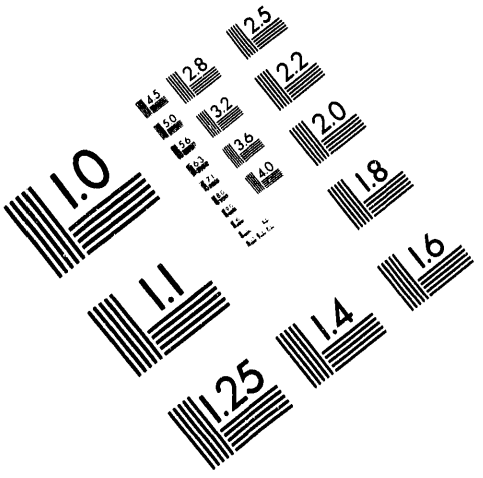
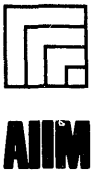




AIIM

Association for Information and Image Management

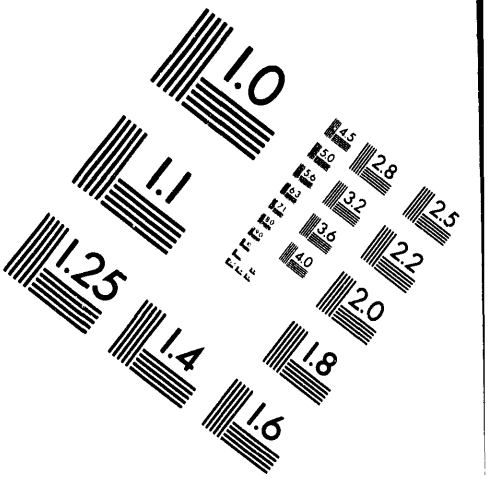
1100 Wayne Avenue, Suite 1100
Silver Spring, Maryland 20910

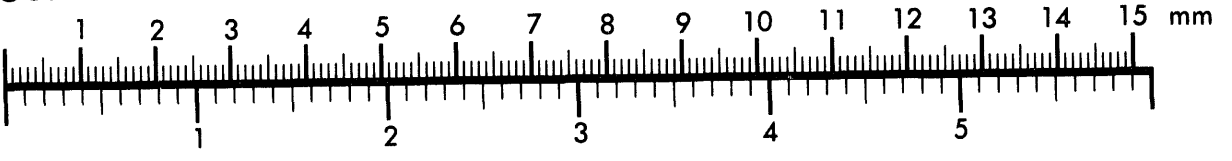
301/587-8202

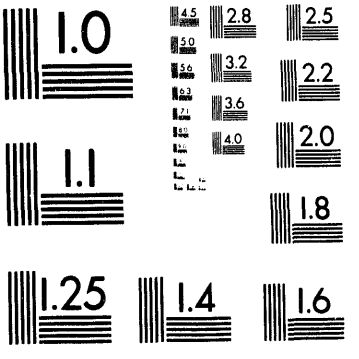
Centimeter

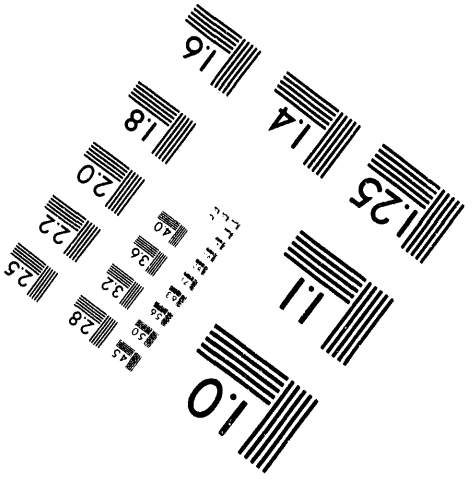
Inches

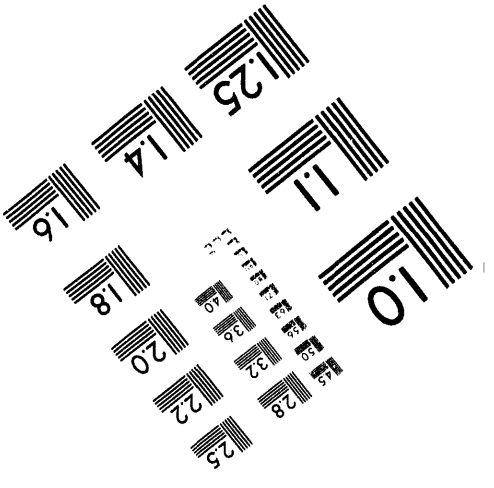
MANUFACTURED TO AIIM STANDARDS
BY APPLIED IMAGE, INC.











1 of 1

[redacted]

[redacted]

(CLASSIFICATION)

[redacted]

[redacted] ENERAL ELECT[redacted] DECLASSIFIED

[redacted]ANFORD ATOMIC PRODUCTS OPERATION - RICHLAND, WASHINGTON

DOCUMENT NO.

HW-76272 RD

SERIES AND COPY NO.

[redacted] 8

DATE

January 21, 1963

[X] [redacted]RICTE[redacted] DATA

THI[redacted]ENT CO[redacted]STRICT[redacted] IN [redacted] ENER[redacted] 1954. [redacted] TRAN[redacted]HE DISC[redacted] OF ITS CONT[redacted] ANY MANNER TO [redacted]UTHORIZED PER[redacted] PROHIBITED.

TITLE

TRANSFORMATION OF RETAINED PHASES IN PLUTONIUM

[ ] OTHER OFFICIAL CLASSIFIED INFORMATION

THIS MATERIAL CONTAINS INFORMATION AFFECTING THE NATIONAL DEFENSE OF THE UNITED STATES WITHIN THE MEANING OF THE ESPIONAGE LAWS, TITLE 18, U.S.C., SECS. 793 AND 794, THE TRANSMISSION OR REVELATION OF WHICH IN ANY MANNER TO AN UNAUTHORIZED PERSON IS PROHIBITED BY LAW.

AUTHOR

R. D. NELSON

ISSUING FILE

[illegible] AREA

JAN 24 1963

RETURN TO

THIS DOCUMENT M[redacted]OT BE LEFT UNATTENDED OR WHERE AN UNAUTHORIZ[redacted]N MAY HAVE ACCE[redacted] TO IT. WHEN [redacted]SE, IT MUST BE STORED [redacted]PROVED LOCKE[redacted]ORY WITHIN AN [redacted] GUARDED [redacted] WHILE IT IS YOUR PO[redacted] AND UNTIL YOU [redacted]TAINED A SIGNED [redacted] FROM CLA[redacted] FILES, IT IS YOUR [redacted]BILITY TO KEEP [redacted] ITS CONTENTS WIT[redacted] LIMITS OF [redacted]ROJECT AND FROM AN[redacted]HORIZED PERSON. [redacted]NSMITTAL TO, AND [redacted] AT YOUR PLACE [redacted] RESIDENCE IS PR[redacted]. IT IS NOT TO [redacted]ICATED. IF ADDI[redacted] COPIES ARE REQUIRED, OBTAIN THEM [redacted] RELATED ISSUING F[redacted]L PERSONS READING [redacted]OCUMENT ARE REQUESTED TO SIGN IN THE SPACE PROVIDED BELOW.

ROUTE TO:	PAYROLL NO.	LOCATION	FILES ROUTE DATE	SIGNATURE AND DATE
R. D. Nelson	15172		1-24-63	
R. D. Nelson	15172	2312	3-19-63	
R. D. Nelson	15172	2312		
R. D. Nelson	15172	2312	OCT 25 '63	

[redacted]

DECLASSIFIED [redacted] MASTER

[redacted]

54-3000-340 (3-57) AEC-GE RICHLAND, W[redacted]

[redacted]CRET

(CLASSIFICATION)

[redacted]

[redacted]

[redacted]

DECLASSIFIED

HW-76272 RD

January 21, 1963

DISTRIBUTION

1-3. Declassification Branch ORE
4. Chicago Patent Group - G. H. Lee
5. Patent Branch, Wash. - R. A. Anderson
6. W. A. Snyder
7. I. D. Thomas
8. R. D. Nelson
9. R. W. Stewart
10. 300 Files

Classification Cancelled (Change to
DECLASSI[redacted]
By Authority [redacted]
DB[redacted] 2-1[redacted]3
By [redacted] 3-7-63

Classification Cancelled and Changed To
DECLASSIFIED
By Authority of RM Iten
TCG-WM-1, RFP-3900 3-16-94
By J L Savely 4-1-94
Verified By DK Hanson, 4-15-94

TRANSFORMATION OF RETAINED PHASES

R. D. NELSON

Classification Cancelled (Change to
CONF UN[redacted]
By Authority [redacted]
DB[redacted] 3-[redacted]63
By [redacted] 5-7-63

[redacted]

[redacted] y manner to [redacted]

This document consists of 10 pages, Copy No. 8 of 10 copies. Series A.

Classification Cancelled (Cha[redacted]
SECRET
By Authority [redacted] Carroll,
DB[redacted] 9-2[redacted]
[redacted] Rainer 10-24-[redacted]

[redacted]

DECLASSIFIED

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

DECLASSIFIED

January 21, 1963

TRANSFORMATION OF RETAINED PHASES

The transformation of retained phases of plutonium of different quality has been determined over a period of 10 - 12 months, by observing the density variation with time. These results are shown in Figures 1 - 3. A large density increase of each specimen was observed. The density increase of the low quality metal was the greatest and that of the highest quality metal was the least. The magnitudes of these increases are apparent from the graphs. One of the specimens fractured into two pieces after ten months. Also, surface cracks appeared in two of the other specimens. The fractured surfaces probably originated from the stresses associated with the transformation of retained phases or possibly from stress corrosion. The density increase with time was the same for the as-cast and as-cast and cold treated specimens.

The density variation with time of a series of high density plutonium specimens having had different mechanical and heat treatments have been started. The treatments given the metal were: 1) no treatment, i.e., as-cast; 2) thermally cycled by direct immersion between + 100 C and -80 C; 3) hydrostatic pressing at 90,000 psi at 160 C and cooled 10 minutes under pressure; 4) hydrostatic pressing 15 minutes at 90,000 psi and room temperature; and 5) hydrostatic pressing at 80,000 psi at 130 C and cooling 20 minutes under pressure. The density variation with time of specimens given these treatments are presented in Figures 4 - 8.

The rate of density increase of the high density as-cast specimens, Figure 4, was comparable to that of the specimens shown in Figures 1 - 3. The densities of all the specimens thermally cycled increased, with the exception of the specimen cycled 20 times, Figure 5. The rate of increase of the specimens cycled up to 5 times was comparable to the as-cast metal.

The density increase of the specimens pressed in the alpha phase was slight, Figure 6. The increase from 9 hours to 30 days was less than 0.005 g/cm³. However, the specimens beta pressed exhibited a rate of increase comparable to the as-cast metal, even though the densities were 19.73 g/cm³, Figure 7. This indicated that the pressing time was insufficient or the final temperature after pressing was too high to allow complete transformation. The specimen pressed at the lower temperature of 130 C indicated a slight density decrease of 0.007 g/cm³ after 55 days, Figure 8.

These data on beta pressing show that the pressing conditions need to be more thoroughly evaluated to obtain optimum pressing conditions to insure a minimum amount of retained phases.

R. D. Nelson
Physical Metallurgy
METALLURGY RESEARCH OPERATION

RDN: vls

[redacted]

[redacted]

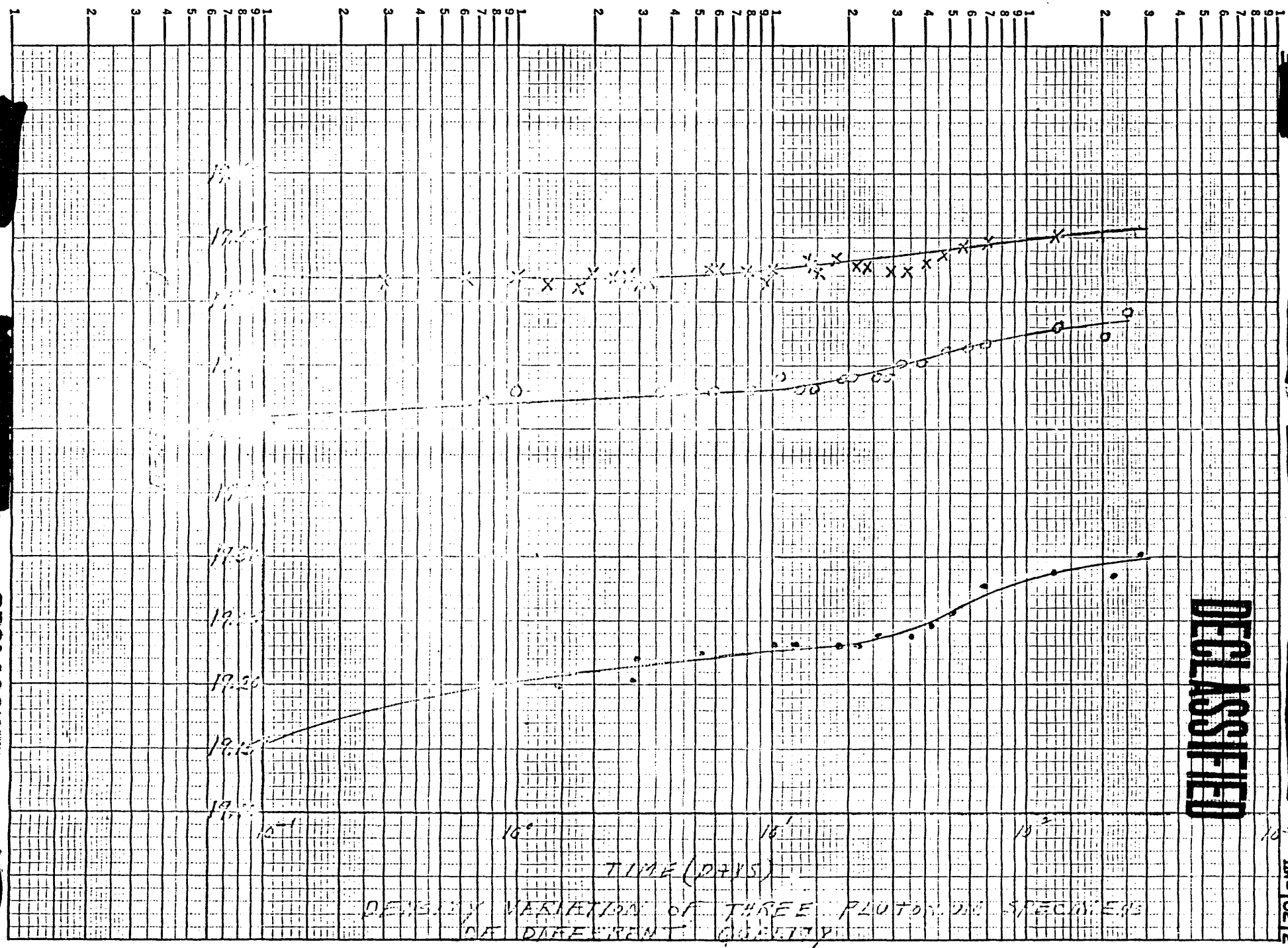
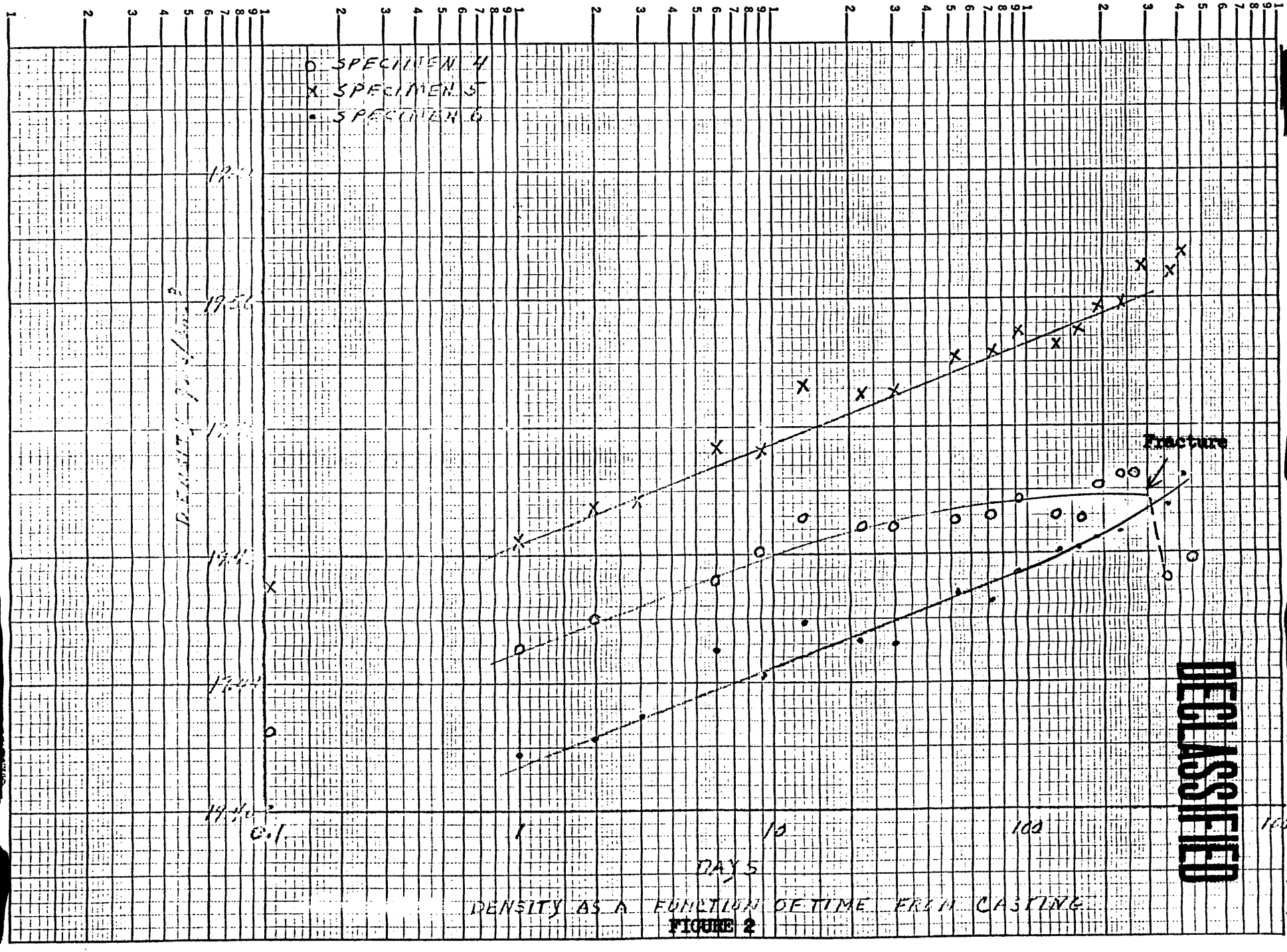


FIGURE 1

DECLASSIFIED

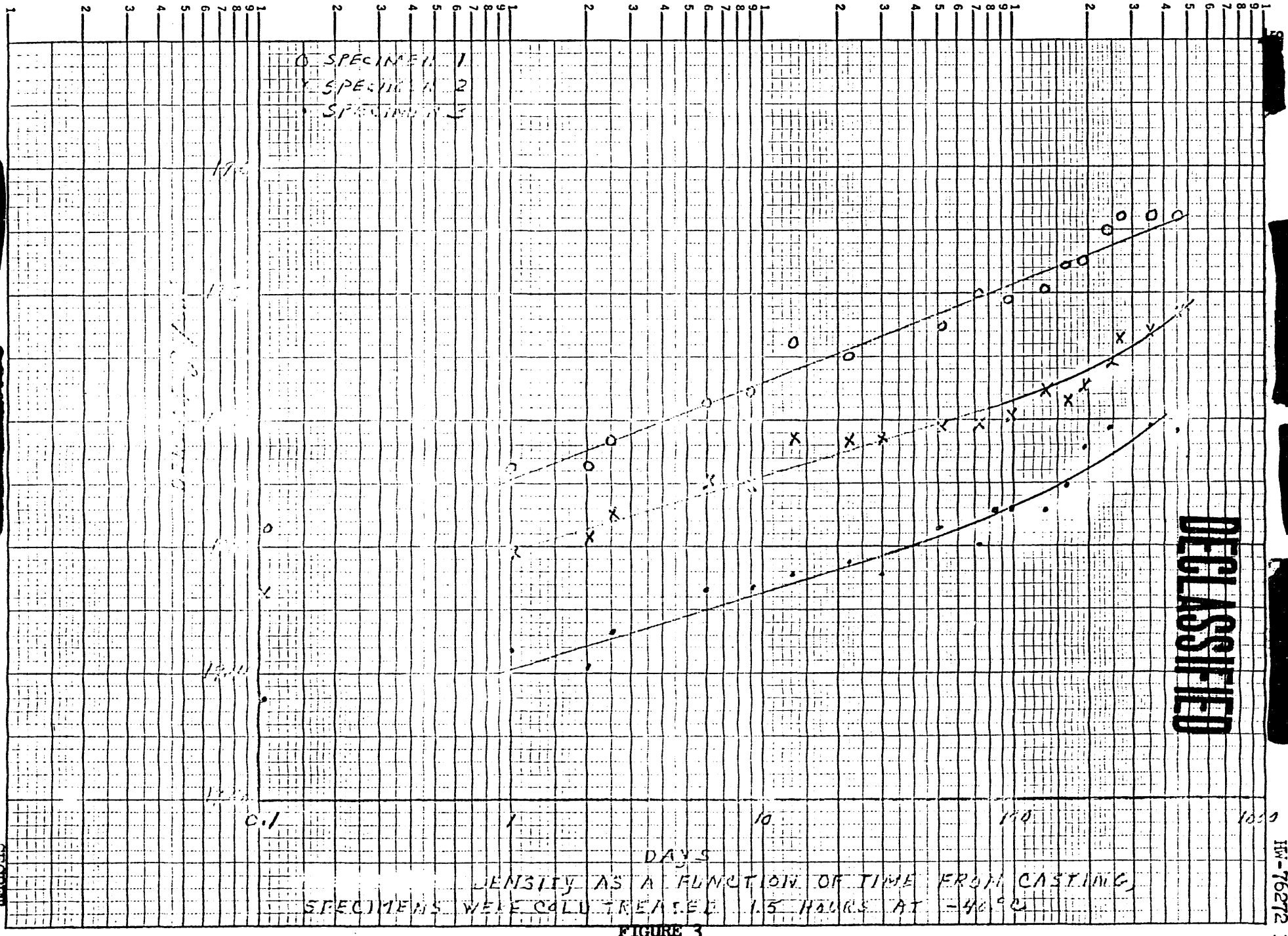
K+E SEMI-LOGARITHMIC 358-91
KEUFFEL & ESSER CO. MADE IN U.S.A.
5 CYCLES X 70 DIVISIONS



DENSITY AS A FUNCTION OF TIME FROM CASTING
FIGURE 2

DECLASSIFIED

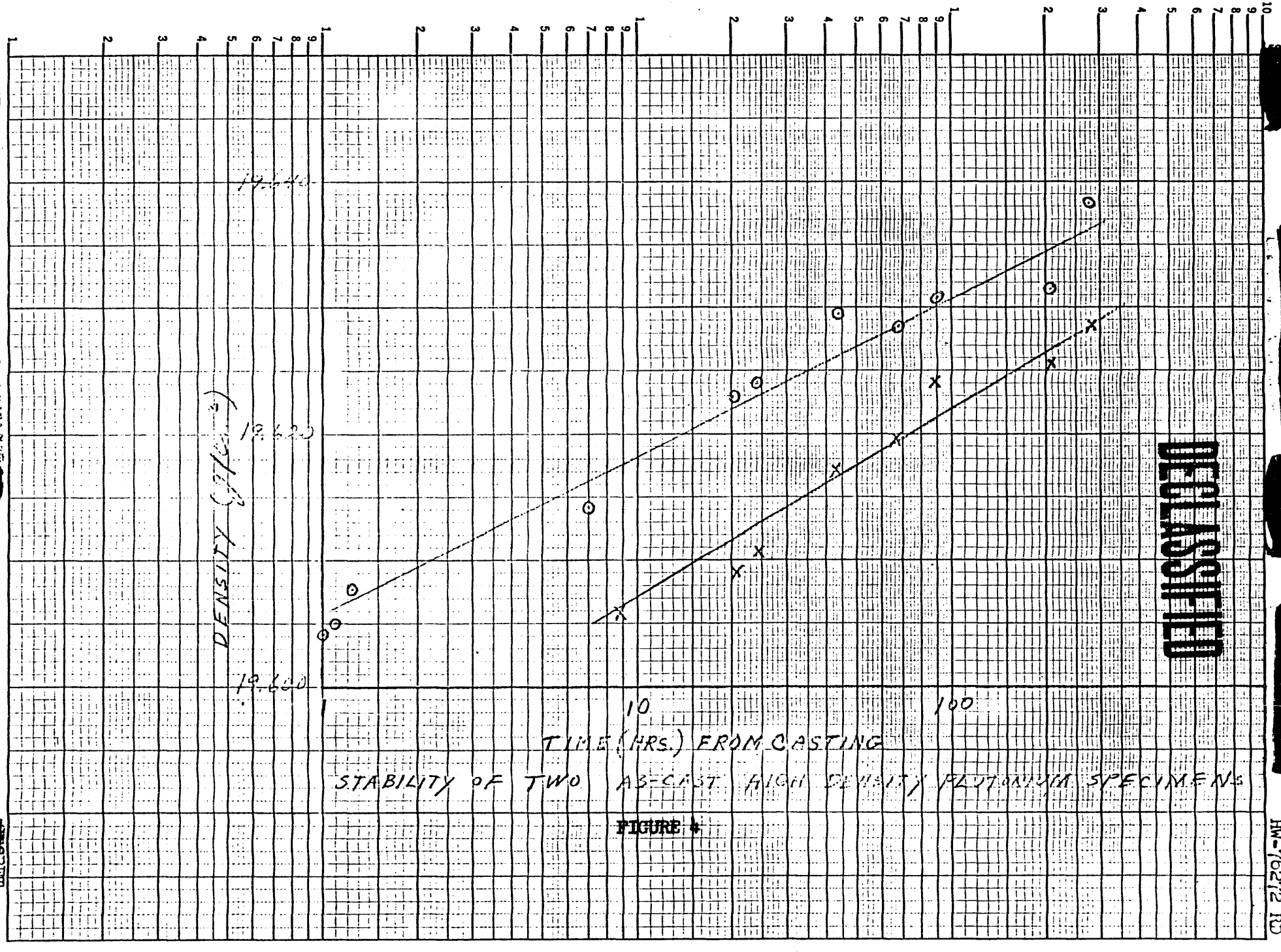
K+E SEMI-LOGARITHMIC 358-91
KEUFFEL & ESSER CO. MADE IN U.S.A.
5 CYCLES X 70 DIVISIONS



DENSITY AS A FUNCTION OF TIME FROM CASTING,
SPECIMENS WERE COLD TREATED 1.5 HOURS AT -40°C

FIGURE 3

DECLASSIFIED

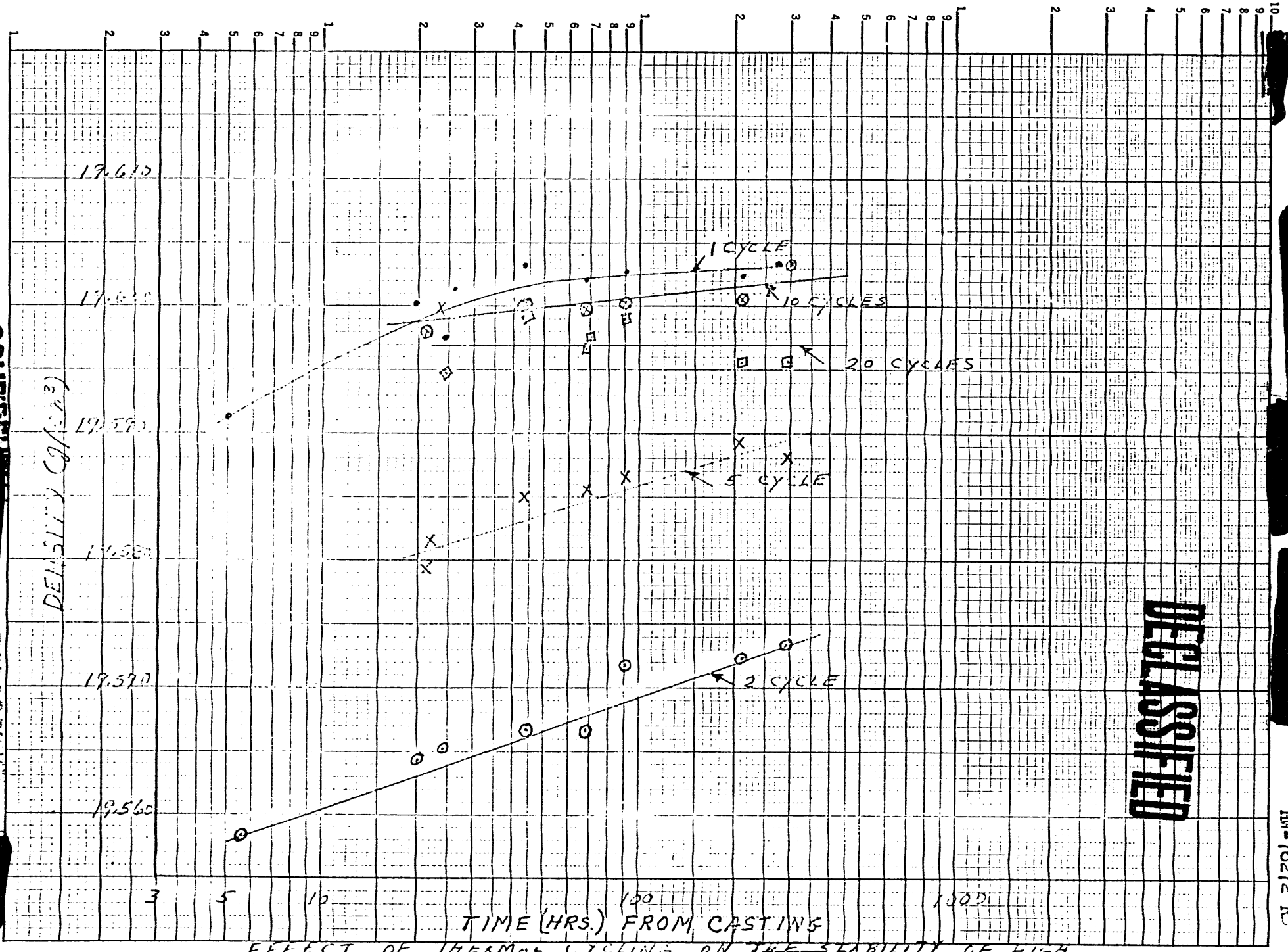


STABILITY OF TWO AS-CAST HIGH DENSITY PLUTONIUM SPECIMENS

FIGURE 4

DECLASSIFIED

K+E SEMI-LOGARITHMIC 358-81
KEUFFEL & ESSER CO. MADE IN U.S.A.
4 CYCLES X 70 DIVISIONS



EFFECT OF THERMAL CYCLING ON THE STABILITY OF HIGH QUALITY ALPHA PLUTONIUM

FIGURE 5

DECLASSIFIED

K+E SEMI-LOGARITHMIC 358-81
KEUFFEL & ESSER CO. MADE IN U.S.A.
4 CYCLES X 70 DIVISIONS

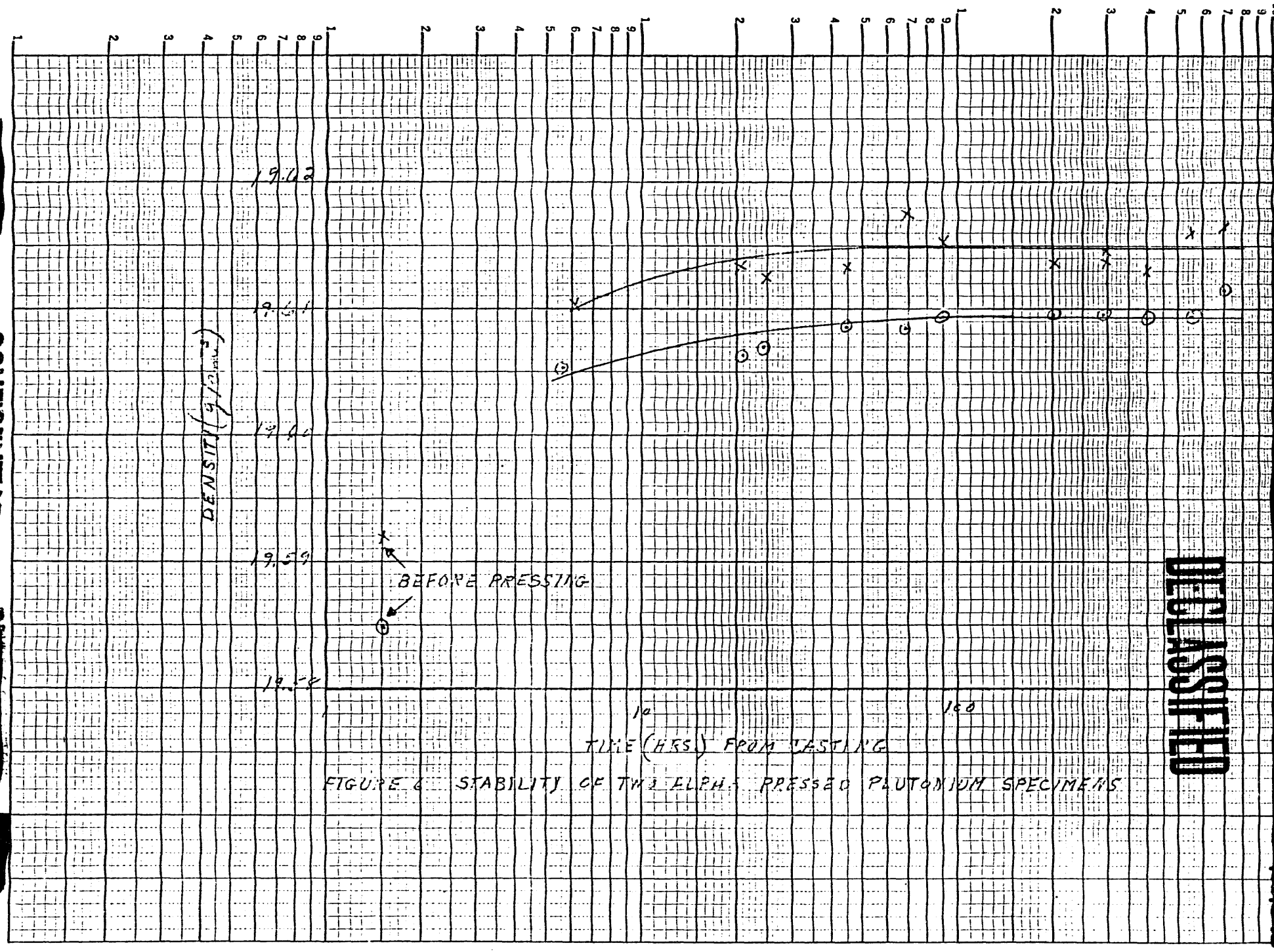
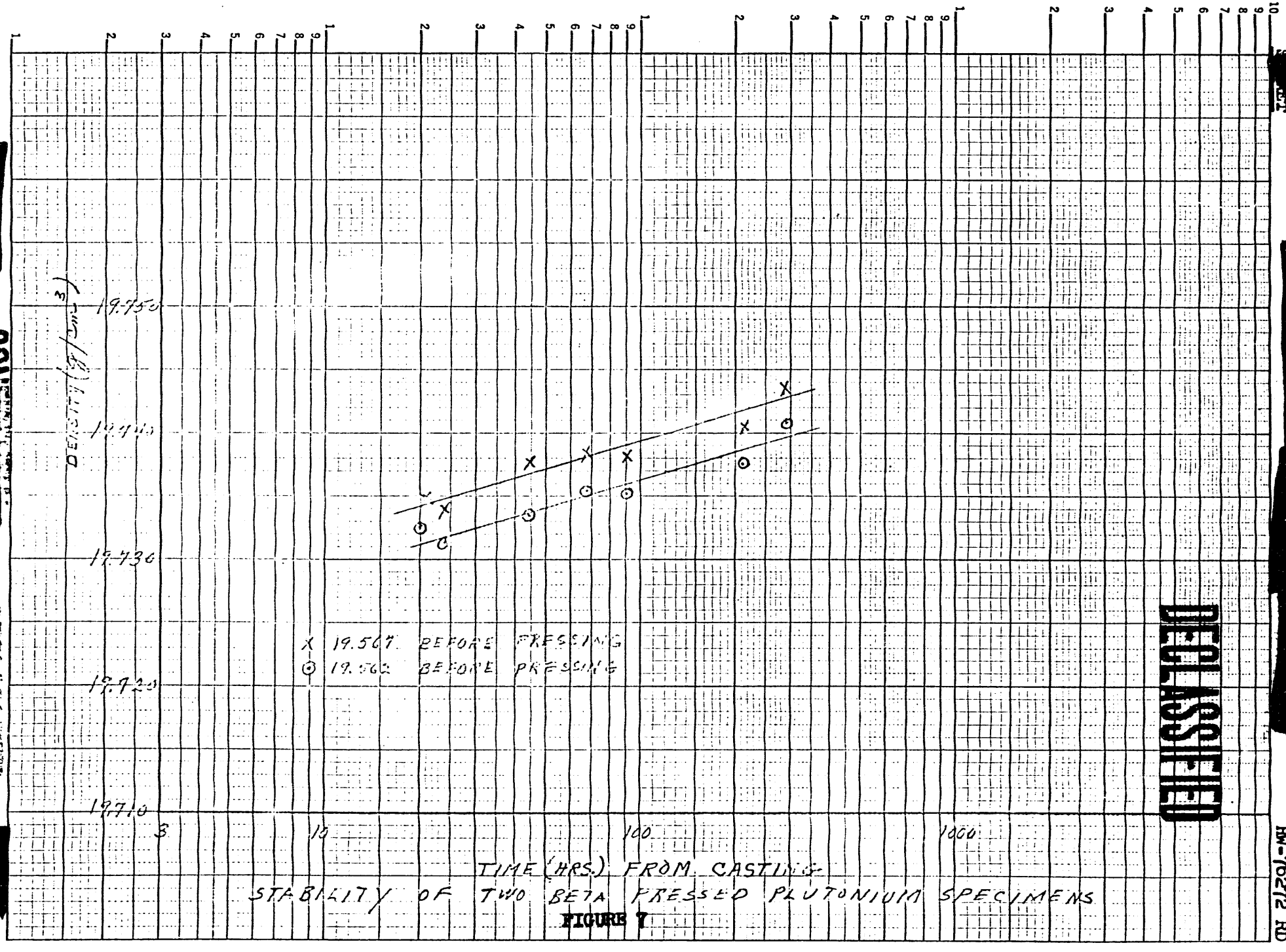


FIGURE 6 STABILITY OF TWO ALPHA PRESSED PLUTONIUM SPECIMENS

DECLASSIFIED

BM-76272 BD

K+E SEMI-LOGARITHMIC 358-81
KEUFFEL & ESSER CO. MADE IN U.S.A.
4 CYCLES X 70 DIVISIONS

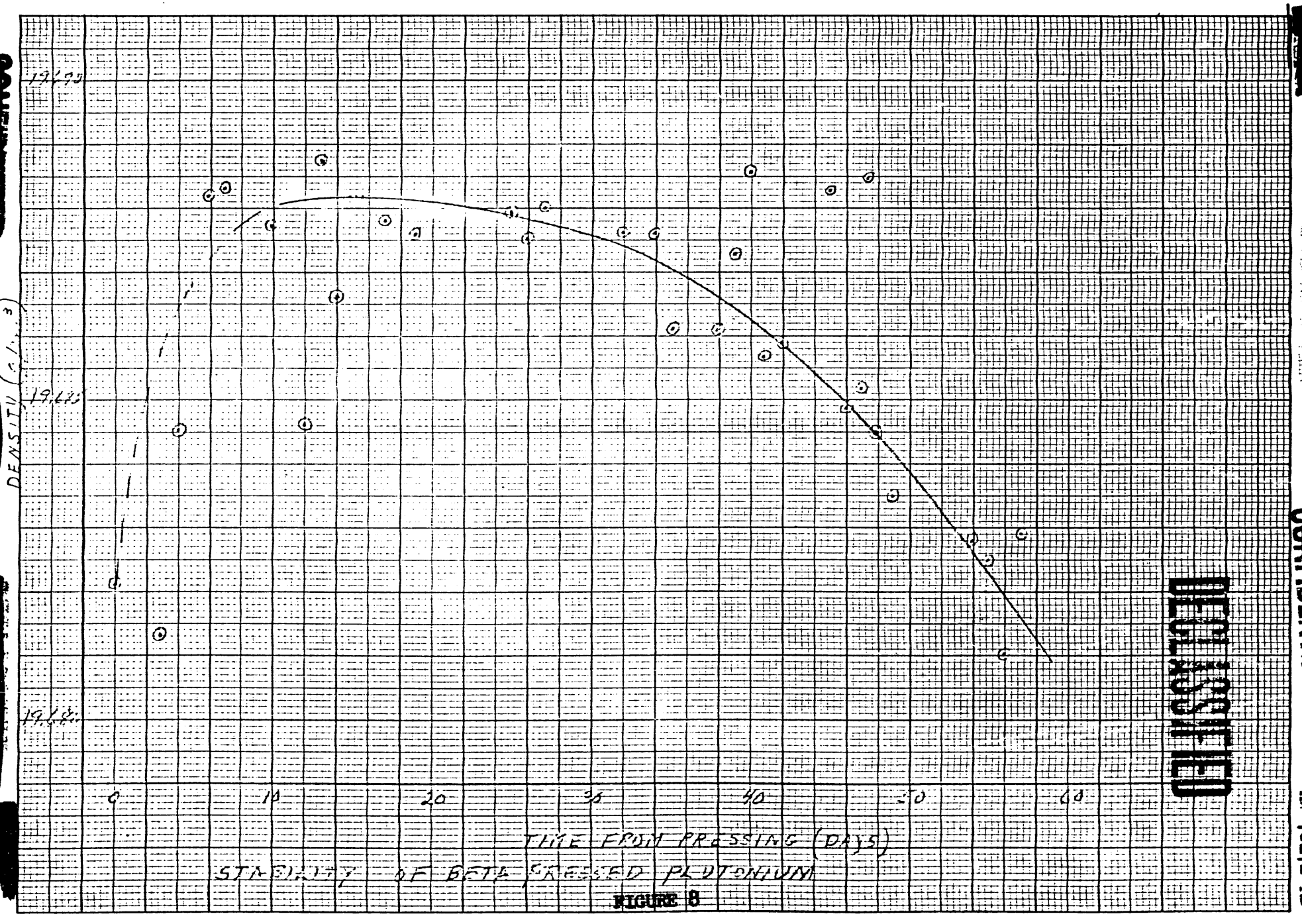


STABILITY OF TWO BETA PRESSED PLUTONIUM SPECIMENS

FIGURE 7

DECLASSIFIED

K+E 10 X 10 TO THE ½ INCH 358-11
KEUFFEL & ESSER CO. MADE IN U.S.A.



STABILITY OF BETA PRESSED PLUTONIUM

FIGURE 8

DECLASSIFIED

DATE
FILMED
8/9/94

END