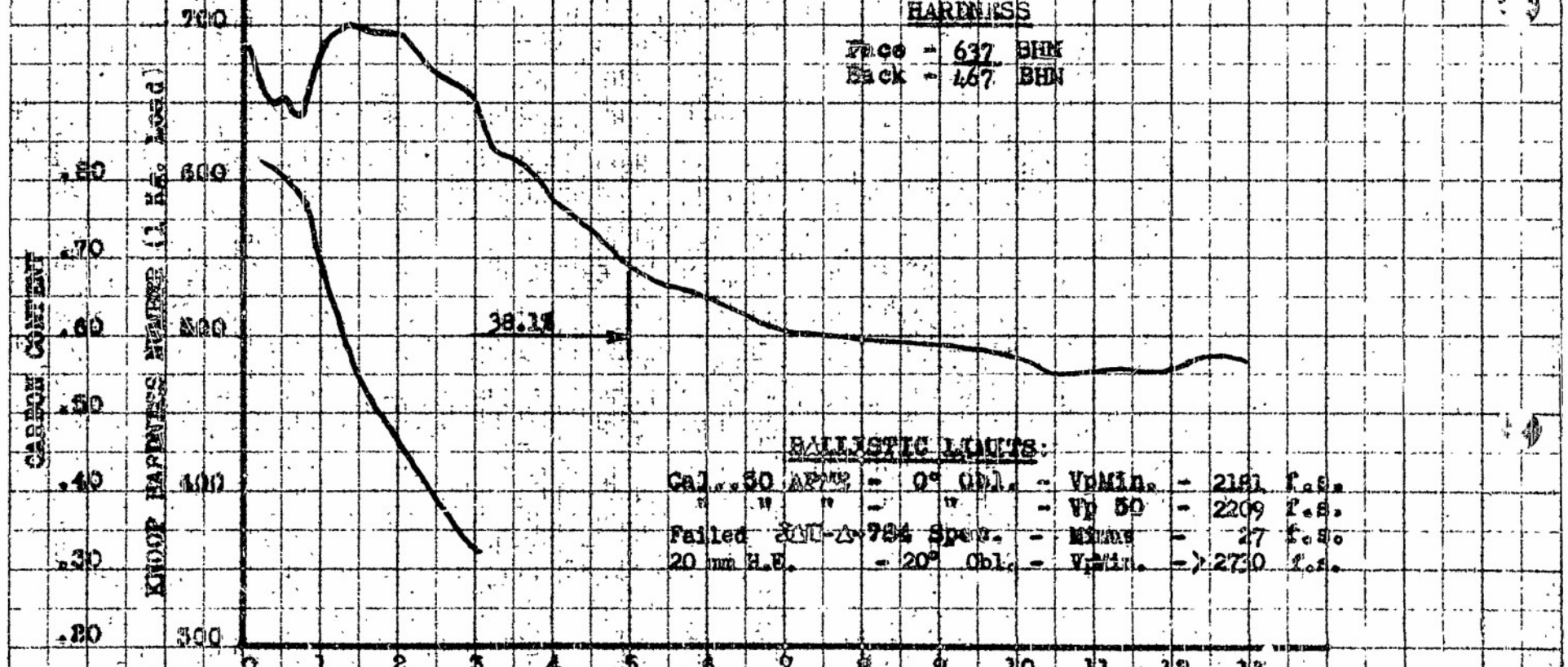
HARDNESS DISTRIBUTION THROUGH CROSS SECTION OF
LITHIUM CO. .526" PLATE NO. E-9-A HEAT NO. 67

HEAT TREATMENT

Hardened at 1550° F. - 1 Hr. - Oil Quenched.
Drawn at 300° F. - 1 Hr.

HARDNESS

Face - 637 BHN
Back - 467 BHN



BALLISTIC LIMITS:

Cal. .50 APWC - 0° Obl. - VpMin. - 2181 f.s.
" " " - " - Vp 50 - 2209 f.s.
Failed 20 mm H.E. - 784 Spcn. - 20° Obl. - MxMs - 27 f.s.
VpMin. - 2730 f.s.

Figure 32

CONFIDENTIAL

APPENDIX C

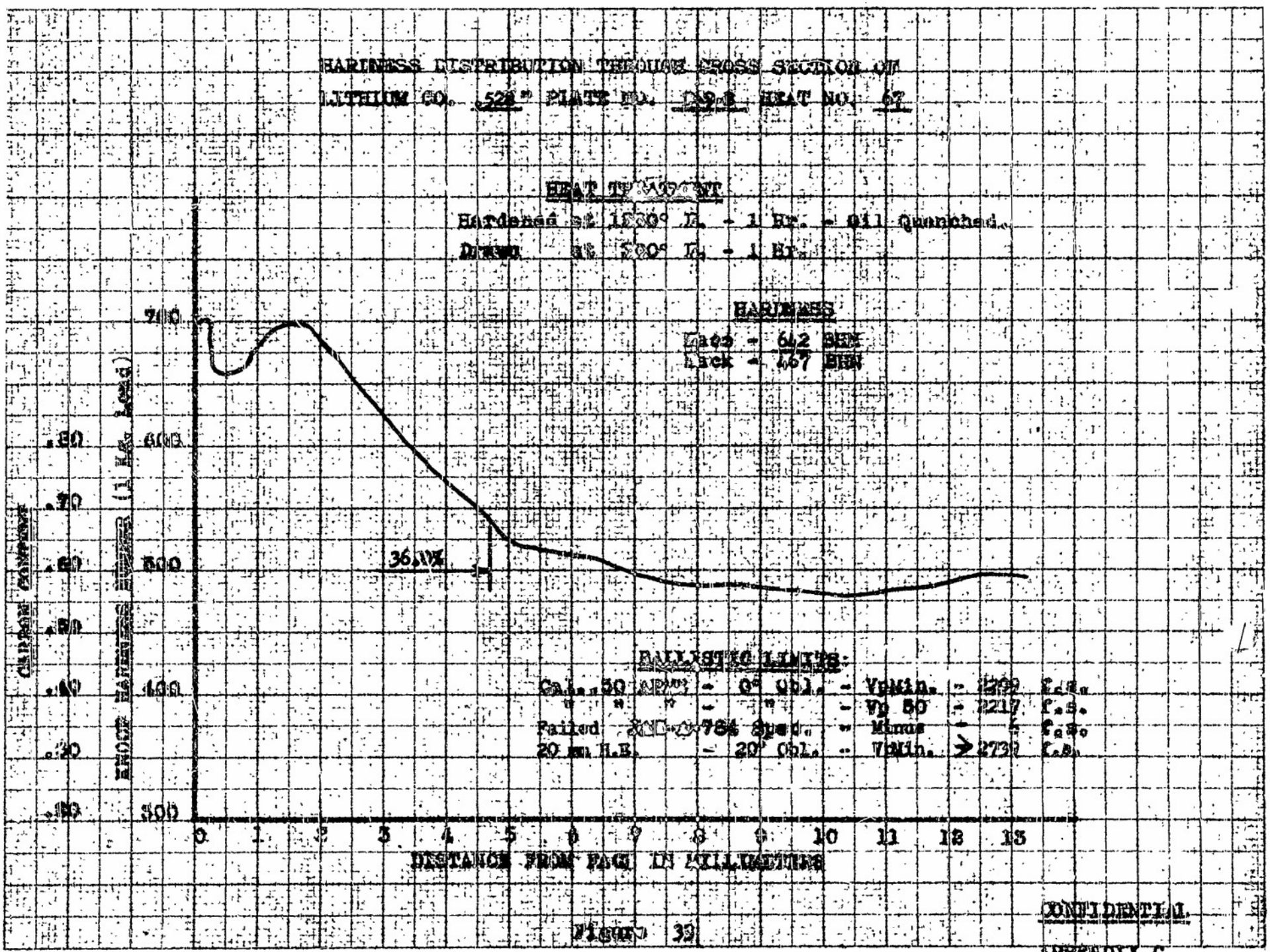
HARDNESS DISTRIBUTION THROUGH CROSS SECTION OF

LITHIUM CO. .528" PLATE NO. D2-8 HEAT NO. 67

HEAT TREATMENT

Hardened at 1550° F. - 1 Hr. - Oil Quenched.

Drawn at 500° F. - 1 Hr.



BALLISTIC LIMITS:

Cal. .50 AP M2 - 0° Obl. - V50Min. - 1309 f.s.

" " " - " " - V50 - 1217 f.s.

Failed 78% Speed - Minus - ½ f.s.

20 mm H.B. - 20° Obl. - V50Min. ≥ 2730 f.s.

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Figure 32

APPENDIX C

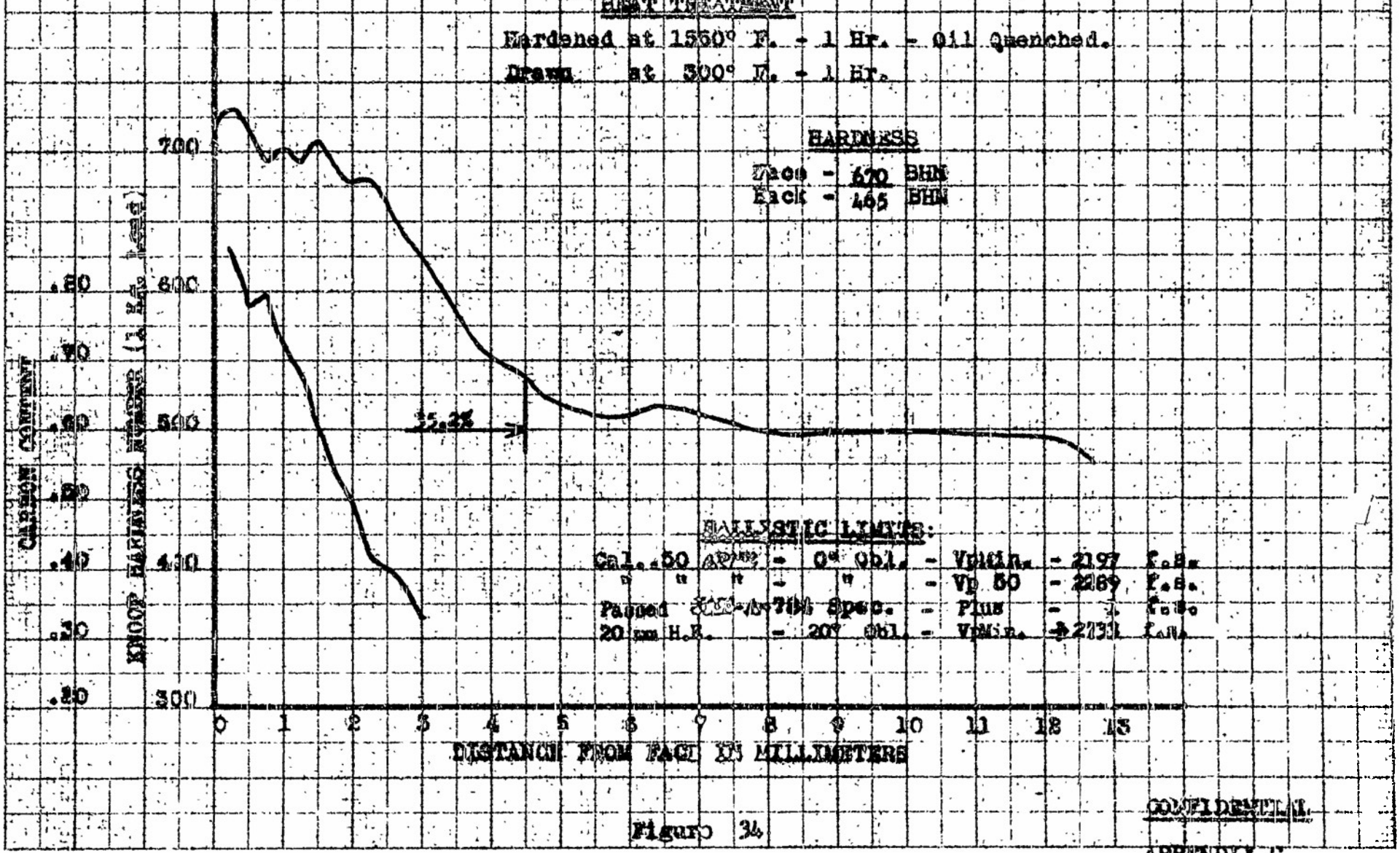
HARDNESS DISTRIBUTION THROUGH CROSS SECTION OF
LITHIUM CO. [illegible]" PLATE NO. [illegible] HEAT NO. 66

HEAT TREATMENT

Hardened at 1550° F. - 1 Hr. - Oil Quenched.
Drawn at 300° F. - 1 Hr.

HARDNESS

Face - 670 BHN
Back - 465 BHN



BALLISTIC LIMITS:

Cal. .50 AP[illegible] - 0° Obl. - V50Min. - 2197 f.s.
" " " - " - V50 - 2269 f.s.
Packed [illegible]-A 71% Spec. - Plus - [illegible] f.s.
20 mm H.E. - 20° Obl. - V50Min. - 2731 f.s.

Figure 34

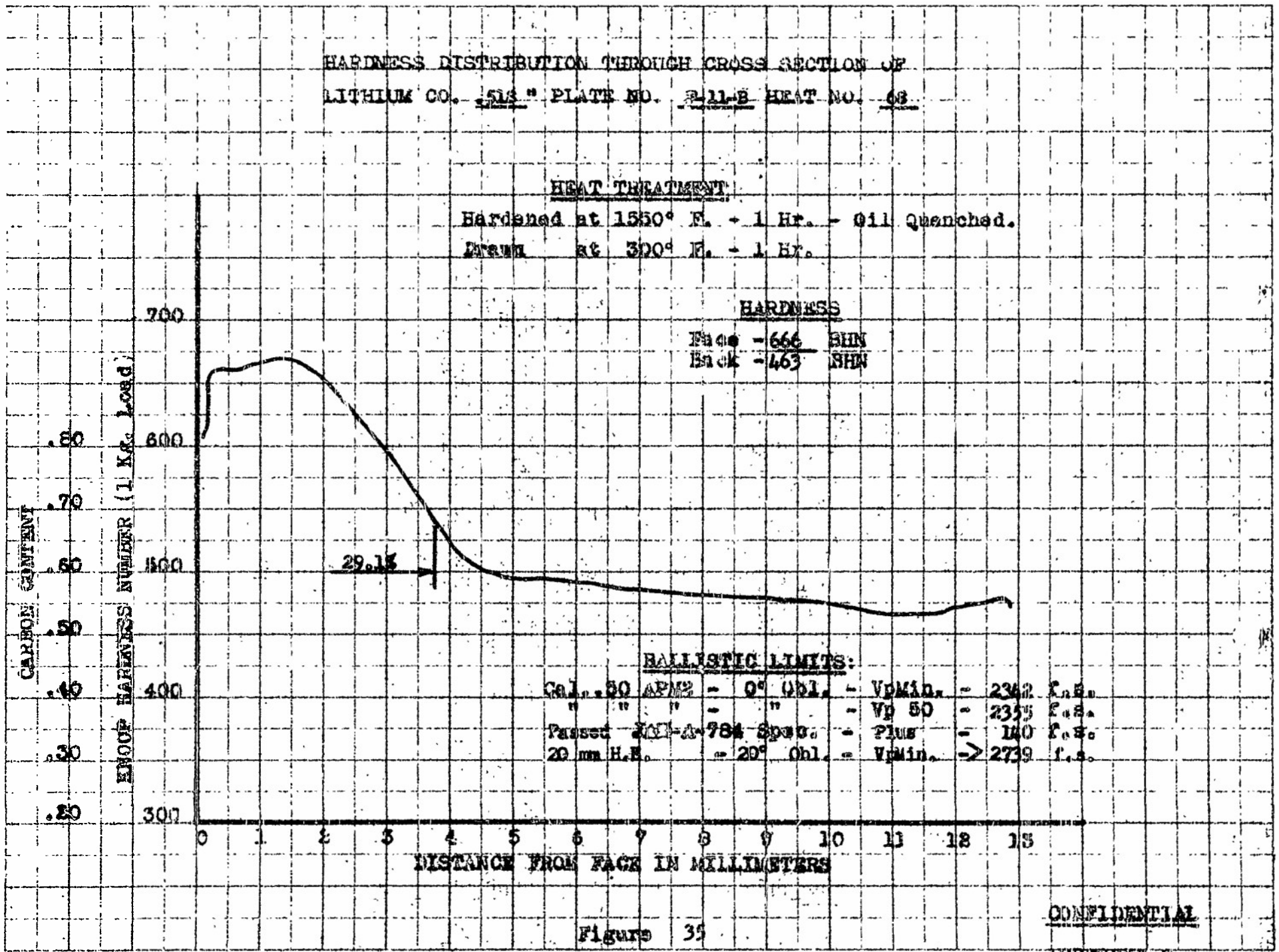
CONFIDENTIAL

APPENDIX C

HARDNESS DISTRIBUTION THROUGH CROSS SECTION OF
LITHIUM CO. .51" PLATE NO. 2-11-B HEAT NO. 68

HEAT TREATMENT:
Hardened at 1550° F. - 1 Hr. - Oil Quenched.
Drawn at 300° F. - 1 Hr.

HARDNESS
Face - 666 BHN
Back - 463 BHN



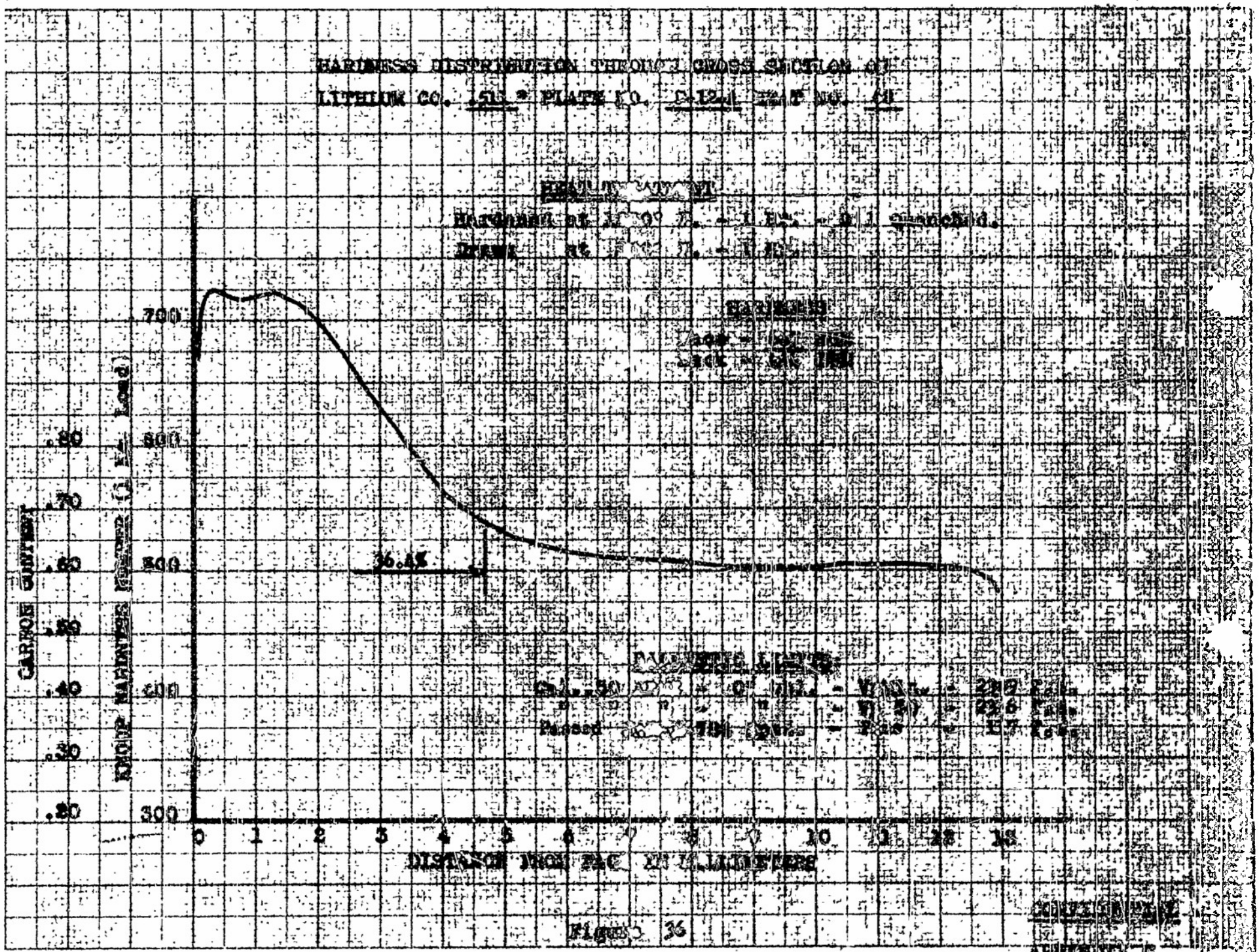
BALLISTIC LIMITS:

Cal. .50 APM2	- 0° Obl.	- VpMin.	- 2362 f.s.	
" " "	- "	- Vp 50	- 2355 f.s.	
Passed MIL-A-784 Spec.	- Plus	- 140 f.s.		
20 mm H.E.	- 20° Obl.	- VpMin.	-> 2739 f.s.	

Figure 35

CONFIDENTIAL

APPENDIX C


HARDNESS DISTRIBUTION THROUGH CROSS SECTION OF
LITHIUM CO. .50" PLATE NO. D-124 AS-F NO. 41
700
600
500
400
300
.80
.70
.60
.50
.40
.30
.20
36.4%
0 1 2 3 4 5 6 7 8 9 10 11 12 13
DISTANCE FROM FACE IN MILLIMETERS
Figure 36
APPENDIX B

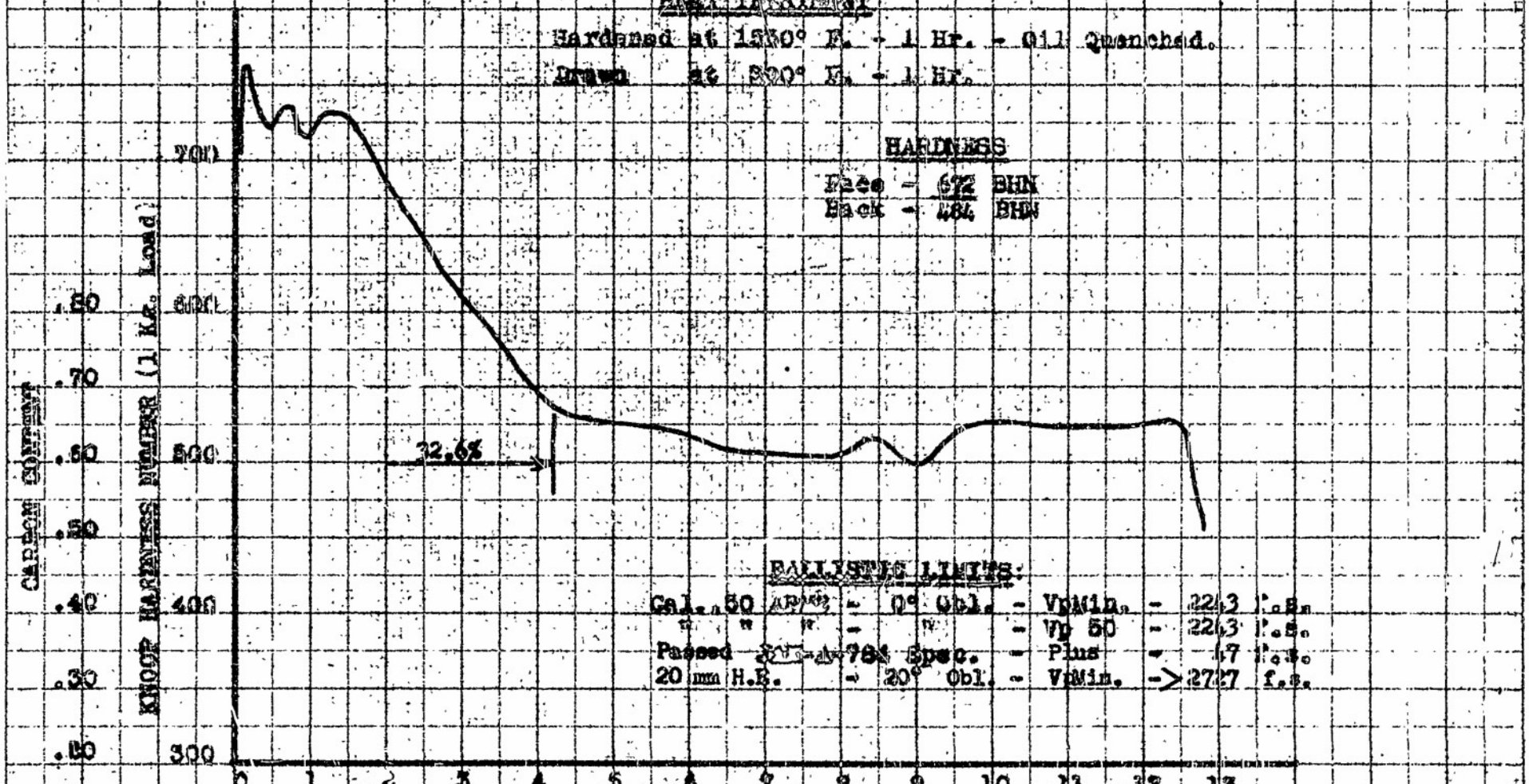
HARDNESS DISTRIBUTION THROUGH CROSS SECTION OF
LITHIUM CO. .514" PLATE NO. F-12-B HEAT NO. 68

HEAT TREATMENT

Hardened at 1550° F. + 1 Hr. - Oil Quenched.
Drawn at 830° F. + 1 Hr.

HARDNESS

Face - 672 BHN
Back - 484 BHN



BALLISTIC LIMITS:

Cal. .50 AP M2 - 0° Obl. - VpMin. - 2243 f.s.
" " " - " - Vp 50 - 2263 f.s.
Passed 20 mm H.E. - 78% Spec. - Plus - 17 f.s.
20 mm H.E. - 20° Obl. - VpMin. -> 2727 f.s.

Figure 37

CONFIDENTIAL

APPENDIX C

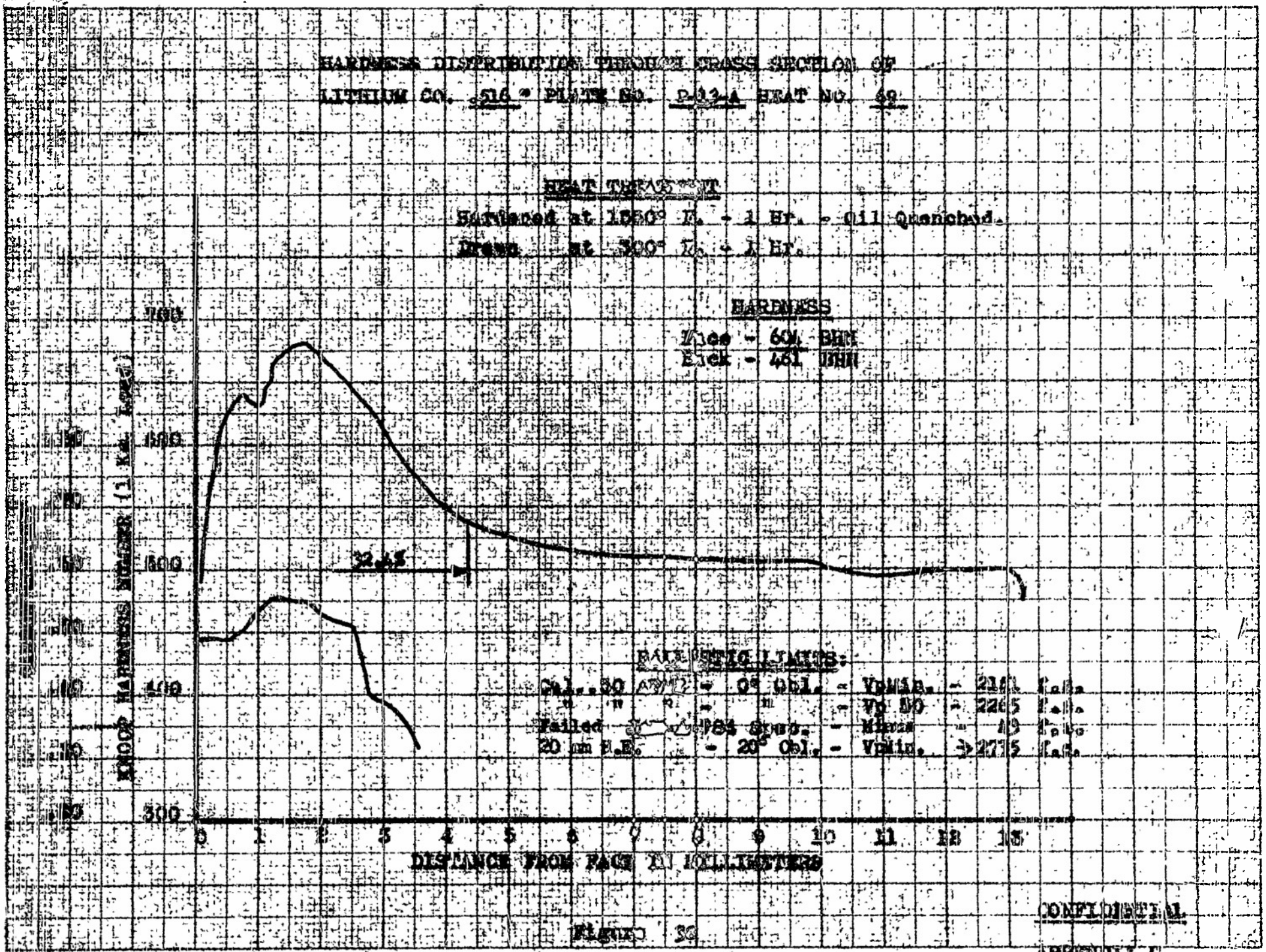
HARDNESS DISTRIBUTION THROUGH CROSS SECTION OF
LITHIUM CO. 516" PLATE NO. P-134-A HEAT NO. 48

HEAT TREATMENT

Austenized at 1650° F. + 1 Hr. - Oil Quenched.
Temp. at 300° F. + 1 Hr.

HARDNESS

Face - 601 BHN
Back - 481 BHN



BALLISTIC LIMITS:

Obl. 30 Avg. - 0° Obl. - V50 Min. - 2161 f.p.s.
" " " - " - V50 - 2265 f.p.s.
Failed 4/5 - 80% Quad. - Mean - 19 f.p.s.
20 mm F.E. - 20° Obl. - V50 Min. - 2775 f.p.s.

CONFIDENTIAL

Figure 30

APPENDIX C

HARDNESS DISTRIBUTION THROUGH CROSS SECTION OF

LITHIUM CO. .514 " PLATE NO. E-13-B HEAT NO. 69

HEAT TREATMENT

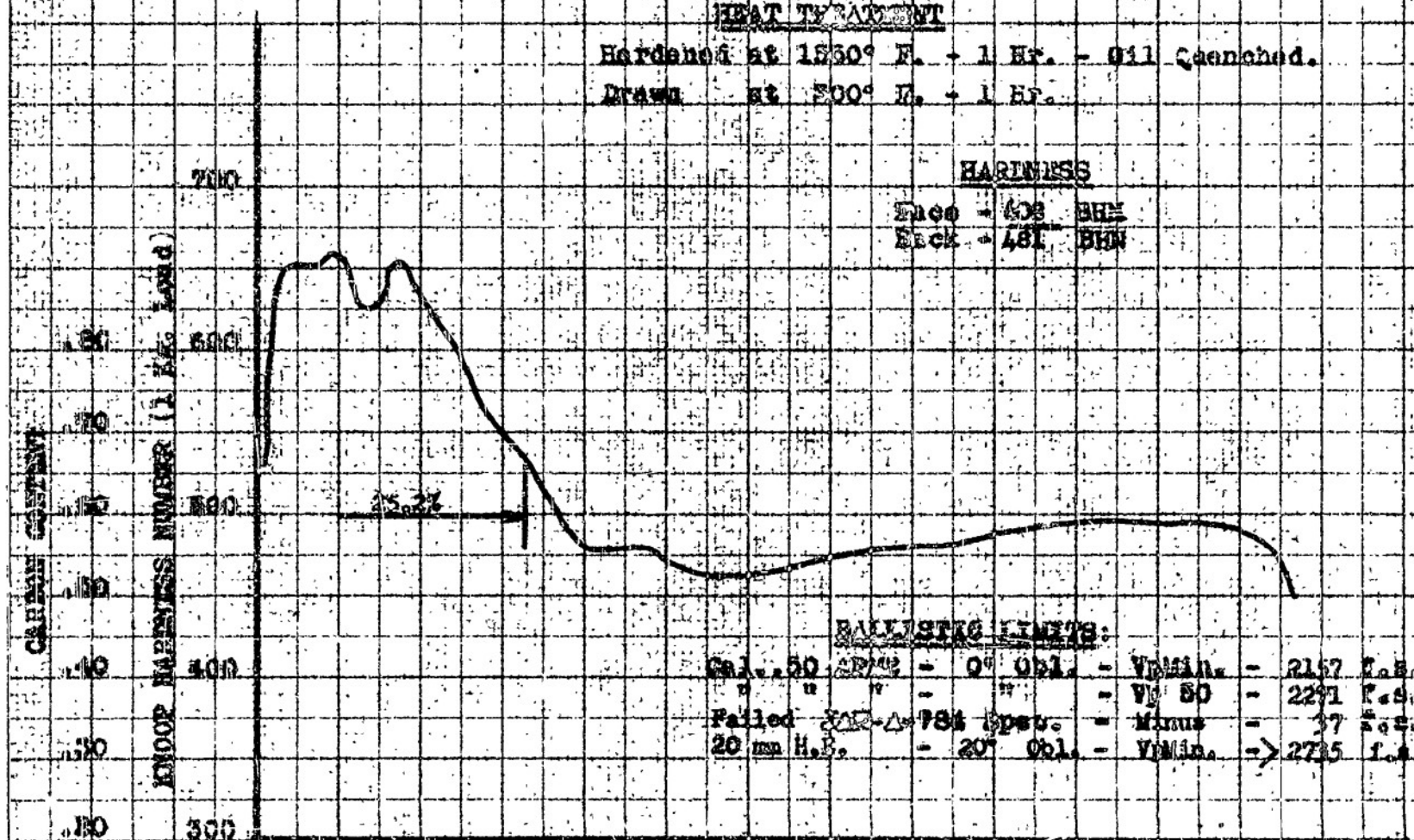
Hardened at 1530° F. + 1 Hr. - Oil Quenched.

Drawn at 500° F. + 1 Hr.

HARDNESS

Face - 403 BHN

Back - 481 BHN



BALLISTIC LIMITS:

Cal. .50 AP/WC	- 0° Obl.	-	V_{P} Min.	-	2157 f.s.
" " "	- "	-	V_{P} 50	-	2291 f.s.
Failed 50%-△-78% Spec.		-	Minus	-	37 f.s.
20 mm H.E.	- 20° Obl.	-	V_{P} Min.	->	2715 f.s.

Figure 39

CONFIDENTIAL

APPENDIX C

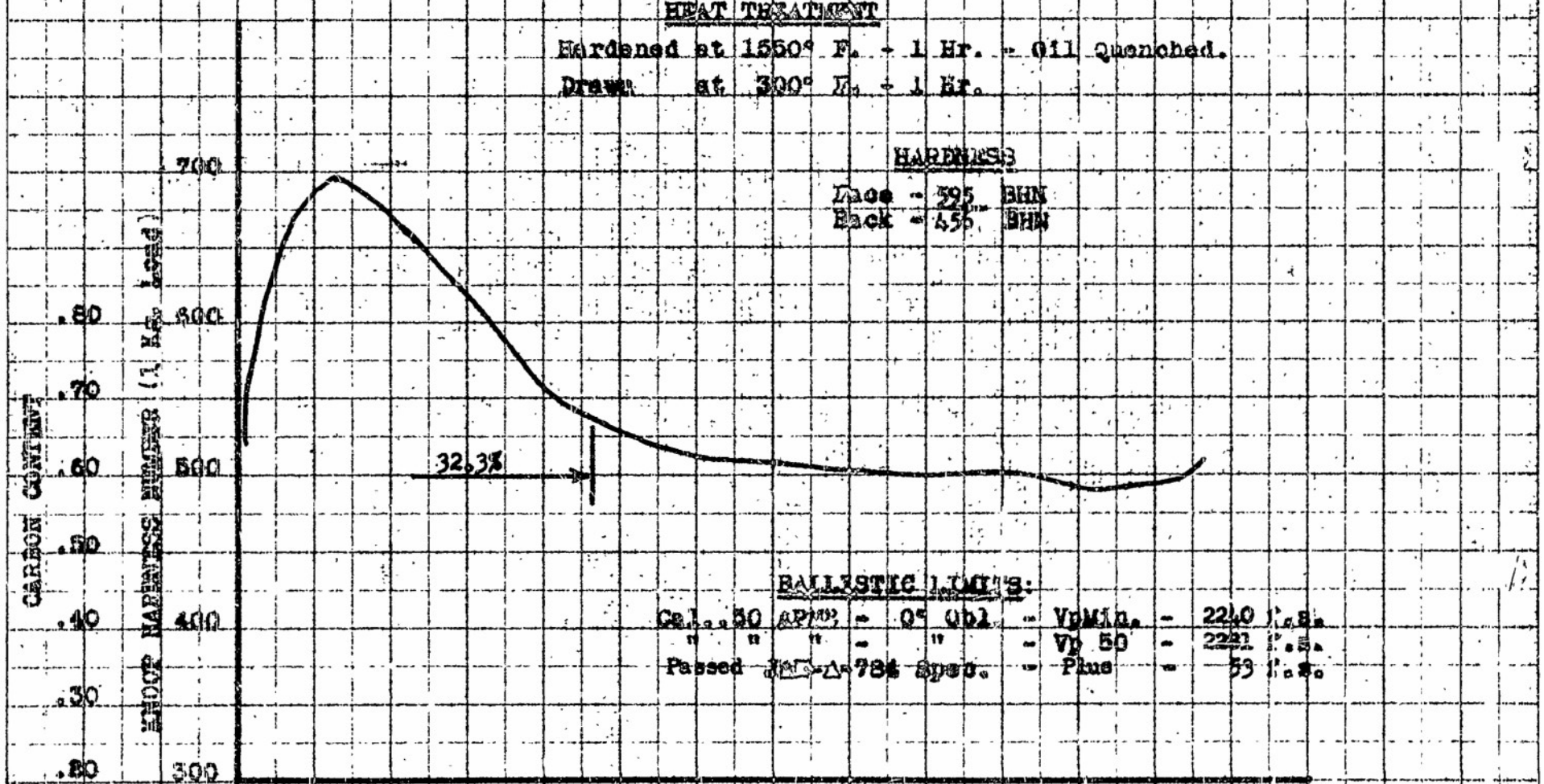
HARDNESS DISTRIBUTION THROUGH CROSS SECTION OF
LITHIUM CO. .502" PLATE NO. L-14-A HEAT NO. 62

HEAT TREATMENT

Hardened at 1550° F. + 1 Hr. - Oil Quenched.
Drawn at 300° F. + 1 Hr.

HARDNESS

Face - 595 BHN
Back - 455 BHN



BALLISTIC LIMITS:

Cal. .50 API [illegible] - 0° Obl. - V50 Min. - 2240 f.s.
" " " - " - V50 - 2221 f.s.
Passed [illegible] - 78% Spec. - Plus - 53 f.s.

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Figure 40

APPENDIX C

HARDNESS DISTRIBUTION THROUGH CROSS SECTION OF

LITHIUM CO. .50" PLATE NO. [illegible] HEAT NO. 69

HEAT TREATMENT

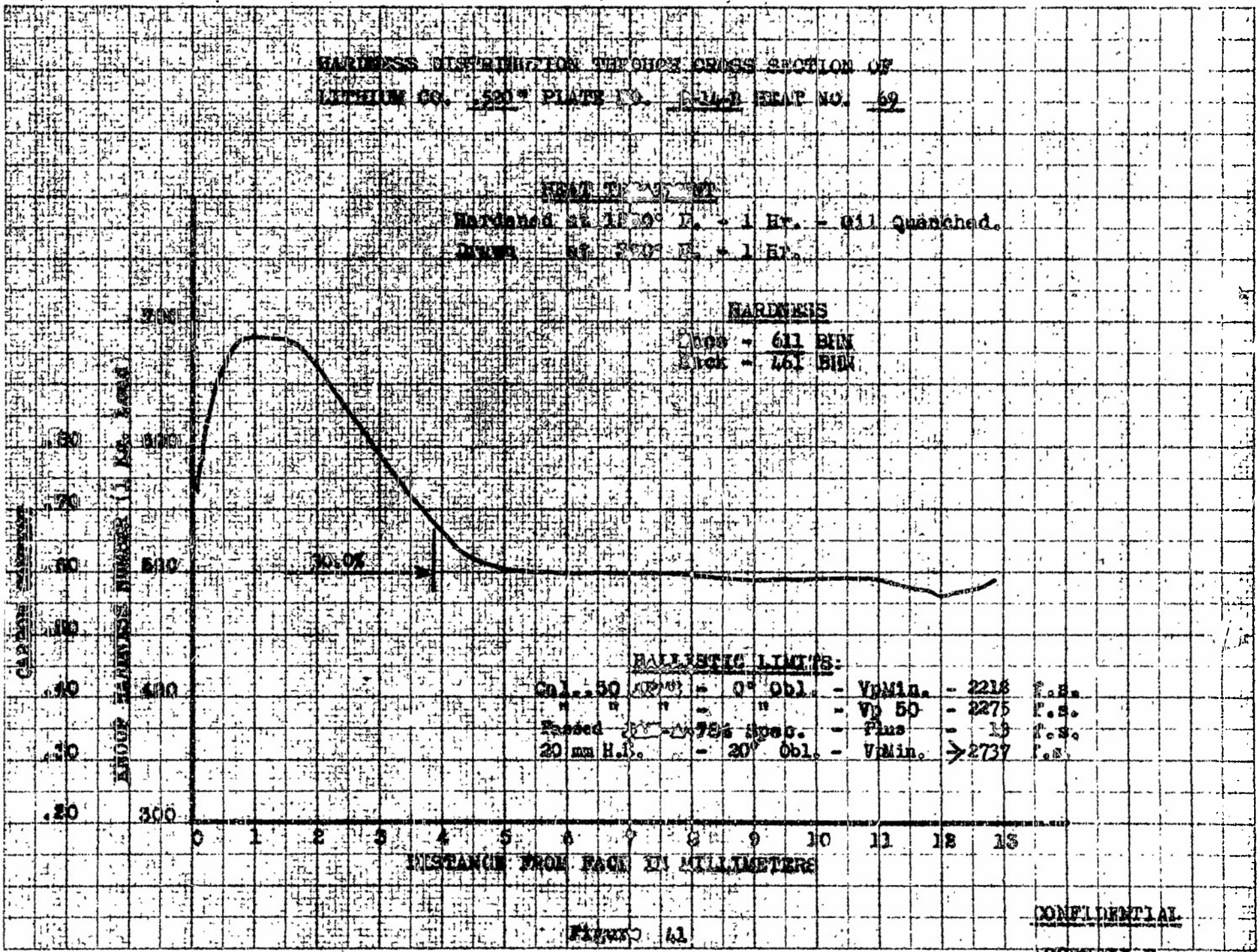
Hardened at 1100° F. - 1 Hr. - Oil Quenched.

Drawn at 700° F. - 1 Hr.

HARDNESS

Face - 611 BHN

Back - 461 BHN



BALLISTIC LIMITS:

Col..50 (P) - 0° Obl. - VpMin. - 2218 F.S.

" " " - " - V50 - 2275 F.S.

Passed [illegible] - 75° Spec. - Plug - [illegible] F.S.

20 mm H.E. - 20° Obl. - VpMin. >2737 F.S.

Figure 41

CONFIDENTIAL

APPENDIX C

HARDNESS DISTRIBUTION THROUGH CROSS SECTION OF

LITHIUM CO. .522" PLATE NO. C-15-A HEAT NO. 59

HEAT TREATMENT

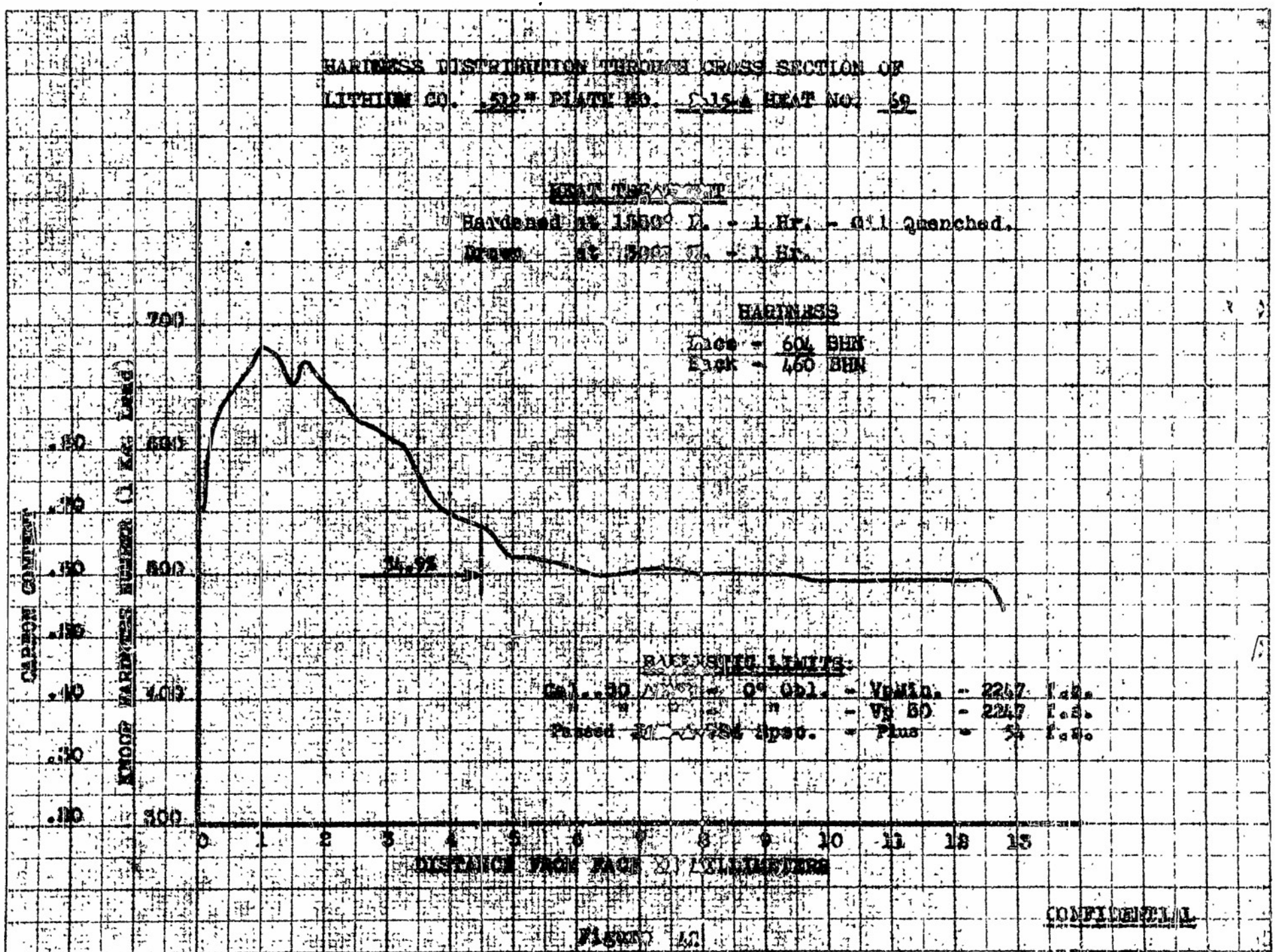
Hardened at 1550° F. - 1 Hr. - Oil Quenched.

Drawn at 500° F. - 1 Hr.

HARDNESS

Face - 604 BHN

Back - 460 BHN



RADIOGRAPH LIMITS:

Cal. .50 Alum. - 0° Obl. - Vg Min. - 2247 I.S.

" " " - " " - Vg 50 - 2247 I.S.

Passed 2" Alum. Spec. - Plus - 54 I.S.

Figure 40

CONFIDENTIAL

APPENDIX C

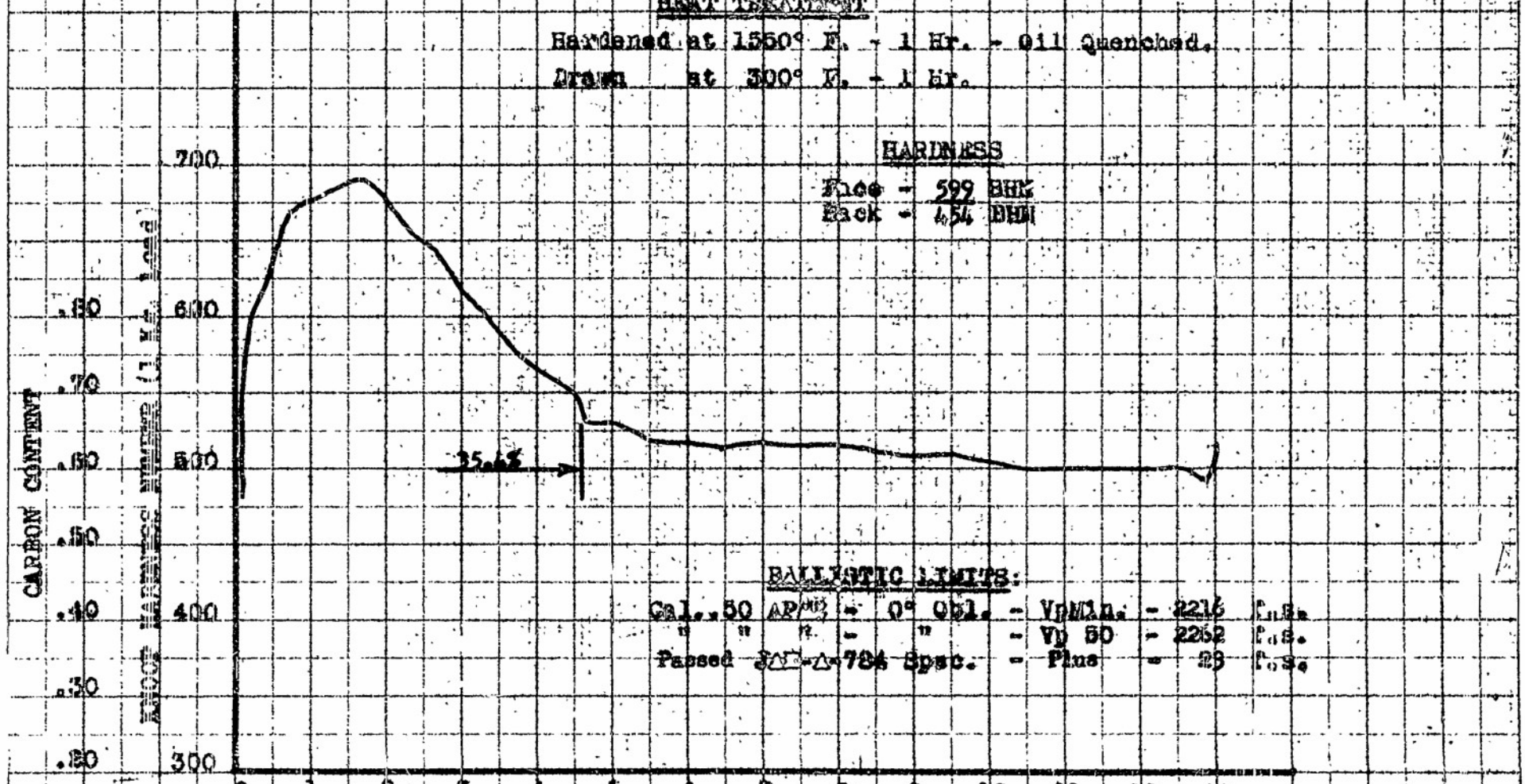
HARDNESS DISTRIBUTION THROUGH CROSS SECTION OF
LITHIUM CO. .512" PLATE NO. 3-15-B HEAT NO. 69

HEAT TREATMENT

Hardened at 1550° F. - 1 Hr. - Oil Quenched.
Drawn at 300° F. - 1 Hr.

HARDNESS

Face - 599 BHN
Back - 454 BHN



BALLISTIC LIMITS:

Cal. .50 AP/WC - 0° Obl. - V50 Min. - 2216 f.s.
" " " - " - V50 - 2262 f.s.
Passed MIL-A-46100 Spec. - Plus - 46 f.s.

Figure 43

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APPENDIX C

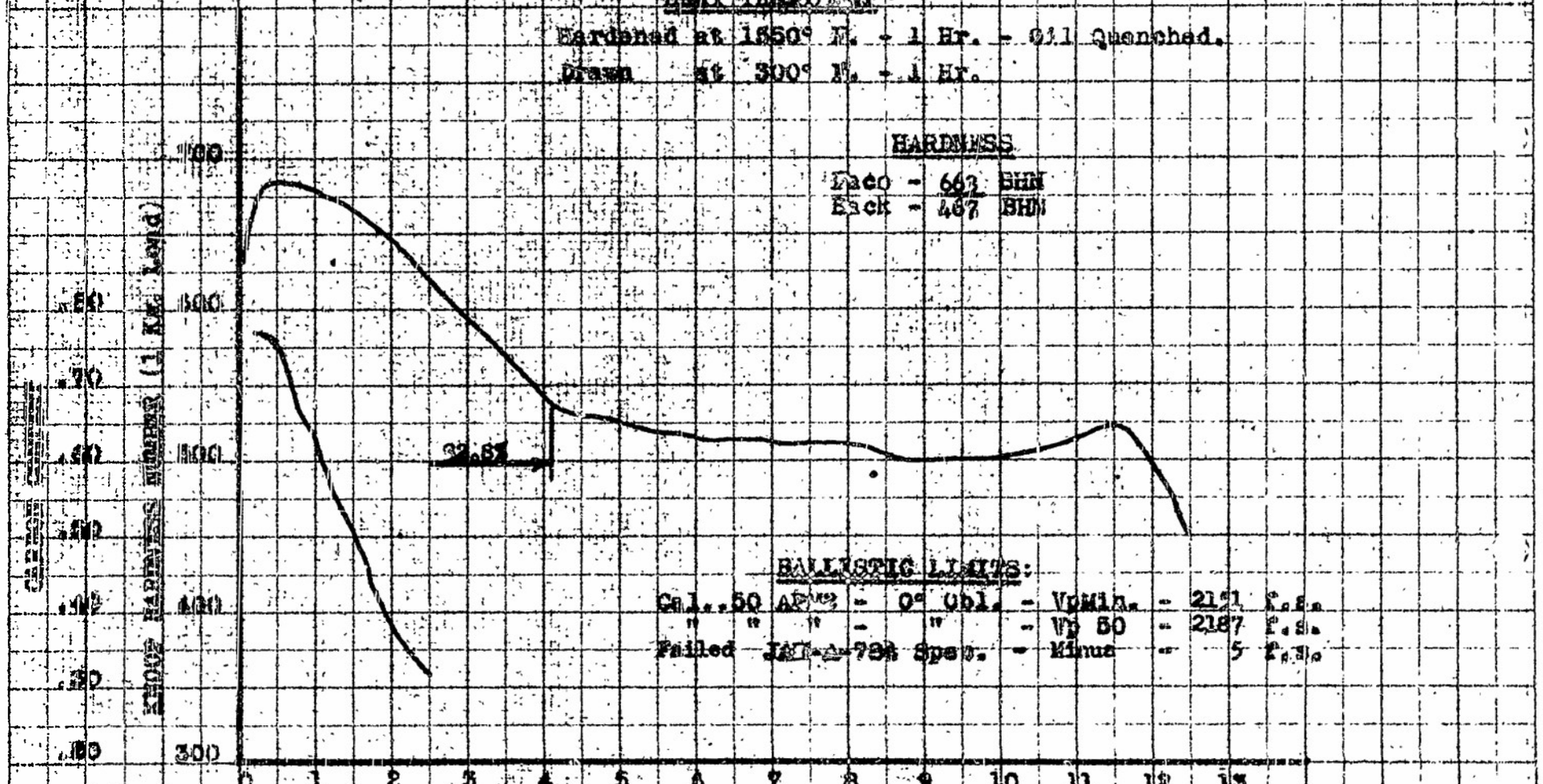
HARDNESS DISTRIBUTION THROUGH CROSS SECTION OF
LITHIUM CO. .50" PLATE NO. P-16-A HEAT NO. 70

HEAT TREATMENT

Hardened at 1550° F. - 1 Hr. - Oil Quenched.
Drawn at 300° F. - 1 Hr.

HARDNESS

Face - 663 BHN
Back - 467 BHN



BALLISTIC LIMITS:

Cal..50 AP M2 - 0° Obl. - V50Min. - 2151 f.s.
" " " - " - V50 - 2187 f.s.
Failed JAN-A-73A Spec. - Minus - 5 f.s.

Figure 44

CONFIDENTIAL

APPENDIX V

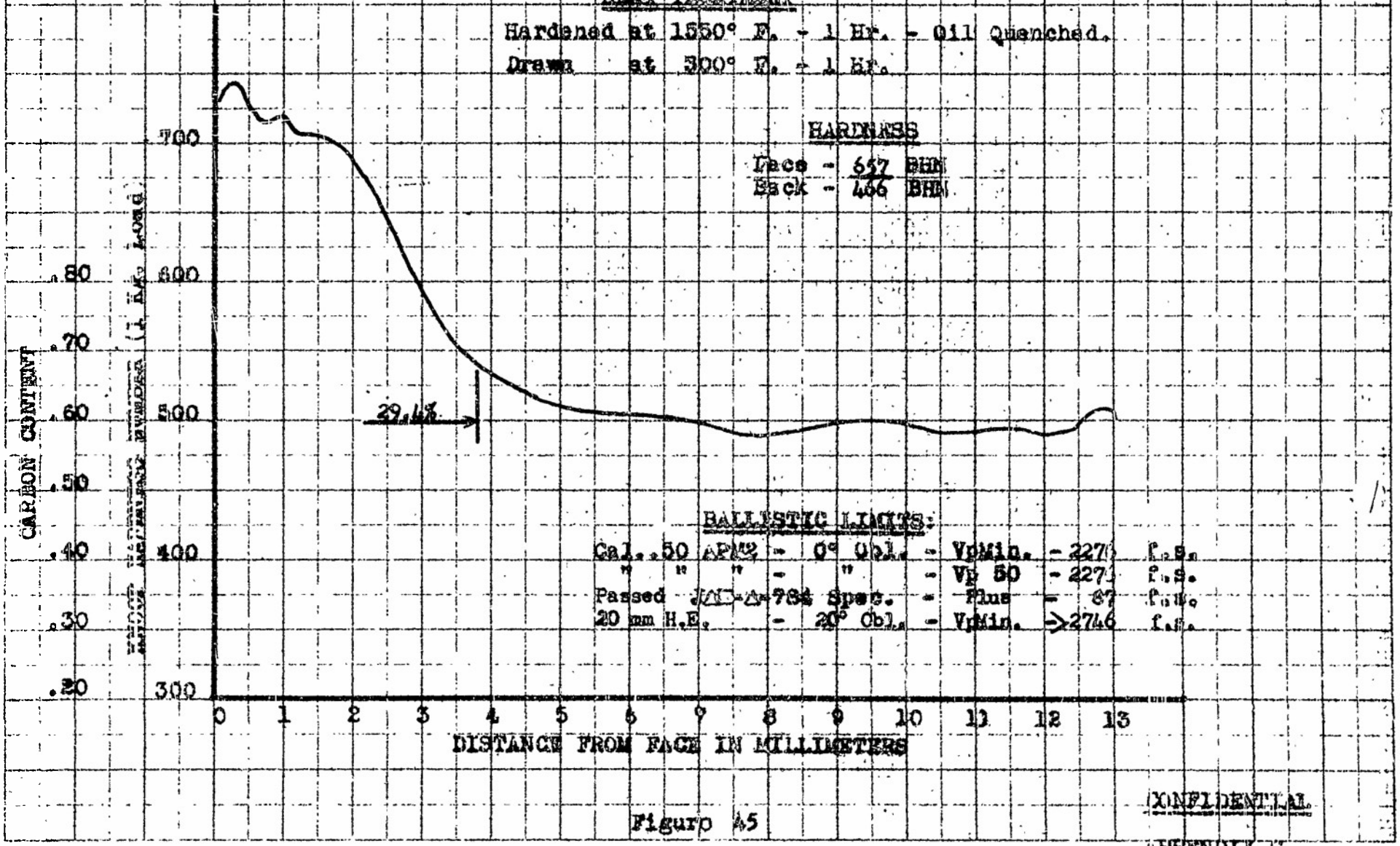
HARDNESS DISTRIBUTION THROUGH CROSS SECTION OF
LITHIUM CO. .509" PLATE NO. P-16-B HEAT NO. 10

HEAT TREATMENT

Hardened at 1550° F. + 1 Hr. - Oil Quenched.
Drawn at 300° F. + 1 Hr.

HARDNESS

Face - 627 BHN
Back - 466 BHN



BALLISTIC LIMITS:

Cal. .50 APM2	- 0° Obl.	- V50 Min.	- 2270 f.s.
" " "	- "	- V50	- 2270 f.s.
Passed MIL-A-46100 Spec.	-	Plus	- 67 f.s.
20 mm H.E.	- 20° Obl.	- V50 Min.	- >2746 f.s.

Figure 45

CONFIDENTIAL

APPENDIX C

HARDNESS DISTRIBUTION THROUGH CROSS SECTION OF

LITHIUM CO. .503" PLATE NO. E-12-A HEAT NO. 70

HEAT TREATMENT

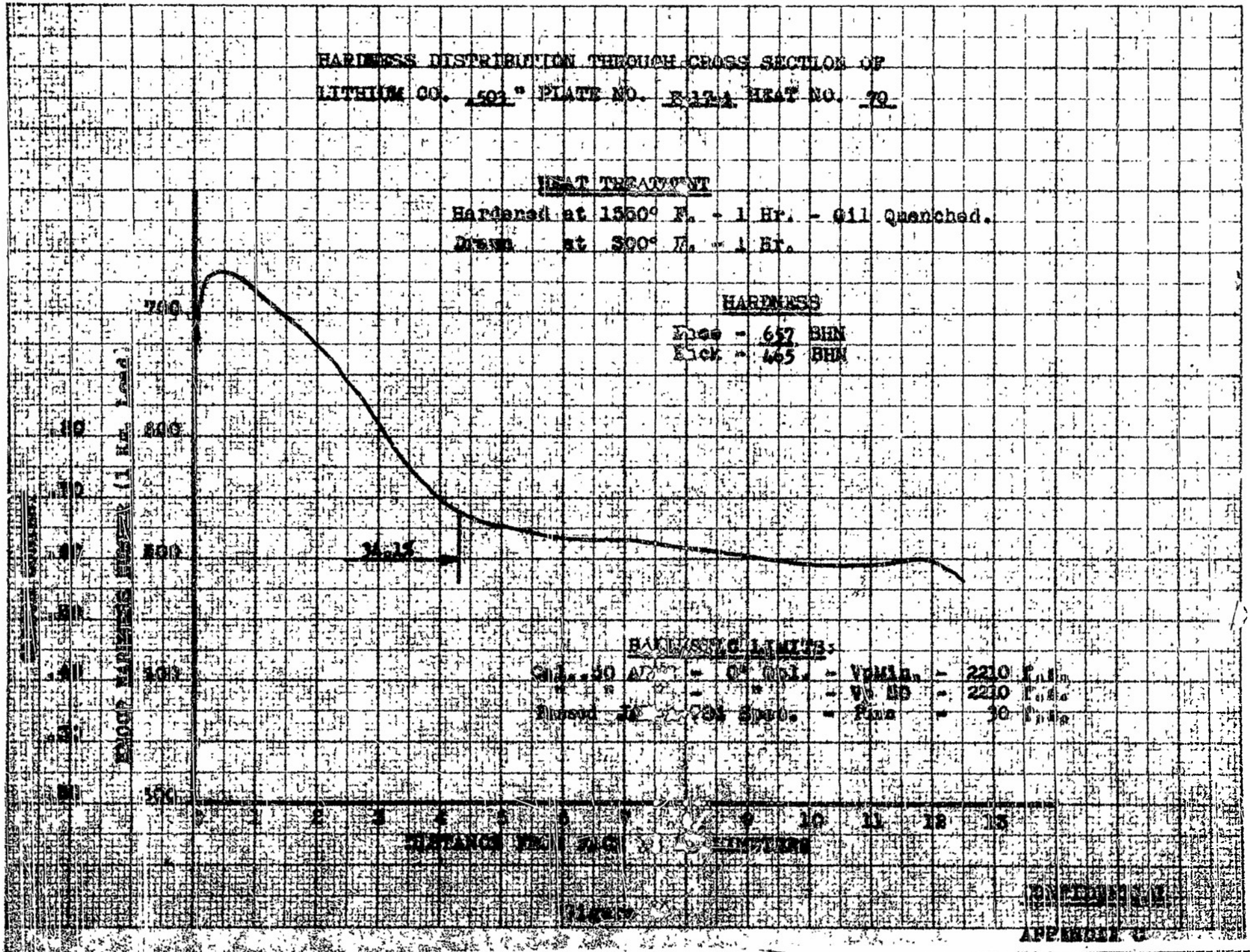
Hardened at 1500° F. - 1 Hr. - Oil Quenched.

Drawn at 800° F. - 1 Hr.

HARDNESS

Face - 657 BHN

Ctr. - 465 BHN



BALLISTIC LIMITS:

.30 AP - 0° Obl. - V50 Min. - 2210 f.s.

" " - " " - V50 Obl. - 2210 f.s.

Mixed AP - 50% Spec. - Fine - 30 f.s.

APPENDIX C

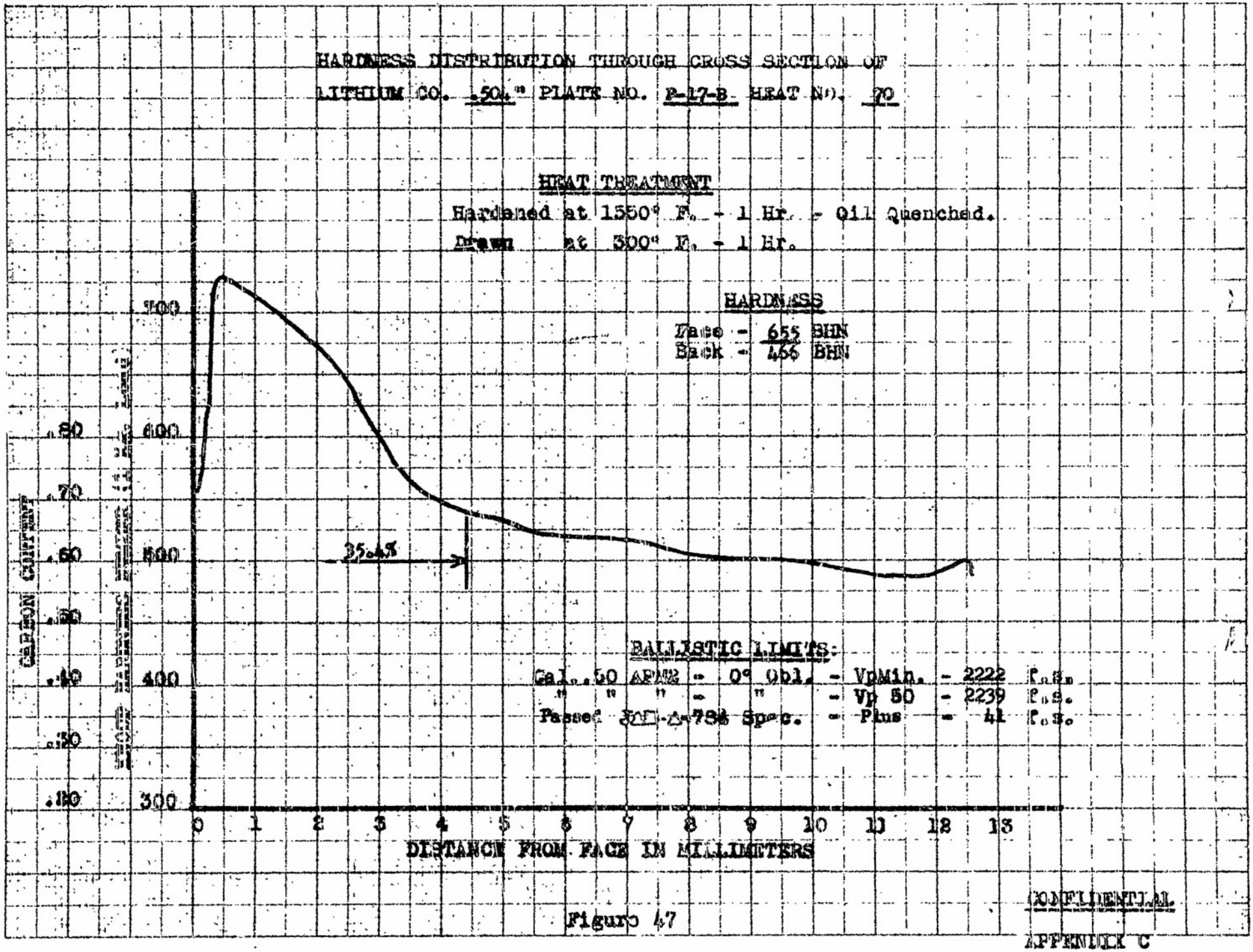
HARDNESS DISTRIBUTION THROUGH CROSS SECTION OF
LITHIUM CO. .50" PLATE NO. P-17-B HEAT NO. 70

HEAT TREATMENT

Hardened at 1550° F. - 1 Hr. - Oil Quenched.
Drawn at 300° F. - 1 Hr.

HARDNESS

Face - 655 BHN
Back - 466 BHN



BALLISTIC LIMITS:

Cal. .50 APM2 - 0° Obl. - VpMin. - 2222 f.s.
" " " - " - Vp 50 - 2239 f.s.
Passed 50% - 78% Spec. - Plus - 41 f.s.

Figure 47

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APPENDIX C

KEUFFEL & ESSER CO. N.Y.

HARDNESS DISTRIBUTION THROUGH CROSS SECTION OF

LITHIUM CO. .522" PLATE NO. 3-31 HEAT NO. 20

HEAT TREATMENT

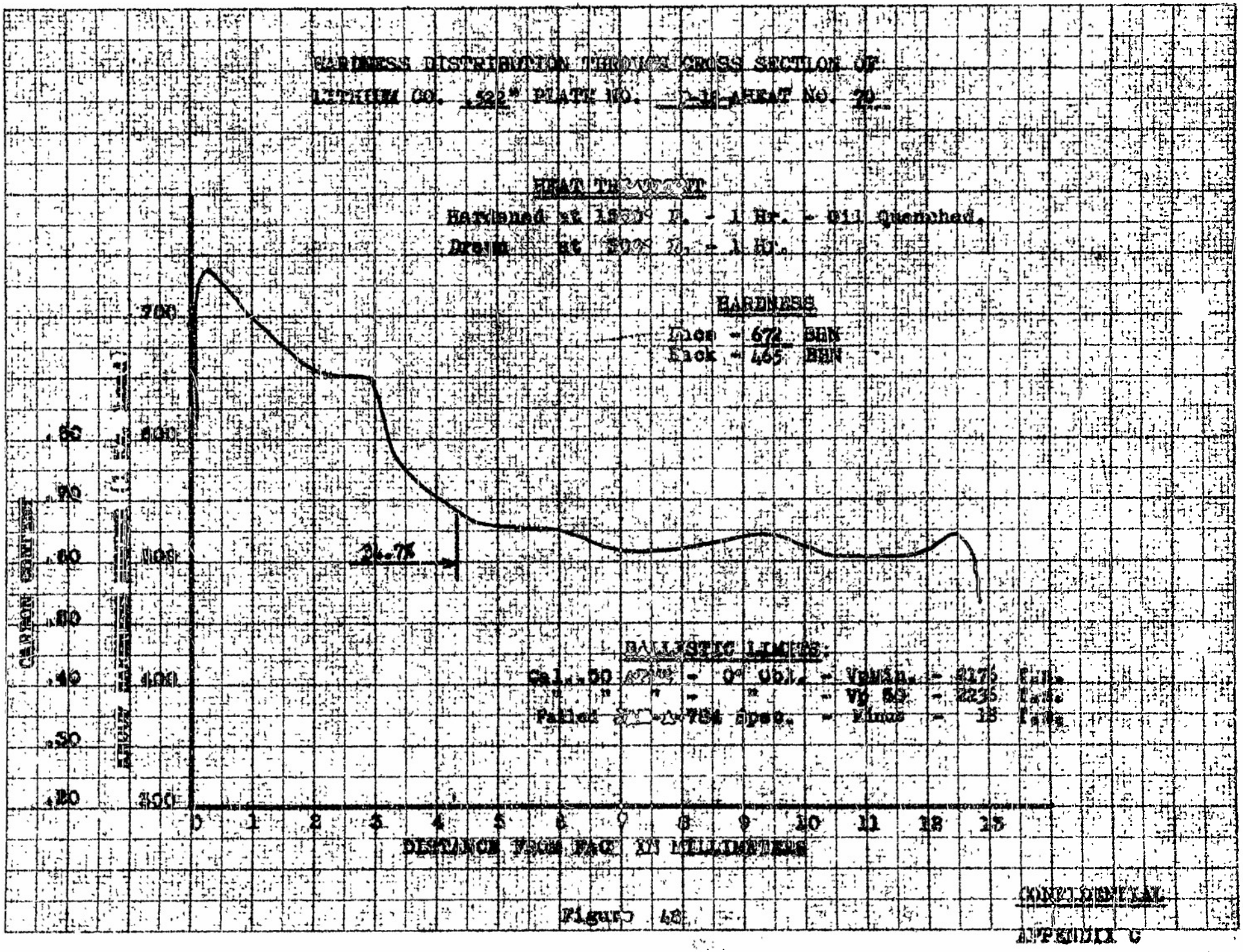
Hardened at 1525° F. - 1 Hr. - Oil Quenched.

Drawn at 500° F. - 1 Hr.

HARDNESS

Face - 672 BHN

Back - 465 BHN



BALLISTIC LIMITS:

Cal. .50 AP M2 - 0° Obl. - V50 - 2175 f.p.s.

" " " - " - V50 - 2235 f.p.s.

Failed at 75° Obl. - Vmax - 18 f.p.s.

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Figure 48

APPENDIX C

HARDNESS DISTRIBUTION THROUGH CROSS SECTION OF

LITHIUM CO. .506" PLATE NO. D-18-2 HEAT NO. 70

HEAT TREATMENT

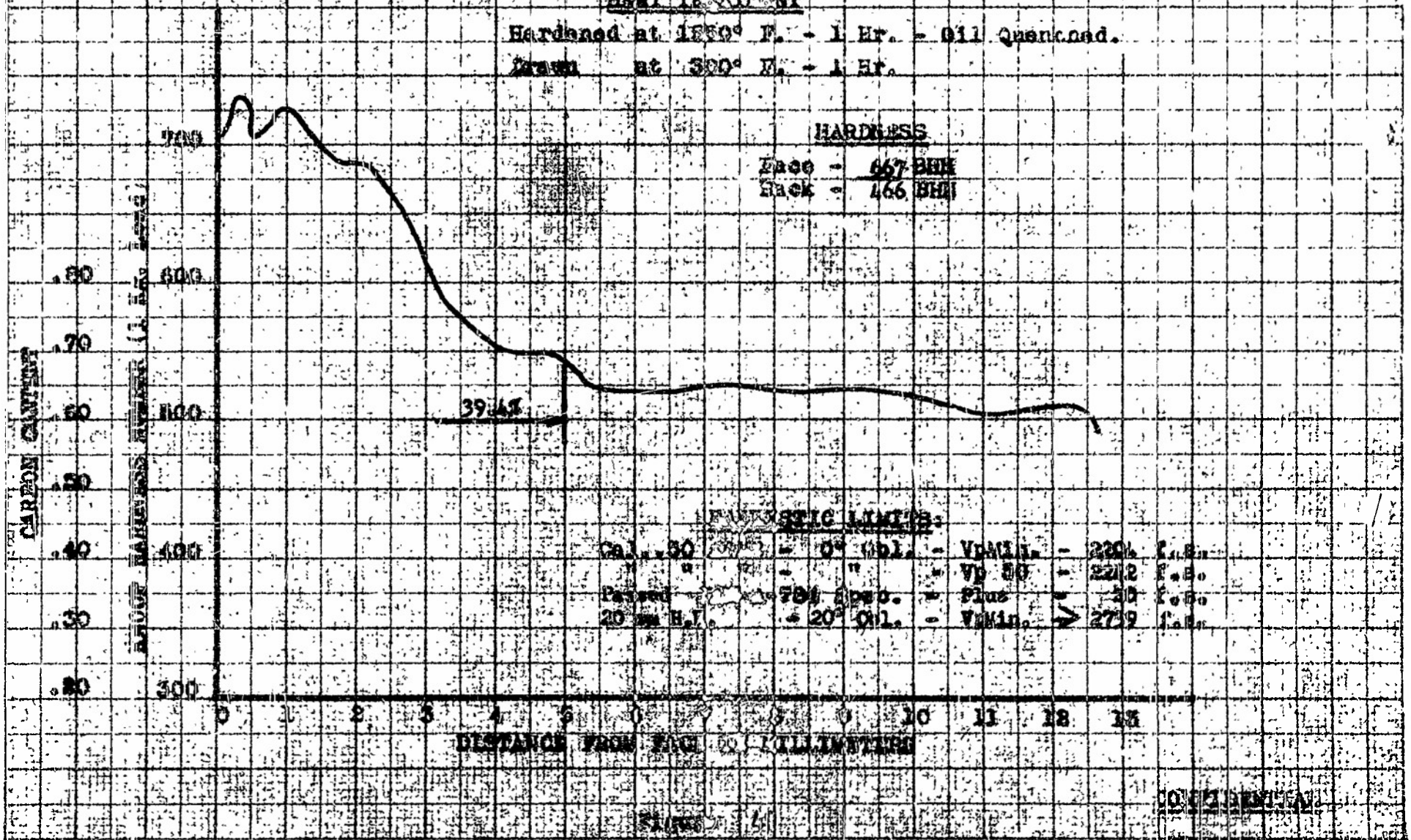
Hardened at 1550° F. - 1 Hr. - Oil Quenched.

Drawn at 300° F. - 1 Hr.

HARDNESS

Face - 667 BHN

Back - 466 BHN



FOR STATIC LIMITS:

Ca. .30 - 0° Obl. - Vp Min. - 220 f.s.

" " - " - Vp 30 - 222 f.s.

Passed 70% Spec. - Plus - 30 f.s.

20 mm H.I. - 20° Obl. - V Min. > 2739 f.s.

FIGURE 4

APPENDIX I

HARDNESS DISTRIBUTION THROUGH CROSS SECTION OF

LITHIUM CO. .501" PLATE NO. F-19-A HEAT NO. 71

HEAT TREATMENT

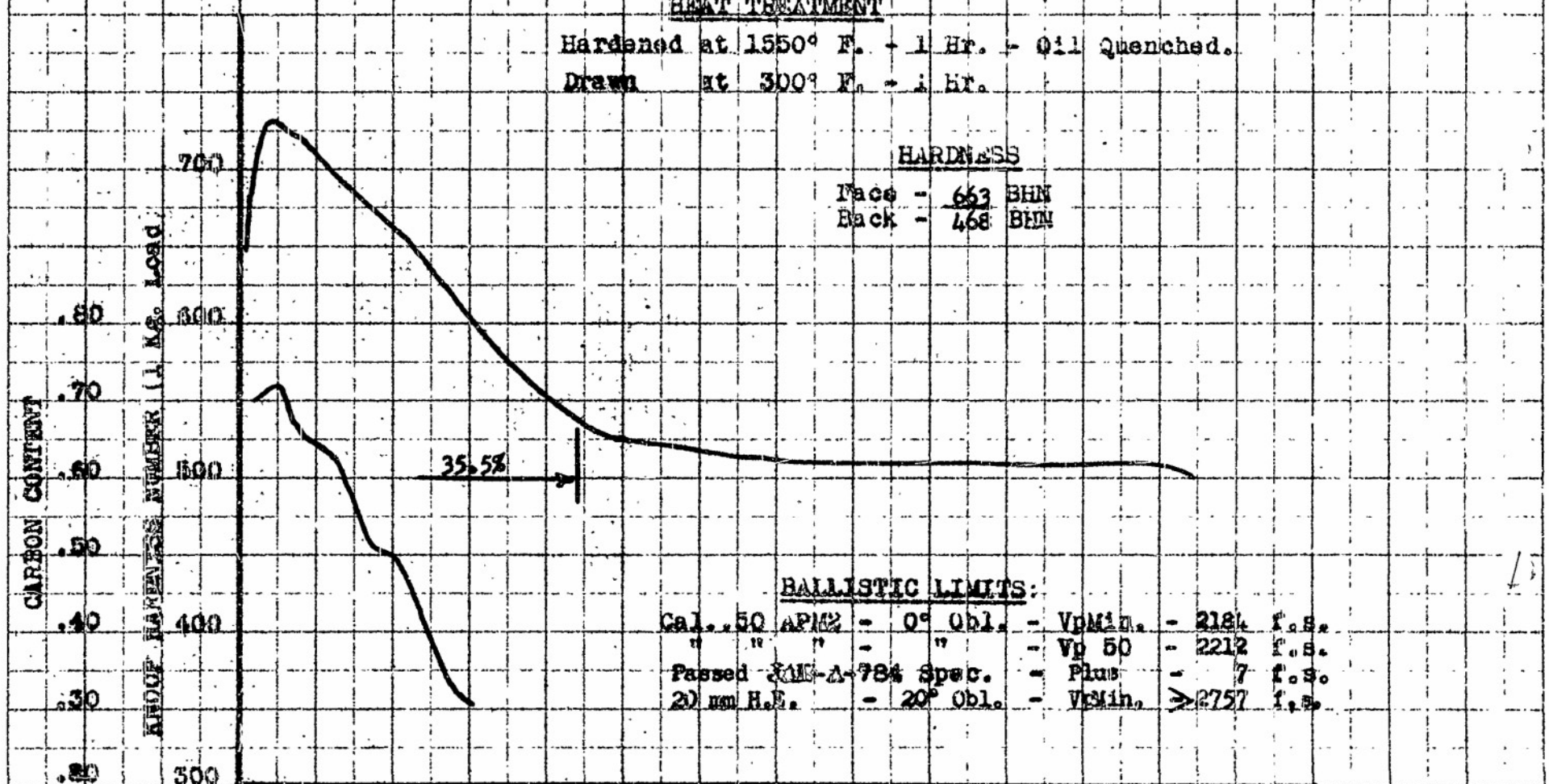
Hardened at 1550° F. - 1 Hr. - Oil Quenched.

Drawn at 300° F. - 1 Hr.

HARDNESS

Face - 663 BHN

Back - 468 BHN



BALLISTIC LIMITS:

Cal..50 APM2 - 0° Obl. - VpMin. - 2184 f.s.

" " " - " - Vp 50 - 2212 f.s.

Passed MIL-A-784 Spec. - Plus - 7 f.s.

20 mm H.E. - 20° Obl. - VsMin. ≥2757 f.s.

Figure 50

CONFIDENTIAL

APPENDIX C

HARDNESS DISTRIBUTION THROUGH CROSS SECTION OF

LITHIUM CO. .50" PLATE NO. P-19-B HEAT NO. 71

HEAT TREATMENT

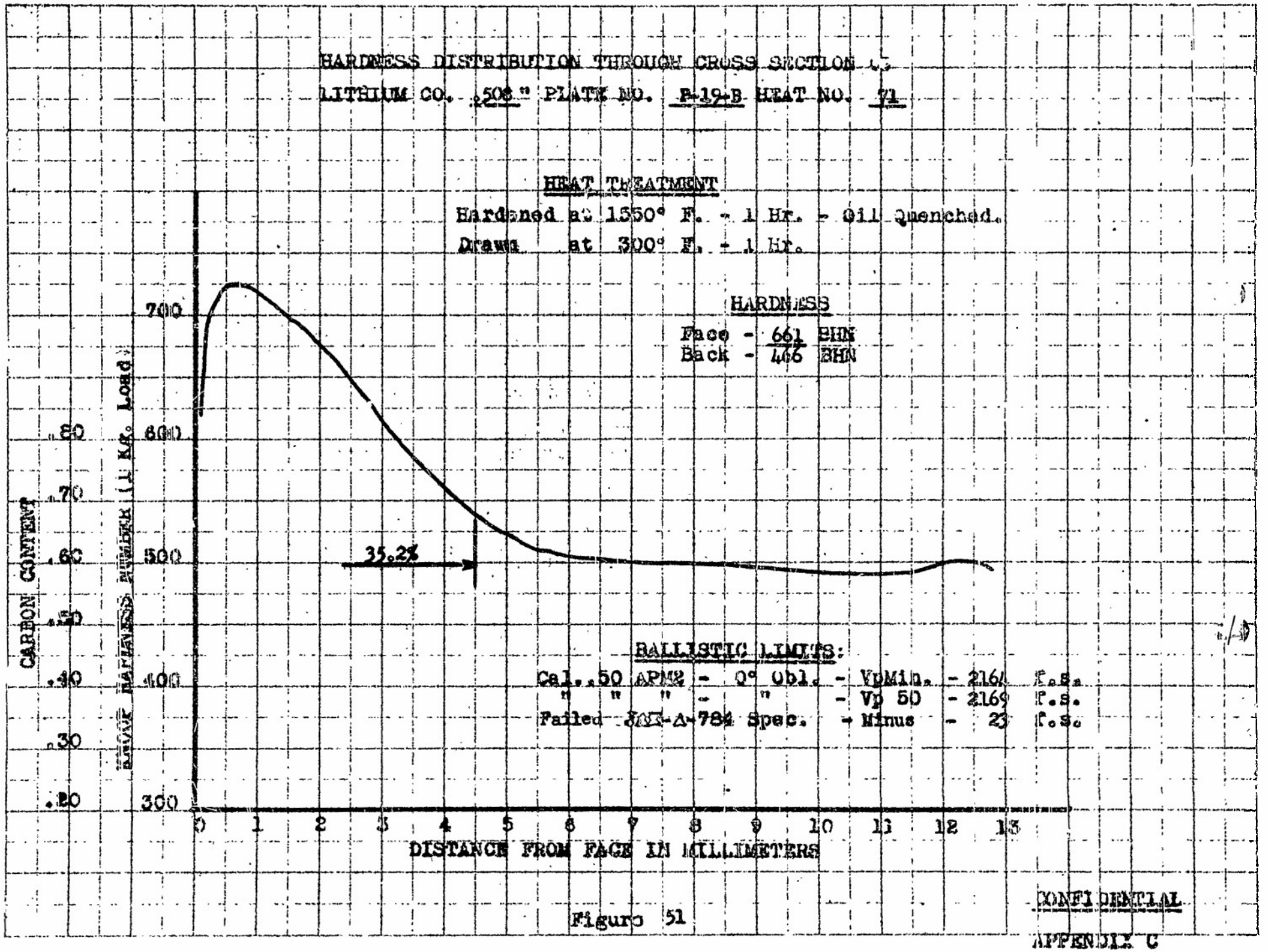
Hardened at 1550° F. - 1 Hr. - Oil Quenched.

Drawn at 300° F. - 1 Hr.

HARDNESS

Face - 661 BHN

Back - 466 BHN



BALLISTIC LIMITS:

Cal. .50 APM2 - 0° Obl. - VpMin. - 2164 F.S.

" " " - " - Vp 50 - 2169 F.S.

Failed MIL-A-46100 Spec. - Minus - 23 F.S.

Figure 51

CONFIDENTIAL

APPENDIX C

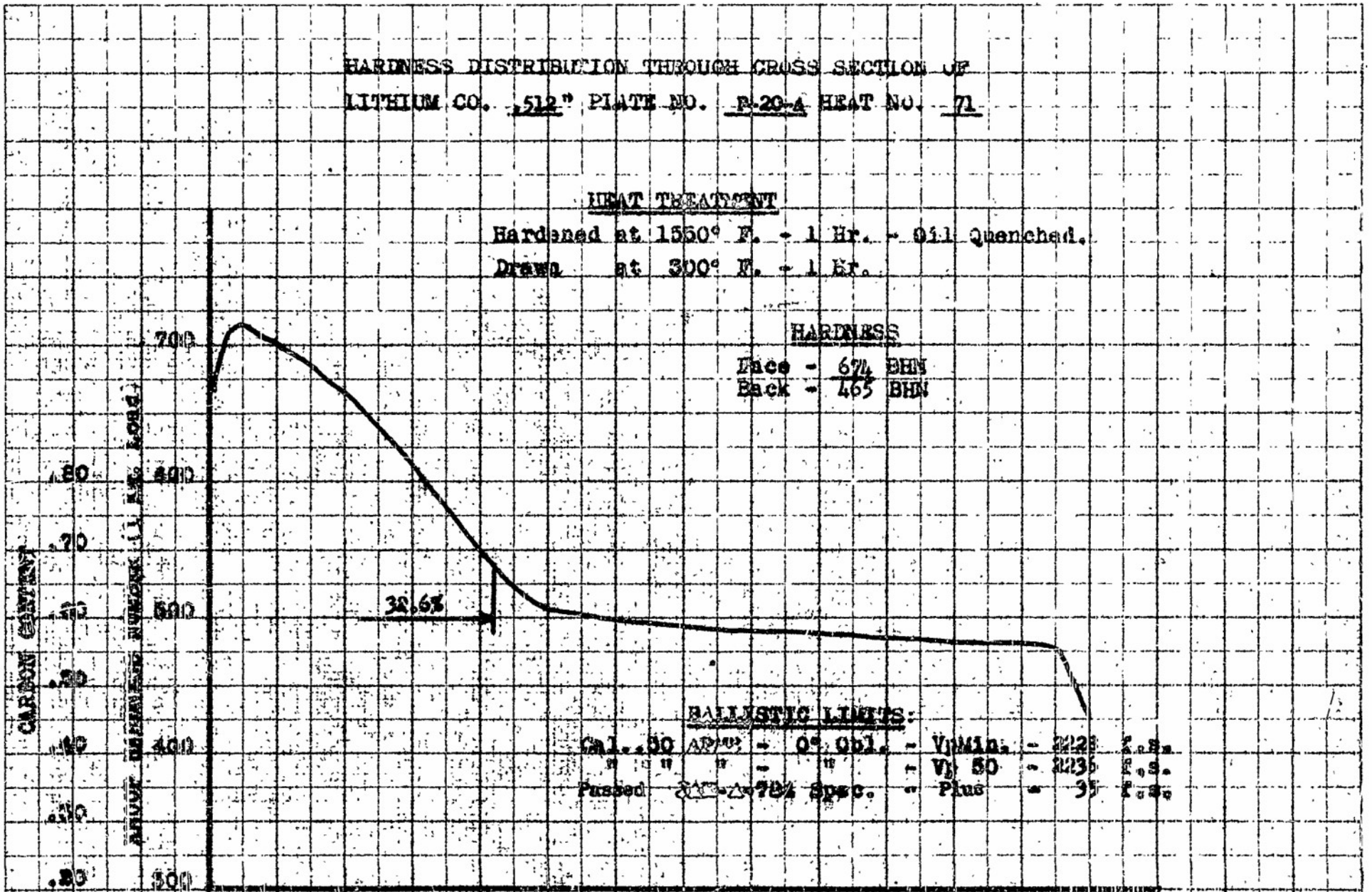
HARDNESS DISTRIBUTION THROUGH CROSS SECTION OF
LITHIUM CO. .512" PLATE NO. P-20-A HEAT NO. 71

HEAT TREATMENT

Hardened at 1550° F. - 1 Hr. - Oil Quenched.
Drawn at 300° F. - 1 Hr.

HARDNESS

Face - 674 BHN
Back - 465 BHN



BALLISTIC LIMITS:

Cal. .50 AP M2 - 0° Obl. - V1 Min. - 2428 f.s.
" " " - " - V50 - 2436 f.s.
Passed 8 out of 10 Spec. - Plus - 35 f.s.

Figure 52

CONFIDENTIAL

APPENDIX C

HARDNESS DISTRIBUTION THROUGH CROSS SECTION OF

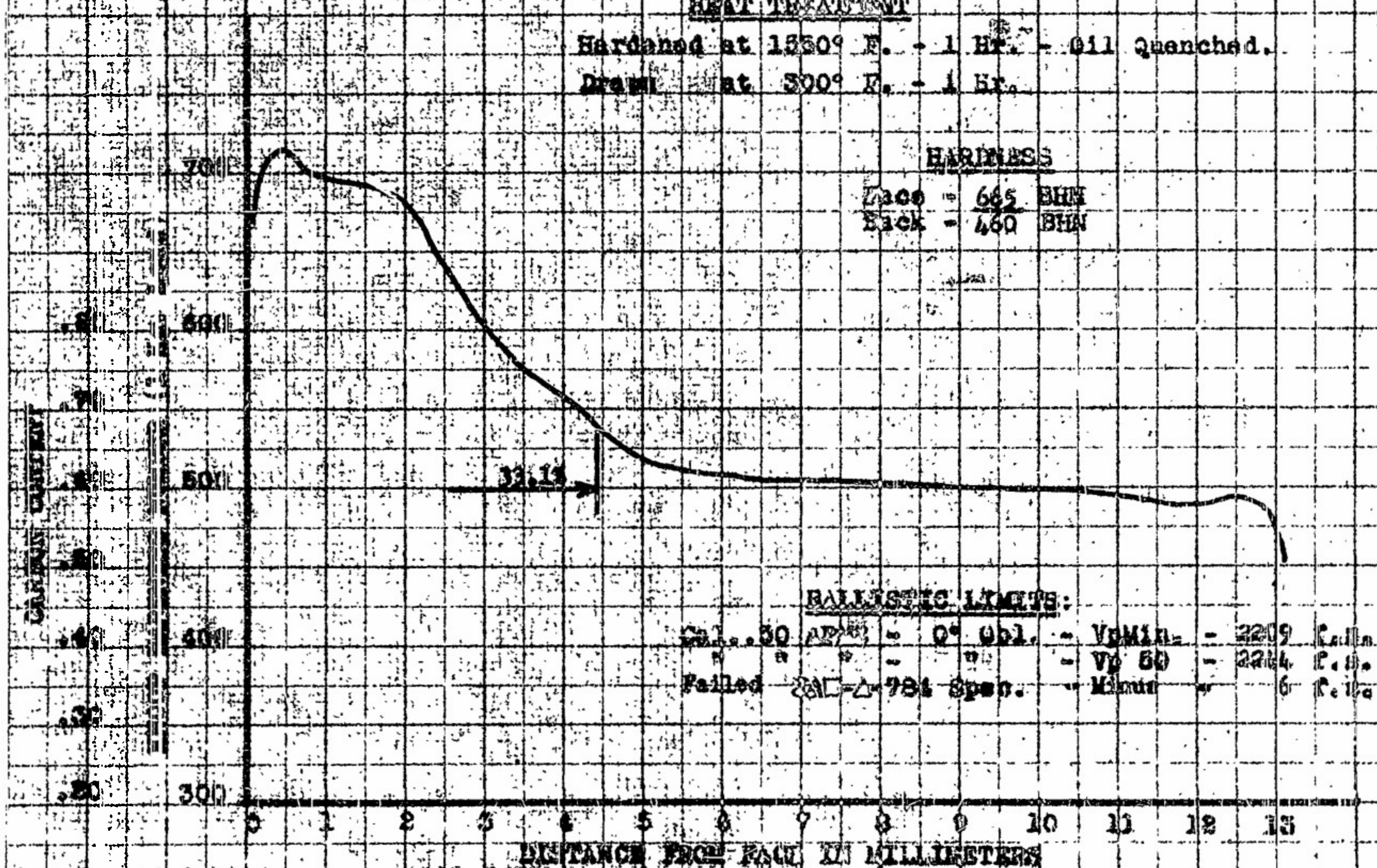
LITHIUM CO. .527" PLATE NO. E-20-B HEAT NO. 71

HEAT TREATMENT

Hardened at 1550° F. - 1 Hr. - Oil Quenched.
Drawn at 300° F. - 1 Hr.

HARDNESS

Face - 665 BHN
Back - 460 BHN



BALLISTIC LIMITS:

Cal. .50 AP" - 0° Obl. - VpMin. - 2209 f.s.
" " " - " - Vp 50 - 2244 f.s.
Failed SAE-Δ-781 Spec. - Minus - 6 f.s.

Figure 53

CONFIDENTIAL

APPENDIX C

HARDNESS DISTRIBUTION THROUGH CROSS SECTION OF

LITHIUM CO. .535" PLATE NO. P-21-A HEAT NO. 71

HEAT TREATMENT

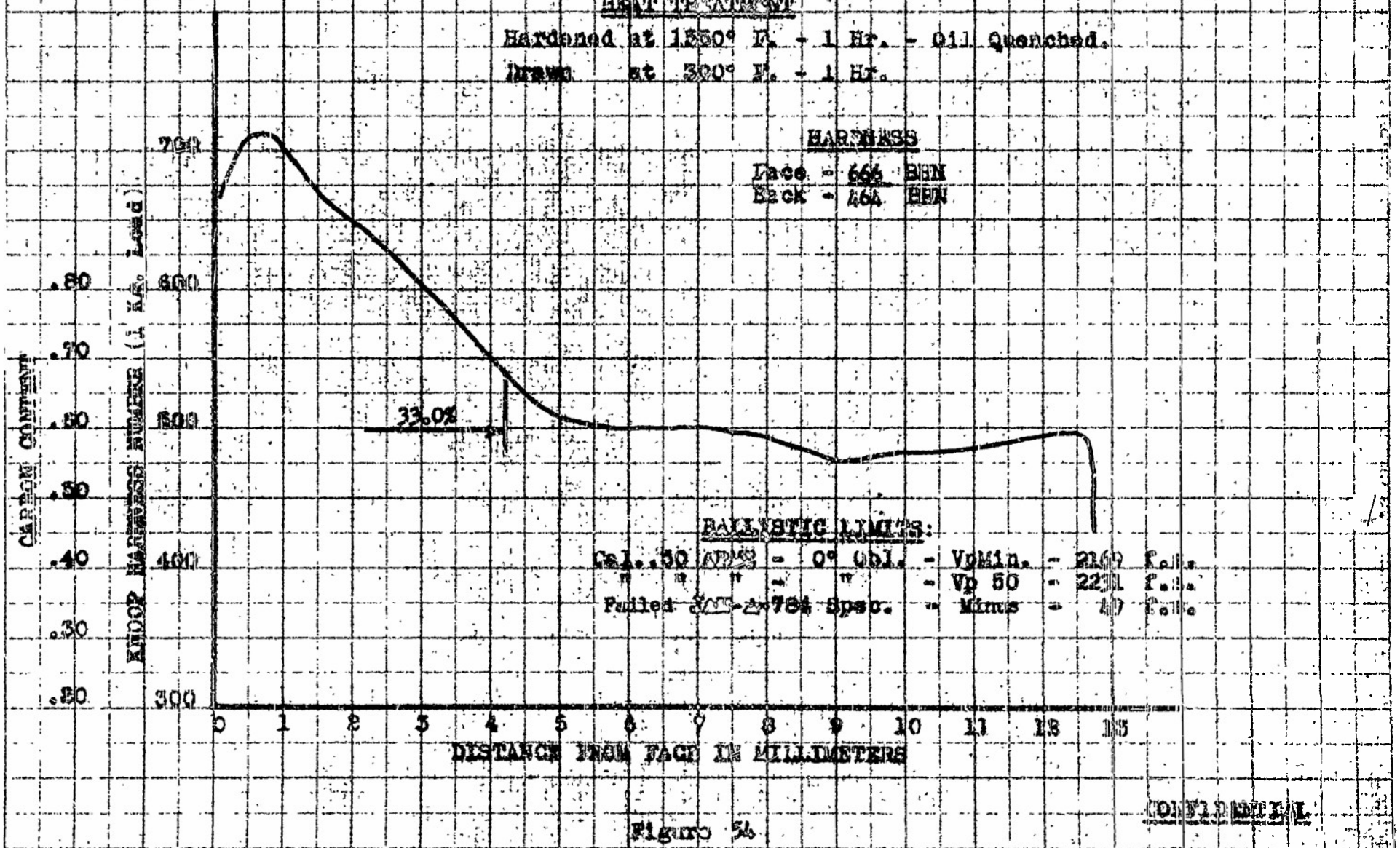
Hardened at 1550° F. - 1 Hr. - Oil Quenched.

Drawn at 300° F. - 1 Hr.

HARDNESS

Face - 666 BHN

Back - 464 BHN



BALLISTIC LIMITS:

Cal..50 APWC - 0° Obl. - VpMin. - 2160 f.s.

" " " - " - Vp 50 - 2231 f.s.

Fuzed M55-A-784 Spec. - Minus - 40 f.s.

CONFIDENTIAL

Figure 5b

APPENDIX C

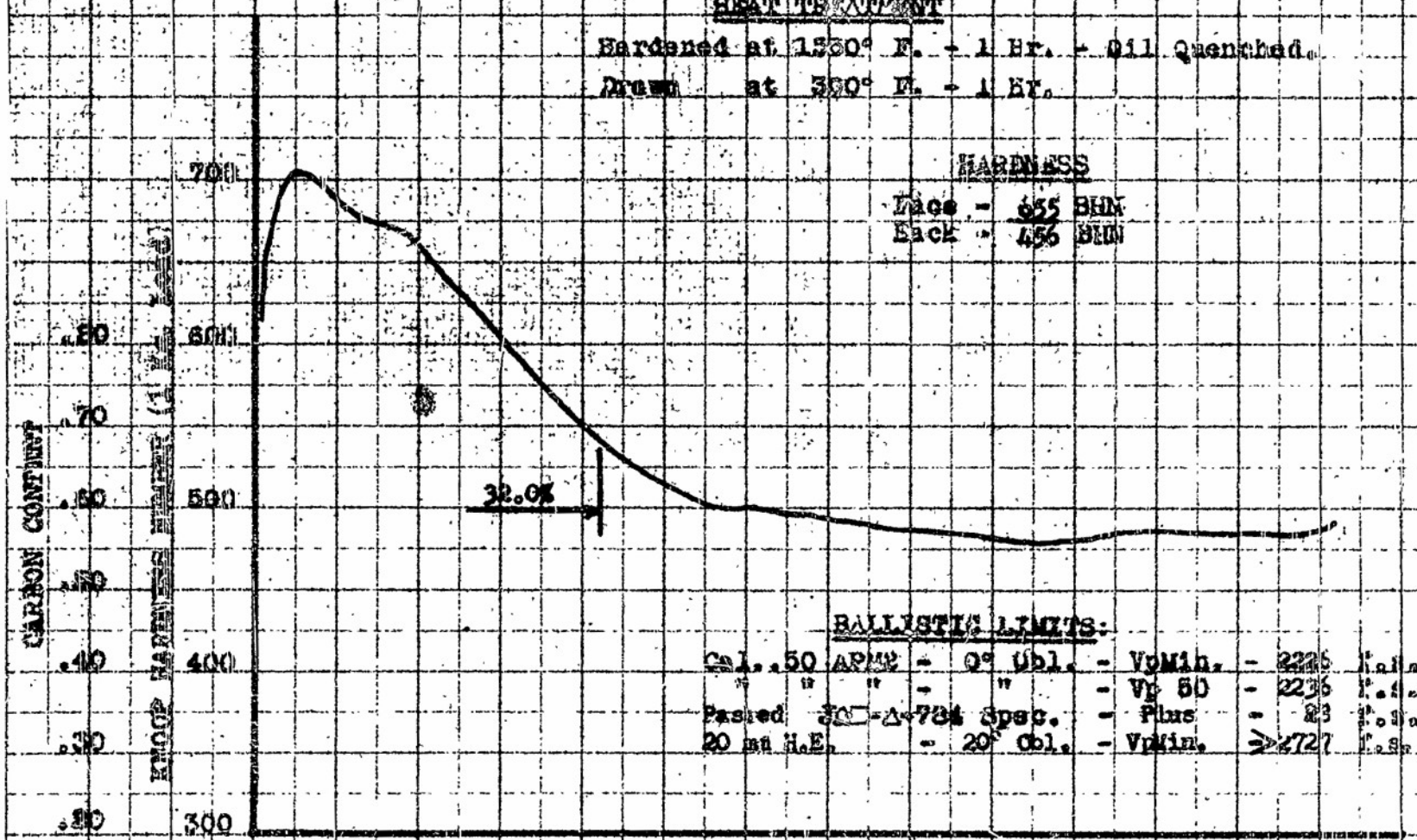
HARDNESS DISTRIBUTION THROUGH CROSS SECTION OF
LITHIUM CO. .515" PLATE NO. F-21-B HEAT No. 71

HEAT TREATMENT

Hardened at 1530° F. + 1 Hr. + Oil Quenched.
Drawn at 300° F. + 1 Hr.

HARDNESS

Face - 655 BHN
Back - 456 BHN



BALLISTIC LIMITS:

Cal. .50 APWC - 0° Obl. - VpMin. - 2236 f.s.
" " " - " - Vp 50 - 2236 f.s.
Passed 30 - Δ<70% Spec. - Plus - 23 f.s.
20 mm H.E. - 20° Obl. - VpMin. >2727 f.s.

Figure 55

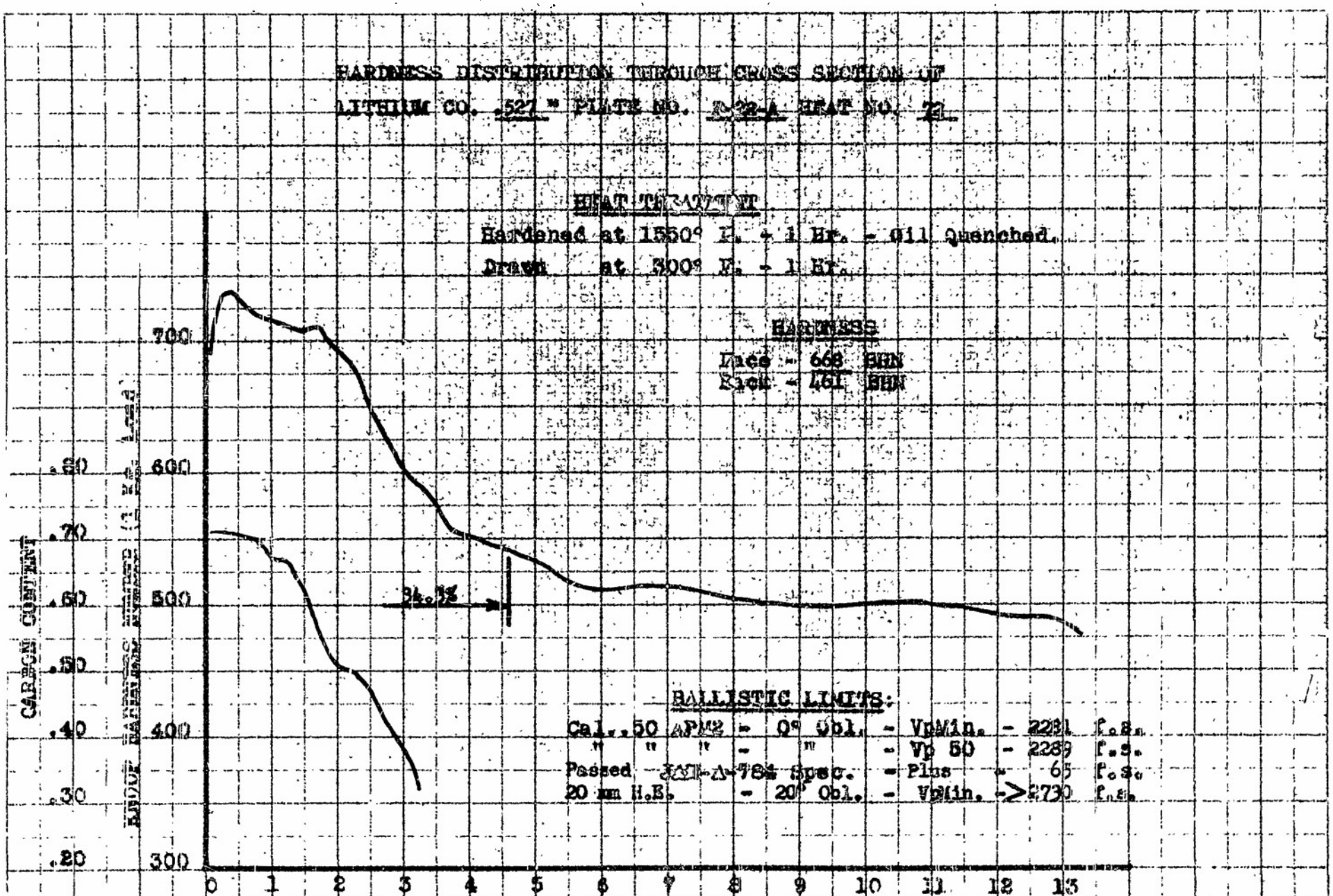
CONFIDENTIAL

APPENDIX C

HARDNESS DISTRIBUTION THROUGH CROSS SECTION OF
LITHIUM CO. .527" PLATE NO. C-22-A HEAT NO. 72

HEAT TREATMENT
Hardened at 1550° F. + 1 Hr. - Oil Quenched.
Drawn at 500° F. + 1 Hr.

HARDNESS
Face - 668 BHN
Back - 461 BHN



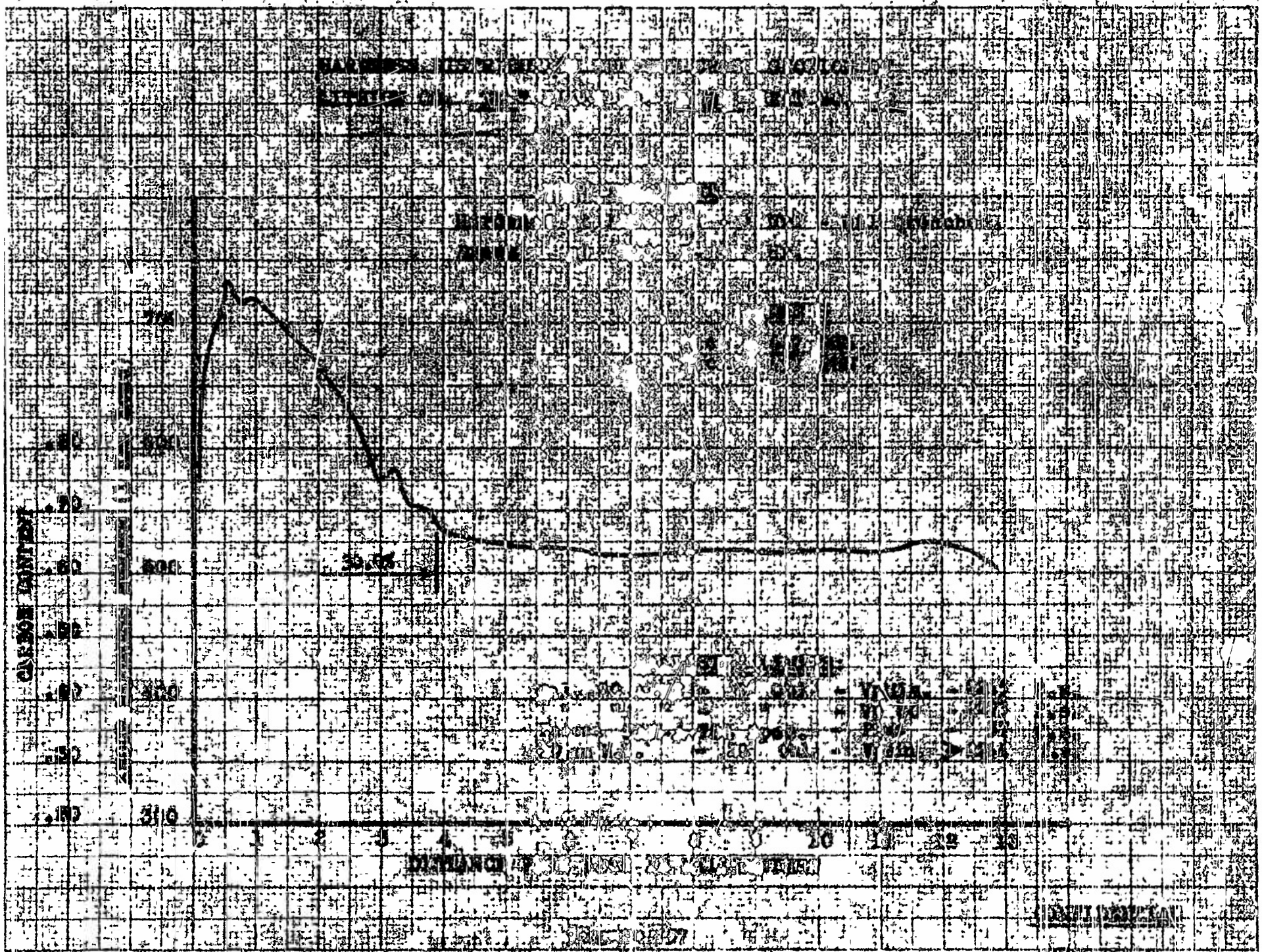
BALLISTIC LIMITS:

Cal..50 APIS	- 0° Obl.	- V50Min.	- 2281	f.s.
" " "	- "	- V50	- 2289	f.s.
Passed MIL-A-46% Spec.		- Plus	- 65	f.s.
20 mm H.E.	- 20° Obl.	- V50Min.	- >2730	f.s.

Figure 56

CONFIDENTIAL

APPENDIX C



APPENDIX C

HARDNESS DISTRIBUTION THROUGH CROSS SECTION OF

LITHIUM CO. .512 " PLATE NO. I-23-A HEAT NO. 72

HEAT TREATMENT

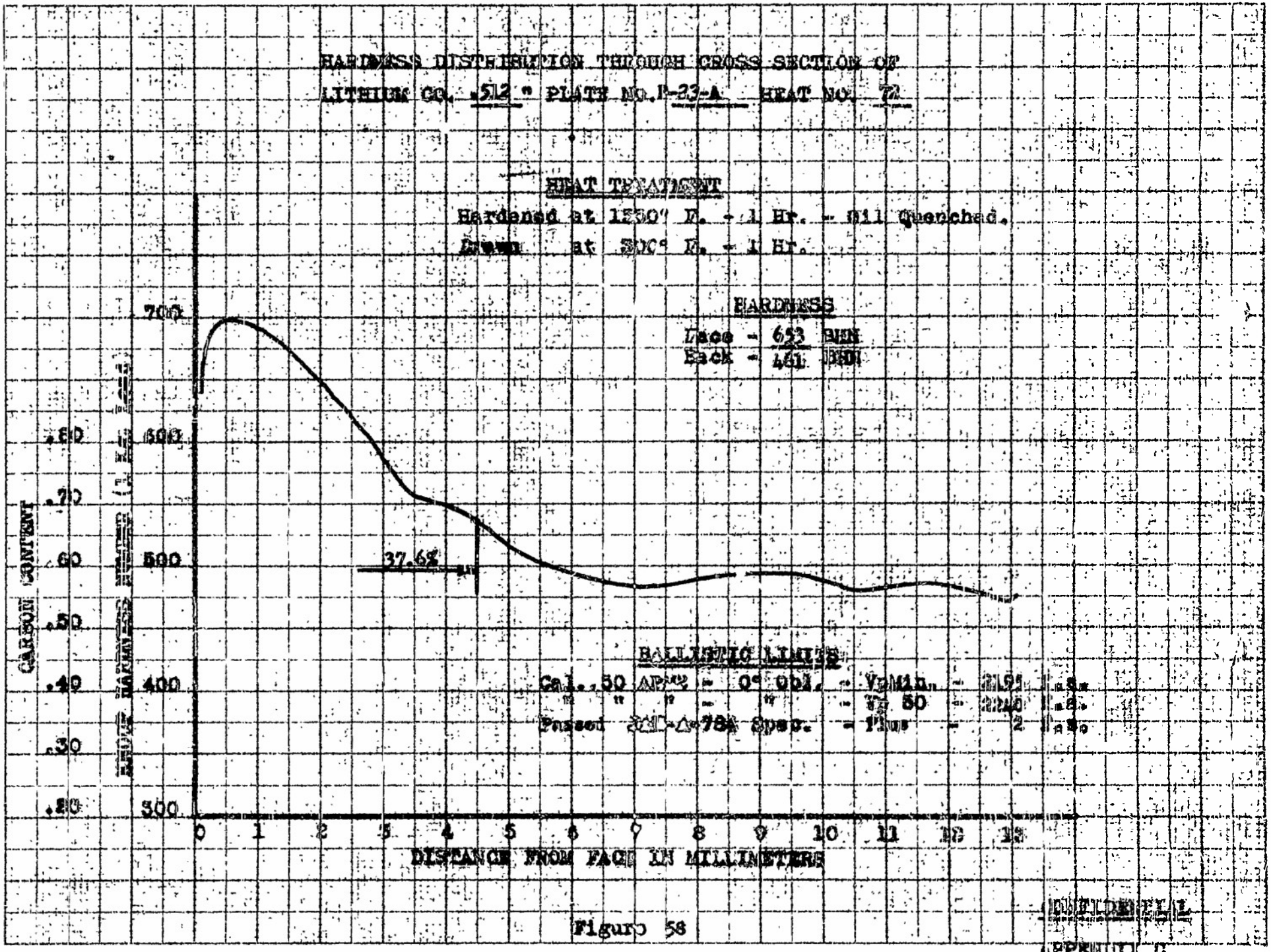
Hardened at 1550° F. - 1 Hr. - Oil Quenched.

Drawn at 300° F. - 1 Hr.

HARDNESS

Face - 653 BHN

Back - 461 BHN



BALLISTIC LIMIT

Cal. .50 AP M2 - 0° Obl. - V50 Min. - 2191 f.s.

" " " " - " - V50 - 2240 f.s.

Passed MIL-A-46100 Spec. - Plus - 2 f.s.

Figure 58

APPENDIX C

HARDNESS DISTRIBUTION THROUGH CROSS SECTION OF
LITHIUM CO. .515 " PLATE NO. F-23-B HEAT NO. 72

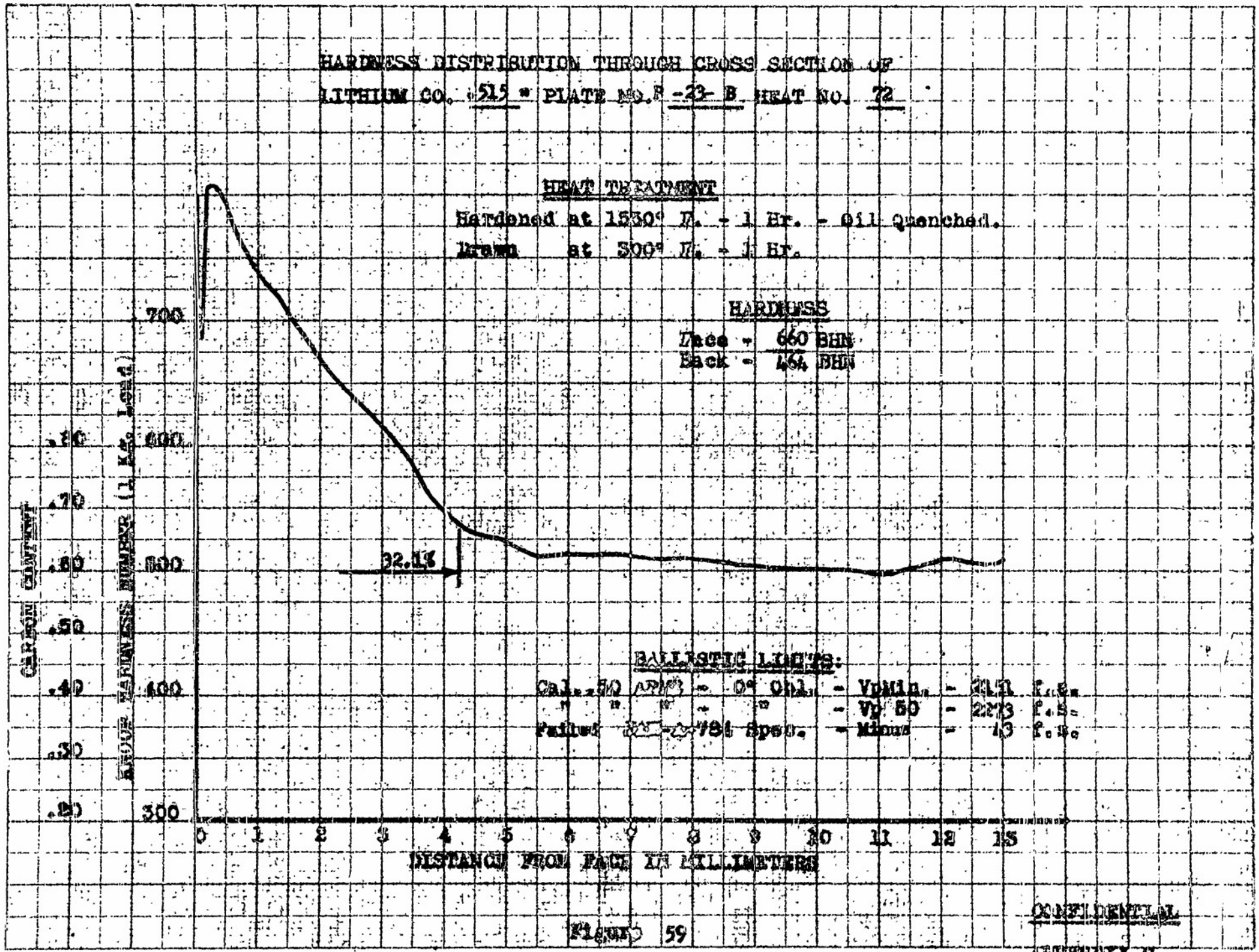


Figure 59

CONFIDENTIAL

APPENDIX C

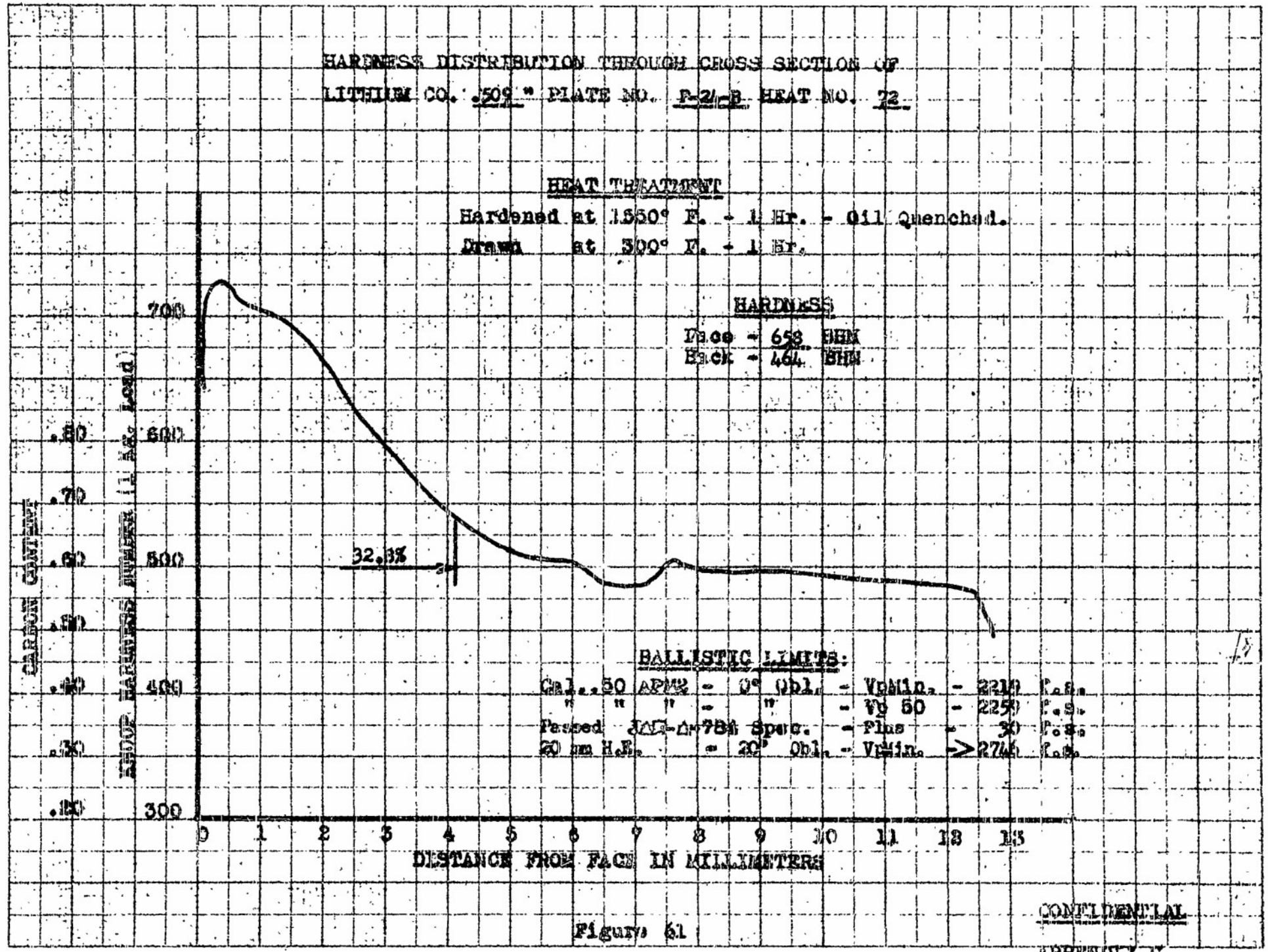
HARDNESS DISTRIBUTION THROUGH CROSS SECTION OF
LITHIUM CO. .509 " PLATE NO. P-2/-B HEAT NO. 72

HEAT TREATMENT

Hardened at 1550° F. - 1 Hr. - Oil Quenched.
Drawn at 300° F. - 1 Hr.

HARDNESS

Face - 658 BHN
Back - 464 BHN



BALLISTIC LIMITS:

Cal. .50 APM2 - 0° Obl. - V50 Min. - 2210 F.P.S.
" " " - " - V50 - 2250 F.P.S.
Passed MIL-A-46100 Spec. - Plus - 30 F.P.S.
20 mm H.E. - 20° Obl. - V50 Min. - >2740 F.P.S.

Figure 61

CONFIDENTIAL

APPENDIX C

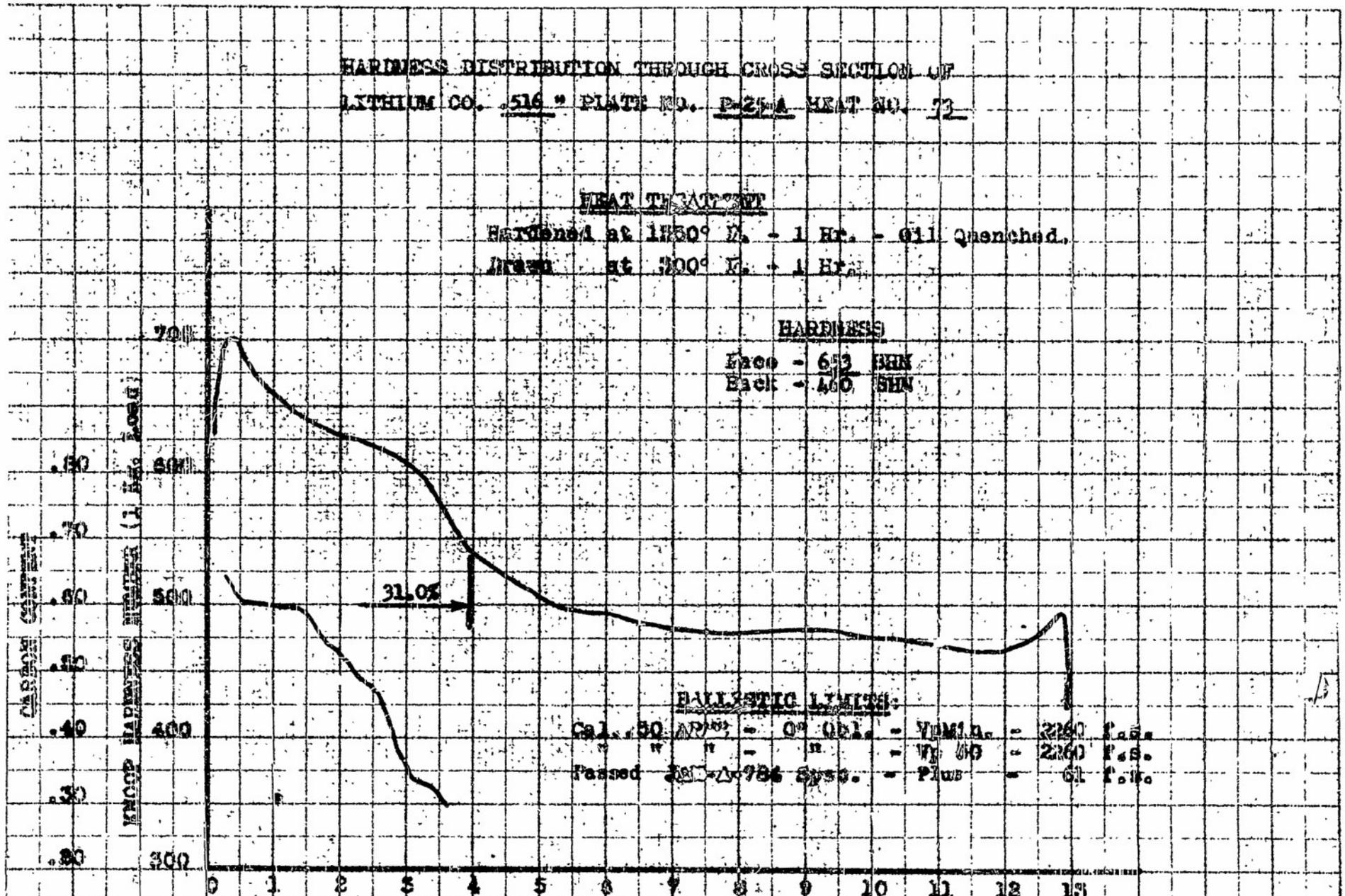
HARDNESS DISTRIBUTION THROUGH CROSS SECTION OF
LITHIUM CO. .516 " PLATE NO. P-25-A HEAT NO. 73

HEAT TREATMENT

Hardened at 1550° F. - 1 Hr. - Oil Quenched.
Drawn at 300° F. - 1 Hr.

HARDNESS

Face - 653 BHN
Back - 460 BHN



BALLISTIC LIMIT:

Cal. .50 AP M2 - 0° Obl. - V50 Min. - 2260 f.p.s.
" " " - " - V50 Max - 2280 f.p.s.
Passed MIL-A-46100 Spec. - Plus - 61 f.p.s.

Figure 52

CONFIDENTIAL

APPENDIX C

HARDNESS DISTRIBUTION THROUGH CROSS SECTION OF

LITHIUM CO. .525 " PLATE NO. P-25-B HEAT NO. 73

HEAT TREATMENT

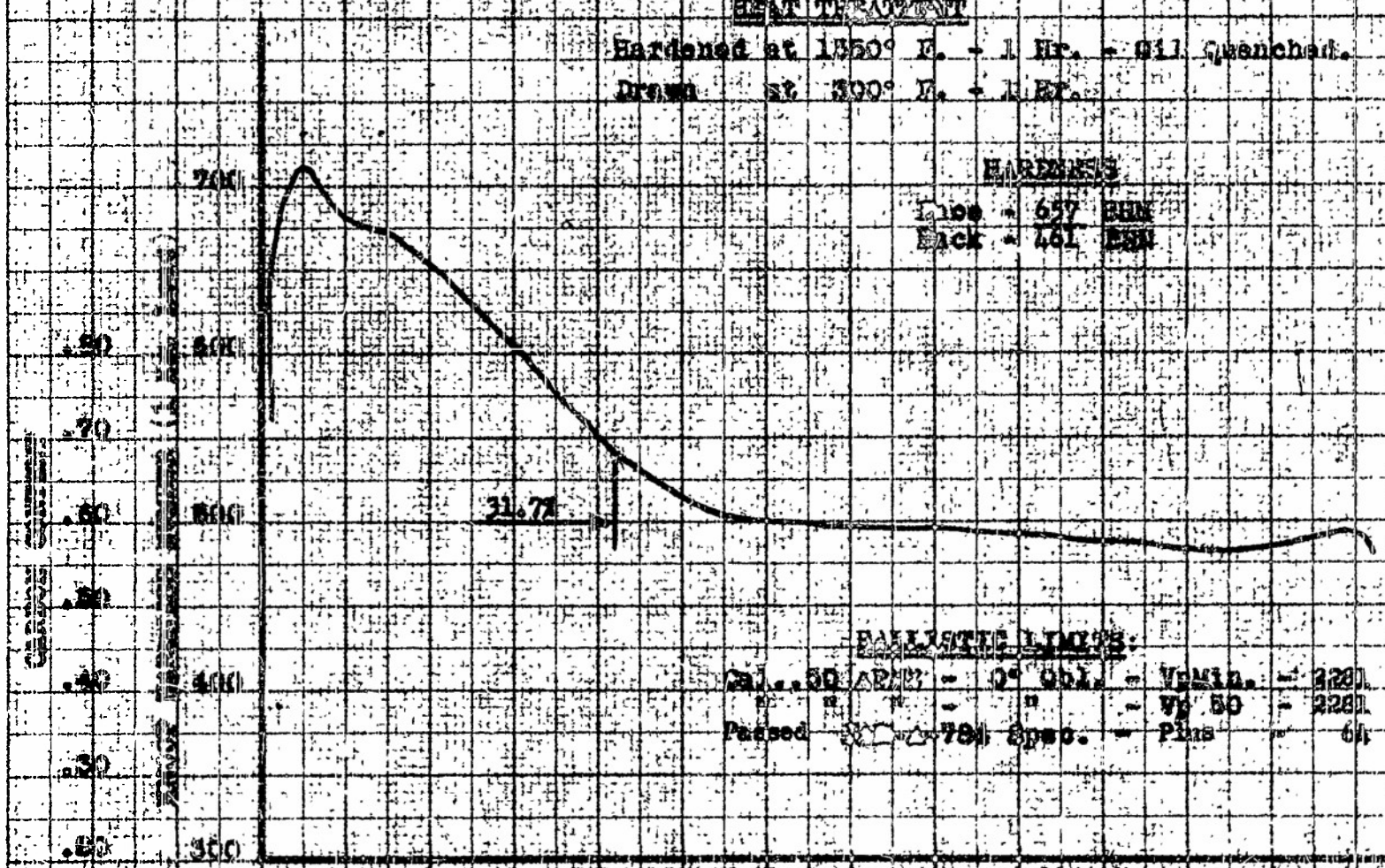
Hardened at 1550° F. + 1 Hr. - Oil Quenched.

Drawn at 300° F. + 1 Hr.

HARDNESS

Face - 657 BHN

Back - 461 BHN



BALLISTIC LIMITS:

Cal. .50 AP/T - 0° Obl. - V_{min} - 3220 f.p.s.

" " " - " - V_{50} - 3220 f.p.s.

Passed 3 of 4 at 780 f.p.s. - Plus - 6% f.p.s.

Figure 63

APPENDIX C

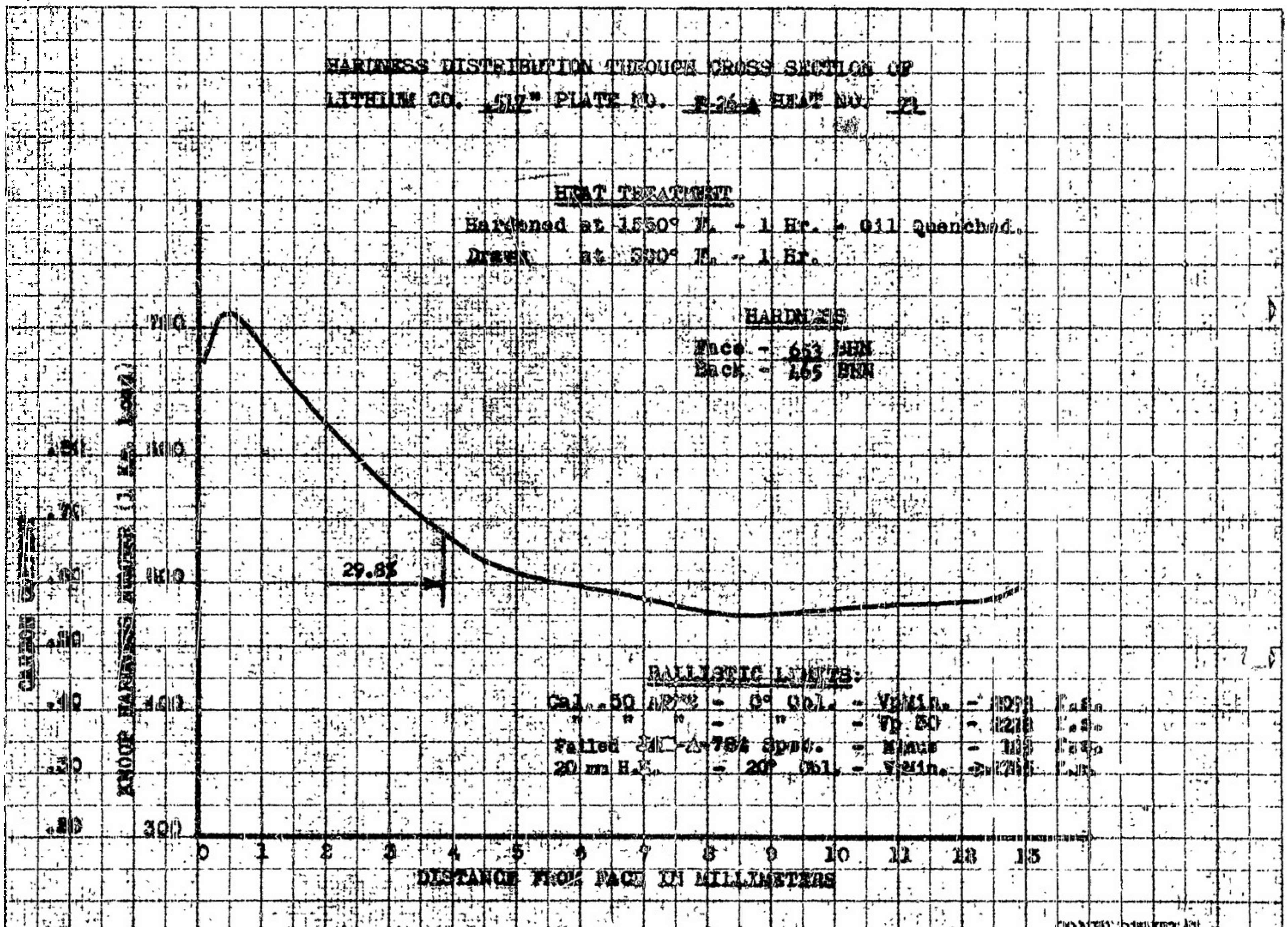


Figure 64

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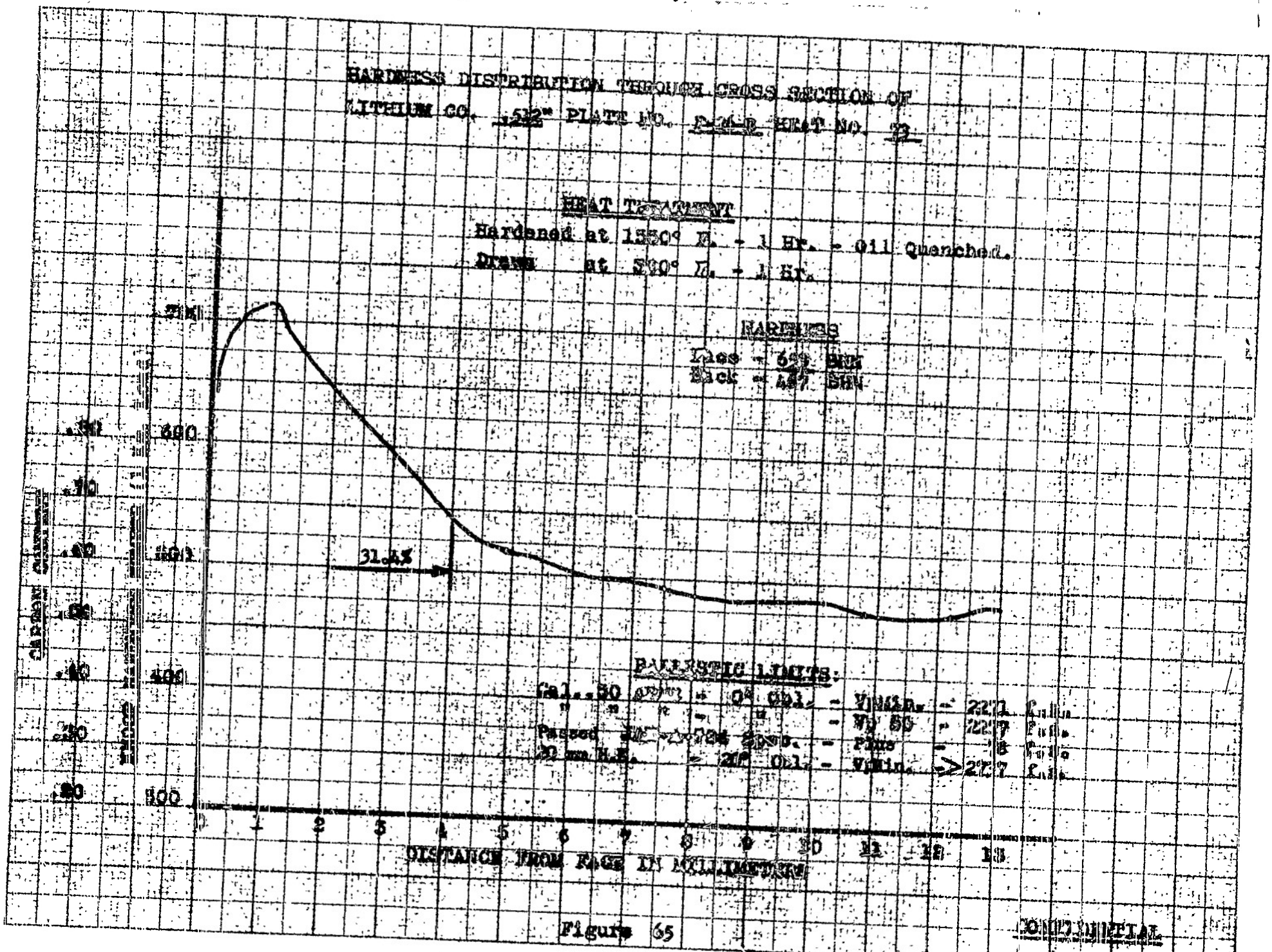
APPENDIX C


HARDNESS DISTRIBUTION THROUGH CROSS SECTION OF
LITHIUM CO. .532" PLATE NO. [illegible] HEAT NO. 33
HEAT TREATMENT
Hardened at 1550° F. + 1 Hr. - Oil Quenched.
Drawn at 500° F. + 1 Hr.
HARDNESS
Face - 627 BHN
Back - 487 BHN
31.45
BALLISTIC LIMITS:
Fail..50 APWC @ 0° Obl. - V50Min. - 2221 f.p.s.
" " @ " - V50 - 2227 f.p.s.
Passed .50 APWC @ 0° Obl. - Plate - 18 f.p.s.
20 mm H.E. - 20° Obl. - V50Min. -> 2727 f.p.s.
CARBON CONTENT
HARDNESS BHN
DISTANCE FROM FACE IN MILLIMETERS
Figure 65
CONFIDENTIAL
APPENDIX C

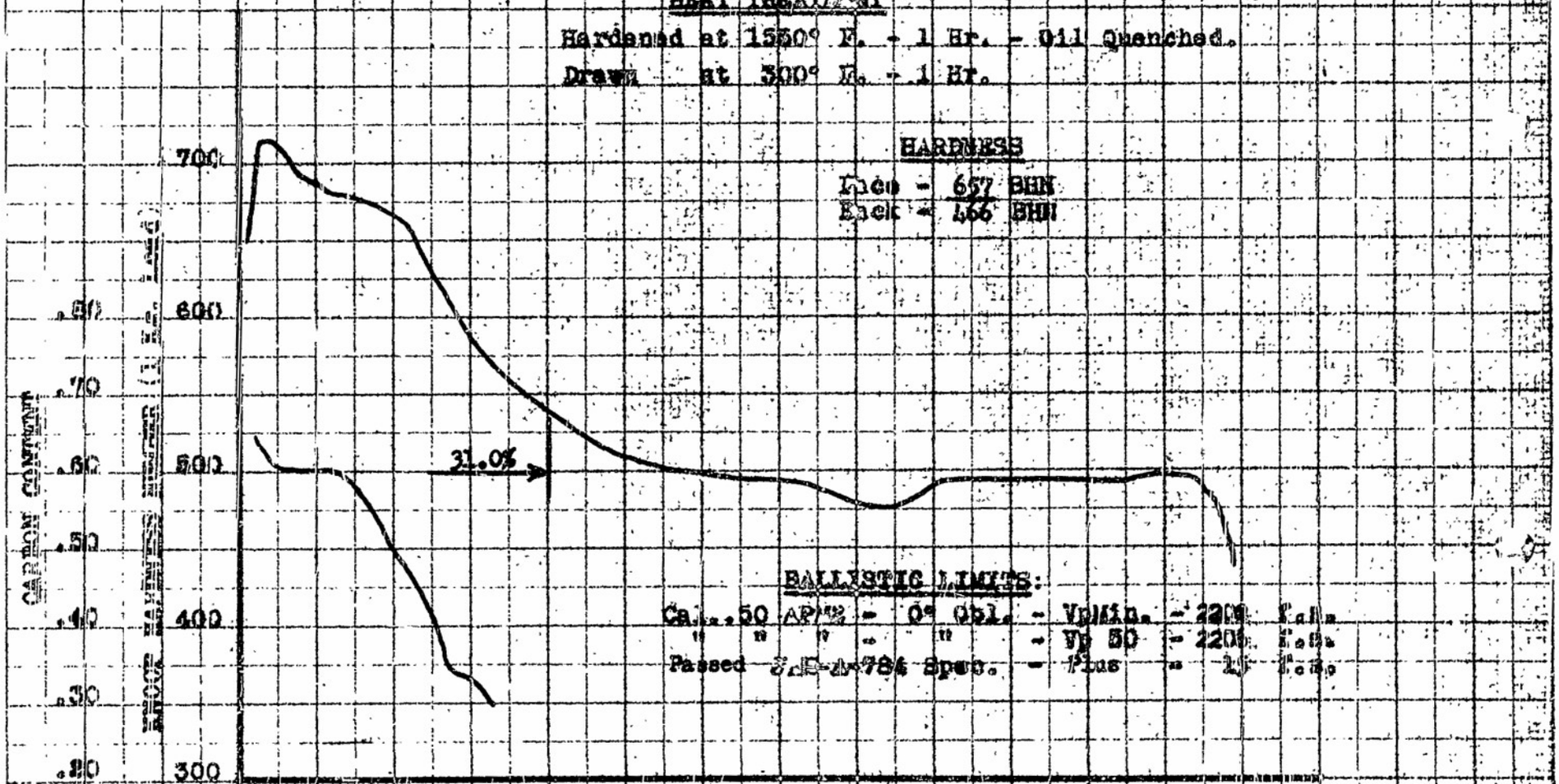
HARDNESS DISTRIBUTION THROUGH CROSS SECTION OF
LITHIUM CO. .512" PLATE NO. P-27-A HEAT NO. 72

HEAT TREATMENT

Hardened at 1550° F. - 1 Hr. - Oil Quenched.
Drawn at 300° F. - 1 Hr.

HARDNESS

Face - 657 BHN
Back - 466 BHN



BALLISTIC LIMITS:

Ca..50 AP M2 - 0° Obl. - V50 Min. - 2200 f/s
" " " - " - V50 - 2200 f/s
Passed MIL-A-46784 Spec. - Plus - 2% f/s

Figure 66

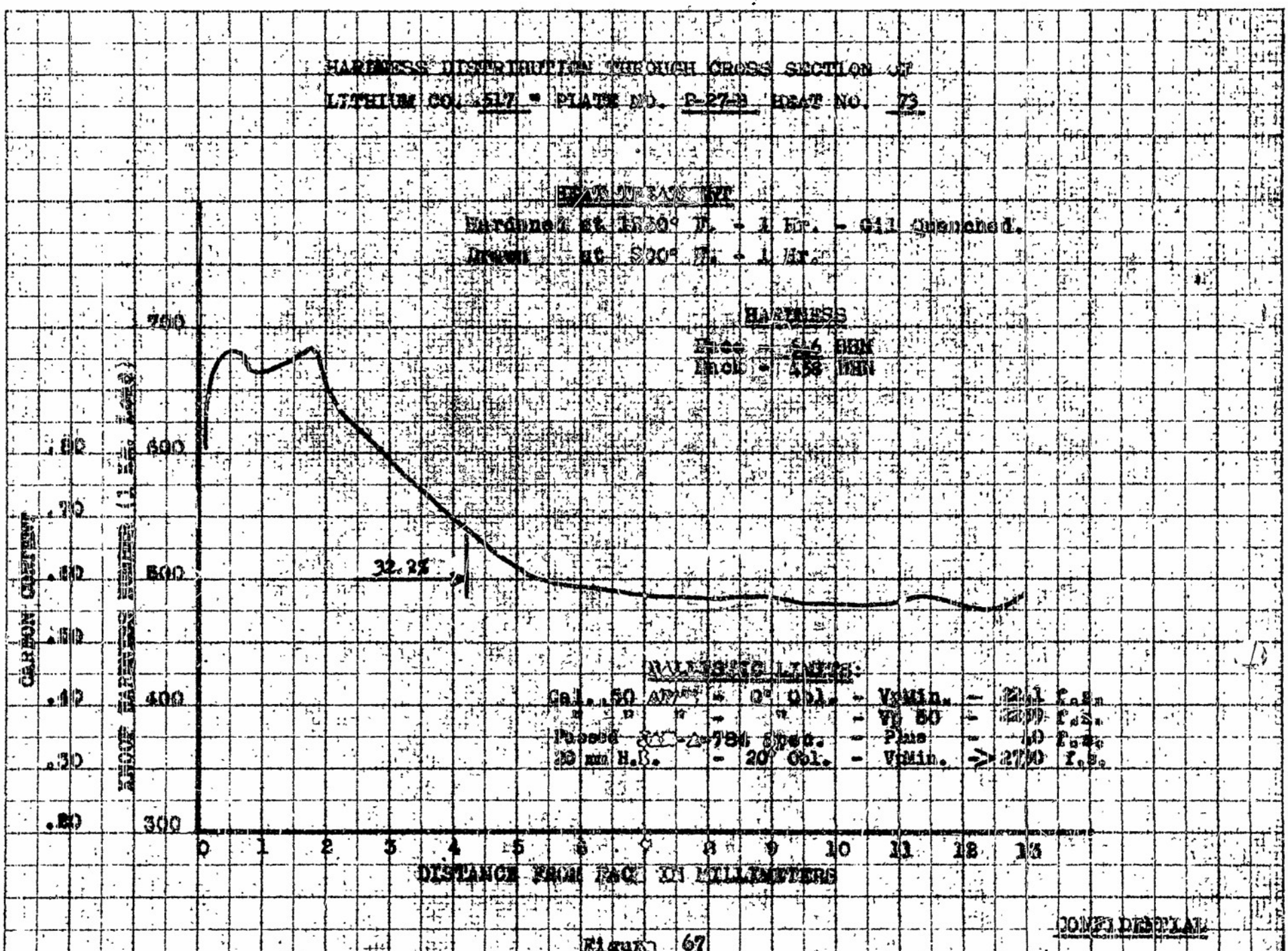


Figure 67

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APPENDIX C

HARDNESS DISTRIBUTION THROUGH CROSS SECTION OF

LITHIUM CO. .125" PLATE (S. P.28.) HEAT NO. 7L

HEAT TREAT

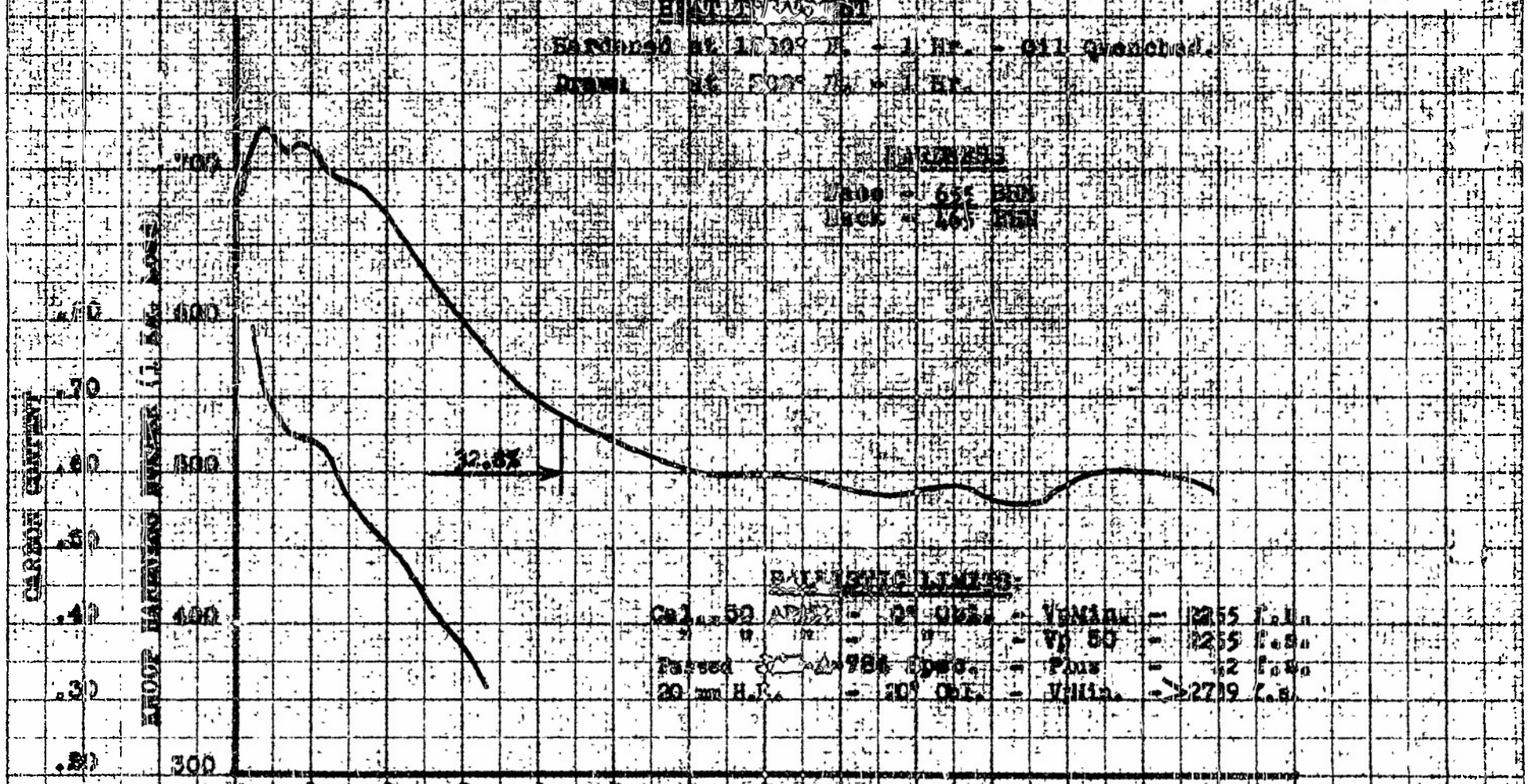
Hardened at 1530° F. - 1 Hr. - Oil Quenched.

Drawn at 500° F. - 1 Hr.

HARDNESS

Face - 655 BHN

Back - 461 BHN



BALLISTIC LIMITS:

Cal. .50 AP M2 - 0° Obl. - V50 Min. - 2855 f.s.

" " " - V50 - 2855 f.s.

Passed 784 Spec. - Plus - 2 f.s.

20 mm H.E.I. - 30° Obl. - Ballis. - >2739 f.s.

Figure 63

CONFIDENTIAL

APPENDIX C

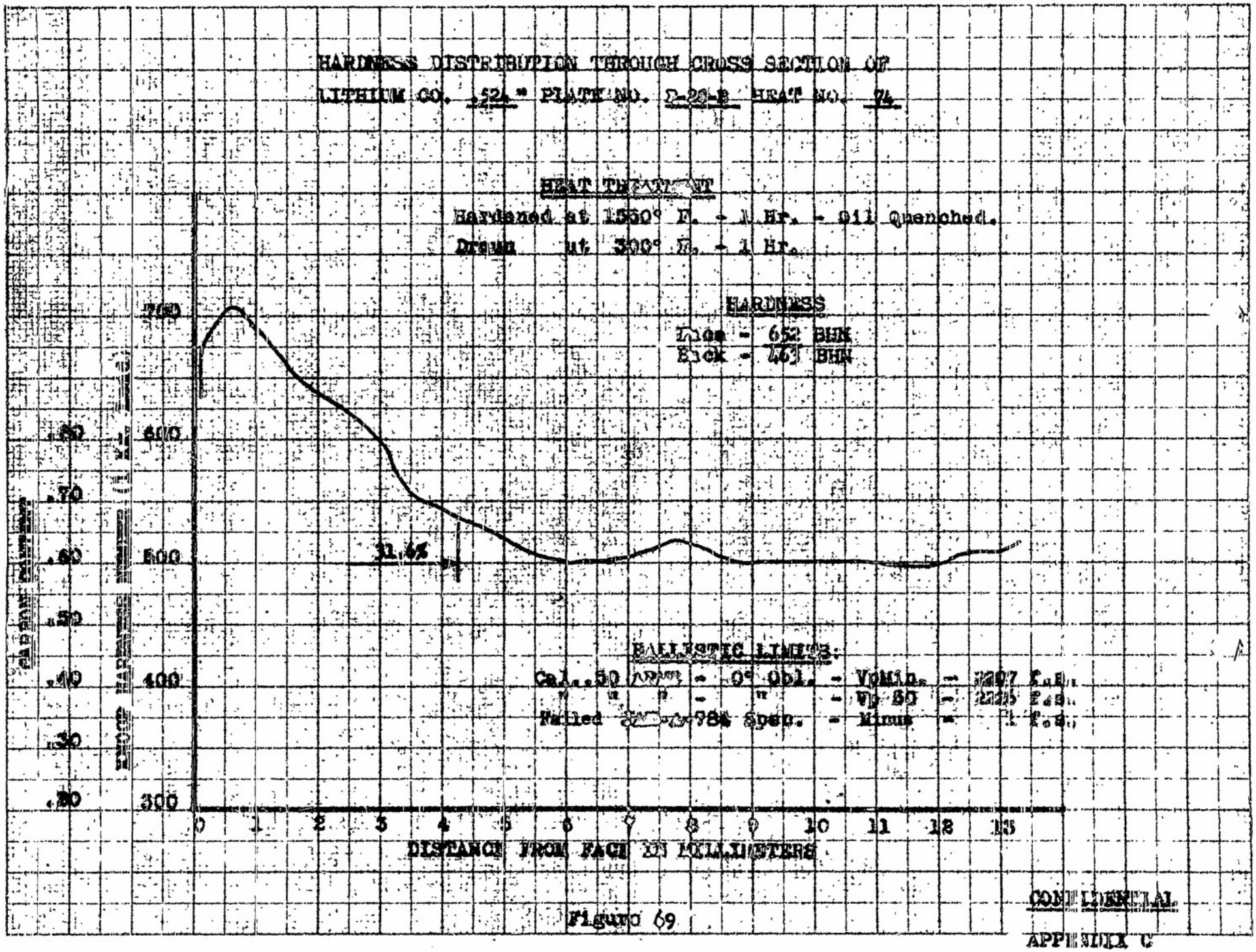


Figure 69

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APPENDIX C

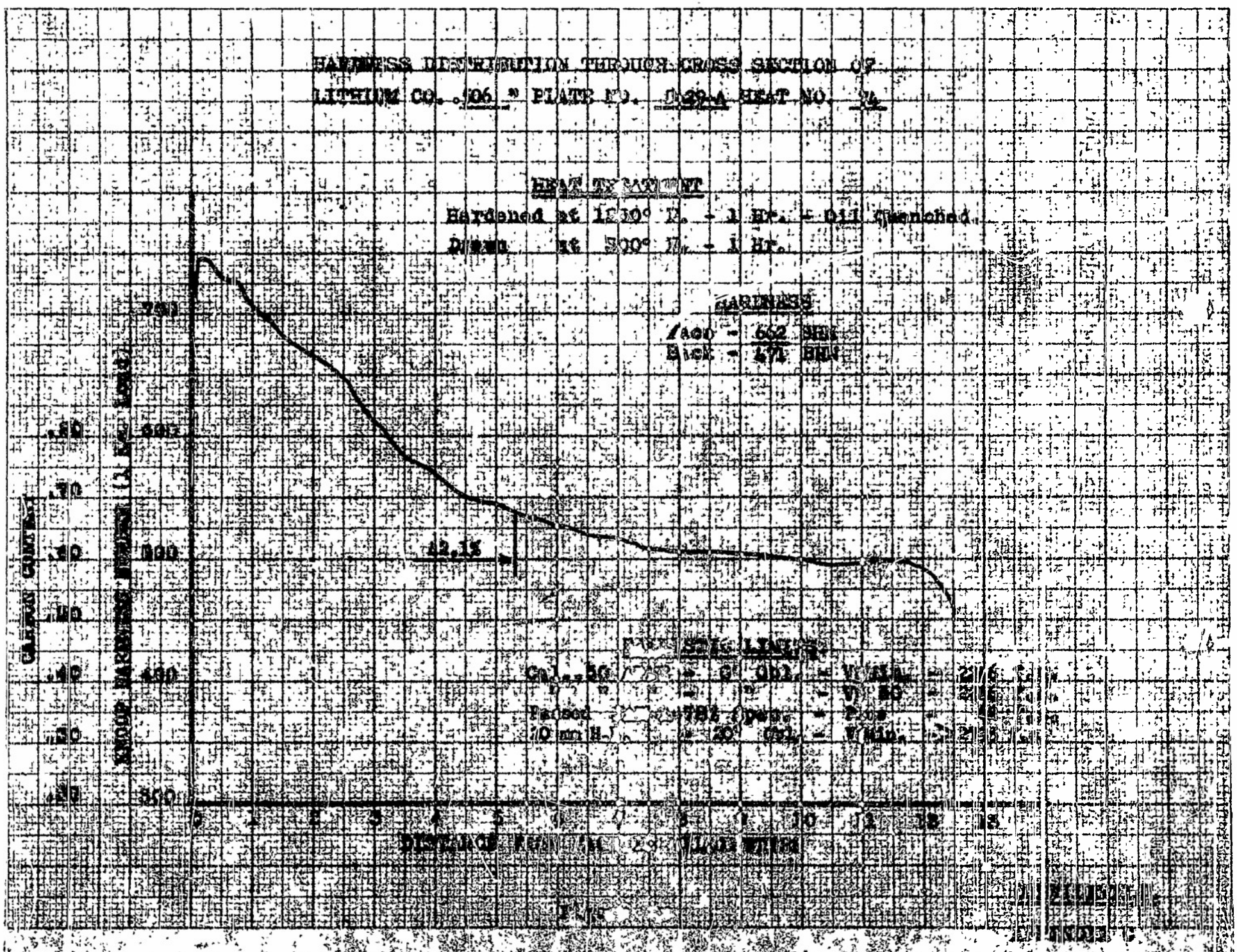
HARDNESS DISTRIBUTION THROUGH CROSS SECTION OF
LITHIUM CO. .06 " PLATE NO. 1-29-A HEAT NO. 24

HEAT TREATMENT

Hardened at 1530° F. - 1 Hr. - Oil Quenched.
Drawn at 500° F. - 1 Hr.

HARDNESS

Face - 662 BHN
Back - 471 BHN



HARDNESS DISTRIBUTION THROUGH CROSS SECTION OF

LITHIUM CO. .505 " PLATE NO. P-29-B HEAT NO. 74

HEAT TREATMENT

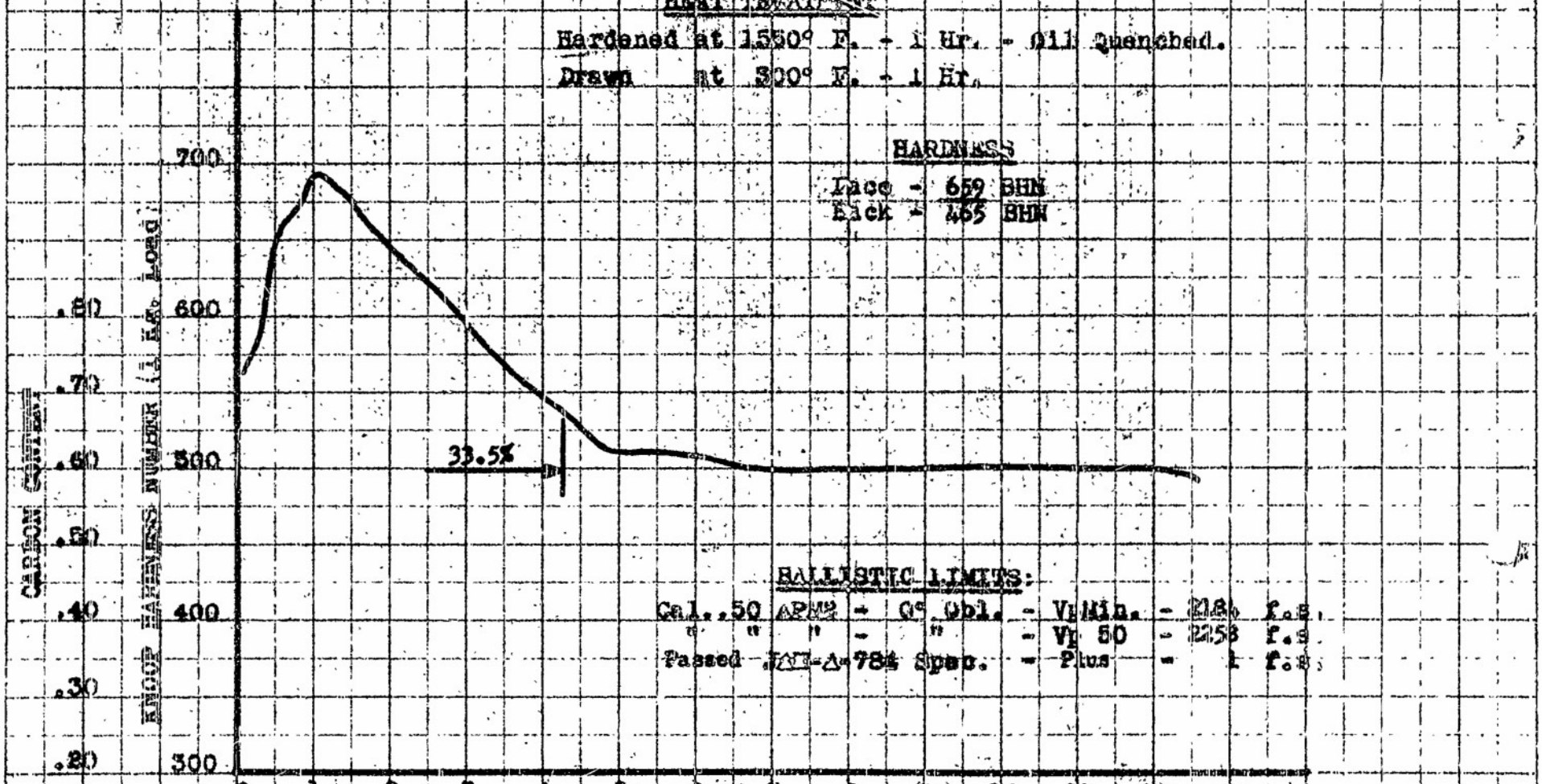
Hardened at 1550° F. - 1 Hr. - Oil Quenched.

Drawn at 300° F. - 1 Hr.

HARDNESS

Face - 659 BHN

Back - 465 BHN



BALLISTIC LIMITS:

Cal. .50 APM2 - 0° Obl. - V1 Min. - 2160 f.s.

" " " - " - V50 - 2258 f.s.

Passed MIL-A-46100 Spec. - Plus - 1 f.s.

Figure 71

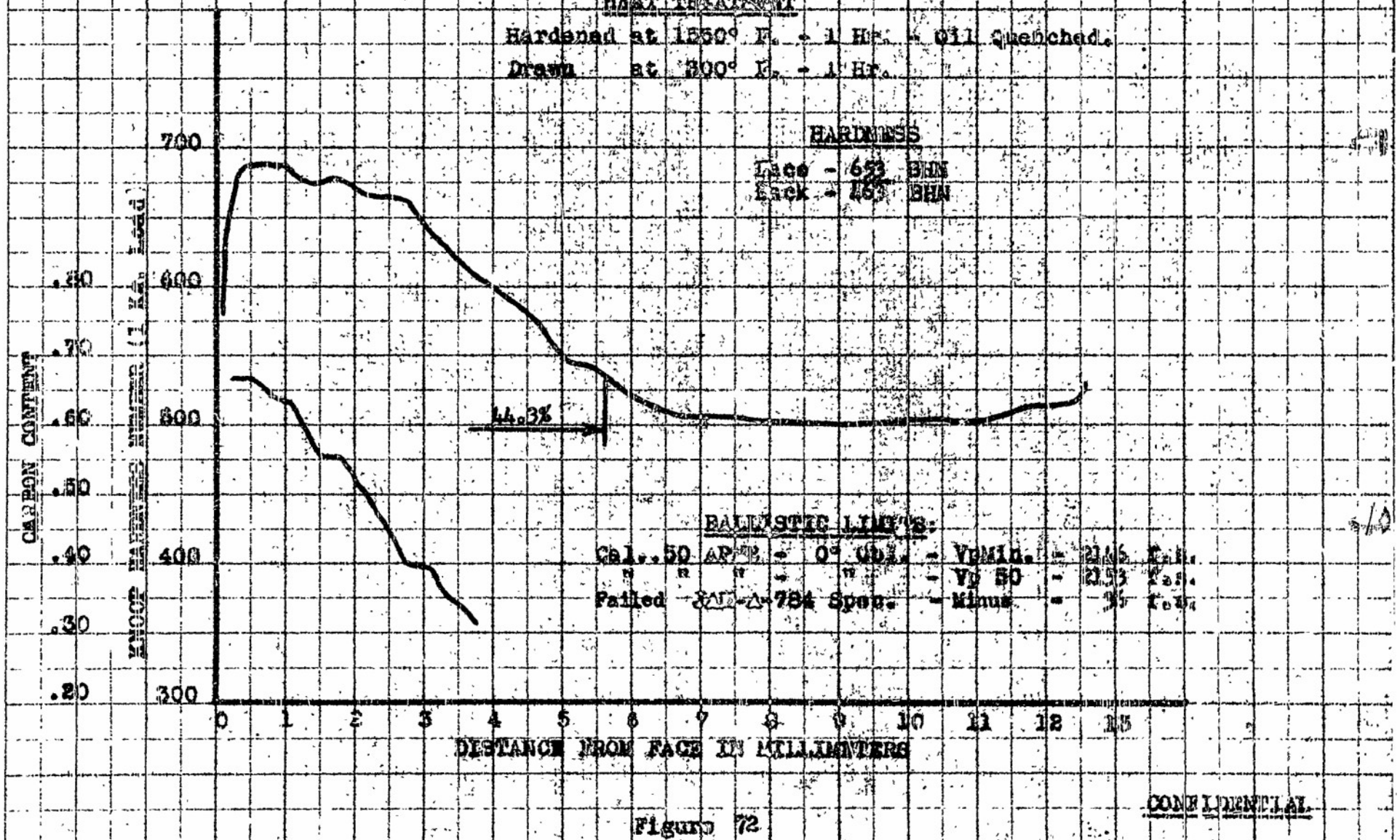
CONFIDENTIAL

APPENDIX C

HARDNESS DISTRIBUTION THROUGH CROSS SECTION OF
LITHIUM CO. .507" PLATE NO. P-30-A HEAT NO. 25

HEAT TREATMENT
Hardened at 1550° F. - 1 Hr. - Oil Quenched.
Drawn at 300° F. - 1 Hr.

HARDNESS
Face - 653 BHN
Back - 653 BHN



BALLISTIC LIMITS:
Cal..50 AP M2 - 0° Obl. - V50 Min. - 2146 f.s.
" " " - " - V50 - 2193 f.s.
Failed 2 at -4- 784 Spec. - Minus - [illegible] f.s.

Figure 72

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APPENDIX C

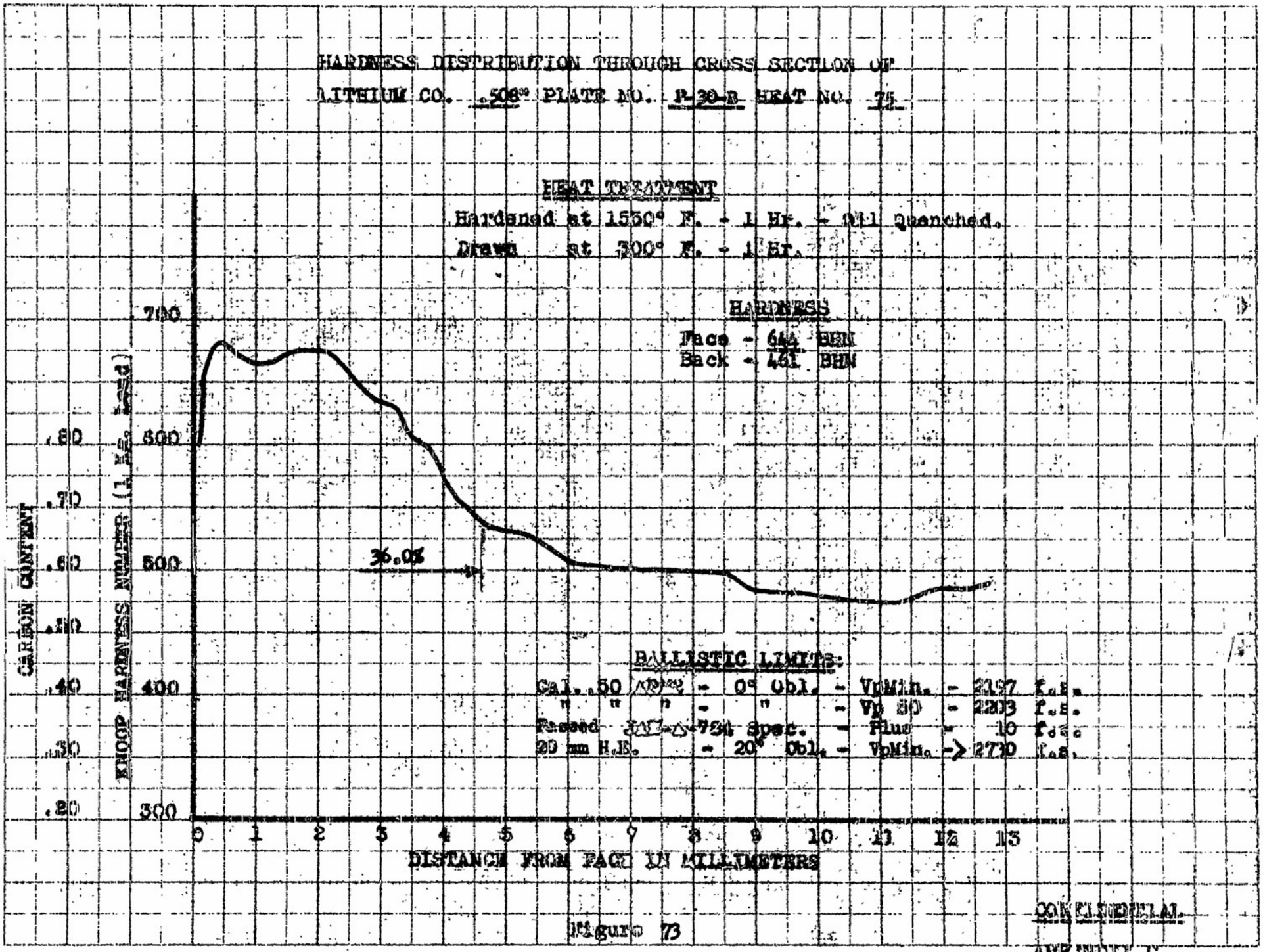
HARDNESS DISTRIBUTION THROUGH CROSS SECTION OF
LITHIUM CO. .508" PLATE NO. P-30-B HEAT NO. 75

HEAT TREATMENT

Hardened at 1550° F. - 1 Hr. - Oil Quenched.
Drawn at 300° F. - 1 Hr.

HARDNESS

Face - 644 BHN
Back - 481 BHN



BALLISTIC LIMITS:

Cal. .50 AP M2 - 0° Obl. - VpMin. - 2197 f.s.
" " " - " - Vp 50 - 2203 f.s.
Passed 20 mm H.E. - 72° Spec. - 20° Obl. - Plug - 10 f.s. VpMin. -> 2730 f.s.

CONFIDENTIAL

Figure 73

APPENDIX C

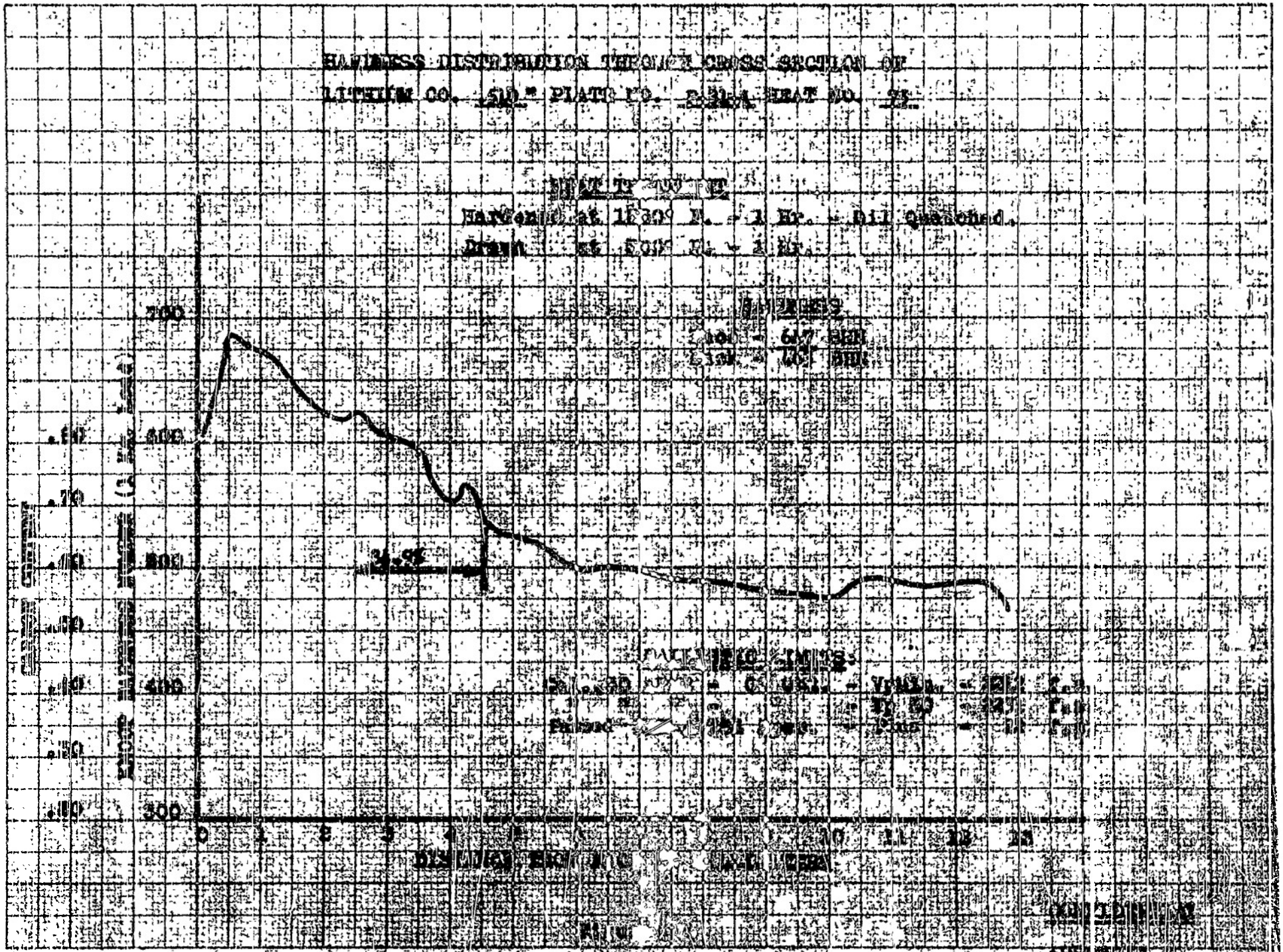
HARDNESS DISTRIBUTION THROUGH CROSS SECTION OF

LITHIUM CO. .500" PLATE NO. [illegible] HEAT NO. 33

HEAT TREAT

Hardened at 1550° F. - 1 Hr. - Oil Quenched.

Drawn at 500° F. - 1 Hr.



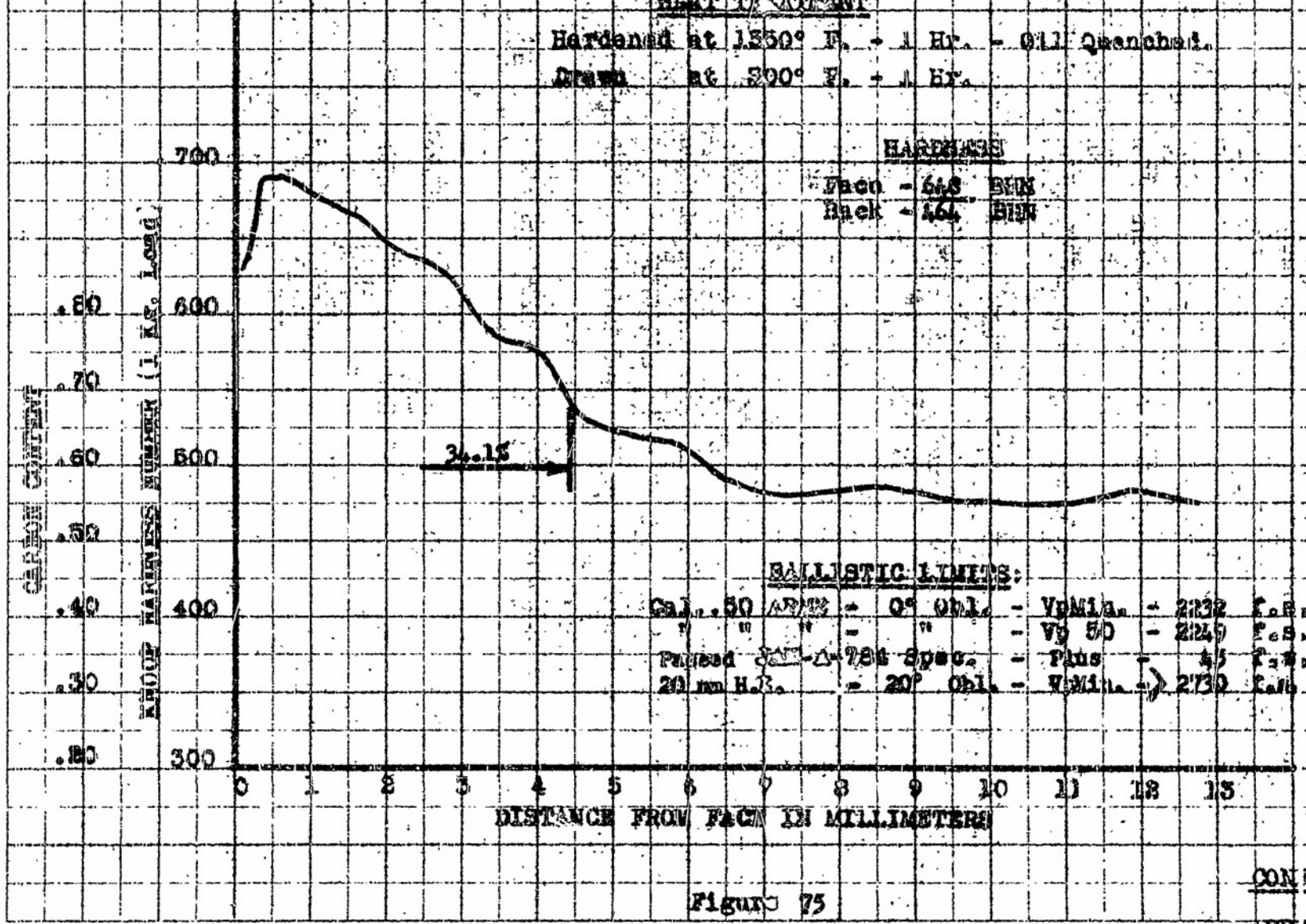
HARDNESS DISTRIBUTION THROUGH CROSS SECTION OF
LITHIUM CO. .50" PLATE NO. P-31-B HEAT NO. 75

HEAT TREATMENT

Hardened at 1550° F. + 1 Hr. - Oil Quenched.
Drawn at 300° F. + 1 Hr.

HARDNESS

Face - 648 BHN
Back - 464 BHN



BALLISTIC LIMITS:

Cal. .50 APWC - 0° Obl. - V50 Min. - 2232 f.p.s.
" " " - " - V50 - 2249 f.p.s.
Passed 2 - 784 Spec. - Plus - 45 f.p.s.
20 mm H.E. - 20° Obl. - V50 Min. - 2730 f.p.s.

Figure 75

CONFIDENTIAL

APPENDIX C

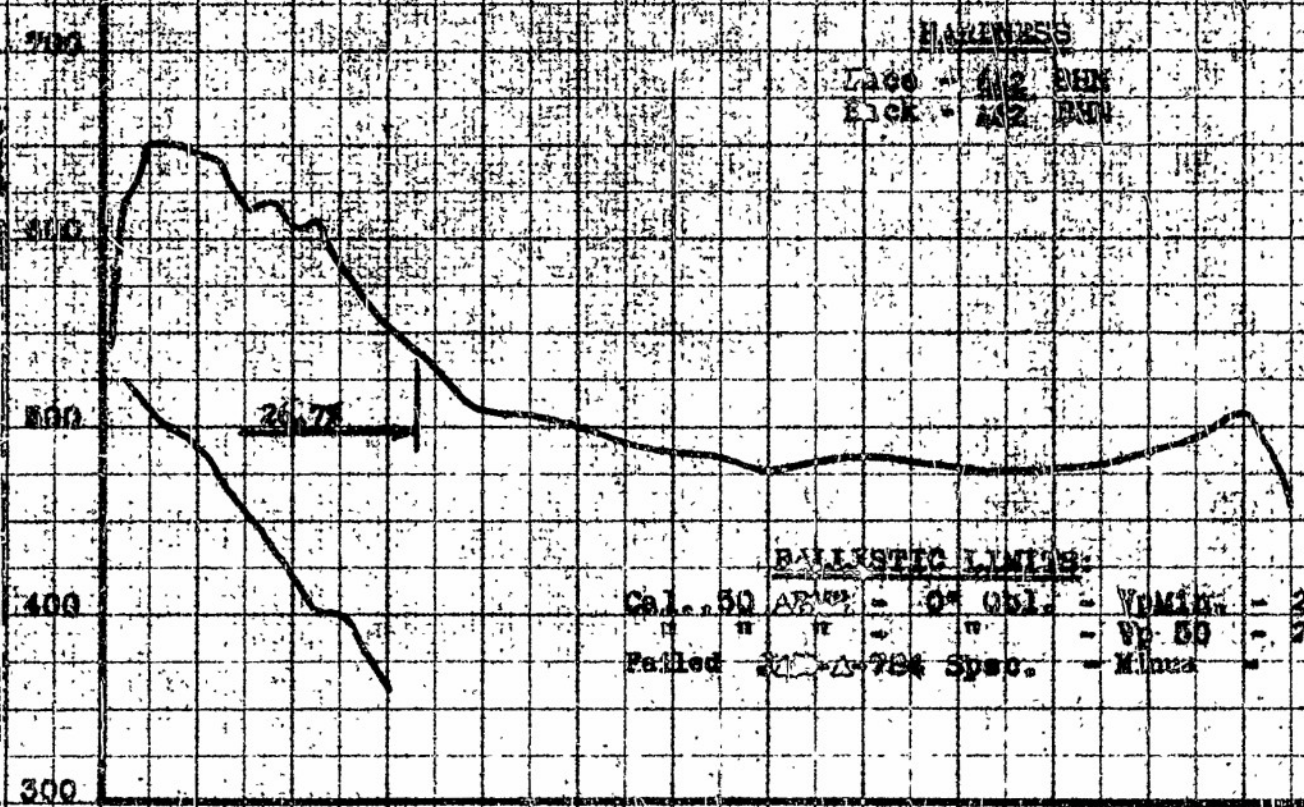
HARDNESS DISTRIBUTION THROUGH CROSS SECTION OF
LUTHIUM CO. 301 * PLATE L. L 32 A HEAT NO. 28

HEAT TREATMENT

Hardened at 1575° F. - 1 Hr. - Oil Quenched.
Drawn at 500° F. - 1 Hr.

HARDNESS

Face - 412 BHN
Back - 402 BHN



BALLISTIC LIMITS:

Cal. .50 AP M2 - 0° Obl. - $V_{p\,Min}$ - 2147 f.s.
" " " - " - $V_{p\,50}$ - 2247 f.s.
Failed .30 Cal. A-784 Spec. - Minus - 32 f.s.

Figure 73

CONFIDENTIAL

APPENDIX C

HARDNESS DISTRIBUTION THROUGH CROSS SECTION OF

LITHIUM CO. .495" PLATE NO. P-32-B HEAT NO. 76

HEAT TREATMENT

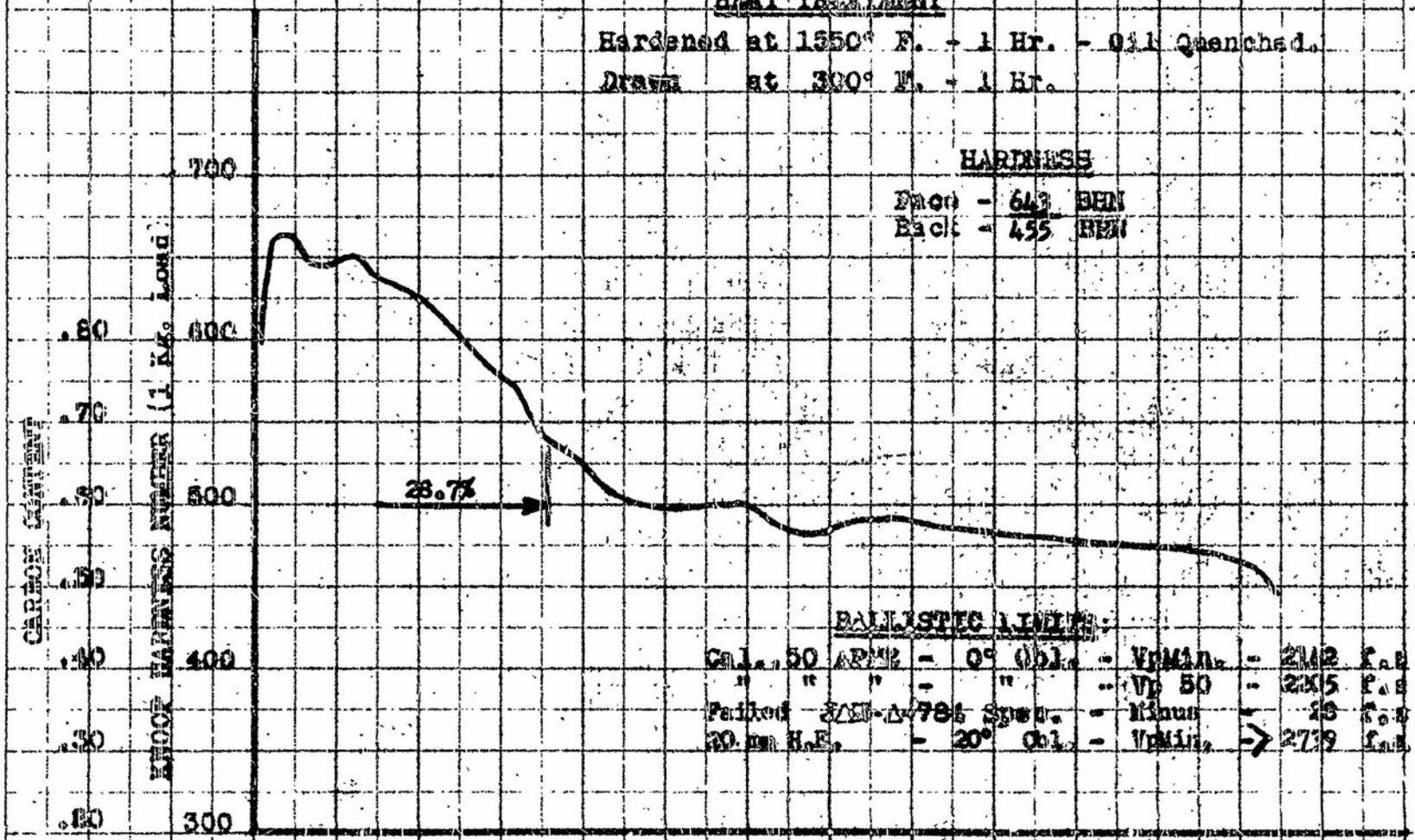
Hardened at 1550° F. + 1 Hr. - Oil Quenched.

Drawn at 300° F. + 1 Hr.

HARDNESS

Face - 643 BHN

Back - 455 BHN



BALLISTIC LIMITS:

Cal. .50 APM2 - 0° Obl. - VpMin. - 2842 f.p.s.

" " " - " - Vp 50 - 2915 f.p.s.

Pallet 3/8"-A-708 Spec. - Minus - 73 f.p.s.

20 mm H.E. - 20° Obl. - VpMin. -> 2739 f.p.s.

Figure 77

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APPENDIX C

HARDNESS DISTRIBUTION THROUGH CROSS SECTION OF
LITHIUM CO. .525" PLATE NO. D-33-A HEAT NO. 76

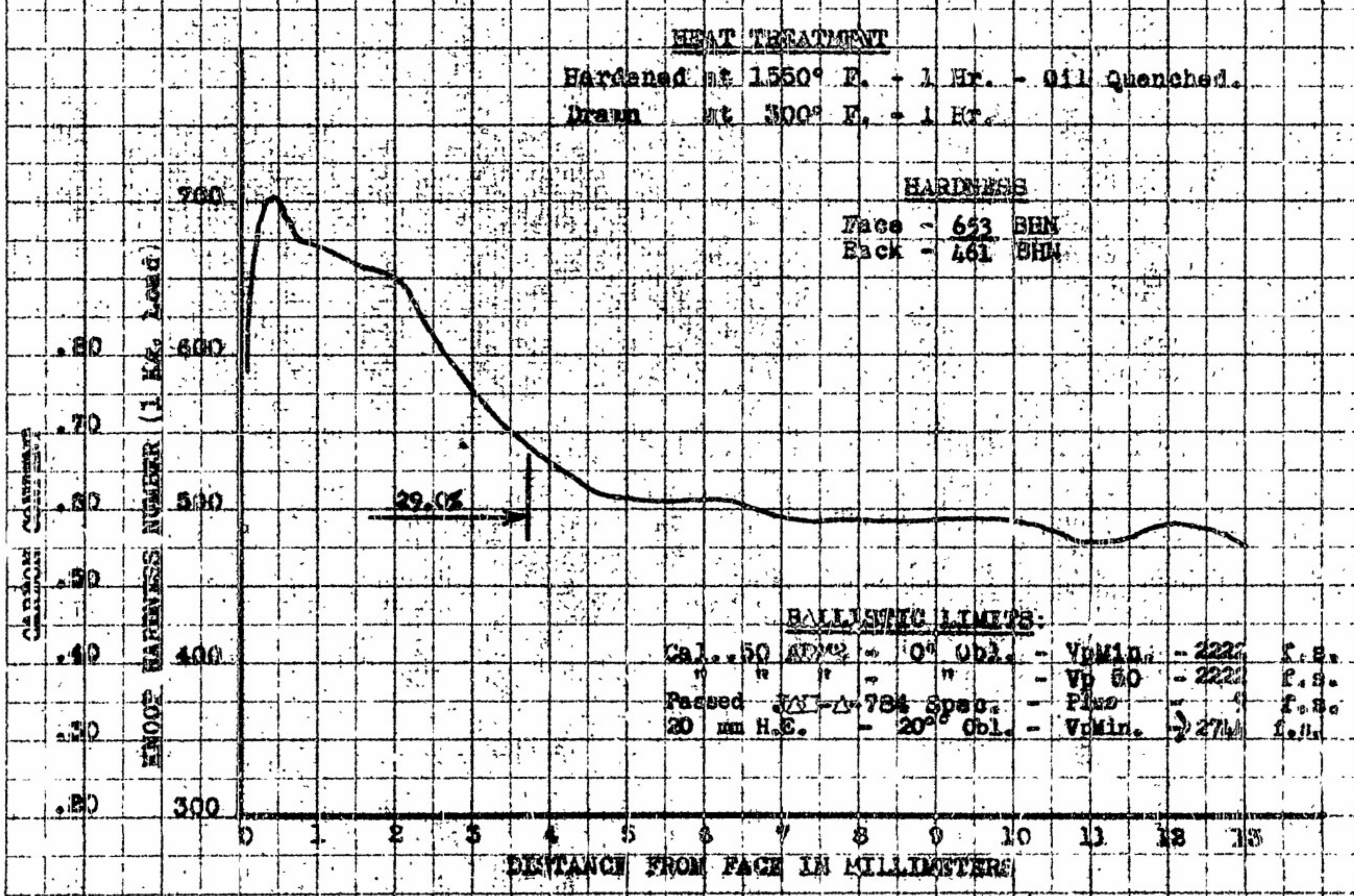

Figure 78

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APPENDIX

HARDNESS DISTRIBUTION THROUGH CROSS SECTION OF

MATTHEW CO. 523 * PLATE NO. P-33-B HEAT NO. 76

HEAT TREATMENT

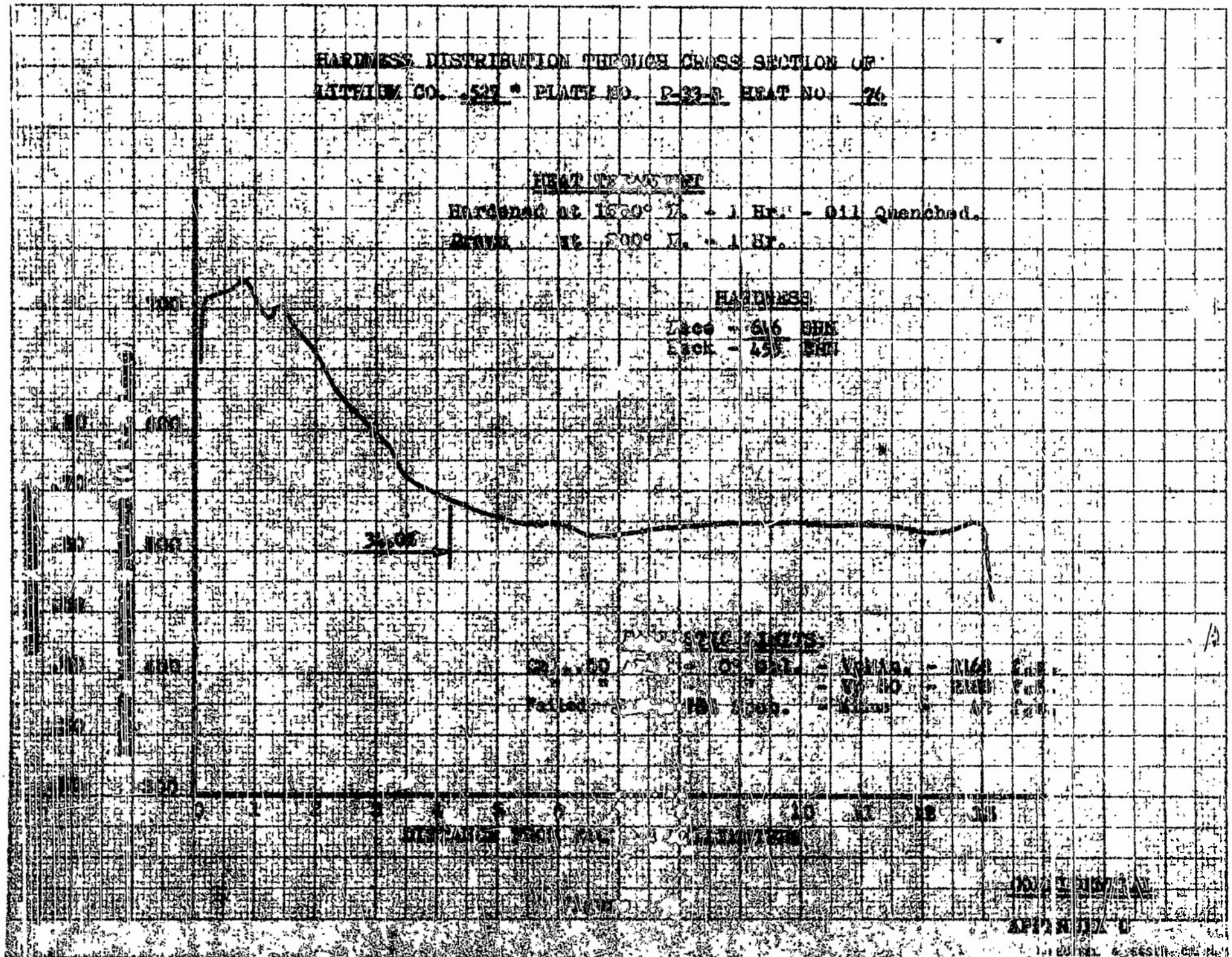
Hardened at 1500° F. - 1 Hr. - Oil Quenched.

Drawn at 800° F. - 1 Hr.

HARDNESS

Face - 616 BHN

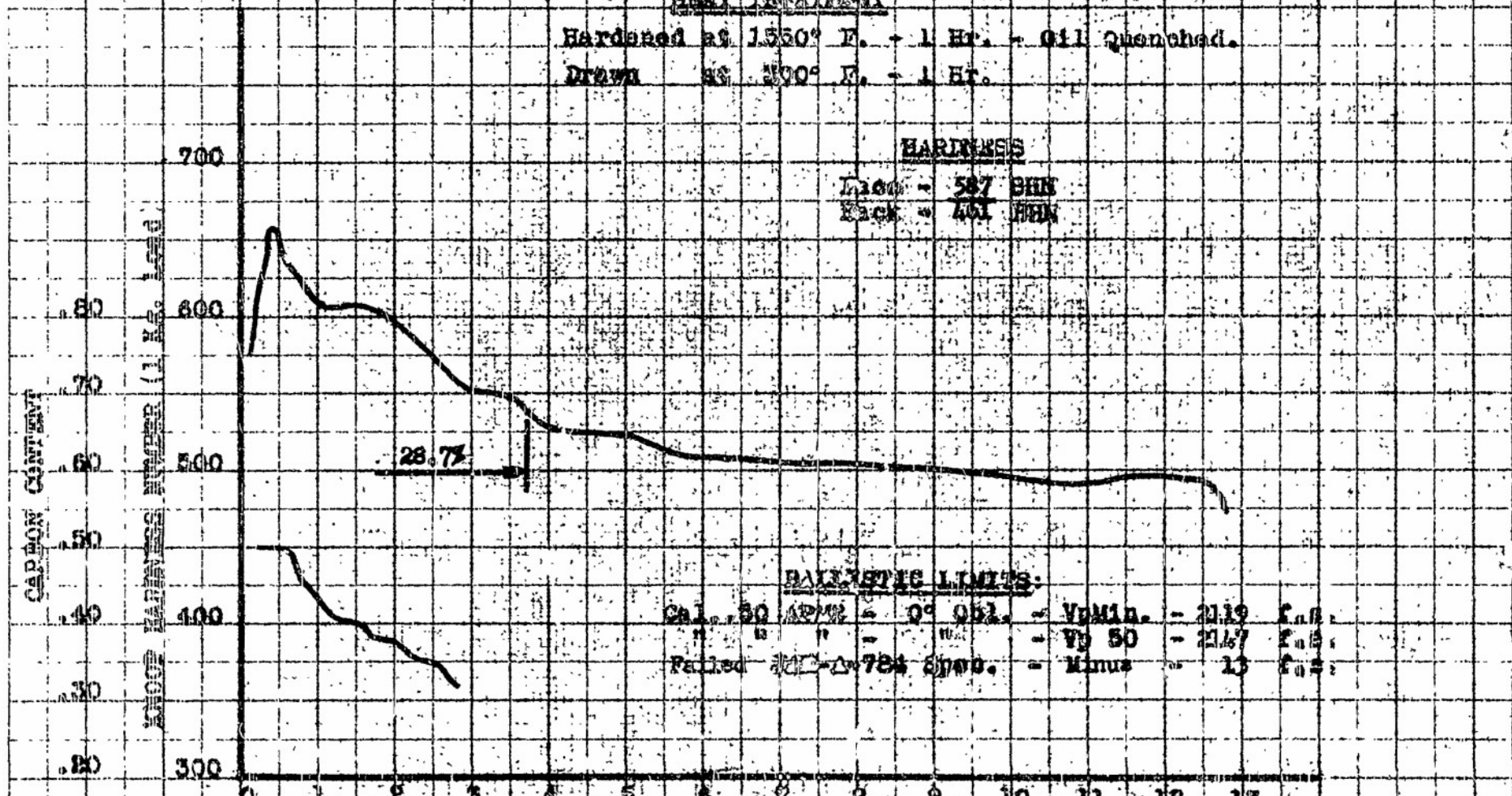
Back - 455 BHN



HARDNESS DISTRIBUTION THROUGH CROSS SECTION OF
LITHIUM CO. ".506" PLATE NO. P-24-A HEAT NO. 77

HEAT TREATMENT

Hardened at 1550° F. + 1 Hr. + Oil Quenched.
Drawn at 700° F. - 1 Hr.



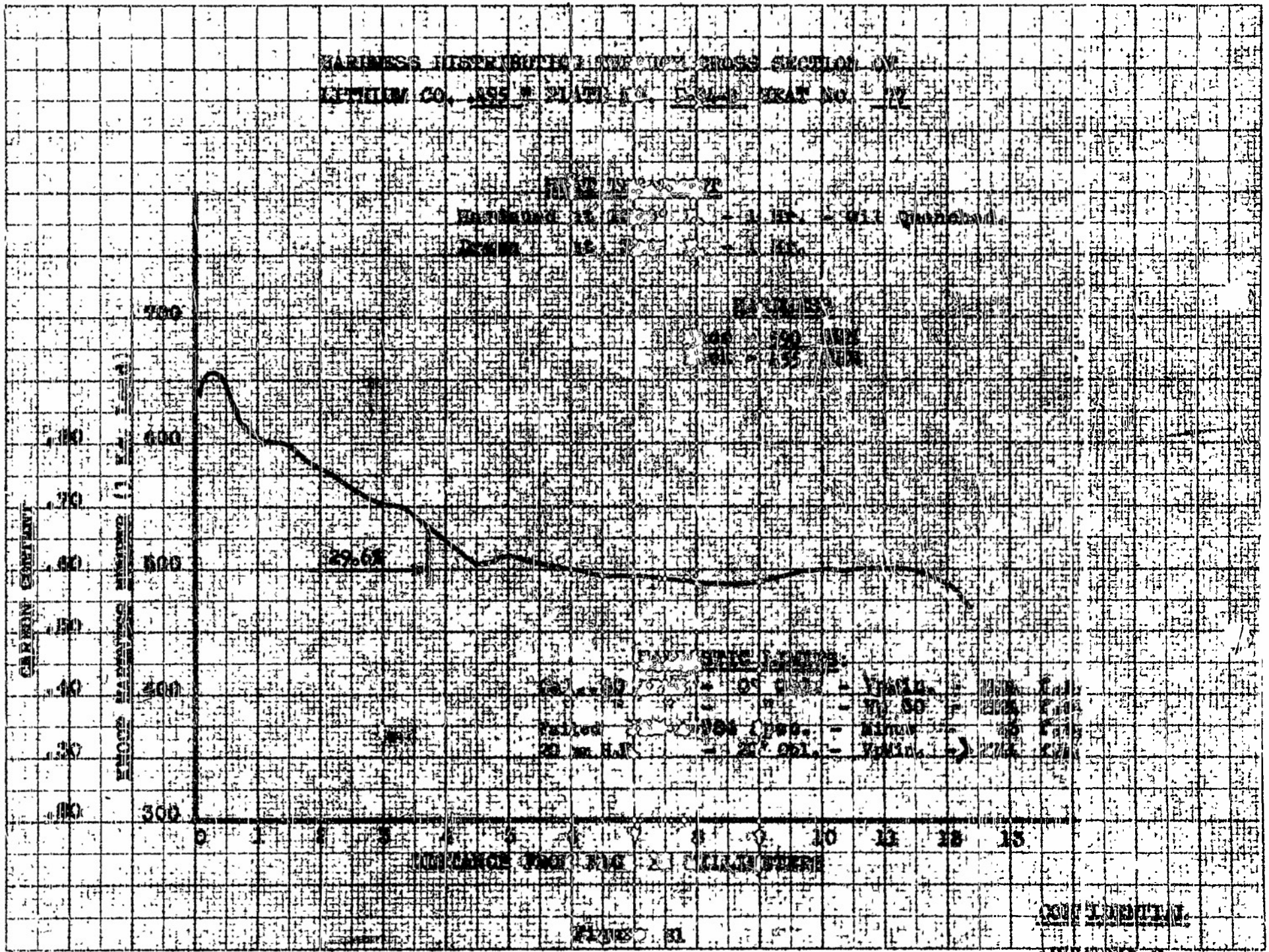
BALLISTIC LIMITS:

Cal. .30 AP M2 - 0° Obl. - VpMin. - 2119 f.s.
" " " - " - V50 - 2147 f.s.
Failed at 72° Obl. - Minus - 13 f.s.

Figure 80

CONFIDENTIAL

APPENDIX C



CONFIDENTIAL

APPENDIX C

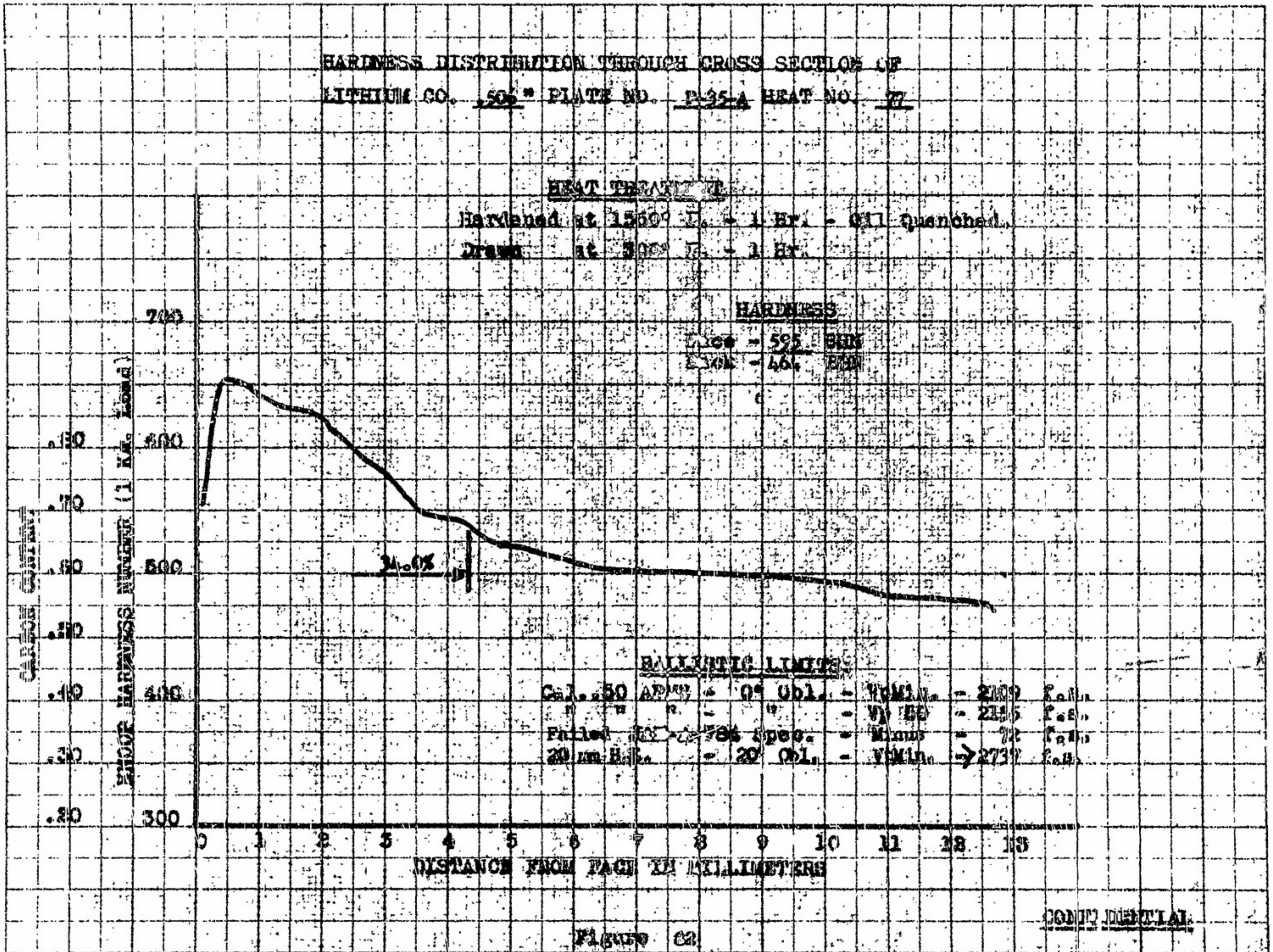


Figure 62

CONFIDENTIAL

APPENDIX C

HARDNESS DISTRIBUTION THROUGH CROSS SECTION OF
LITHIUM CO. .516" PLATE NO. C-15-1 HEAT NO. 77

HEAT TREATMENT
Hardened at 1520° F. + ½ Hr. - Oil Quenched.
Drawn at 1100° F. + 2 Hr.

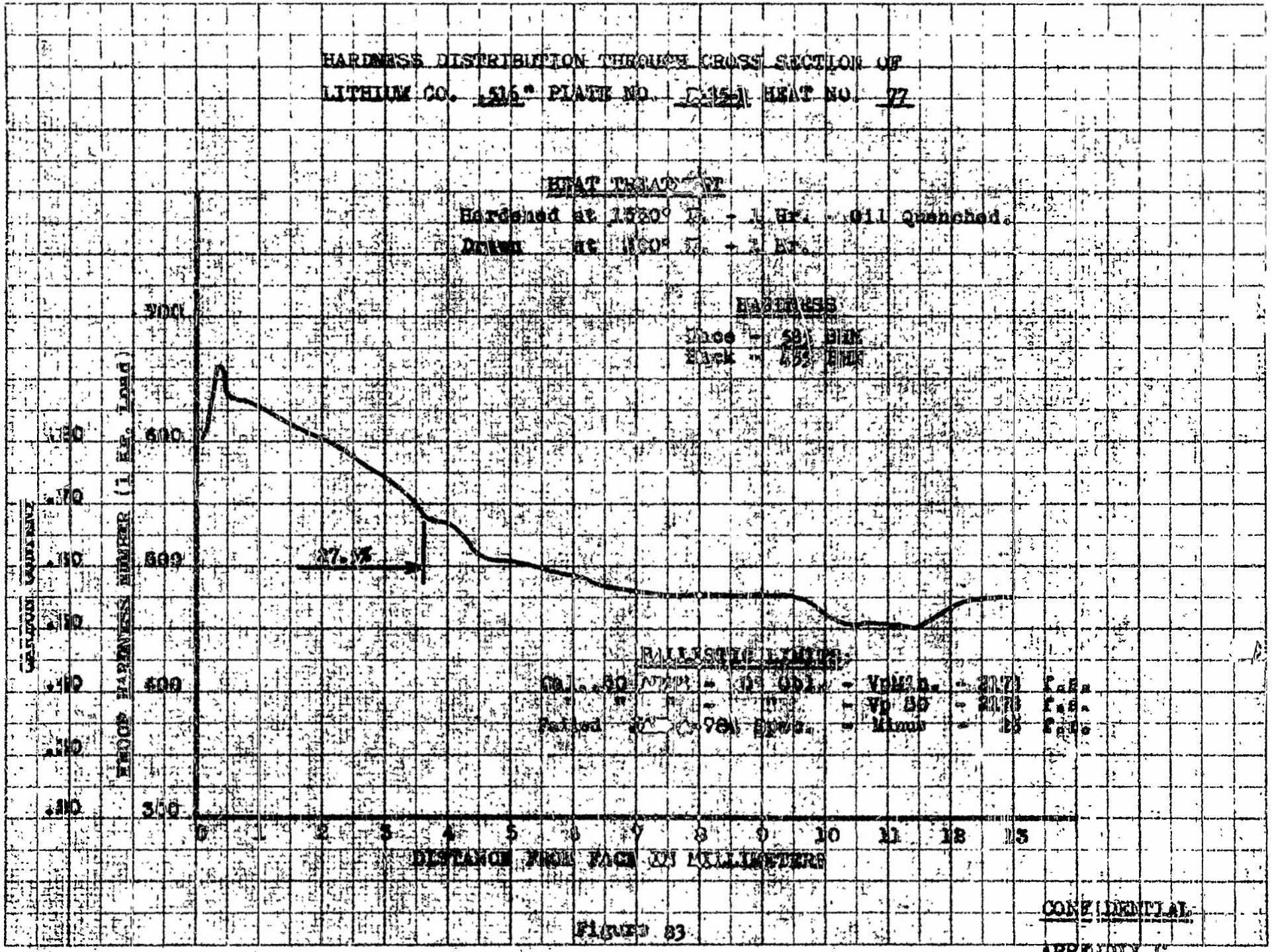


Figure 83

CONFIDENTIAL

APPENDIX C

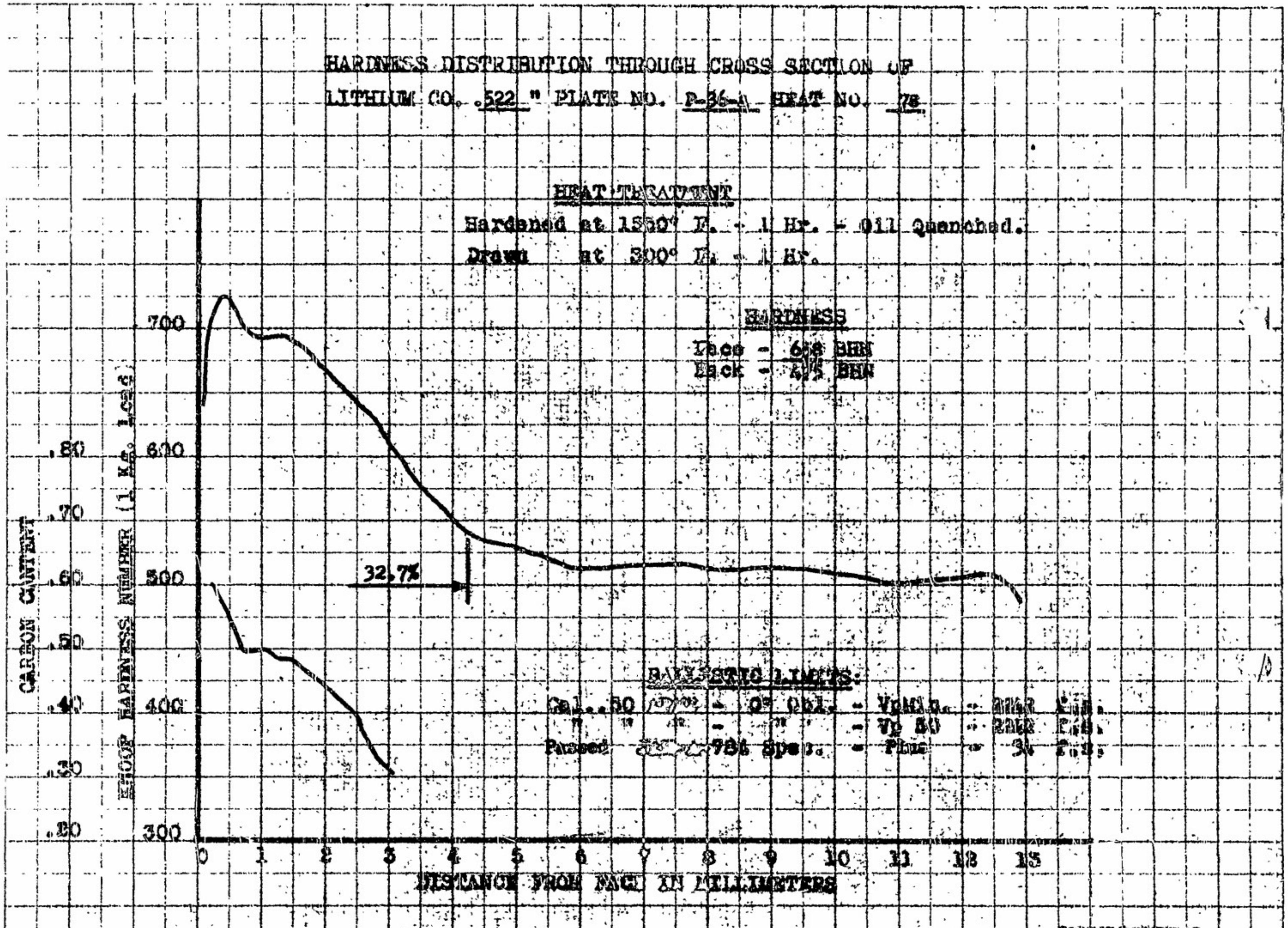


Figure 64

CONFIDENTIAL

APPENDIX C

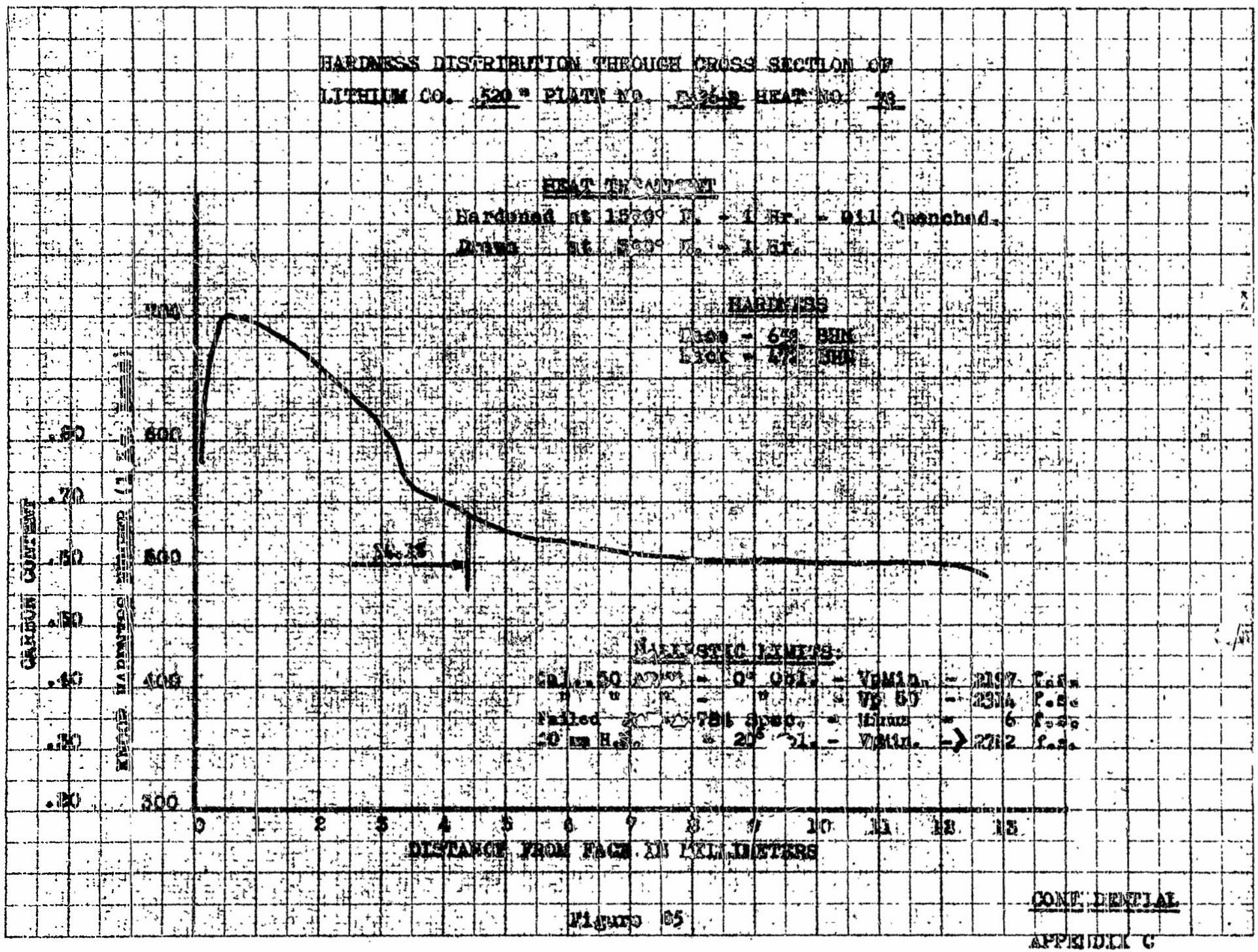
HARDNESS DISTRIBUTION THROUGH CROSS SECTION OF

LITHIUM CO. .520" PLATE NO. [illegible] HEAT NO. 23

HEAT TREATMENT

Hardened at 1525° F. + 1 Hr. + Oil Quenched.

Drawn at 500° F. + 1 Hr.



BALLISTIC LIMITS:

[illegible] 50 [illegible] - 0° Obl. - V50 - 2197 f.s.

" " " - " - V50 - 2334 f.s.

Failed [illegible] 78% Spec. - Thru - 6 f.s.

20 on H.O. - 20° Obl. - V50 - 2212 f.s.

CONFIDENTIAL

Figure 85

APPENDIX C

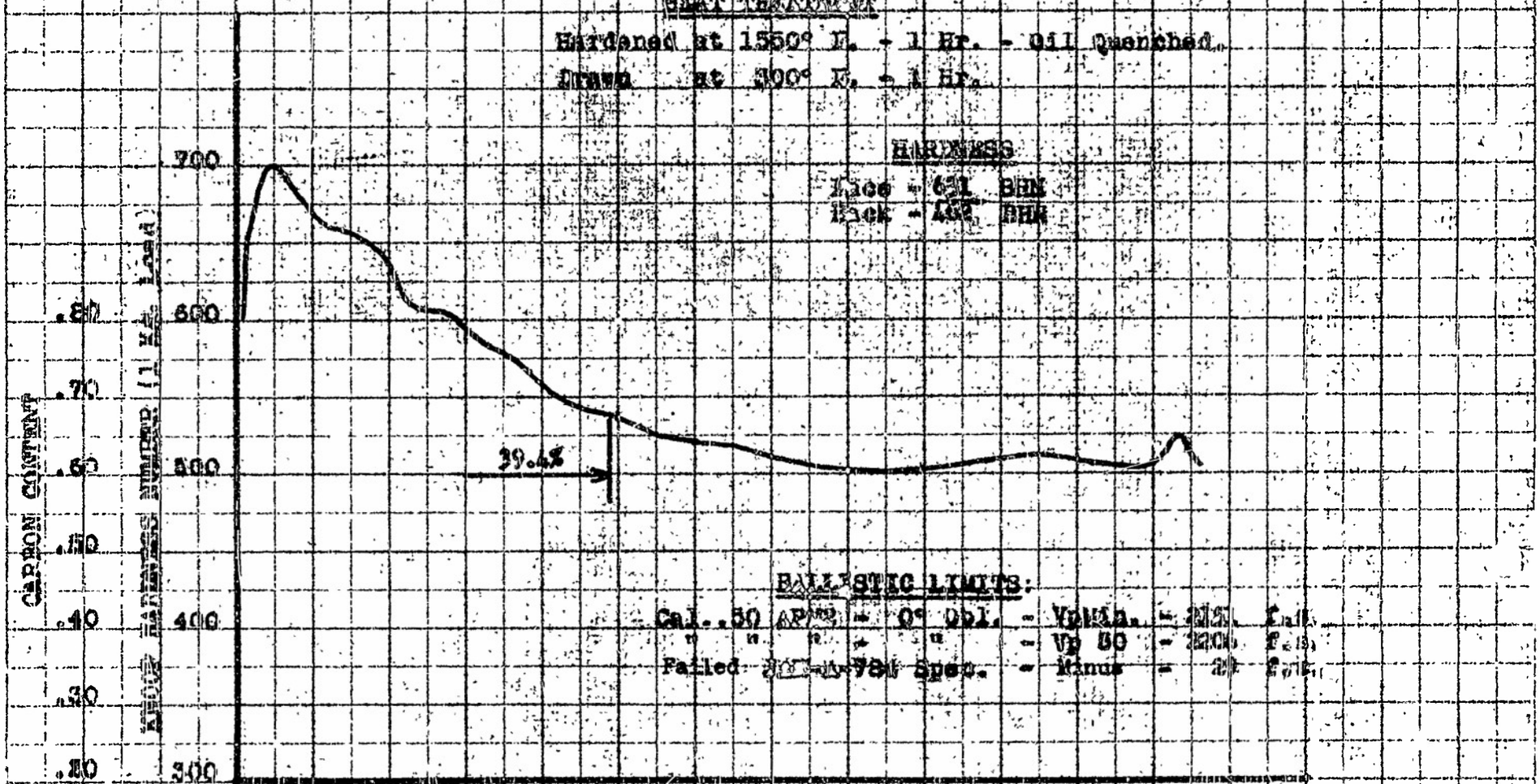
HARDNESS DISTRIBUTION THROUGH CROSS SECTION OF
LITHIUM CO. .510" PLATE NO. P-37-1 HEAT NO. 28

HEAT TREATMENT

Hardened at 1550° F. - 1 Hr. - Oil Quenched.
Drawn at 300° F. - 1 Hr.

HARDNESS

Face - 631 BHN
Back - 601 BHN



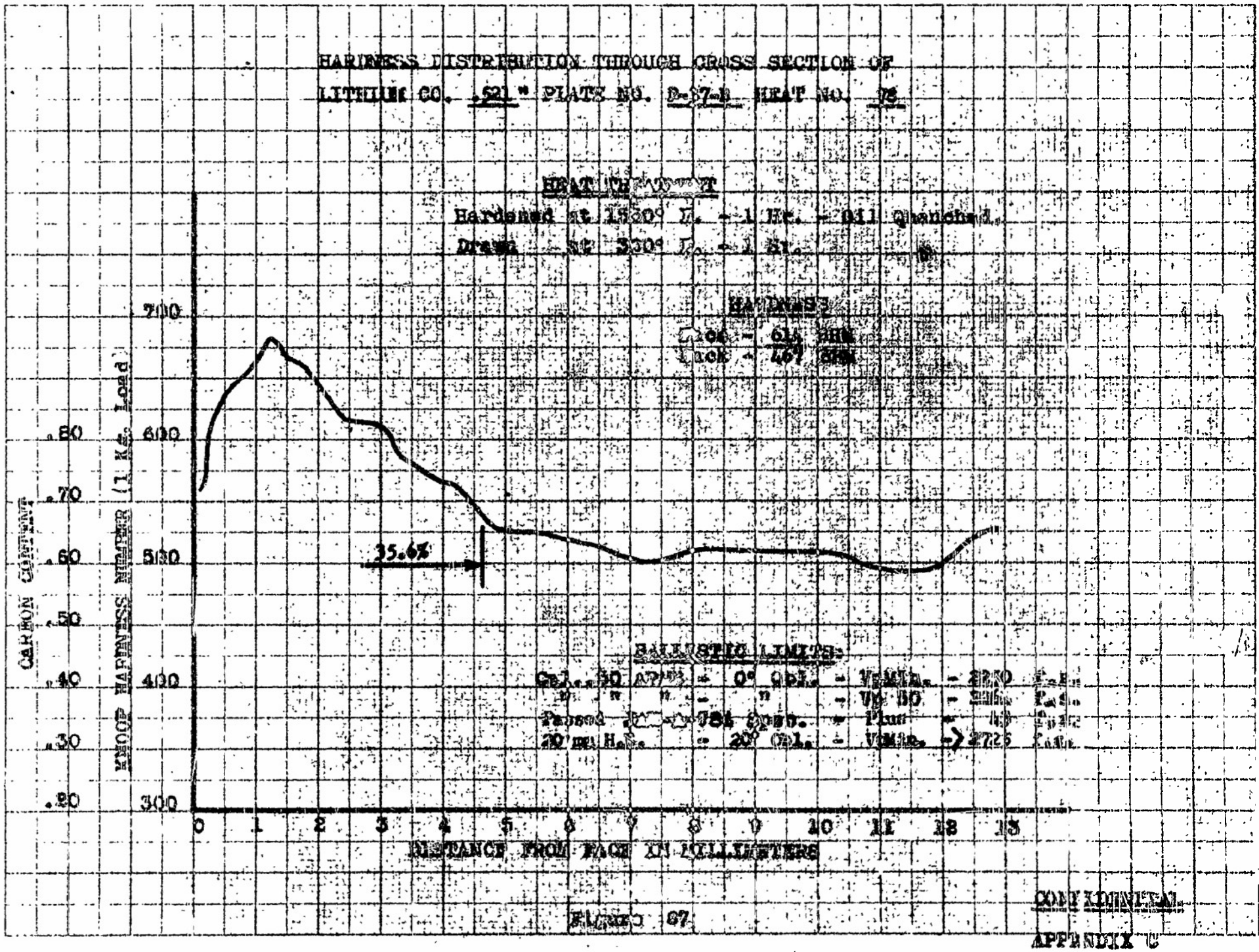
BALLISTIC LIMITS:

Cal. .50 AP M2 - 0° Obl. - V50 Min. - 2125 F.S.
" " " - " - V50 - 2200 F.S.
Failed [illegible] Spec. - Minus - 2[illegible] F.S.

Figure 86

CONFIDENTIAL

APPENDIX C



CONFIDENTIAL

APPENDIX C

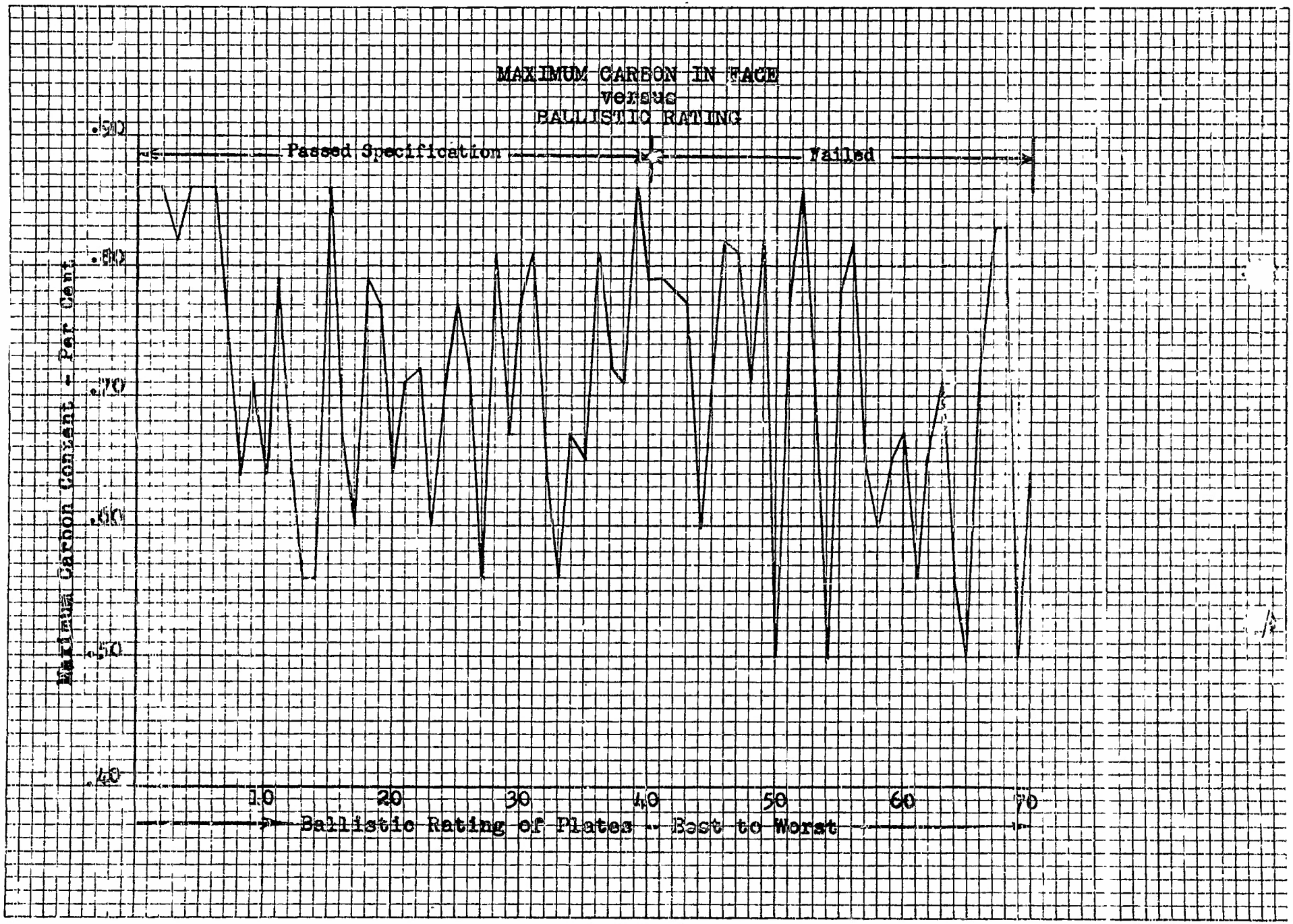


FIGURE 88

APPENDIX C

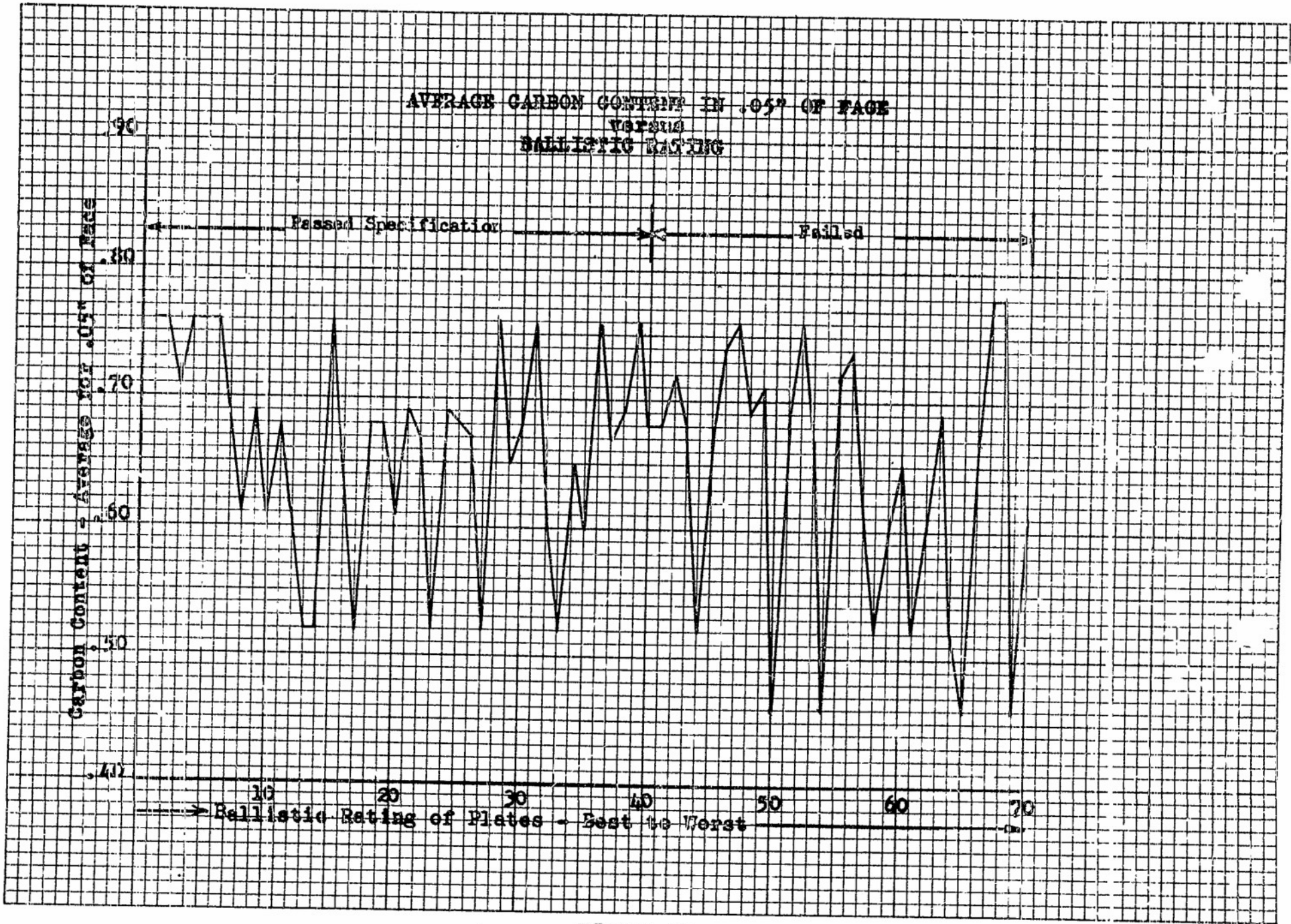

AVERAGE CARBON CONTENT IN .05" OF FACE
versus
BALLISTIC RATING
Passed Specification
Failed
Carbon Content - Average for .05" of Face
.90
.80
.70
.60
.50
.42
10
20
30
40
50
60
70
Ballistic Rating of Plates - Best to Worst

FIGURE 89

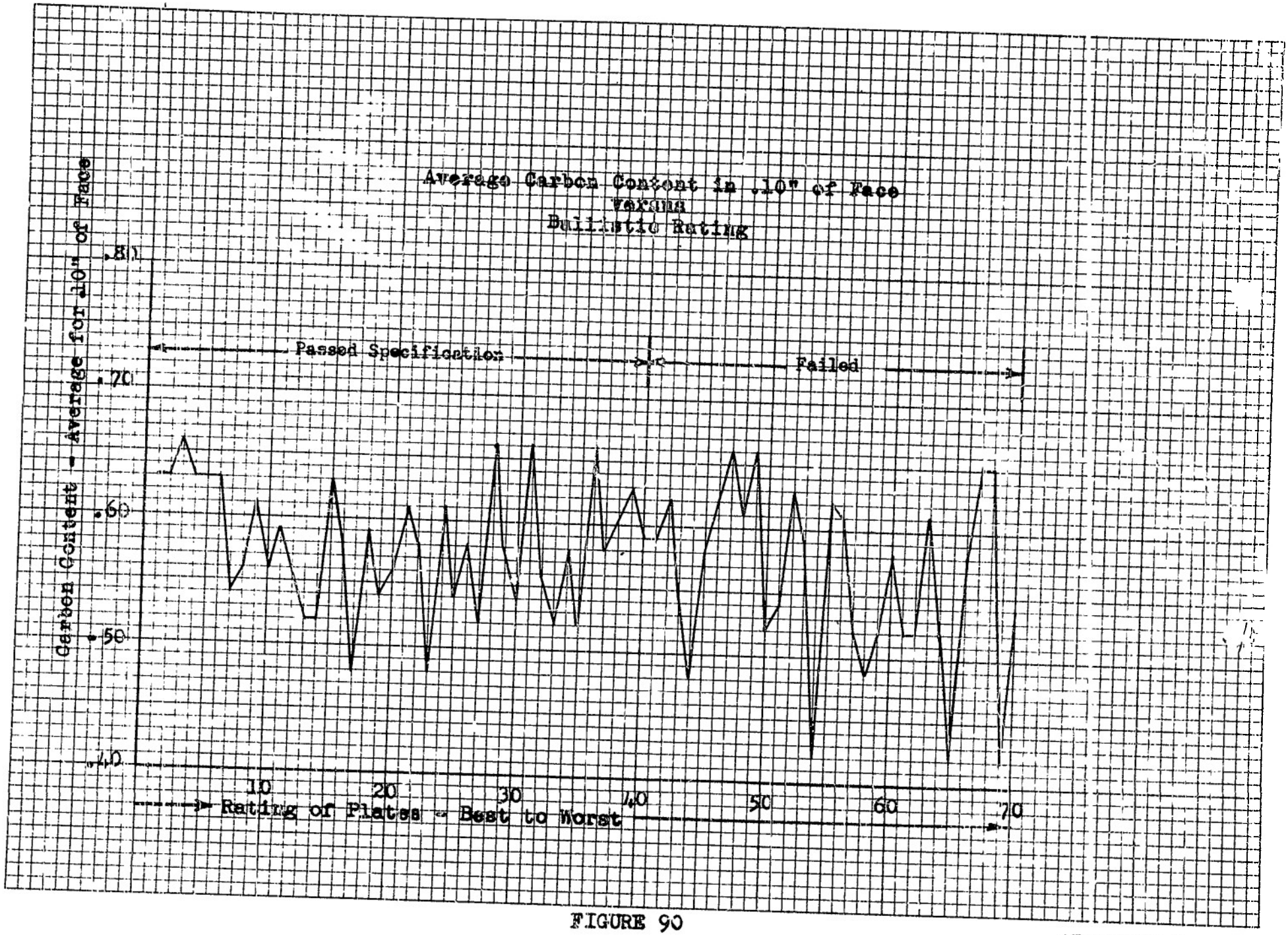

Average Carbon Content in .10" of Face
versus
Ballistic Rating
Carbon Content - Average for .10" of Face
.80
.70
.60
.50
.40
Passed Specification
Failed
10
20
30
40
50
60
70
Rating of Plates - Best to Worst

FIGURE 90

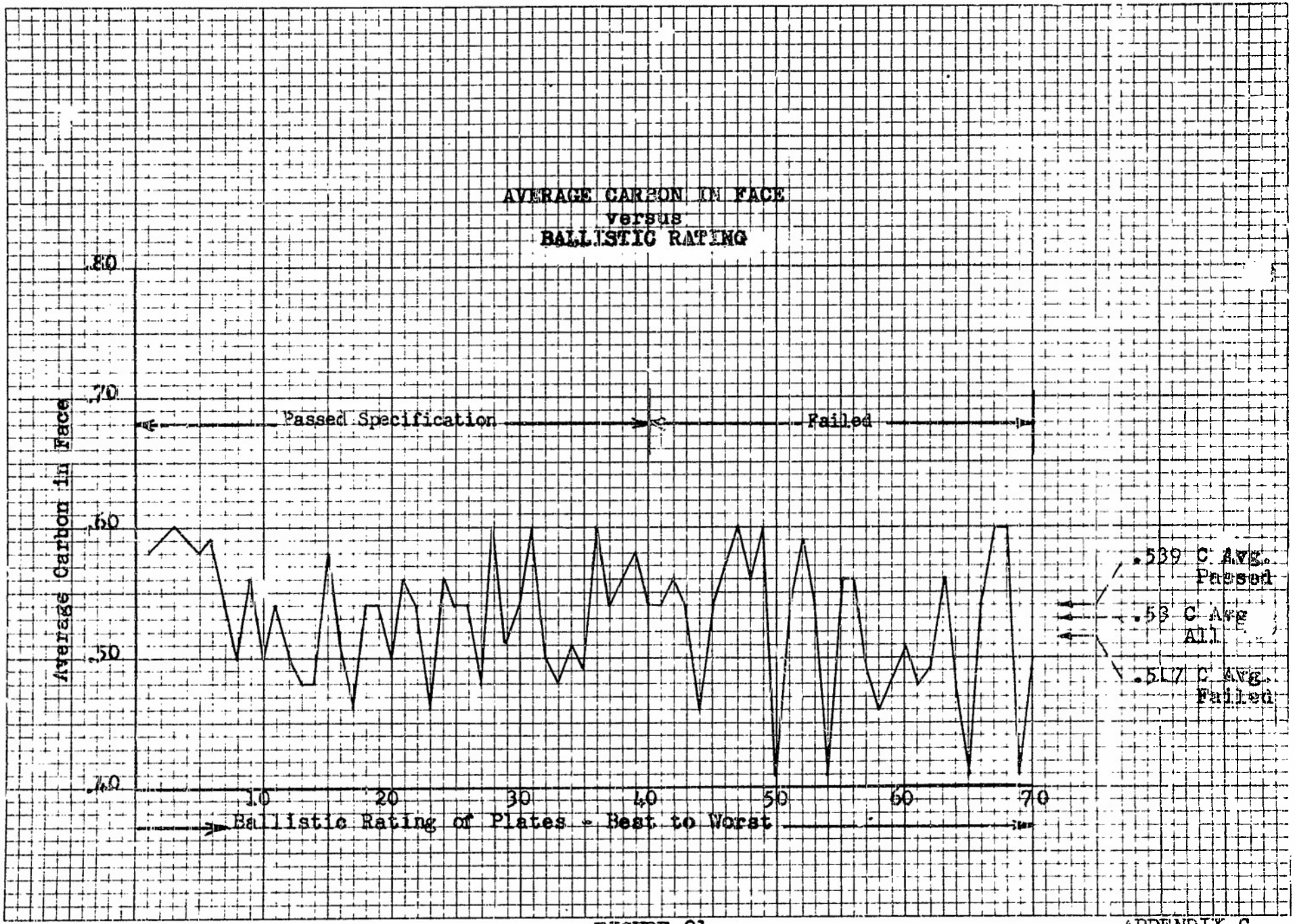
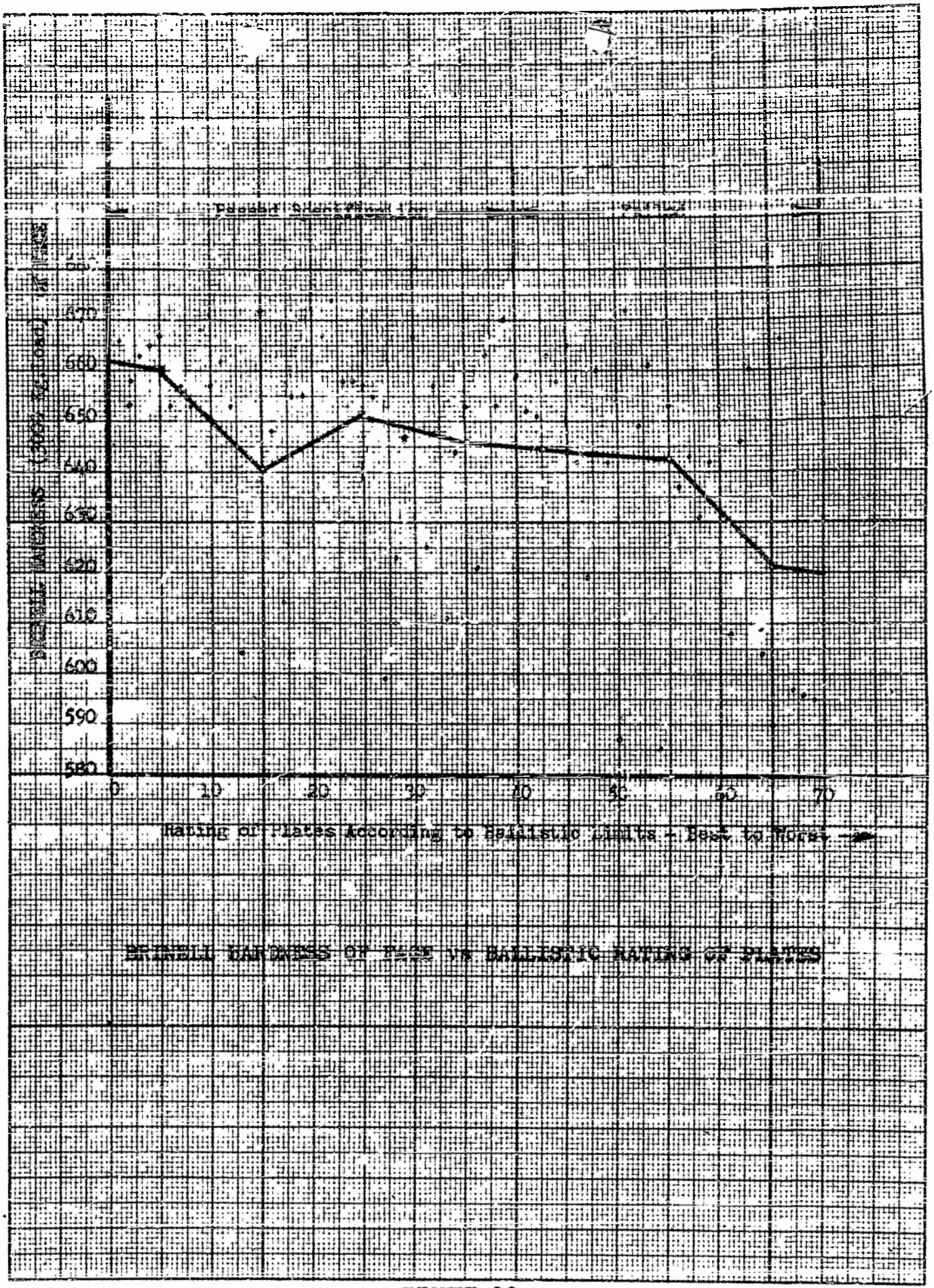


FIGURE 91

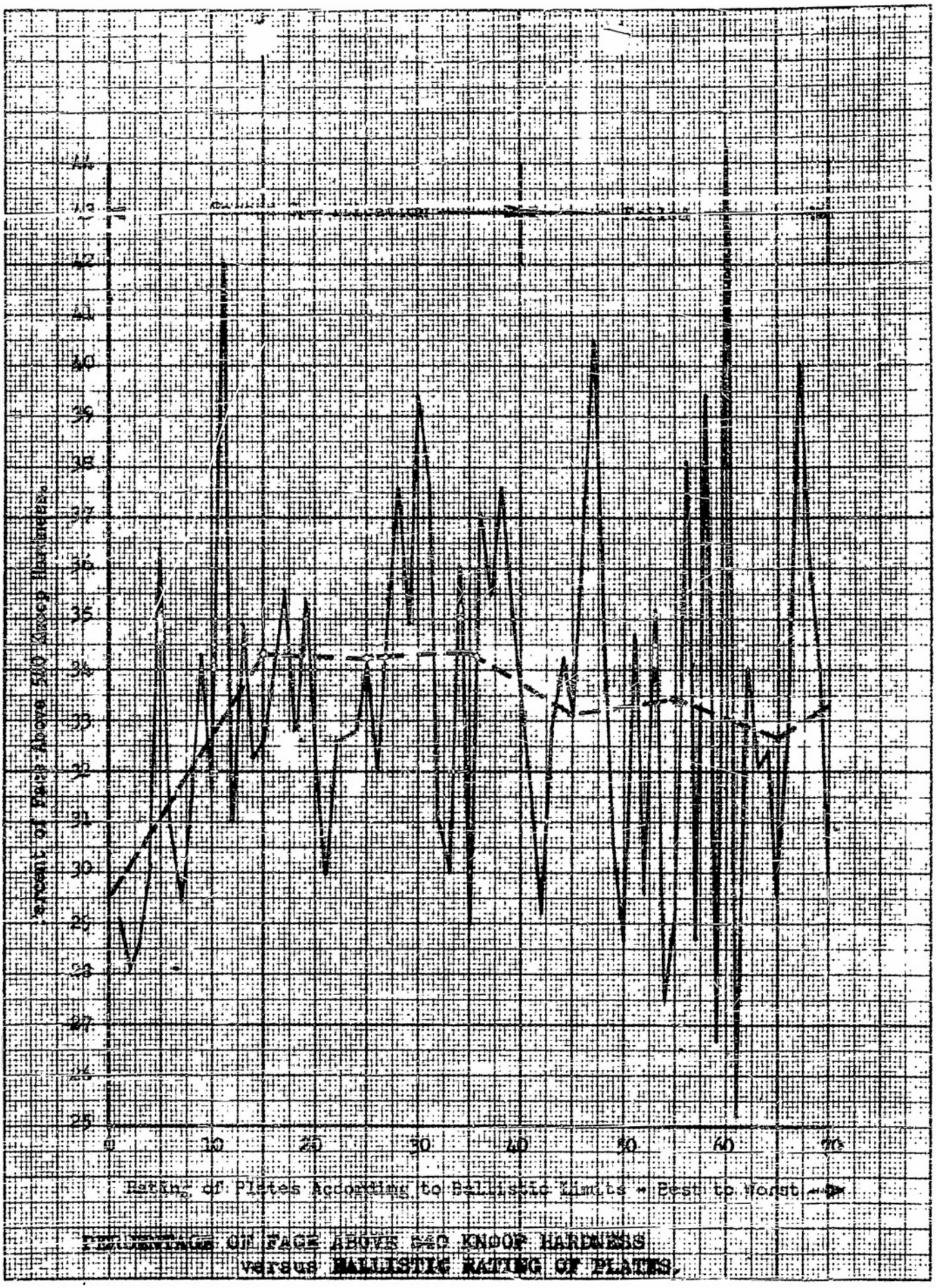
APPENDIX C



BRINELL HARDNESS OF PLATE VS BALLISTIC RATING OF PLATES

FIGURE 92

APPENDIX C



PERCENTAGE OF FACE ABOVE 500 KNOOP HARDNESS
versus BALLISTIC RATING OF PLATES.

FIGURE 93 APPENDIX C

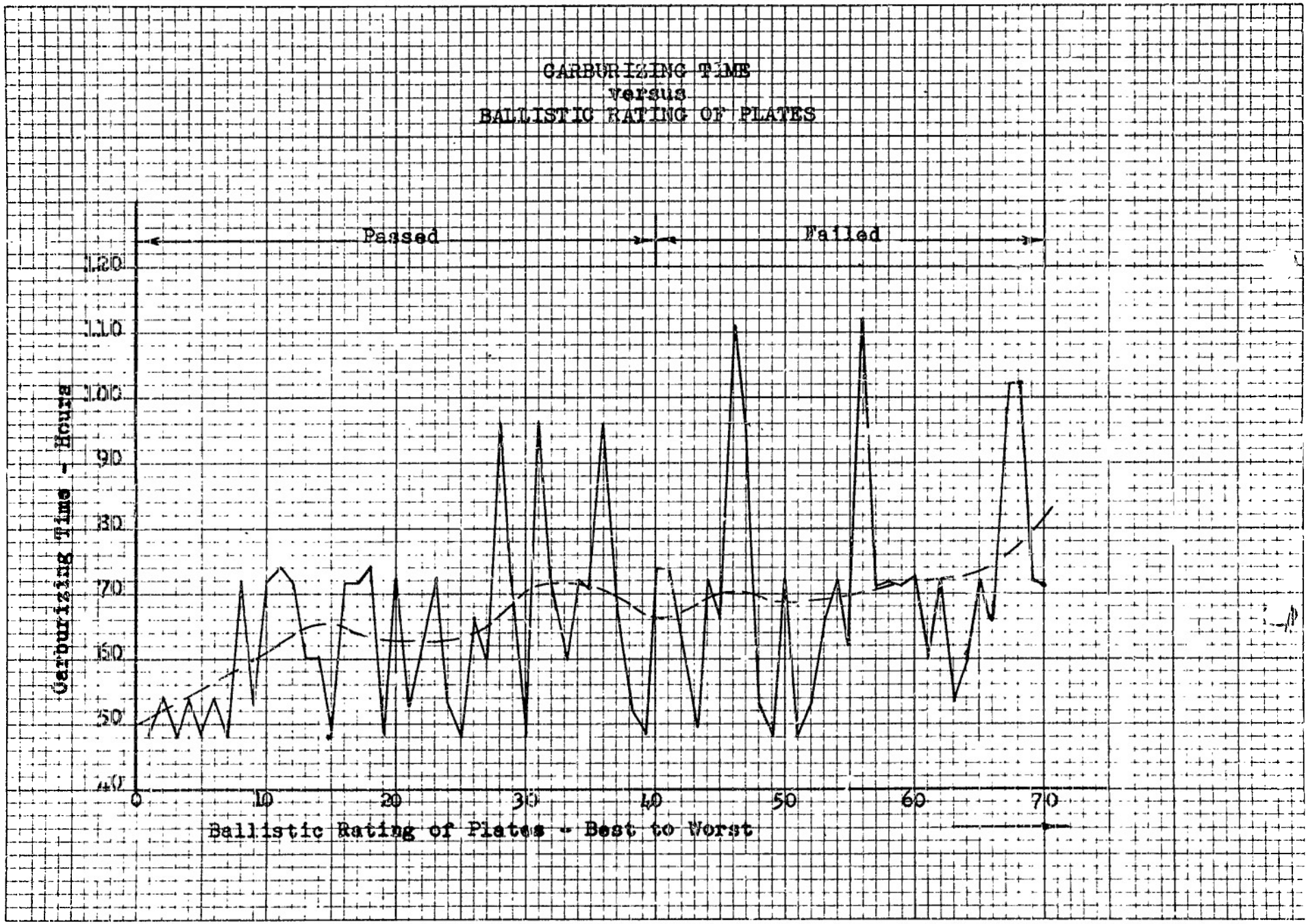


FIGURE 94

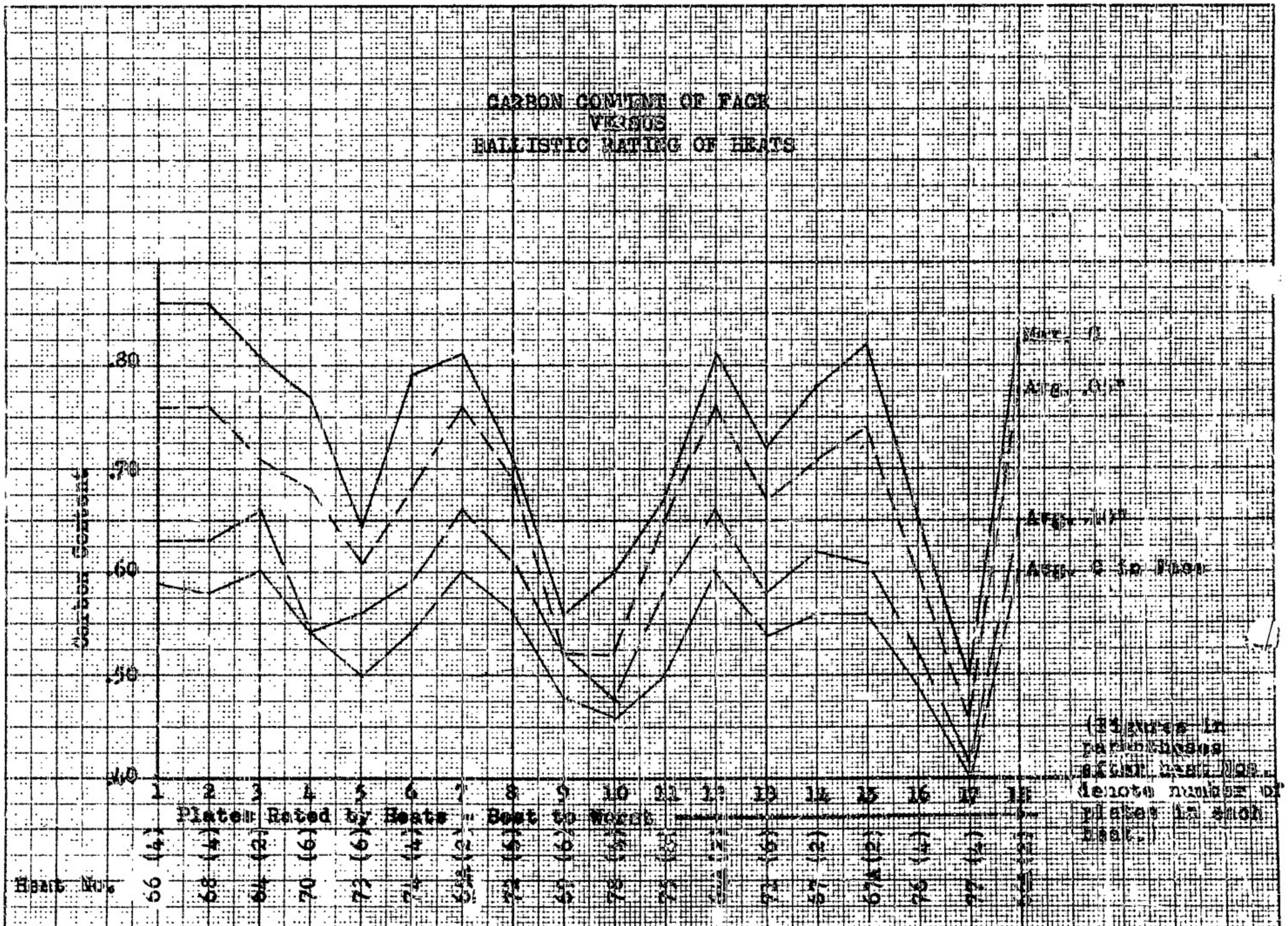


FIGURE 95

APPENDIX C

APPENDIX C

FIGURE 96

Figure 97 Plate No. P-4-A

Nital-Picral Etch. Mag. 1000X
Hardness 575 Knoop.
Retained Austenite in Tempered Martensite.

Figure 98 Plate No. P-4-A

Nital-Picral Etch. Mag. 1000X
Hardness 690 Knoop.
Tempered Martensite showing relatively small percentage of Retained Austenite.

STRUCTURES IN LOW BALLISTIC TEST PLATE

NP9-46896

Figure 99 Plate No. P-11-B

Nital-Picral Etch. Mag. 1000X
Hardness 658 Knoop.

Figure 100 Plate No. P-11-B

Nital Picral Etch Mag. 1000X
Hardness 671 Knoop.

TEMPERED MARTENSITIC STRUCTURES IN FACE OF HIGH BALLISTIC TEST PLATE

NPG-46895

LIGHT ARMOR FIRING RECORD

PRNC-AFG-59

SHEET NO.

X X X X X	TEMPERATURE	TIME					
ANNEAL			YP				
NORM			TS				
HARDEN	550	1½ hr	EL		PLATE		
QUENCH	Oil		RA		SIZE		
DRAW	300	1 hr.			WEIGHT		
	air cooled						
GAUGE	C. 512	C. 512		Back			
PROJ.	Cal. 50 APHE	20MM HE	C	20-.24	DATE	10 February 1951	
GUN	299	850003	Mn	.45-.52	MFR.	Lukens Co.	
RANGE	1	1	S	.025 max.	CONTR.		
OBL.	0	20°	P	.025 max	TYPE	F.H.	
RC	2193	2740	Si	.20-.30	SPECS.	MIL-A-12560	
LC	2183	—	Ni	3.30-3.70	PLATE	1A	
HI	2159 V50	2730	Cr		GROUP		
LIMIT	2171 2183	>2730	Mo	.35-.45	HEAT	6A	
RESULT	Failed	Passed			BHN		
					STEEL	T-3015-1 T-12564	

RD.	BULLET	CHARGE	STR. VEL.	OBL.	YAW	PENET	BULLET	CONDITION OF PLATE
1	Cal. 50 APHE	11.6	2111	0	0	I	FOP	SB
2	"	11.9	2159	0	0	I	FOP	MB
3	"	12.1	2235	0	0	C	NR	½" C Pun
4	"	12.2	2252	0	0	I	FOP	MB
5	"	12.3	2256	0	0	C	NR	½" C Pun
6	"	12.3	2261	0	0	C	NR	½" C Pun
7	"	12.0	2147	0	0	I	FOP	MB
8	"	12.0	2200	0	0	C	NR	½" C. Pun
9	"	12.0	2183	0	0	C	NR	½" C Pun
10	"	11.9	2194	0	0	C	NR	½" C Pun
11	"	11.6	2097	0	0	I	FOP	SB
12	"	11.7	2158	0	0	I	FOP	SB
13	"	11.7	2061	0	0	I	FOP	SB
14	"	11.8	2135	0	0	I	FOP	SB
15	20M. HE	435	2707	20	-	I	HO	MB
16	"	435	2730	20	-	I	HO	MB

PRNC-3-70-62-6500

LIGHT ARMOR FIRING RECORD
PRRC-MPG-59

SHEET NO.

X X X X X	TEMPERATURE	TIME				
ANNEAL			YP			
NORM			TS			
HARDEN	1550	1 hr	EL	PLATE		
QUENCH	Oil		RA	SIZE		
DRAW	300 Air Cooled	1 hr		WEIGHT		
			Back			
GAUGE	0"513	0"513	C .20-.24	DATE	9 February 1951	
PROJ.	CAL 50 APM2	20MM HE	Mn .45-.51	MFR.	Lithium Co.	
GUN	299	8:0003	S .025 Max	CONTR.		
RANGE	1	1	P .025 MAX	TYPE	F.N.	
OBL.	0	20°	Si .20-.30	SPECS.	JAN-A-784	
RC	2195	2740	Ni 3.30-3.70	PLATE	1B	
LC	2327	—	Cr	GROUP		
HI	2301 VP50	2733	Mo .35-.45	HEAT	64	
LIMIT VL+VPMK	2314 2337	>2733		BHN		
RESULT	Passed	Passed		STEEL	T-3015-1 T-6264	

RD.	BULLET	CHARGE	STR. VEL.	OBL.	YAW	PENET	BULLET	CONDITION OF PLATE
1	CAL 50 APM2	11.0	1985	0	0	I	FOP	SB
2	"	11.2	2073	0	0	I	FOP	SB
3	"	11.5	2062	0	0	I	FOP	SB
4	"	11.7	2185	0	0	I	FOP	SB
5	"	11.9	2100	0	0	I	FOP	SB
6	"	12.2	2182	0	0	I	FOP	SB
7	"	12.4	2297	0	0	I	FOP	SB
8	"	12.6	2301	0	0	I	FOP	MB
9	"	12.8	2336	0	0	C	NR	1/2" C PUN
10	"	12.9	2362	0	0	C	NR	3/8" C PUN
11	"	12.8	2284	0	0	I	FOP	SB
12	"	12.8	2344	0	0	I	FOP	MB
13	"	12.9	2327	0	0	C	NR	1/2" C PUN
14	"	12.9	2340	0	0	I	FOP	MB
15	"	12.9	2421	0	0	C	NR	1/2" C PUN
16	20MM HE	435	2640	20	—	I	HO	MB
17	"	435	2733	20	—	I	HO	MB

LIGHT ARMOR FIRING RECORD

PREC-#PG-39

SHEET NO.

XXXXX	TEMPERATURE	TIME
ANNEAL		
NORM		
HARDEN	1550	1 hour
QUENCH	Oil	
DRAW	300 Air Cooled	1 hour
GAUGE	OPEN	OPEN
PROJ.	Cal. 50M2	20MM HE
GUN	279	EDC303
RANGE	1	1
OBL.	0	20
RC	2195	2740
LC	2197	—
HI	2177 V50	2714
LIMIT	2137 2195	2714
RESULT	Passed	Passed.

YP

TS

EL

RA

PLATE

SIZE 24"X36"

WEIGHT

C .20-24

Mn .45-52

S .025 Max

P .025 Max

Si .20-30

Ni 3.30-3.70

Cr

Mo .35-.45

DATE 181 JAN. 195?

MFR. LITHIUM CO NPS TREAT

CONTR.

TYPE F.H.

SPECS. JAN-A-784

PLATE 2A

GROUP

HEAT

BHN

STEEL T-3015-1 T-6264

RD.	BULLET	CHARGE	STR. VEL.	OBL.	YAW	PENET	BULLET	CONDITION OF PLATE
1	Cal 50M2	11.8	2177	0	0	I	FOP	SB
2	"	11.9	2204	0	0	C	NR	7/16" CPUN
3	"	12.0	2203	0	0	C	NR	7/16" x 1/2" CPUN.
4	"	12.1	2237	0	0	I	FOP	SB
5	"	11.8	2117	0	0	M	Missed Plate.	
6	"	11.8	2118	0	0	I	FOP	SB
7	"	11.9	2124	0	0	I	FOP	SB
8	"	11.9	2169	0	0	I	FOP	SB
9	"	12.0	2164	0	0	I	FOP	SB
10	"	12.1	2197	0	0	C	NR	7/16" CPUN
11	"	12.0	2232	0	0	I	FOP	SB
12	"	11.9	2166	0	0	I	FOP	MB
13	"	12.0	2177	0	0	I	FOP	MB
14	"	12.1	2169	0	0	I	FOP	MB
15	"	12.2	2230	0	0	C	NR	7/16" CPUN
16	20MM HE	430	2714	20	—	I	HO	MB CIR. FACE Cake

LIGHT ARMOR FIRING RECORD

PRDC-RFD-50

SHEET NO.

XXXX	TEMPERATURE	TIME			
ANNEAL			YP		
NORM.			TS		
HARDEN	1550	1 hr.	EL	PLATE	
QUENCH	oil		RA	SIZE	24"X36"
DRAW	300 air cooled	1 hr		WEIGHT	

GAUGE	0.515	0.515	C .20-.24	DATE	23 JAN. 1951
PROJ.	Cal. 50 APM2	20MM HE	Mn .45-.52	MFR.	LITHIUM CO, NPG TECH
GUN	2-99	85000	S .025 max.	CONTR.	
RANGE	1	1	P .025 max.	TYPE	F. H.
OBL.	0	20	Si .20-.30	SPECS.	JAN-A-11 & 9A
RC	2198	2740	Ni 3.30-3.70	PLATE	28
LC	2206	—	Cr	GROUP	
HI	2203 VP50	2714	Mo .35-.45	HEAT	
LIMIT	2205 2285	>2714		BHN	
RESULT	Passed	Passed.		STEEL	T-3015-1 T-6264

RD.	BULLET	CHARGE	STR. VEL.	OBL.	YAW	PENET	BULLET	CONDITION OF PLATE
1	Cal 50M2	11.8	2164	0	0	I	FOP	SB
2	"	11.8	2089	0	0	I	FOP	SB
3	"	12.0	2201	0	0	I	FOP	SB
4	"	12.1	2206	0	0	C	NR	3/8" C PUN
5	"	12.1	2203	0	0	I	FOP	SB
6	"	12.2	2233	0	0	I	FOP	SB
7	"	12.3	2232	0	0	I	FOP	SB
8	"	12.4	2272	0	0	I	FOP	SB
9	"	12.5	2295	0	0	I	FOP	SB
10	"	12.5	2361	0	0	C	NR	5/8" C PUN
11	"	12.4	2315	0	0	C	NR	3/8" C PUN
12	"	12.2	2215	0	0	I	FOP	SB 1" cracked at plate edge
13	"	12.3	2279	0	0	I	FOP	MB
14	"	12.3	2252	0	0	C	NR	3/8" C PUN
15	"	12.3	2281	0	0	C	NR	1/2" C PUN
16	20MM HE	430	2714	20	—	I	HO	MB CIR FACE CRKS.

LIGHT ARMOR FIRING RECORD
PRDC-NPG-59

SHEET NO.

XXXXX	TEMPERATURE	TIME
ANNEAL		
NORM		
HARDEN	1550	1 hr.
QUENCH	oil	
DRAW	300 Air Cooled	1 hr.
GAUGE	0.1521	0.1521
PROJ.	Cal. 50 APM2	20MM HE
GUN	299	850003
RANGE	1	1
OBL.	0	20
RC	2207	2740
LC	2233	—
HI	2215 V50	2725
LIMIT	2224 2262	2725
RESULT	Passed	Passed.

YP
TS
EL — PLATE
RA — SIZE 24" X 36"
WEIGHT

C .20-.24 — DATE 25 JAN 1951
Mn .45-.52 — MFR. LITHIUM Co NPG Treated
S .025 max — CONTR.
P .025 max — TYPE F.H.
Si .20-.30 — SPECS. JAN-A-784
Ni 3.30-3.70 — PLATE 3A
Cr — GROUP
Mo .35-.45 — HEAT
BHN
STEEL T-3015-1 T-6264

RD.	BULLET	CHARGE	STR. VEL.	OBL.	YAW	PENET	BULLET	CONDITION OF PLATE
1	Cal. 50M2	11.9	2164	0	0	I	FOP	SB
2	"	12.0	2210	0	0	I	FOP	SB
3	"	12.0	2167	0	0	I	FOP	SB
4	"	12.1	2245	0	0	C	NR	5/8" X 1/2" C PUN
5	"	12.1	2242	0	0	I	FOP	SB
6	"	12.2	2210	0	0	I	FOP	SB
7	"	12.3	2237	0	0	I	FOP	SB
8	"	12.4	2252	0	0	I	FOP	SB
9	"	12.5	2297	0	0	C	NR	7/16" C PUN
10	"	12.4	2233	0	0	C	NR	3/8" X 5/16" C PUN
11	"	12.1	2194	0	0	I	FOP	SB
12	"	12.2	2215	0	0	I	FOP	SB
13	"	12.3	2274	0	0	C	NR	3/8" C PUN
14	"	12.1	2153	0	0	I	FOP	SB
15	20MM HE	430	2725	20	—	I	HO	HB CIR. FACE Cracks

LIGHT ARMOR FIRING RECORD

PRNC-NPG-59

SHEET NO.

X X X X X	TEMPERATURE	TIME
ANNEAL		
NORM		
HARDEN	1550	1 hr.
QUENCH	oil	
DRAW	300 Air cooled	1 hr.
GAUGE	2"524	2"524
PROJ.	Cal .50 M2	20MM HE
GUN	249	850003
RANGE		
OBL.	0	20
RC	2211	2740
LC	2231 Vss	
HI	2230	2714
LIMIT	2234 2269	>2714
RESULT	Passed	Passed

YP			
TS			
EL	PLATE		
RA	SIZE		
	WEIGHT		

C .20-.24 DATE 25 Jan 1951

Mn .45-.52 MFR. LITHIUM CO NPG TEST

S .025 max. CONTR.

P .025 max. TYPE F.H

Si .20-.30 SPECS. JAN-A-784

Ni 3.30-3.70 PLATE 3B

Cr GROUP

Mo .35-.45 HEAT

BHN

STEEL T-3015-1 T-6264

RD.	BULLET	CHARGE	STR. VEL.	OBL.	YAW	PENET	BULLET	CONDITION OF PLATE
1	Cal .50 M2	11.9	2159	0	0	I	FOP	SB
2	"	12.0	2169	0	0	I	FOP	SB
3	"	12.1	2203	0	0	I	FOP	SB
4	"	12.2	2249	0	0	I	FOP	SB
5	"	12.3	2230	0	0	I	FOP	FUN S 1/16"
6	"	12.4	2306	0	0	C	NR	3/8" C PUN
7	"	12.4	2293	0	0	C	NR	3/8" C PUN
8	"	12.3	2249	0	0	I	FOP	SB
9	"	12.3	2256	0	0	I	FOP	SB
10	"	12.4	2293	0	0	C	NR	7/16" C PUN
11	"	12.3	2254	0	0	C	NR	3/8" C PUN
12	"	12.3	2301	0	0	C	NR	3/8" C PUN
13	"	12.2	2237	0	0	C	NR	7/16" C PUN
14	20MM HE	430	2714	20	—	I	HO	MB CIR FACE CRKS

PRNC-3-10-49-6500

LIGHT ARMOR FIRING RECORD

PRIIC-NPG-59

SHEET NO.

XXXXX	TEMPERATURE	TIME
ANNEAL		
NORM		
HARDEN	1550	1 hr.
QUENCH	oil	
DRAW	300	1 hr.
	[illegible]	
GAUGE	0.515	0.515
PROJ.	Cal. 50 APM2	20MMHE
GUN	299	650005
RANGE	1	1
OBL.	0	20
RC	2198	2740
LC	2132	—
HI	2127 1/2	2742
LIMIT	2130 2133	>2742
RESULT	FAILED(-66)	Passed.

YP			
TS			
EL	PLATE		
RA	SIZE		
	WEIGHT		

Back

C	.20-.24	DATE	10 APRIL 1951
Mn	.45-.52	MFR.	Lukens Co.
S	.025 max.	CONTR.	
P	.025 max.	TYPE	E.H.
Si	.20-.30	SPECS.	JAN-A-12A
Ni	3.20-3.70	PLATE	4B
Cr		GROUP	
Mo	.25-.45	HEAT	
		BHN	
		STEEL	

T-3015.1
T-826d

RD.	BULLET	CHARGE	STR. VEL.	OBL.	YAW	PENET	BULLET	CONDITION OF PLATE
1	Cal.50M2	11.4	2097	0	0	I	FOP	SB
2	"	11.5	2155	0	0	C	NR	1/2" C Pun
3	"	11.6	2153	0	0	C	NR	3/8" C Pun
4	"	11.4	2118	0	0	I	FOP	SB
5	"	11.4	2134	0	0	Disregard hit on plate frame.		
6	"	11.4	2132	0	0	C	NR	5/8" x 1/2" C Pun
7	"	11.2	2019	0	0	I	FOP	SB
8	"	11.3	2092	0	0	I	FOP	SB
9	"	11.4	2127	0	0	I	FOP	SB
10	"	11.6	2134	0	0	C	NR	7/16" C Pun
11	"	11.6	2167	0	0	I	FOP	SB
12	"	11.8	2208	0	0	I	FOP	SB
13	"	11.8	2189	0	0	C	NR	3/8" C Pun
14	20MMHE	435	2742	20	—	I	HE	HB

PRNC-3-10-49-6500

LIGHT ARMOR FIRING RECORD

PREC-RPG-59

SHEET NO.

XXXXX	TEMPERATURE	TIME				
ANNEAL			YP			
NORM			TS			
HARDEN	1550	1½ hr.	EL	PLATE		
QUENCH	Oil		RA	SIZE		
DRAW	300	1½ hr.		WEIGHT		
	Air cooled					
GAUGE	0.521	0.521	C	.20-.24 Back	DATE	10 February 1951
PROJ.	Cal. 50 APM2	20MMHE	Mn	.45-.52	MFR.	Lithium Mfg. Co.
GUN	399	399C3	S	.025 max.	CONTR.	
RANGE	1	1	P	.025 max.	TYPE	F.H.
OBL.	0	20	Si	.20-.30	SPECS.	MIL-A-46100
RC	2807	2740	Ni	3.30-3.70	PLATE	5A
LC	2311	—	Cr		GROUP	
HI	2293 VP50	2725	Mo	.35-.45	HEAT	606
LIMIT	2302 2344	>2725			BHN	
RESULT	Passed	Passed			STEEL	T-3015-1 T-3216-1

RD.	BULLET	CHARGE	STR. VEL.	OBL.	YAW	PENET	BULLET	CONDITION OF PLATE
1	Cal. 50 APM2	11.6	2120	0	0	I	FOP	VSB
2	"	11.9	2118	0	0	I	FOP	SB
3	"	12.2	2225	0	0	I	FOP	SB
4	"	12.4	2270	0	0	I	FOP	Pun S 1/16"
5	"	12.6	2270	0	0	I	FOP	Pun S 1/16"
6	"	12.8	2323	0	0	I	FOP	MB
7	"	13.0	2409	0	0	C	NR	1/2" C Pun
8	"	12.9	2362	0	0	C	NR	1/2" C Pun
9	"	12.8	2311	0	0	C	NR	1/2" C Pun
10	"	12.8	2321	0	0	C	NR	3/8" C Pun
11	"	12.6	2293	0	0	I	FOP	SB
12	"	12.7	2340	0	0	I	FOP	MB
13	"	12.6	2327	0	0	I	FOP	MB
14	"	12.9	2352	0	0	C	NR	1/2" C Pun
15	20MMHE	435	2725	20	-	I	HO	MB

PREC-3-10-60-3500

LIGHT ARMOR FIRING RECORD

PRNC-NPG-59

SHEET NO.

XXXXX	TEMPERATURE	TIME
ANNEAL		
NORM		
HARDEN	1550	1 hr
QUENCH	Oil	
DRAW	300	1 hr
	Air Cooled	
GAUGE	0"515	
PROJ.	CAL 50 APM2	
GUN	599	
RANGE	1	
OBL.	0	
RC	2198	
LC	2327	
HI	2303 V50	
LIMIT	2315 2338	
RESULT	Passed	

YP			
TS			
EL	PLATE		
RA	SIZE		
	WEIGHT		

Back

C	.20 - .24	DATE	10 February 1951
Mn	.45 - .52	MFR.	Lithium Co
S	.025 MAX	CONTR.	
P	.025 MAX	TYPE	F.H.
Si	.20 - .30	SPECS.	JAN-A-784
Ni	3.30 - 3.70	PLATE	5B
Cr		GROUP	
Mo	.35 - .45	HEAT	66
		BHN	
		STEEL	T-3015-1 T 6264

RD.	BULLET	CHARGE	STR. VEL.	OBL.	YAW	PENET	BULLET	CONDITION OF PLATE
1	Caliber .50	11.6	2112	0	0	I	FOP	SB
2	"	11.9	2197	0	0	I	FOP	SB
3	"	12.2	2235	0	0	I	FOP	SB
4	"	12.4	2247	0	0	I	FOP	MB
5	"	12.6	2303	0	0	I	FOP	MB
6	"	12.8	2327	0	0	C	NR	1/2" C PUN
7	"	12.9	2353	0	0	C	NR	1/2" C PUN
8	"	12.9	2348	0	0	C	NR	1/2" C PUN
9	"	12.8	2333	0	0	C	NR	1/2" C PUN
10	"	12.6	2334	0	0	I	FOP	MB
11	"	12.6	2291	0	0	I	FOP	SB
12	"	12.7	2301	0	0	I	FOP	SB
13	"	12.9	2355	0	0	I	FOP	MB
14	"	13.0	2371	0	0	I	FOP	MB
15	"	13.2	2403	0	0	C	NR	5/8" C PUN
16	"	13.2	2444	0	0	C	NR	1/2" C PUN

PRNC-3-10-49-5500

LIGHT ARMOR FIRING RECORD

PREC-HPG-59

SHEET NO.

X X X X X	TEMPERATURE	TIME
ANNEAL		
NORM		
HARDEN	1550 C	1 hr
QUENCH	Oil	
DRAW	300 AIR COOLED	1 hr
GAUGE	0"517	
PROJ.	Cal 50 APM2	
GUN	2.99	
RANGE	1	
OBL.	2	
RC	2201	
LC	2182	
HI	2158 VP 50	
LIMIT	2170 2190	
RESULT	Failed	

YP

TS

EL

RA

PLATE

SIZE

WEIGHT

Back

C	.20-.24	DATE	10 FEBRUARY 1951
Mn	.45-.52	MFR.	Lithium Co.
S	.025 MAX	CONTR.	
P	.025 MAX	TYPE	F.H.
Si	.20-.30	SPECS.	JAN-A-784
Ni	3.30-3.70	PLATE	6A
Cr		GROUP	
Mo	.35-.45	HEAT	66
		BHN	
		STEEL	T-30152-1 T-6264

RD.	BULLET	CHARGE	STR. VEL.	OBL.	YAW	PENET	BULLET	CONDITION OF PLATE
1	Cal 50 APM2	11.6	2083	0	0	I	FOP	SB
2	"	11.9	2182	0	0	C	NR	1/2" C PUN
3	"	12.1	2190	0	0	I	FOR	MB
4	"	12.3	2288	0	0	C	NR	1/2" C PUN
5	"	12.2	2233	0	0	C	NR	1/2" C PUN
6	"	12.1	2216	0	0	C	NR	1/2" C PUN
7	"	11.8	2140	0	0	I	FOP	MB
8	"	11.8	2115	0	0	I	FOP	MB
9	"	11.9	2091	0	0	I	FOP	MB
10	"	12.0	2190	0	0	I	FOP	MB
11	"	11.9	2203	0	0	I	FOP	MB
12	"	11.8	2068	0	0	I	FOP	MB
13	"	11.9	2158	0	0	I	FOP	MB
14	"	12.2	2218	0	0	C	NR	1/2" C PUN

PRINC-3-7.0-30-3500

LIGHT ARMOR FIRING RECORD

PRNC-NFG-59

SHEET NO.

XXXXX	TEMPERATURE	TIME				
ANNEAL			YP			
NORM			TS			
HARDEN	1530	1 HR	EL	PLATE		
QUENCH	OIL		RA	SIZE		
DRAW	300 AIR COOLED	1 HR		WEIGHT		

BACK

GAUGE	0" 518	0" 518	C .20-.24	DATE	10 FEBRUARY 1951
PROJ.	CAL .50 APM2	20MMHE	Mn .45-.52	MFR.	Lithium 63
GUN	.399	850003	S .025 MAX	CONTR.	
RANGE	1	1	P .025 MAX	TYPE	F. H.
OBL.	0	20	Si .20-.30	SPECS.	JAN-A-784
RC	2202	2740	Ni 3.30-3.70	PLATE	6B
LC	2336	—	Cr	GROUP	
HI	2323 V50	2717	Mo .35-.45	HEAT	66
LIMIT VLa VPmin	2330 2332	>2717		BHN	
RESULT	Passed	Passed		STEEL	T.30135-1 T.6264

RD.	BULLET	CHARGE	STR. VEL.	OBL.	YAW	PENET	BULLET	CONDITION OF PLATE
1	CAL.50 APM2	11.5	2117	0	0	I	FOP	SB
2	"	11.8	2156	0	0	I	FOP	SB
3	"	12.1	2261	0	0	I	FOP	SB
4	"	12.3	2225	0	0	I	FOP	MB
5	"	12.5	2261	0	0	I	FOP	MB
6	"	12.7	2323	0	0	I	FOP	MB
7	"	12.9	2352	0	0	I	FOP	MB
8	"	13.1	2397	0	0	C	NR	3/8" C PUN
9	"	13.0	2359	0	0	C	NR	3/8" C PUN
10	"	12.9	2370	0	0	I	FOP	PUN. S. 1/4"
11	"	12.9	2342	0	0	I	FOP	MB
12	"	13.0	2336	0	0	C	NR	1/2" C PUN
13	"	13.0	2425	0	0	C	NR	1/2" C PUN
14	"	12.8	2315	0	0	I	FOP	MB
15	20MMHE	435	2717	20	—	I	HO	MB

FLSC-3-10-69-6500

LIGHT ARMOR FIRING RECORD

FRNC-MPG-59

SHEET NO.

X X X X X	TEMPERATURE	TIME			
ANNEAL			YP		
NORM			TS		
HARDEN			EL	PLATE	
QUENCH			RA	SIZE	
DRAW				WEIGHT	
GAUGE			C	DATE	
PROJ.			Mn	MFR.	Fitchburg Co.
GUN			S	CONTR.	
RANGE			P	TYPE	F.H.
OBL.			Si	SPECS.	MIL-A-784
RC			Ni	PLATE	7A
LC			Cr	GROUP	
HI			Mo	HEAT	
LIMIT				BHN	
RESULT	Badly Cracked - Did not fire			STEEL	T-5013-1 T-6264

RD.	BULLET	CHARGE	STR. VEL.	OBL.	YAW	PENET	BULLET	CONDITION OF PLATE

FRNC-3-10-[illegible]

LIGHT ARMOR FIRING RECORD

PRNC-WPG-59

SHEET NO.

X X X X X	TEMPERATURE	TIME
ANNEAL		
NORM.		
HARDEN		
QUENCH		
DRAW		
GAUGE		
PROJ.		
GUN		
RANGE		
OBL.		
RC		
LC		
HI		
LIMIT		
RESULT		

YP			
TS			
EL		PLATE	
RA		SIZE	
		WEIGHT	
	C	DATE	
	Mn	MFR.	Bethlehem Co.
	S	CONTR.	
	P	TYPE	F.H.
	Si	SPECS.	AXE-A-768
	Ni	PLATE	78
	Cr	GROUP	
	Mo	HEAT	
		BHN	
		STEEL	T-2815-1 T-5264

Badly cracked - Did not fire

RD.	BULLET	CHARGE	STR. VEL.	OBL.	YAW	PENET	BULLET	CONDITION OF PLATE

LIGHT ARMOR FIRING RECORD

PRNC-NFO-59

SHEET NO.

X X X X X	TEMPERATURE	TIME				
ANNEAL			YP			
NORM			TS			
HARDEN	1550	1 hour	EL	PLATE		
QUENCH	Oil		RA	SIZE		
DRAW	300 Air cooled	1 hour		WEIGHT		
GAUGE	0.574	0.574	C	0.3-.4	DATE	12 February 1951
PROJ.	Cal .50 APM2	60MM HE	Mn	.45-.52	MFR.	Lithium Co.
GUN	T99	T50003	S	.025 Max	CONTR.	
RANGE	1	1	P	.025 Max	TYPE	E.H.
OBL.	0	20	Si	.20-.30	SPECS.	JAN-A-784
RC	2196	2740	Ni	3.30-3.70	PLATE	B.A
LC	2169	—	Cr		GROUP	
HI	2155 VP50	2722	Mo	.35-.45	HEAT	67
LIMIT	2162 2212	> 2722			BHN	
RESULT	Failed	Passed			STEEL	T3015-1 T6264

RD.	BULLET	CHARGE	STR. VEL.	OBL.	YAW	PENET	BULLET	CONDITION OF PLATE
1	Cal .50 APM2	11.5	2100	0	0	I	FOP	SB
2	"	11.7	2147	0	0	I	FOP	MB
3	"	11.9	2174	0	0	I	FOP	MB
4	"	12.1	2200	0	0	I	FOP	MB
5	"	12.1	2169	0	0	C	NR	3/8" C PUN
6	"	12.0	2242	0	0	C	NR	1/2" C PUN
7	"	12.0	2189	0	0	I	FOP	SB
8	"	11.5	2079	0	0	I	FOP	SB
9	"	11.7	2121	0	0	I	FOP	PUNS 1/64
10	"	11.8	2155	0	0	I	FOP	SB
11	"	12.0	2203	0	0	I	FOP	MB
12	"	12.2	2192	0	0	I	FOP	SB
13	"	12.2	2228	0	0	C	NR	1/2" C PUN
14	"	12.2	2210	0	0	C	NR	1/2" C PUN
15	20MM HE	4.35	2722	20	--	I	HO	MB

LIGHT ARMOR FIRING RECORD
PRNC-NPG-59

SHEET NO.

X X X X X	TEMPERATURE	TIME				
ANNEAL			YP			
NORM			TS			
HARDEN	1550	1 hr	EL		PLATE	
QUENCH	Oil		RA		SIZE	
DRAW	300 Air cooled	1 hr			WEIGHT	
GAUGE	3/5 in	0.534	C	.20-.?	DATE	10 February 1951
PROJ.	Cal. 50 Ball M2	20MMHE	Mn	.45-.?	MFR.	Lithium Co.
GUN	299	350203	S	.025 Max	CONTR.	
RANGE	1	1	P	.025 Max	TYPE	F.H.
OBL.	0	20	Si	.20-.30	SPECS.	JAN-A-784
RC	2211	2740	Ni	3.30-3.70	PLATE	8 B
LC	2211	—	Cr		GROUP	
HI	2200 VPSD	2720	Mo	.35-.45	HEAT	67
LIMIT	2206 2212	>2720			BHN	
RESULT	Failed	Passed			STEEL	T3015-1 T6264

RD.	BULLET	CHARGE	STR. VEL.	OBL.	YAW	PENET	BULLET	CONDITION OF PLATE
1	Cal. 50 M2	11.6	2150	0	0	I	FOP	SB
2	"	11.8	2148	0	0	Disregard –		Bad Hit
3	"	12.0	2220	0	0	C	NR	1/2" C Pun
4	"	11.9	2200	0	0	I	FOP	MB
5	"	12.0	2227	0	0	C	NR	1/2" C Pun
6	"	12.1	2225	0	0	I	FOP	MB
7	"	12.2	2227	0	0	C	NR	1/2" C Pun
8	"	12.3	2244	0	0	C	NR	1/2" C Pun
9	"	12.0	2126	0	0	I	FOP	MB
10	"	12.1	2187	0	0	I	FOP	MB
11	"	12.1	2211	0	0	C	NR	3/8" x 1/2" C Pun
12	"	12.1	2240	0	0	C	NR	1/2" C Pun
13	"	12.0	2155	0	0	I	FOP	MB
14	"	12.0	2180	0	0	I	FOP	MB
15	"	12.0	2238	0	0	I	FOP	MB
16	"	12.0	2238	0	0	I	FOP	MB
17	"	12.0	2147	0	0	I	FOP	MB
18	20MMHE	485	2720	20	—	I	HO	MB

PRNC-5-10-49-6000

LIGHT ARMOR FIRING RECORD

PRMC-MFG-59

SHEET NO.

XXXXX	TEMPERATURE	TIME
ANNEAL		
NORM		
HARDEN	1550	1 hr.
QUENCH	Oil	
DRAW	300	1 hr.
	Air cooled	
GAUGE	0.526	0.526
PROJ.	Cal. 50 APM2	20MMHE
GUN	294	850003
RANGE	1	1
OBL.	0	20
RC	2214	2740
LC	2187	—
HI	LIT 20	2730
LIMIT	2181 2209	2715.0
RESULT	FAILED(-31)	Passed

YP

TS

EL

RA

PLATE

SIZE 20"x30"

WEIGHT

Buck.

C .20 - .24

Mn .45 - .52

S .025 max.

P .025 max.

Si .20 - .30

Ni 3.50 - 3.70

Cr

Mo .35 - .45

DATE 10, APRIL 1951

MFR. Lukens Co.

CONTR

TYPE F.H.

SPECS. JAN-A-46A

PLATE 9A

GROUP

HEAT

BHN

STEEL T-3015-1 T-4264

RD.	BULLET	CHARGE	STR. VEL.	OBL.	YAW	PENET	BULLET	CONDITION OF PLATE
1	Cal. 50 M2	11.8	2200	0	0	I	FOP	PUN S 5/16"
2	"	11.9	2201	0	0	C	NR	9/16" C PUN
3	"	11.7	2161	0	0	I	FOP	SB
4	"	11.7	2174	0	0	I	FOP	SB
5	"	11.8	2174	0	0	I	FOP	MB
6	"	11.9	2194	0	0	I	FOP	SB
7	"	12.0	2187	0	0	C	NR	3/8" C PUN
8	"	12.0	2242	0	0	I	FOP	SB
9	"	12.0	2203	0	0	C	NR	7/16" C PUN
10	"	12.0	2215	0	0	C	NR	5/8" C PUN
11	"	11.9	2143	0	0	I	FOP	SB
12	"	12.0	2227	0	0	I	FOP	SB
13	20MMHE	435	2730	20	—	I	HO	HB

PRMC-3-10-49-5500

LIGHT ARMOR FIRING RECORD

PRAC-RFG-59

XXXXX	TEMPERATURE	TIME		
ANNEAL			YP	
NORM.			TS	
HARDEN	1550	1½	EL	PLA
QUENCH	Oil		RA	SI
DRAW	300	1 Hr.		NE
	Air Cooled			
GAUGE	0.578	0.578	C	.20-.24
PROJ.	Cal.50M2	20MM HE	Mn	.45-.52
GUN	299	850003	S	.025 max
RANGE	1	1	P	.025 max
OBL.	0	20	Si	.20-.30
RC	2217	2740	Ni	3.50-3.7
LC	2211	—	Cr	
HI	2206 VPSO	2739	Mo	.35-.4
LIMIT	2209 2211	2739		
RESULT	FAILED(-6)	Passed		

Back

RD.	BULLET	CHARGE	STR. VEL.	OBL.	YAW	PEN
1	Cal.50M2	11.4	2043	0	0	I
2	"	11.6	2156	0	0	
3	"	11.8	2180	0	0	
4	"	11.9	"2200"	0	0	
5	"	12.0	2216	0	0	
6	"	12.0	2227	0	0	
7	"	12.0	2233	0	0	
8	"	12.1	2211	0	0	
9	"	11.9	2206	0		
10	"	11.9	2204	0		
11	"	12.2	2279	0		
12	"	12.0	2215	0		
13	20MM HE	435	2739	2		

LIGHT ARMOR FIRING RECORD

PRMC-MPG-59

SHEET NO.

X X X X X	TEMPERATURE	TIME				
ANNEAL			YP			
NORM			TS			
HARDEN			EL	PLATE		
QUENCH			RA	SIZE		
DRAW				WEIGHT		
GAUGE			C	DATE		
PROJ.			Mn	MFR.	Lukens Co.	
GUN			S	CONTR.		
RANGE			P	TYPE	F.H.	
OBL.			Si	SPECS.	JAN-A-784	
RC			Ni	PLATE	103	
LC			Cr	GROUP		
HI			Mo	HEAT		
LIMIT				BHN		
RESULT	Badly cracked - Did not fire			STEEL		T-2813-1 T-62Cat

RD.	BULLET	CHARGE	STR. VEL.	OBL.	YAW	PENET	BULLET	CONDITION OF PLATE

LIGHT ARMOR FIRING RECORD

PRDC-MPG-59

SHEET NO.

X X - X X	TEMPERATURE	TIME
ANNEAL		
NORM		
HARDEN	1550	1½ hr.
QUENCH	Oil	
DRAW	300	1 hr
	air cooled	
GAUGE	0.514	0.514
PROJ.	Cal. 50 APM2	20MM HE
GUN	299	[illegible]
RANGE	1	1
OBL.	0°	30
RC	2196	2740
LC	2191	—
HI	2197 VPSD	2733
LIMIT VLo - VPMin	2197 2289	>2733
RESULT	Passed	Passed

YP			
TS			
EL		PLATE	
RA		SIZE	
		WEIGHT	

Bulk

C	.20-.24	DATE	8 February 1951
Mn	.45-.52	MFR.	Lithium Co.
S	.025 max.	CONTR.	
P	.025 max.	TYPE	F H
Si	.20-.30	SPECS.	JAN-A-784
Ni	3.30-3.70	PLATE	IIA
Cr		GROUP	
Mo	.35-.45	HEAT	68
		BHN	
		STEEL	T-3015-1 T-6264

RD.	BULLET	CHARGE	STR. VEL.	OBL.	YAW	PENET	BULLET	CONDITION OF PLATE
1	Cal 50 M2	11.0	2025	0	0	I	FOP	VSB
2	"	11.4	1975	0	0	I	FOP	VSB
3	"	11.6	2126	0	0	I	FOP	VSB
4	"	12.0	2187	0	0	I	FOP	SB
5	"	12.1	2159	0	0	I	FOP	SB
6	"	12.2	2197	0	0	C	NR	½" C PUN
7	"	12.2	2213	0	0	I	FOP	SB
8	"	12.4	2301	0	0	C	NR	½" C PUN
9	"	12.1	2183	0	0	I	FOP	PUN. S. 1/32"
10	"	12.1	2228	0	0	I	FOP	SB
11	"	12.1	2274	0	0	I	FOP	PUN. S. 1/8"
12	"	12.1	2215	0	0	I	FOP	SB
13	"	12.0	2194	0	0	I	FOP	SB
14	"	12.2	2197	0	0	I	FOP	SB
15	"	12.4	2288	0	0	C	NR	½" C PUN
16	"	12.4	2308	0	0	I	FOP	SB
17	"	12.6	2272	0	0	I	FOP	1/16" PUN S
18	"	12.8	2340	0	0	C	NR	½" C PUN
19	20MM HE	435	2733	30	—	I	HO	MB

LIGHT ARMOR FIRING RECORD
PRNC-NPG-59

SHEET NO.

X X X X X	TEMPERATURE	TIME					
ANNEAL			YP				
NORM			TS				
HARDEN	1550	1 hr.	EL		PLATE		
QUENCH	oil		RA		SIZE		
DRAW	300	1 hr			WEIGHT		
	Air cooled			Back			
GAUGE	0"510	0"518	C	.20-.24	DATE	10 February 1951	
PROJ.	Cal. 50 APM2	20 MM HE	Mn	.45-.52	MFR.	Lebanon Co	
GUN	27?	850203	S	.025 max.	CONTR.		
RANGE	1	1	P	.025 max.	TYPE	F.H.	
OBL.	0	20°	Si	.20-.30	SPECS.	AXS-A-78f	
RC	2202	2740	Ni	3.50-3.70	PLATE	11B	
LC	2353	—	Cr		GROUP		
HI	2331 V50	2739	Mo	.35-.45	HEAT	68	
LIMIT	2342 2353	>2739			BHN		
RESULT	Passed	Passed			STEEL	T-3015-1 F-Ballast	

RD.	BULLET	CHARGE	STR. VEL.	OBL.	YAW	PENET	BULLET	CONDITION OF PLATE
1	Cal. .50 APM2	11.5	2015	0	0	I	FOP	SB
2	"	11.7	2129	0	0	I	FOP	SB
3	"	11.9	2187	0	0	I	FOP	SB
4	"	12.1	2238	0	0	I	FOP	SB
5	"	12.3	2257	0	0	I	FOP	MB
6	"	12.5	2297	0	0	I	FOP	Pun S ½"
7	"	12.7	2315	0	0	I	FOP	MB
8	"	12.9	2353	0	0	C	NR	½" C Pun
9	"	12.9	2329	0	0	I	FOP	MB
10	"	12.9	2381	0	0	C	NR	½" C Pun
11	"	12.9	2306	0	0	I	FOP	MB
12	"	13.2	2449	0	0	C	NR	5/8" C Pun
13	"	13.0	2364	0	0	C	NR	3/8" C Pun
14	"	12.8	2331	0	0	I	FOP	MB
15	"	12.8	2373	0	0	I	FOP	MB
16	"	13.1	2495	0	0	C	NR	½" C Pun
17	20MM HE	435	2739	20	—	I	HO	MB

PRNC-3-10-49-5500

LIGHT ARMOR FIRING RECORD

PRNC-APG-59

SHEET NO.

XXXXA	TEMPERATURE	TIME
ANNEAL		
NORM		
HARDEN	1550	1 hr.
QUENCH	Oil	
DPAW	300	1 hr
	Air Cool	
GAUGE	0.5H	
PROJ.	Cal 50APM2	
GUN	299	
RANGE	1	
OBL.	0	
RC	2192	
LC	2311	
HI	2306 VPSD	
LIMIT VL4 VPmin	2309 2316	
RESULT	Passed	

YP			
TS			
EL	PLATE		
RA	SIZE		
	WEIGHT		

Back

C	.20-.24	DATE	26 February 1951
Mn	.45-.52	MFR.	Lithium Co.
S	.025 Max	CONTR.	
P	.025 Max	TYPE	F H
Si	.20-.30	SPECS.	JAN-A-784
Ni	3.30-3.70	PLATE	12A
Cr		GROUP	
Mo	.35-.45	HEAT	68
		BHN	
		STEEL	T3015-1 T63.64

RD.	BULLET	CHARGE	STR. VEL.	OBL.	YAW	PENET	BULLET	CONDITION OF PLATE
1	Cal 50M2	11.2	2020	0	0	I	FOP	SB
2	"	11.5	2129	0	0	I	FOP	SB
3	"	11.8	2223	0	0	I	FOP	SB
4	"	11.8	2200	0	0	I	FOP	SB
5	"	11.8	2185	0	0	I	FOP	MB
6	"	12.0	2247	0	0	I	FOP	MB
7	"	12.2	2275	0	0	I	FOP	MB
8	"	12.4	2311	0	0	C	NR	3/8" C PUN
9	"	12.4	2319	0	0	C	NR	1/2" C PUN
10	"	12.4	2283	0	0	I	FOP	SB
11	"	12.3	2329	0	0	I	FOP	PUNS 1/32
12	"	12.5	2336	0	0	C	NR	1/2" C PUN
13	"	12.5	2306	0	0	I	FOP	MB
14	"	12.6	2353	0	0	C	NR	1/2" C PUN

PRNC-2-10-60-5000

LIGHT ARMOR FIRING RECORD
PRVC-NPC-59

SHEET NO.

XXXXX	TEMPERATURE	TIME				
ANNEAL			YP			
NORM			TS			
HARDEN	1550	1 hr.	EL		PLATE	
QUENCH	Water		RA		SIZE	
DRAW	300 Air Cooled	1 hr.			WEIGHT	
			Back			
GAUGE	0.514	0.514	C	.20-.24	DATE	24 February 1957
PROJ.	Cal.50AP M2	20MM HE	Mn	.45-.52	MFR.	Lithium Co.
GUN	299	850003	S	.025 Max	CONTR.	
RANGE	1	1	P	.025 Max	TYPE	FH
OBL.	0	20	Si	.20-.30	SPECS.	JAN-A-784
RC	2196	2740	Ni	3.30-3.70	PLATE	12-B
LC	2244	—	Cr		GROUP	
HI	2242 VPSD	2727	Mo	.35-.45	HEAT	68
LIMIT	2243 2243	>2727			BHN	
RESULT	Passed	Passed			STEEL	T3015-1 T6264

RD.	BULLET	CHARGE	STR. VEL.	OBL.	YAW	PENET	BULLET	CONDITION OF PLATE
1	Cal.50M2	11.2	2061	0	0	I	FOP	VSB
2	"	11.4	2079	0	0	I	FOP	VSB
3	"	11.6	2114	0	0	I	FOP	VSB
4	"	11.8	2201	0	0	I	FOP	SB
5	"	12.0	2225	0	0	I	FOP	SB
6	"	12.2	2315	0	0	C	NR	1/2" C PUN
7	"	12.4	2306	0	0	C	FCIP	1/2" PUN Out
8	"	12.4	2331	0	0	C	NR	1/2" C PUN
9	"	12.2	2256	0	0	C	NR	1/2" C PUN
10	"	12.0	2244	0	0	C	NR	1/2" C PUN
11	"	11.9	2204	0	0	I	FOP	SB
12	"	11.9	2242	0	0	I	FOP	SB
13	"	11.9	2249	0	0	C	NR	1/2" C PUN
14	"	11.8	2177	0	0	I	FOP	VSB
15	20MM HE	435	2727	20	—	I	HO	MB

PRVC-5-20-8 P-8500

LIGHT ARMOR FIRING RECORD
PRNC-AFG-59

SHEET NO.

X X X X X	TEMPERATURE	TIME
ANNEAL		
NORM		
HARDEN	1550	1 hr.
QUENCH	Oil	
DRAW	300	1 hr.
	Air Cooled	
GAUGE	0°516	0°516
PROJ.	Cal .50 APM2	20mm HE
GUN	599	250-003
RANGE	1	1
OBL.	0	20°
PC	2199	2740
LC	2154	—
HI	2145 V50	2735
LIMIT	2151 2265	>2735
RESULT	Failed	Passed

YP			
TS			
EL	PLATE		
RA	SIZE		
	WEIGHT		
	BHN		
	STEEL	T3015-1 T6264	

BRUCK

C	.20-.27	DATE	24 February 1951
Mn	.45-.52	MFR.	Lithium Co.
S	.025 Max	CONTR.	
P	.025 Max	TYPE	FH
Si	.20-.30	SPECS.	JAN-A-784
Ni	3.30-3.70	PLATE	13A
Cr		GROUP	
Mo	.35-.45	HEAT	69

RD.	BULLET	CHARGE	STR. VEL.	OBL.	YAW	PENET	BULLET	CONDITION OF PLATE
1	Cal .50	112	2046	0	0	I	FOP	SB
2	"	11.4	2044	0	0	I	FOP	SB
3	"	11.6	2142	0	0	I	FOP	MB
4	"	11.8	2213	0	0	I	FOP	MB
5	"	12.0	2177	0	0	C	NR	3/8" C PUN
6	"	12.2	2232	0	0	I	FOP	MB V.Slight B. Crk.
7	"	12.4	2301	0	0	C	NR	1/2" C PUN
8	"	12.2	2281	0	0	I	FOP	MB
9	"	12.2	2244	0	0	I	FOP	MB
10	"	12.4	2367	0	0	C	NR	1/2" C PUN
11	"	12.4	2377	0	0	C	NR	3/8" C PUN
12	"	12.0	2249	0	0	I	FOP	MB
13	"	11.6	2156	0	0	C	NR	1/2" C PUN
14	"	11.5	2126	0	0	I	FOP	SB
15	"	11.5	2145	0	0	I	FOP	SB
16	20mm HE	435	2735	20	—	I	HO	MB

PRNC-3-10-46-3500

LIGHT ARMOR FIRING RECORD

PRNC-M-10-59

SHEET NO.

XXXX	TEMPERATURE	TIME
ANNEAL		
NORM		
HARDEN	1550	1 hr
QUENCH	Water	
DRAW	300	1 hr
	Air Cooled	
GAUGE	0.514	0.514
PROJ.	Cal .50 APM2	20MM HE
GUN	299	850003
RANGE	1	1
OBL.	0	20
RC	2196	2740
LC	2159	—
HI	2155 VPS	2735
LIMIT	2157 2271	>2735
RESULT	Failed	Passed

YP

TS

EL

RA

PLATE

SIZE

WEIGHT

Back.

C	.20 - .24	DATE	24 February 1951
Mn	.45 - .52	MFR.	Lithium Co.
S	.025 Max	CONTR.	
P	.025 Max	TYPE	F. H.
Si	.20 - .30	SPECS.	JAN-A-784
Ni	3.30 - 3.70	PLATE	13 B
Cr		GROUP	
Mo	.35 - .45	HEAT	69
		BHN	
		STEEL	T3015-1 T6264

RD.	BULLET	CHARGE	STR. VEL.	OBL.	YAW	PENET	BULLET	CONDITION OF PLATE
1	Cal.50M2	11.2	2094	0	0	I	FOP	SB
2	"	11.4	2108	0	0	I	FOP	SB
3	"	11.6	2159	0	0	C	NR	3/8" C PUN
4	"	11.8	2213	0	0	I	FOP	SB
5	"	12.0	2263	0	0	I	FOP	MB
6	"	12.2	2272	0	0	I	FOP	MB
7	"	12.4	2311	0	0	C	NR	3/8" C PUN
8	"	12.4	2313	0	0	I	FOP	MB - Mud Cr'Ks.
9	"	12.6	2331	0	0	C	NR	1/2" C PUN
10	"	12.6	2340	0	0	C	NR	1/2" C PUN
11	"	12.0	2235	0	0	I	FOP	SB
12	"	11.8	2206	0	0	C	NR	1/2" C PUN
13	"	11.6	2155	0	0	I	FOP	SB
14	"	11.6	2166	0	0	I	FOP	SB
15	"	11.4	2126	0	0	I	FOP	SB
16	20MM HE	435	2735	20	-	I	HO	MB - Cir. Face Cr'K.

PRNC-S-10-60-6600

LIGHT ARMOR FIRING RECORD
PRNC-WPG-69

SHEET NO.

X X X X X	TEMPERATURE	TIME			
ANNEAL			YP		
NORM			TS		
HARDEN	1550	1 hr.	EL	PLATE	
QUENCH	Oil		RA	SIZE	
DRAW	300 Air Cooled	1 hr.		WEIGHT	
			Back		
GAUGE	0.520	0.520	C .20-.24	DATE	24 February 1951
PROJ.	Cal.50 APM2	20MM HE	Mn .45-.52	MFR.	Lithium Co.
GUN	299	350003	S .025 max	CONTR.	
RANGE	1	1	P .025 max	TYPE	F. H.
OBL.	0	20	Si .20-.30	SPECS.	JAN-A-784
RC	2205	2740	Ni 3.30-3.70	PLATE	1/4 B
LC	2227	—	Cr	GROUP	
HI	2208 VPSO	2737	Mo .35-.45	HEAT	69
LIMIT	2218 2275	>2737		BHN	
RESULT	Passed	Passed		STEEL	T3015-1 T6264

RD.	BULLET	CHARGE	STR. VEL.	OBL.	YAW	PENET	BULLET	CONDITION OF PLATE
1	Cal.50 M2	11.3	2091	0	0	I	FOP	VSB
2	"	11.5	2161	0	0	I	FOP	VSB
3	"	11.7	2189	0	0	I	FOP	VSB
4	"	11.9	2227	0	0	C	NR	1/2" C Pun
5	"	11.8	2199	0	0	I	FOP	MB
6	"	11.8	2237	0	0	I	FOP	MB
7	"	11.8	2208	0	0	I	FOP	MB
8	"	12.1	2244	0	0	I	FOP	MB
9	"	12.3	2297	0	0	C	NR	1/2" C Pun
10	"	12.2	2266	0	0	I	FOP	SB
11	"	12.3	2297	0	0	C	NR	1/2" C Pun
12	"	12.3	2288	0	0	I	FOP	MB
13	"	12.3	2295	0	0	C	NR	1/2" C. Pun
14	"	11.8	2228	0	0	I	FOP	SB
15	20MM HE	435	2737	20	-	I	HO	MB- Cir. F. Crk.

PRNC-3-10-50-5500

LIGHT ARMOR FIRING RECORD

FRNC-RFG-59

SHEET NO.

XXXXX	TEMPERATURE	TIME				
ANNEAL			YP			
NORM			TS			
HARDEN	1550	1 hr.	EL	PLATE		
QUENCH	Oil		RA	SIZE		
DRAW	300	1 hr.		WEIGHT		
	Air Cooled					

Back

GAUGE	0.".512	C 20-24	DATE 24 February 1951
PROJ.	Cal. .30 APM2	Mn 45-52	MFR. Lithium Co.
GUN	299	S .025 max	CONTR.
RANGE	1	P .025 max	TYPE F.H.
OBL.	0	Si 20-30	SPECS. JAN-A-784
RC	2193	Ni 3.30-3.70	PLATE 15A
LC	2254	Cr	GROUP
HI	2240 V50	Mo .35-.45	HEAT 69
LIMIT	2247 2247		BHN
RESULT	Passed		STEEL T3015-1 T6264

RD.	BULLET	CHARGE	STR. VEL.	OBL.	YAW	PENET	BULLET	CONDITION OF PLATE
1	Cal. .30 M2	11.2	2094	0	0	I	FOP	MB
2	"	11.4	2097	0	0	I	FOP	MB
3	"	11.6	2129	0	0	I	FOP	MB
4	"	11.8	2192	0	0	I	FOP	PUNS 1/32"
5	"	11.8	2185	0	0	I	FOP	MB
6	"	11.8	2187	0	0	I	FOP	MB
7	"	12.0	2204	0	0	I	FOP	MB
8	"	12.4	2295	0	0	C	NR	1/2" C PUN
9	"	12.4	2265	0	0	C	NR	1/2" C PUN
10	"	12.2	2254	0	0	C	NR	1/2" C PUN
11	"	12.0	2240	0	0	I	FOP	MB
12	"	12.0	2213	0	0	I	FOP	MB
13	"	12.1	2265	0	0	C	NR	1/2" C PUN
14	"	11.9	2200	0	0	I	FOP	MB

FRNC-3-10-1M-6500

LIGHT ARMOR FIRING RECORD
PRNC-MPG-59

SHEET NO.

X X X X X	TEMPERATURE	TIME
ANNEAL		
NORM		
HARDEN	1550	1 hr.
QUENCH	Oil	
DRAW	300	1 hr.
	Air Cooled	
GAUGE	0.512	
PROJ.	Cal. 50 ARM2	
GUN	299	
RANGE	1	
OBL.	0	
RC	2193	
LC	2216	
HI	2216 VPSD	
LIMIT	2216 2262	
RESULT	Passed	

YP
TS
EL
RA
PLATE
SIZE
WEIGHT

Back

C .20-.24
Mn .45-.52
S .025 MAX
P .025 MAX
Si .20-.30
Ni 3.30-3.70
Cr
Mo .35-.45

DATE 24 February 1951
MFR. Lithium Co.
CONTR.
TYPE E. H.
SPECS. JAN-A-784
PLATE 15B
GROUP
HEAT 69
BHN
STEEL T3015-4
T6264

RD.	BULLET	CHARGE	STR. VEL.	OBL.	YAW	PENET	BULLET	CONDITION OF PLATE
1	Cal. 50 M2	11.2	2076	0	0	I	FOP	SB
2	"	11.4	2158	0	0	I	FOP	MB
3	"	11.6	2220	0	0	I	FOP	MB
4	"	11.8	2190	0	0	I	FOP	MB
5	"	12.0	2197	0	0	I	FOP	PUNS 1/16"
6	"	12.2	2257	0	0	C	NR	1/2" C PUN
7	"	12.4	2325	0	0	I	FOP	PUN S 1/16"
8	"	12.6	2361	0	0	C	NR	3/8" C PUN
9	"	12.5	2316	0	0	C	NR	1/2" C PUN
10	"	12.2	2275	0	0	I	FOP	MB
11	"	12.1	2227	0	0	C	NR	1/2" C PUN
12	"	12.0	2238	0	0	I	FOP	MB
13	"	11.8	2263	0	0	C	NR	1/2" C. PUN
14	"	11.8	2227	0	0	I	FOP	MB
15	"	11.8	2216	0	0	C	NR	3/8" C PUN
16	"	11.6	2131	0	0	I	FOP	SB
17	"	11.7	2145	0	0	I	FOP	SB
18	"	11.8	2216	0	0	I	FOP	MB

PRNC-3-20-49-6500

LIGHT ARMOR FIRING RECORD

PRNC-MPG-59

SHEET NO.

X X X X X	TEMPERATURE	TIME
ANNEAL		
NORM	NPG Relieved	
HARDEN	1550	1 hr.
QUENCH	Oil	
DRAW	300	1 hr.
	Air Cooled	
		AFTER TREAT
GAUGE	0.501	0.501
PROJ.	Cal. 50 APM4	Cal. 50 M2
GUN	299	299
RANGE	1	1
OBL.	0	0
RC	2177	2117
LC	2177	2112
HI	2167 VP50	2129 VP50
LIMIT	2173 453451	2181
RESULT	Passed	FAILED

YP

TS

EL

RA

PLATE 1" x 6"

SIZE 24 X 36

WEIGHT

C .20-.24

Mn .45-.52

S .025 max.

P .025 max.

Si .20-.30

Ni 3.50-3.70

Cr

Mo .35-.45

DATE 24, Aug 1950

MFR. Lukens Co.

CONTR.

TYPE

SPECS. JAN-A-784

PLATE 16A

GROUP

HEAT 90

BHN 0.54/477

STEEL T-3015-1 T-6264

RD.	BULLET	CHARGE	STR. VEL.	OBL.	YAW	PENET	BULLET	CONDITION OF PLATE
1	Cal.50M2	11.5	2143	0	0	I	FOP	SB
2	"	11.6	2151	0	0	I	FOP	SB
3	"	11.8	2187	0	0	C	NR	3/8" x 1/2" C PUN Slight BCr.
4	"	11.7	2127	0	0	I	FOP	NB
5	"	11.6	2139	0	0	I	FOP	SB
6	"	11.8	2167	0	0	I	FOP	SB
7	"	12.0	2194	0	0	I	FOP	PUN S 1/32"
8	"	12.2	2223	0	0	C	NR	7/16" C PUN
9	"	12.2	2244	0	0	C	NR	7/16" C PUN
10	"	11.9	2179	0	0	C	NR	7/16" C PUN
AFTER-RETREATMENT BY NPG 17, Jan 1951								
11	Cal.50M2	11.6	2067	0	0	I	FOP	SB
12	"	11.7	2095	0	0	I	FOP	SB
13	"	11.8	2192	0	0	I	FOP	SB
14	"	12.0	2254	0	0	C	NR	1/2" x 7/16" C PUN
15	"	11.9	2129	0	0	I	FOP	NB
16	"	11.8	2179	0	0	C	NR	3/8" x 7/16" C PUN
17	"	11.7	2117	0	0	I	FOP	SB
18	"	11.9	2238	0	0	C	NR	1/2" C PUN

LIGHT ARMOR FIRING RECORD
PRNC-11PG-59a

SHEET NO.
Encl. ( )

PLATE 16 A - LITHIUM Co

Jan 17, 1951

T-30157-1
T-6268

RD.	BULLET	CHARGE	STRIKING VELOCITY	OBL.	YAW	PENET.	BULLET	CONDITION OF PLATE
19	Cal 50mm	11.7	2206	0	0	I	FOP	SB
20	"	11.6	2124	0	0	I	FOP	SB
21	"	11.7	2172	0	0	C	NR	1/2" x 3/8" CPUN
22	"	11.6	2079	0	0	I	FOP	SB

PRNC-3-11-45-6000

LIGHT ARMOR FIRING RECORD

PRNC-NPG-59

SHEET NO.

XXXXX	TEMPERATURE	TIME					
ANNEAL			YP				
NORM	NPG Retreated		TS				
HARDEN	1550	1 hr.	EL		PLATE		
QUENCH	oil		RA		SIZE	24"x24"	
DRAW	300	1 hr.			WEIGHT		
	air cooled	AFTER RETREAT					
GAUGE	0.509	0"509	0.509	C .20-.24	DATE	29 Aug 1950	
PROJ.	Cal.50 APM2	Cal.50 M2	20MMHE	Mn .45-.52	MFR.	Lukens Co.	
GUN	299	299	850003	S .025 max	CONTR.		
RANGE	1	1	1	P .025 max	TYPE		
OBL.	0°	0	20	Si .20-.30	SPECS.	JAN-A-784	
RC	2189	2189	2740	Ni 3.30-3.70	PLATE	168	
LC	2114	2295	—	Cr	GROUP		
HI	2108 VP50	2251 VP50	2746	Mo .35-.45	HEAT	70	
LIMIT	2111 2119	2270 2276	>2746		BHN	643 / 474	
RESULT	Failed	Passed			STEEL	T3215-1 T6264	

RD.	BULLET	CHARGE	STR. VEL.	OBL.	YAW	PENET	BULLET	CONDITION OF PLATE
1	Cal.50 APM2	11.6	2129	0	0	C	NR	7/16 x 3/8 C PUN
2	"	11.4	2027	0	0	I	FOP	SB
3	"	11.5	2124	0	0	I	FOP	SB
4	"	11.5	2139	0	0	C	NR	7/16" x 1/2" C PUN
5	"	11.5	2040	0	0	I	FOP	SB
6	"	11.6	2114	0	0	C	NR	3/8" C. PUN
7	"	11.5	2121	0	0	C	NR	3/8" C. PUN
8	"	11.5	2098	0	0	I	FOP	SB
9	"	11.5	2118	0	0	I	FOP	1/16 PUN. S
10	"	11.5	2108	0	0	I	FOP	SB
AFTER RETREATMENT BY NPG Jan 17, 1951								
11	Cal.50 M2	11.4	2071	0	0	I	FOP	SB
12	"	11.6	2127	0	0	I	FOP	SB
13	"	11.8	2139	0	0	I	FOP	SB
14	"	12.0	2180	0	0	I	FOP	MB
15	"	11.9	2199	0	0	I	FOP	SB
16	"	12.0	2210	0	0	I	FOP	PUNS 1/16"
17	"	12.1	2189	0	0	I	FOP	MB
18	"	12.2	2232	0	0	I	FOP	MB

LIGHT ARMOR FIRING RECORD
PRNC-MPG-593

SHEET NO.
Encl. ( )

PLATE 16B LITHIUM CO. Jan 17, 1951

T-3015-1
T-6264

RD.	BULLET	CHARGE	STRIKING VELOCITY	OBL.	YAW	PENET.	BULLET	CONDITION OF PLATE
19	Cal. 50 M2	12.4	2295	0	0	C	NR	1/2" C PUN
20	"	12.3	2215	0	0	I	FOP	PUN S 1/4"
21	"	12.4	2303	0	0	C	NR	7/16" C PUN
22	"	12.3	2310	0	0	C	NR	3/8 x 1/2" C PUN
23	"	12.3	2297	0	0	C	NR	1/2" C PUN
24	"	12.2	2230	0	0	I	FOP	SB
25	"	12.3	2259	0	0	I	FOP	MB
26	20MM HE	440	2746	20	-	I	HO	HB CIV. F. CRK.

PRNC-3-10-60-1000

LIGHT ARMOR FIRING RECORD
PRIC-MPG-59

SHEET NO.

XXXX	TEMPERATURE	TIME
ANNEAL		
NORM	1775 Reheated	
HARDEN	1550	12 hr.
QUENCH	Oil	
DRAW	500	1 hr.
	Air Cooled	
		AFTER RETEST
GAUGE	0°503	0°505
PROJ.	Cal. 50 APM2	Cal. 50 M2
GUN	299	299
RANGE	1	1
OBL.	0°	0
RC	2180	2180
LC	2148	2210
HI	2132 VP50	2210 VP50
LIMIT	2140 2155	220 2210
RESULT	Failed.	Passed.

YP
TS
EL
RA

PLATE
SIZE 24"X36"
WEIGHT

C .20-.24
Mn .45-.52
S .025 max.
P .025 max.
Si .20-.30
Ni 3.30-3.70
Cr
Mo .35-.45

DATE 29 Aug 1950
MFR. Lukens Co.
CONTR.
TYPE
SPECS. JAN-A-184
PLATE 17A
GROUP
HEAT 70
BHN 653 477
STEEL T-3015-1 T6264

RD.	BULLET	CHARGE	STR. VEL.	OBL.	YAW	PENET	BULLET	CONDITION OF PLATE
1	Cal. 50 M2	11.6	2114	0	0	I	FOP	MB
2	"	11.6	2132	0	0	I	FOP	1/32" PUNS
3	"	11.6	2065	0	0	I	FOP	SB
4	"	11.7	2126	0	0	I	FOP	MB
5	"	11.8	2161	0	0	I	FOP	1/32 PUNS
6	"	11.9	2195	0	0	C	NR	7/16" X 1/2" C. PUN.
7	"	11.8	2148	0	0	C	NR	7/16" X 1/2" C. PUN
8	"	11.8	2175	0	0	C	NR	1/2" C. PUN
9	"	11.7	2127	0	0	I	FOP	MB
10	"	11.7	2114	0	0	I	FOP	1/16 PUNS
11	"	11.8	2166	0	0	C	NR	7/16" X 1/2" C PUN
12	Cal. 50 M2	11.6	2058	0	0	I	FOP	SB
13	"	11.8	2137	0	0	I	FOP	SB
14	"	11.9	2175	0	0	I	FOP	SB
15	"	12.0	2172	0	0	I	FOP	SB
16	"	12.1	2245	0	0	C	NR	3/8" C PUN
17	"	12.0	2210	0	0	C	NR	1/2" X 7/16" C PUN
18	"	11.9	2142	0	0	I	FOP	SB

PRIC-3-10-49-6500

LIGHT ARMOR FIRING RECORD
PRNC-WPG-590

SHEET NO.
Encl. ( )

PLATE 17A LITHIUM CO

Jan 17, 1951

T-3015-1
T-6264

RD.	BULLET	CHARGE	STRIKING VELOCITY	OBL.	YAW	PENET.	BULLET	CONDITION OF PLATE
19	Cal.50 M2	12.0	2179	0	0	I	FOP	SB
20	"	12.0	2210	0	0	I	FOP	MB
21	"	12.1	2179	0	0	I	FOP	MB
22	"	12.2	2220	0	0	C	NR	7/16" C PUN
23	"	12.2	2259	0	0	C	NR	1/2" X 7/16" C PUN

PRNC-3-11-49-6500

LIGHT ARMOR FIRING RECORD

PRFC-NPG-59

SHEET NO.

XXXXX	TEMPERATURE	TIME			
ANNEAL			YP		
NORM	NPG Retreated		TS		
HARDEN	1550	1 hr.	EL	PLATE	
QUENCH	oil		RA	SIZE	2½"x3⅜"
DRAW	300	1 hr.		WEIGHT	
	Air Cooled	AFTER RETREAT			
GAUGE	0".504	0".504	C .20-.24	DATE	29 Aug. 1950
PROJ.	Cal.50 APM2	Cal.50M2	Mn .45-.52	MFR.	Lukens Co.
GUN	299	299	S .025 max.	CONTR.	
RANGE	1	1	P .025 max.	TYPE	
OBL.	0°	0	Si .20-.30	SPECS.	JAN-A-784
RC	2181	2181	Ni 3.30-3.70	PLATE	17B
LC	2158	2233	Cr	GROUP	
HI	2156 VPS0	2211 VPS0	Mo .35-.45	HEAT	7A
LIMIT	2157 2%	2222 2239		BHN	401/476
RESULT	Failed	Passed.		STEEL	T3015-1 T6209

RD.	BULLET	CHARGE	STR. VEL.	OBL.	YAW	PENET	BULLET	CONDITION OF PLATE
1	Cal.50M2	11.7	2139	0	0	I	FOP	MB
2	"	11.8	2156	0	0	I	FOP	SB
3	"	11.9	2166	0	0	C	NR	7/16"x1/2" C PUN
4	"	11.9	2121	0	0	I	FOP	SB
5	"	11.9	2169	0	0	C	NR	9/16"x3/16" C PUN
6	"	11.8	2177	0	0	I	FOP	MB
7	"	11.9	2203	0	0	I	FOP	MB
8	"	12.0	2190	0	0	C	NR	3/8" C PUN
9	"	11.9	2179	0	0	C	NR	7/16"x1/2" C PUN
10	"	11.8	2158	0	0	C	NR	1/2" C PUN
11	"	11.7	2143	0	0	I	FOP	SB
AFTER NPG RETREATMENT:							18 Jan 1951	
12	Cal.50M2	11.5	2132	0	0	I	FOP	SB
13	"	11.7	2135	0	0	I	FOP	SB
14	"	11.9	2073	0	0	I	FOP	SB
15	"	11.8	2126	0	0	I	FOP	SB
16	"	12.0	2192	0	0	I	FOP	SB
17	"	12.2	2211	0	0	I	FOP	SB
18	"	12.3	2233	0	0	C	NR	3/8" x 7/16" C PUN

PRNC-3-10-52-6100

LIGHT ARMOR FIRING RECORD
PRNC-MPG-59A

SHEET NO.
Encl. ( )

PLATE
17B - LITHIUM CO.

18 JAN. 1951

T-3015-1
T-6264

RD.	BULLET	CHARGE	STRIKING VELOCITY	OBL.	YAW	PENET.	BULLET	CONDITION OF PLATE
19	Cal.50M2	12.2	2235	0	0	I	FOP	MB
20	"	12.1	2210	0	0	I	FOP	SB
21	"	12.3	2237	0	0	I	FOP	SB
22	"	12.4	2297	0	0	C	NR	3/8" C PUN
23	"	12.4	2252	0	0	C	NR	1/2" C PUN

PRNC-3-30-49-6500

LIGHT ARMOR FIRING RECORD

PREC-NPG-52

SHEET NO.

XXXX	TEMPERATURE	TIME
ANNEAL		
NORM	NPG Retreated	
HARDEN	1550	1 hr.
QUENCH	oil	
DRAW	300	1 hr.
	air cooled	
		AFTER RETREAT
GAUGE	0".522	0".522
PROJ.	Cal.50 APM2	Cal.50 M2
GUN	299	299
RANGE	1	1
OBL.	0°	0°
RC	2208	2208
LC	2129	2190
HI	2123 "VPS0"	2161 VPS0
LIMIT	2129 2136	2176 2236
RESULT	Failed	FAILED

YP

TS

EL

RA

PLATE

SIZE 24"x36"

WEIGHT

C .20-.24

Mn .45-.52

S .025 max.

P .025 max.

Si .20-.30

Ni 3.30-3.70

Cr

Mo .35-.45

DATE 29 Aug. 1950

MFR. Lukens Co.

CONTR.

TYPE

SPECS. JAN-A-784

PLATE 18A

GROUP

HEAT 70

BHN 444 444

STEEL T-3015-1 T-62104

RD.	BULLET	CHARGE	STR. VEL.	OBL.	YAW	PENET	BULLET	CONDITION OF PLATE
1	Cal.50 M2	11.9	2172	0	0	C	NR	1/2" C. PUN.
2	"	11.8	2145	0	0	C	NR	1/2"X 7/16" C.PUN.
3	"	11.7	2147	0	0	I	FOP	SB
4	"	11.7	2135	0	0	C	NR	3/8 X 7/16 C.PUN
5	"	11.5	2102	0	0	I	FOP	SB
6	"	11.6	2129	0	0	C	NR	3/8"X 7/16" C.PUN
7	"	11.6	2129	0	0	I	FOP	1/32 PUN. S.
8	"	11.6	2123	0	0	I	FOP	SB
9	"	11.7	2124	0	0	I	FOP	SB
10	"	11.7	2135	0	0	I	FOP	SB
AFTER NPG RETREATMENT							18 Jan 1951	
11	Cal.50 M2	11.6	2118	0	0	I	FOP	SB
12	"	11.7	2129	0	0	I	FOP	SB
13	"	11.8	2158	0	0	I	FOP	SB
14	"	12.0	2210	0	0	I	FOP	SB
15	"	12.1	2220	0	0	I	FOP	SB
16	"	12.2	2242	0	0	I	FOP	PUN 5 1/8"
17	"	12.3	2266	0	0	C	NR	5/8"x 1/2" C.PUN
18	"	12.2	2256	0	0	C	NR	3/8"X 1/2" C PUN

LIGHT ARMOR FIRING RECORD
PRHC-8PG-50a

SHEET NO.
Encl. ( )

PLATE
18A · LITHIUM CO.

18 Jan 1951

T-3015-1
T-6264

RD.	BULLET	CHARGE	STRIKING VELOCITY	OBL.	YAW	PENET.	BULLET	CONDITION OF PLATE
19	Cal.50 NM2	12.0	2218	0	0	C	NR	3/8" CPLN
20	"	11.9	2151	0	0	I	FOP	SB
21	"	12.0	2085	0	0	I	FOP	SB
22	"	12.1	2190	0	0	C	NR	3/8" CPLN
23	"	11.9	2129	0	0	I	FOP	SB
24	"	11.8	2158	0	0	I	FOP	SB
25	"	11.9	2161	0	0	I	FOP	SB

PRHC-3-20-49-6500

LIGHT ARMOR FIRING RECORD

PRNC-NPG-59

SHEET NO.

XXXXX	TEMPERATURE	TIME					
ANNEAL			YP				
NORM	NPG Retreated		TS				
HARDEN	1550	1 hr.	EL		PLATE		
QUENCH	air		RA		SIZE		
DRAW	300	1 hr.			WEIGHT		
	air cooled						
		AFTER RETREAT					
GAUGE	0.506	0.506	0.506	C .20-.24	DATE	29 AUG 1950	
PROJ.	Cal. 50 M2	Cal. 50 M2	20 MM TK	Mn .45-.52	MFR.	Lithium Co.	
GUN	299	299	650203	S .025 max.	CONTR.		
RANGE	1	1	1	P .025 max.	TYPE		
OBL.	0°	0	20	Si .20-.30	SPECS.	JAN-A-784	
RC	2184	2184	2740	Ni 3.30-3.70	PLATE	1 B	
LC	2083	2204		Cr	GROUP		
HI	2071 VPS	2204 VPS	2739	Mo .35-.45	HEAT	70	
LIMIT	2077 208	2204 2242	> 2739		BHN	651, 672	
RESULT	Failed	Passed			STEEL	T-301S-1 T6264	

RD.	BULLET	CHARGE	STR. VEL.	OBL.	YAW	PENET	BULLET	CONDITION OF PLATE
1	Cal 50 M2	11.9	2167	0	0	C	NR	5/8" C. FUN.
2	"	11.7	2164	0	0	C	NR	7/16" C. FUN
3	"	11.5	2126	0	0	C	NR	7/16" x 1/2" C FUN
4	"	11.3	2043	0	0	I	FOP	SB
5	"	11.4	2086	0	0	C	NR	3/4" x 9/16" C FUN
6	"	11.3	2135	0	0	I	FOP	SB
7	"	11.3	2094	0	0	I	FOP	SB
8	"	11.3	2053	0	0	I	FOP	1/32" FUM. S.
9	"	11.3	2071	0	0	I	FOP	SB
10	"	11.4	2083	0	0	C	NR	7/16" x 1/2" C. FUN,
AFTER NPG RETREATMENT							18 Jan. 1951	
11	Cal. 50 M2	11.6	2129	0	0	I	FOP	SB
12	"	11.8	2143	0	0	I	FOP	SB
13	"	11.9	2177	0	0	I	FOP	MB
14	"	12.0	2204	0	0	C	NR	5/8" C FUN
15	"	11.9	2163	0	0	I	FOP	SB
16	"	12.0	2194	0	0	I	FOP	SB
17	"	12.1	2218	0	0	I	FOP	SB
18	"	12.2	2257	0	0	C	NR	1/2" C FUN

LIGHT ARMOR FIRING RECORD
PREC-MYG-59a

SHEET NO.
Encl. ( )

PLATE
18B - LITHIUM CO.

18 Jan 1951

T-3015-1
T-6264

RD.	BULLET	CHARGE	STRIKING VELOCITY	OBL.	YAW	PENET.	BULLET	CONDITION OF PLATE
19	Cal. 50 M2	12.0	2155	0	0	I	FOP	PUNS 1/32"
20	"	12.1	2169	0	0	I	FOP	SB
21	"	12.2	2204	0	0	I	FOP	SB
22	"	12.3	2252	0	0	C	NR	3/8" x 1/2" CPUN
23	20MM HE	435	2739	20	-	I	HO	MB - Cir. F. Crk.

Page 1 of 2

LIGHT ARMOR FIRING RECORD
PRNC-NPG-59

SHEET NO.

XXXXX	TEMPERATURE	TIME					
ANNEAL			YP				
NORM	NPG Retreated		TS				
HARDEN	1550	1 hr	EL		PLATE		
QUENCH	air		RA		SIZE		
DRAW	300	1 hr			WEIGHT		
	air cooled						
		AFTER RETREAT					
GAUGE	0"501	0"501	0"5021	C .22-.24	DATE	29 Dec	1950
PROJ.	Cal.50 APM2	Cal.50M2	YUMA HE	Mn .45-.51	MFR.	Rock Island Co.	
GUN	259	299	550023	S .025 max	CONTR.		
RANGE	1	1	1	P .025 max	TYPE		
OBL.	00	0	262	Si .20-.30	SPECS.	AXN-A-784	
RC	2177	2177	2740	Ni 3.30-3.70	PLATE	1.0	
L.	2140	2189	—	Cr	GROUP		
HI	2134 V50	2179 V50	2757	Mo .35-.45	HEAT	71	
LIMIT	2137 2137	2184 2184	>2757		BHN	651 to 716	
RESULT	Failed	Passed			STEEL	T3015-1 Fig 104	

RD.	BULLET	CHARGE	STR. VEL.	OB.	YAW	PENET	BULLET	CONDITION OF PLATE
1	Cal.50M2	11.3	2059	0	0	I	FOP	SB
2	"	11.6	2106	0	0	I	FOP	SB
3	"	11.9	2159	0	0	C	NR	3/8" x 7/16 C.PUN
4	"	11.8	2140	0	0	C	NR	3/8" C PUN
5	"	11.7	2145	0	0	C	NR	3/8" C.PUN.
6	"	11.5	2100	0	0	I	FOP	SB
7	"	11.6	2134	0	0	I	FOP	1/32 PUN. S
8	"	11.6	2111	0	0	I	FOP	SB
9	"	11.7	2114	0	0	I	FOP	1/16" PUN.S.
10	"	11.8	2150	0	0	C	NR	7/16" C.PUN
AFTER NPG RETREATMENT.						19 Jan 1951		
11	Cal.50M2	11.6	2148	0	0	I	FOP	PUN S 1/16"
12	"	11.7	2143	0	0	I	FOP	SB
13	"	11.8	2189	0	0	C	NR	3/8" C PUN
14	"	11.8	2167	0	0	I	FOP	SB
15	"	11.9	2179	0	0	I	FOP	MB
16	"	12.0	2169	0	0	I	FOP	SB
17	"	12.1	2223	0	0	I	FOP	SB
18	"	12.2	2244	0	0	I	FOP	PUN S 1/8"

PRNC-5-10-49-6100

LIGHT ARMOR FIRING RECORD
PRHC-HPG-59a

SHEET NO.
Encl. ( )

PLATE 19A LITHIUM Co

19 Jan 1951

T-3015-1
T-6264

RD.	BULLET	CHARGE	STRIKING VELOCITY	OBL.	YAW	PENET.	BULLET	CONDITION OF PLATE
19	Cal. 50 M2	12.2	2199	0	0	C	NR	3/8" C PUN
20	"	12.3	2279	0	0	C	NR	7/16" C PUN
21	"	12.1	2215	0	0	C	NR	7/16" C PUN
22	"	11.8	2111	0	0	I	FOP	SB
23	"	11.9	2200	0	0	I	FOP	MB
24	20MM HE	43.5	2757	20	—	I	HO	MB - CIR. F. CRKS.

LIGHT ARMOR FIRING RECORD
PROC-APG-59

SHEET NO.

XXXXX	TEMPERATURE	TIME
ANNEAL		
NORM	APG Retreated	
HARDEN	1550	1 hr.
QUENCH	Oil	
DRAW	300	1 hr.
	Retreated	
		AFTER RETREAT.
GAUGE	0.508	0.508
PROJ.	Cal.50 APM2	Cal.50 APM2
GUN	299	299
RANGE	1	1
OBL.	0°	0
RC	2167	2187
LC	2100	2164
HI	2095 YP50	2164 YP50
LIMIT	2098 2157	2164 2169
RESULT	Failed!!	Failed

YP			
TS			
EL		PLATE	
RA		SIZE	
		WEIGHT	

C	.20-.24	DATE	29 Aug. 1950
Mn	.45-.52	MFR.	Lukens No.
S	.025 max.	CONTR.	
P	.025 max.	TYPE	
Si	.20-.30	SPECS.	JAN-A-784
Ni	3.50-3.70	PLATE	19B
Cr		GROUP	
Mo	.35-.45	HEAT	71
		BHN	624/474
		STEEL	T3015-1 T6264

RD.	BULLET	CHARGE	STR. VEL.	OBL.	YAW	PENET	BULLET	CONDITION OF PLATE
1	50 Cal. M2	11.7	2163	0	0	C	NR	7/16 C. PUN.
2	"	11.5	2108	0	0	C	NR	3/8" C. PUN.
3	"	11.3	2076	0	0	I	FOP	SB
4	"	11.4	2070	0	0	I	FOP	SB
5	"	11.5	2095	0	0	I	FOP	SB
6	"	11.6	2120	0	0	I	FOP	SB
7	"	11.7	2158	0	0	I	FOP	3/16" PUN. S.
8	"	11.7	2148	0	0	I	FOP	1/8" PUN. S.
9	"	11.8	2166	0	0	C.	NR	9/16" x 7/16" C. PUN.
10	"	11.7	2161	0	0	C	NR	3/8" x 7/16" C. PUN.
11	"	11.5	2108	0	0	I	FOP	SB
12	"	11.5	2100	0	0	C	NR	3/8" x 1/2" C. PUN.
AFTER RETREATMENT						18	Jan. 1951	
13	Cal. 50 M2	11.6	2105	0	0	I	FOP	SB
14	"	11.8	2164	0	0	C	NR	7/16" C PUN
15	"	11.7	2164	0	0	I	FOP	SB
16	"	11.8	2159	0	0	I	FOP	SB
17	"	11.9	2166	0	0	I	FOP	SB
18	"	12.0	2127	0	0	I	FOP	MP

LIGHT ARMOR FIRING RECORD
PRNC-ROG-59A

SHEET NO.
Encl. ( )

PLATE
198 - Lithium Co

18 Jan 1951

T-3015-1
T-6264

RD.	BULLET	CHARGE	STRIKING VELOCITY	OBL.	YAW	PENET.	BULLET	CONDITION OF PLATE
19	Calsonite	12.1	2232	0	0	C	NR	7/16" CPUN
20	"	12.0	2183	0	0	C	NR	7/16" CPUN
21	"	11.5	2094	0	0	I	FOP	SB
22	"	11.7	2161	0	0	I	FOP	SB BAR slight.

12

PRNC-0-21-50-0000

LIGHT ARMOR FIRING RECORD
PRNC-NPG-59

SHEET NO.

XXXXX	TEMPERATURE	TIME
ANNEAL		
NORM	NPG Retreated	
HARDEN	1550	1 hr.
QUENCH	oil	
DRAW	300	1 hr.
	Air cooled	
		After Retreat
GAUGE	0.512	0.512
PROJ.	Cal 50 APM2	Cal 50 APM 2
GUN	299	299
RANGE	1	1
OBL.	0°	0°
RC	2193	2193
LC	2126	2228
HI	2112 "VRS0"	2227 "VP50"
LIMIT	2119 2192	2238 2236
RESULT	Failed	

YP			
TS			
EL	PLATE		
RA	SIZE		
	WEIGHT		
C	.20-.24	DATE	29 Aug. 1950
Mn	.45-.52	MFR.	Rizkum Co.
S	.025 max	CONTR.	
P	.025 max	TYPE	
Si	.20-.30	SPECS.	JAN-A-784
Ni	3.30-3.70	PLATE	20A
Cr		GROUP	
Mo	.35-.45	HEAT	71
		BHN	652 / 766
		STEEL	T3073-1 T2264

RD.	BULLET	CHARGE	STR. VEL.	OBL.	YAW	PENET	BULLET	CONDITION OF PLATE
1	Cal 50 M2	11.5	2022	0	0	I	FOP	SB
2	"	11.7	2137	0	0	I	FOP	1/16" PON. S.
3	"	11.7	2150	0	0	I	FOP	MB
4	"	11.9	2156	0	0	I	FOP	SB
5	"	~~12.2~~	~~2247~~	~~0~~	~~0~~	C	NR	Overpowered - too close to last round 1/2 x 9/16 C PON
6	"	12.1	2225	0	0	C	NR	5/8" x 3/8" C PON
7	"	12.0	2180	0	0	C	NR	7/8" x 3/4" C PON
8	"	11.9	2183	0	0	C	NR	11/16" x 9/16" C PON
9	"	11.7	2159	0	0	C	NR	3/8" x 1/4" C PON
10	"	11.6	2126	0	0	C	NR	3/4" x 3/4" C PON
11	"	11.4	2112	0	0	I	FOP	SB
12	"	11.5	2074	0	0	I	FOP	Very B
	After NPG Retreatment							
13	Cal 50 APM2	11.4	2124	0	0	I	FOP	SB
14	"	11.5	2108	0	0	I	FOP	SB
15	"	11.7	2195	0	0	I	FOP	SB
16	"	11.7	2153	0	0	I	FOP	SB
17	"	11.9	2177	0	0	I	FOP	SB
18	"	12.1	2227	0	0	I	FOP	MB

LIGHT ARMOR FIRING RECORD
PRNC-NPG-59A

SHEET NO.
Encl. ( )

PLATE 20A
Lithium Company

1 February 1951

T3015-1
T6264

RD.	BULLET	CHARGE	STRIKING VELOCITY	OBL.	YAW	PENET.	BULLET	CONDITION OF PLATE
19	Cal.50M2	12.3	2281	0	0	I	FOP	MB
20	"	12.5	2319	0	0	C	NR	1/2" C PUN
21	"	12.5	2319	0	0	I	FOP	PUNS 1/16"
22	"	12.5	2295	0	0	C	NR	1/2" C PUN
23	"	12.7	2346	0	0	C	NR	1/2" C PUN
24	"	12.7	2303	0	0	C	NR	1/2" C PUN
25	"	12.4	2286	0	0	C	NR	1/2" C PUN
26	"	12.2	2228	0	0	C	NR	1/2" C PUN
27	"	12.0	2183	0	0	I	FOP	PUNS 1/32"
28	"	12.0	2151	0	0	I	FOP	SP
29	"	12.1	2254	0	0	C	NR	1/2" C PUN
30	"	12.0	2227	0	0	I	FOP	PUNS 1/32"

PRNC-3-10-49-8500

LIGHT ARMOR FIRING RECORD

PRNC-NPG-59

SHEET NO.

X X X X X	TEMPERATURE	TIME
ANNEAL		
NORM	NPG Retreated	
HARDEN	1550	1 hr.
QUENCH	oil	
DRAW	300	1 hr.
	Air cooled	After Retreat
GAUGE	0.527	0.527
PROJ.	Cal 50 APM2	Cal. 50 APM2
GUN	299	299
RANGE	1	1
OBL.	0	0
RC	2216	2216
LC	2171	2210
HI	2143 VP50	2208 VP50
LIMIT	2157 2178	2209 2244
RESULT	Failed	

YP
TS
EL
RA

PLATE
SIZE
WEIGHT

C .20-.24
Mn .45-.52
S .025 max.
P .025 max.
Si .20-.30
Ni 3.30-3.70
Cr
Mo .55-.45

DATE 29 Aug 1950
MFR. Lukens Co.
CONTR.
TYPE
SPECS. MIL-A-784
PLATE 20B
GROUP
HEAT 71
SHN 651, 464
STEEL T3015-1 T6264

RD.	BULLET	CHARGE	STR. VEL.	OBL.	YAW	PENET	BULLET	CONDITION OF PLATE
1	Cal.50 M2	11.6	2171	0	0	C	NR	7/16" x 1½" C. PUN.
2	"	11.4	2065	0	0	I	FOP	SB
3	"	11.5	2143	0	0	I	FOP	SB
4	"	11.6	2126	0	0	I	FOP	SB
5	"	11.8	2137	0	0	I	FOP	SB
6	"	12.0	2185	0	0	I	FOP	SB
7	"	12.2	2216	0	0	C	NR	7/16" x 1½" C PUN
8	"	12.0	2204	0	0	C	FCIP	7/16 x ½ PUN OUT
9	"	11.9	2201	0	0	C	NR	7/16" x 3/8" C PUN
10	"	11.7	2114	0	0	I	FOP	SB
11	"	11.8	2123	0	0	I	FOP	SB
		After NPG Retreatment						
12	Cal.50 M2	11.6	2106	0	0	I	FOP	SB
13	"	11.7	2159	0	0	I	FOP	SB
14	"	11.9	2194	0	0	I	FOP	SB
15	"	12.1	2245	0	0	I	FOP	MB
16	"	12.3	2310	0	0	C	NR	1½" C PUN
17	"	12.3	2261	0	0	C	FCIP	3/8 R PUN
18	"	12.3	2277	0	0	I	FOP	MB

PRNC-A-10-66-6500

LIGHT ARMOR FIRING RECORD
PRNC-KPG-59a

SHEET NO.
Encl. ( )

PLATE 20B
Lithium Company

1 February 1951

T3015-1
T6264

RD.	BULLET	CHARGE	STRIKING VELOCITY	OBL.	YAW	PENET.	BULLET	CONDITION OF PLATE
19	Cal.50M2	12.4	2293	0	0	C	NR	½" C PUN
20	"	12.2	2210	0	0	C	NR	½" C PUN
21	"	12.0	2187	0	0	I	FOP	PUN S 1/32"
22	"	12.1	2238	0	0	C	NR	½" C PUN
23	"	12.0	2195	0	0	I	FOP	PUN S 1/32"
24	"	12.0	2230	0	0	I	FOP	SB
25	"	11.8	2123	0	0	I	FOP	SB
26	"	11.9	2208	0	0	I	FOP	MB

LIGHT ARMOR FIRING RECORD
PRNC-NPG-59

SHEET NO.

XXXXX	TEMPERATURE	TIME				
ANNEAL			YP			
NORM	NPG Retreated		TS			
HARDEN	1550	1 hr.	EL	PLATE		
QUENCH	oil		RA	SIZE		
DRAW	300 air cooled	1 hr.		WEIGHT		
		After Retreat				
GAUGE	0°535	0°535	C .20-.24	DATE	29 Aug. 1950	
PROJ.	Cal.50 APM2	Cal.50 APM2	Mn .45-.52	MFR.	Lukens Co.	
GUN	299	299	S .025 max.	CONTR.		
RANGE	1	1	P .025 max.	TYPE		
OBL.	0	0	Si .20-.30	SPECS.	JAN-A-784	
RC	2222	2228	Ni 3.30-3.70	PLATE	21A	
LC	1945	2179	Cr	GROUP		
HI	1923" 1950	2159 V50	Mo .35-.45	HEAT	71	
LIMIT	1934 2088	2169 2231		BHN	617	
RESULT	Failed			STEEL	T-30155-1 T62504	

RD.	BULLET	CHARGE	STR. VEL.	OBL.	YAW	PENET	BULLET	CONDITION OF PLATE
1	Cal.50 M2	11.6	1923	0	0	I	FOP	SB
2	"	11.6	2187	0	0	C	NR	7/8" x 3/4" C. PUN
3	"	11.2	2052	0	0	C	NR	1/2" x 7/16" C.PUN
4	"	11.0	1945	0	0	C	NR	1/2" x 3/8" C.PUN
5	"	10.8	1917	0	0	I	FOP	MB
6	"	10.9	1971	0	0	I	FOP	MB
7	"	11.0	1966	0	0	I	FOP	SB
8	"	11.2	2048	0	0	I	FOP	SB
9	"	11.4	2095	0	0	I	FOP	SB
10	"	11.6	2067	0	0	I	FOP	SB
11	"	11.7	2175	0	0	I	FOP	SB
12	"	11.9	2175	0	0	C	NR	1/2" x 3/8" C PUN
		After NPG Retreatment						
13	Cal.50 M2	11.4	2064	0	0	I	FOP	SB
14	"	11.6	2103	0	0	I	FOP	SB
15	"	11.8	2179	0	0	C	NR	1/2" C PUN
16	"	11.8	2223	0	0	I	FOP	MB
17	"	12.0	2232	0	0	I	FOP	MB
18	"	12.2	2232	0	0	C	NR	1/2" C PUN

LIGHT ARMOR FIRING RECORD
PRRC-MPG-59a

SHEET NO.
Encl. ( )

PLATE 21A
Lithtown Co.

1 February 1951

T30ISE-1
T6264

RD.	BULLET	CHARGE	STRIKING VELOCITY	OBL.	YAW	PENET.	BULLET	CONDITION OF PLATE
19	Cal.50M2	12.3	2240	0	0	C	NR	1/2" C PUN
20	"	11.9	2220	0	0	I	FOP	MB
21	"	11.7	2099	0	0	I	FOP	MB
22	"	11.8	2190	0	0	I	FOP	MB
23	"	11.7	2126	0	0	I	FOP	SB
24	"	11.7	2159	0	0	I	FOP	MB
25	"	12.4	2272	0	0	C	NR	1/2" C PUN

PRRC-3-10-49-6500

LIGHT ARMOR FIRING RECORD

PRNC-NPG-59

SHEET NO.

XXXXX	TEMPERATURE	TIME						
ANNEAL			YP					
NORM	NPG Retreated.		TS					
HARDEN	1550	1 hr.	EL			PLATE		
QUENCH	Oil		RA			SIZE		
DRAW	200	1 hr.				WEIGHT		
	Air cooled	After Retreat						
GAUGE	0.515	0.515	0.515	C	.20-.24	DATE	30 Aug 1950	
PROJ.	Cal.50APM2	Cal.50APM2	20MM HE	Mn	.45-.52	MFR.	Rustless Co.	
GUN	299	299	850003	S	.025 max.	CONTR.		
RANGE	1	1	1	P	.025 max.	TYPE		
OBL.	0°	0	20°	Si	.20-.30	SPECS.	JAN-A-784	
RC	2198	2198	2740	Ni	3.50-3.70	PLATE	218	
LC	2166	2227	—	Cr		GROUP		
HI	2164 VP50	2225 VP50	2727	Mo	.35-.45	HEAT	71	
LIMIT	2165 2165	2226 2226	>2727			BHN	601, 597	
RESULT	Failed	Passed	Passed			STEEL	T3015-1 T6264	

RD.	BULLET	CHARGE	STR. VEL.	OBL.	YAW	PENET	BULLET	CONDITION OF PLATE
1	Cal50MZ	11.4	2106	0	0	I	FOP	SB
2	"	11.6	2124	0	0	I	FOP	SB
3	"	11.8	2166	0	0	C	NR	3/8" C.PUN.
4	"	11.7	2129	0	0	I	FOP	MB
5	"	11.8	2161	0	0	I	FOP	SB
6	"	11.9	2215	0	0	C	NR	1/2"x9/16" C.PUN.
7	"	11.8	2163	0	0	I	FOP	SB
8	"	11.9	2185	0	0	C	NR	3/8"x7/16" C.PUN.
9	"	11.9	2112	0	0	I	FOP	SB
10	~~"~~	~~11.9~~	~~2172~~	0	~~Damaged by close to other round~~	C	NR	3/8"x1/2" C.PUN.
11	"	11.9	2164	0	0	I	FOP	MB
		After NPG	Retreatment					
12	Cal.50MZ	11.4	2100	0	0	I	FOP	SB
13	"	11.6	2151	0	0	I	FOP	MB
14	"	11.8	2174	0	0	I	FOP	MB
15	"	12.0	2225	0	0	I	FOP	PUNS 1/16
16	"	12.0	2237	0	0	C	NR	1/2" C PUN
17	"	12.0	2227	0	0	C	NR	1/2" C PUN
18	"	11.9	2153	0	0	I	FOP	MB

PRNC-3-10-49-6500

LIGHT ARMOR FIRING RECORD
PREC-ARTC-6500

SHEET NO.
Encl. 1

PLATE 2.13
Lithium Co.

1 February 1951

T3015-1
T62.64

RD.	BULLET	CHARGE	STRIKING VELOCITY	OBL.	YAW	PENET.	BULLET	CONDITION OF PLATE
19	Cal.50 M2	11.8	2192	0	0	I	FOP	PUN S 1/32"
20	"	11.8	2195	0	0	I	FOP	SB
21	"	11.6	2114	0	0	I	FOP	SB
22	"	12.0	2201	0	0	I	FOP	PUN S 1/8"
23	"	12.1	2230	0	0	I	FOP	MB
24	"	12.3	2279	0	0	C	NR	1/2" C PUN
25	"	12.2	2249	0	0	I	FOP	MB
26	"	12.4	2261	0	0	C	NR	1/2" C PUN
27	20MM HE	435	2727	20	-	I	HO	MB- Cir. Face Cks.

PREC-3-10-49-6500

LIGHT ARMOR FIRING RECORD
PRNC-RPG-59

SHEET NO.

XXXXX	TEMPERATURE	TIME				
ANNEAL			YP			
NORM			TS			
HARDEN	1550	1 Hr	EL	PLATE		
QUENCH	Oil		RA	SIZE		
DRAW	300	1 Hr		WEIGHT		
			Back			
GAUGE	0"527	0"527	C .20-.24	DATE	24 February 1951	
PROJ.	Cal 50 APM2	20 MM HE	Mn .45-.52	MFR.	Lithium Co.	
GUN	259	85 CC 252	S .025 max	CONTR.		
RANGE	1	1	P .025 max	TYPE	F. H.	
OBL.	0	20	Si .20-.30	SPECS.	JAN-A-784	
RC	2216	2740	Ni 3.30-3.75	PLATE	22 A	
LC	2293	—	Cr	GROUP		
HI	2268 HPSD	2730	Mo .35-.45	HEAT	72	
LIMIT	2281 2289	> 2730		BHN		
RESULT	Passed	Passed		STEEL	T3015-1 T6264	

RD.	BULLET	CHARGE	STR. VEL.	OBL.	YAW	PENET	BULLET	CONDITION OF PLATE
1	Cal 50 M2	11.4	2076	0	0	I	FOP	V SB
2	"	11.6	2132	0	0	I	FOP	V SB
3	"	11.8	2220	0	0	I	FOP	V SB
4	"	12.0	2195	0	0	I	FOP	SB
5	"	12.2	2263	0	0	I	FOP	SB
6	"	12.4	2313	0	0	X	FCIP	1" PUN out of Back
7	"	12.4	2313	0	0	I	FOP	MB
8	"	12.6	2340	0	0	C	NR	3/8" C PUN
9	"	12.6	2331	0	0	C	NR	1/2" C PUN
10	"	12.5	2313	0	0	C	NR	1/2" C PUN
11	"	12.3	2301	0	0	C	NR	3/8" C PUN
12	"	12.2	2293	0	0	C	NR	1/2" C PUN
13	"	12.0	2218	0	0	I	FOP	PUN S 1/8"
14	"	12.0	2208	0	0	I	FOP	SB
15	"	12.1	2249	0	0	I	FOP	SB
16	"	12.1	2268	0	0	I	FOP	SB
17	20MM HE M35		2730	20	-	I	HO	MB - Cir. Face Crk.

PRNC-3-10-48-5500

LIGHT ARMOR FIRING RECORD
FRNC-MPG-59

SHEET NO.

X X X X X	TEMPERATURE	TIME				
ANNEAL			YP			
NORM			TS			
HARDEN	1550	1 hr	EL	PLATE		
QUENCH	Water		RA	SIZE		
DRAW	300 Air Cooled	1 hr.		WEIGHT		

Ba-K

GAUGE	0".522	0".522	C .20-.24	DATE	24 February 1951
PROJ.	Cal. 50 APM2	20MM HE	Mn .45-.52	MFR.	Lithium Co.
GUN	299	[illegible]203	S .025 MAX	CONTR.	
RANGE	1	1	P .025 MAX	TYPE	F. H.
OBL.	0	20	Si .20-.30	SPECS.	JAN-A-784
RC	2208	2740	Ni 3.30-3.70	PLATE	22 B
LC	2247	—	Cr	GROUP	
HI	2242 VPS	2744	Mo .35-.45	HEAT	12
LIMIT	2245 2273	>2744		BHN	
RESULT	Passed	Passed		STEEL	T3015-1 TK269

RD.	BULLET	CHARGE	STR. VEL.	OBL.	YAW	PENET	BULLET	CONDITION OF PLATE
1	Cal.50M2	11.2	2027	0	0	I	FOP	VSB
2	"	11.4	2118	0	0	I	FOP	SB
3	"	11.6	2167	0	0	I	FOP	SB
4	"	11.8	2206	0	0	I	FOP	SB
5	"	12.0	2242	0	0	I	FOP	PUNS 1/32
6	"	12.2	2249	0	0	I	FOP	SB
7	"	12.4	2306	0	0	I	FOP	SB
8	"	12.6	2334	0	0	C	NR	1/2" CPUN
9	"	12.5	2331	0	0	C	NR	1/2" CPUN
10	"	12.2	2288	0	0	I	FOP	MB
11	"	12.3	2295	0	0	C	NR	3/8" CPUN
12	"	12.2	2233	0	0	I	FOP	SB
13	"	12.3	2331	0	0	C	NR	1/2" CPUN
14	"	12.2	2315	0	0	C	NR	1/2" CPUN
15	"	12.2	2254	0	0	C	NR	1/2" CPUN
16	"	12.0	2247	0	0	C	NR	3/8" CPUN
17	"	11.8	2142	0	0	I	FOP	VSB
18	"	11.9	2218	0	0	I	FOP	VSB
19	20MMHE	435	2744	20	—	I	HO	MB

FRNC-9-10-60-(300)

LIGHT ARMOR FIRING RECORD

PRNC-MPG-59

SHEET NO.

XXXXX	TEMPERATURE	TIME				
ANNEAL			YP			
NORM			TS			
HARDEN	1550	1 hr.	EL	PLATE		
QUENCH	Oil		RA	SIZE		
DRAW	300 Air Cooled	1 hr.		WEIGHT		
			Back			
GAUGE	0.512		C .20-.24	DATE	21st February 1957	
PROJ.	Cal.50 AP M2		Mn .45-.52	MFR.	Lithium Co.	
GUN	299		S .025 max	CONTR.		
RANGE	1.		P .025 max	TYPE	F. H.	
OBL.	0		Si .20-.30	SPECS.	JAN-A-784	
RC	2193		Ni 3.30-3.70	PLATE	23 A	
LC	2199		Cr	GROUP		
HI	2190 VPSB		Mo .35-.45	HEAT	72	
LIMIT	2195 2240			BHN		
RESULT	Passed			STEEL	T3015-1 T6264	

RD.	BULLET	CHARGE	STR. VEL.	OBL.	YAW	PENET	BULLET	CONDITION OF PLATE
1	Cal.50 M2	11.4	2121	0	0	I	FOP	VSB
2	"	11.6	2180	0	0	I	FOP	VSB
3	"	11.8	2199	0	0	C	NR	1/2" C PUN
4	"	11.8	2190	0	0	I	FOP	SB
5	"	11.7	2182	0	0	I	FOP	SB
6	"	11.7	2174	0	0	I	FOP	VSB
7	"	12.0	2242	0	0	C	NR	1/2 C PUN
8	"	11.9	2187	0	0	I	FOP	MB
9	"	12.0	2228	0	0	I	FOP	MB
10	"	12.2	2268	0	0	C	NR	1/2" C PUN
11	"	12.1	2265	0	0	C	NR	1/2" C PUN
12	"	12.0	2268	0	0	I	FOP	MB
13	"	12.4	2313	0	0	I	FOP	MB
14	"	12.7	2383	0	0	C	FCIP	1/2" PUN OUT

LIGHT ARMOR FIRING RECORD

PRNC-MPG-59

SHEET NO.

XXXXX	TEMPERATURE	TIME
ANNEAL		
NORM		
HARDEN	1550	1 hr.
QUENCH	Oil	
DRAW	300 Air Cooled	1 hr.
GAUGE	0.505	
PROJ.	Cal.50 APM2	
GUN	299	
RANGE	1	
OBL.	0	
RC	2198	
LC	2135	
HI	2147 VP50	
LIMIT	2151 2275	
RESULT	Failed	

YP

TS

EL

RA

PLATE

SIZE

WEIGHT

Back

C .20-.24

Mn .45-.52

S .025 max

P .025 max

Si .20-.30

Ni 3.30-3.70

Cr

Mo .35-.45

DATE 2 March 1951

MFR. Lithium Co.

CONTR.

TYPE F.H.

SPECS. JAN-A-784

PLATE 2.3 B

GROUP

HEAT 72

BHN

STEEL T3015-1 T6204

RD.	BULLET	CHARGE	STR. VEL.	OBL.	YAW	PENET	BULLET	CONDITION OF PLATE
1	Cal.50M2	11.2	2088	0	0	I	FOP	VSB
2	"	11.5	2129	0	0	I	FOP	VSB
3	"	11.8	2155	0	0	C	NR	1/2" C PUN
4	"	11.6	2204	0	0	I	FOP	VSB
5	"	11.5	2129	0	0	I	FOP	SB
6	"	11.5	2147	0	0	I	FOP	SB
7	"	12.0	2228	0	0	I	FOP	PUN S 1/16
8	"	12.2	2227	0	0	I	FOP	MB
9	"	12.4	2301	0	0	C	NR	3/8" C PUN
10	"	12.3	2311	0	0	C	NR	3/8" C PUN
11	"	12.2	2281	0	0	C	NR	1/2" C PUN
12	"	12.1	2283	0	0	I	FOP	MB
13	"	12.0	2235	0	0	I	FOP	SB
14	"	12.2	2319	0	0	C	NR	3/8" C PUN

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PRNC-3-10-49-3500

LIGHT ARMOR FIRING RECORD
PRMC-MPG-59

SHEET NO.

X X X X X	TEMPERATURE	TIME
ANNEAL		
NORM		
HARDEN	1550	1 hr.
QUENCH	Oil	
DRAW	300	1 hr.
	Air Cooled	
GAUGE	0.504	
PROJ.	Cal. 50 APM2	
GUN	399	
RANGE	1	
OBL.	0	
RC	2181	
LC	2172	
HI	2150 ~~1950~~	
LIMIT	2161 2304	
RESULT	Failed	

YP
TS
EL
RA

PLATE
SIZE
WEIGHT

Back

C .20-.24 DATE 24 February 1951
Mn .45-.52 MFR. Lithium Co.
S .025 M2X CONTR.
P .025 M2X TYPE F.H.
Si .20-.30 SPECS. JAN-A-784
Ni 3.30-3.70 PLATE 24A
Cr GROUP
Mo .35-.45 HEAT 72
BHN
STEEL T3013-1 T6264

RD.	BULLET	CHARGE	STR. VEL.	OBL.	YAW	PENET	BULLET	CONDITION OF PLATE
1	Cal. 50 M2	11.2	2040	0	0	I	FOP	VSB
2	"	11.4	2088	0	0	I	FOP	VSB
3	"	11.6	2172	0	0	C	FCIP	1/2" Pun Out
4	"	11.5	2120	0	0	I	FOP	VSB
5	"	11.6	2150	0	0	I	FOP	SB
6	"	11.8	2203	0	0	I	FOP	MB
7	"	12.0	2270	0	0	I	FOP	MB
8	"	12.2	2266	0	0	I	FOP	MB
9	"	12.4	2333	0	0	C	NR	1/2" C Pun
10	"	12.3	2308	0	0	C	NR	1/2" C Pun
11	"	12.2	2275	0	0	I	FOP	Puns 1/16"
12	"	11.6	2197	0	0	I	FOP	SB
13	"	11.5	2140	0	0	I	FOP	VSB
14	"	12.2	2260	0	0	I	FOP	Pun S 1/16"

PRMC-5-10-10-5000

LIGHT ARMOR FIRING RECORD

PREC-RPG-59

SHEET NO.

XXXXX	TEMPERATURE	TIME
ANNEAL		
NORM		
HARDEN	1550	1 hr.
QUENCH	Oil	
DRAW	300 Air Cooled	1 hr.
GAUGE	0.509	0.509
PROJ.	Cal.50 APM2	20MM HE
GUN	299	350003
RANGE	1	1
OBL.	0	20
RC	2189	2740
LC	2237	—
HI	2200 VP50	2746
LIMIT	2219 2259	>2746
RESULT	Passed	Passed

Y.P

TS

EL

RA

PLATE

SIZE

WEIGHT

Back

C .20-.24 DATE 24 February 1951

Mn .45-.52 MFR. Lithium Co.

S .025-Max CONTR.

P .025 max TYPE F. H.

Si .20-.30 SPECS. JAN-A-784

Ni 3.30-3.70 PLATE 24 B

Cr GROUP

Mo .35-.45 HEAT 72

BHN

STEEL T3815-1 T6264

RD.	BULLET	CHARGE	STR. VEL.	OBL.	YAW	PENET	BULLET	CONDITION OF PLATE
1	Cal.50 M2	11.2	2046	0	0	I	FOP	VSB
2	"	11.4	2105	0	0	I	FOP	VSB
3	"	11.6	2200	0	0	I	FOP	VSB
4	"	11.8	2187	0	0	I	FOP	RUN S 1/16"
5	"	11.9	2237	0	0	C	NR	1/2" C RUN
6	"	11.8	2240	0	0	I	FOP	MB
7	"	11.8	2179	0	0	I	FOP	MB
8	"	11.8	2158	0	0	I	FOP	MB
9	"	12.2	2279	0	0	I	FOP	MB
10	"	12.4	2302	0	0	C	NR	1/2" C RUN
11	"	12.4	2316	0	0	C	NR	1/2" C RUN
12	"	12.2	2277	0	0	I	FOP	MB
13	"	12.3	2290	0	0	C	NR	1/2" C RUN
14	"	12.2	2290	0	0	C	NR	1/2" C RUN
15	20MM HE	435	2746	20	—	I	HO	MB - Cir. Fold. C.R.

PRMC-3-10-52-5000

LIGHT ARMOR FIRING RECORD
FRHC-4PG-59

SHEET NO.

X X X X X	TEMPERATURE	TIME				
ANNEAL			YP			
NORM	NPG Retreated		TS			
HARDEN	1550	1 hr.	EL	PLATE		
QUENCH	oil		RA	SIZE		
DRAW	300	1 hr.		WEIGHT		
	Air cooled	After Retreat				
GAUGE	0.516	0.516	C .20-.24	DATE	30 Aug 1950	
PROJ.	Cal. 50 APM2	Cal. 50 APM2	Mn .45-.52	MFR.	Lukens Co	
GUN	299	299	S .025 max.	CONTR.		
RANGE	1	1	P .025 max.	TYPE		
OBL.	0°	0°	Si .20-.30	SPECS.	JAN-A-T84	
RC	2199	2199	Ni 3.30-3.70	PLATE	25A	
LC	2164	2266	Cr	GROUP		
HI	2159 "VP50"	2254 VP50	Mo .35-.45	HEAT	74	
LIMIT	2162 2148	2260 2260		BHN	655 / 477	
RESULT				STEEL	T30N5-1 T62A4	

RD.	BULLET	CHARGE	STR. VEL.	OBL.	YAW	PENET	BULLET	CONDITION OF PLATE
1	Cal.50M2	11.4	2050	0	0	I	FOP	SB
2	"	11.6	2123	0	0	I	FOP	SB
3	"	11.8	2131	0	0	I	FOP	SB
4	"	11.9	2159	0	0	I	FOP	1/32" PUN. S.
5	"	11.9	2171	0	0	I	FOP	MB
6	"	12.2	2259	0	0	C	NR	3/8" X 3/8" C. PUN
7	"	12.0	2206	0	0	I	FOP	1/8" PUN. S.
8	"	12.0	2223	0	0	C	NR	3/8" X 7/16" C. PUN.
9	"	12.0	2203	0	0	C	NR	3/8" X 3/8" C. PUN
10	"	11.9	2175	0	0	C	NR	3/8" X 1/2" C PUN
11	"	11.9	2180	0	0	C	NR	Discard - Fit old Compact 3/8 C. PUN
12	"	11.9	2164	0	0	C	NR	1/2 X 3/8 C. PUN.
13	"	11.9	2171	0	0	C	NR	3/8" X 3/8" C. PUN.
		AFTER NPG RETREATMENT						
14	Cal.50M2	11.5	2132	0	0	I	FOP	SB
15	"	11.7	2156	0	0	I	FOP	SB
16	"	11.9	2240	0	0	I	FOP	SB
17	"	12.1	2254	0	0	I	FOP	SB
18	"	12.3	2266	0	0	C	NR	1/2" C PUN

LIGHT ARMOR FIRING RECORD
PRVC-4PG-59a

SHEET NO.
Encl. ( )

PLATE 25A
Lithium Co.

2 February 1951

T3015-1
T6264

RD.	BULLET	CHARGE	STRIKING VELOCITY	OBL.	YAW	PENET.	BULLET	CONDITION OF PLATE
19	Cal. 50 M2	12.5	2270	0	0	C	NR	3/4" C PUN
20	"	12.4	2302	0	0	C	NR	1/2" C PUN
21	"	12.2	2286	0	0	C	NR	1/2" C PUN
22	"	12.0	2210	0	0	I	FOP	SB
23	"	11.8	2187	0	0	I	FOP	SB
24	"	12.0	2218	0	0	I	FOP	SB
25	"	12.1	2237	0	0	I	FOP	MB
26	"	12.1	2242	0	0	I	FOP	SB

PRVC-2-10-49-6610

LIGHT ARMOR FIRING RECORD
PREC-NPG-59

SHEET NO.

XXXXX	TEMPERATURE	TIME
ANNEAL		
NORM	NPG Retreated	
HARDEN	1550	1 hr.
QUENCH	Oil	
DRAW	300	1 hr.
	Oil cooled	After Retreat
GAUGE	0.528	0.528
PROJ.	Cal. 50 API M2	Cal. 50 API M2
GUN	299	299
RANGE	1	1
OBL.	0°	0°
RC	2217	2217
LC	1708	2250
HI	1694 VP50	2272 VP50
LIMIT	1701 1750	2281 2281
RESULT	Failed	

YP
TS
EL
RA

PLATE			
SIZE			
WEIGHT			

C	.20-.24	DATE	30 August 1950
Mn	.45-.52	MFR.	Lithium Co.
S	.025 max.	CONTR.	
P	.025 max.	TYPE	
Si	.20-.30	SPECS.	JAN-A-784
Ni	3.30-3.70	PLATE	2.5B
Cr		GROUP	
Mo	.35-.45	HEAT	93
		BHN	477 321
		STEEL	C3015-1 T6264

RD.	BULLET	CHARGE	STR. VEL.	OBL.	YAW	PENET	BULLET	CONDITION OF PLATE
1	Cal. 50 M2	11.4	2105	0	0	C	NR	3/8" X 1/2" C. PUN.
2	"	11.2	2068	0	0	C	NR	5/8" X 5/8" C. PUN.
3	"	11.0	2009	0	0	C	NR	1/2" X 1/2" C. PUN.
4	"	10.8	1969	0	0	C	NR	3/8" Hole
5	"	10.6	1928	0	0	C	NR	3/8" Hole
6	"	10.2	1785	0	0	C	NR	3/4" X 1/2" C. PUN.
7	"	9.8	1708	0	0	C	NR	1/2" X 3/8" C. PUN.
8	"	9.4	1615	0	0	I	FOP	MB
9	"	9.6	1719	0	0	I	RJ	1/4" Hole
10	"	9.5	1722	0	0	I	FOP	MB
11	"	9.5	1661	0	0	I	FOP	HB
12	"	9.6	1694	0	0	I	CIP	1/8" Nose thru
13	"	9.4	1636	0	0	I	RJ	1/8" Hole
14	"	9.2	1646	0	0	I	RJ	1/8" Hole
15	"	9.2	1655	0	0	I	RJ	1/8" Hole
16	"	9.0	1580	0	0	I	CIP	1/8" Nose thru
		AFTER NPG Retreatment						
17	Cal. 50 M2	11.5	2049	0	0	I	FOP	SB
18	"	11.7	2159	0	0	I	FOP	SB

PREC-5-10-GR-6500

LIGHT ARMOR FIRING RECORD
PRNC-4PG-59a

SHEET NO.
Encl. ( )

PLATE 25B.
Lithium Co.

2 February 1951

T3015-1
T6264

RD.	BULLET	CHARGE	STRIKING VELOCITY	OBL.	YAW	PENET.	BULLET	CONDITION OF PLATE
19	Cal.50 M2	11.9	2204	0	0	I	FOP	SB
20	"	12.1	2225	0	0	I	FOP	MB
21	"	12.3	2290	0	0	C	NR	1/2" C PUN
22	"	12.5	2304	0	0	C	NR	3/4" C PUN
23	"	12.3	2290	0	0	C	NR	1/2" C PUN
24	"	12.1	2227	0	0	I	FOP	SB
25	"	12.1	2189	0	0	I	FOP	VSB
26	"	12.2	2247	0	0	I	FOP	SB
27	"	12.2	2272	0	0	I	FOP	SB
28	"	12.3	2306	0	0	C	NR	1/2" C PUN

PRNC-3-10-49-8500

LIGHT ARMOR FIRING RECORD

PRMC-MPG-69

SHEET NO.

XXXXX	TEMPERATURE	TIME				
ANNEAL			YP			
NORM	MPG Retested		TS			
HARDEN	1550	1 Hr.	EL		PLATE	
QUENCH	oil		RA		SIZE	
DRAW	300	1 Hr.			WEIGHT	
	air cooled		After Retreat			
GAUGE	0.517	0.517	0.517	C .20-.24	DATE	31 AUGUST 1950
PROJ.	Cal. 50 APM2	20MM HE	Cal. 50 APM2	Mn .45-.52	MFR.	Lukens Co.
GUN	299	850003	299	S .025 max.	CONTR.	
RANGE	1	1	1	P .025 max.	TYPE	
OBL.	0°	20°	0	SI .20-.30	SPECS.	JAN-A-784
RC	2201	2740	2201	NI 3.30-3.70	PLATE	26A
LC	2089		2098	Cr	GROUP	
HI	2053 VPS0	2765	2088 VPS0	Mo .35-.45	HEAT	73
LIMIT	2071 2183	> 2765	2093 2228		BHN	570, 576:
RESULT	Failed	Passed			STEEL	T3205-1 T6264

RD.	BULLET	CHARGE	STR. VEL.	OBL.	YAW	PENET	BULLET	CONDITION OF PLATE
1	Cal. 50 M2	11.4	2053	0	0	I	FOP	SB
2	"	11.8	2192	0	0	I	FOP	1/32" FUN. S.
3	"	12.0	2185	0	0	C	NR	3/8" X 7/16" C. PUN.
4	"	12.0	2163	0	0	I	FOP	1/32" FUN. S.
5	"	12.0	2167	0	0	I	FOP	SB
6	"	12.0	2230	0	0	C	NR	3/8" Hole C. PUN.
7	"	12.1	2204	0	0	C	NR	1/2" X 7/16" C. PUN.
8	"	12.0	2201	0	0	C	NR	7/16" X 1/2" C. PUN.
9	"	11.8	2137	0	0	C	NR	1/2" X 9/16" C. PUN.
9	"	11.8	2174	0	0	I	FOP	SB
10	"	11.5	2155	0	0	I	FOP	SB
11	"	11.3	2040	0	0	I	FOP	SB
12	"	11.4	2047	0	0	I	FOP	SB
13	"	11.5	2089	0	0	C	NR	3/8" X 7/16" C. PUN.
14	20MM HE	440	2765	20°	—	I	HO	HB
	After MPG Retreatment							
15	Cal. 50 M2	11.5	2098	0	0	C	NR	1/2" C PUN
16	"	11.5	2085	0	0	I	FOP	SB

PRMC-2-10-65-6500

LIGHT ARMOR FIRING RECORD
PRMC-BPG-59a

SHEET NO.
Encl. ( )

PLATE 26A
Lithium Co

2 February 1951

T3015-1
T6264

RD.	BULLET	CHARGE	STRIKING VELOCITY	OBL.	YAW	PENET.	BULLET	CONDITION OF PLATE
17	Cal. 50M2	11.4	2088	0	0	I	FOP	SB
18	"	11.4	2025	0	0	I	FOP	SB
19	"	11.6	2112	0	0	I	FOP	SB
20	"	11.8	2158	0	0	I	FOP	MB
21	"	12.0	2232	0	0	I	FOP	MB
22	"	12.2	2266	0	0	Disregard - Bad Hit		
23	"	12.2	2206	0	0	I	FOP	MB
24	"	12.4	2336	0	0	C	NR	1/2" C PUN
25	"	12.3	2247	0	0	I	FOP	MB
26	"	12.3	2240	0	0	C	NR	1/2" C PUN
27	"	12.3	2286	0	0	C	NR	1/2" C PUN

PRMC-3-10-48-6500

LIGHT ARMOR FIRING RECORD

PRNC-M°G-59

SHEET NO.

XXXXX	TEMPERATURE	TIME					
ANNEAL			YP				
NORM	NPG Reheated		TS				
HARDEN	1550	1 hr.	EL		PLATE		
QUENCH	oil		RA		SIZE		
DRAW	300	1 hr.			WEIGHT		
	air cooled						
GAUGE	0.512	0.512		C .20-.24	DATE	2 February 1951	
PROJ.	Cal.50 APM2	20MM HE		Mn .45-.52	MFR.	Lithium Co.	
GUN	299	850003		S .025 max.	CONTR.		
RANGE	1	1		P .025 max.	TYPE		
OBL.	0°	20°		Si .20-.30	SPECS.	JAN-A 784	
RC	2193	2740		Ni 3.30-3.70	PLATE	26B	
LC	2274	—		Cr	GROUP		
HI	22.68 VP50	2737		Mo .35-.45	HEAT	77	
LIMIT	2211 2271	>2731			BHN	640 - 673	
RESULT	Passed	Passed			STEEL	T3015-1 T6264	

RD.	BULLET	CHARGE	STR. VEL.	OBL.	YAW	PENET	BULLET	CONDITION OF PLATE
1	Cal.50 M2	11.5	2102	0	0	I	FOP	VSB
2	"	11.7	2115	0	0	I	FOP	VSB
3	"	11.9	2183	0	0	I	FOP	MB
4	"	12.1	2220	0	0	I	FOP	MB
5	"	12.3	2201	0	0	I	FOP	MB
6	"	12.5	2286	0	0	C	NR	1/2" C PUN
7	"	12.4	2250	0	0	I	FOP	MB
8	"	12.5	2290	0	0	C	NR	1/2" C PUN
9	"	12.5	2310	0	0	C	NR	1/2" C PUN
10	"	12.4	2279	0	0	I	FOP	MB
11	"	12.4	2247	0	0	I	FOP	MB
12	"	12.5	2274	0	0	C	NR	1/2" C PUN
13	"	12.6	2425	0	0	C	NR	1/2" C PUN
14	"	12.4	2268	0	0	I	FOP	MB
15	20MMHE	435	2737	20	-	I	HO	MB

LIGHT ARMOR FIRING RECORD

PRAC-AFG-59

SHEET NO.

X X X X X	TEMPERATURE	TIME
ANNEAL		
NORM	APG Remarks	
HARDEN	1550	1 hr.
QUENCH	oil	
DRAW	300	1 hr.
	Air cooled	
GAUGE	0.512	
PROJ.	Cal. 50 APM2	
GUN	299	
RANGE	1	
OBL.	00	
RC	2193	
LC	2218	
HI	2197 VP50	
LIMIT	2208 2206	
RESULT		

YP			
TS			
EL	PLATE		
RA	SIZE		
	WEIGHT		
C .20-.24	DATE	2 FEBRUARY 1951	
Mn .45-.52	MFR.	Lithium Co.	
S .025 max	CONTR.		
P .025 max	TYPE		
Si .20-.30	SPECS.	MIL-A-784	
Ni 3.30-3.70	PLATE	27A	
Cr	GROUP		
Mo .35-.45	HEAT	73	
	BHN	341 352	
	STEEL	T5015-1 T6264	

RD.	BULLET	CHARGE	STR. VEL.	OBL.	YAW	PENET	BULLET	CONDITION OF PLATE
1	Cal.50M2	11.5	2100	0	0	I	FOP	SB
2	"	11.7	2083	0	0	I	FOP	SB
3	"	11.9	2197	0	0	I	FOP	MB
4	"	12.1	2179	0	0	I	FOP	SB
5	"	12.3	2254	0	0	C	NR	1/2" C PUN
6	"	12.3	2247	0	0	I	FOP	MB
7	"	12.4	2257	0	0	I	FOP	PUN S 1/16"
8	"	12.4	2237	0	0	C	NR	1/2" C PUN
9	"	12.5	2297	0	0	C	NR	1/2" C PUN
10	"	12.2	2220	0	0	C	NR	1/2" C PUN
11	"	12.1	2218	0	0	C	NR	1/2" C PUN
12	"	12.0	2174	0	0	I	FOP	SB
13	"	12.0	2102	0	0	I	FOP	SB
14	"	12.0	2195	0	0	I	FOP	SB

LIGHT ARMOR FIRING RECORD

PRRC-APG-59

SHEET NO.

XXXXX	TEMPERATURE	TIME
ANNEAL		
NORM	APG Retreated	
HARDEN	1550	1 hr.
QUENCH	oil	
DRAW	300	1 hr.
	air cooled	
GAUGE	0.517	0.517
PROJ.	Cal. 50 APM2	20MM HE
GUN	299	850003
RANGE	1	1
OBL.	0°	20°
RC	2201	2740
LC	2244	—
HI	2238 YP30	2730
LIMIT	2241 2254	>2735
RESULT	Passed	Passed

YP			
TS			
EL	PLATE		
RA	SIZE		
	WEIGHT		

C .20-.24 DATE 2 February 1957

Mn .45-.52 MFR. Lukens Co.

S .025 max. CONTR.

P .025 max. TYPE

Si .20-.30 SPECS. JAN-A-784

Ni 3.30-3.70 PLATE 27B

Cr GROUP

Mo .35-.45 HEAT 73

BHN 341-363

STEEL T3015-1 T8264

RD.	BULLET	CHARGE	STR. VEL.	OBL.	YAW	PENET	BULLET	CONDITION OF PLATE
1	Cal. 50 M2	11.5	2083	0	0	I	FOP	SB
2	"	11.7	2120	0	0	I	FOP	SB
3	"	11.9	2197	0	0	I	FOP	SB
4	"	12.1	2174	0	0	I	FOP	SB
5	"	12.3	2238	0	0	I	FOP	PUNS 1/4"
6	"	12.4	2250	0	0	C	NR	1/2" C PUN
7	"	12.4	2250	0	0	I	FOP	MB
8	"	12.5	2244	0	0	C	NR	1/2" C PUN
9	"	12.6	2315	0	0	I	FOP	PUNS 1/8"
10	"	12.7	2327	0	0	C	NR	1/2" C PUN
11	"	12.6	2270	0	0	C	NR	1/2" C PUN
12	"	12.4	2270	0	0	C	NR	1/2" C PUN
13	"	12.2	2220	0	0	I	FOP	SB
14	"	12.2	2237	0	0	I	FOP	SB
15	20MM HE	435	2730	20	—	I	HO	MB Slight FSCE C+Ks.

LIGHT ARMOR FIRING RECORD

PRNC-NPC-59

SHEET NO.

X X X X X	TEMPERATURE	TIME				
ANNEAL			YP			
NORM			TS			
HARDEN	1550° F	1 hr.	EL	PLATE		
QUENCH	Oil		RA	SIZE		
DRAW	300	1 hr.		WEIGHT		
			Back			
GAUGE	C: .525	D: .525	C .20-.24	DATE	5 March 1951	
PROJ.	Cal 50 APM2	20MM HE	Mn .45-.52	MFR.	Lithium Co.	
GUN	299	850003	S .025 max	CONTR.		
RANGE	1	1	P .025 max	TYPE	F H	
OBL.	0	20	Si .20-.30	SPECS.	JAN-A-784	
RC	2213	2740	Ni 3.30-3.70	PLATE	28 A	
LC	2256	—	Cr	GROUP		
HI	2254 VP50	2739	Mo .35-.45	HEAT	74	
LIMIT	2255 2255	>2739		BHN		
RESULT	Passed	Passed		STEEL	T3015-1 T6264	

RD.	BULLET	CHARGE	STR. VEL.	OBL.	YAW	PENET	BULLET	CONDIT ON OF PLATE
1	Cal 50 M2	11.5	2109	0	0	I	FOP	SB
2	"	11.8	2204	0	0	I	FOP	SB
3	"	11.8	2194	0	0	I	FOP	SB
4	"	11.8	2163	0	0	I	FOP	SB
5	"	12.0	2203	0	0	I	FOP	MB
6	"	12.2	2261	0	0	C	NR	3/8" x 1/2" C PUN
7	"	12.2	2270	0	0	I	FOP	MB
8	"	12.3	2310	0	0	C	NR	1/2" C PUN
9	"	12.2	2256	0	0	C	NR	1/2" C PUN
10	"	12.1	2254	0	0	I	FOP	SB
11	"	12.2	2295	0	0	C	NR	1/2" C PUN
12	"	12.1	2233	0	0	I	FOP	MB
13	20MM HE	435	2739	20	—	I	HO	MB - Cir. F. Cr Ks.

PRNC-3-10-59-5500

LIGHT ARMOR FIRING RECORD

FRNC-MPG-59

SHEET NO.

X X X X X	TEMPERATURE	TIME
ANNEAL		
NORM		
HARDEN	1550°F	1 hr.
QUENCH	Oil	
DRAW	300	1 hr.
GAUGE	0.524	
PROJ.	Cal.50 APM2	
GUN	299	
RANGE	1	
OBL.	0	
RC	2211	
LC	2210	
HI	2204 V50	
LIMIT	2207 *2226	
RESULT	Failed	

Rock

YP			
TS			
EL		PLATE	
RA		SIZE	
		WEIGHT	
C	.20-.24	DATE	2 March 1951
Mn	.45-.52	MFR.	Lithium Co.
S	.025 MAX	CONTR.	
P	.025 MAX	TYPE	E. H.
Si	.20-.30	SPECS.	JAN-A-784
Ni	3.30-3.70	PLATE	28 B
Cr		GROUP	
Mo	.35-.45	HEAT	74
		BHN	
		STEEL	T3015-1 T6264

RD.	BULLET	CHARGE	STR. VEL.	OBL.	YAW	PENET	BULLET	CONDITION OF PLATE
1	Cal.50M2	11.5	2147	0	0	I	FOP	SB
2	"	11.6	2204	0	0	I	FOP	MB
3	"	11.8	2197	0	0	I	FOP	MB
4	"	11.8	2213	0	0	I	FOP	SB
5	"	12.0	2244	0	0	C	NR	3/8" C PUN
6	"	12.2	2257	0	0	C	NR	1/2" C PUN
7	"	12.0	2242	0	0	C	NR	1/2" C PUN
8	"	11.8	2203	0	0	I	FOP	PUN S 1/8"
9	"	11.8	2210	0	0	C	NR	1/2" C PUN
10	"	11.8	2223	0	0	I	FOP	SB
11	"	11.7	2158	0	0	I	FOP	SB
12	"	11.7	2175	0	0	I	FOP	SB

FRNC-3-10-49-5000

LIGHT ARMOR FIRING RECORD
PRRC-NPG-59

SHEET NO.

XXXXX	TEMPERATURE	TIME				
ANNEAL			YP			
NORM®			TS			
HARDEN	1550	1 hr.	EL	PLATE		
QUENCH	Oil		RA	SIZE		
DRAW	300	1 hr.		WEIGHT		

Back

GAUGE	0.506	0.506	C .20-.24	DATE	5 March 1951
PROJ.	Cal.50APM2	20MM HE	Mn .45-.52	MFR.	Lithium Co.
GUN	399	850003	S .025 MAX	CONTR.	
RANGE	1	1	P .025 MAX	TYPE	F. H.
OBL.	0	20	Si .20-.30	SPECS.	JAN-A-784
RC	2184	2740	Ni 3.30-3.70	PLATE	24 A
LC	2254	—	Cr	GROUP	
HI	2237 VP50	2735	Mo .35-.45	HEAT	74
LIMIT	2246 2266	>2735		BHN	
RESULT	Passed	Passed		STEEL	T3015-1 T6264

RD.	BULLET	CHARGE	STR. VEL.	OBL.	YAW	PENET	BULLET	CONDITION OF PLATE
1	Cal.50M2	11.5	2112	0	0	I	FOP	SB
2	"	11.8	2189	0	0	I	FOP	MB
3	"	11.8	2175	0	0	I	FOP	MB
4	"	11.8	2206	0	0	I	FOP	MB
5	"	12.0	2215	0	0	I	FOP	MB
6	"	12.2	2237	0	0	I	FOP	MB
7	"	12.3	2306	0	0	C	NR	3/8" x 1/2" CPUN
8	"	12.2	2257	0	0	I	FOP	MB
9	"	12.3	2327	0	0	C	NR	1/2" CPUN
10	"	12.2	2288	0	0	C	NR	1/2" CPUN
11	"	12.2	2254	0	0	C	NR	1/2" CPUN
12	"	12.1	2201	0	0	I	FOP	MB
13	"	12.1	2221	0	0	I	FOP	SB
14	"	12.2	2265	0	0	I	FOP	MB
15	20MMHE	435	2735	20	-	I	HO	MB- Cap F' OK.

LIGHT ARMOR FIRING RECORD

SHEET NO.

XXXXX	TEMPERATURE	TIME
ANNEAL		
NORM		
HARDEN	1550°F	1 hr.
QUENCH	Oil	
DRAW	300°F	1 hr.
GAUGE	0.505	
PROJ.	Cal. 50 APM2	
GUN	299	
RANGE	1	
OBL.	0	
RC	2183	
LC	2185	
HI	2182 V50	
LIMIT	2184 2238	
RESULT	Passed	

YP			
TS			
EL	PLATE		
RA	SIZE		
	WEIGHT		

Book

C	.20-.24	DATE	2 March 1951
Mn	.45-.52	MFR.	Lithium Co.
S	.025 Max	CONTR.	
P	.025 Max	TYPE	F H
Si	.20-.30	SPECS.	JAN-A-784
Ni	3.30-3.70	PLATE	29 B
Cr		GROUP	
Mo	.35-.45	HEAT	74
		BHN	
		STEEL	T3013-1 T6264

RD.	BULLET	CHARGE	STR. VEL.	OBL.	YAW	PENET	BULLET	CONDITION OF PLATE
1	Cal. 50 M2	11.5	2132	0	0	I	FOP	SB
2	"	11.6	2131	0	0	I	FOP	VSB
3	"	11.7	2166	0	0	I	FOP	SB
4	"	11.8	2180	0	0	I	FOP	SB
5	"	11.8	2185	0	0	C	NR	1/2" C PUN
6	"	11.8	2221	0	0	I	FOP	MB
7	"	11.7	2182	0	0	I	FOP	SB
8	"	12.0	2261	0	0	C	NR	3/8" C PUN
9	"	11.9	2220	0	0	I	FOP	MB
10	"	12.0	2244	0	0	I	FOP	MB
11	"	12.0	2247	0	0	C	NR	3/8" C PUN
12	"	12.1	2235	0	0	I	FOP	SB
13	"	12.2	2247	0	0	I	FOP	SB
14	"	12.3	2277	0	0	C	NR	3/8" C PUN

PRNC-3-10-49-6500

LIGHT ARMOR FIRING RECORD
PRNC-KPG-59

SHEET NO.

X X X X X	TEMPERATURE	TIME
ANNEAL		
NORM		
HARDEN	1550° F	1 hr.
QUENCH	Oil	
DRAW	300° F	1 hr.

YP				
TS				
EL	PLATE			
RA	SIZE			
	WEIGHT			

	Back		
GAUGE	0"50T	C .20-.24	DATE 5 March 1951
PROJ.	Cal.50AP.M2	Mn .45-.52	MFR. Lithium Co.
GUN	299	S .025 max	CONTR.
RANGE	1	P .025 max	TYPE F H
OBL.	0	Si .20-.30	SPECS. JAN-A-784
RC	2186	Ni 3.30-3.70	PLATE 30 A
LC	2150	Cr	GROUP
HI	2142 VP50	Mo .55-.45	HEAT 75
LIMIT	2146 2155		BHN
RESULT	Failed		STEEL T3015-1 T62164

RD.	BULLET	CHARGE	STR. VEL.	OBL.	YAW	PENET	BULLET	CONDITION OF PLATE
1	Cal.50M2	11.6	2150	0	0	C	NR	1/2" C PUN
2	"	11.5	2137	0	0	I	FOP	SB
3	"	11.5	2134	0	0	I	FOP	SB
4	"	11.5	2139	0	0	I	FOP	SB
5	"	11.8	2180	0	0	C	NR	1/2" C PUN
6	"	11.7	2156	0	0	I	FOP	SB
7	"	11.8	2172	0	0	I	FOP	SB
8	"	11.8	2156	0	0	C	NR	1/2" C PUN
9	"	11.8	2200	0	0	C	NR	1/2" C PUN
10	"	11.7	2142	0	0	I	FOP	SB
11	"	11.8	2192	0	0	I	FOP	SB
12	"	12.0	2164	0	0	C	NR	3/8" C PUN
13	"	12.0	2238	0	0	C	NR	3/8" X 1/2" C PUN

PRNC-2-10-49-6500

LIGHT ARMOR FIRING RECORD
PRNC-MPG-59

SHEET NO.

XXXXX	TEMPERATURE	TIME
ANNEAL		
NORM		
HARDEN	1550° F	1 hr.
QUENCH	Oil	
DRAW	300° F	1 hr.
GAUGE	0.308	0.308
PROJ.	Cal. 50 APM2	20MM HE
GUN	297	850003
RANGE	1	1
OBL.	0	20°
RC	2187	2740
LC	2211	
HI	2183 VP50	2730
LIMIT	2197 2203	>2730
RESULT	Passed	Passed

YP			
TS			
EL	PLATE		
RA	SIZE		
	WEIGHT		

Book

C	.20-.24	DATE	5 March 1951
Mn	.45-.52	MFR.	Lithium Co.
S	.025 MAX	CONTR.	
P	.025 MAX	TYPE	FH
Si	.20-.30	SPECS.	JAN-A-784
Ni	3.30-3.70	PLATE	30 B
Cr		GROUP	
Mo	.35-.45	HEAT	75
		BHN	
		STEEL	T3015-1 T0264

RD.	BULLET	CHARGE	STR. VEL.	OBL.	YAW	PENET	BULLET	CONDITION OF PLATE
1	Cal. 50 M2	11.5	2129	0	0	I	FOP	SB
2	"	11.8	2211	0	0	C	NR	1/2" C PUN
3	"	11.7	2115	0	0	I	FOP	VSB
4	"	11.8	2172	0	0	I	FOP	MB
5	"	11.8	2182	0	0	I	FOP	SB
6	"	11.8	2183	0	0	I	FOP	SB
7	"	11.8	2156	0	0	I	FOP	PUN. S. 1/32"
8	"	12.0	2240	0	0	C	NR	1/2" C PUN
9	"	12.0	2220	0	0	I	FOP	MB
10	"	12.0	2237	0	0	I	FOP	MB
11	"	12.1	2261	0	0	C	NR	1/2" C PUN
12	"	12.1	2256	0	0	C	NR	1/2" C PUN.
13	"	12.0	2029	0	0	I	FOP	VSB
14	"	12.0	2252	0	0	C	NR	3/8" C PUN
15	20MM HE	435	2730	20	-	I	HO	MB 2"x3" Corner of plate broke off.

PRNC-2-10-40-6500

LIGHT ARMOR FIRING RECORD
PRNC-MPG-59

SHEET NO.

X X X X X	TEMPERATURE	TIME			
ANNEAL			YP		
NORM			TS		
HARDEN	1550°F	1 hr.	EL	PLATE	
QUENCH	Oil		RA	SIZE	
DRAW	300°F	1 hr.		WEIGHT	

Back

GAUGE	0.510	C .20-.24	DATE	5 March 1951
PROJ.	Cal. 50 APM2	Mn .45-.52	MFR.	Lithium Co.
GUN	299	S .025 max	CONTR.	
RANGE	1	P .025 max	TYPE	F. H
OBL.	0°	Si .20-.30	SPECS.	AXN-A-784
RC	2190	Ni 3.30-3.70	PLATE	31 A
LC	2223	Cr	GROUP	
HI	2200 V50	Mo .35-.45	HEAT	75
LIMIT	2212 2231		BHN	
RESULT	Passed		STEEL	T3015-1 T6264

RD.	BULLET	CHARGE	STR. VEL.	OBL.	YAW	PENET	BULLET	CONDITION OF PLATE
1	Cal. 50 M2	11.6	2112	0	C	I	FOP	SB
2	"	11.8	2223	0	0	C	NR	1/2" C PUN
3	"	11.8	2200	0	0	I	FOP	SB
4	"	11.8	2172	0	0	I	FOP	SB
5	"	11.8	2200	0	0	I	FOP	MB
6	"	11.9	2171	0	0	I	FOP	SB
7	"	12.0	2237	0	0	I	FOP	SB
8	"	12.1	2281	0	0	C	NR	1/2" C PUN
9	"	12.1	2225	0	0	C	Part of FCIP	1/2" PUN out
10	"	12.1	2237	0	0	I	FOP	MB
11	"	12.2	2279	0	0	C	NR	1/2" C PUN
12	"	12.2	2274	0	0	C	NR	1/2" C PUN

PRNC-3-10-49-8500

LIGHT ARMOR FIRING RECORD

PRNC-NPG-59

SHEET NO.

XXXXX	TEMPERATURE	TIME
ANNEAL		
NORM		
HARDEN	1550°F	1 Hr.
QUENCH	Oil	
DRAW	300°F	1 Hr.
GAUGE	0.508	0.508
PROJ.	Cal. 50 APM2	20MM HE
GUN	299	350003
RANGE	1	1
OBL.	0	20
RC	2187	2740
LC	2244	—
HI	2220 ~~1250~~	2730
LIMIT	2232 2249	>2730
RESULT	Passed	Passed

Bar K

YP			
TS			
EL		PLATE	
RA		SIZE	
		WEIGHT	

C	.20-.24	DATE	5 March 1951
Mn	.45-.52	MFR.	Lithium Co.
S	.025 Max	CONTR.	
P	.025 Max	TYPE	E. H.
Si	.20-.30	SPECS.	JAN-A-784
Ni	3.30-3.70	PLATE	31 B
Cr		GROUP	
Mo	.35-.45	HEAT	75
		BHN	
		STEEL	T3015-1 T6264

RD.	BULLET	CHARGE	STR. VEL.	OBL.	YAW	PENET	BULLET	CONDITION OF PLATE
1	Cal. 50 M2	11.6	2161	0	0	I	FOP	SB
2	"	11.6	2132	0	0	I	FOP	SB
3	"	11.8	2216	0	0	I	FOP	SB
4	"	11.8	2192	0	0	I	FOP	SB
5	"	12.0	2220	0	0	I	FOP	SB
6	"	12.2	2256	0	0	C	NR	1/2" C PUN
7	"	12.2	2263	0	0	C	NR	1/2" C PUN
8	"	12.1	2244	0	0	C	NR	1/2" C PUN
9	"	12.0	2192	0	0	I	FOP	PUN S 1/4"
10	"	12.0	2206	0	0	I	FOP	SB
11	"	12.1	2279	0	0	C	NR	1/2" C PUN
12	"	12.1	2256	0	0	I	FOP	PUN S 1/32"
13	"	12.2	2247	0	0	C	NR	1/2" C PUN
14	"	12.3	2303	0	0	C	NR	1/2" C PUN
15	20MM HE	435	2730	20	—	I	HO	MB - Small F. Crk.

PRNC-3-10-60-6500

LIGHT ARMOR FIRING RECORD
PRNC-RFG-59

SHEET NO.

XXXXX	TEMPERATURE	TIME				
ANNEAL			YP			
NORM			TS			
HARDEN	1550° F	1 hr.	EL	PLATE		
QUENCH	Oil		RA	SIZE		
DRAW	300° F	1 hr.		WEIGHT		
			Back			
GAUGE	0.503		C .20-.24	DATE	5 March 1951	
PROJ.	Cal.50APM2		Mn .45-.52	MFR.	Lithgow Co.	
GUN	599		S .025 max	CONTR.		
RANGE	1		P .025 max	TYPE	F. H	
OBL.	0		Si .20-.30	SPECS.	JAN-A-784	
RC	2180		Ni 3.30-3.70	PLATE	32 A	
LC	2148		Cr	GROUP		
HI	2175 VPSD		Mo .35-.45	HEAT	76	
LIMIT	2147 2147			BHN		
RESULT	Failed			STEEL	T3015-1 T2284	

RD.	BULLET	CHARGE	STR. VEL.	OBL.	YAW	PENET	BULLET	CONDITION OF PLATE
1	Cal.50M2	11.6	2095	0	0	I	FOP	MB-slight B. Crk.
2	"	11.8	2179	0	0	C	NR	1/2" C PUN
3	"	11.8	2216	0	0	C	NR	1/2" C PUN
4	"	11.6	2143	0	0	I	FOP	MB
5	"	11.6	2159	0	0	C	NR	1/2" x 3/8" C PUN
6	"	11.6	2085	0	0	I	FOP	MB
7	"	11.6	2145	0	0	I	FOP	MB
8	"	11.5	2118	0	0	I	FOP	SB
9	"	11.6	2155	0	0	C	NR	3/8" C PUN
10	"	11.6	2148	0	0	C	NR	1/2" C PUN
11	"	11.5	2109	0	0	I	FOP	MB
12	"	11.5	2047	0	0	I	FOP	SB

PRNC-3-10-41-6500

LIGHT ARMOR FIRING RECORD
PRNC-KPE-59

SHEET NO.

XXXXX	TEMPERATURE	TIME				
ANNEAL			YP			
NORM			TS			
HARDEN	1550°F	1 Hr.	EL	PLATE		
QUENCH	Oil		RA	SIZE		
DRAW	300°F	1 Hr.		WEIGHT		
			Back			
GAUGE	0.495	0.495	C .20-.24	DATE	5 March 1951	
PROJ.	Cal. 50 APM2	20 MM HE	Mn .45-.52	MFR.	Lithium Co.	
GUN	299	850003	S .025 max	CONTR.		
RANGE	1	1	P .025 max	TYPE	F. H	
OBL.	0°	20	Si .20-.30	SPECS.	JAN-A-784	
RC	2170	2740	Ni 3.30-3.70	PLATE	32 B	
LC	2142	—	Cr	GROUP		
HI	2142 VPS	2739	Mo .35-.45	HEAT	76	
LIMIT	2142 2205	>2739		BHN		
RESULT	Failed	Passed		STEEL	T-2015-1 T6264	

RD.	BULLET	CHARGE	STR. VEL.	OBL.	YAW	PENET	BULLET	CONDITION OF PLATE
1	Cal. 50 M2	11.5	2142	0	0	C	NR	3/8" x 1/2" C Pun
2	"	11.4	2106	0	0	I	FOP	MB
3	"	11.4	2121	0	0	I	FOP	MB
4	"	11.4	2070	0	0	I	FOP	SB
5	"	11.5	2139	0	0	I	FOP	MB
6	"	11.5	2123	0	0	I	FOP	MB
7	"	11.6	2137	0	0	I	FOP	Pun S 1/32"
8	"	11.6	2142	0	0	I	FOP	MB
9	"	11.7	2172	0	0	C	NR	3/8" C Pun
10	"	11.7	2174	0	0	I	FOP	MB
11	"	11.8	2153	0	0	I	FOP	MB
12	"	11.9	2169	0	0	I	FOP	MB
13	"	12.0	2227	0	0	C	NR	1/2" C Pun
14	"	12.0	2261	0	0	C	NR	1/2" C Pun
15	"	11.8	2185	0	0	I	FOP	SB
16	20 MM HE	.435	2739	20	—	I	HO	MB - Cir. F. Cr.

PRNC-3-10-49-6500

LIGHT ARMOR FIRING RECORD

PRRC-MPG-59

SHEET NO.

XXXXX	TEMPERATURE	TIME				
ANNEAL			YP			
NORM			TS			
HARDEN	1550°F	1 hr.	EL	PLATE		
QUENCH	Oil		RA	SIZE		
DRAW	300°F	1 hr.		WEIGHT		
			Back			
GAUGE	0.525"	0.525	C .20-.24	DATE	2 March 1951	
PROJ.	Cal.50APM2	20MMHE	Mn .45-.52	MFR.	Lithium Co.	
GUN	299	850003	S .025 MAX	CONTR.		
RANGE	1	1	P .025MAX	TYPE	F.H.	
OBL.	0	20°	Si .20-.30	SPECS.	JAN-A-784	
RC	2213	2740	Ni 3.30-3.70	PLATE	33A	
LC	2223	—	Cr	GROUP		
HI	2221 VP50	2744	Mo .35-.45	HEAT	76	
LIMIT	2222 2222	>2744		BHN		
RESULT	Passed	Passed		STEEL	T3015-1 T8264	

RD.	BULLET	CHARGE	STR. VEL.	OBL.	YAW	PENET	BULLET	CONDITION OF PLATE
1	Cal.50M12	11.5	2161	0	0	I	FOP	SB
2	"	11.8	2199	0	0	I	FOP	SB
3	"	11.8	2137	0	0	I	FOP	VSB
4	"	11.8	2166	0	0	I	FOP	SB
5	"	12.0	2244	0	0	C	NR	3/8" C PUN
6	"	11.9	2189	0	0	I	FOP	SB
7	"	12.0	2215	0	0	I	FOP	SB
8	"	12.2	2279	0	0	C	NR	1/2" C PUN
9	"	12.1	2257	0	0	C	NR	1/2" C PUN
10	"	12.0	2223	0	0	C	FCIP	1/2" PUN OUT
11	"	11.9	2221	0	0	I	FOP	SB
12	"	11.9	2195	0	0	I	FOP	SB
13	"	11.9	2225	0	0	C	NR	1/2" C PUN
14	"	11.8	2167	0	0	I	FOP	SB
15	20MMHE	435	2744	20	—	I	HO	MB- SLIGHT F. CRKS.

PRRC-3-10-49-6500

LIGHT ARMOR FIRING RECORD

PRNC-XPG-59

SHEET NO.

XXXXX	TEMPERATURE	TIME
ANNEAL		
NORM		
HARDEN	1550° F	1 hr.
QUENCH	Oil	
DRAW	300° F	1 hr.

YP			
TS			
EL	PLATE		
RA	SIZE		
	WEIGHT		

BACK

GAUGE	0."506	C	.20-.24
PROJ.	Cal. 50 AP M2	Mn	.45-.52
GUN	299	S	.025 MAX
RANGE	1	P	.025 MAX
OBL.	0°	Si	.20-.30
RC	2184	Ni	3.30-3.70
LC	2171	Cr	
HI	2154 VP50	Mo	.35-.45
LIMIT	VL Min 2163 2147		
RESULT	VP Min 2119 Failed		

DATE 5 March 1951
MFR. Lithium Co.
CONTR.
TYPE F.H.
SPECS. JAN-A-784
PLATE 34 A
GROUP
HEAT 77
BHN
STEEL T3015-1 · TB264

RD.	BULLET	CHARGE	STR. VEL.	OBL.	YAW	PENET	BULLET	CONDITION OF PLATE
1	Cal. 50 M2	11.6	2106	0	0	I	FoP	SB
2	"	11.8	2208	0	0	C	NR	1/2" C Pun
3	"	11.8	2189	0	0	C	NR	1/2" C Pun
4	"	11.8	2206	0	0	C	NR	3/8" x 1/2" C Pun
5	"	11.8	2194	0	0	X	FCIP	3/8" Pun out
6	"	11.7	2154	0	0	I	FoP	SB
7	"	11.7	2123	0	0	X	FCIP	3/8" Pun out
8	"	11.8	2175	0	0	C	NR	1/2" C Pun
9	"	11.6	2139	0	0	I	FoP	SB
10	"	11.6	2114	0	0	I	FoP	MB
11	"	11.7	2179	0	0	C	NR	1/2" C Pun
12	"	11.6	2137	0	0	I	FoP	SB
13	"	11.6	2171	0	0	C	NR	3/8" x 1/2" C Pun
14	"	11.5	2129	0	0	I	FoP	SB
15	"	11.5	2127	0	0	I	FoP	MB

PRNC-3-10-49-6500

LIGHT ARMOR FIRING RECORD
PRNC-SPG-59

SHEET NO.

XXXXX	TEMPERATURE	TIME
ANNEAL		
NORM		
HARDEN	1550° F	1 hr.
QUENCH	Oil	
DRAW	300° F	1 hr.
GAUGE	0".495	0".495
PROJ.	Cal. 50 APM2	20MM HE
GUN	299	850003
RANGE	1	1
OBL.	0	20
RC	2170	2740
LC	2124	—
HI	2123 Plug	2744
LIMIT	2124 2124	>2744
RESULT	Failed	Passed

YP			
TS			
EL	PLATE		
RA	SIZE		
	WEIGHT		

Book

C	.20-.24	DATE	3 March 1951
Mn	.45-.52	MFR.	Lithium Co.
S	.025 max	CONTR.	
P	.025 max	TYPE	F. H.
Si	.20-.30	SPECS.	JAN-A-784
Ni	3.30-3.70	PLATE	34 B
Cr		GROUP	
Mo	.35-.45	HEAT	77
		BHN	
		STEEL	T3015-1 T6264

RD.	BULLET	CHARGE	STR. VEL.	OBL.	YAW	PENET	BULLET	CONDITION OF PLATE
1	Cal. 50M2	11.5	2124	0	0	C	NR	3/8" C PUN
2	"	11.3	2112	0	0	I	FOP	MB
3	"	11.3	2117	0	0	I	FOP	PUN S 3/16"
4	"	11.3	2070	0	0	I	FOP	MB
5	"	11.5	2095	0	0	I	FOP	MB
6	"	11.6	2155	0	0	C	NR	1/2" C PUN
7	"	11.6	2192	0	0	C	NR	3/8" C PUN
8	"	11.5	2123	0	0	I	FOP	MB
9	"	11.5	2156	0	0	C	NR	1/2" C PUN
10	"	11.4	2123	0	0	I	FOP	SB
11	"	11.5	2114	0	0	I	FOP	MB
12	"	11.6	2147	0	0	C	NR	1/2" C PUN
13	20MM HE	435	2744	20	—	I	HO	MB - Slight Cir. F. Cks.

PRNC-3-10-49-6500

LIGHT ARMOR FIRING RECORD

PRNC-3-10-49-5500

SHEET NO.

XXXX	TEMPERATURE	TIME
ANNEAL		
NORM		
HARDEN	1550°F	1 hr
QUENCH	Oil	
DRAW	300° F	1 hr
GAUGE	0.506	0.506
PROJ.	Cal.50APM2	20MMHE
GUN	299	850003
RANGE	1	1
OBL.	0	20
RC	2184	2740
LC	2112	—
HI	2106 VPSO	2737
LIMIT	2109 2155	>2737
RESULT	Failed	Passed

YP

TS

EL PLATE

RA SIZE

WEIGHT

Back

C .20-.24 DATE 5 March 1951

Mn .45-.52 MFR. Lithium Co.

S .025 Max CONTR.

P .025 Max TYPE F.H.

Si .20-.30 SPECS. JAN-A-784

Ni 3.30-3.70 PLATE 35=A

Cr GROUP

Mo .35-.45 HEAT 77

BHN

STEEL T-2015-1 T6264

RD.	BULLET	CHARGE	STR. VEL.	OBL.	YAW	PENET	BULLET	CONDITION OF PLATE
1	Cal.50M2	11.6	2150	0	0	I	FOP	MB
2	"	11.8	2180	0	0	C	NR	3/8"x1/2"C PUN
3	"	11.8	2180	0	0	C	NR	1/2"C PUN
4	"	11.7	2182	0	0	C	NR	1/2"C PUN
5	"	11.6	2155	0	0	I	FOP	MB
6	"	11.6	2145	0	0	I	FOP	PUN S 1/16"
7	"	11.6	2147	0	0	I	FOP	MB
8	"	11.7	2147	0	0	C	NR	3/8"x1/2"C PUN
9	"	11.8	2203	0	0	C	NR	1/2"C PUN
10	"	11.5	2126	0	0	C	NR	3/8"x1/2"C PUN
11	"	11.4	2112	0	0	C	NR	1/2"C PUN
12	"	11.2	2067	0	0	I	FOP	MB
13	"	11.2	2083	0	0	I	FOP	MB
14	"	11.2	2106	0	0	I	FOP	MB
15	20MMHE	435	2737	20	—	I	HO	MB

LIGHT ARMOR FIRING RECORD

PRNC-RTG-59

SHEET NO.

X X X X X	TEMPERATURE	TIME			
ANNEAL			TP		
NORM			TS		
HARDEN	1550°F	1 hr.	EL	PLATE	
QUENCH	Oil		RA	SIZE	
DRAW	300°F	1 hr.		WEIGHT	

Back

GAUGE	0.516	C	.20-.24	DATE	5 March 1951
PROJ.	Cal. 50 APM2	Mn	.45-.52	MFR.	Lithium Co.
GUN	599	S	.025 Max	CONTR.	
RANGE	1	P	.025 Max	TYPE	E. H.
OBL.	0	Si	.20-.30	SPECS.	JAN-A-784
RC	2199	Ni	3.30-3.70	PLATE	35B
LC	2174	Cr		GROUP	
HI	2171 VP50	Mo	.35-.45	HEAT	77
LIMIT	2173 2178			BHN	
RESULT	Failed			STEEL	T3015-1 T62-64

RD.	BULLET	CHARGE	STR. VEL.	OBL.	YAW	PENET.	BULLET	CONDITION OF PLATE
1	Cal. 50 M2	11.5	2118	0	0	I	FOP	SB
2	"	11.8	2192	0	0	I	FOP	PUNS 1/8"
3	"	11.8	2235	0	0	I	FOP	PUNS 1/8"
4	"	11.8	2185	0	0	I	FOP	PUNS 3/16
5	"	11.8	2192	0	0	C	NR	7/16" C PUN
6	"	11.7	2171	0	0	I	FOP	MB
7	"	11.9	2139	0	0	I	FOP	SB
8	"	12.0	2242	0	0	C	NR	1/2" C PUN
9	"	12.0	2213	0	0	C	NR	1/2" C PUN
10	"	12.0	2235	0	0	C	NR	1/2" C PUN
11	"	11.8	2195	0	0	C	NR	1/2" C PUN
12	"	11.7	2174	0	0	C	NR	1/2" C PUN
13	"	11.6	2132	0	0	I	FOP	SB
14	"	11.6	2161	0	0	I	FOP	SB

LIGHT ARMOR FIRING RECORD

PRNC-WPG-59

SHEET NO.

	TEMPERATURE	TIME
ANNEAL		
NORM		
HARDEN	1550° F	1 Hr.
QUENCH	Oil	
DRAW	300° F	1 Hr.
GAUGE	0.522	
PROJ.	Cal. .30 AP M2	
GUN	24"	
RANGE	1	
OBL.	0	
RC	2208	
LC	2245	
HI	2238 VP 30	
LIMIT	2242 2247	
RESULT	Passed	

YP

TS

EL

RA

PLATE

SIZE

WEIGHT

Bulk

C .20-.24 DATE 5 March 1951

Mn .45-.52 MFR. Lithium Co.

S .025 MAX CONTR.

P .025 MAX TYPE F. H.

Si .20-.30 SPECS. JAN-A-784

Ni 3.30-3.70 PLATE 36A

Cr GROUP

Mo .35-.45 HEAT 78

BHN

STEEL T-3013-1 T6264

RD.	BULLET	CHARGE	STR. VEL.	OBL.	YAW	PENET	BULLET	CONDITION OF PLATE
1	Cal .30 AP M2	11.4	2103	0	0	I	FOP	SB
2	"	11.6	2174	0	0	I	FOP	PUNS 1/64
3	"	11.7	2151	0	0	I	FOP	VSB
4	"	11.8	2185	0	0	I	FOP	VSB
5	"	11.8	2151	0	0	I	FOP	SB
6	"	12.0	2216	0	0	I	FOP	SB
7	"	12.2	2277	0	0	C	NR	3/8" C PUN
8	"	12.2	2279	0	0	C	NR	1/2" C PUN
9	"	12.1	2263	0	0	C	NR	1/2" C PUN
10	"	12.0	2179	0	0	I	FOP	SB
11	"	12.0	2137	0	0	I	FOP	VSB
12	"	12.1	2245	0	0	C	NR	1/2" C PUN
13	"	12.1	2238	0	0	I	FOP	MB
14	"	12.1	2281	0	0	C	NR	1/2" C PUN

PRNC-1-10-49-5000

LIGHT ARMOR FIRING RECORD

SHEET NO.

X X X X X	TEMPERATURE	TIME			
ANNEAL			YP		
NORM			TS		
HARDEN	1550°F	1 Hr.	EL	PLATE	
QUENCH	Oil		RA	SIZE	
DRAW	300°F	1 Hr.		WEIGHT	
			BALE		
GAUGE	0.520	0.520	C .20-.24	DATE	5 March 1951
PROJ.	Cal.50APM2	20MMHE	Mn .45-.52	MFR.	LITHIUM CO.
GUN	299	550003	S .025 MAX	CONTR.	
RANGE	1	1	P .025 MAX	TYPE	F.H.
OBL.	0	20	Si .20-.30	SPECS.	JAN-A-784
RC	2205	2740	Ni 3.30-3.70	PLATE	76B
LC	2197	—	Cr	GROUP	
HI	2197 VPS0	2742	Mo .35-.45	HEAT	78
LIMIT	2197 2314	>2742		BHN	
RESULT	Failed	Passed		STEEL	T2015-1 T6204

RD.	BULLET	CHARGE	STR. VEL.	OBL.	YAW	PENET	BULLET	CONDITION OF PLATE
1	Cal.50M2	11.6	2114	0	0	I	FOP	VSB
2	"	11.8	2199	0	0	C	NR	1/2" C PUN
3	"	11.8	2145	0	0	I	FOP	MB
4	"	11.8	2192	0	0	I	FOP	MB
5	"	11.8	2182	0	0	I	FOP	MB
6	"	11.8	2194	0	0	I	FOP	MB
7	"	11.9	2203	0	0	I	FOP	MB
8	"	12.0	2237	0	0	C	NR	3/8" X 1/2" C PUN
9	"	12.0	2208	0	0	I	FOP	MB
10	"	12.0	2227	0	0	I	FOP	MB
11	"	12.1	2230	0	0	I	FOP	MB
12	"	12.2	2275	0	0	I	FOP	MB
13	"	12.3	2284	0	0	I	FOP	MB
14	"	12.4	2313	0	0	I	FOP	MB
15	"	12.6	2362	0	0	I	FOP	MB
16	"	12.9	2405	0	0	C	NR	1/2" C PUN
17	"	12.8	2397	0	0	C	NR	1/2" C PUN
18	20MMHE	435	2742	20	—	I	HO	MB

LIGHT ARMOR FIRING RECORD
PRNC-BPG-59

SHEET NO. 7

XXXXX	TEMPERATURE	TIME
ANNEAL		
NORM		
HARDEN	1550° F	1 hr
QUENCH	Oil	
DRAW	500° F	1 hr
GAUGE	0.510	
PROJ.	Cal .50 AP M2	
GUN	299	
RANGE	1	
OBL.	0	
RC	2190	
LC	2161	
HI	2140 VPSN	
LIMIT	2151 2200	
RESULT	Failed	

YP
TS
EL
RA

PLATE
SIZE
WEIGHT

Back

C .20-.24
Mn .45-.52
S .025 MAX
P .025 MAX
Si .20-.30
Ni 3.30-3.70
Cr
Mo .35-.45

DATE 3 March 1951
MFR. Lithium Co.
CONTR.
TYPE F. H.
SPECS. JAN-A-784
PLATE 37A
GROUP
HEAT 78
BHN
STEEL T-9015-1 T-6264

RD.	BULLET	CHARGE	STR. VEL.	OBL.	YAW	PENET	BULLET	CONDITION OF PLATE
1	Cal. 50M2	11.5	2127	0	0	I	FOP	VSB
2	"	11.8	2203	0	0	I	FOP	SB
3	"	11.8	2201	0	0	I	FOP	SB
4	"	11.8	2208	0	0	C	NR	1/2" C PUN
5	"	11.7	2182	0	0	C	NR	1/2" C PUN
6	"	11.7	2171	0	0	I	FOP	SB
7	"	11.6	2085	0	0	I	FOP	VSB
8	"	11.6	2169	0	0	I	FOP	SB
9	"	12.0	2235	0	0	I	FOP	SB
10	"	12.2	2268	0	0	C	NR	1/2" C PUN
11	"	12.1	2283	0	0	C	FCIP	3/8" PUN out
12	"	12.0	2225	0	0	C	NR	1/2" C PUN
13	"	11.9	2250	0	0	C	NR	3/8" C PUN
14	"	11.7	2161	0	0	C	NR	3/8" C PUN
15	"	11.5	2124	0	0	I	FOP	SB
16	"	11.5	2140	0	0	I	FOP	SB

LIGHT ARMOR FIRING RECORD

PRNC-WPG-59

SHEET NO.

XXXXX	TEMPERATURE	TIME
ANNEAL		
NORM		
HARDEN	1550°F	1 Hr.
QUENCH	Oil	
DRAW	300°F	1 Hr.
GAUGE	0.521	0.521
PROJ.	Cal.50 APM2	20MM HE
GUN	299	850003
RANGE	1	1
OBL.	0	20
RC	2207	2740
LC	2254	
HI	2245 V150	2725
LIMIT	2250 220	>2725
RESULT	Passed	Passed

YP			
TS			
EL	PLATE		
RA	SIZE		
	WEIGHT		

Back

C	.20-.24	DATE	2 March 1957
Mn	.45-.52	MFR.	Lithium Co.
S	.025 max	CONTR.	
P	.025 max	TYPE	F H
Si	.20-.30	SPECS.	JAN-A-184
Ni	3.30-3.70	PLATE	3/8
Cr		GROUP	
Mo	.35-.45	HEAT	78
		BHN	
		STEEL	T-3015-1 T6364

RD.	BULLET	CHARGE	STR. VEL.	OBL.	YAW	PENET	BULLET	CONDITION OF PLATE
1	Cal.50 M2	11.5	2127	0	0	I	FOP	SB
2	"	11.8	2111	0	0	I	FOP	SB
3	"	11.8	2175	0	0	I	FOP	SB
4	"	11.9	2221	0	0	I	FOP	SB
5	"	11.8	2237	0	0	I	FOP	MB
6	"	11.9	2213	0	0	I	FOP	SB
7	"	12.2	2265	0	0	C	FCIP	3/8" PUN Out
8	"	12.2	2245	0	0	I	FOP	MB
9	"	12.3	2306	0	0	C	NR	1/2" C PUN
10	"	12.2	2254	0	0	C	NR	3/8" C PUN
11	"	12.2	2275	0	0	I	FOP	MB
12	"	12.2	2274	0	0	C	NR	1/2" C PUN
13	"	12.3	2283	0	0	C	NR	1/2" C PUN
14	"	12.2	2261	0	0	C	NR	1/2" C PUN
15	20MM HE	435	2725	20	-	I	HO	MB

PRNC-3-10-61

February 1951

[illegible] by the Lithium Catalyst Prod[illegible] by th[illegible]
Caliber .50 [illegible] properties at 0° [illegible] recoil[illegible]
[illegible] tracks are typical of all [illegible] m.

Figure 101

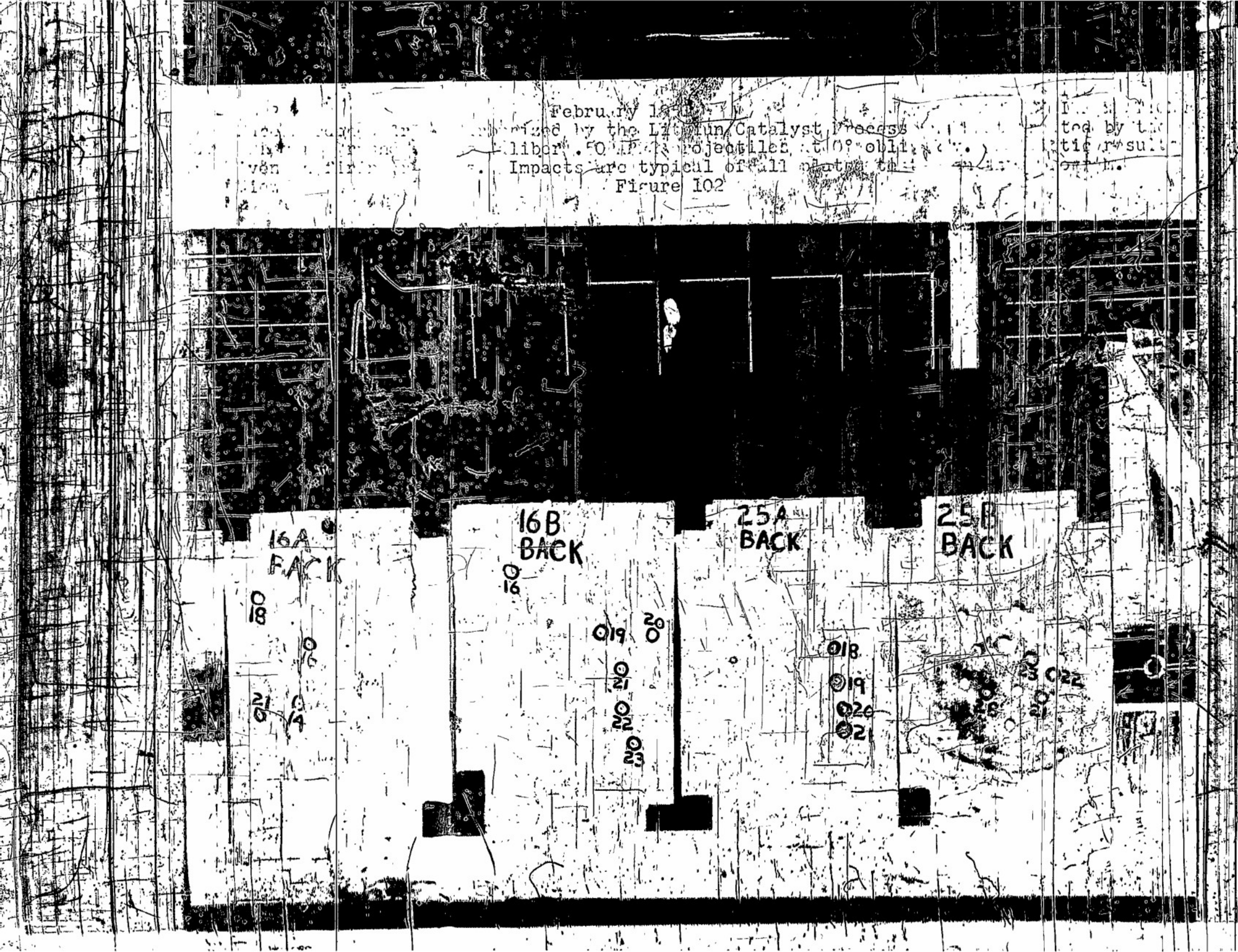

Figure 102

CONFIDENTIAL [illegible] REPORT No. [illegible]

Armor Carburized by the [illegible] Catalyst Furnace

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