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AD-A953 739

MOVES OF BILITIDE WATERS PRESENT IN THE DOCK WORKING

OF HOLLOW STAIN CYLINDERS

Dr. J. D. G. G. G.
Dept. of Geology
Univ. of Toronto

under direction of Dr. J. D. G. G.

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This is a collection of curves of the successive dilations with pressure at various points in hollow steel cylinders of various dimensions, wall ratios, and heat treatments. These constitute the original experimental data upon which are based the practical calculations involved in the cold working or autofrettage of cannon at Watertown and Watervliet Arsenals.

They were prepared about 1925 by Mr. (now Colonel) J. C. Solberg, Capt. (now Brig.Gen.) Donald Armstrong, and Capt. Thomas Conrad, under the direction of Dr. F. C. Langenberg. Original experimental data and calculations are contained in WAL Reports Nos. 217, 220, 223, 224, 228, and 251.

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The attached curves were photographed from the original plots of data observed in the development phases of the Cold Work Process as used at Watertown and Watervliet Arsenals. The photographs were made to preserve the work which was recorded on a heavy graph paper that was embrittled with age and becoming much the worse for wear.

A few of the curves contained herein were published and the highlights of these tests were made available in other reports that exist in the Laboratory files. It was felt desirable to preserve the details of the tests so that needless repetitive work would be avoided.

The original data from which these graphs were made is tabulated in ink on linen cloth in the Engineering files. The drawing numbers of the tabulations are noted in the photographs.

D. H. NEWHALL
Captain, Ord. Dept.

Watertown Arsenal
Watertown, Massachusetts
14 June 1944

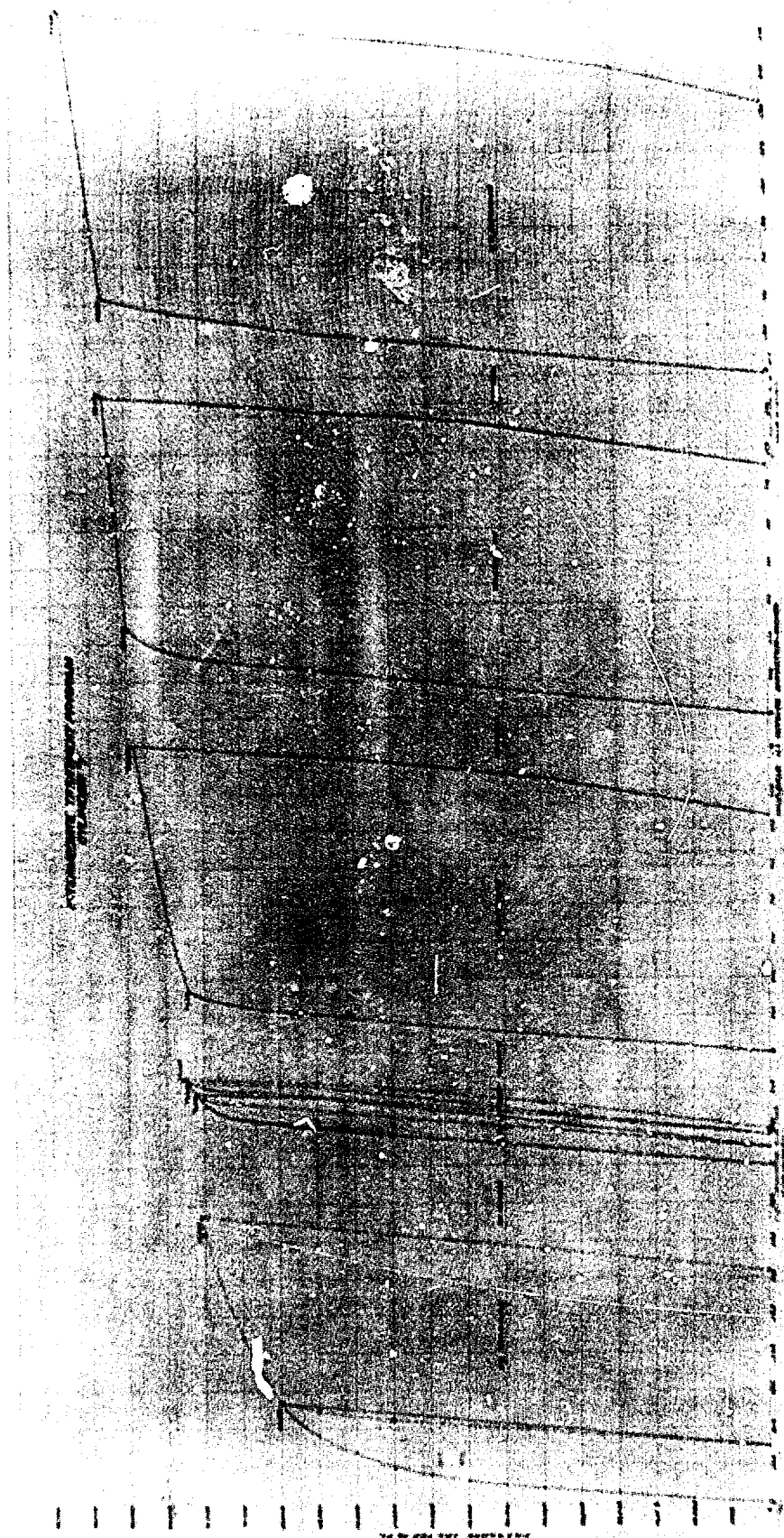
SUCCESSIVE DILATATIONS
 3x9 HOLLOW CYLINDER
 AT POINT C₁

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EXP. REPORT 251

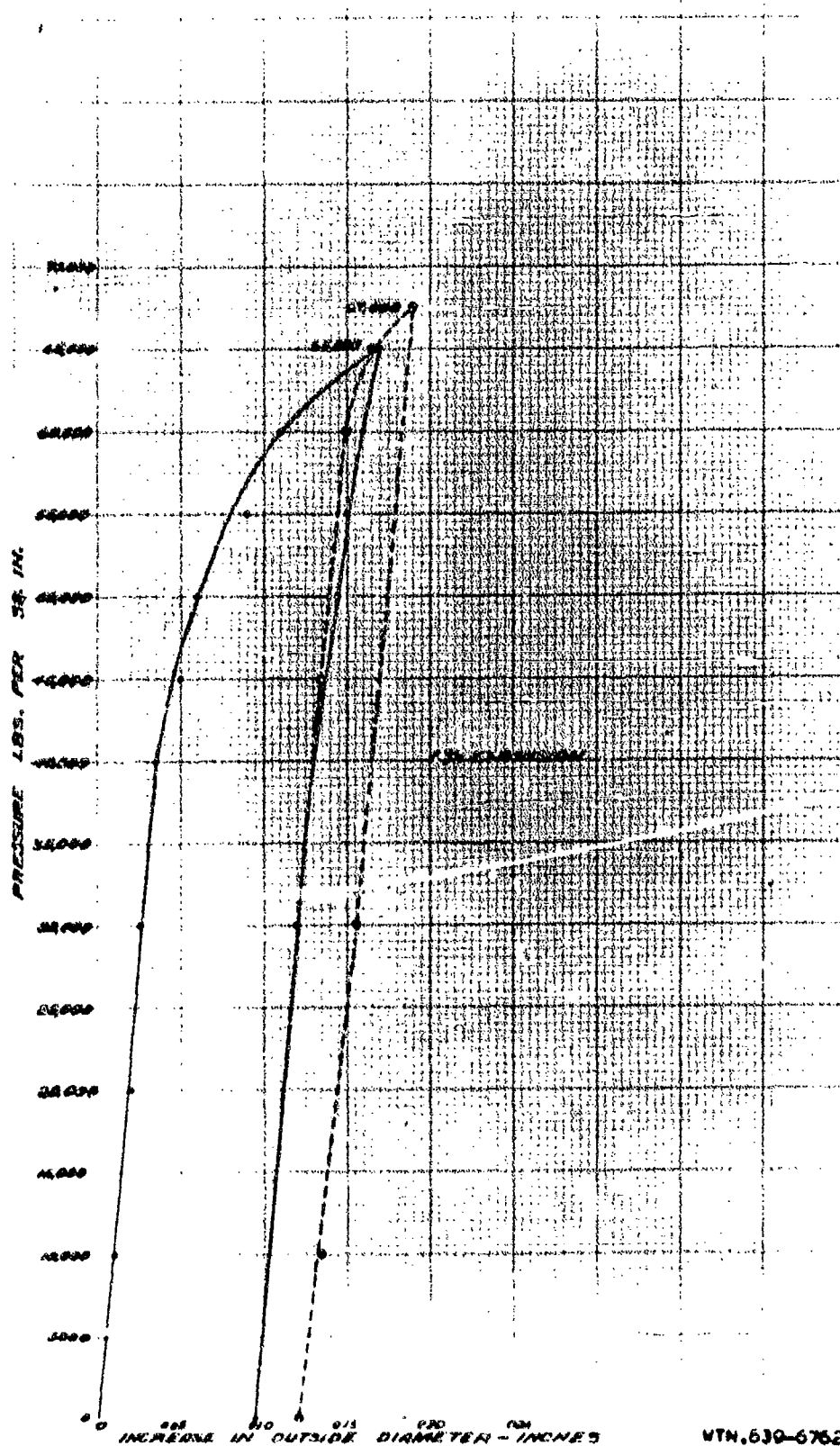
WTN.630-6760

22

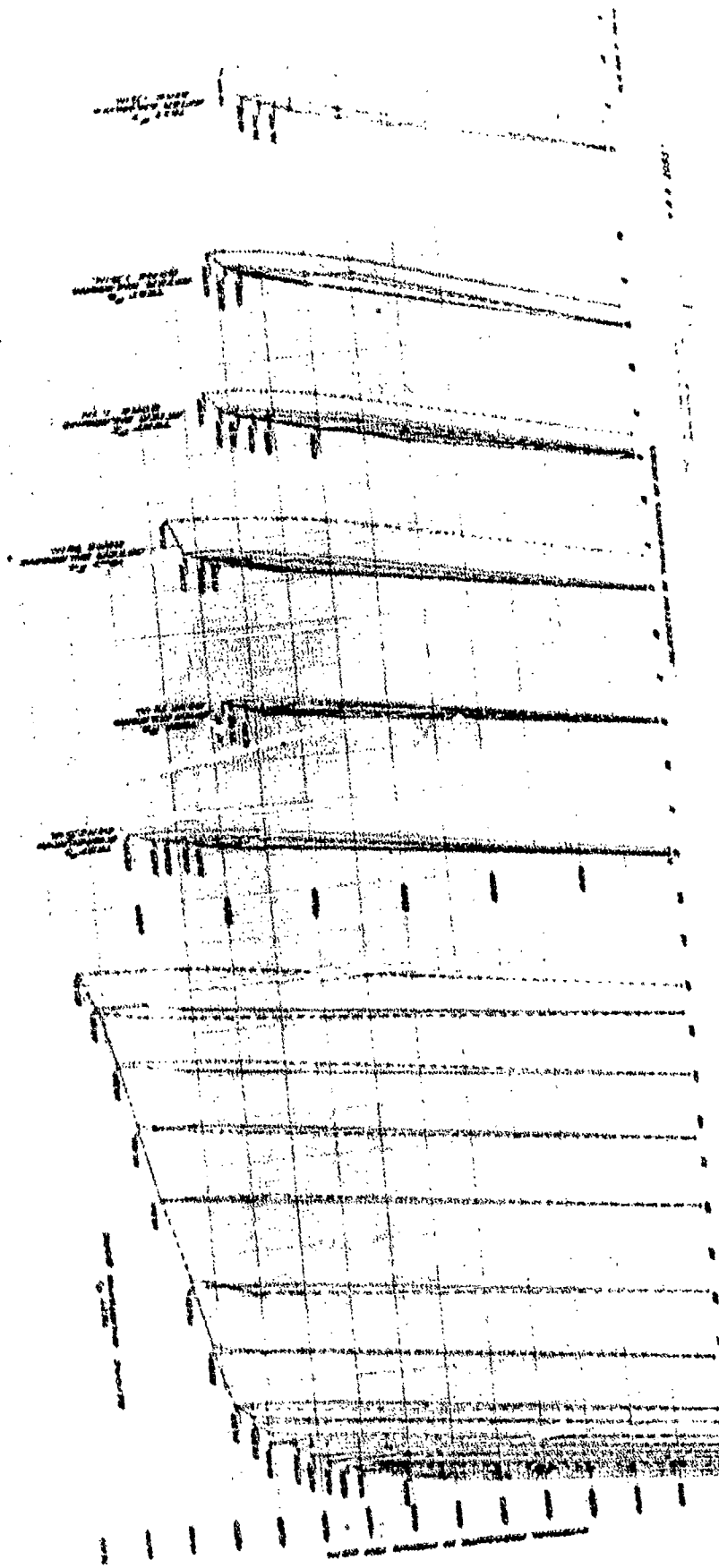


VTN.639-6765

INTERMITTENT TREATMENT PROGRAM
CYLINDER #2



14

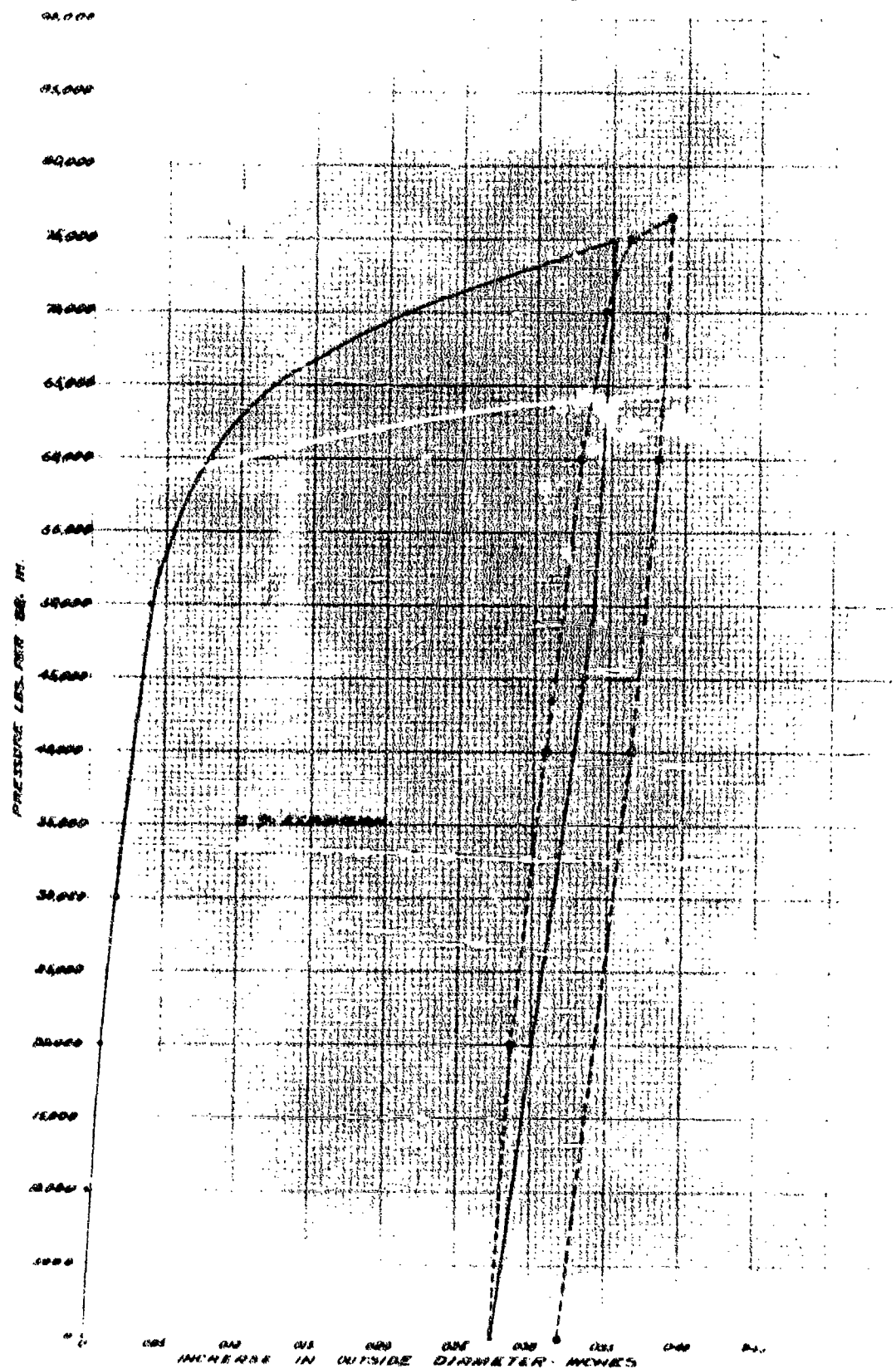


SUCCESSIVE CALCULATIONS
3-9 MELLUM COLUMBIA
AT POINT C

1941.10.10

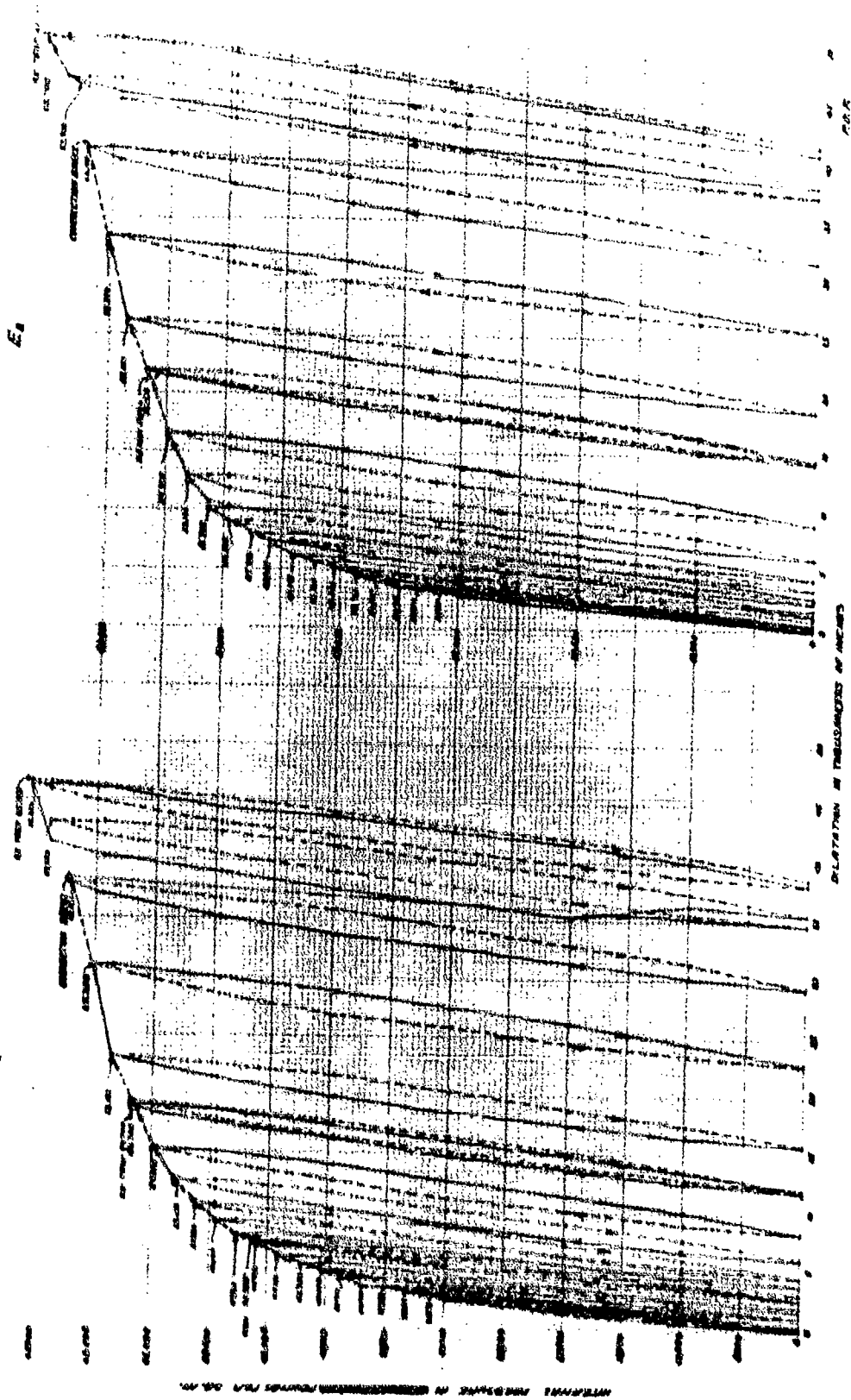
INTERMEDIATE TREATMENT PROGRAM CYLINDER #3

6/24



WTN.630-6773

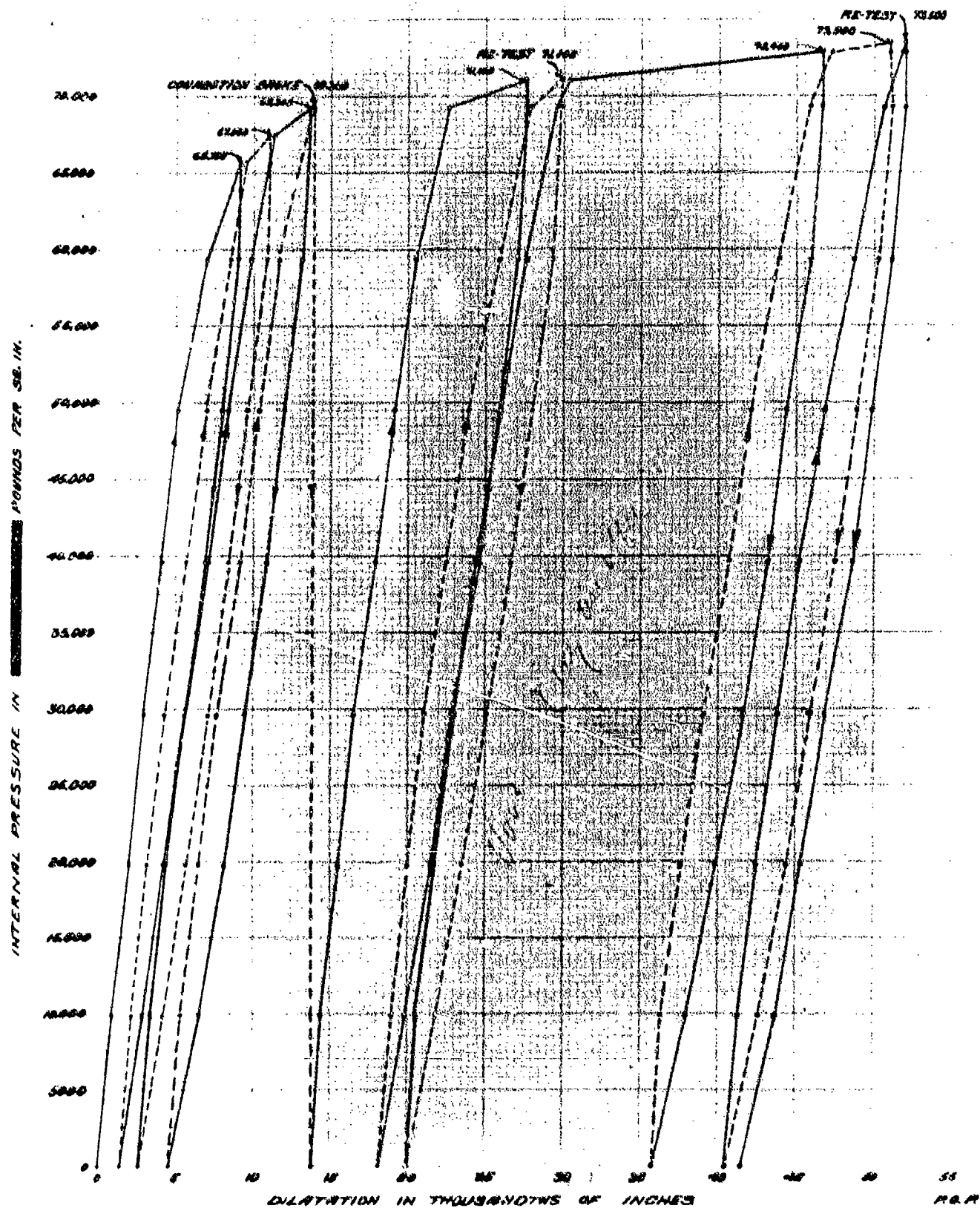
CRANDALL TEST 5
 SUCCESSIVE σ_c DILATATIONS
 3x7.5 HOLLOW CYLINDER
 AT POINT $C_3 - E_3$
 DILATATIONS ON 100-100-100-100-100-100



90L-639-6706

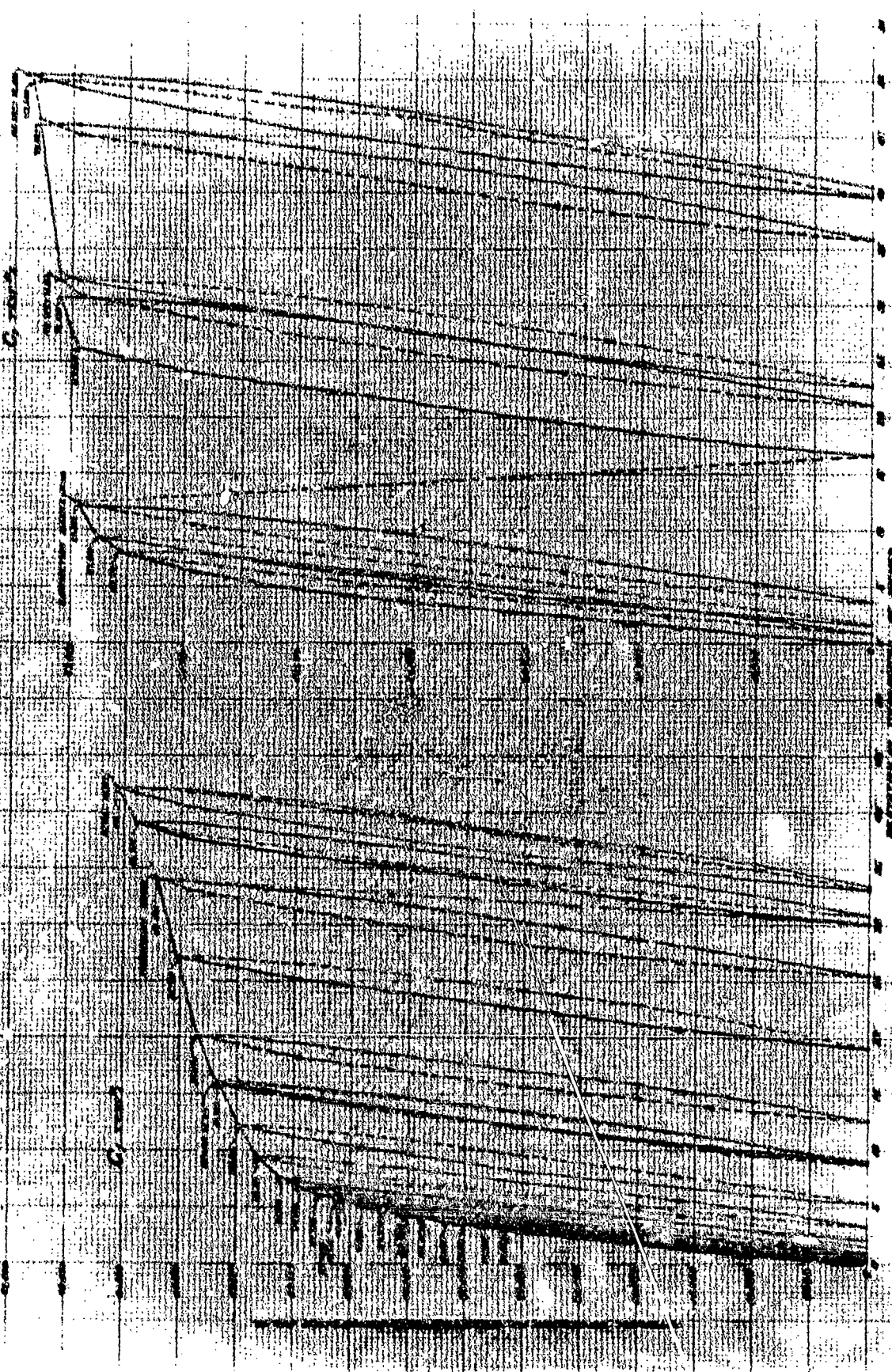
18

CYLINDER #3-TEST #2
 SUCCESSIVE DILATATIONS
 OF
 3x7.5 HOLLOW CYLINDER
 AT POINT D₂
 TABULATION ON DR. NO. A-20635-B



(2)

SUCCESSIVE PLANTATIONS
3.7: HOLLOW CINDER
AT POINT C



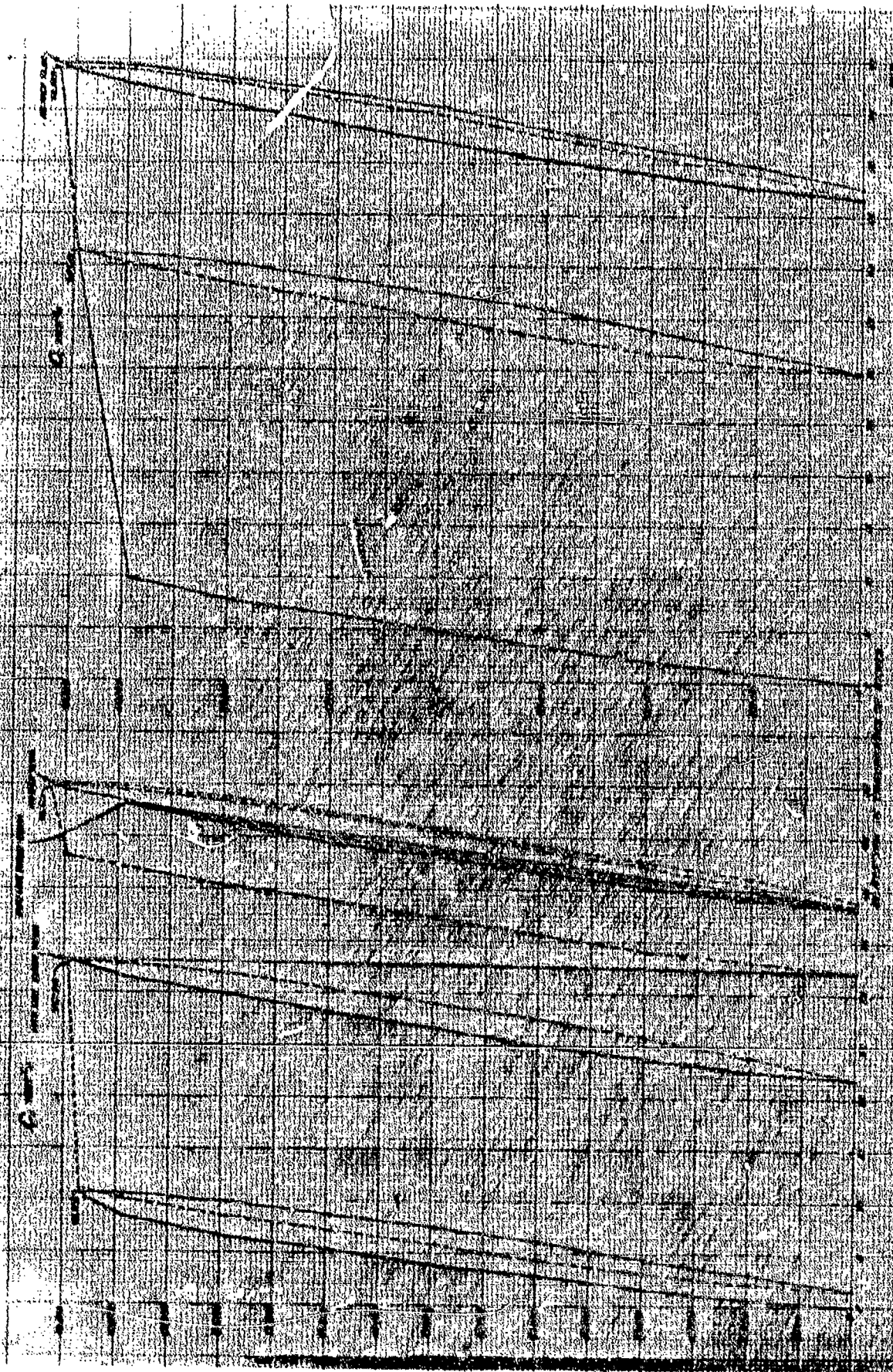
VTN.639-6742

2
THE PRESIDENT OF THE UNITED STATES
WASHINGTON, D. C. 20540



8

STANDARD MOTOR OIL'S
SUCCESSFUL OPERATIONS
ON LOW CYLINDER

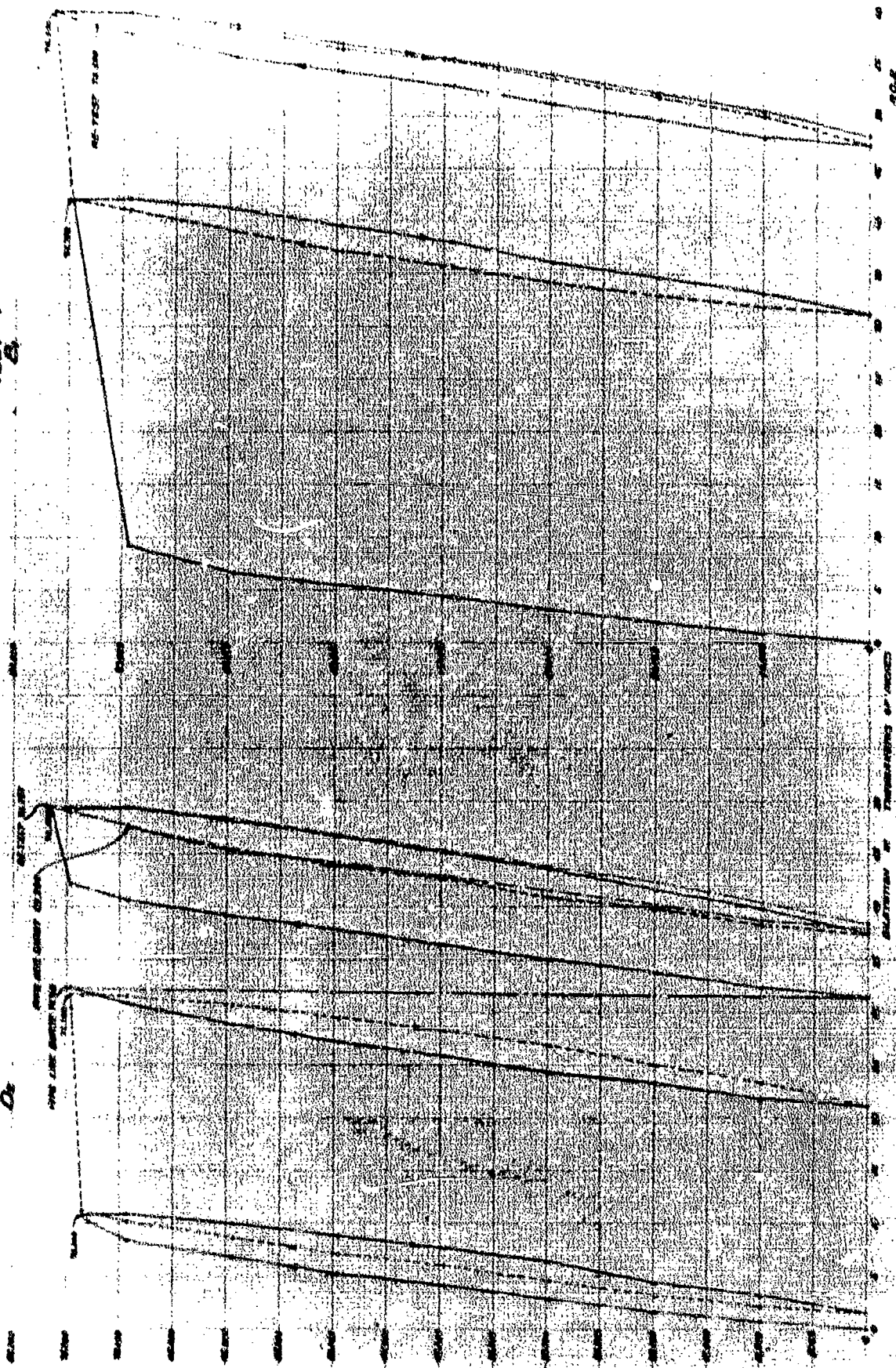


WM. 632-6737

CHURCH & DWIGHT
SUCCESSIVE DILATATIONS
3 x 7.5 HOLLOW CYLINDER
AT POINTS B₁ AND D₁
TEMPERATURE 600 °C. - 600 °C.

TEST #3
D₁

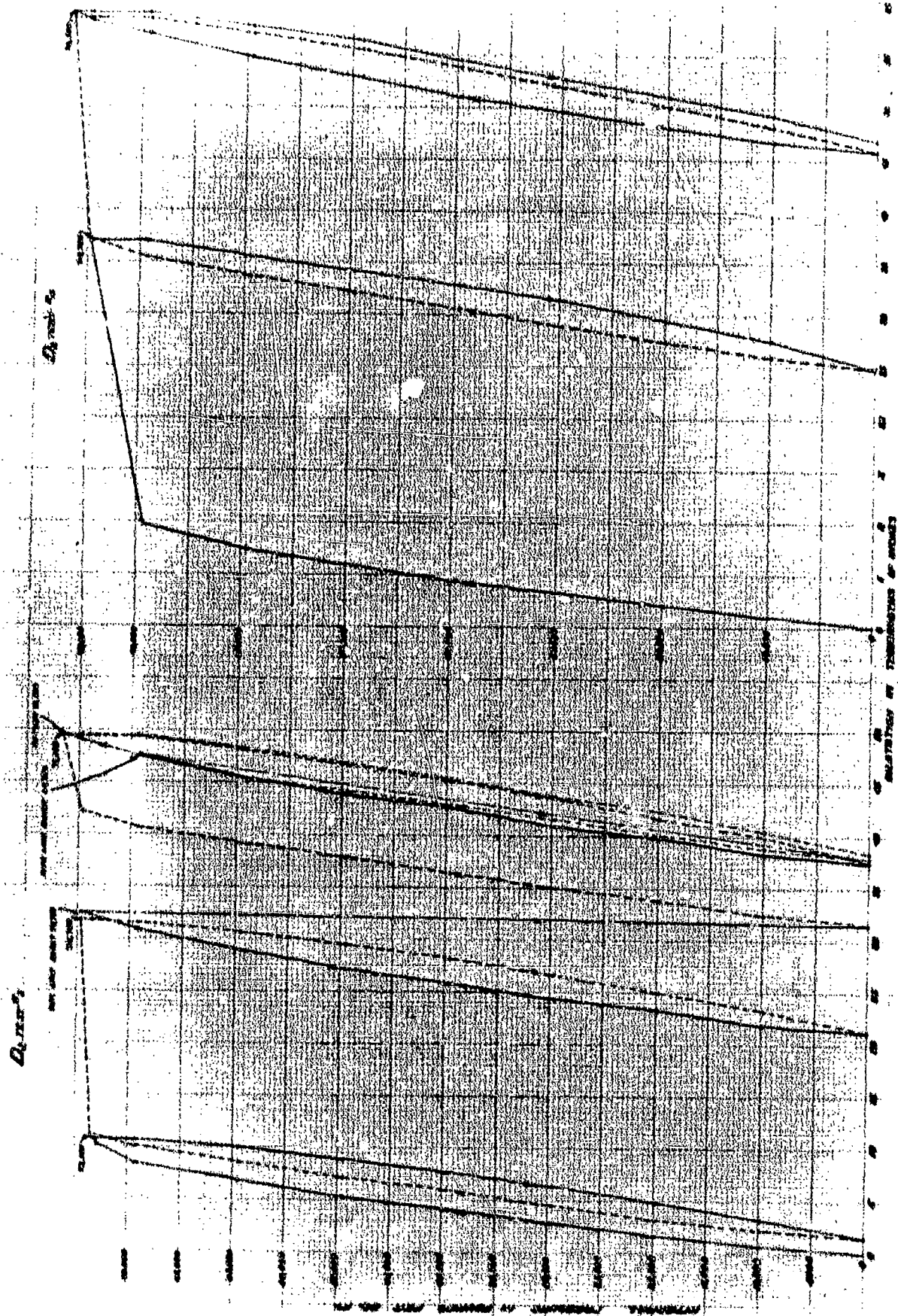
TEST #4
B₁



W7N.630-6703

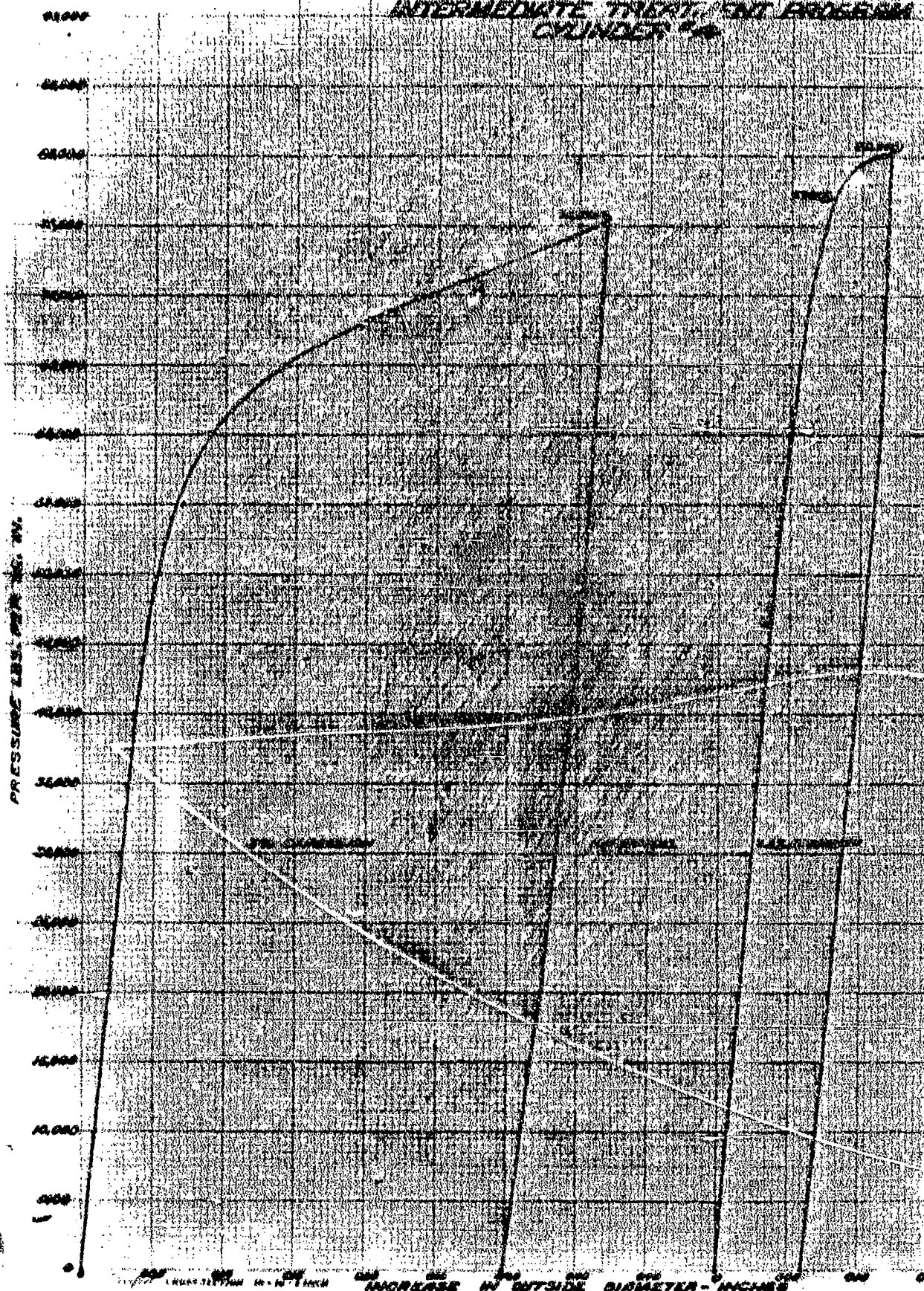
(19)

COLUMBIA TEST 2-4
 SUCCESSIVE DILATATIONS
 3-7.5 HOLLING GRINDER
 AT POINT D₂
 TRANSMISSION OF AIR, 10-15-1950-1951



VTN.639-6710

INTERMEDIATE THERMAL PROGRAM CYLINDER #4

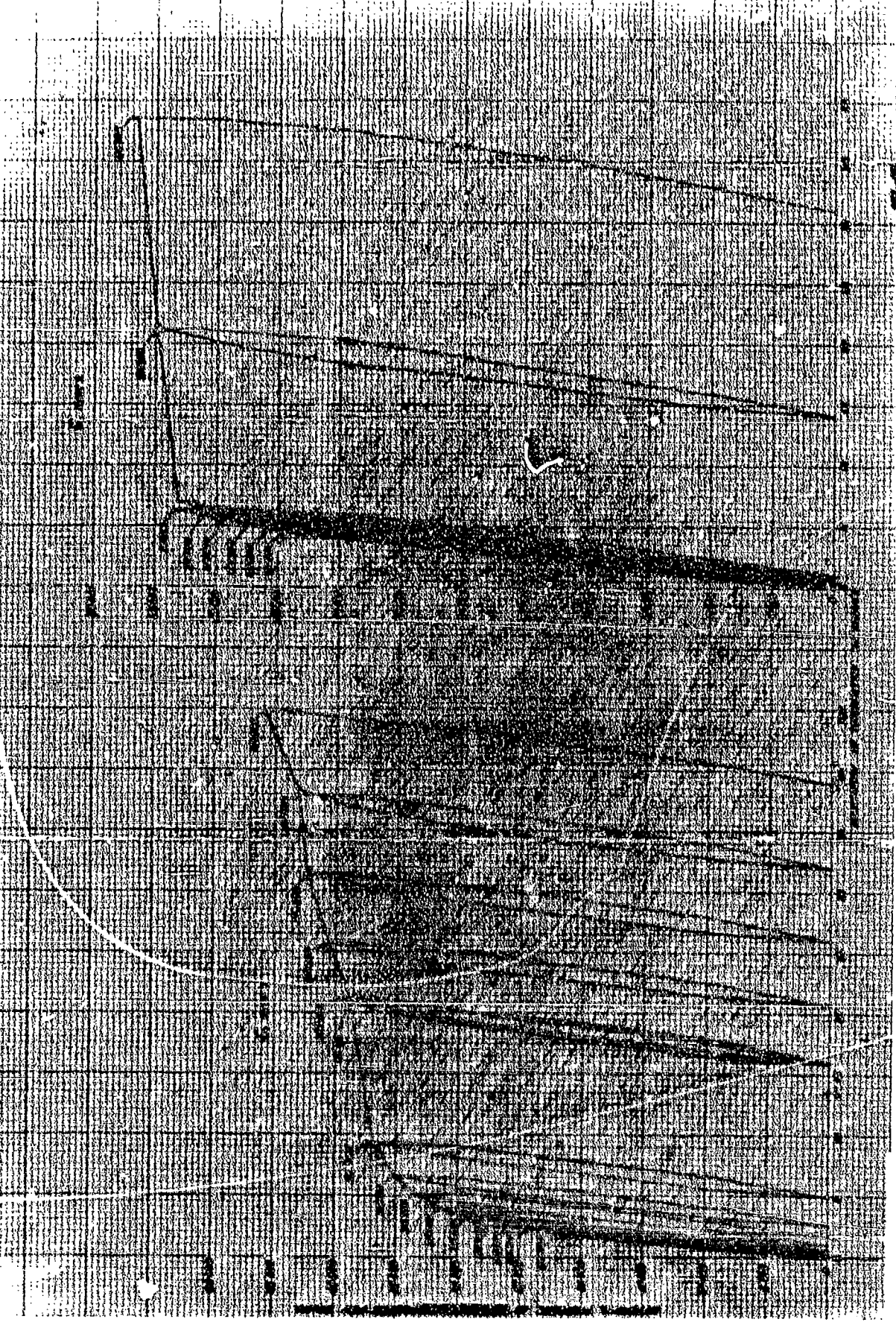


VTN.630-6726

57

49

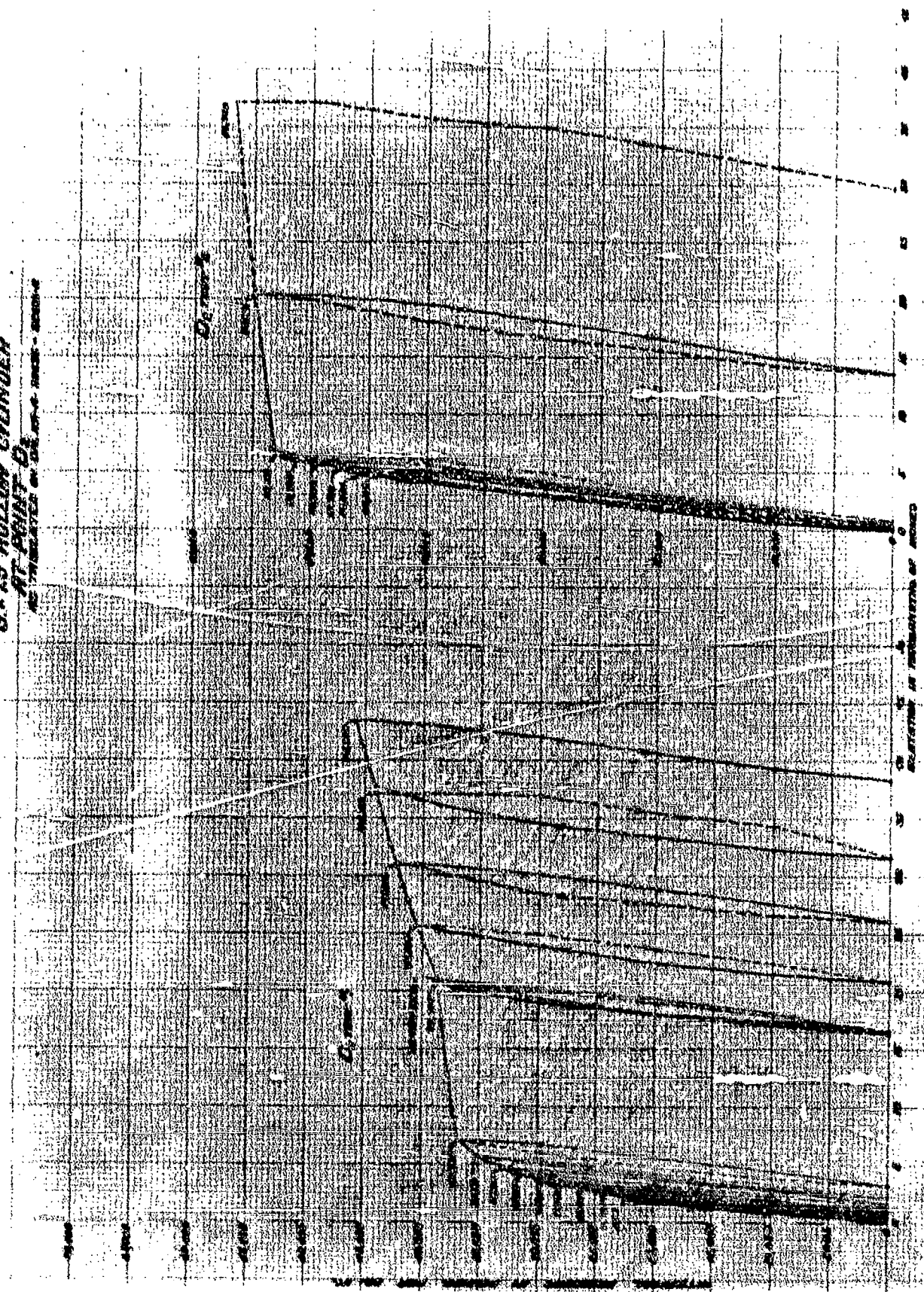
STRESSING OPERATIONS
2.175 HOLLOW CYLINDER
AT POINT C, 1000 LBS. G. TENS. A.
(IN PRESENCE OF 1000 LBS. TENSILE STRESS)



W.N. 639-6736

CYLINDER 4 TEST 1-2
 SUCCESSIVE DILATATION
 3x75 HOLLOW CYLINDER
 AT POINT D₁

AS INDICATED ON D₁ AT 4 INCHES - 2000-4



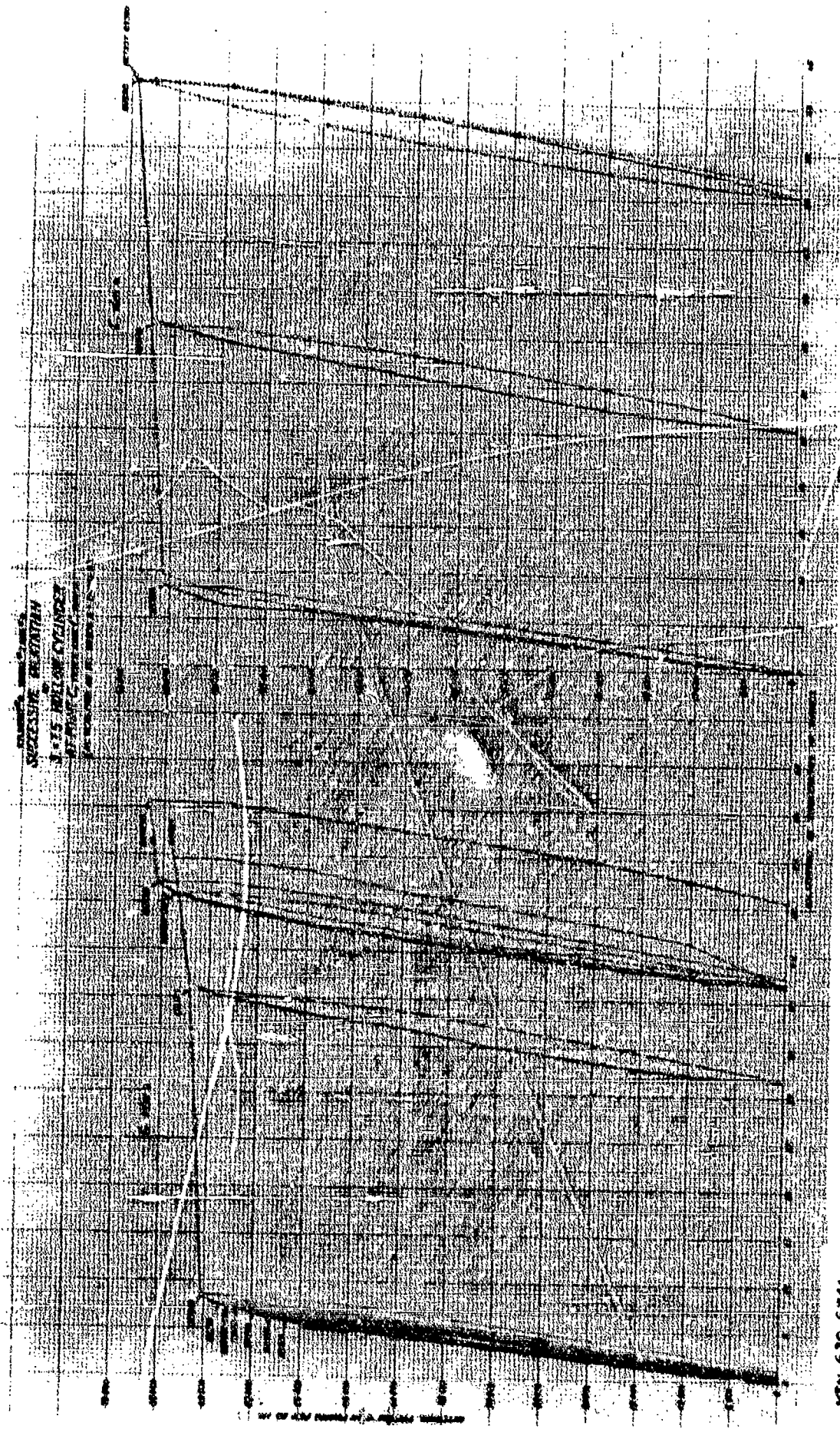
RELATIVE IN INFLUENCE OF MOVED

VTN.639-6704

15

(35)

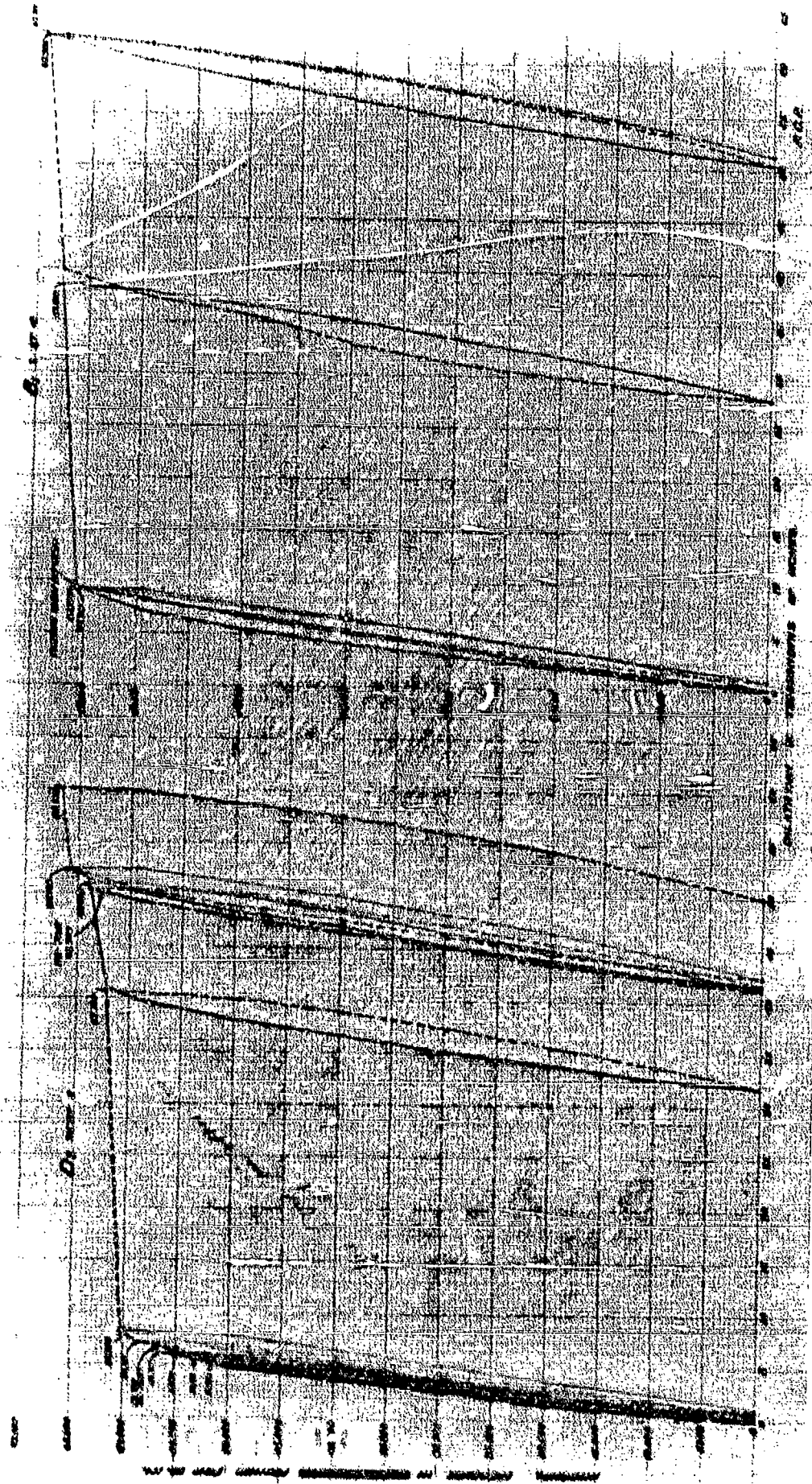
STRESS, RESISTANCE
1.5 MILLION CYCLES
STRESS, RESISTANCE



MTN. 639-6741

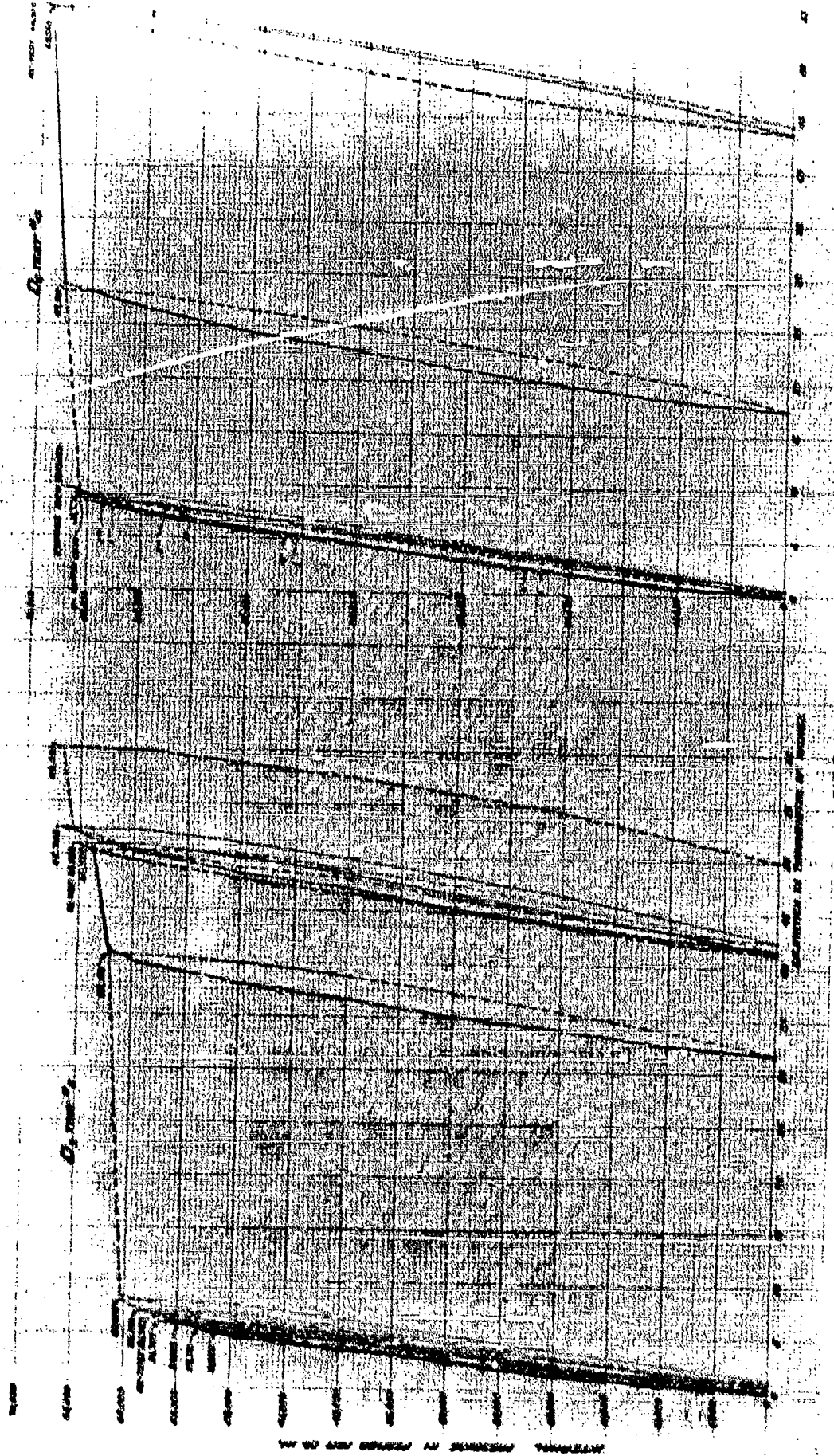
14

CHARGE: 100%
 SUCCESSIVE DILUTION
 3x 7.5 HOLLOW CYLINDER
 AT POINTS Q_1 , Q_2 , Q_3 AND Q_4 TESTS
 (CONCENTRATION OF CHARGE: 100%)



VTN. 639-6703

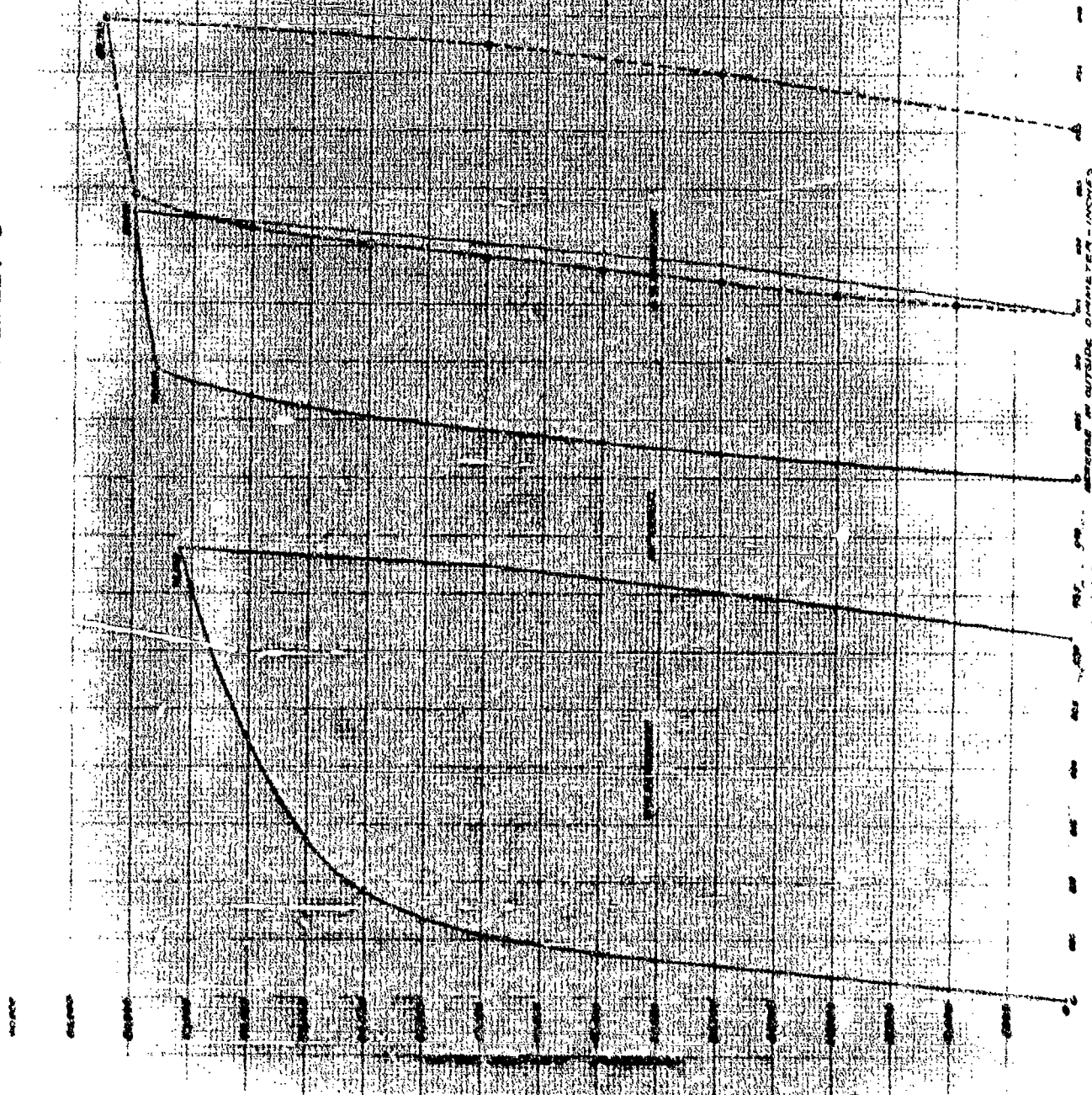
CYLINDER σ_1 TEST σ_2 σ_3
 SUCCESSIVE DILATATION
 3 x 7.5 HOLLOW CYLINDER
 AT POINT σ_1
 AS INDICATED BY ARROW IN FIGURE 1



VTN.630-6600

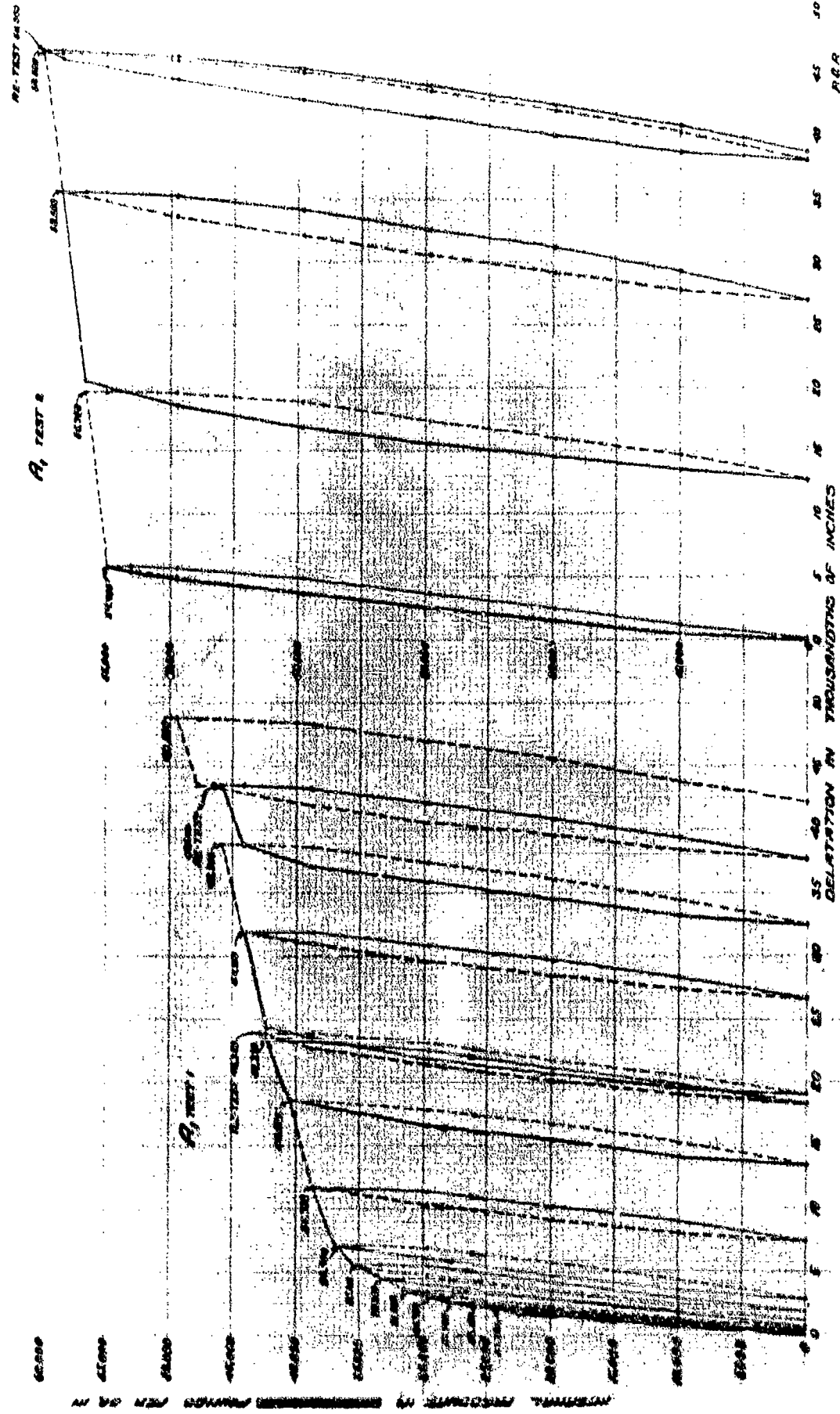
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INTERMEDIATE TREATMENT PROGRAM
CYLINDER #5

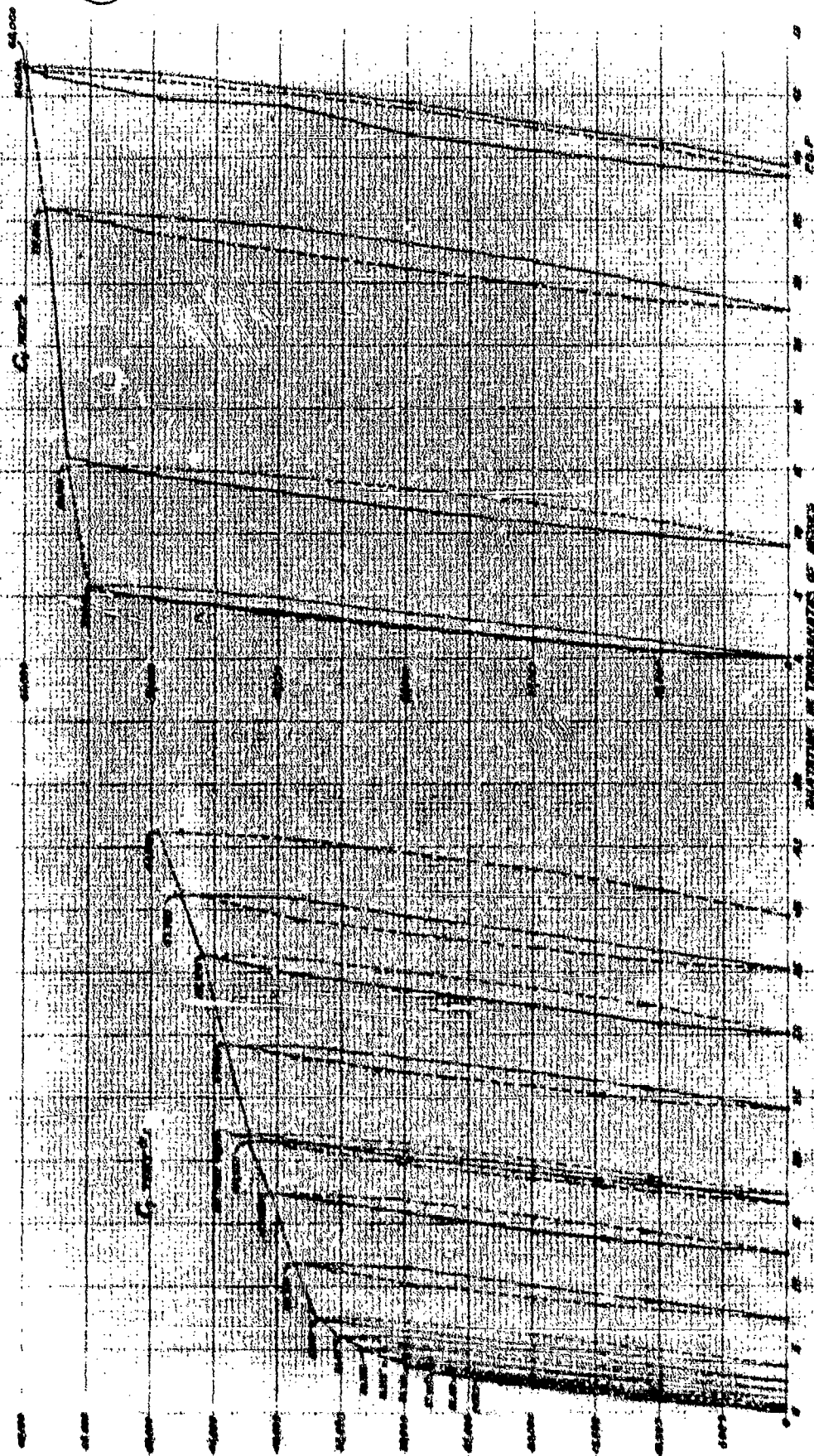


6771-639-6771

CYLINDER 5, TEST 1 AND 2
 SUCCESSIVE OF DILATATION
 3 x 7.5 HOLLOW CYLINDER
 AT POINT A₁ TEST 1 AND A₁ TEST 2
 (NOT TABULATED ON DR. 2057 - 2057H)



CYLINDER $\frac{1}{2}$ TEST $\frac{1}{2}$
 SUCCESSIVE DILATATIONS
 8 x 7.6 HOLLOW CYLINDER
 AT POINT C,
 TRANSMISSION AT 1000-10000



VTN 639-6743

1. The first step in the process is to identify the problem or issue that needs to be addressed. This involves gathering information and understanding the context of the problem.

WTN.639-6729

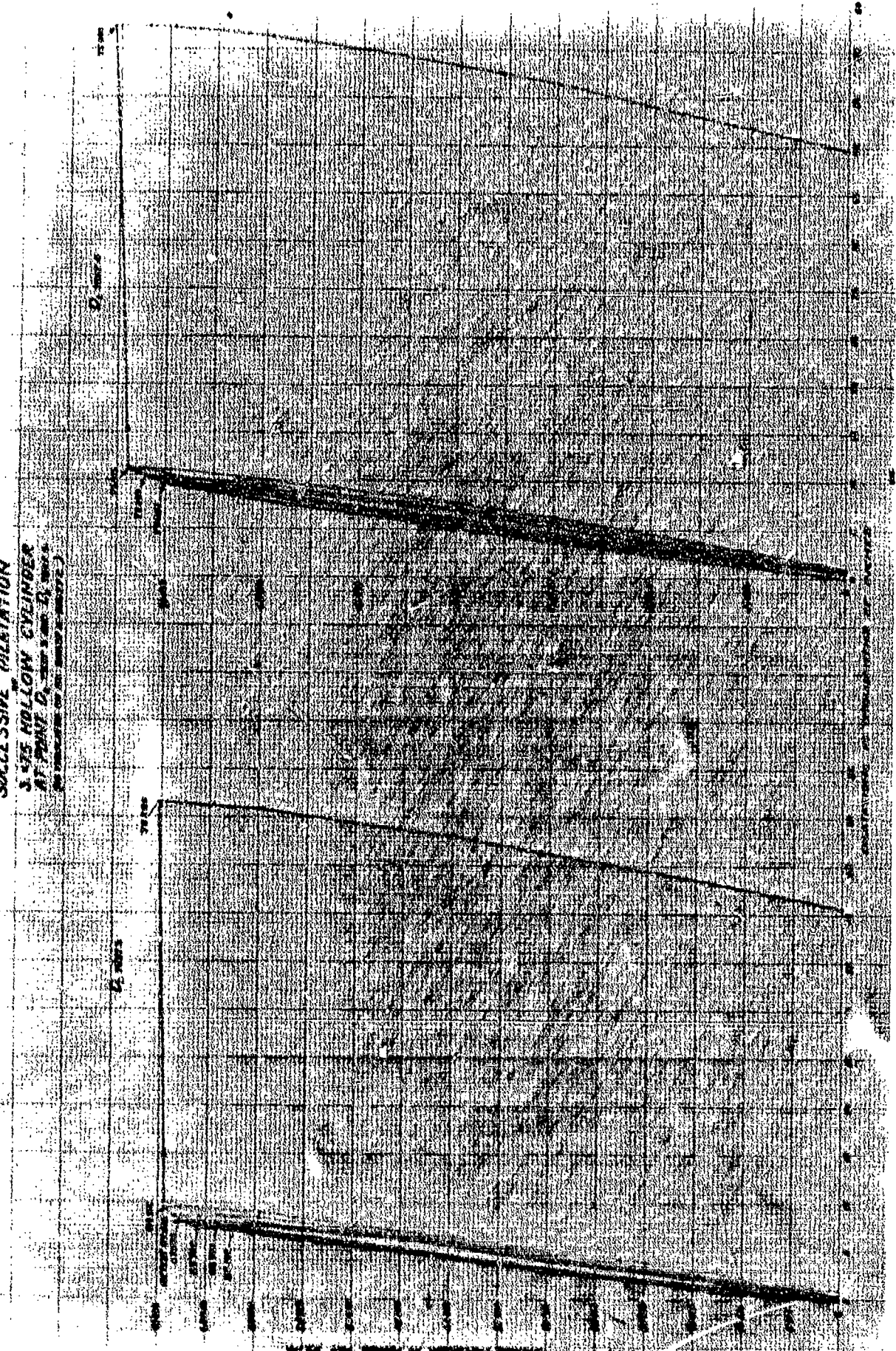
DR. THOMAS J. WILSON, JR., M.D.



WTN 639-6693

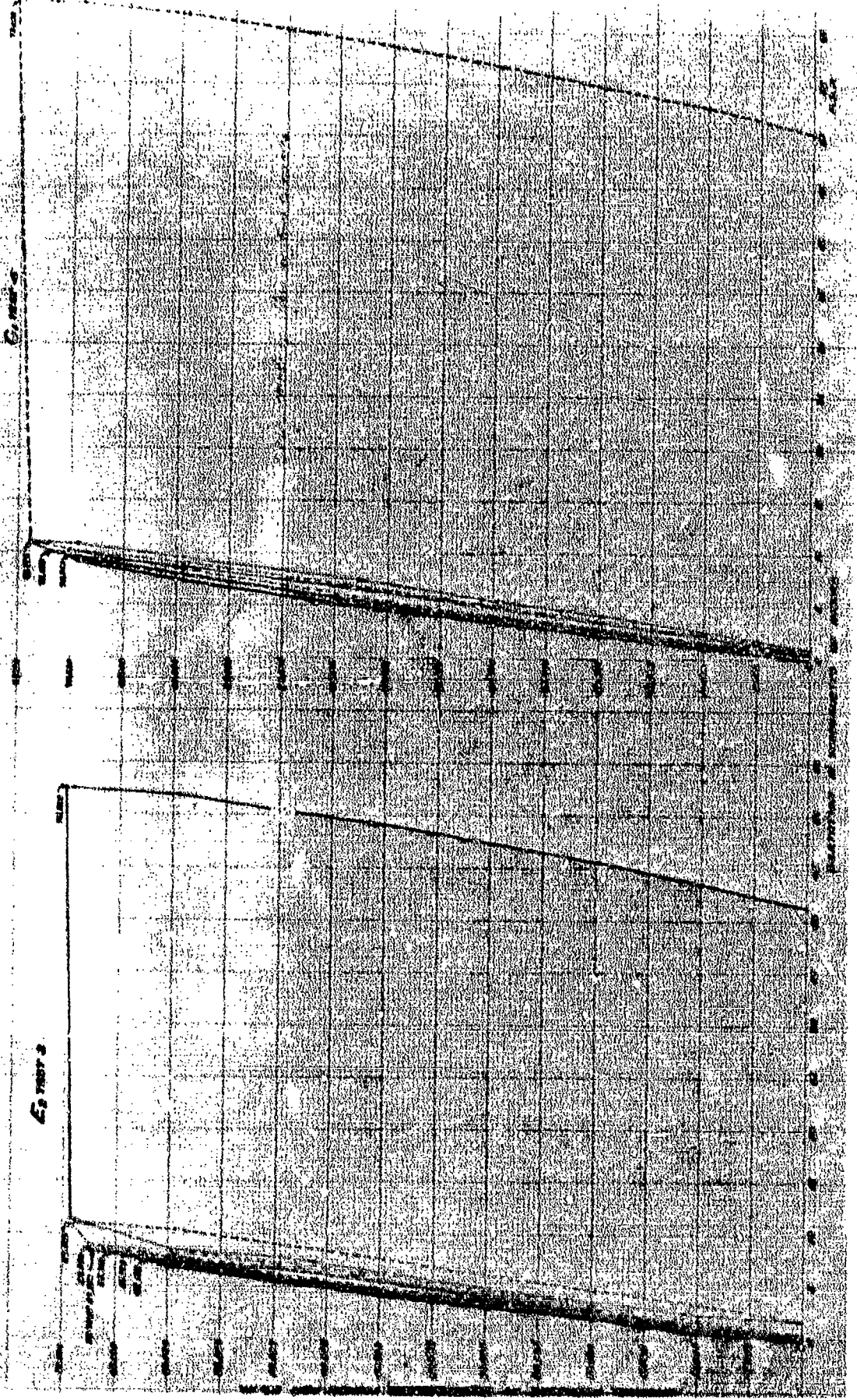
CYLINDER'S 1000" D. AND 1000" L.
 SUCCESSIVE DILATATION
 3.475 HOLLOW CYLINDER
 AT POINT D₁ (SEE FIG. 10)

6



VTN 630-6694

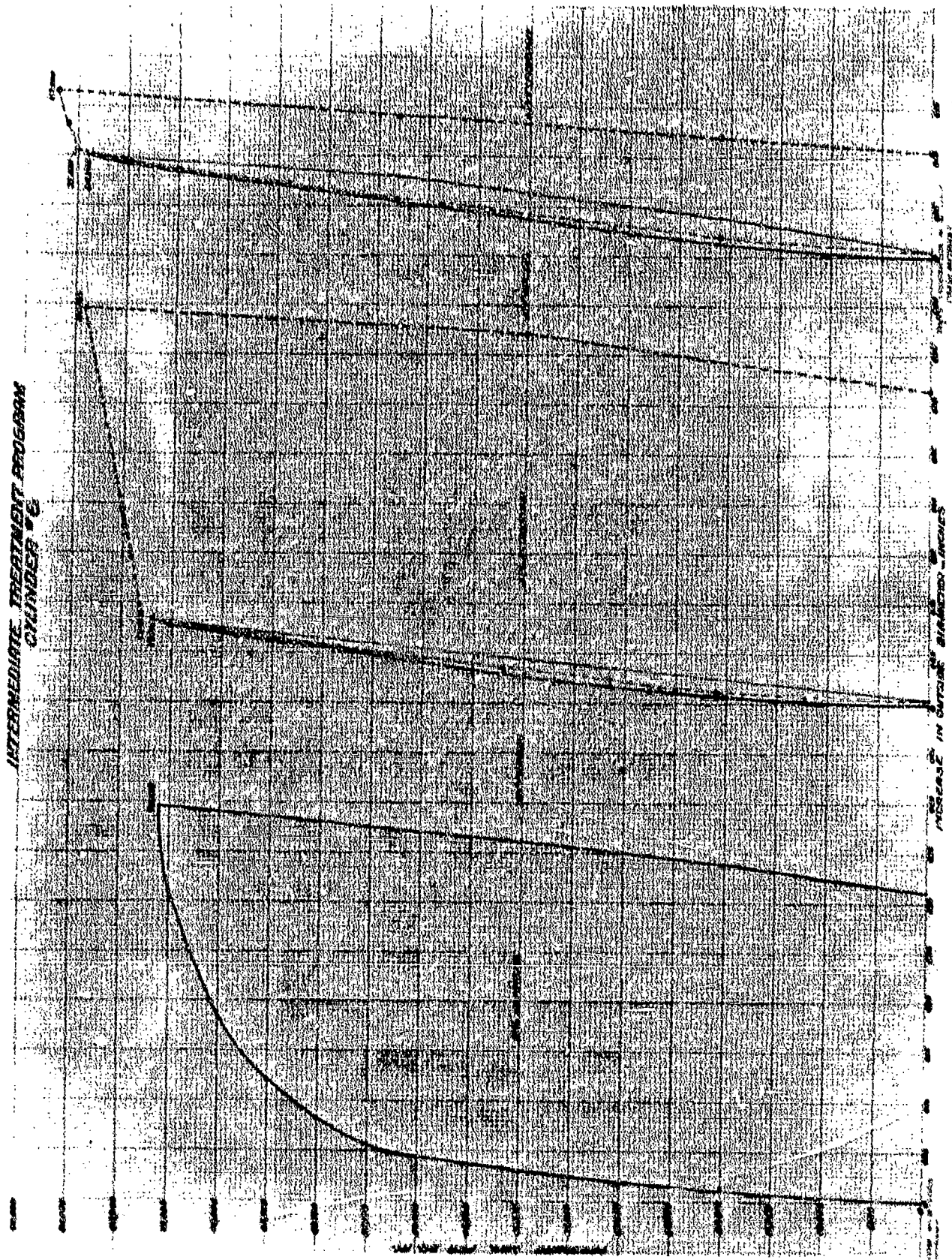
CYLINDER & TEST LINE
 SUCCESSIVE DILATATION
 3/16" HOLLOW CYLINDER
 AT POINT E_2 TEST 2 AND C_1 TEST 2
 (FOR TABULATED IN ALGEBRA - SEE 21)



13

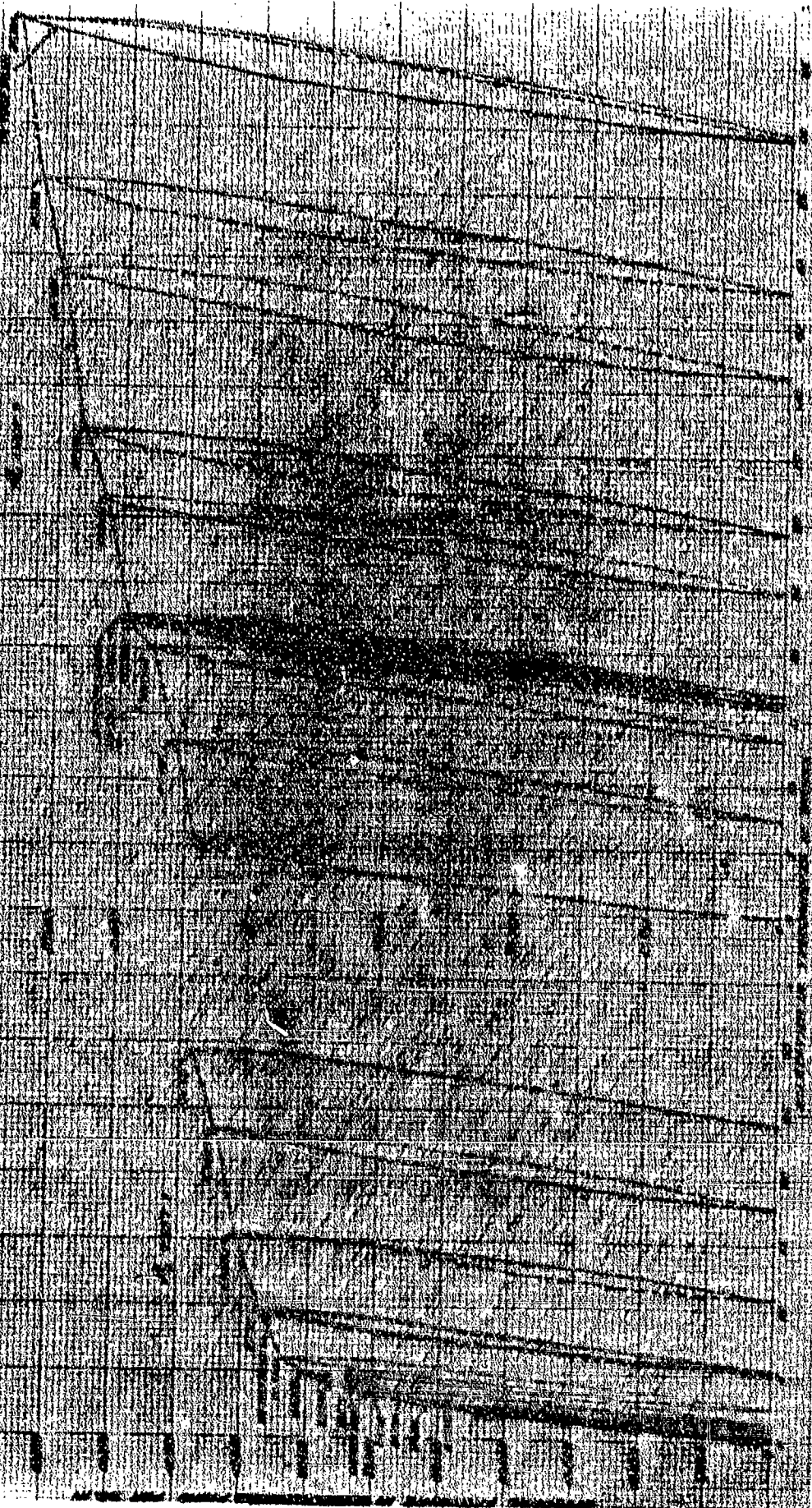
68

INTERMEDIATE TREATMENT PROGRAM
CYLINDER #6



VTN. 639-6776

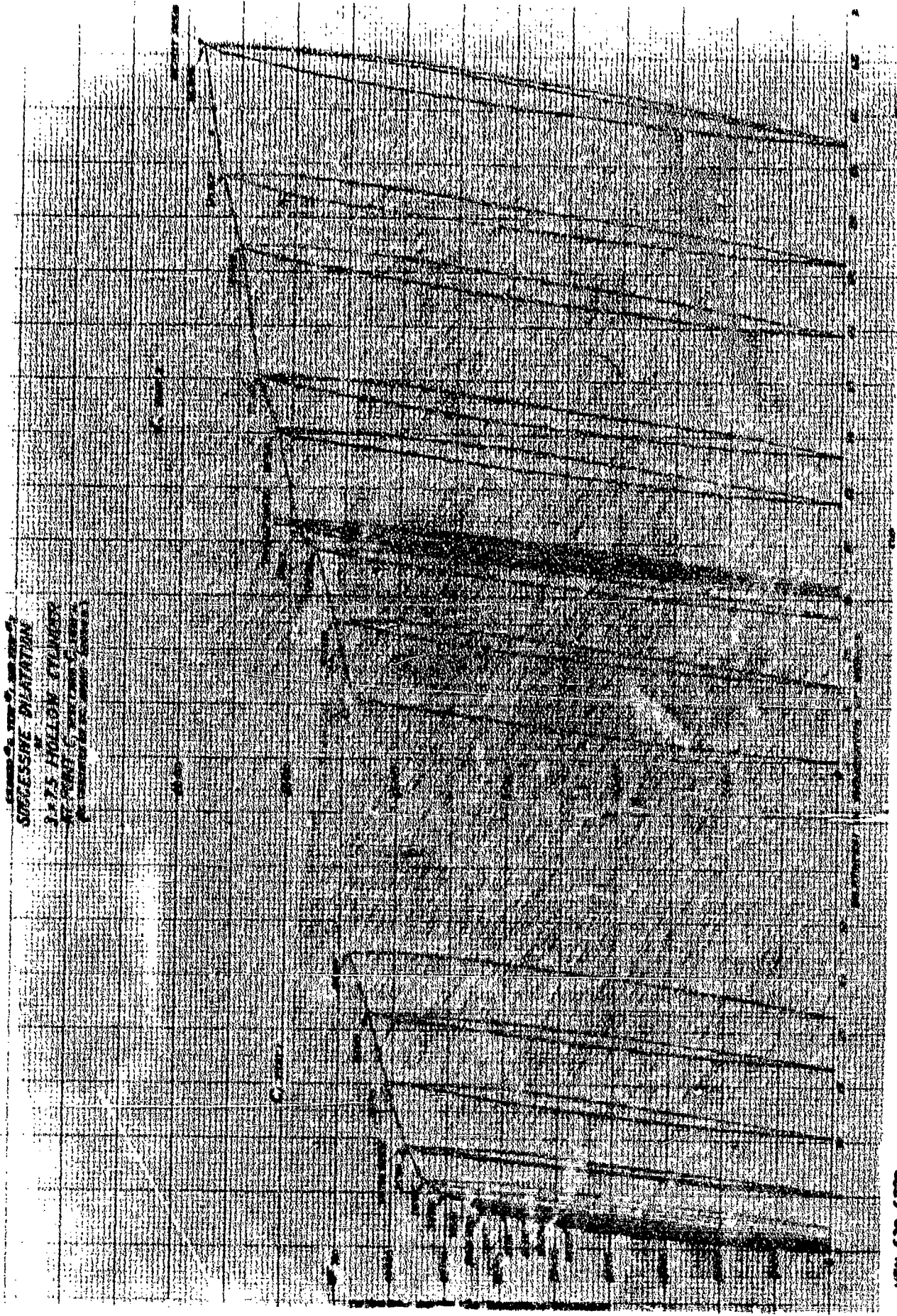
CHARTERED TEST TANK
SUGGESTIVE DILATATION
3/22/60 HOLLOW CYLINDER
AT POINT A



W7M.639-6700

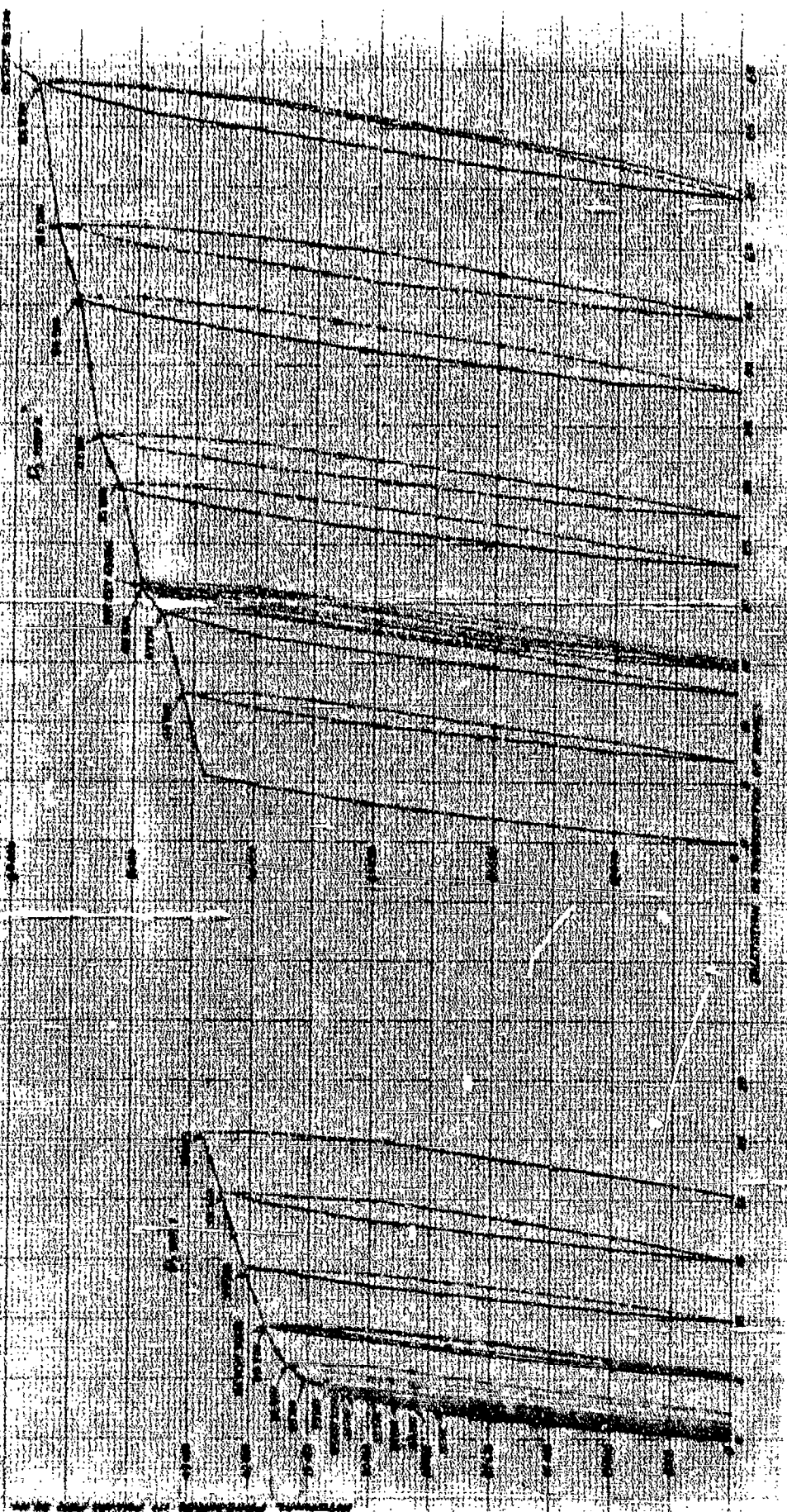
49

COMPRESSIVE DILATATION
3-75 HOLLOW TUBES
AT POINT C



WTH. 639-6738

CYLINDER 6, TEST 7, AND TEST 8
 SUCCESSIVE DILATATION
 OF
 3. 475 HOLLOW CYLINDER
 AT PRESS. 8, TEST 1 AND TEST 2.
 (SEE TESTS OF THE CYLINDERS)

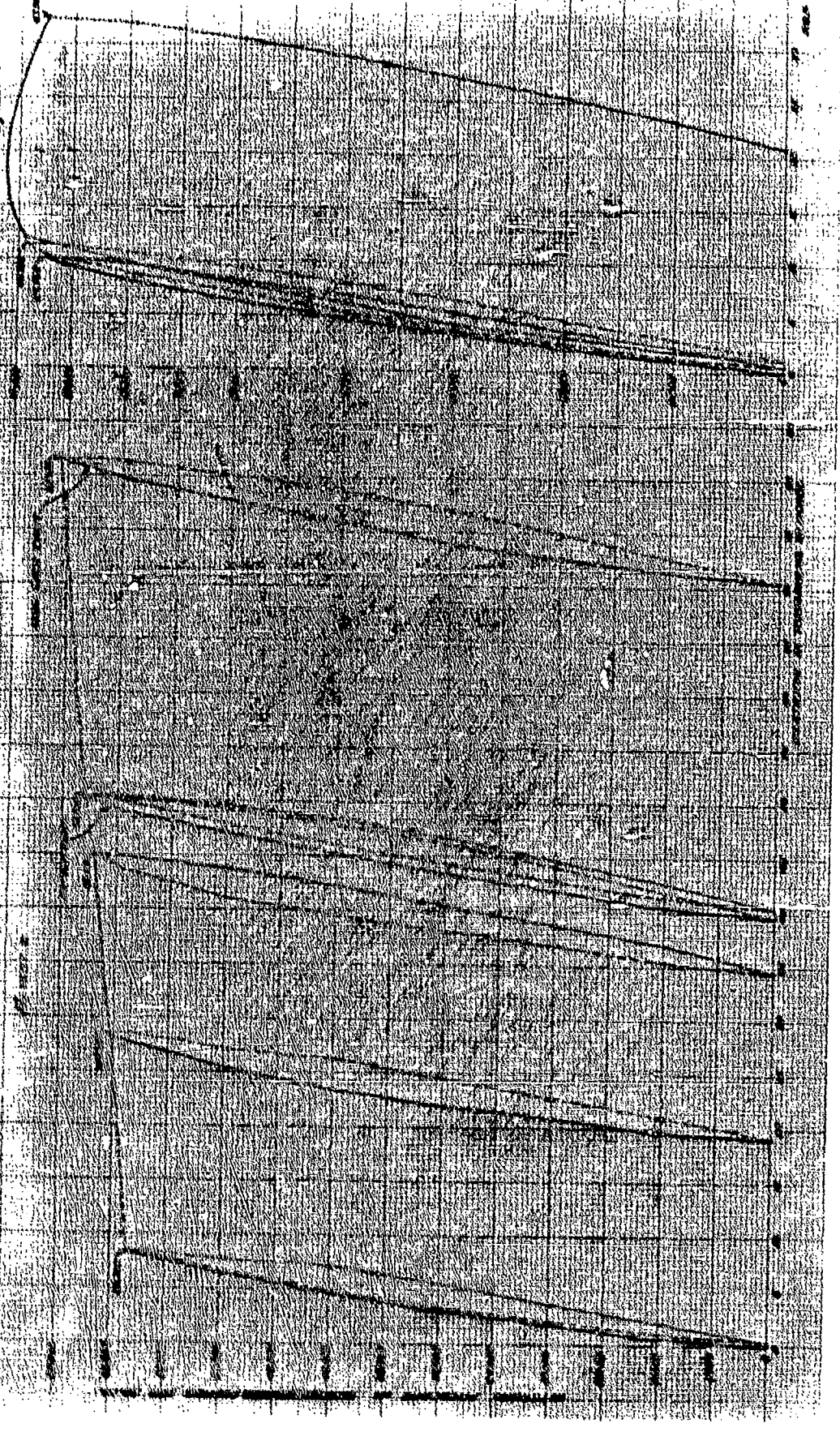


NYN.639-6692

cylinder's test, and
 SUGGESTIVE ORIENTATION
 OF THE HOLLOW CYLINDER
 AT POINT OF IMPACT
 (NO INDICATION OF THE IMPACT POINT)

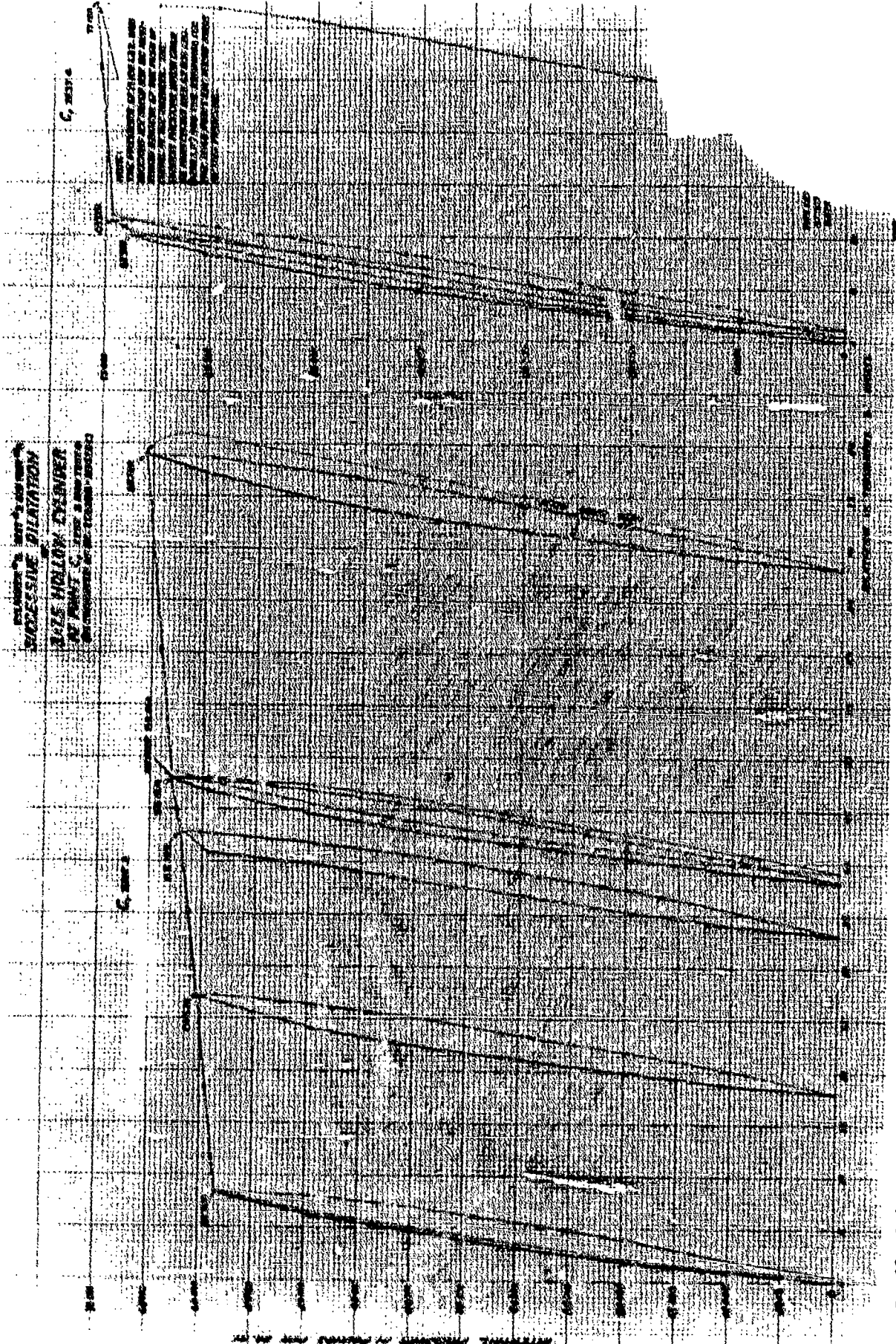
THE FOLLOWING IS A SUMMARY OF THE INFORMATION
 OBTAINED FROM THE TESTS OF THE HOLLOW CYLINDER
 AT POINT OF IMPACT. THE RESULTS OF THE TESTS
 ARE AS FOLLOWS:

9



WTH.639-6698

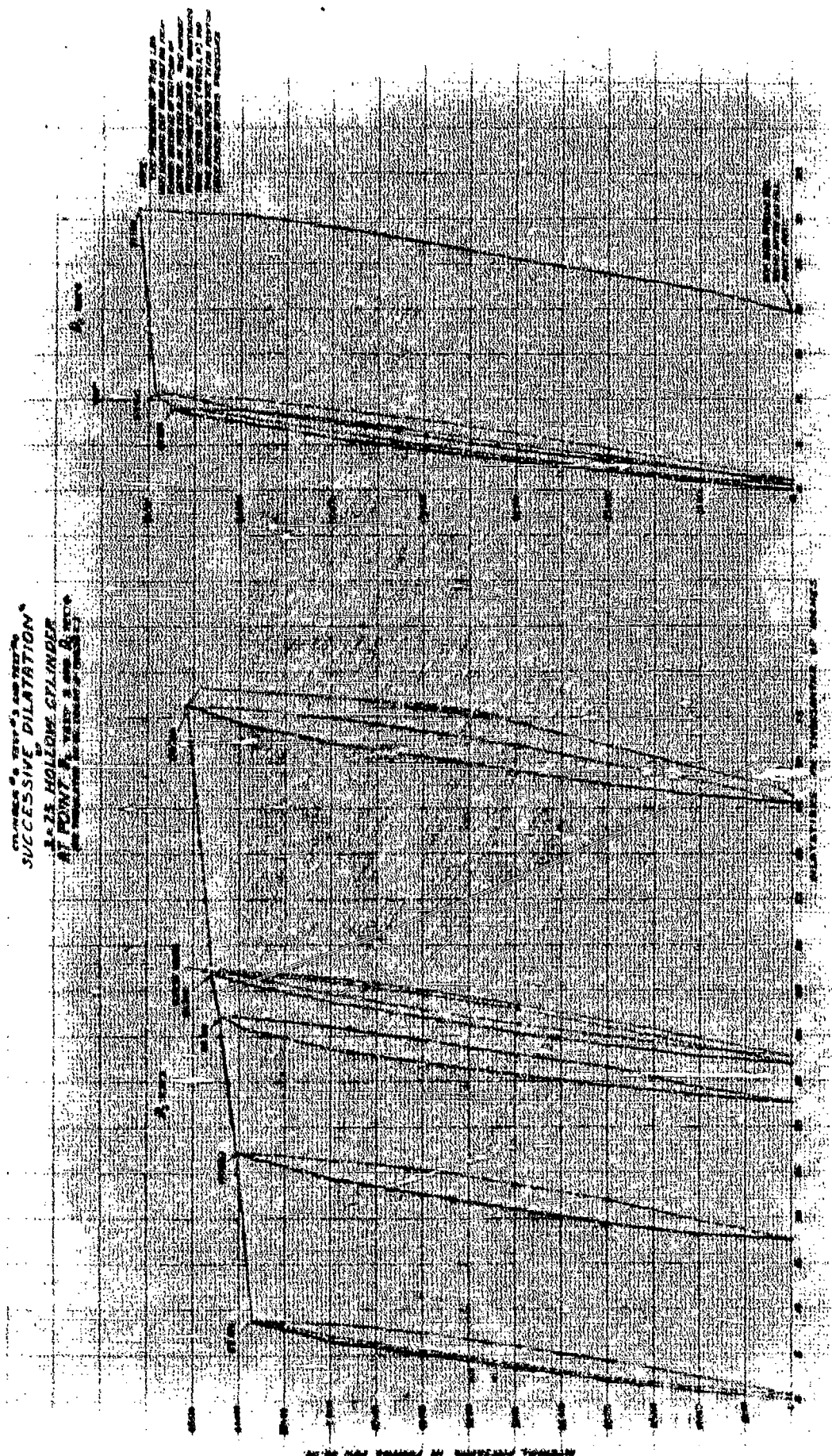
53



WTN.639-6739

16

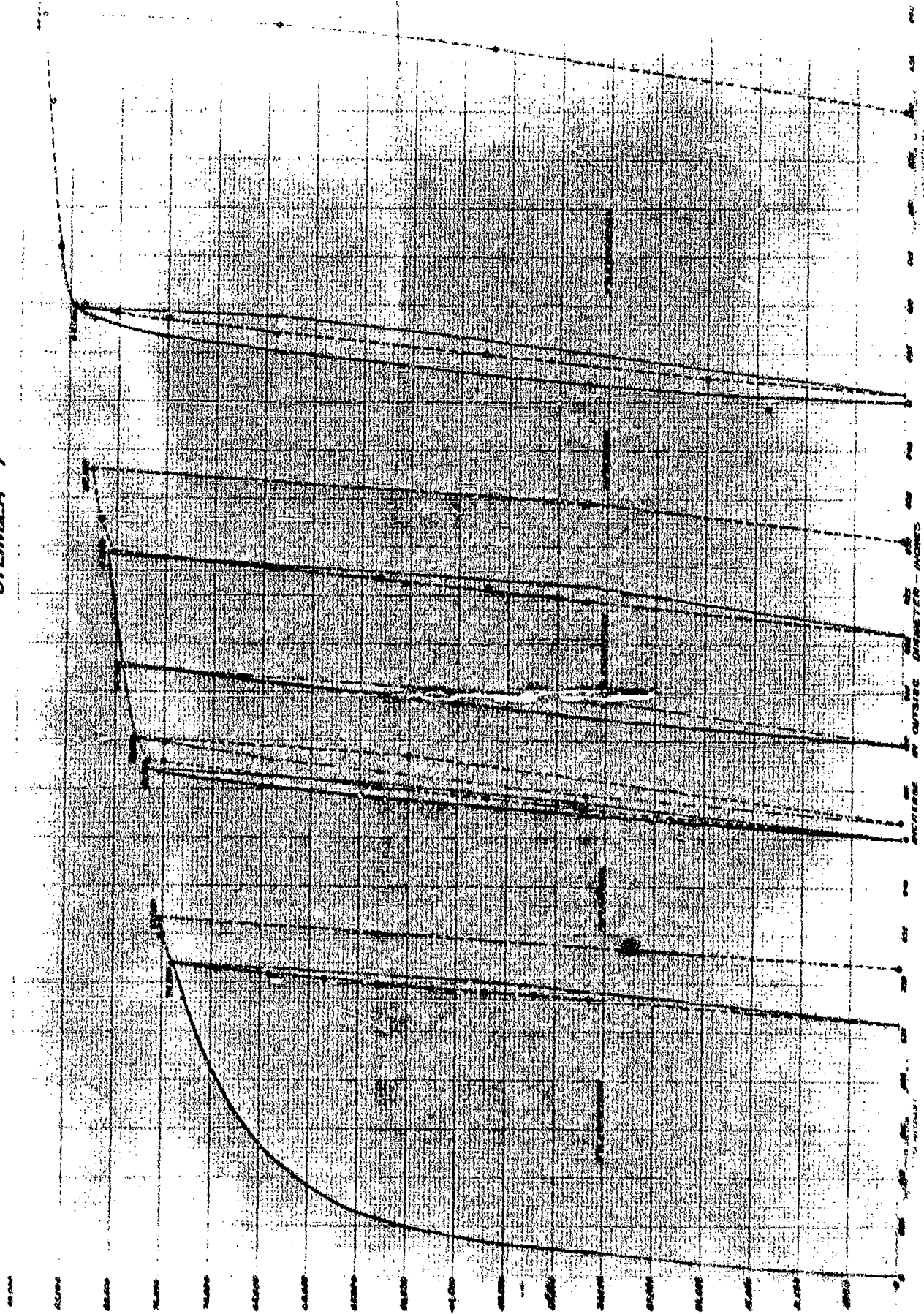
CHANGES IN TEMPERATURE
SUCCESSIVE DILATATION
1.25 HOLLOW CYLINDER
AT POINT A, TEST 2 AND 3



WTN.639-6705

85

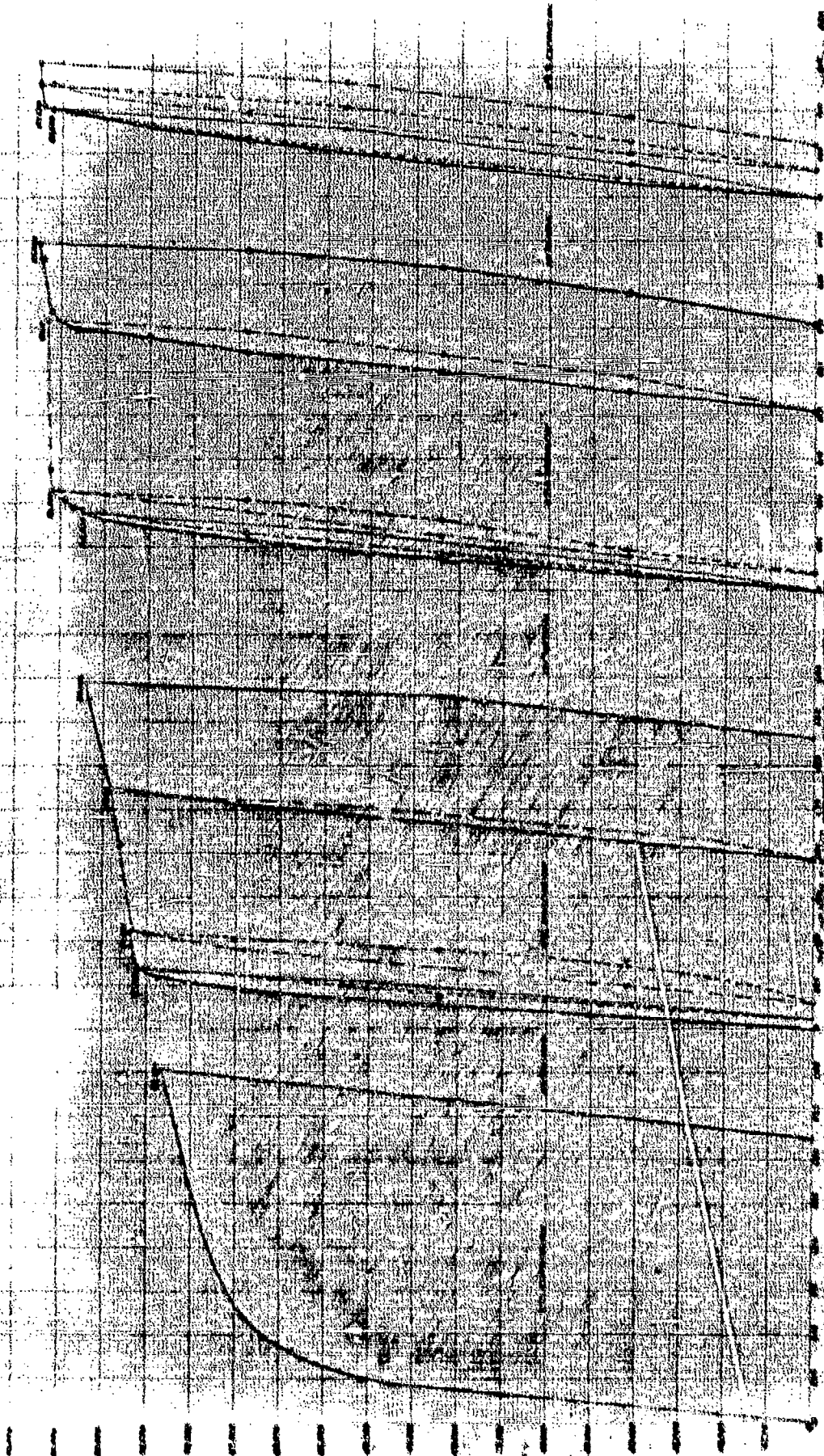
INTERMEDIATE TREATMENT PROGRAM
CYLINDER #7



VTN 639-6774

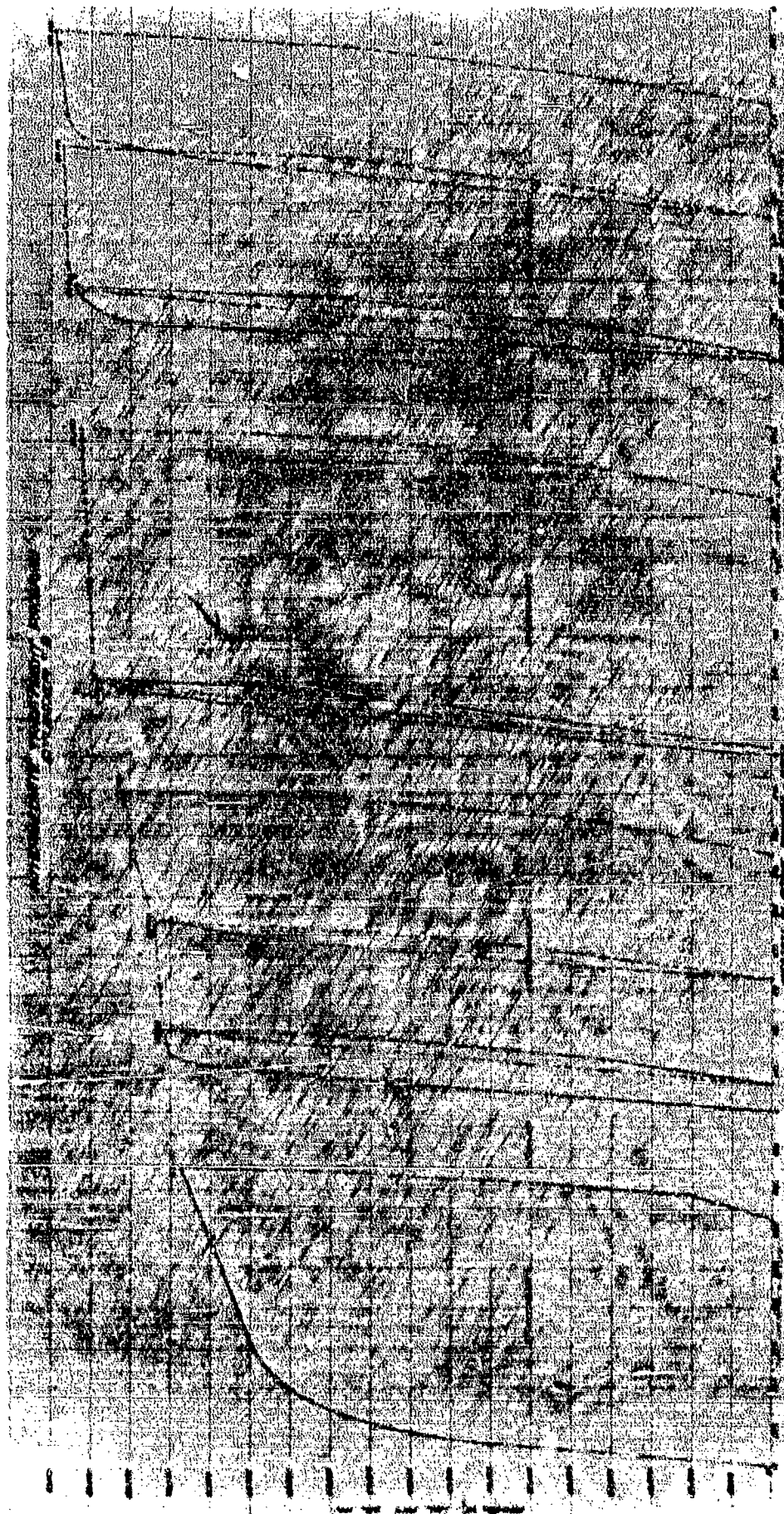
99

INTERMEDIATE THICKNESS PROGRAM
CYLINDER #5



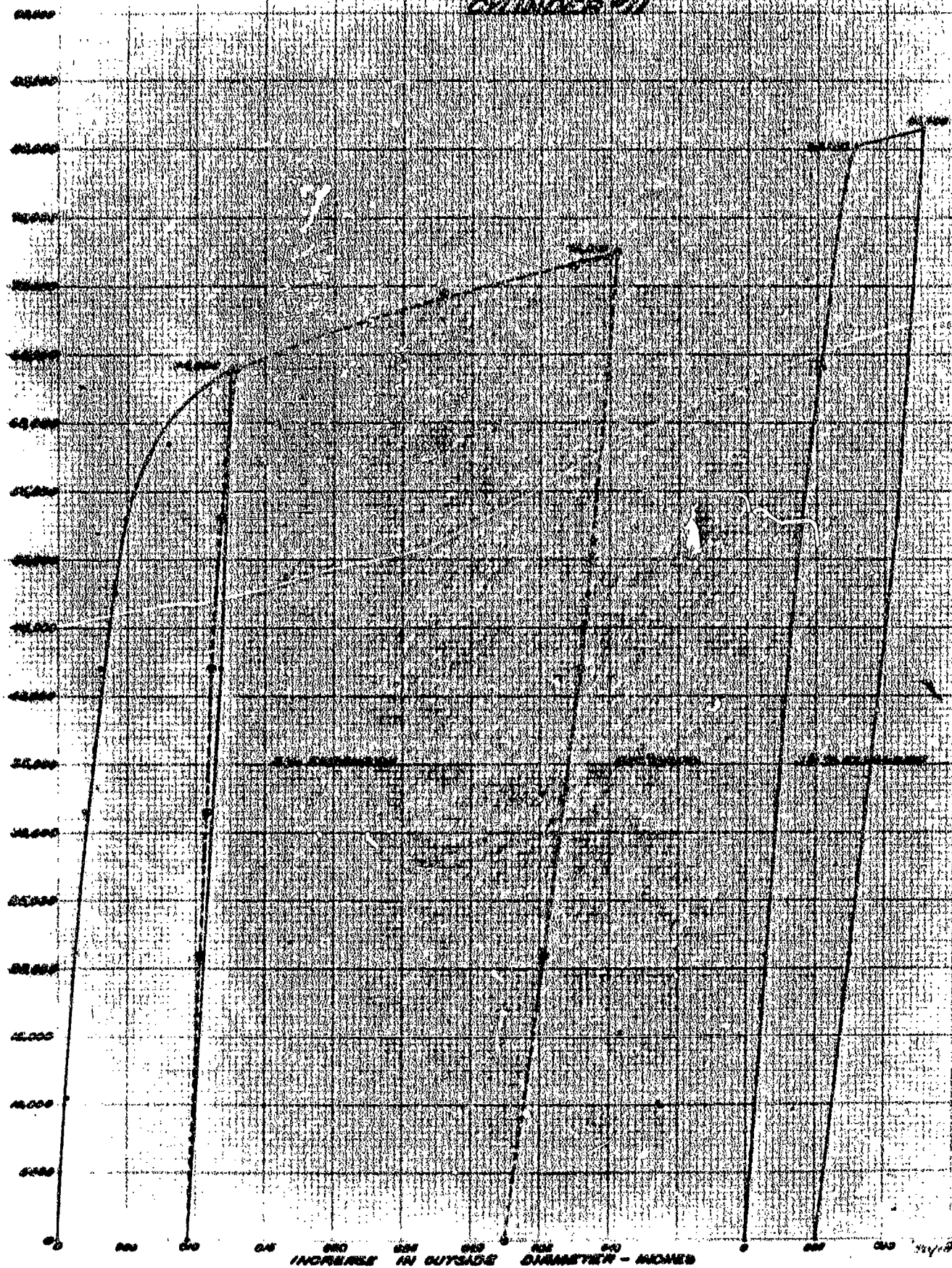
VTN.639-6766

18



WFM 639-6778

INTERMEDIATE TREATMENT PROGRAM CYLINDER #11

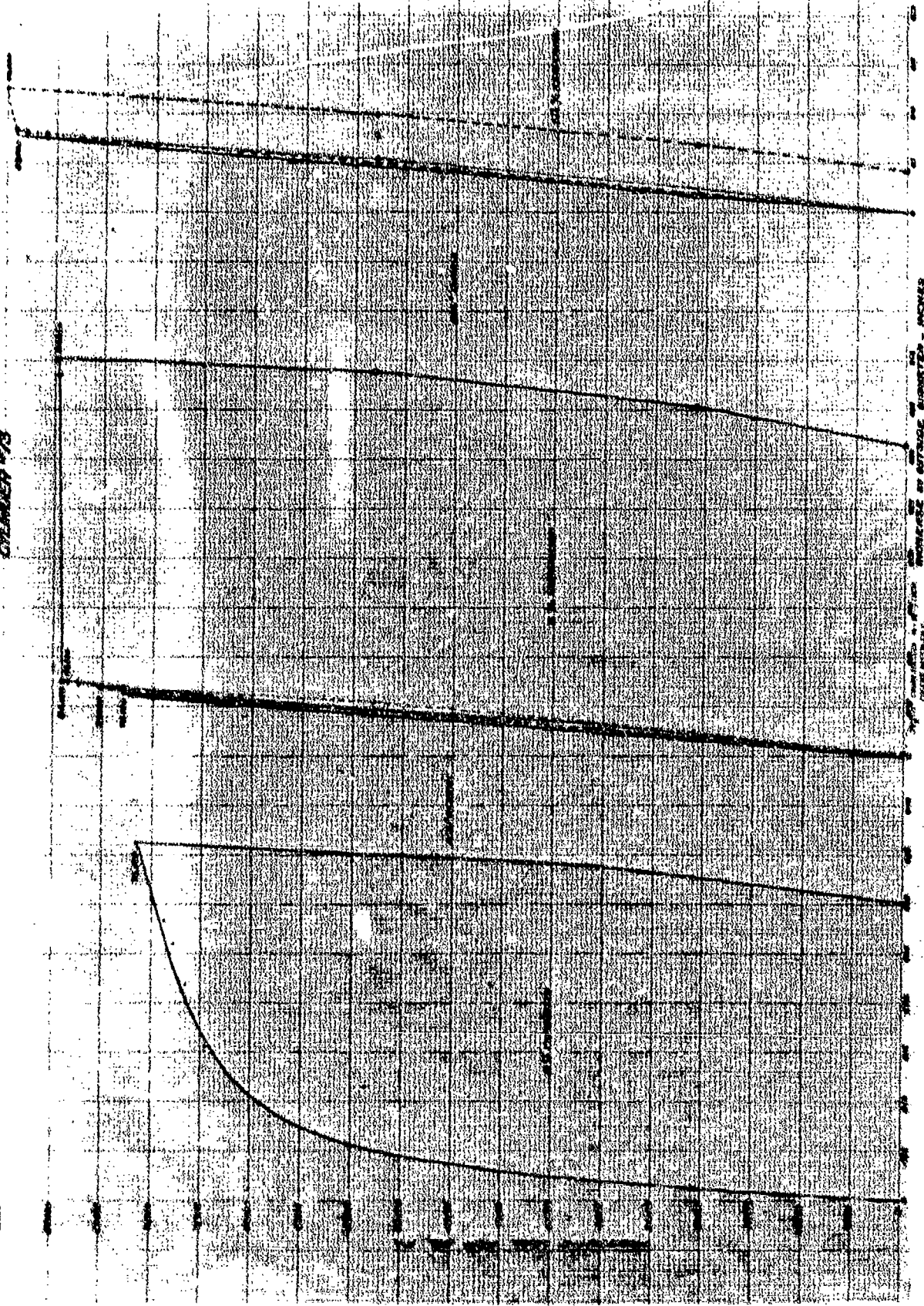


WTN.630-6727

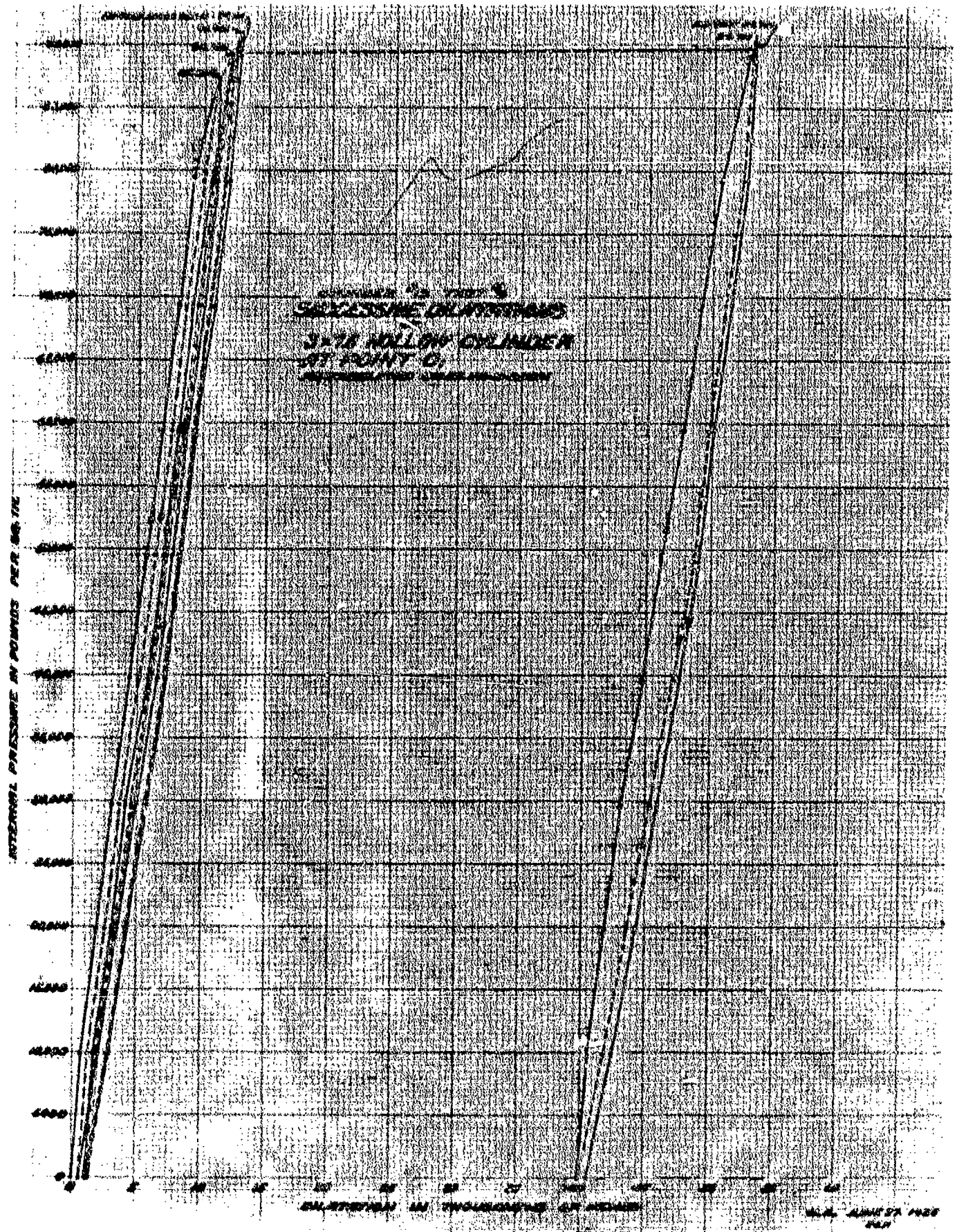
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178

INTERMEDIATE TREATMENT PROGRAM
CHAMBER #13



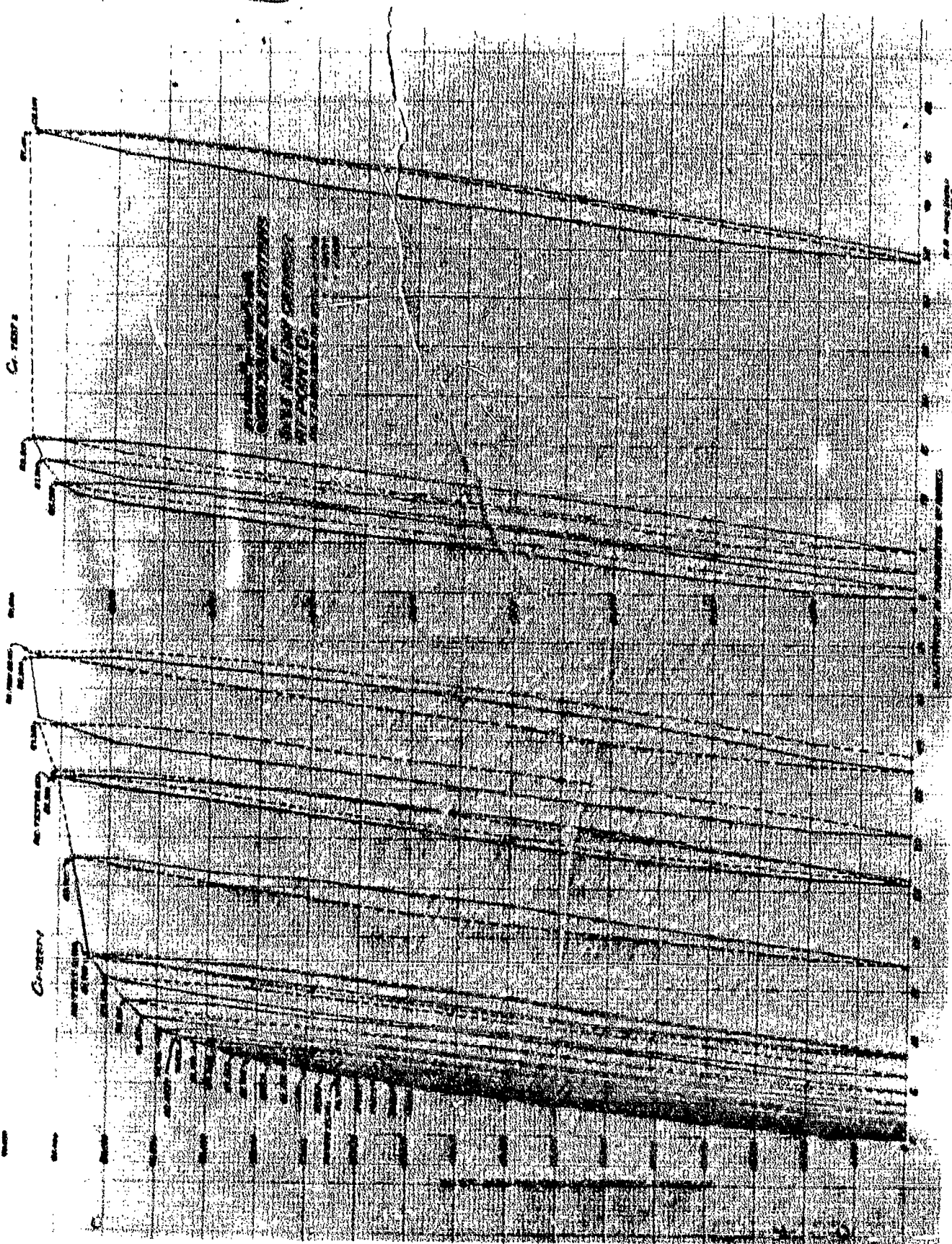
VIN. 630-6767



WTN.639-6690

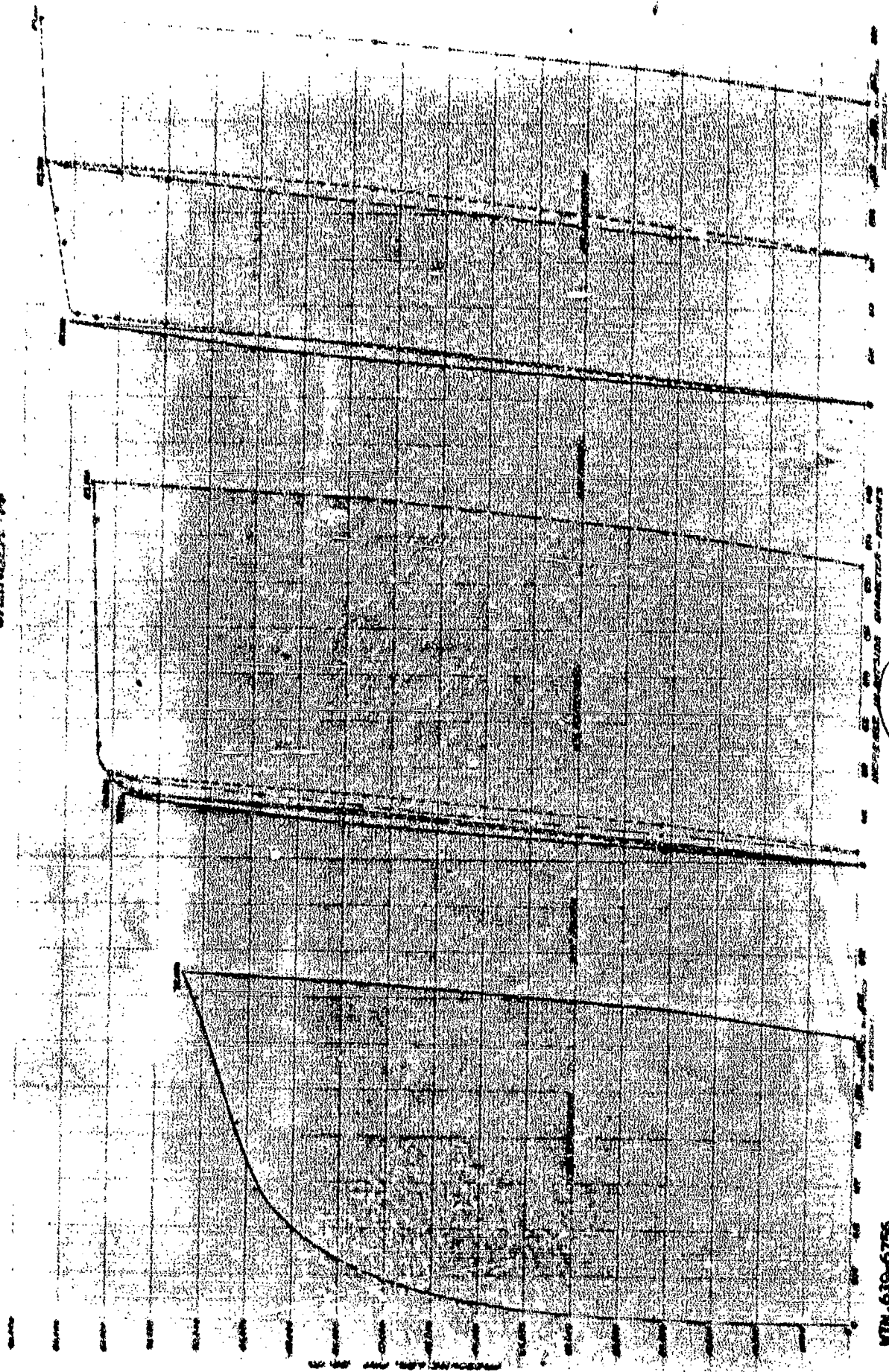
U.S. ARMY 1955
R&D

46



774.630-6735

INTERMEDIATE TREATMENT PROGRAM
CYLINDER 74

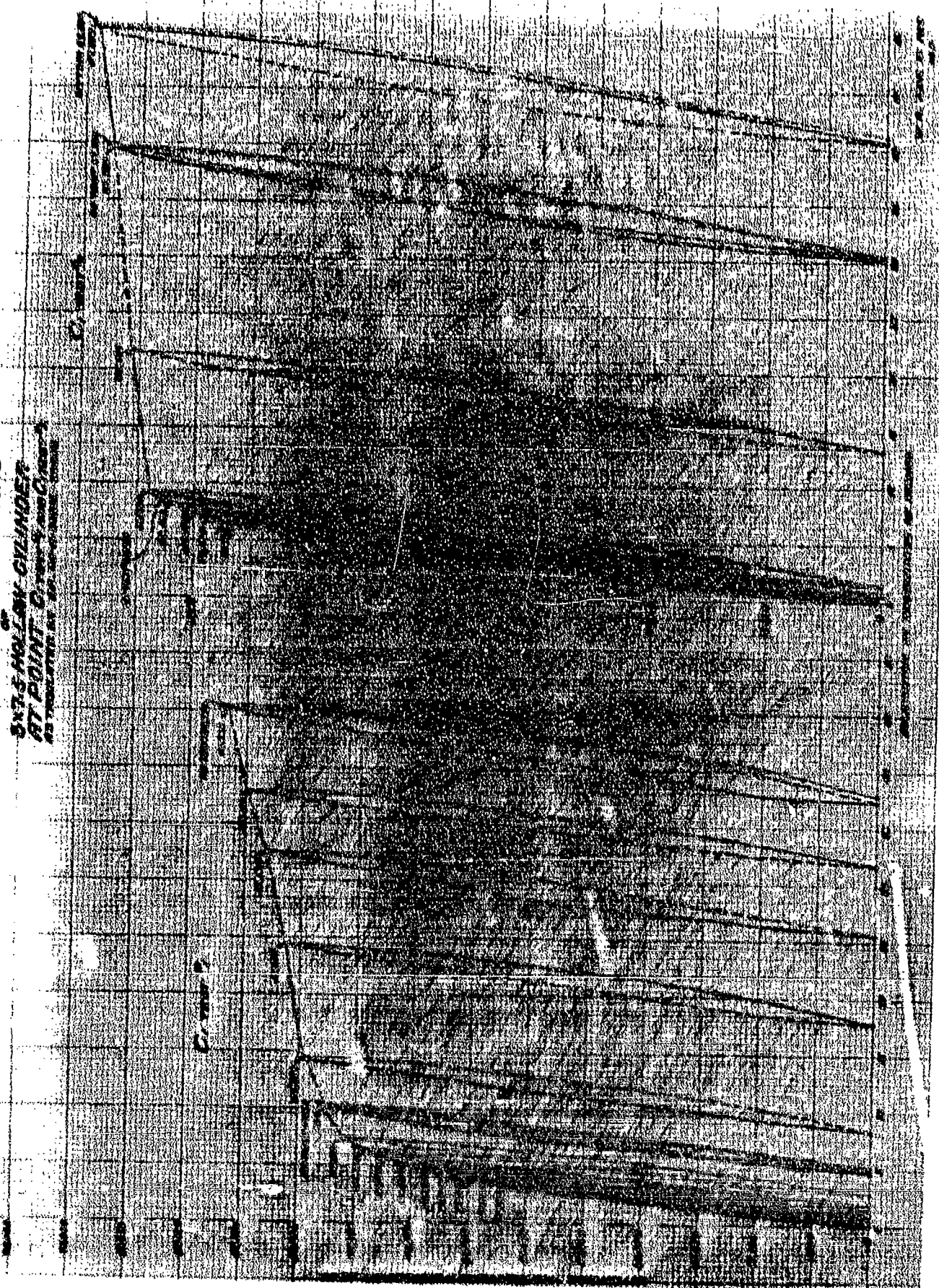


WTA 639-6756

(6A)

CYLINDER IN TEST 3, AND 5,
SUCCESSIVE DILATATIONS

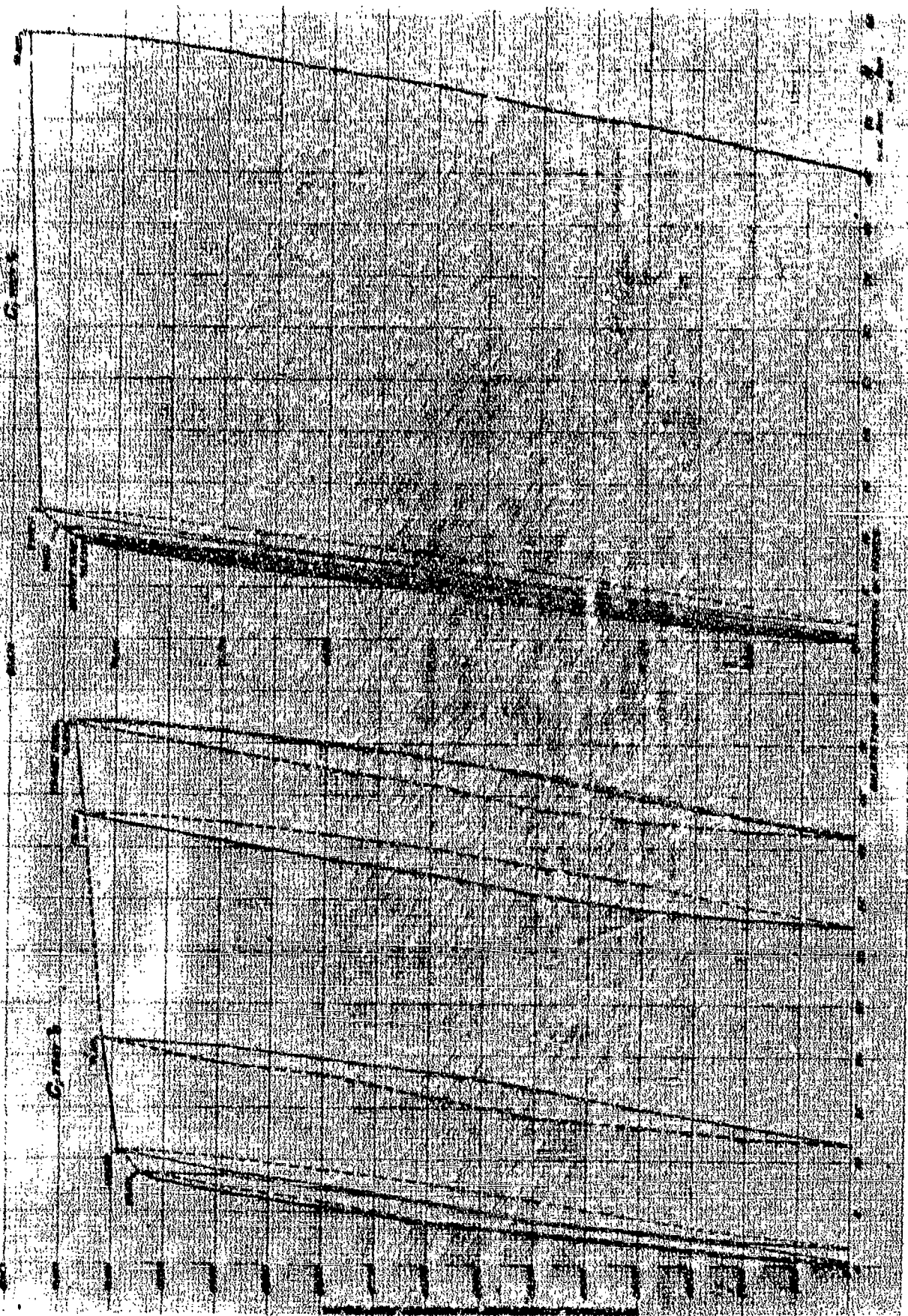
5X7.5 HOLLOW CYLINDER
AT POINT C, TEST 4 AND 5
AS INDICATED BY THE DOTTED LINE



1699-629 NIA

2

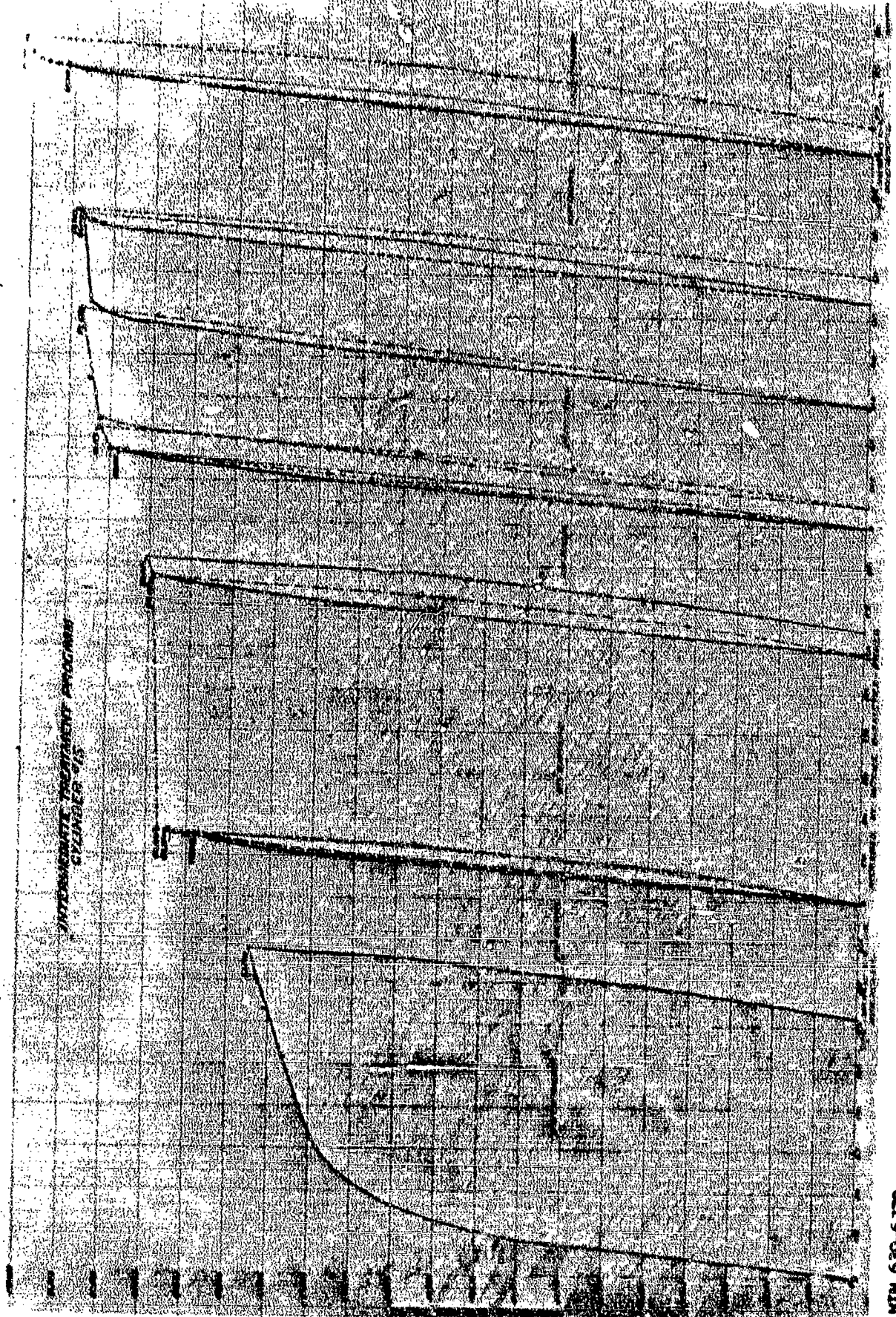
CHANGES IN TIDE GAUGE
SUCCESSIVE DILATIONS
3-7.6 HOLLOW CYLINDER
AT POINT C₁
TRANSVERSELY BY 1/16 IN.



WTH. 639-6691

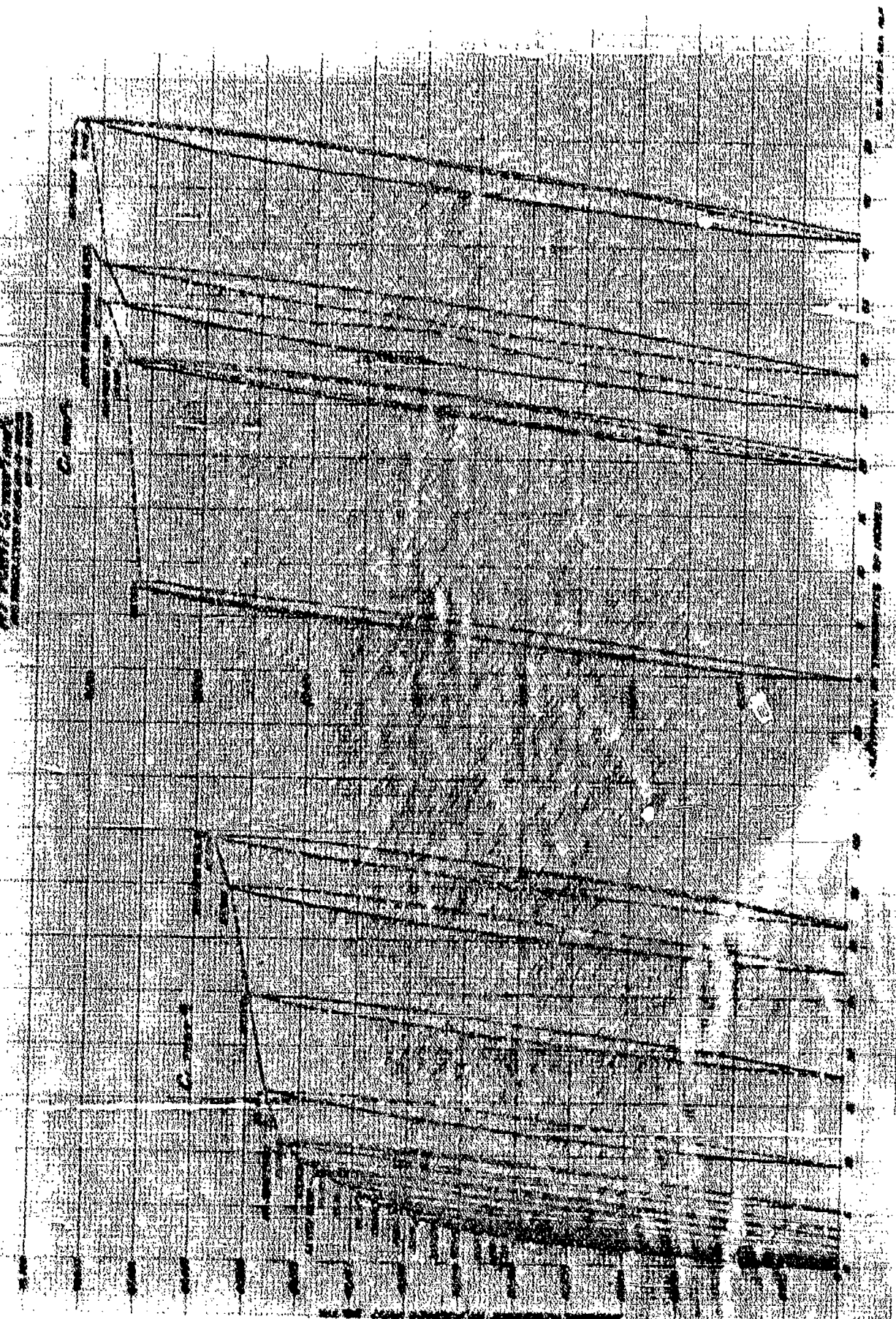
90

INTERMEDIATE TREATMENT PROGRAM
CYLINDER #15



WTN-639-6 779

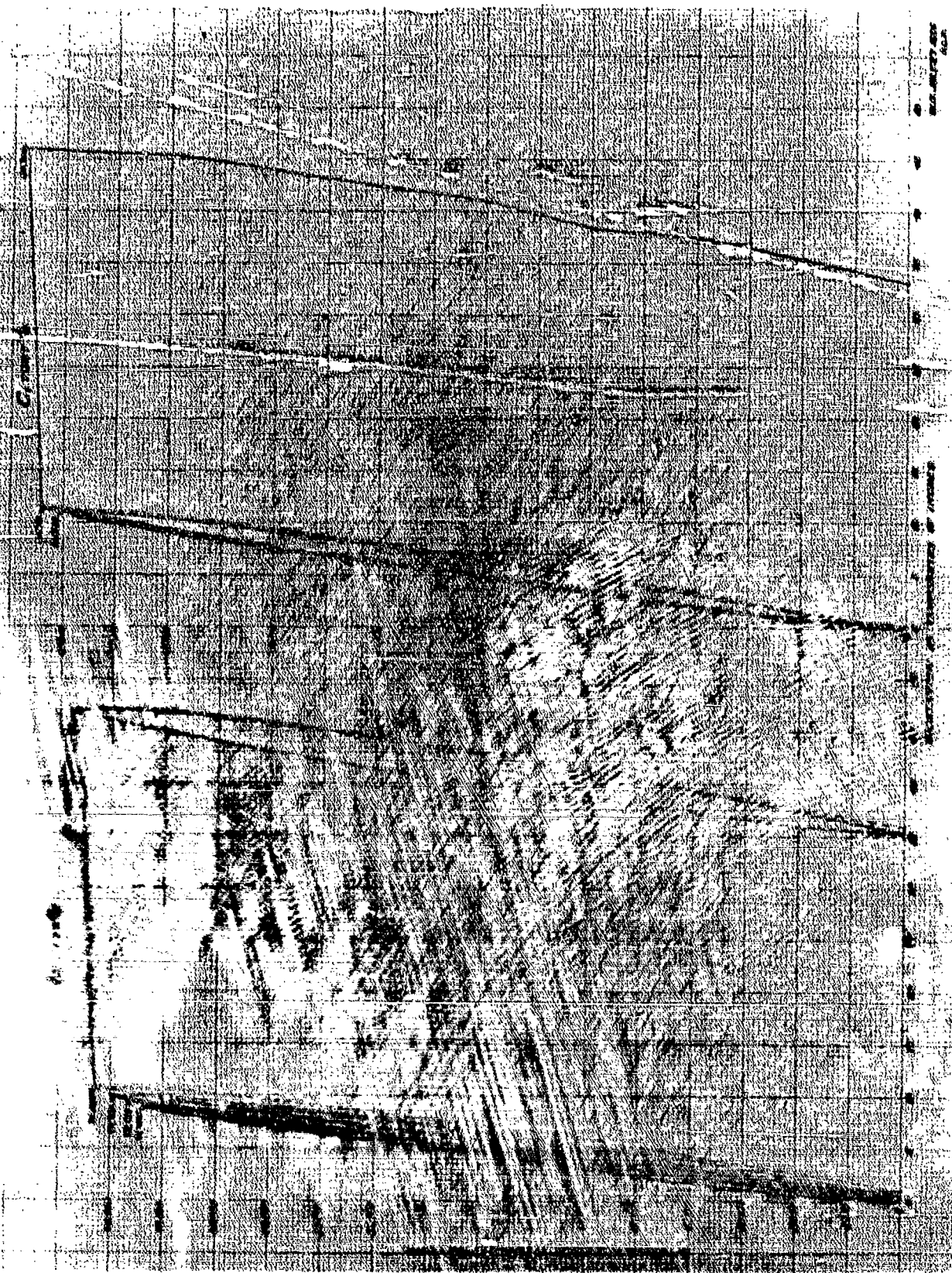
DEFENSE COUNCIL
AT LINT CENTER
AND OTHERS
IN THE
CITY OF NEW YORK



5099-019, W2A

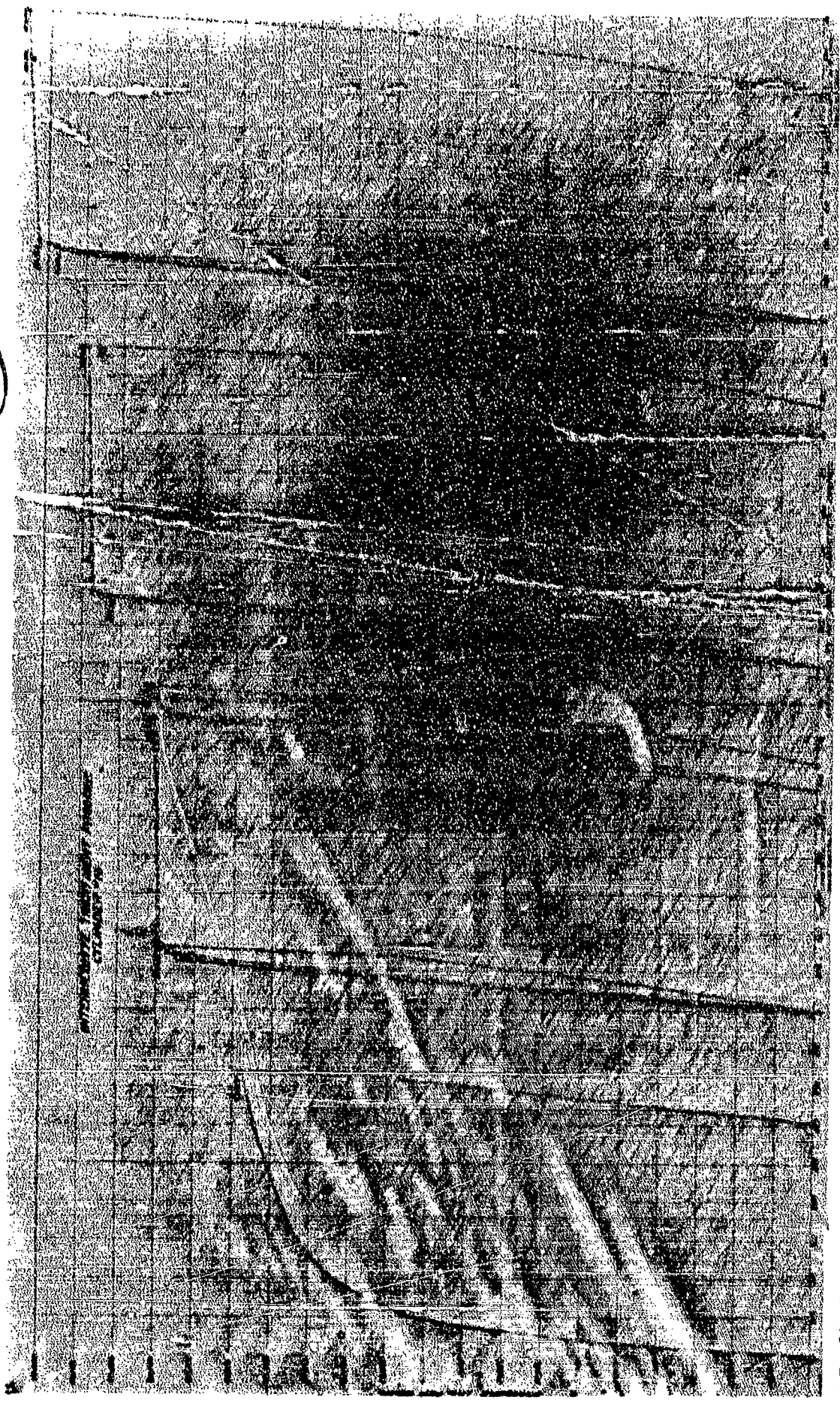
⑦

STATION 8
- 20
3.7E 10.0
3.7E 10.0
3.7E 10.0



VTN. 639-6695

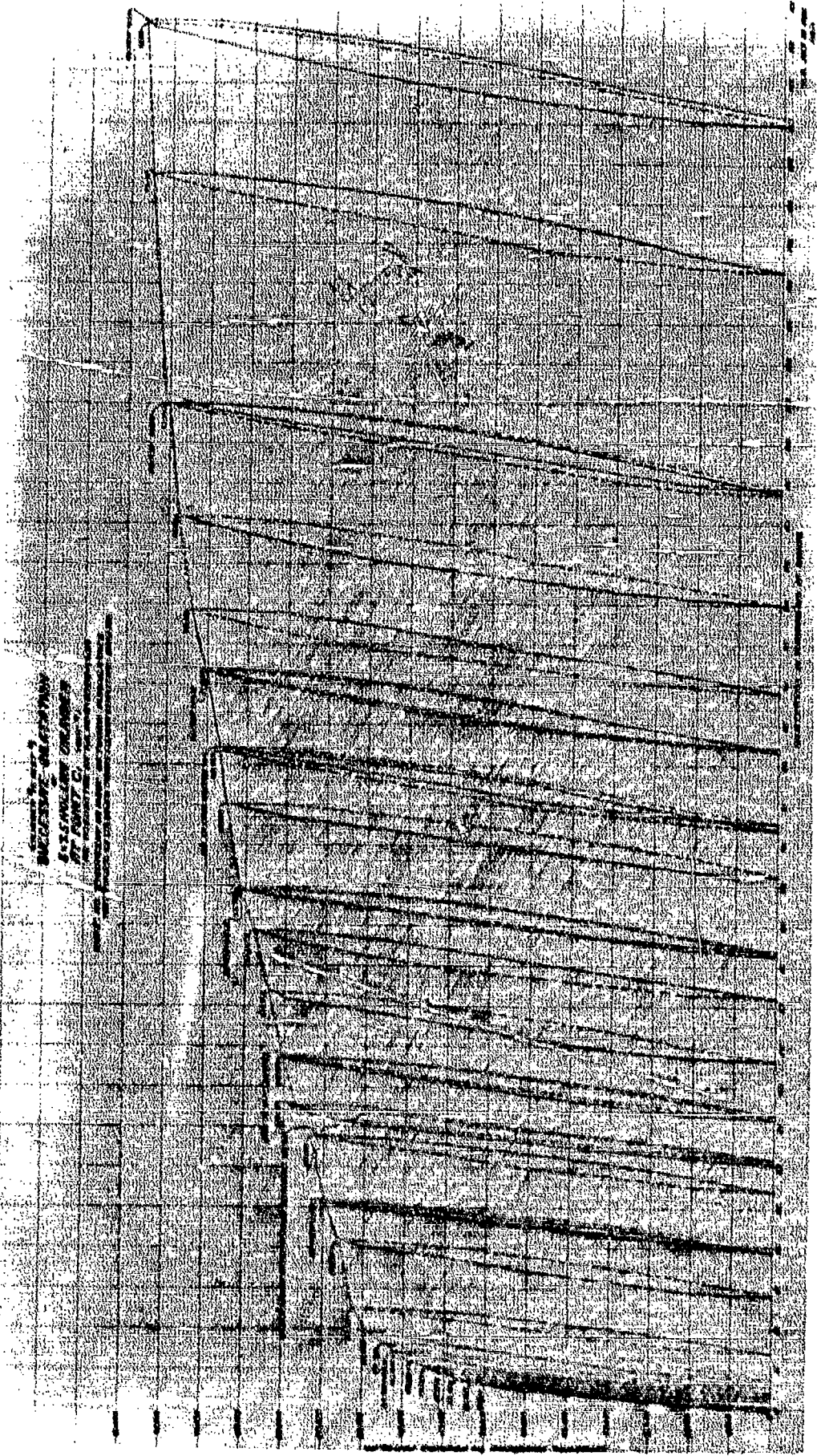
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WTN.639-6777

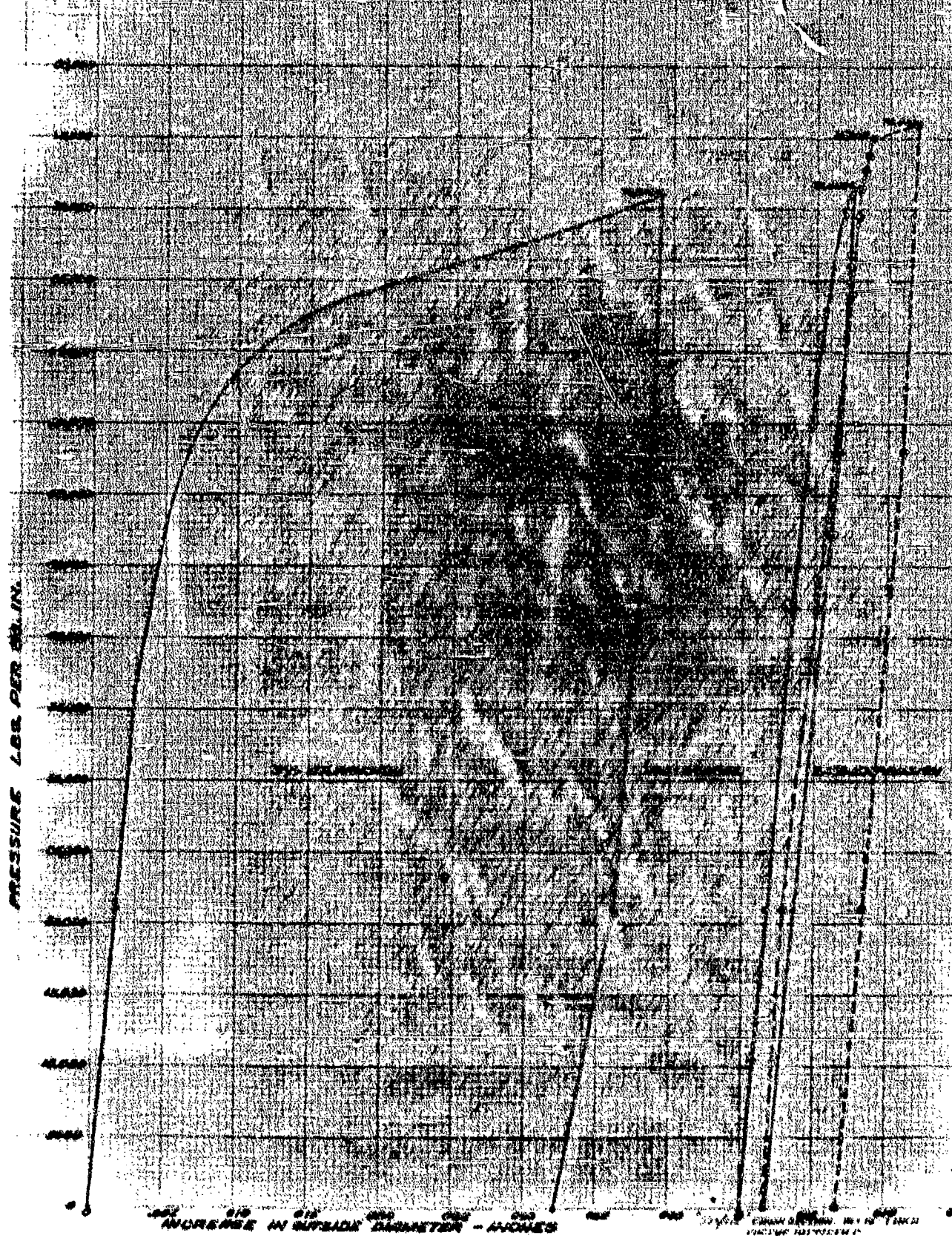
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ST. LOUIS, MO. 63101



VTN.639-6740

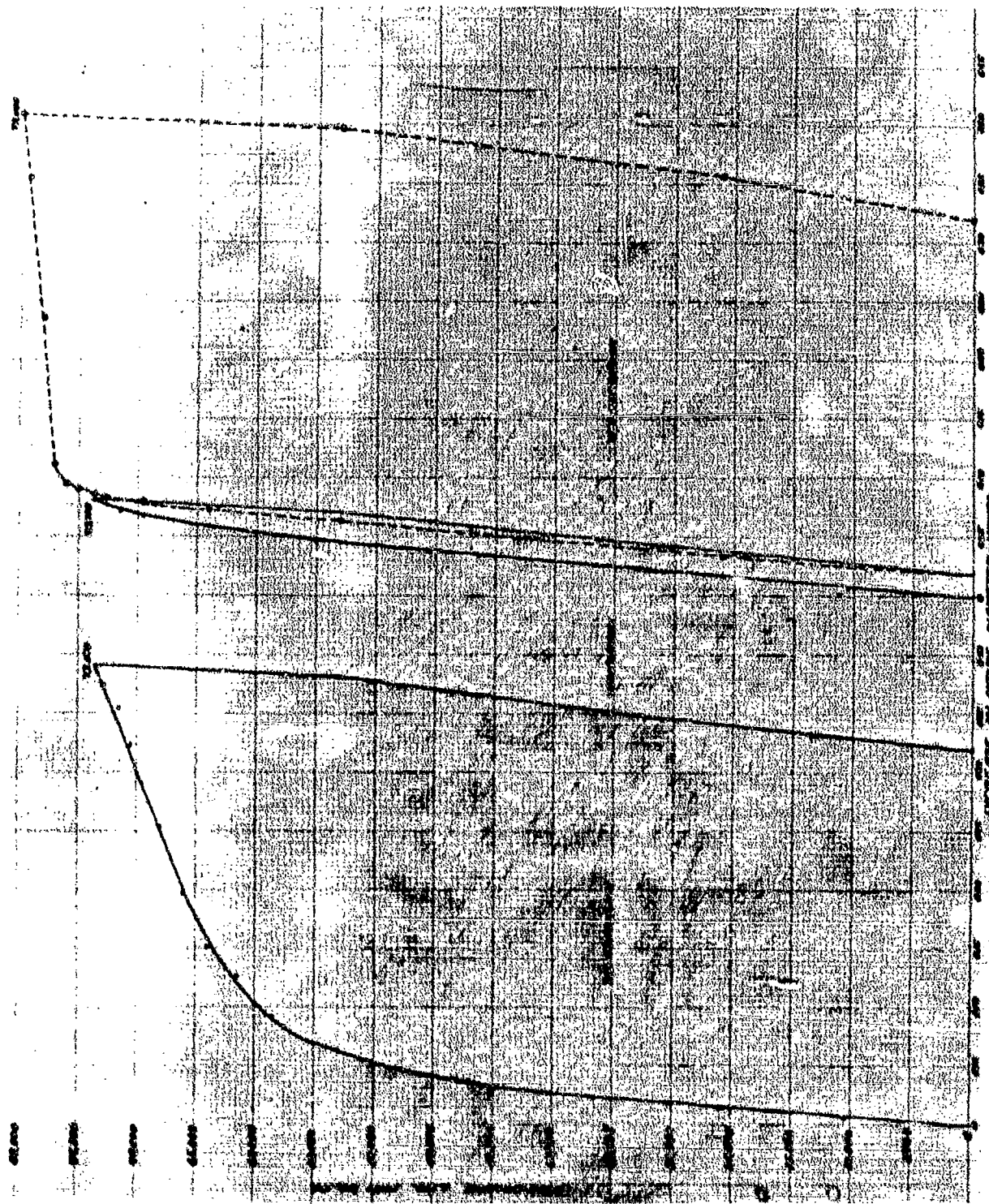
INTERMEDIATE TREATMENT PROGRAM CYLINDER 16



VTN.630-6728

39

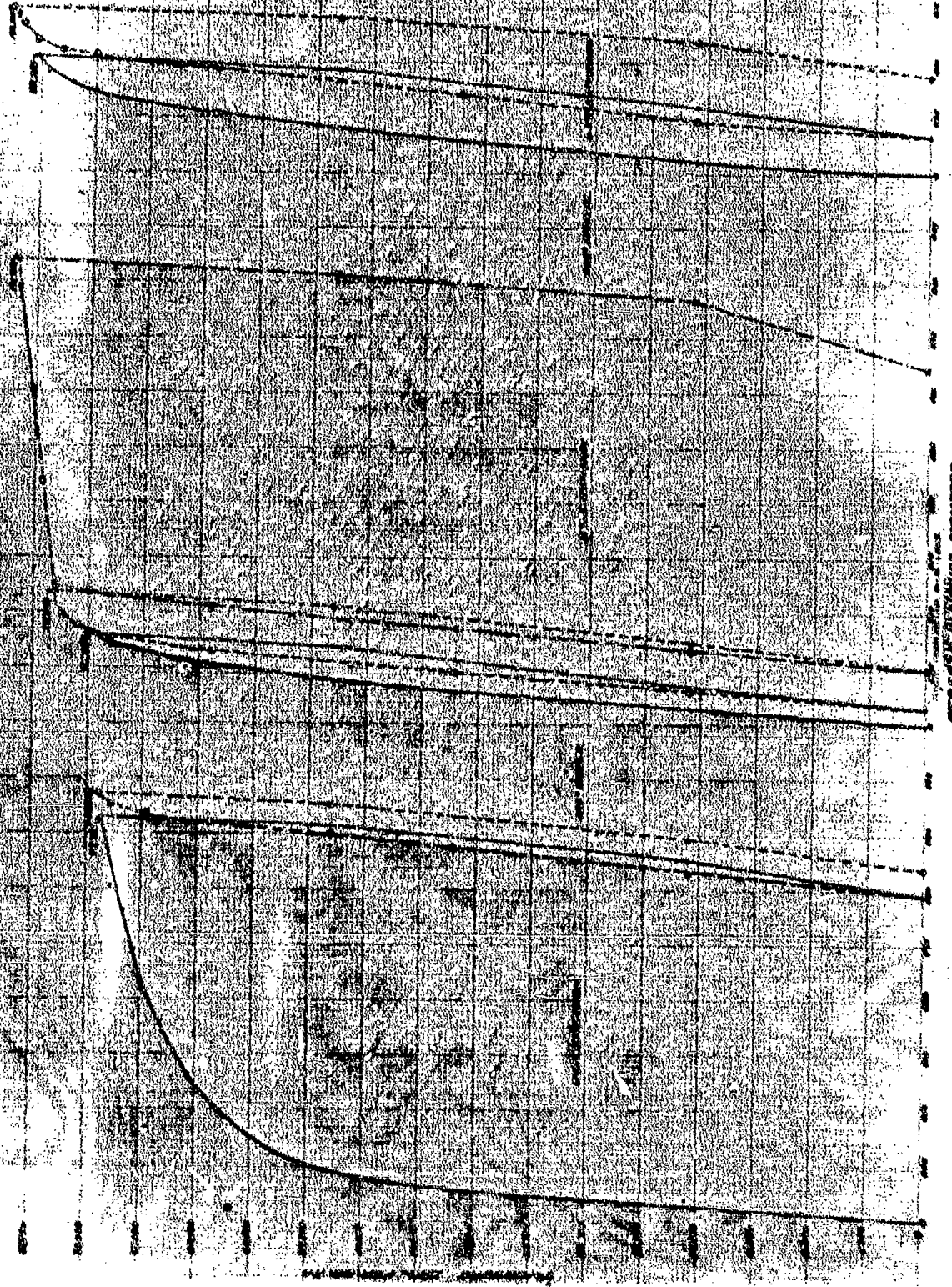
INTERMEDIATE TREATMENT PROGRAM
CYLINDER #19



83

28

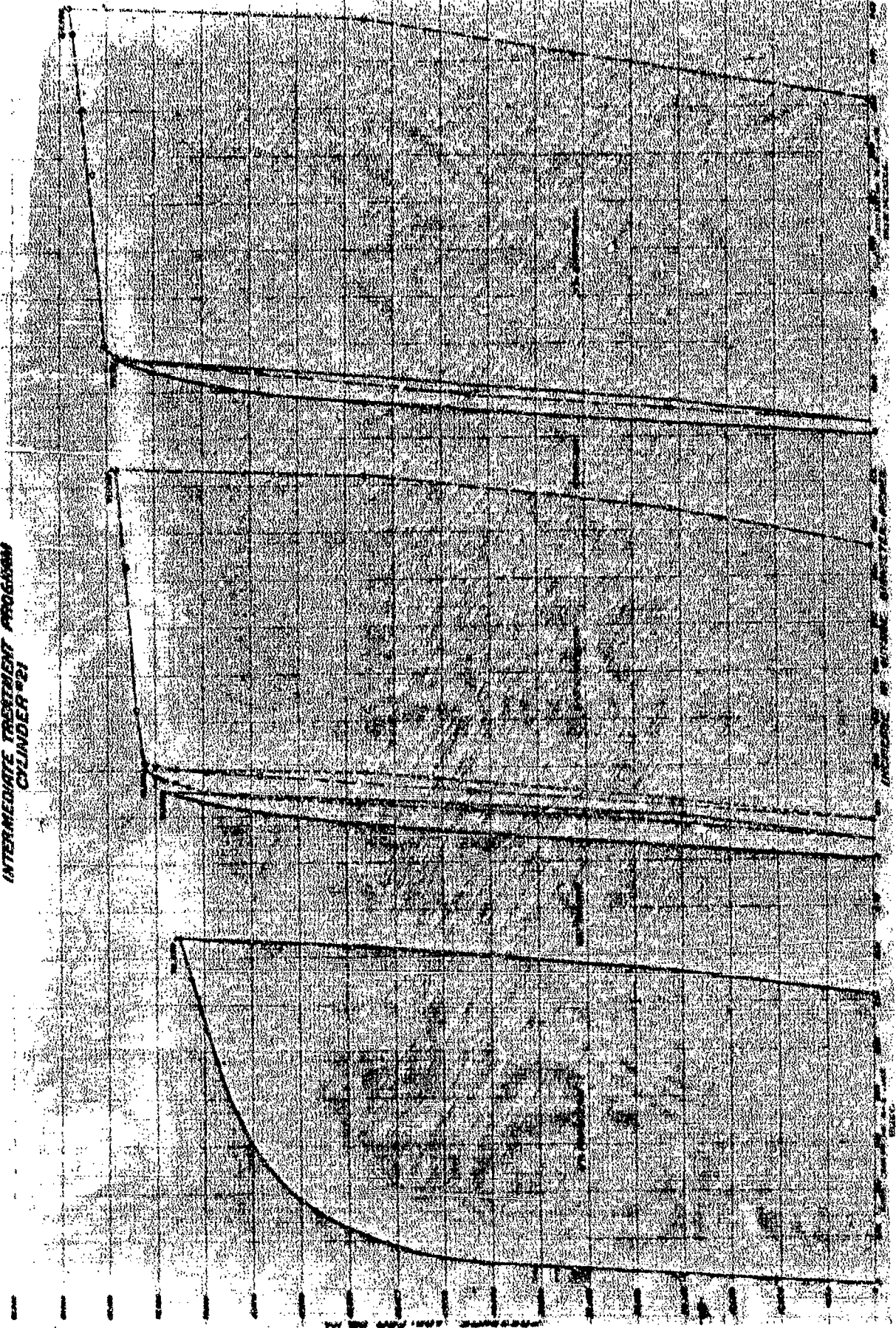
INTERMEDIATE TREATMENT PROGRAM
CYLINDER #20



WM. 639-6775

14

INTERMEDIATE TREATMENT PROGRAM
CYLINDER #21



VTN 639-6768

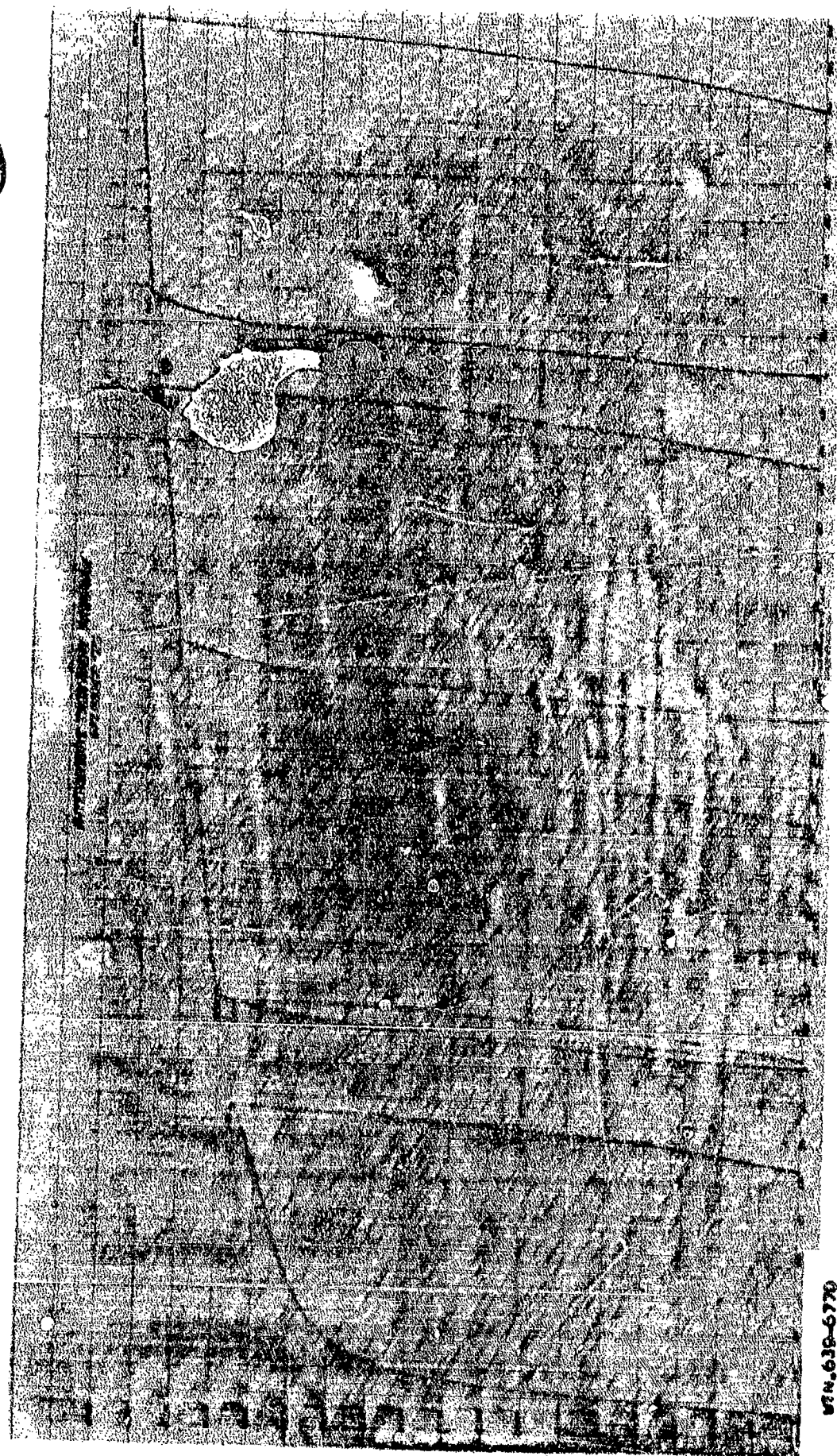
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INTERIM TREATMENT PROGRAM
CIVILIAN



W.N. 630-6780

(8)

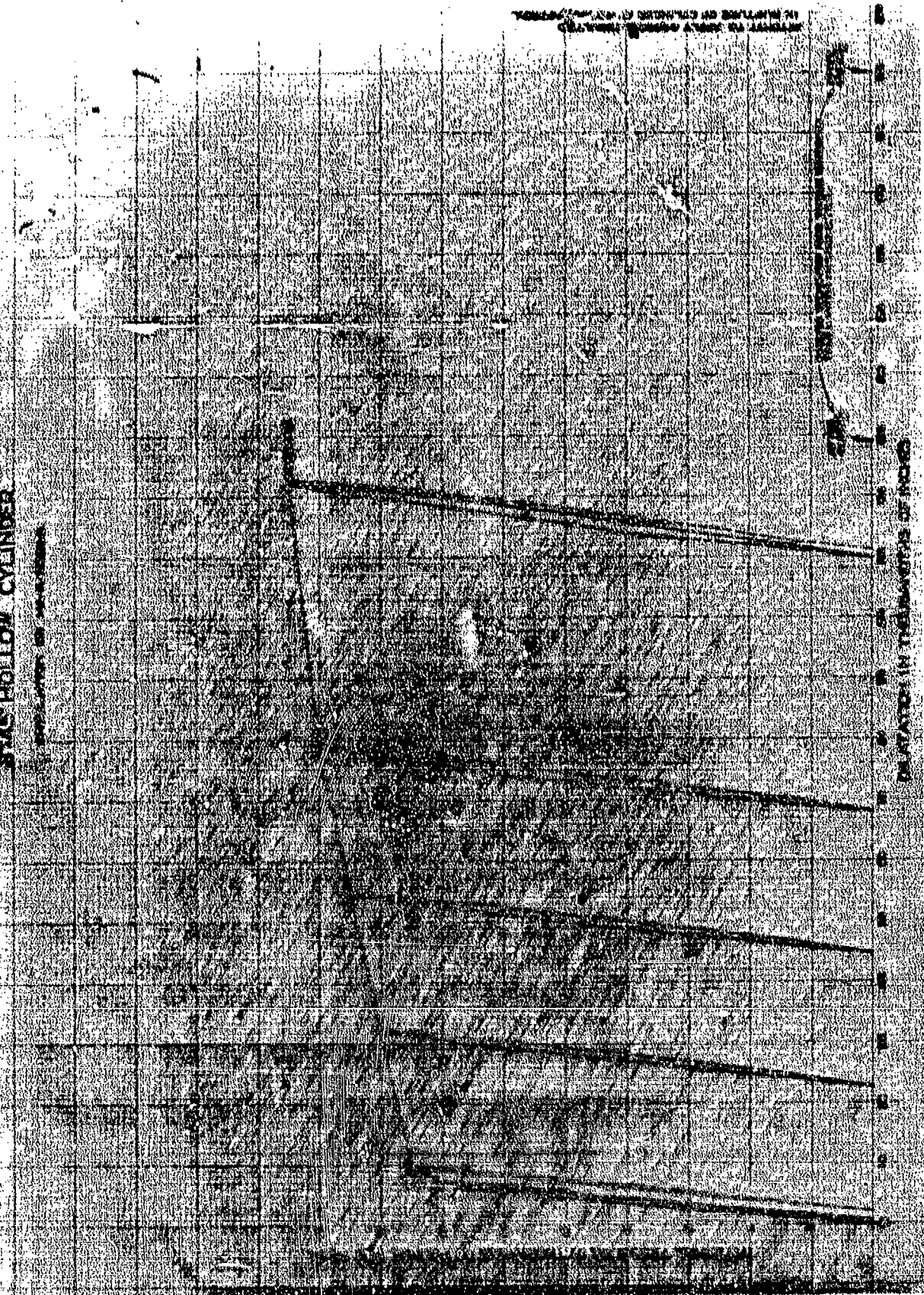


W.N. 638-6770

SUCCESSIVE DILATATIONS AT POINT C

STAIN HOLLOW CYLINDER

EXPANSION IN INCHES



WTA.639-6715

(25)

25

SUCCESSIVE DEVIATIONS AT POINT D.

2.45 MILLION CHANGES THAT WERE

MADE AT POINT D.

IN THE CASE OF CHANGES IN THE CASE OF

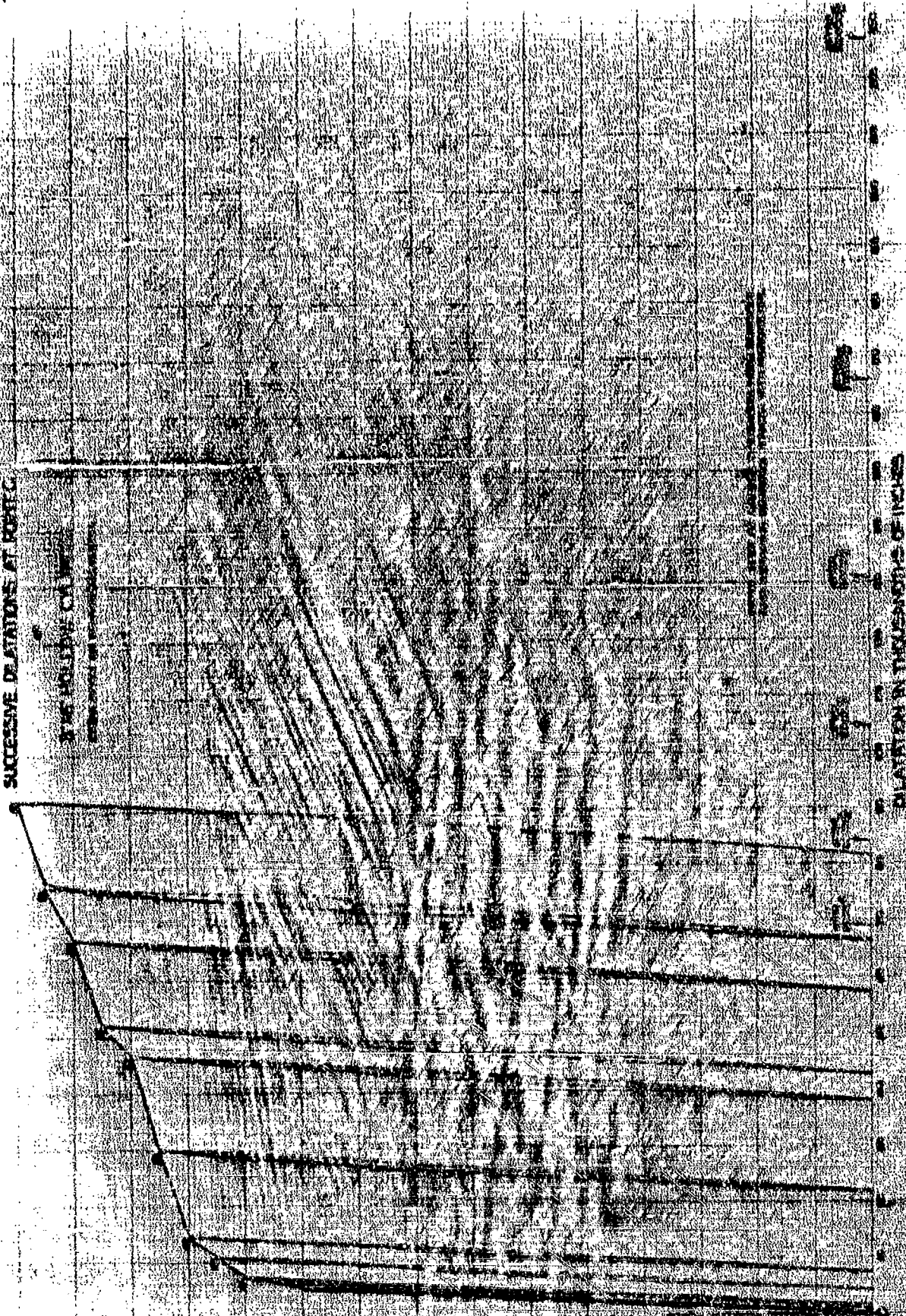
VTN-63D-0714

SUCCESSIVE DEVIATIONS AT POINT C

TIME IN HOURS

DILATION IN THOUSANDS OF INCHES

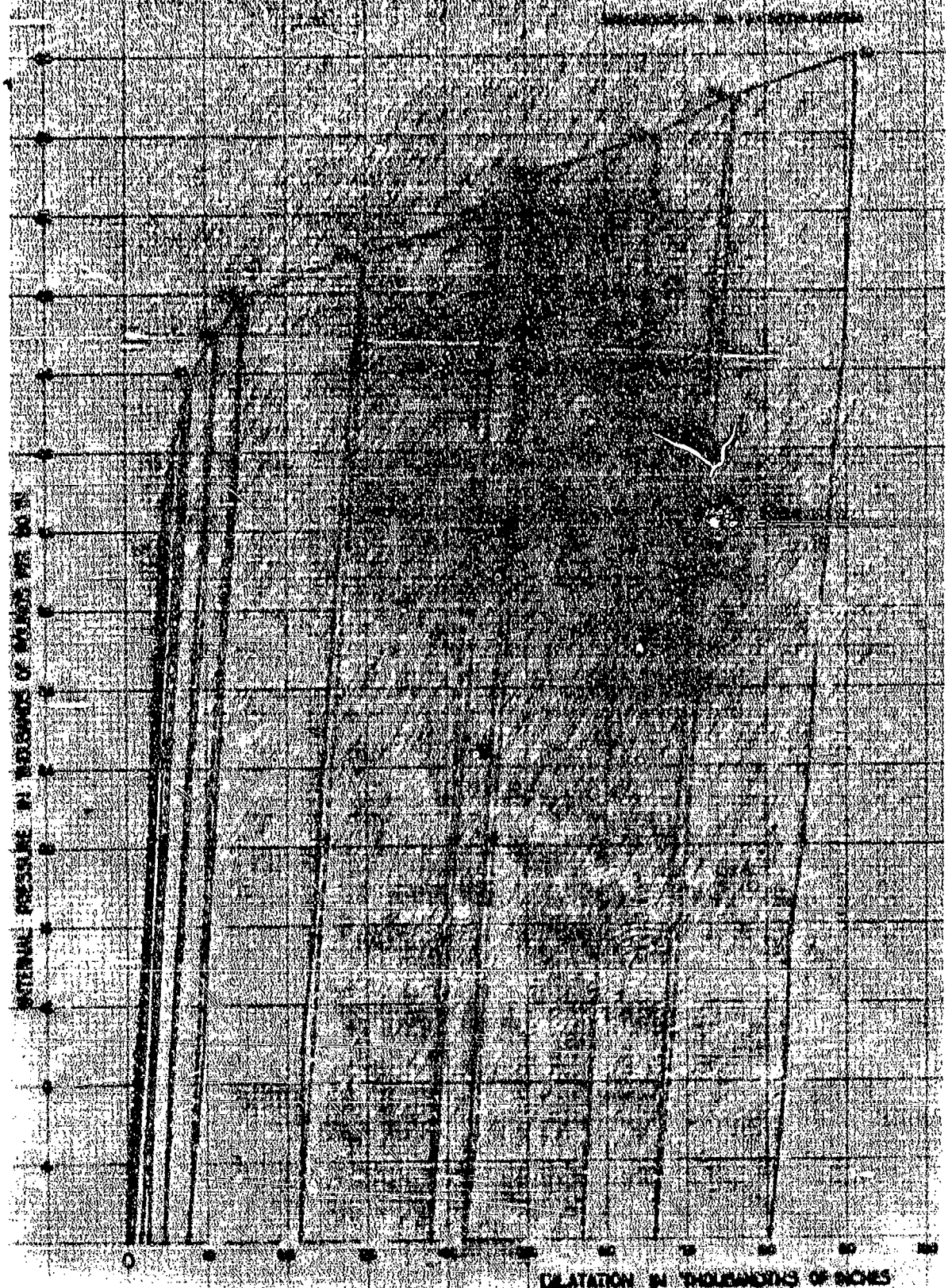
INTERNAL TEMPERATURE IN THOUSANDS OF DEGREES FAHRENHEIT



(23)

SUCCESSIVE DILATATIONS AT POINT C₂

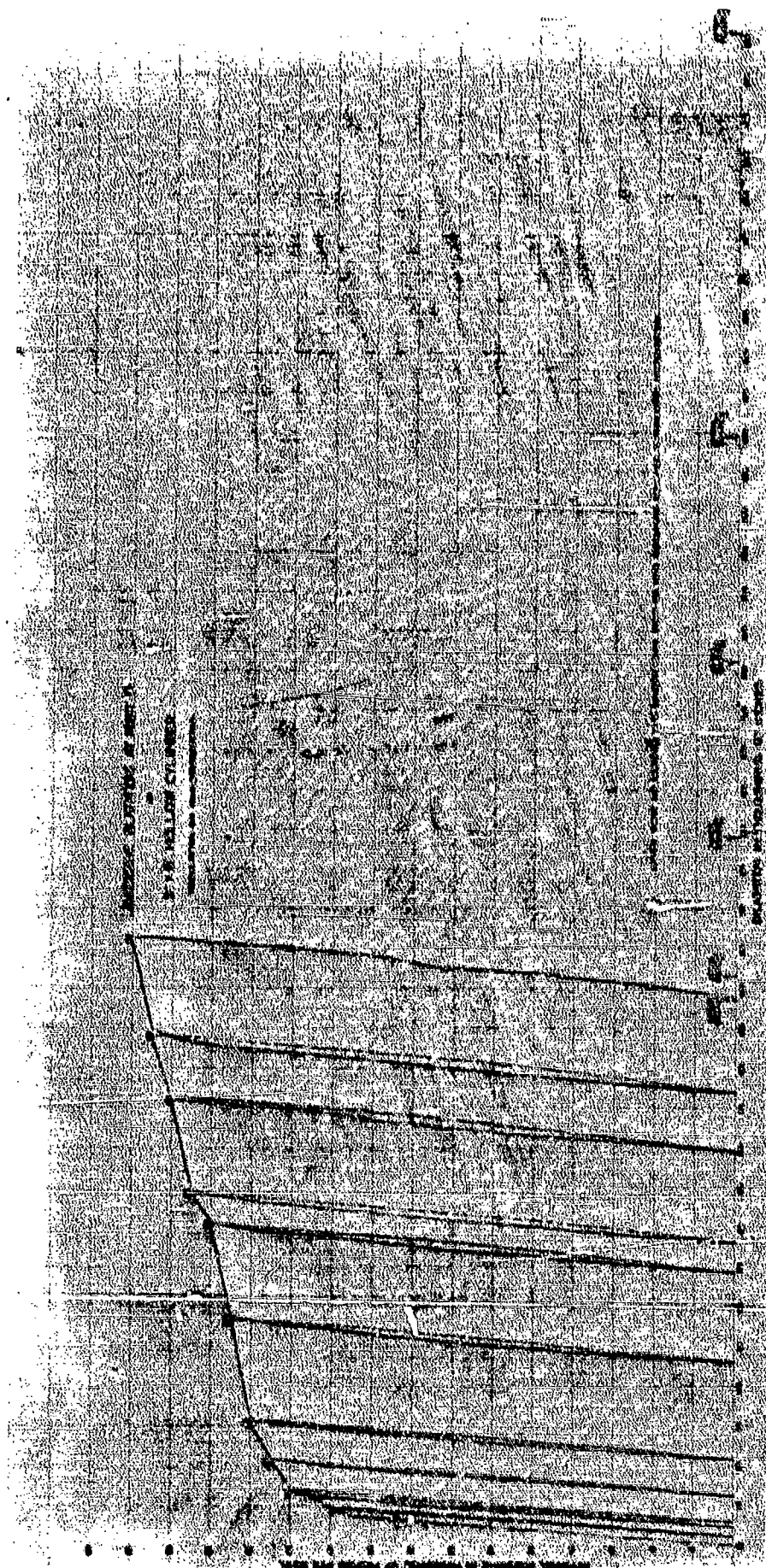
2.5% SODIUM CHLORIDE SOLUTION TREATED



WTN.630-6712

DILATION IN THOUSANDS OF INCHES

50



WTH.639-6711

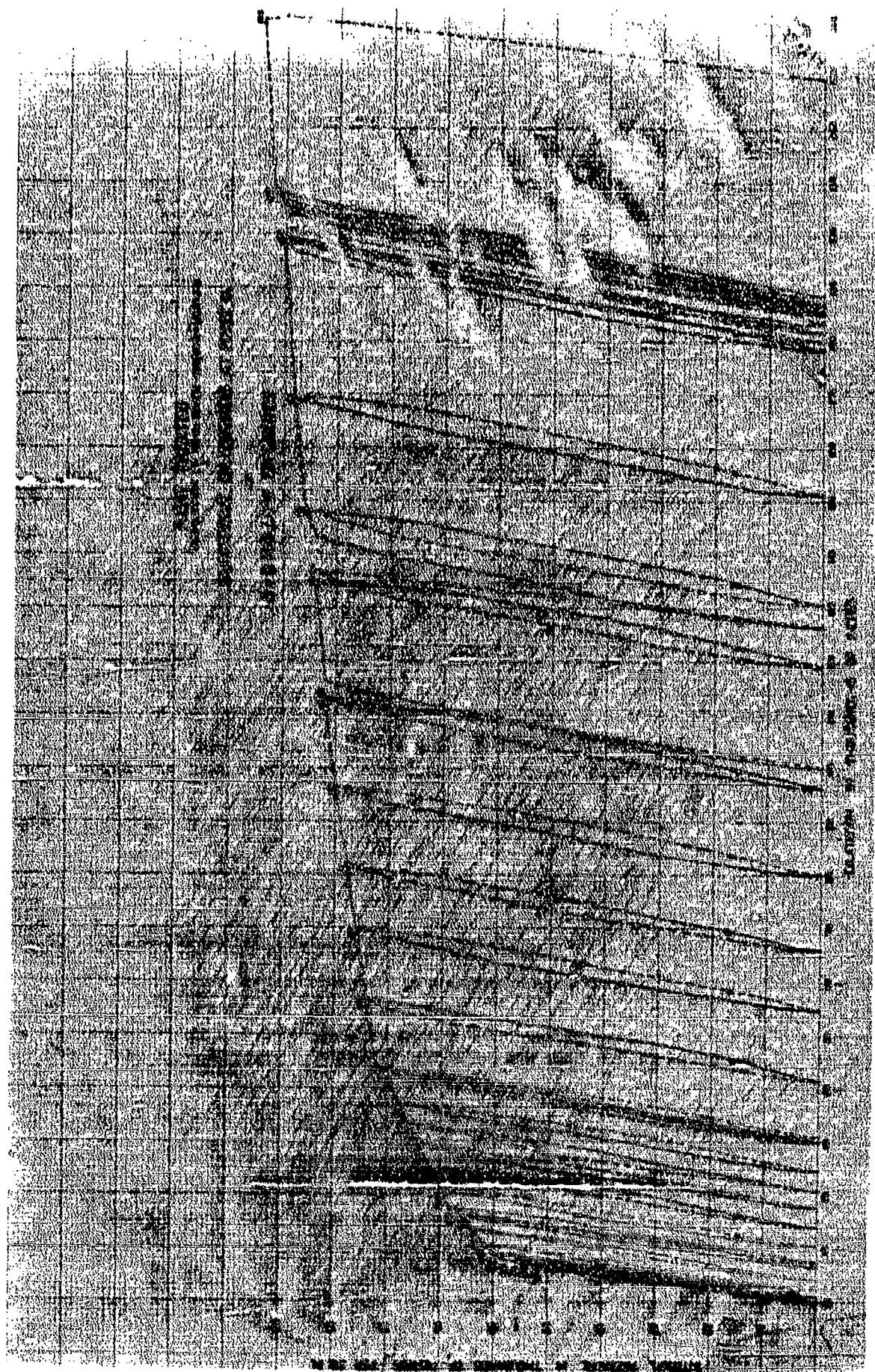
ATTACHED PAGES TO TRANSMISSION OF MESSAGE ARE NO. 10

WTH.630-6734

TRANSMISSION OF MESSAGE

57

44



VTN 639-6733

SUCCESSIVE DILATATIONS AT POINT C

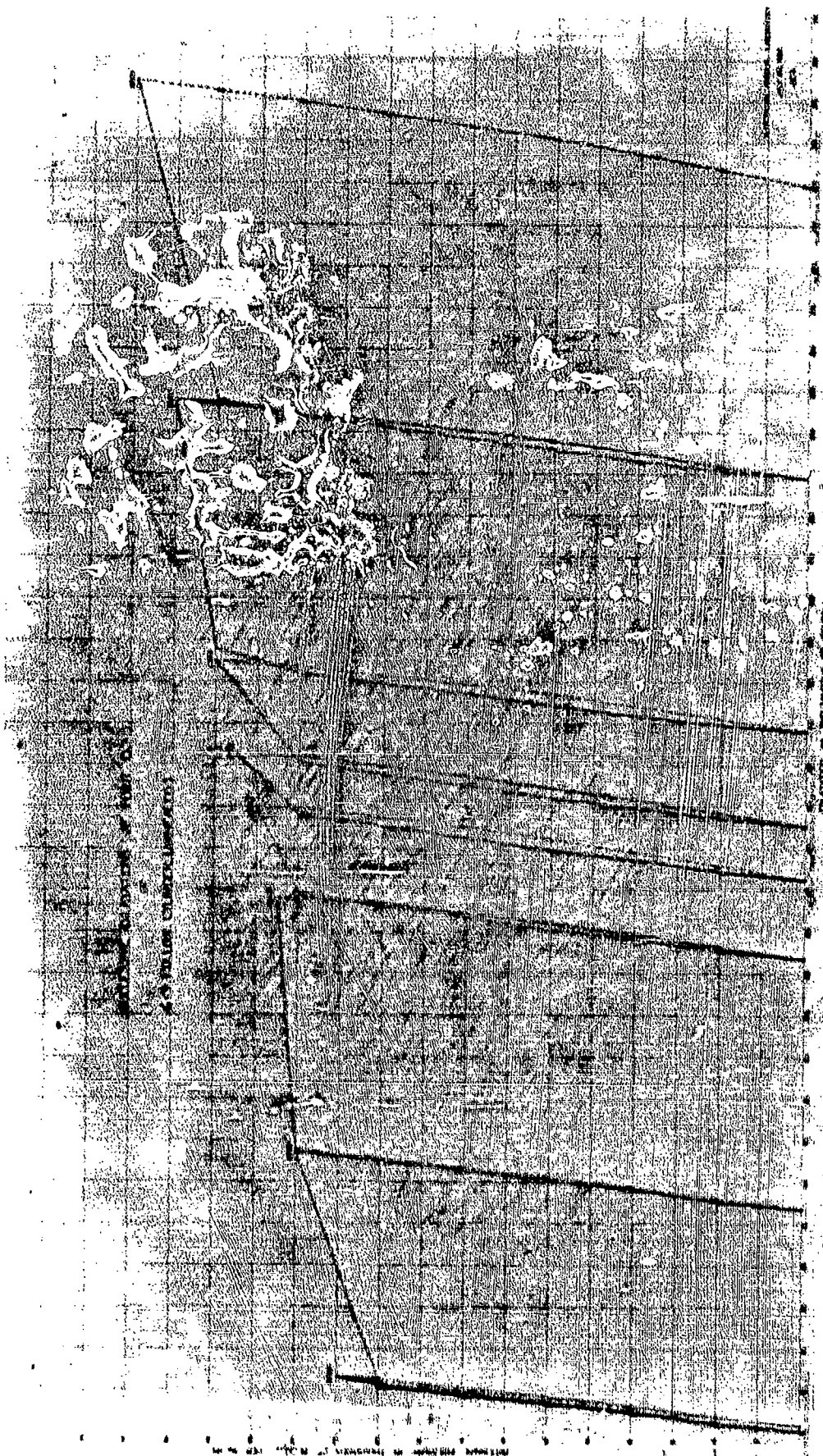
6157 HOLLOW CYLINDER (INCHES)

STRAIN GAGE ON SURFACE



VTM.639-6719

83

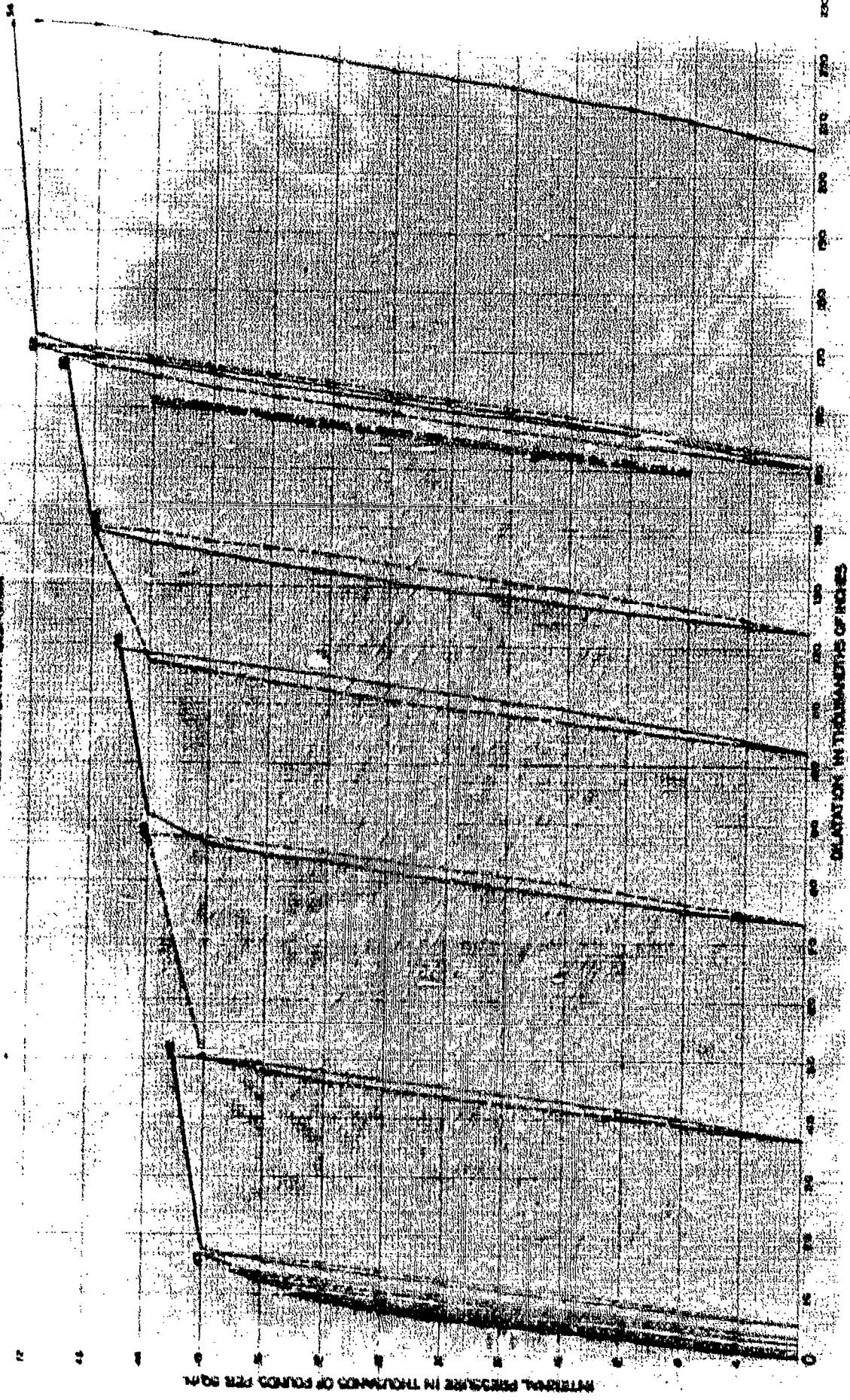


VTN 625-6717

31

SUCCESSIVE DILATIONS AT POINT C,
OF
6" I.D. HOLLOW CYLINDER (ANNEALED)

TENSION ON H.A. SPECIMENS



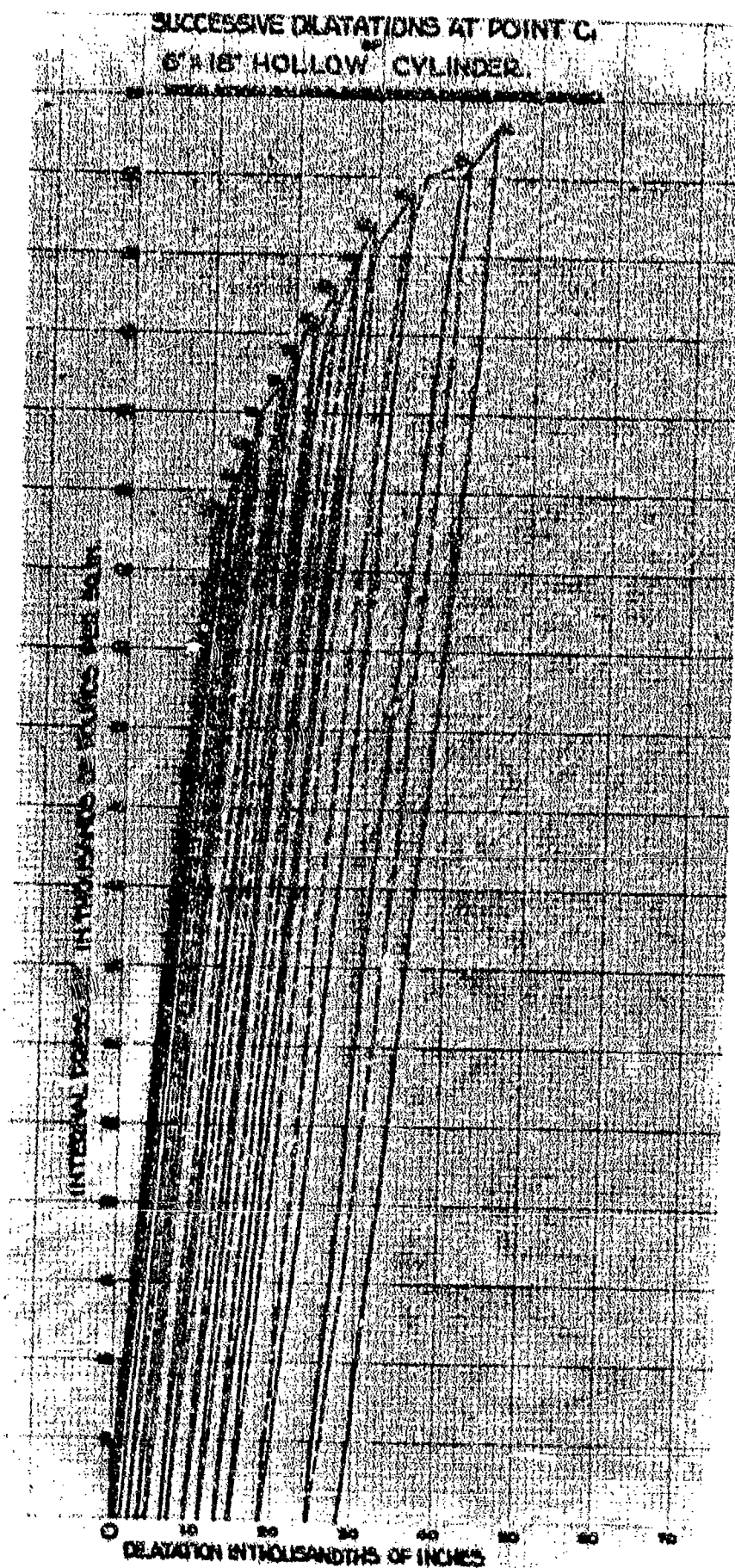
W.H. 639-6720

69

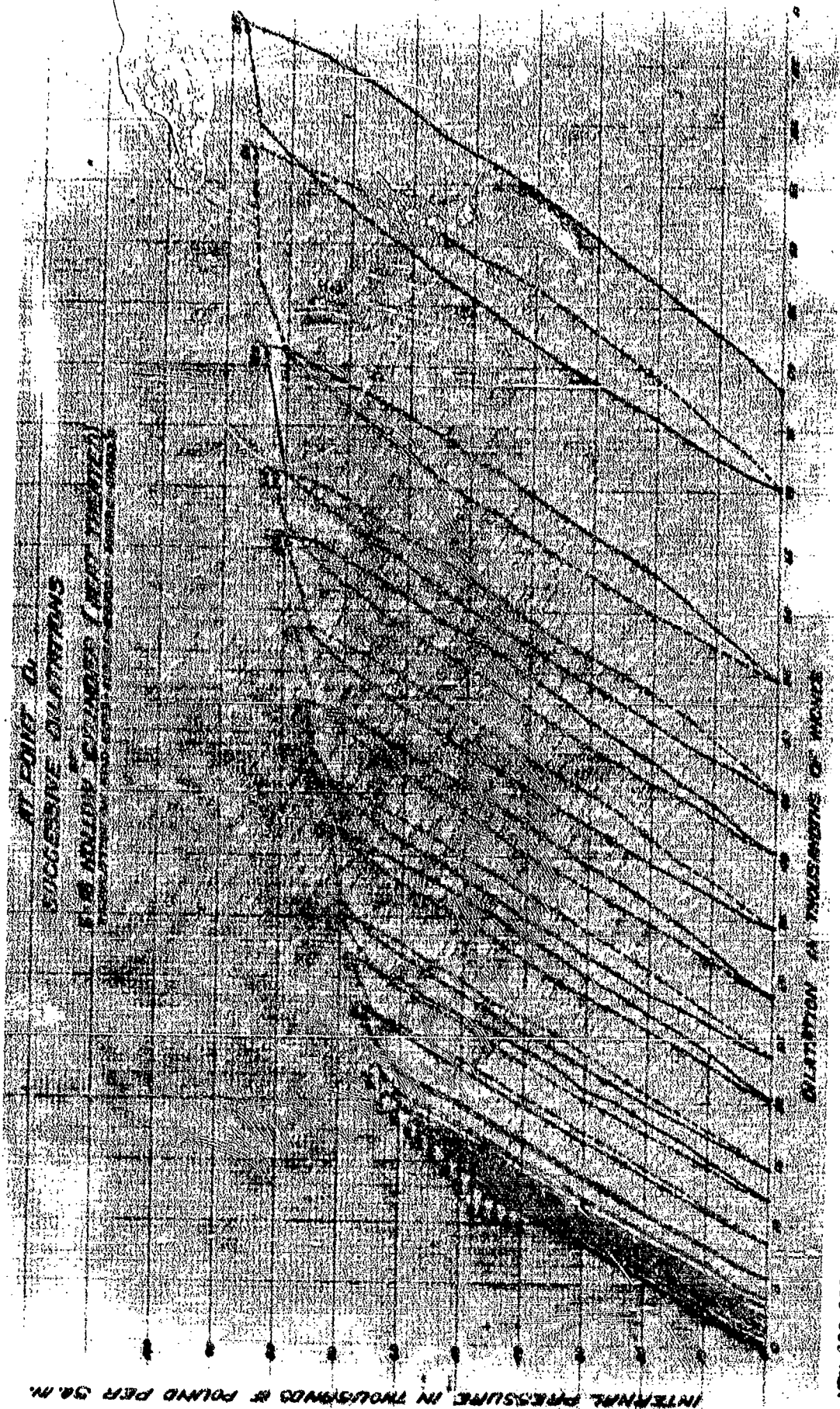


WTM.639-67:8

(29)



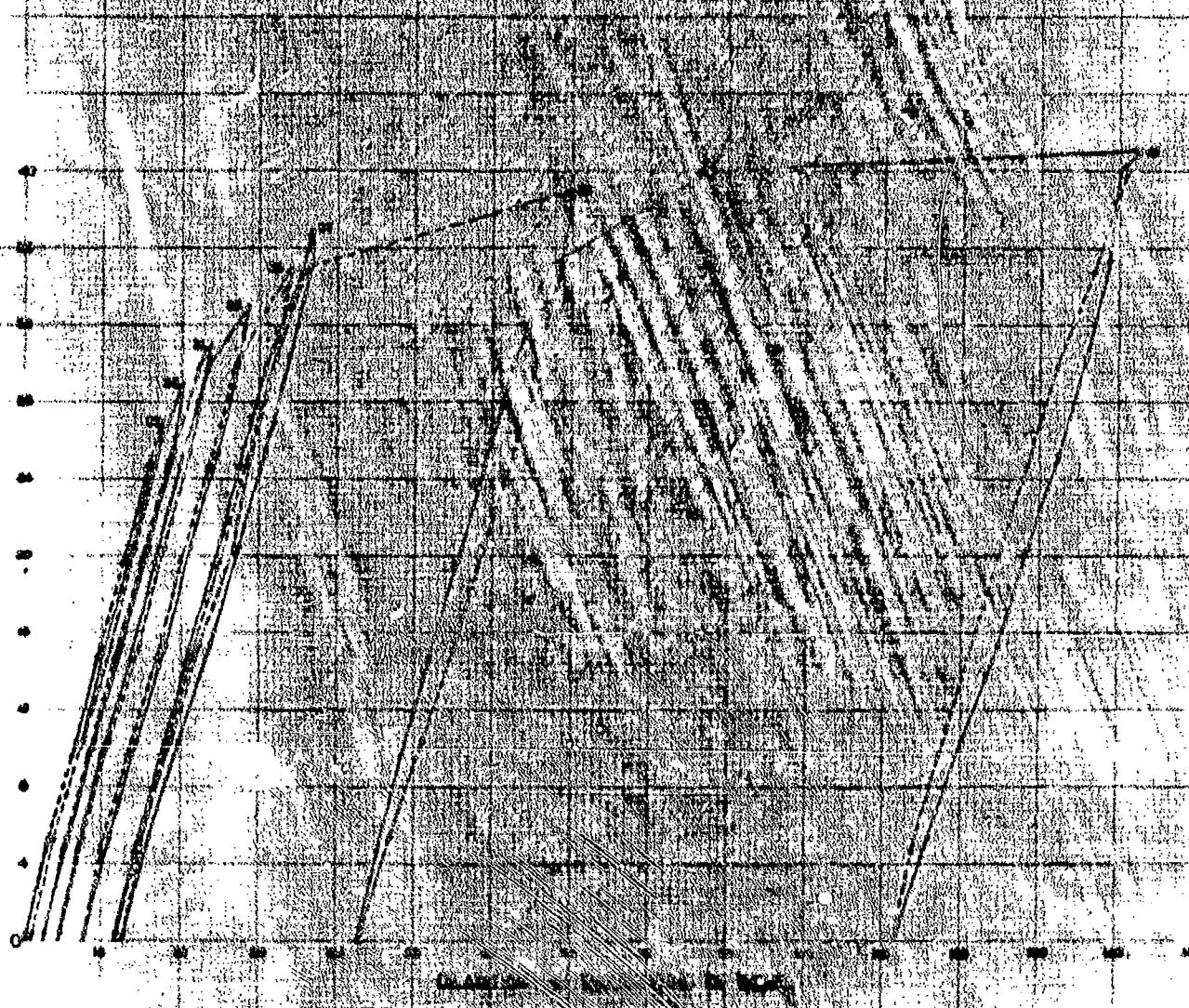
30



AT POINT OF
SUCCESSIVE DILATIONS
IN A HOLLOW CYLINDER (NOT TESTED)

WTN 639-6721

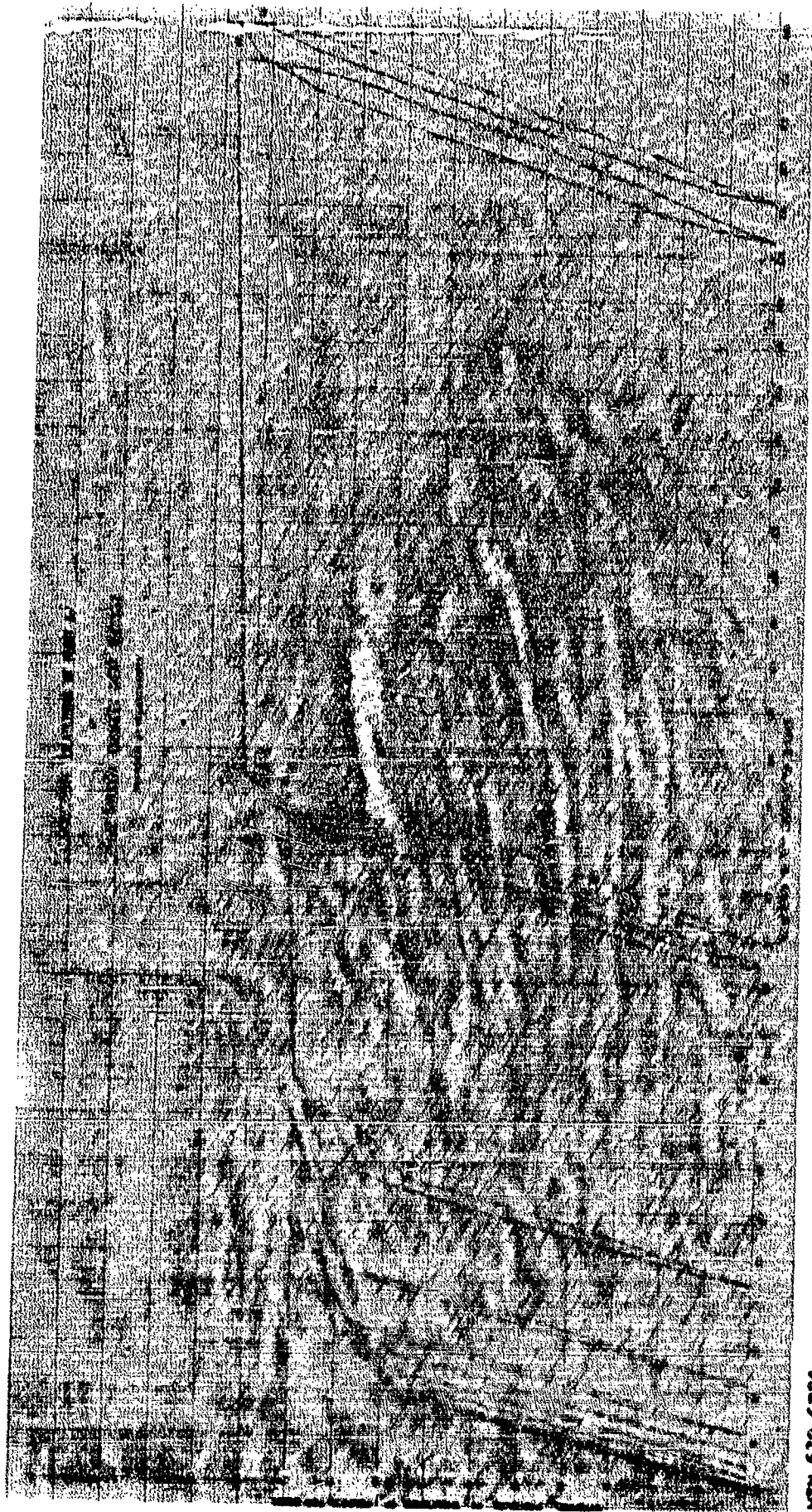
INTERNAL PRESSURE IN THOUSANDS OF POUNDS PER SQ. IN.



WTR. 639-6723

34

35

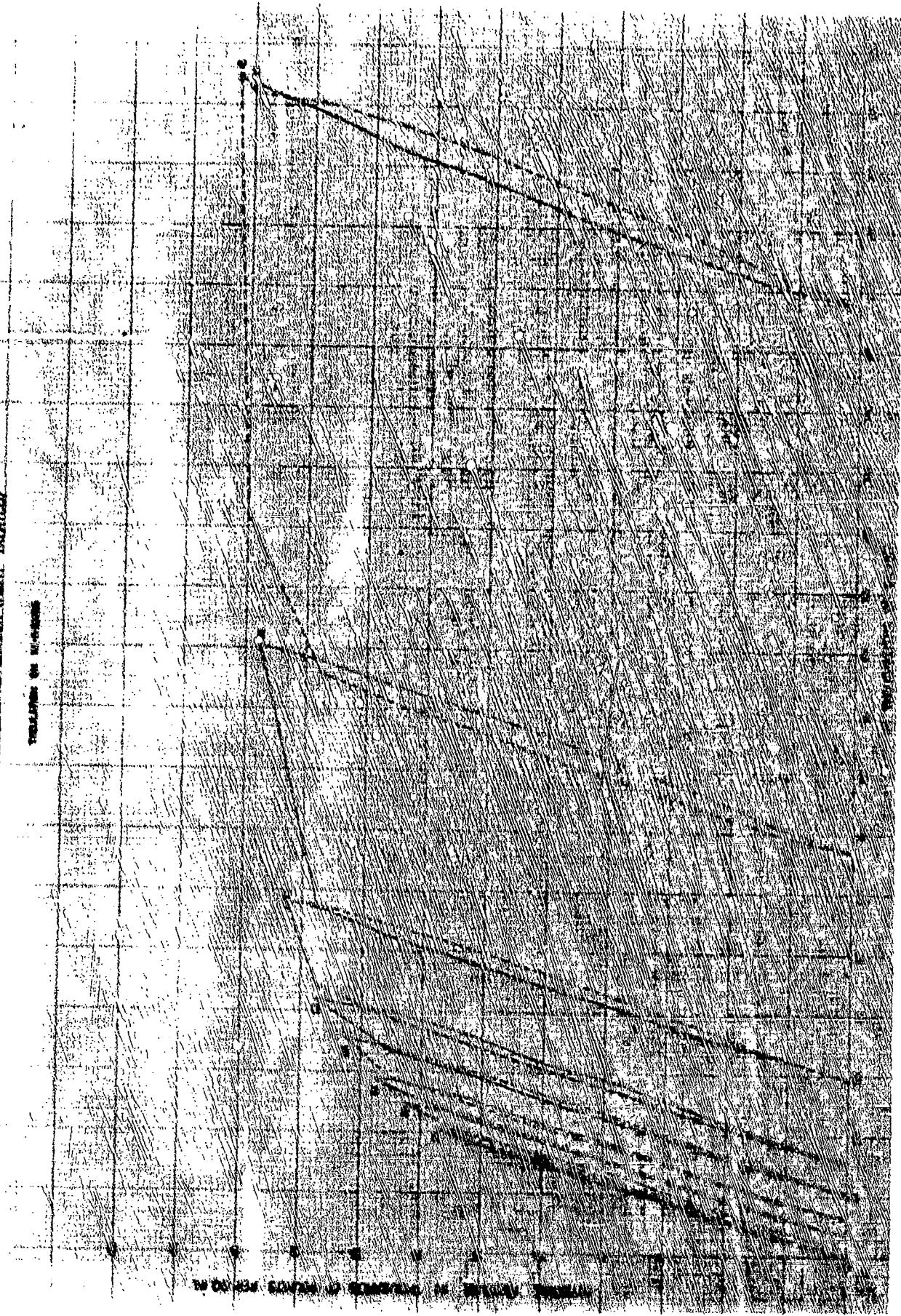


VTM.639-6724

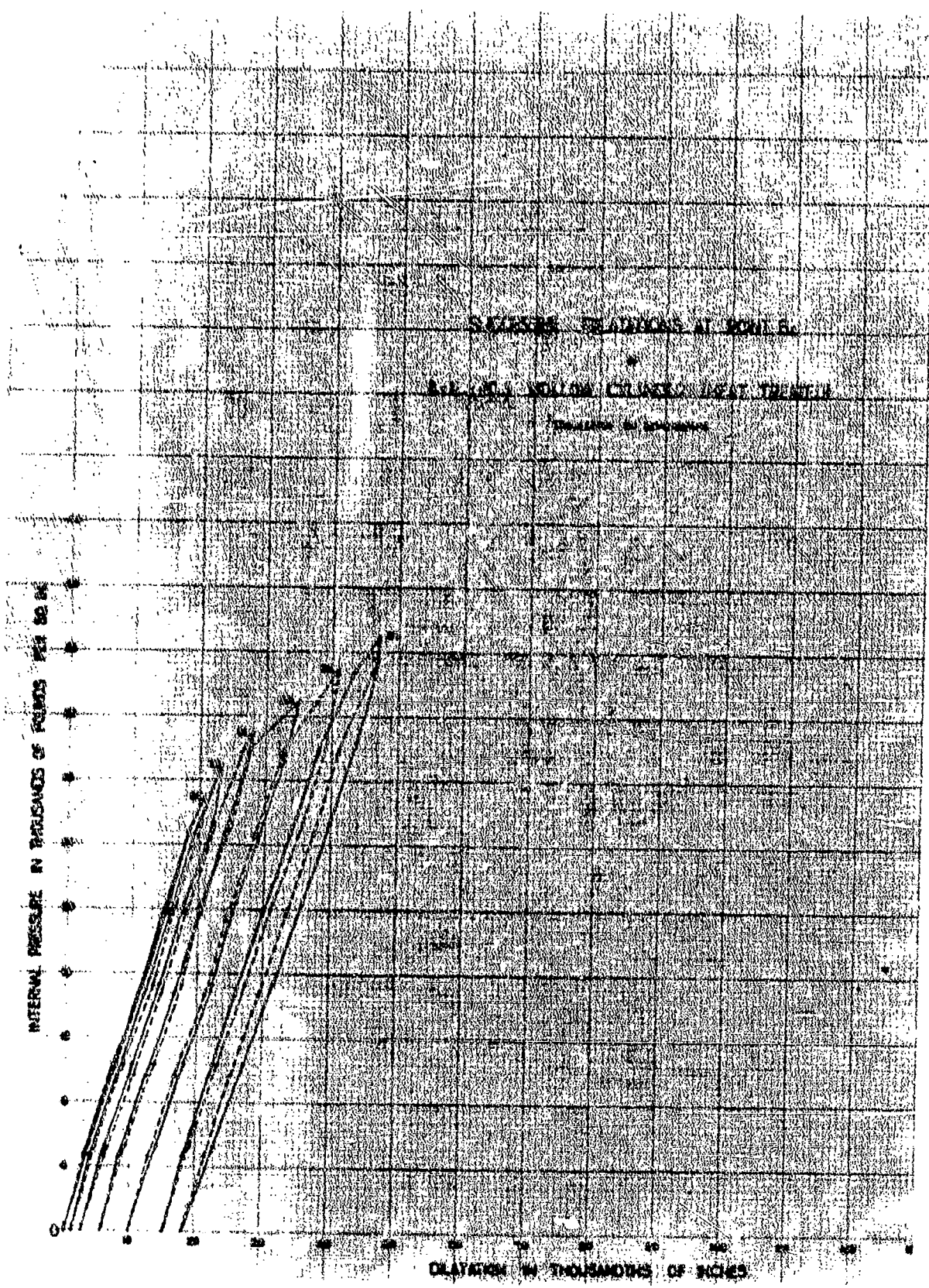
32

SUCCESSIVE DILATIONS AT POINT B.
A.12.140.5 HOLLOW CYLINDER (HEAT TREATED)

TEMPERATURE IN °F

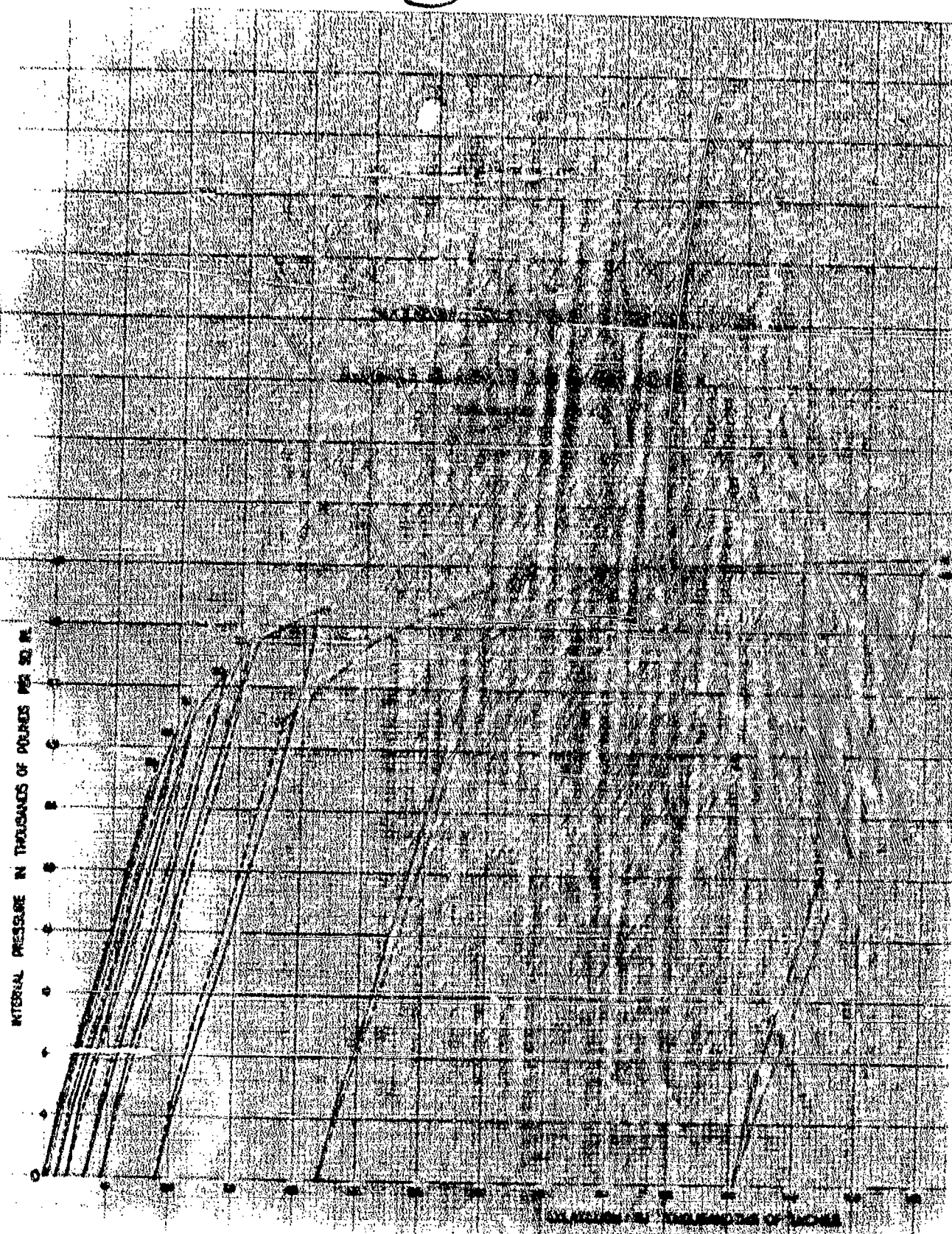


41



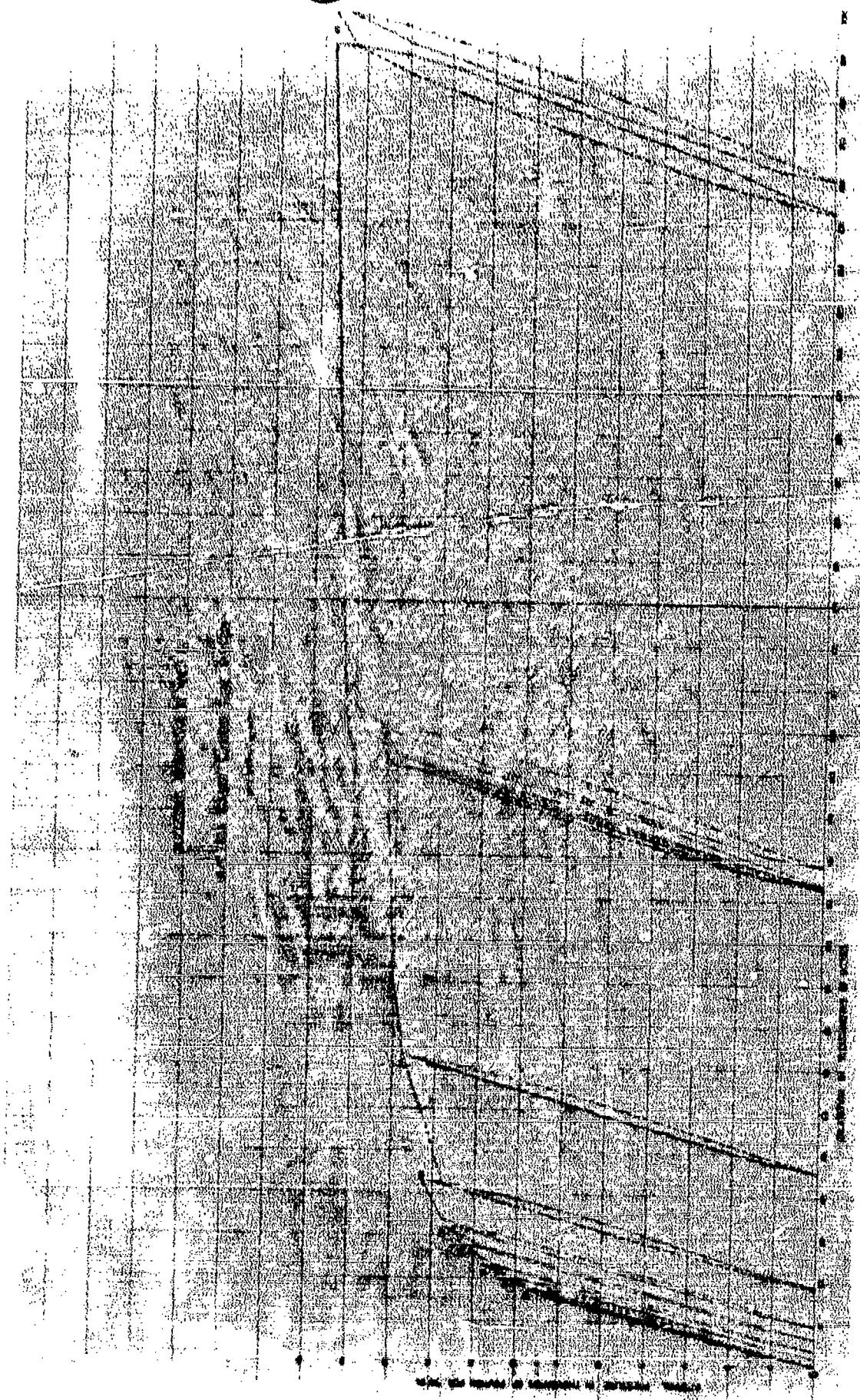
WTN.630-6730

(24)



VTN.630-6731

93



WFM.630-6732

SUCCESSIVE DILATATIONS AT POINT B.

2.12 x 10.5 HOLLOW CYLINDER (HEAT TREATED)

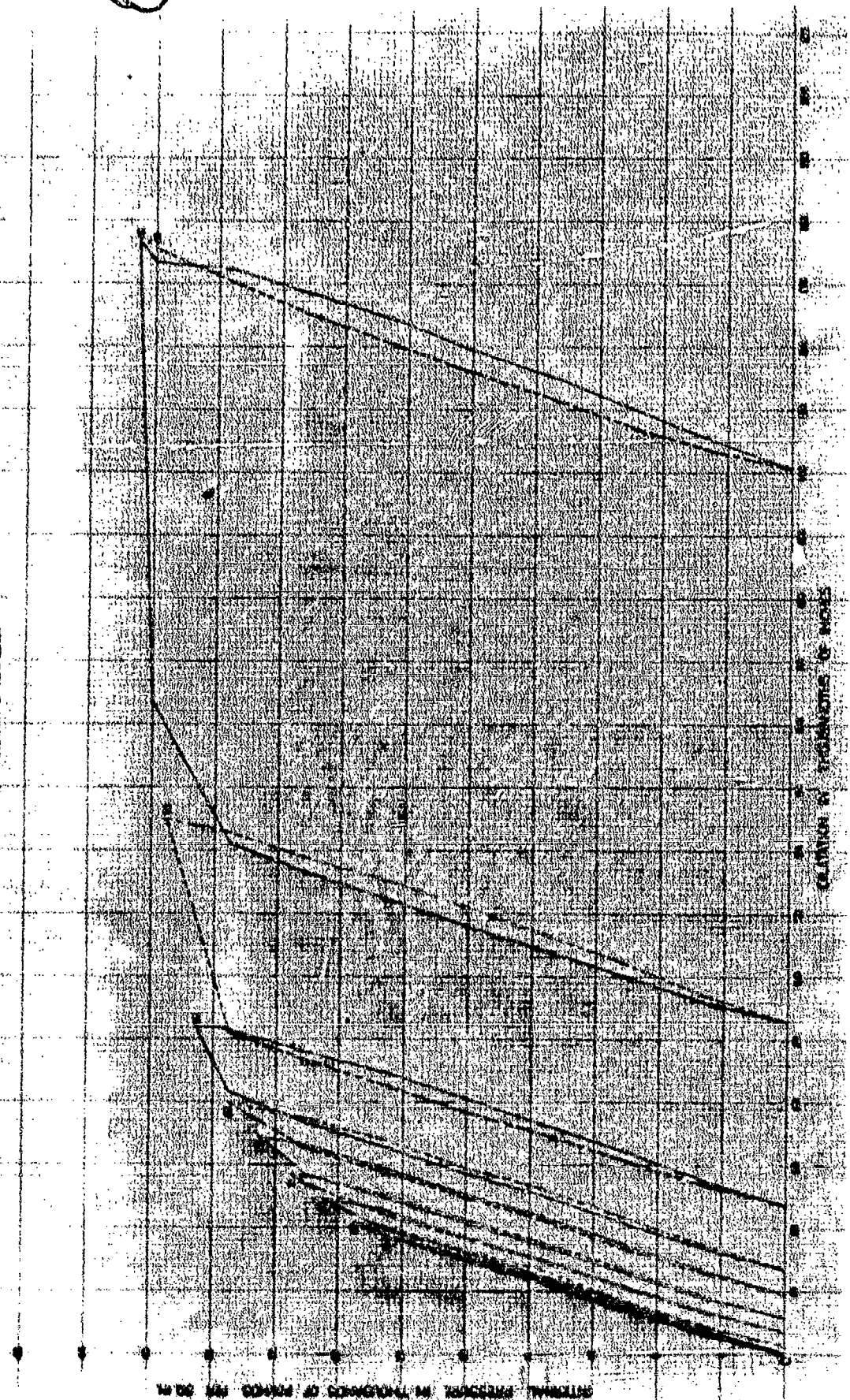
TESTED IN 10-4-10000

689

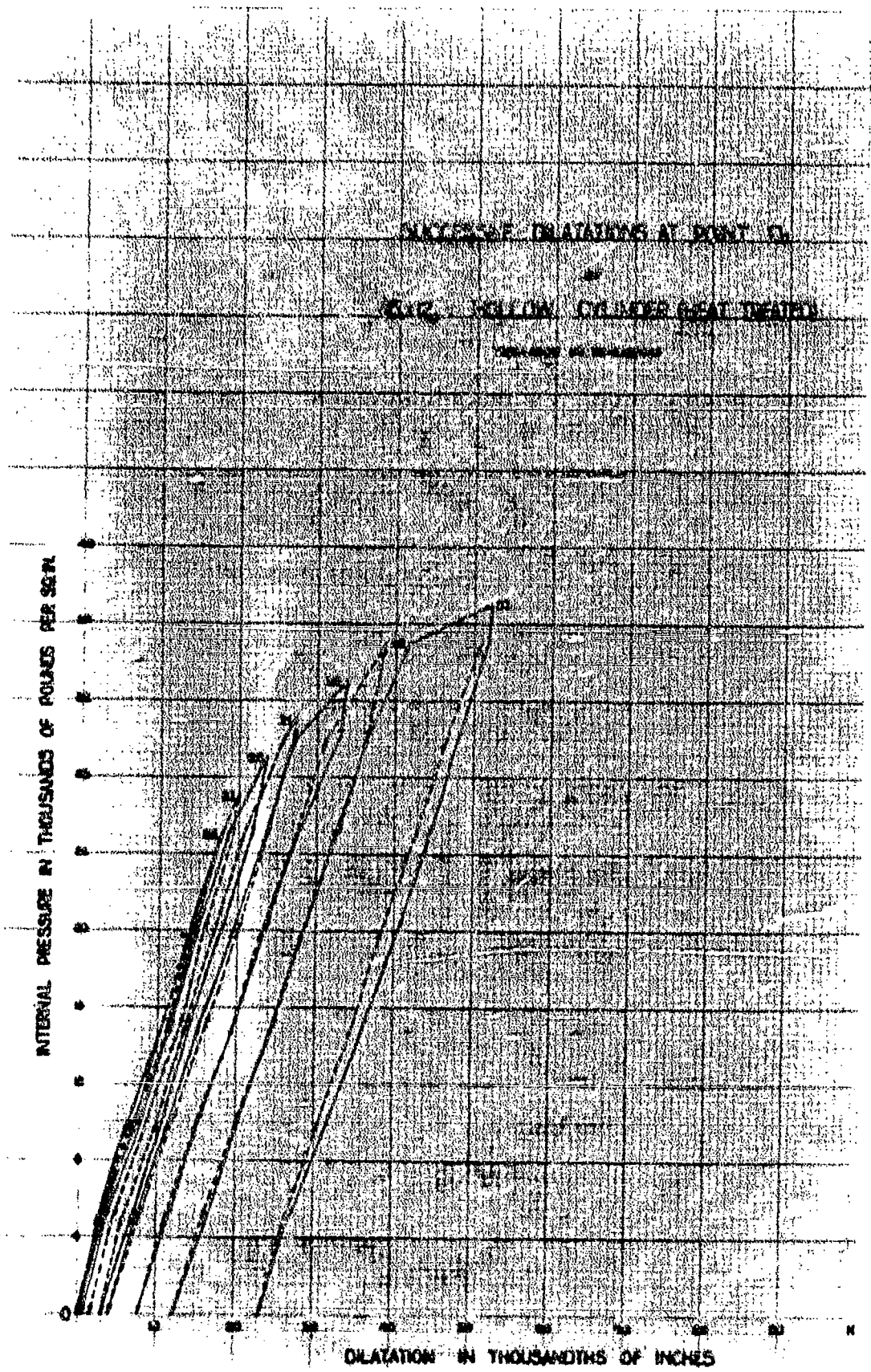
INTERNAL PRESSURE IN THOUSANDS OF POUNDS PER SQ. IN.

EXTENSION IN THOUSANDS OF INCHES

WTH. 630-6748



93



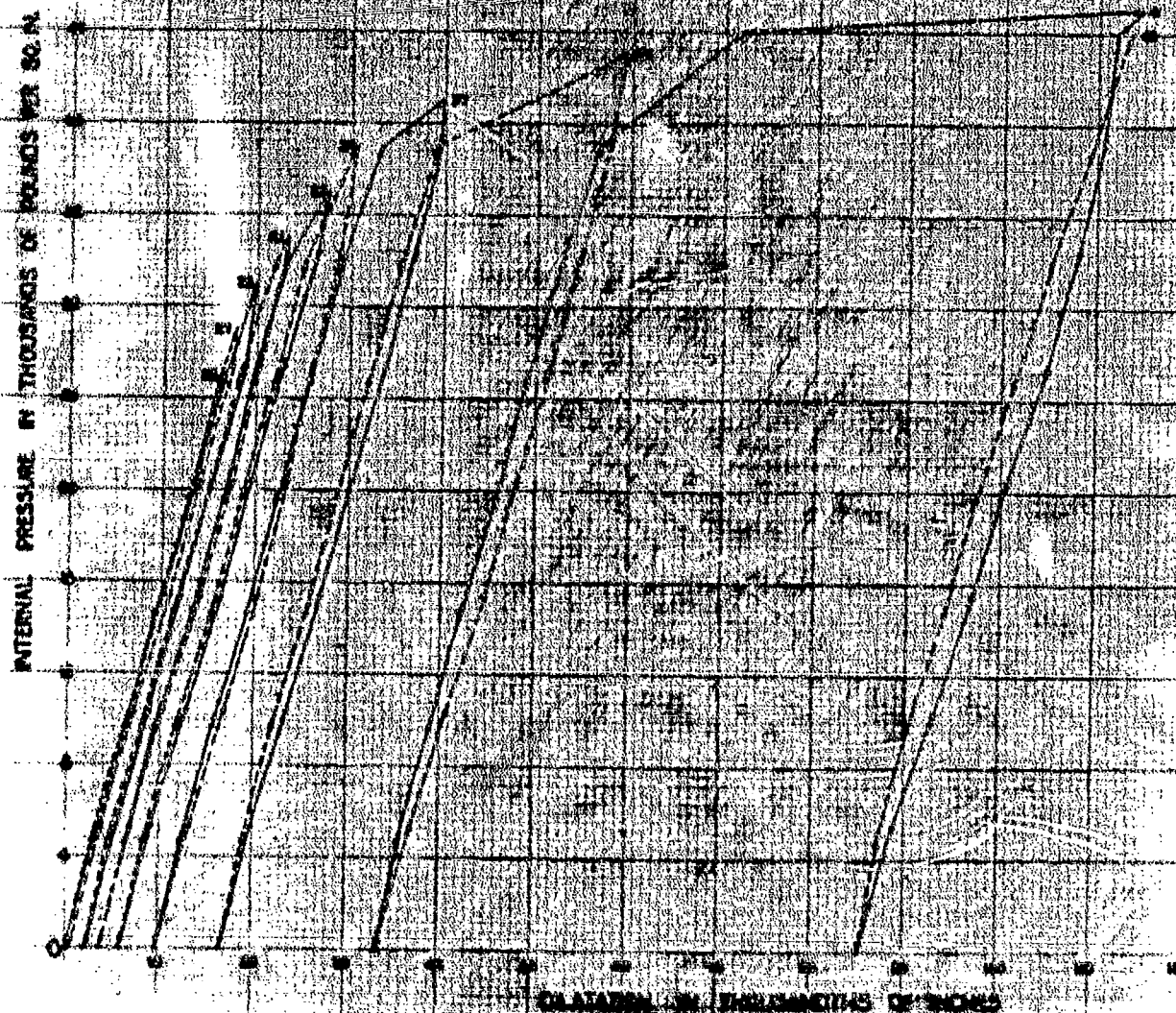
VTN.630-6744

19

SUCCESSIVE DEVIATIONS AT POINT E

3.132.1415 HOLLOW CYLINDER HEAT TREATED

STRESS IN TENSILE



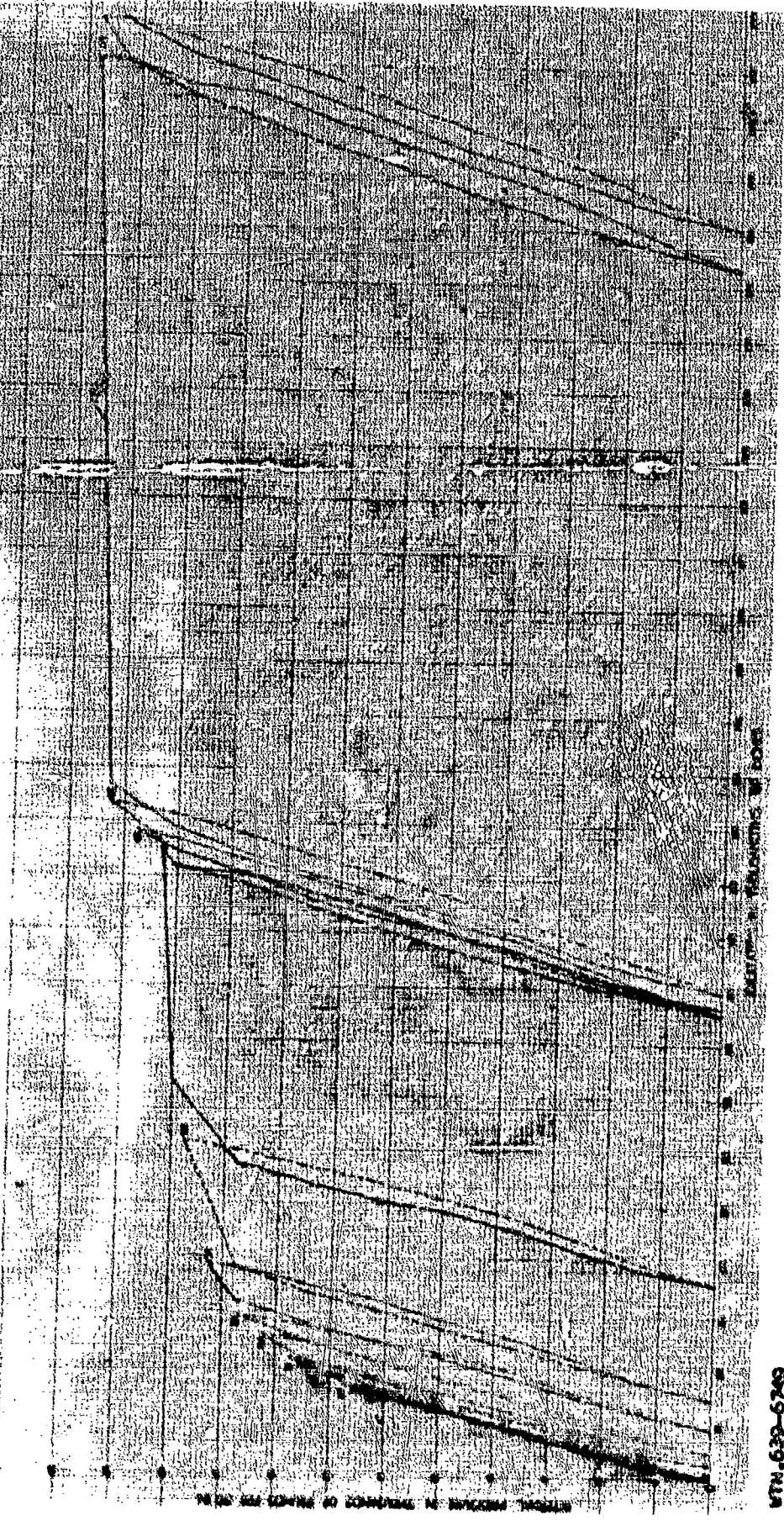
WYN 630-6748

(68)

SUCCESSIVE DRILLINGS AT KONELE

A 12.1 405 HOLLOW CYLINDER NEAR TRENCH

DRILLING IN SECTION



6469-639 RLA

SUCCESSIVE DILATIONS AT POINT C

5 IN. HOLLOW CYLINDER

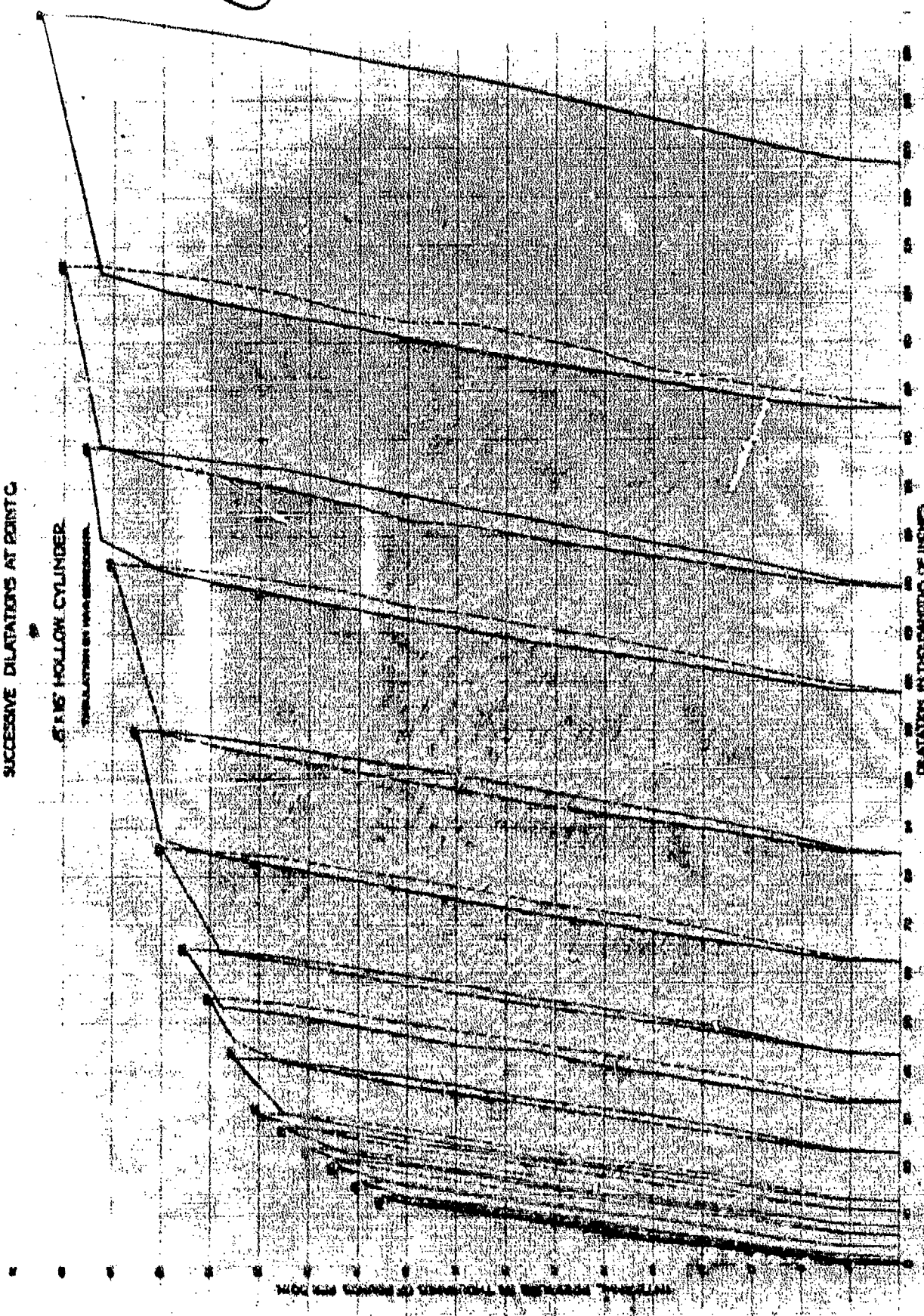
DILATION IN THOUSANDS OF INCHES

INTERNAL PRESSURE IN THOUSANDS OF POUNDS PER SQ. IN.

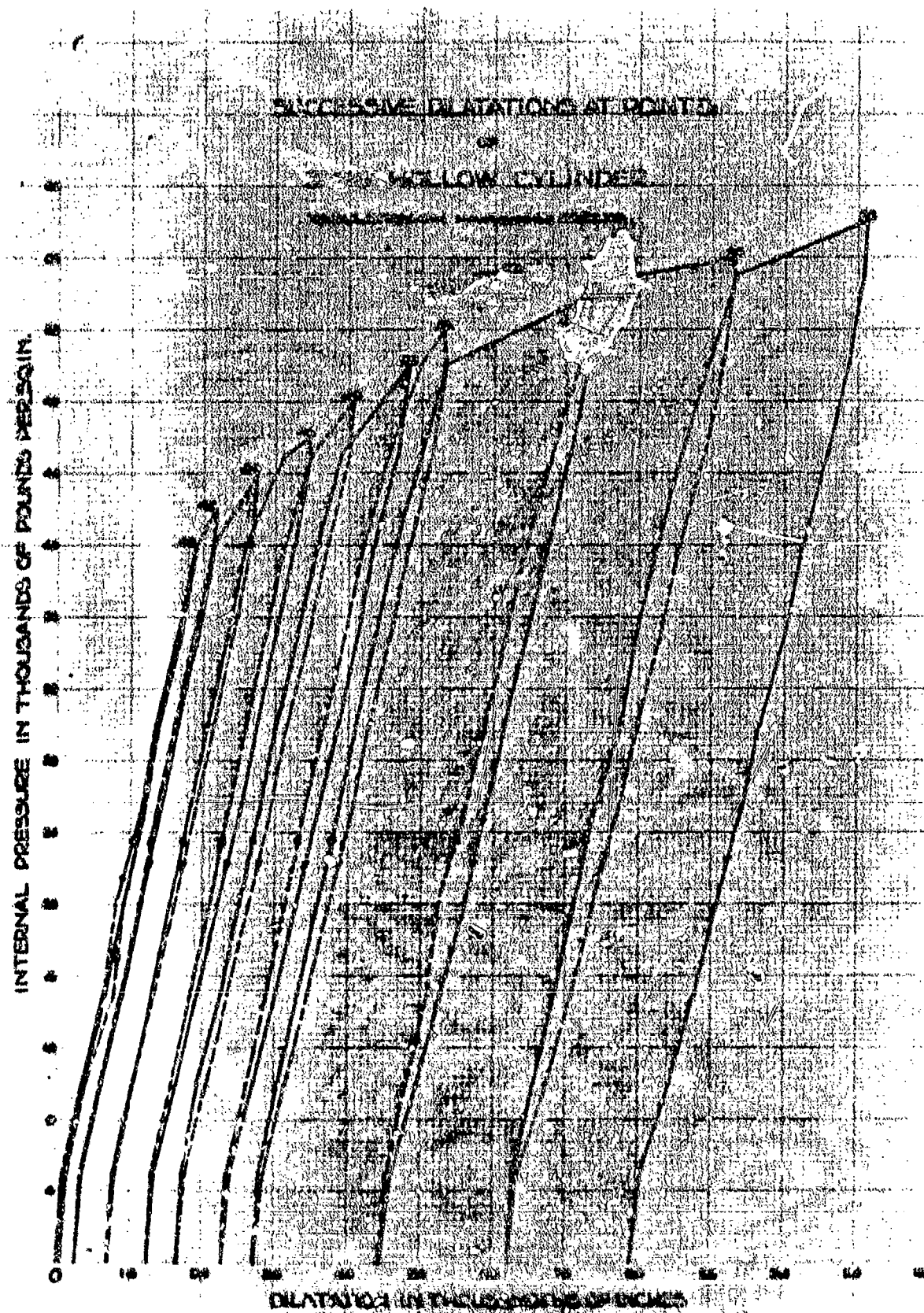
DILATION IN THOUSANDS OF INCHES

VTN 639-6750

(15)



(5)



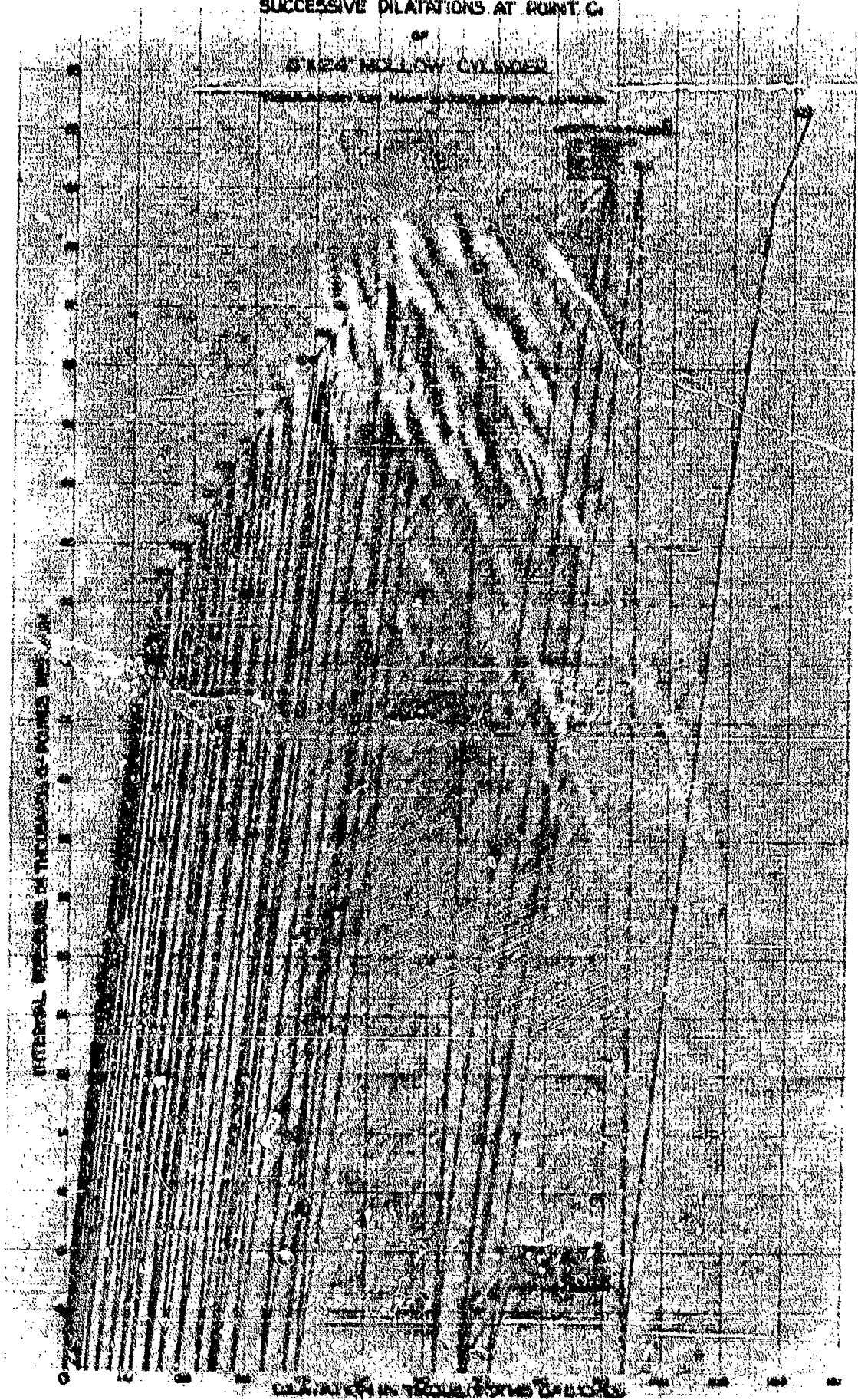
WTR. 630-6760

159

SUCCESSIVE DILATATIONS AT POINT C

OF

5/124 HOLLOW CYLINDER



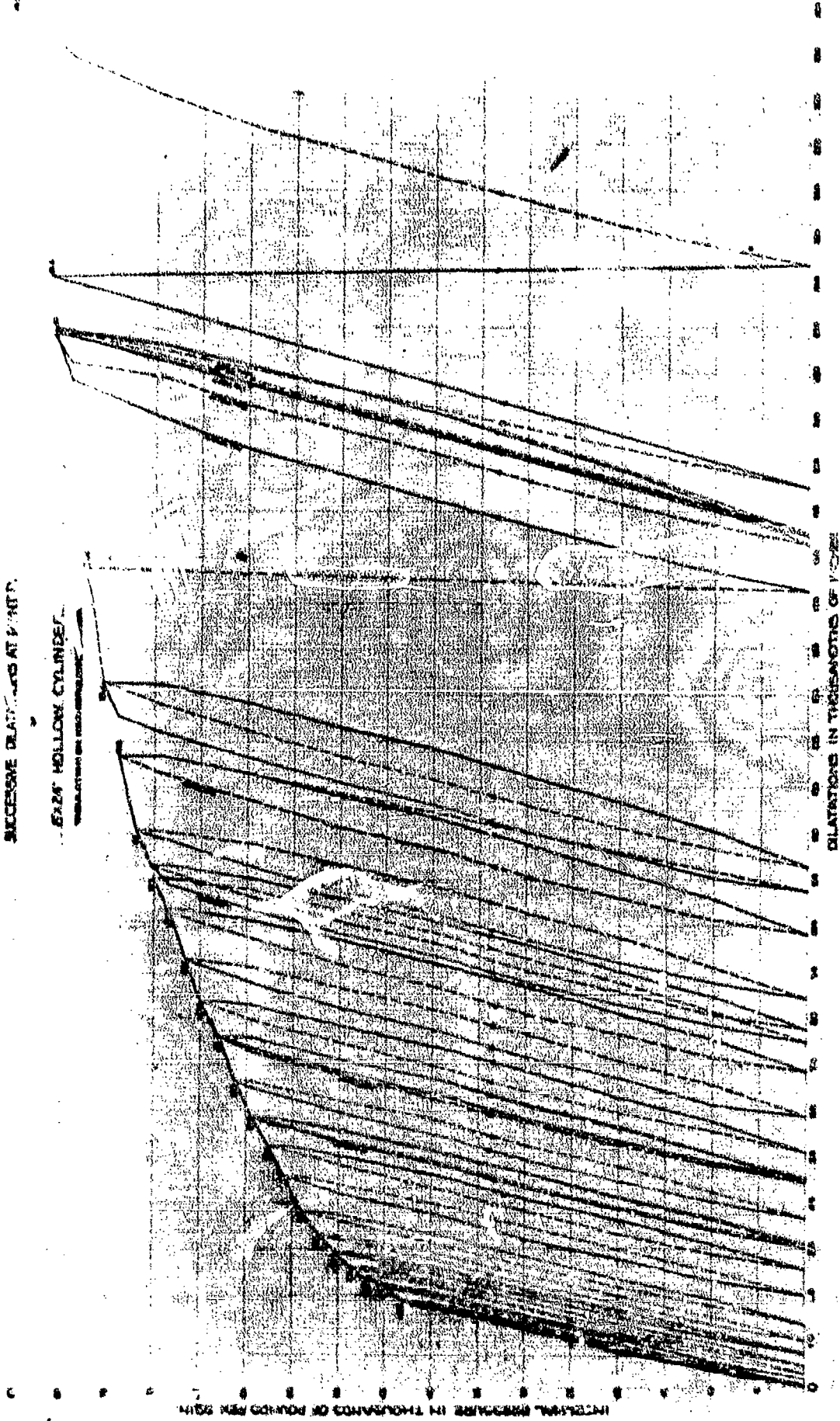
UYN-670-6749

104

SUCCESSIVE DILATATIONS AT 1/2 MIN.

5/25" HOLLOW CYLINDER

TESTED IN AIR



W74-630-6763

75

SUBSIDIARY DRAWINGS OF PORT C.

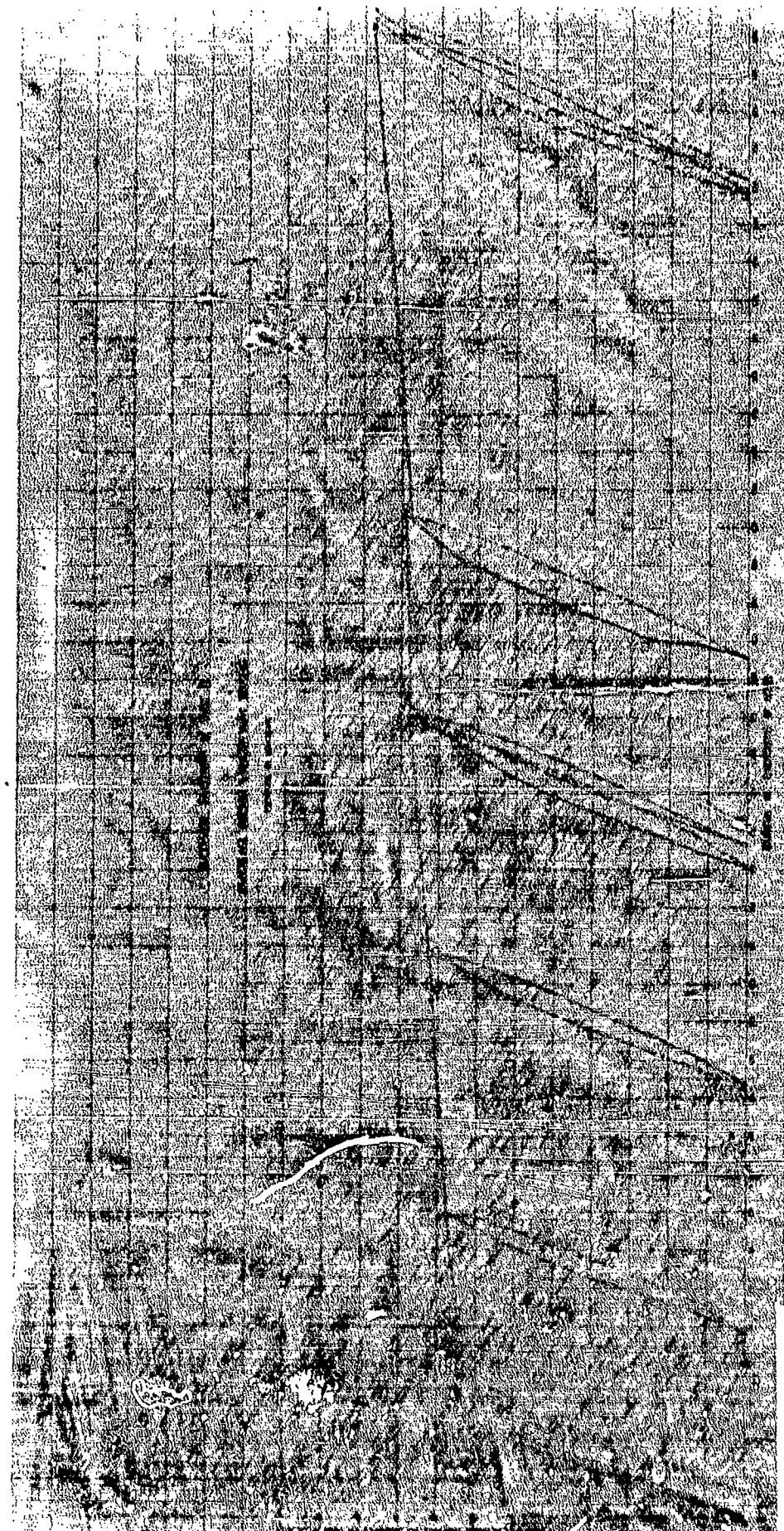
ANALYSIS OF HULL CURVATURE

SECTION OF HULL

SECTION OF HULL CURVATURE

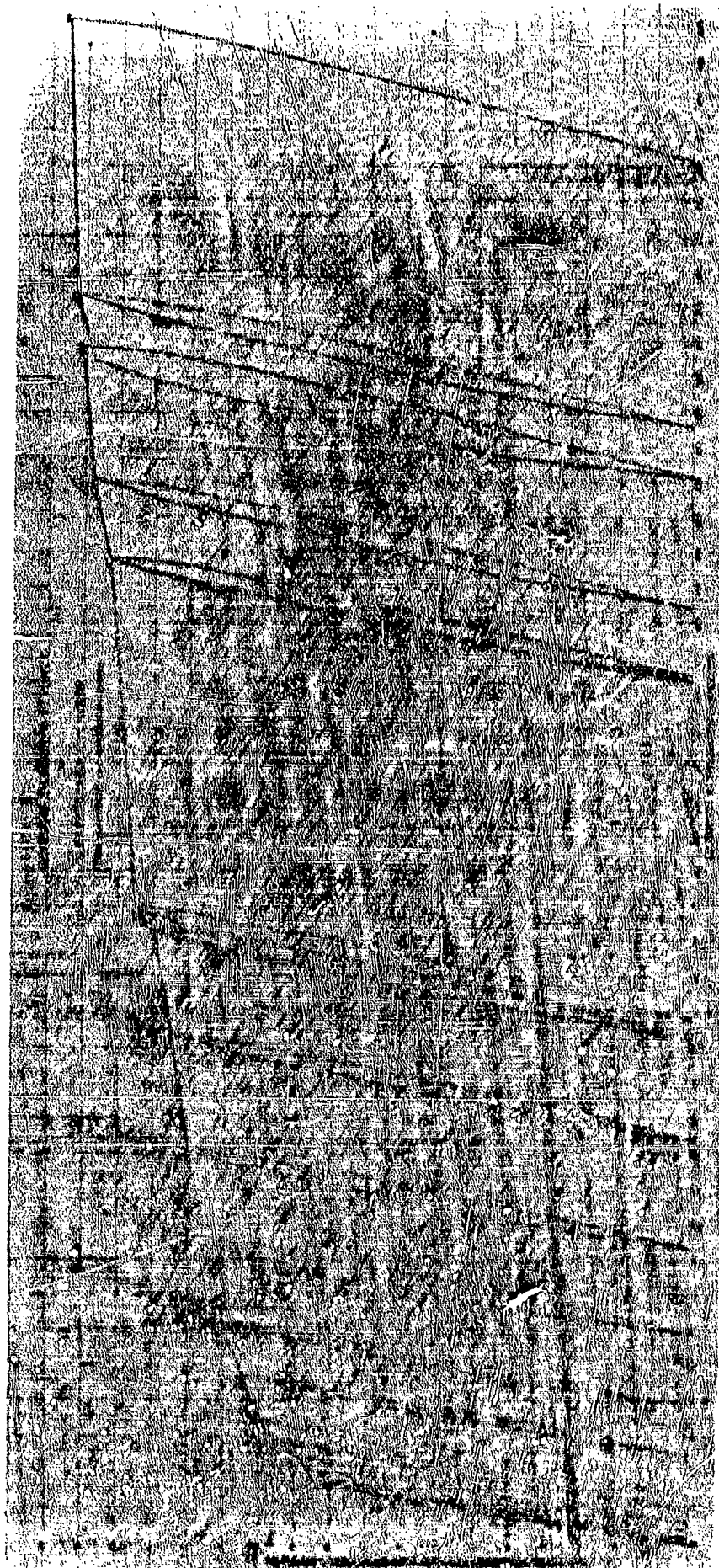
SECTION OF HULL CURVATURE

021



021-021-021

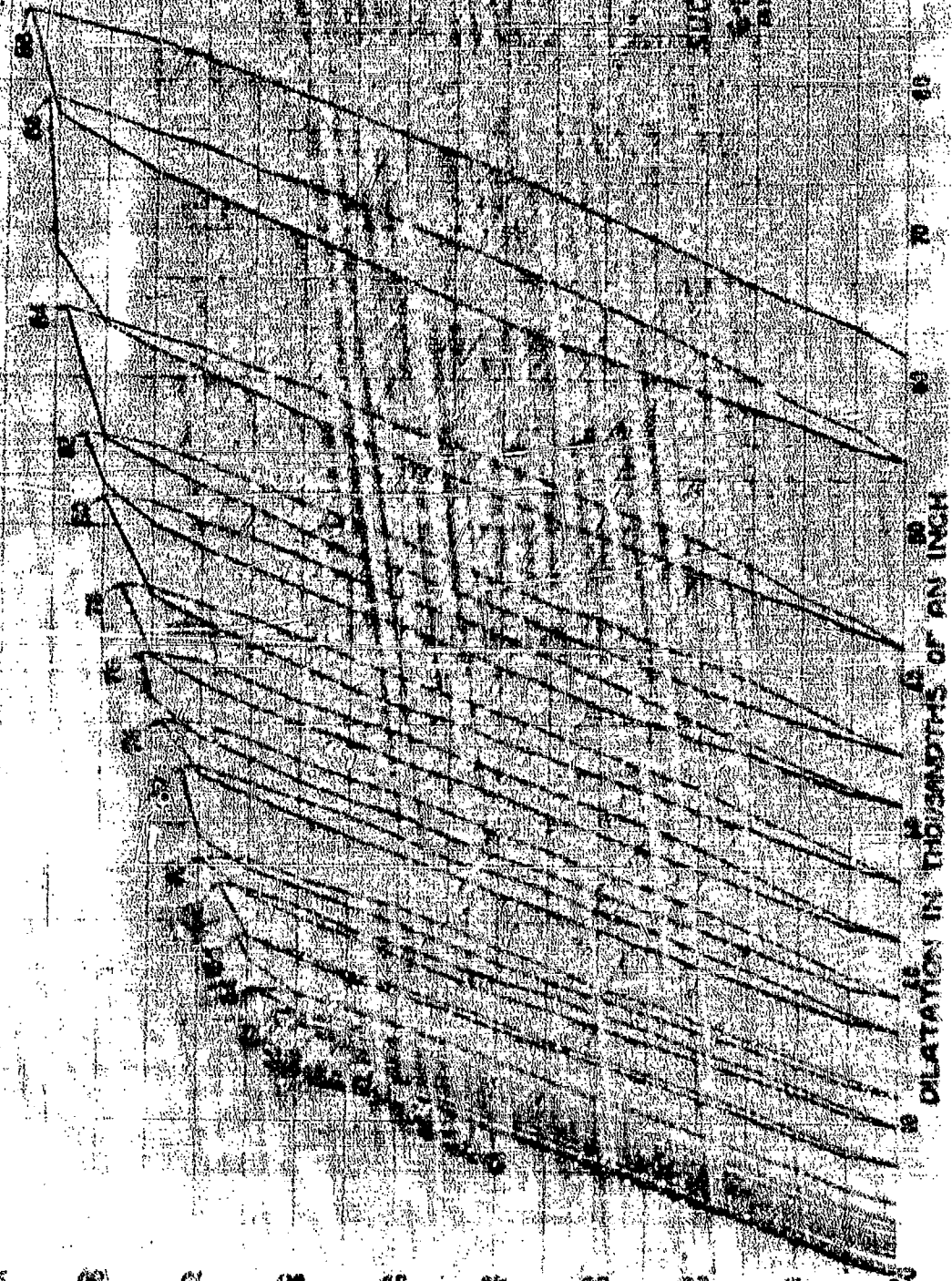
66



194-28-0-755

64

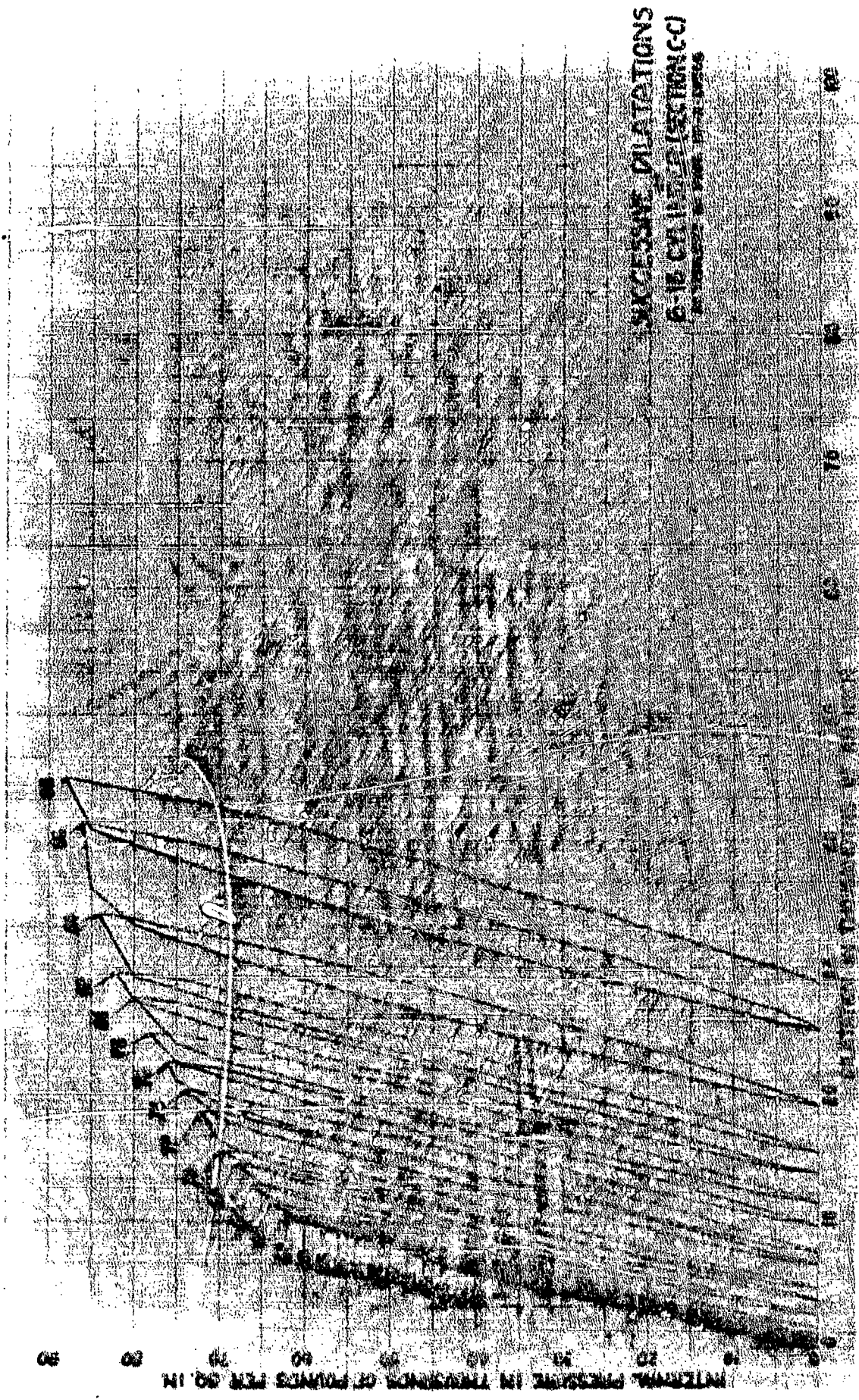
INTERNAL PRESSURE IN THOUSANDS OF POUNDS PER SQ IN.



SUCCESSIVE DILATATIONS
4.5 CYLINDER TESTED
AS SHOWN IN FIG. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100

ENL 9-319-7414

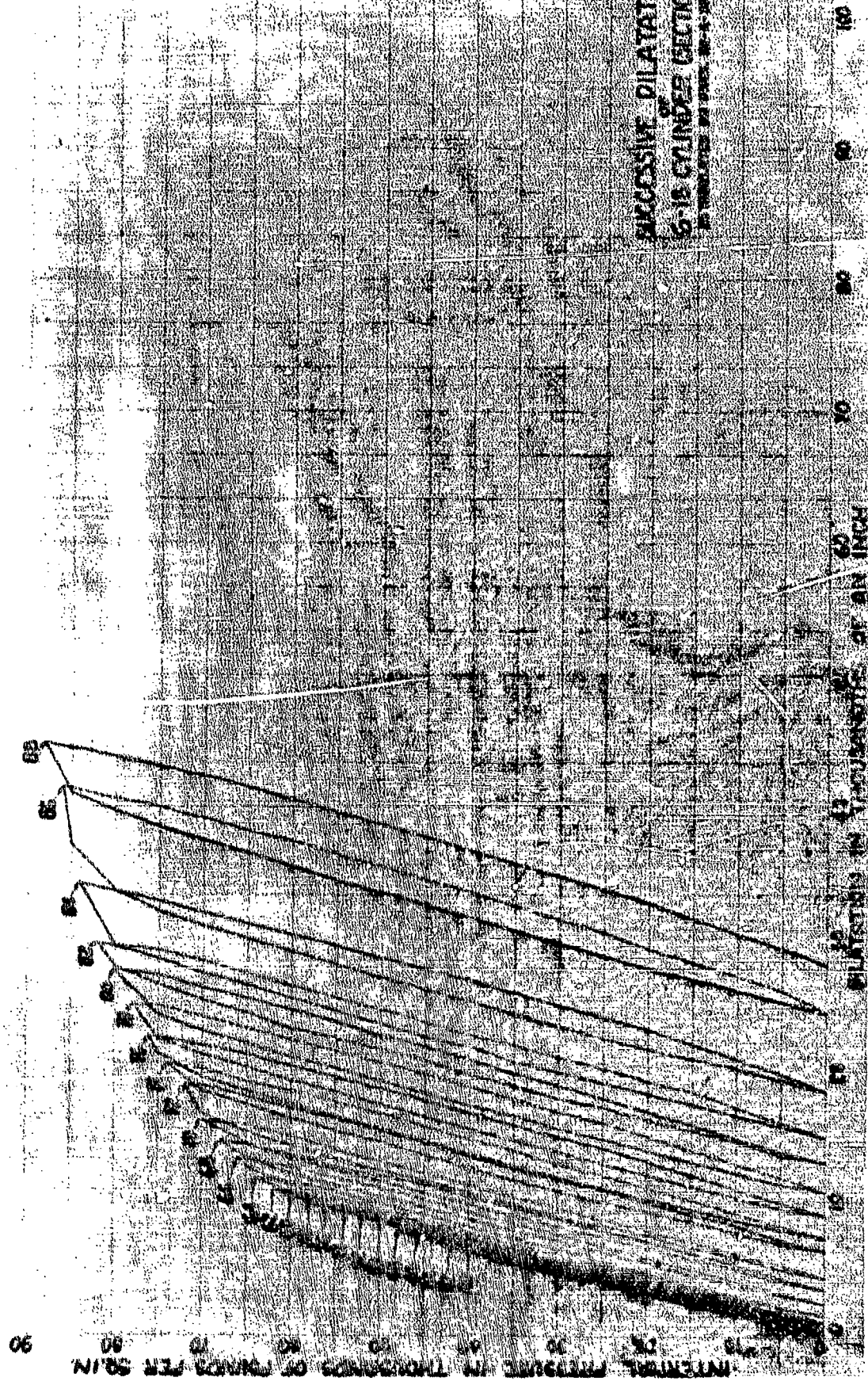
(5)



DTN. 639-6754

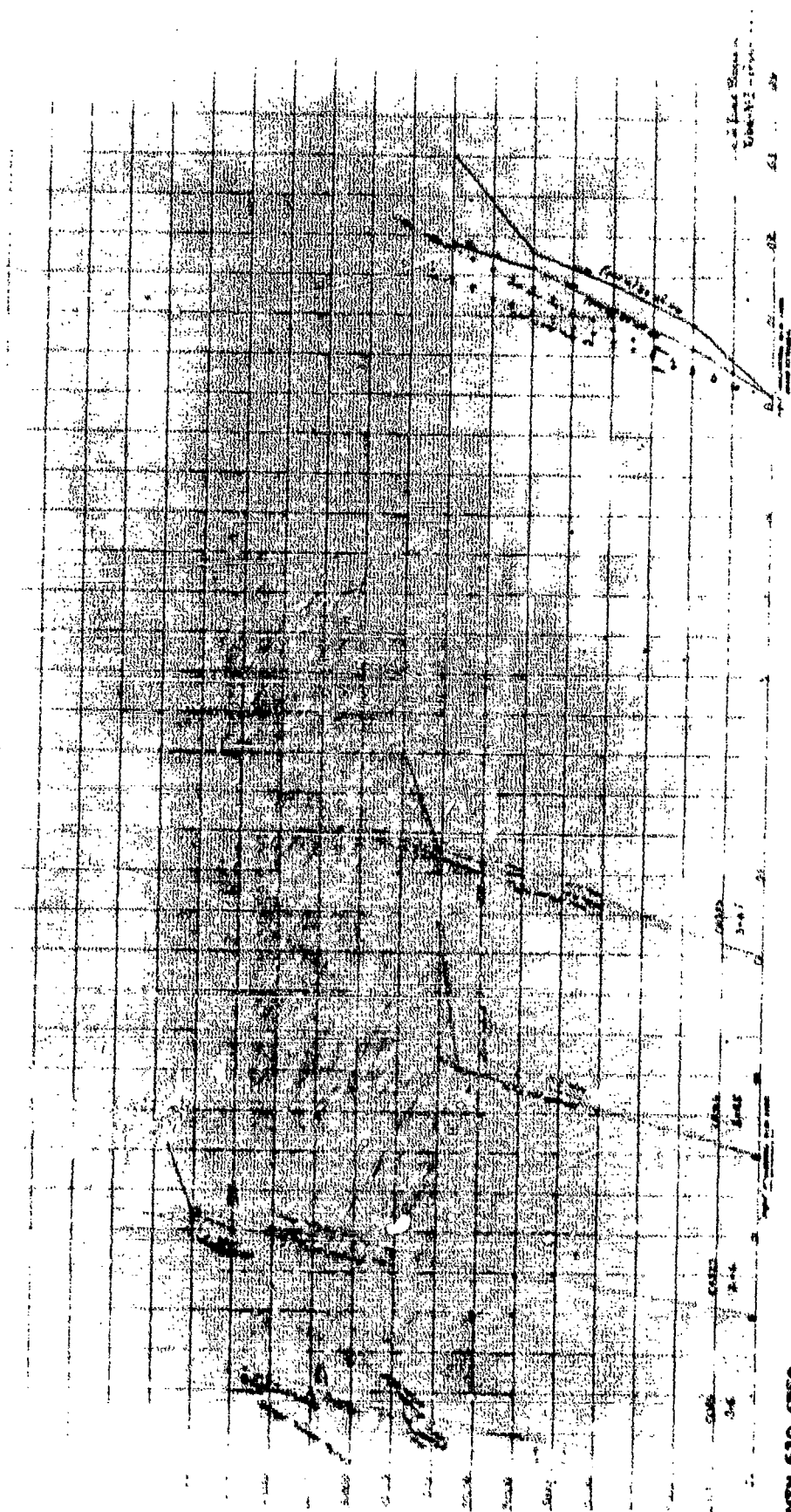
37

SUCCESSIVE DILATATIONS
OF 15 CYLINDERS (ESTIMATED)
BY PRESSURE AND TEMPERATURE



WTR. 630-6722

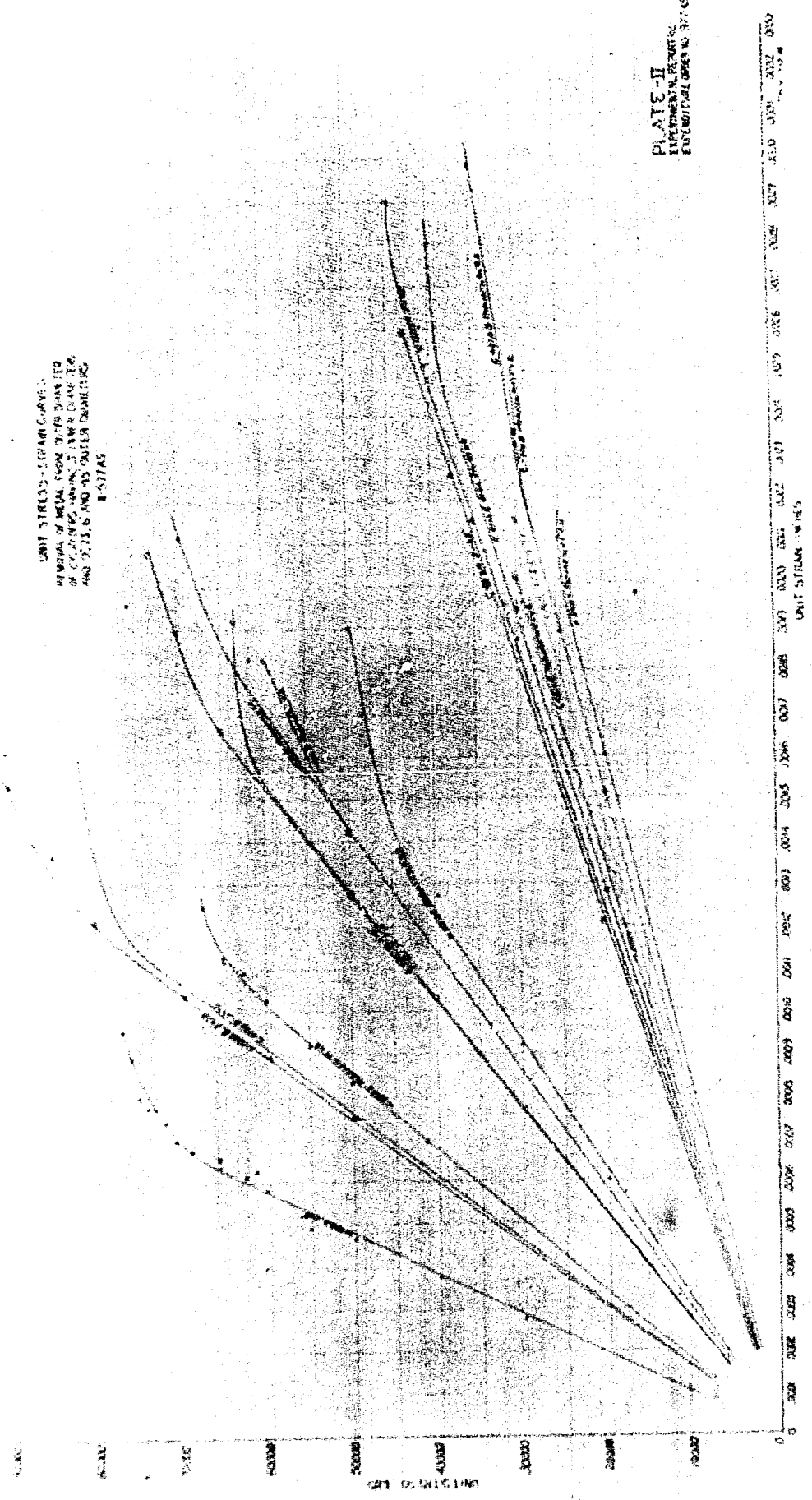
70



64

PLATE II
EXPERIMENTAL RESULTS
END OF TESTS

UNIT STRESS-STRAIN CURVES
OF METAL FROM TESTS MADE
ON SPECIMENS OF 0.125 IN. DIA.
AND 0.125 IN. GAGE LENGTH
IN AIR



VTN.639-6758

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END