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CONSOLIDATED VULTEE AIRCRAFT CORPORATI
FORT WORTH DIVISION • FORT WORTH 1, TEXAS

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REPORT FZA-36-154

MODEL B-36

DATE 22 February 1950

TITLE

SUMMARY OF AERODYNAMIC DATA FOR
STRUCTURAL ANALYSIS OF THE
B-36 AIRPLANE

SUBMITTED UNDER

PREPARED BY: C E Calvert

GROUP: Aerodynamics

REFERENCE:

CHECKED BY: J. E. Gaske

APPROVED BY: R H Widmer

NO. OF PAGES

NO. OF DIAGRAMS

REVISIONS

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INTRODUCTION

This report presents pertinent aerodynamic data for use in the structural analysis of the B-36 airplane.

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DISCUSSION

This report has been compiled to collect into one report all aerodynamic data, which have been previously published in the form of memos and memorandum reports, for use in the structural analysis of the B-36 airplane. A report of this type will alleviate reference to a large number of memoranda in future structural analysis reports, and will make the aerodynamic data used therein more readily available to those requiring it.

Data contained herein have been derived chiefly from wind tunnel tests of the B-36 airplane, of component parts of the B-36 airplane, or from theoretical analyses based on NACA data on similar bodies.

It is intended that aerodynamic data issued in the future be in the form of addenda to this report. The data of the report issued at this date are grouped by subject, such as aileron data, flap data, etc. Addenda will be added in chronological order without grouping by subject.

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LIST OF FIGURES

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LIST OF FIGURES (CONT'D)

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LIST OF FIGURES (CONT'D)

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MEMORANDUM REPORT

ON

AERODYNAMIC CHARACTERISTICS OF AN INTERMEDIATE OUTBOARD B-36 WING SECTION

PURPOSE:

A review of the aileron and wing normal loads and aileron hinge moments used in former structural analyses of the B-36 outboard wing panel (reference 1) indicates that these data (reference 1) are unreliable and should be revised. Consequently, this report presents preliminary aerodynamic characteristics necessary for a structural analysis check of the outboard section of the B-36 wing. Normal loads and chordwise pressure distribution over the wing and aileron are shown. Aileron hinge-moments and wing spanwise load distributions are also included.

CONCLUSIONS:

1. The results presented herein are preliminary and subject to check and/or revision.

2. In general, the normal loads and aileron hinge moments presented in this report are larger than the corresponding data of reference 1 which were employed in former structural analysis of the B-36 outboard wing panel and aileron.

DISCUSSION:

Aerodynamic data required for structural analysis of the outboard portion of the prototype B-36 wing are presented in Figs. 1 to 11. All data shown are for a 20% chord aileron with flaps retracted and, except for the aileron hinge moments of Fig. 1, are estimated for a wing section located at 0.77 b/2 from the root chord.

In Fig. 1 are presented aileron hinge moments measured on the 4/29 scale XB-36 semi-span wing model (reference 2). Aileron normal force coefficient plotted as a function of wing normal force coefficient is presented in Fig. 2 for various aileron deflections with the tab neutral. These normal force coefficients were determined from chordwise pressure distributions over the wing section at 0.77 b/2. The estimated chordwise pressure distributions are shown in Figs. 3 to 11 for aileron deflections of 0°, ±5°, ±10°, ±15° and ±20° each for several wing root angles of attack.

Chordwise pressure distributions for the 20% chord ailerons were derived by modifying the chordwise pressures measured over a two dimensional model of the XB-36 intermediate outboard wing section (reference 3) which incorporated an internally-balanced 12.5% chord aileron. From the section pressure data of reference 3, the 12.5% chord aileron hinge moments were determined from only the external pressure distribution over the aileron. The change in section

DISCUSSION: (CONT'D)

hinge-moment due to increasing the aileron chord from 12.5% to 20% was estimated for a radius nose aileron from reference 4. The external pressure distribution over the aileron was altered to conform with this change and to have the aileron peak pressures occurring at the hinge line location of 80% of the wing chord. In addition, the pressure distribution diagrams of reference 3 were modified to attain the same normal force coefficients as shown in Fig. 12. Figure 12 presents a comparison of the section normal force coefficient with the section lift coefficient. The lift data shown in Fig. 12 with ailerons neutral corresponds to section test data from reference 5 for the XB-36 outboard wing portion. To this lift were applied section lift increments due to aileron deflection as measured in tests (reference 6) conducted with a 20% chord aileron mounted on an airfoil section similar to that of the B-36 airplane.

In order to correlate section data with finite wing data, span load distributions were calculated for the B-36 wing according to the method of reference. 7. The span loadings computed for various aileron deflections at wing root chord angles of attack of 0°, 5°, and 10° are presented in Figs. 13 to 15. From these span loadings the local lift can be determined for a typical section (0.77 b/2) at the aileron and hence the root chord angle of attack for the pressure distribution diagrams (Figs. 3 to 11) can be obtained. From tests of a round nose aileron (reference 8) a comparison of the hinge moments measured by strain gages was made with the hinge moments derived from the external pressure distribution over the aileron at a typical aileron station. The pressure distribution over the ailerons were again altered to conform with this incremental change derived from reference 8. Since the aileron on the B-36 wing is a sealed-internally balanced aileron, the pressure acting on the nose balance was assumed the same as the static pressure existing at the vent (79% wing chord) and to be constant within the balance chamber. The hinge-moments (including balance) determined from the estimated pressure distributions show good agreement with the aileron hinge moments obtained on the 4/29 scale XB-36 semi-span wing model (reference 2). However, exact agreement could not be obtained since the hinge moments of reference 2 are averaged across the aileron span whereas the pressure distribution diagrams give the local hinge moment at a particular aileron section.

From the XB-36 Flight Prediction Report (reference 9) the variation of aileron deflection with servo tab deflection was obtained. The effect of tab deflection on pressure distribution was determined from reference 10 and applied to the pressure diagrams as shown in Figs. 3 to 11. In some cases the tab appears to increase rather than decrease the aileron hinge-moment. This phenomenon is attributed to the floating characteristics of the ailerons and to the interconnection of the B-36 ailerons by means of a cable-tie.

RECOMMENDATIONS:

It is recommended that the data submitted herein serve as a preliminary check on the structural design of the B-36 outboard wing panel and aileron. Further, it is recommended that a more thorough investigation be initiated to

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RECOMMENDATIONS: (CONT'D)

check carefully or determine more accurately the aerodynamic characteristics presented herein since lack of appropriate test data at this facility in conjunction with meeting a time schedule prevented an exact analysis to be made at the present time.

PREPARED BY: C E Calvert

CHECKED BY: T. F. [illegible]

APPROVED BY: [illegible]
for R. H. Widmer

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1. Letter to Mr. C. R. Irvine from Mr. H. W. Hinckley: Aerodynamic Data for Structural Analysis of Outer Panel XB-36 Wing. September 8, 1944.

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3. Preliminary Data for Pressure Distribution Data for the Intermediate Wing Section of the XB-36 Airplane with Balanced Split Flap and Sealed Aileron, (12.5% chord aileron), Two Dimensional Tunnel Section, Langley M.A.L., NACA, October 10, 1942.

4. Crane, Robert M. and Holtzclaw, Ralph W.: Wind Tunnel Investigation of the Effects of Profile Modification and Tabs on the Characteristics of Ailerons on a Low-Drag Airfoil, NACA Report No. 803, 1944.

5. Abbott, Ira H., Von Doenhoff, Albert E., and Stivers, Louis S.: Summary of Airfoil Data, NACA ACR No. L5C05.

6. Visconti, Foiravante: Investigation of an Approximately 0.178-Chord-Thick NACA 6-Series-Type Airfoil Section Equipped with Sealed Internally Balanced 0.20 Chord Ailerons and with an 0.05 Chord Tab, NACA TN No. 1590.

7. Sivells, James C. and Neely, Robert H.: Method for Calculating Wing Characteristics by Lifting Line Theory Using Non-Linear Section Lift Data, NACA TN No. 1269.

8. Luoma, Arvo A.: An Investigation of a High Aspect - Ratio Wing Having 0.20-Chord Plain Ailerons in the Langley 8-foot High Speed Tunnel, NACA RM No. L6H28d, Aug. 28, 1946.

9. Flight Prediction of XB-36 Aerodynamic Characteristics, FZA-36-043, July 1, 1946.

10. Wenzinger, Carl J.: Pressure Distribution Over an Airfoil Section With a Flap and Tab, NACA Report 574, 1936.

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LIST OF SYMBOLS

c_l - airfoil section lift coefficient

c_n or c_{n_w} - airfoil section normal force coefficient

c_{n_a} - aileron normal force coefficient (includes forces on aileron balance)

C_L - wing lift coefficient

α_o - section angle of attack, deg.

α_w - wing root chord angle of attack, deg.

C_{h_a} - hinge-moment coefficient of aileron

$$\frac{H_a}{qb_a\bar{c}_a^{\,2}}$$

H_a - aileron hinge moment, ft.-lb.

b - wing span, ft.

b_a - aileron span, ft.

$\bar{c}_a$ - root-mean-square aileron chord, ft.

$b_a\bar{c}_a^{\,2}$ - product of aileron root-mean-square chord squared and aileron span, 351 ft.^{3}

q - dynamic pressure, lb./sq.ft.

c - airfoil section chord, ft.

$\Delta P/q$ - resultant pressure coefficient

y - distance along semispan from wing center line, ft.

δ_a - aileron deflection, deg. (positive for trailing edge down)

δ_t - aileron servo-trim tab deflection, deg. (positive for trailing-edge down)

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B-36 AIRPLANE

PRESSURE DISTRIBUTION OVER WING SECTION

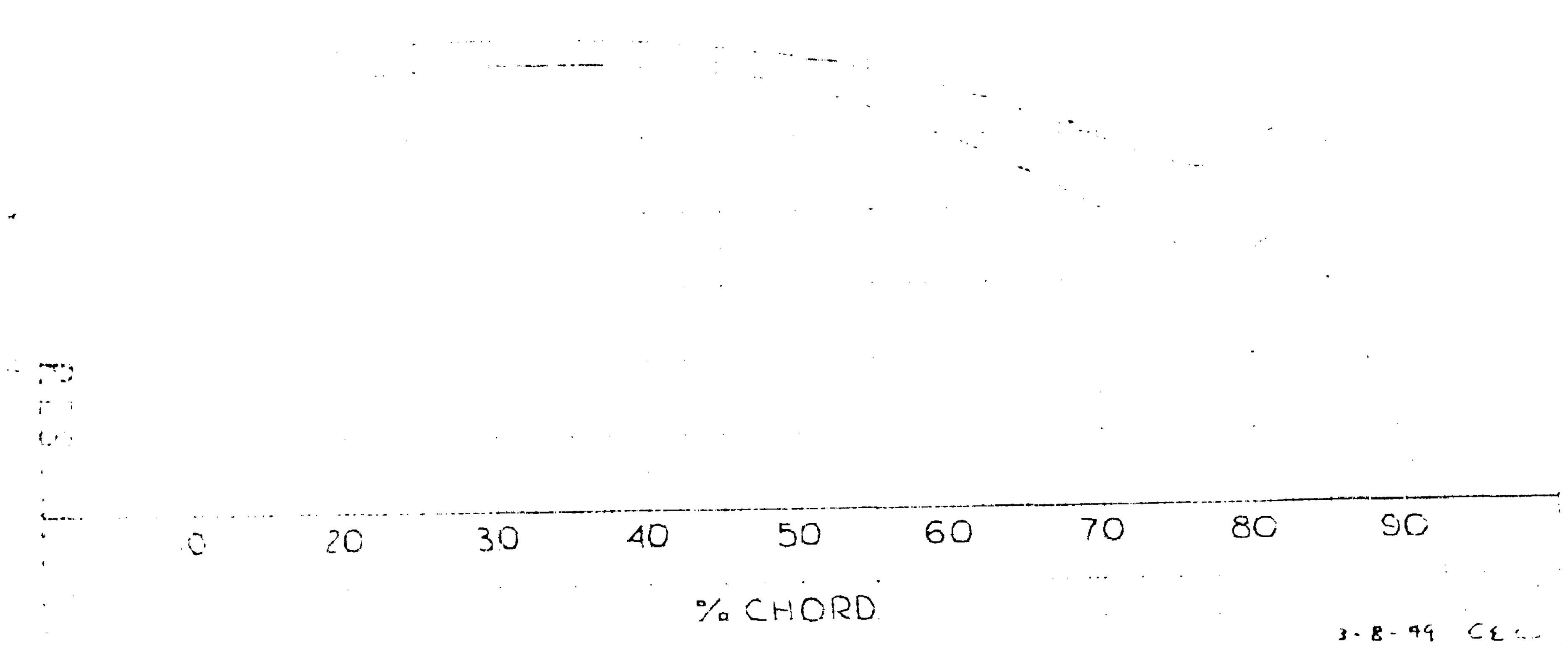
20 % CHORD AILERON

SECTION AT 77 % b/2

$\delta_a = 20°$ $\alpha_w = 0.60°$

——— $\delta_t = 0°$, $C_n = 1.048$

— — — $\delta_t = -25°$, $C_n = .873$



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B-36 AIRPLANE

PRESSURE DISTRIBUTION OVER WING SECTION

20 % CHORD AILERON — SECTION AT 77 % b/2

$\delta a = 20°$ $\alpha w = 5.15°$

—— $\delta t = 0°$, $C_n = 1.297$

– – – $\delta t = -25°$, $C_n = 1.122$

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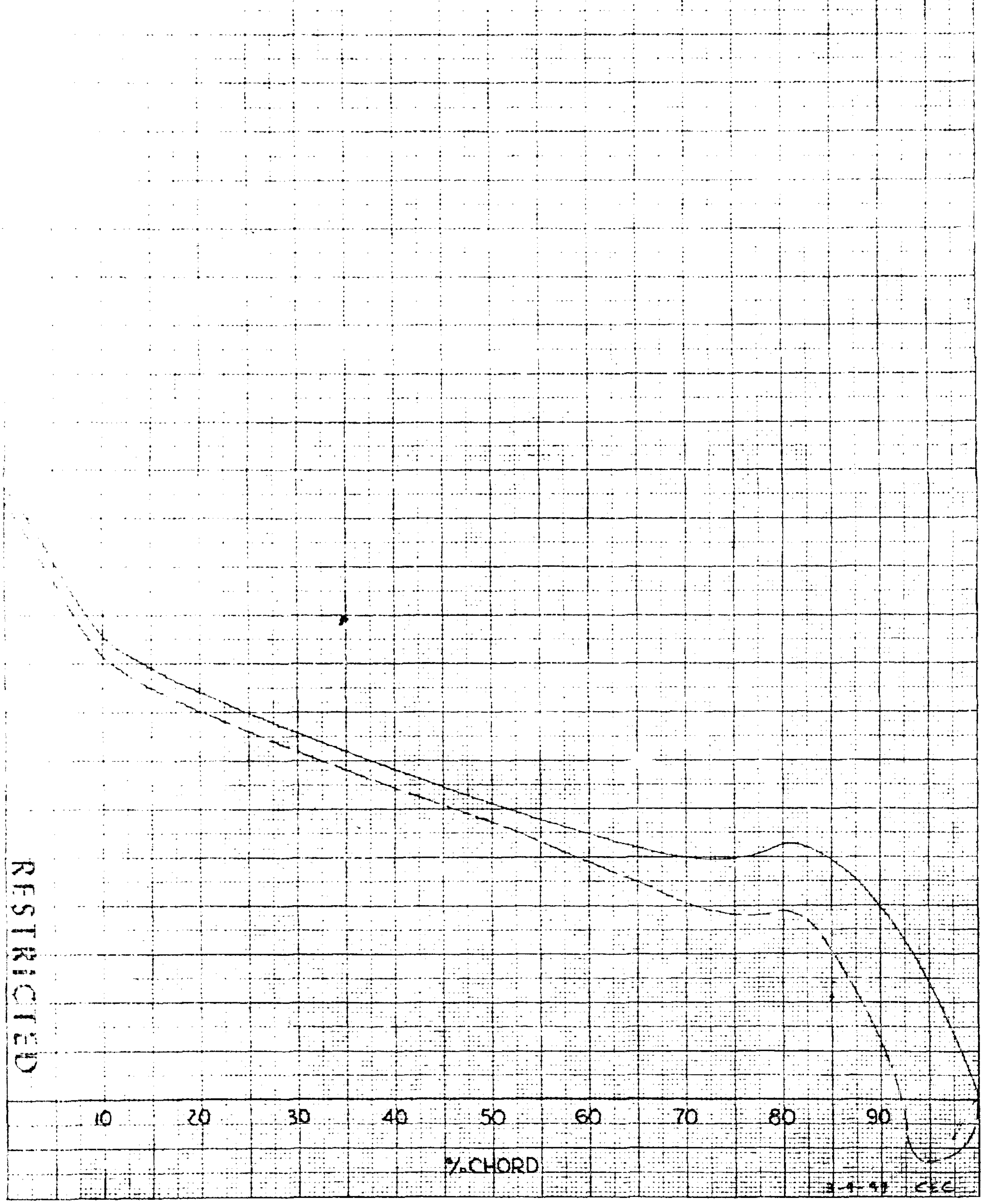

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Fig. 3b

B-36 AIRPLANE

PRESSURE DISTRIBUTION OVER WING SECTION

20 % CHORD AILERON SECTION AT 77 % b/2

$\delta_a = 20°$ $\alpha_w = 11.5°$

——— $\delta_t = 0°$, $C_n = 1.637$

— — — $\delta_t = -25°$, $C_n = 1.462$

Fig. 16
3c

B-36 AIRPLANE

... DISTRIBUTION OVER WING SECTION

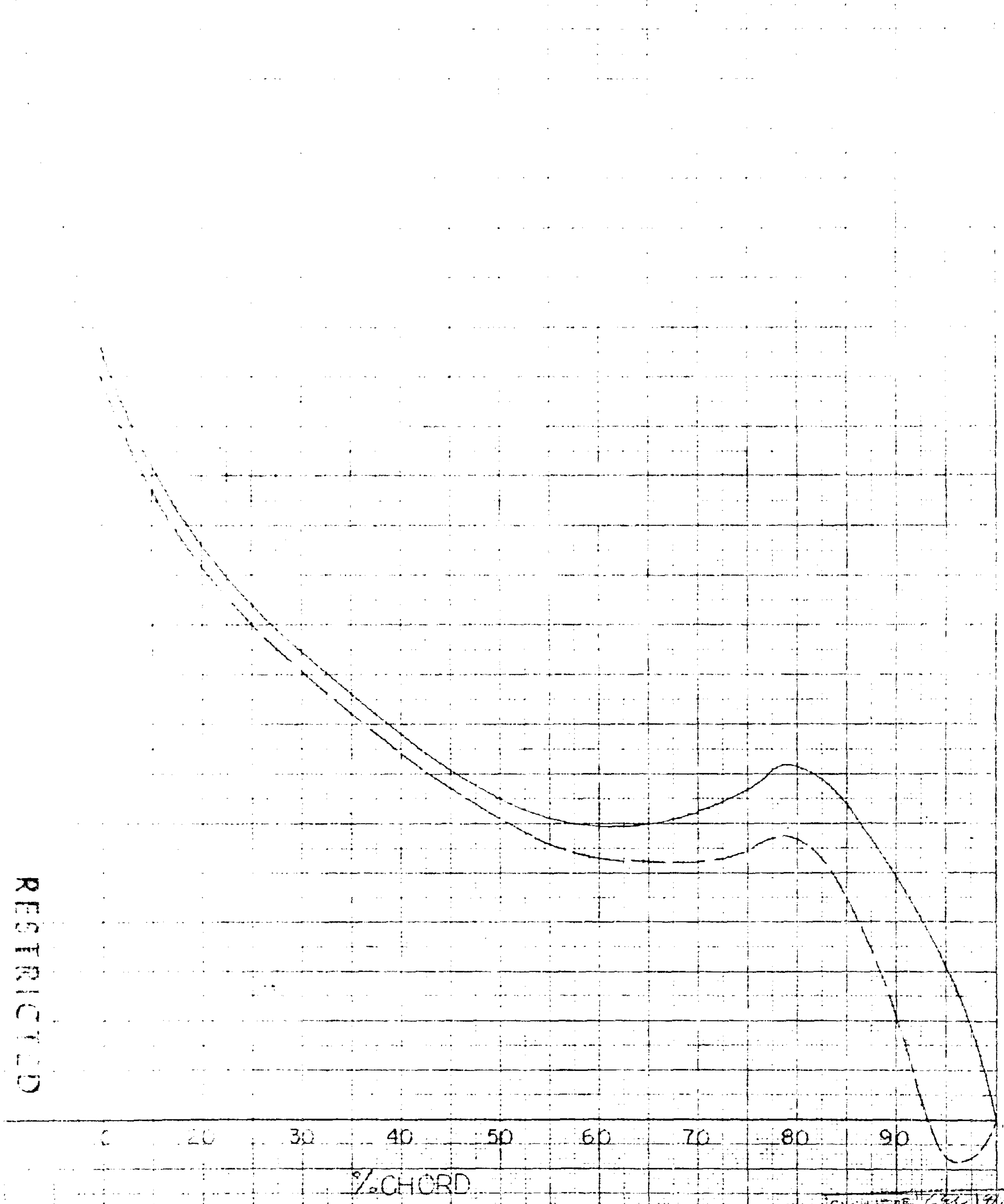

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Fig. 34

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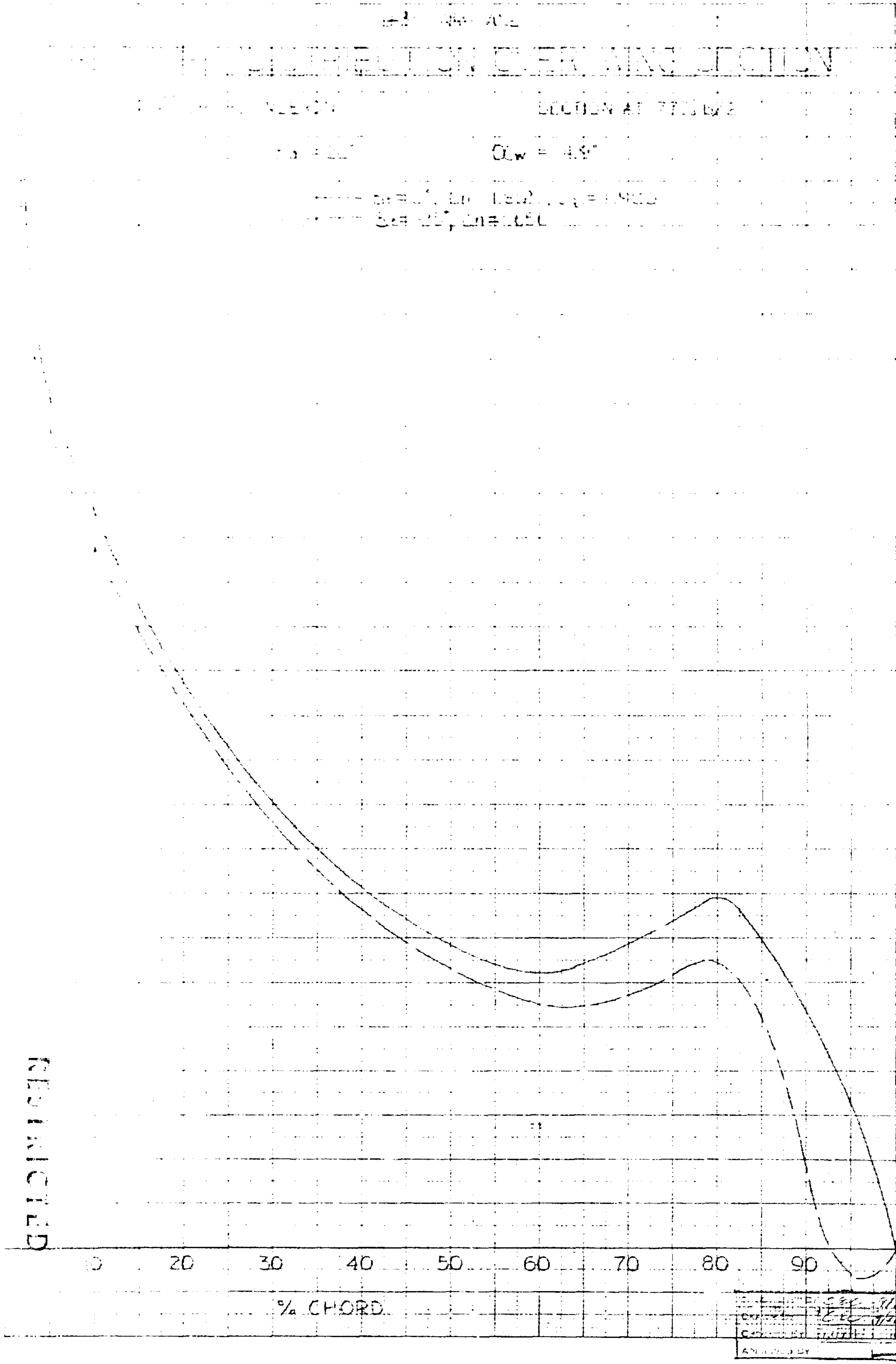

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Fig 3e

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DISTR UT ON VER WING SECTION

AILERON   SECTION AT % b/2

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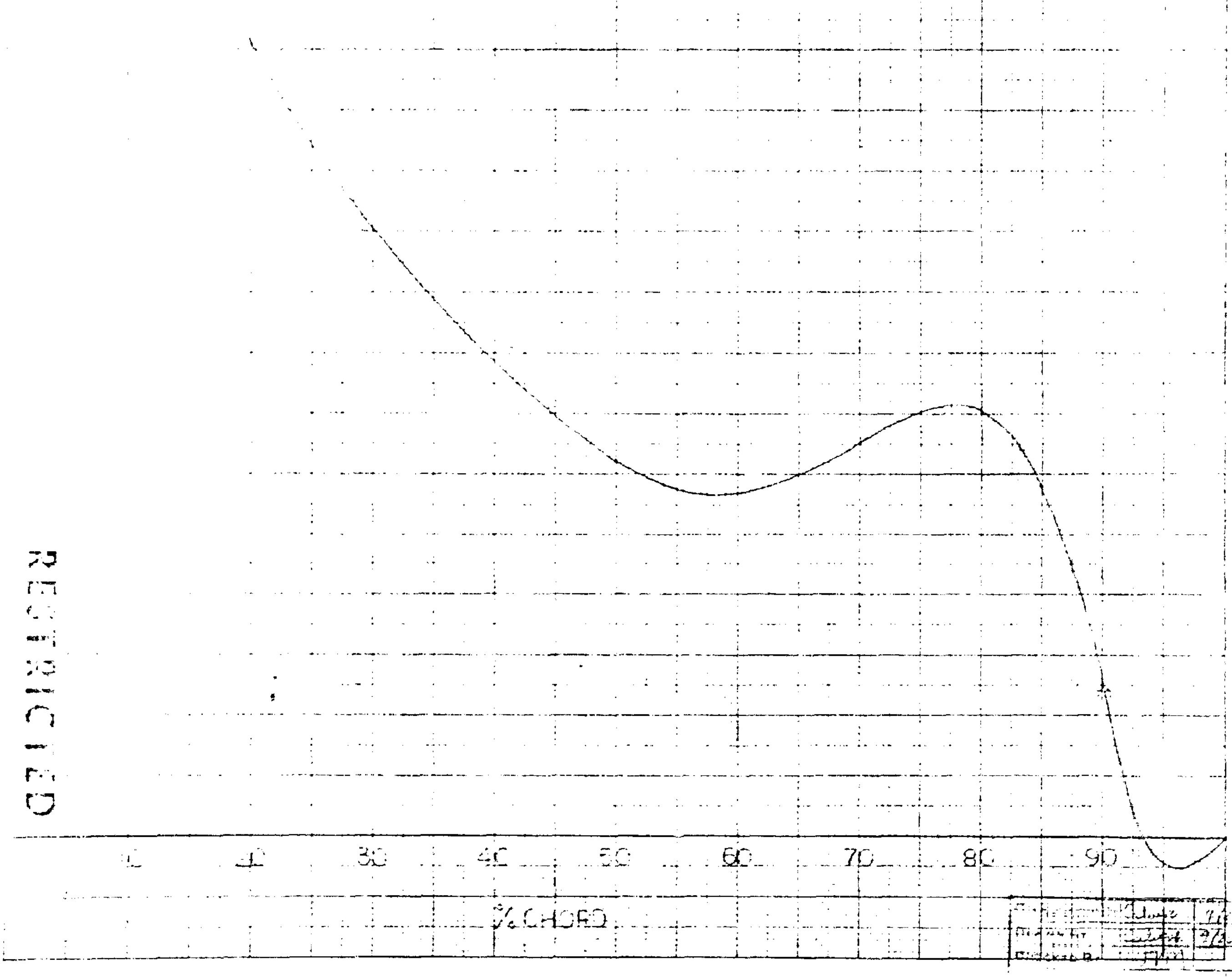

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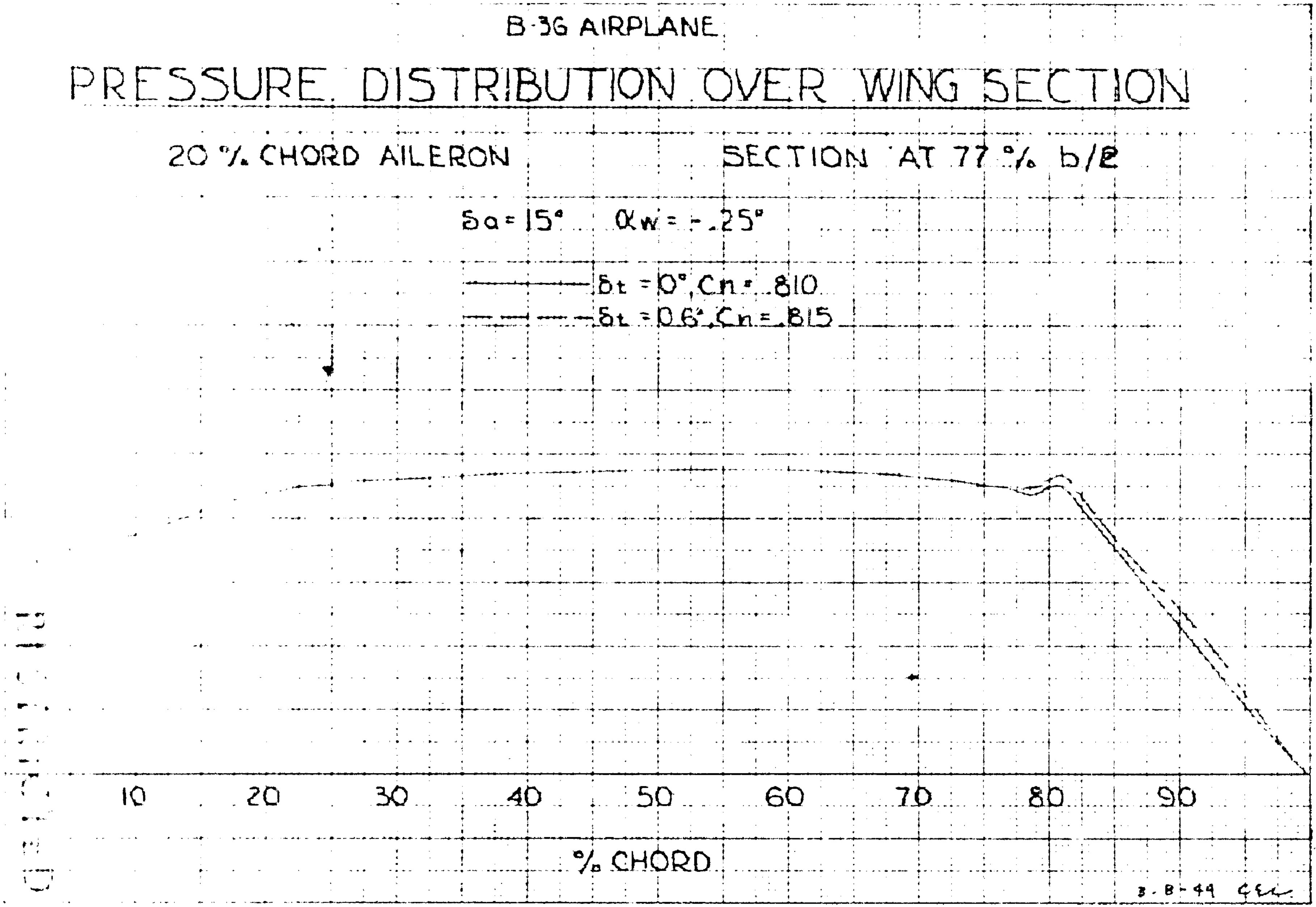
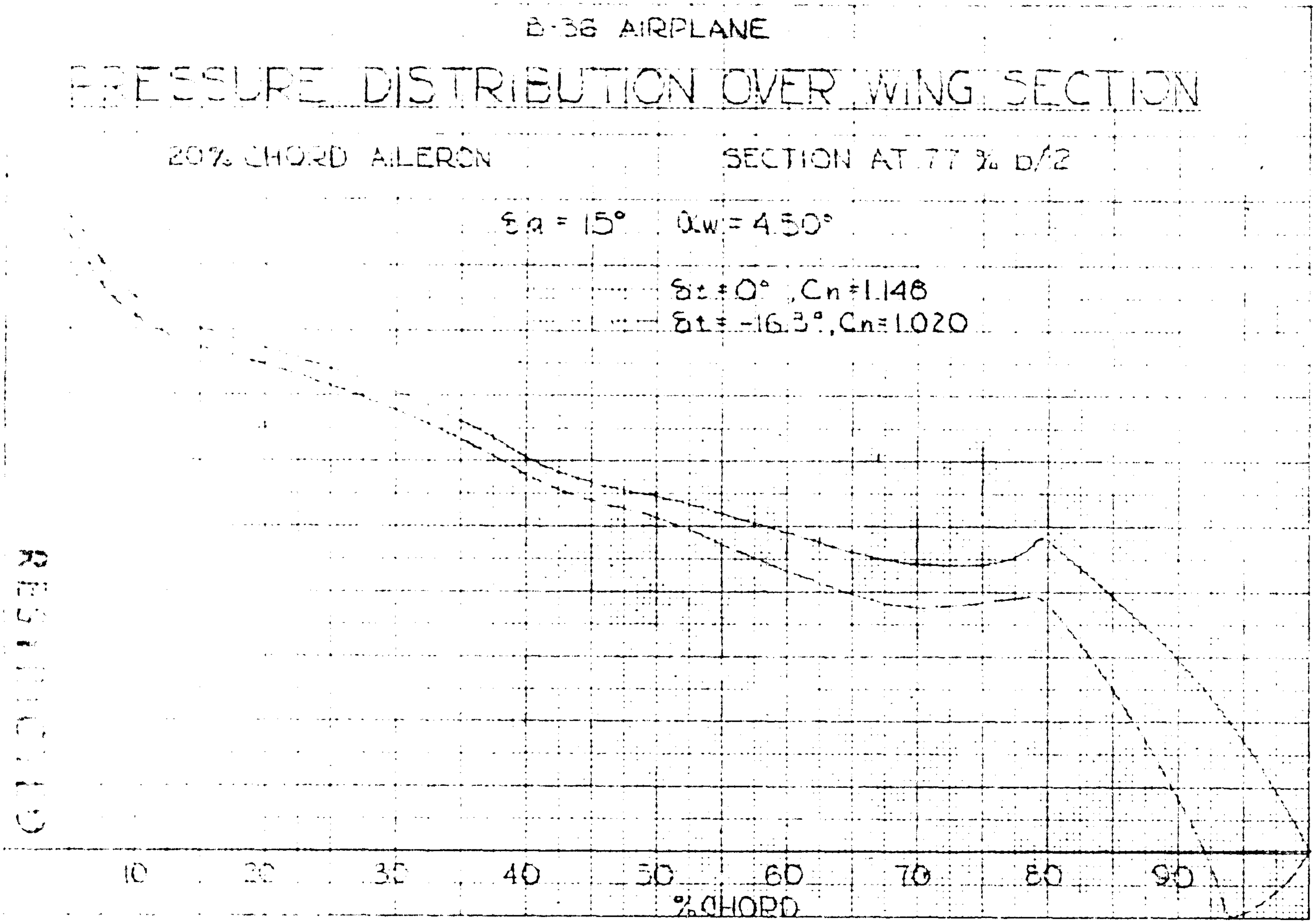
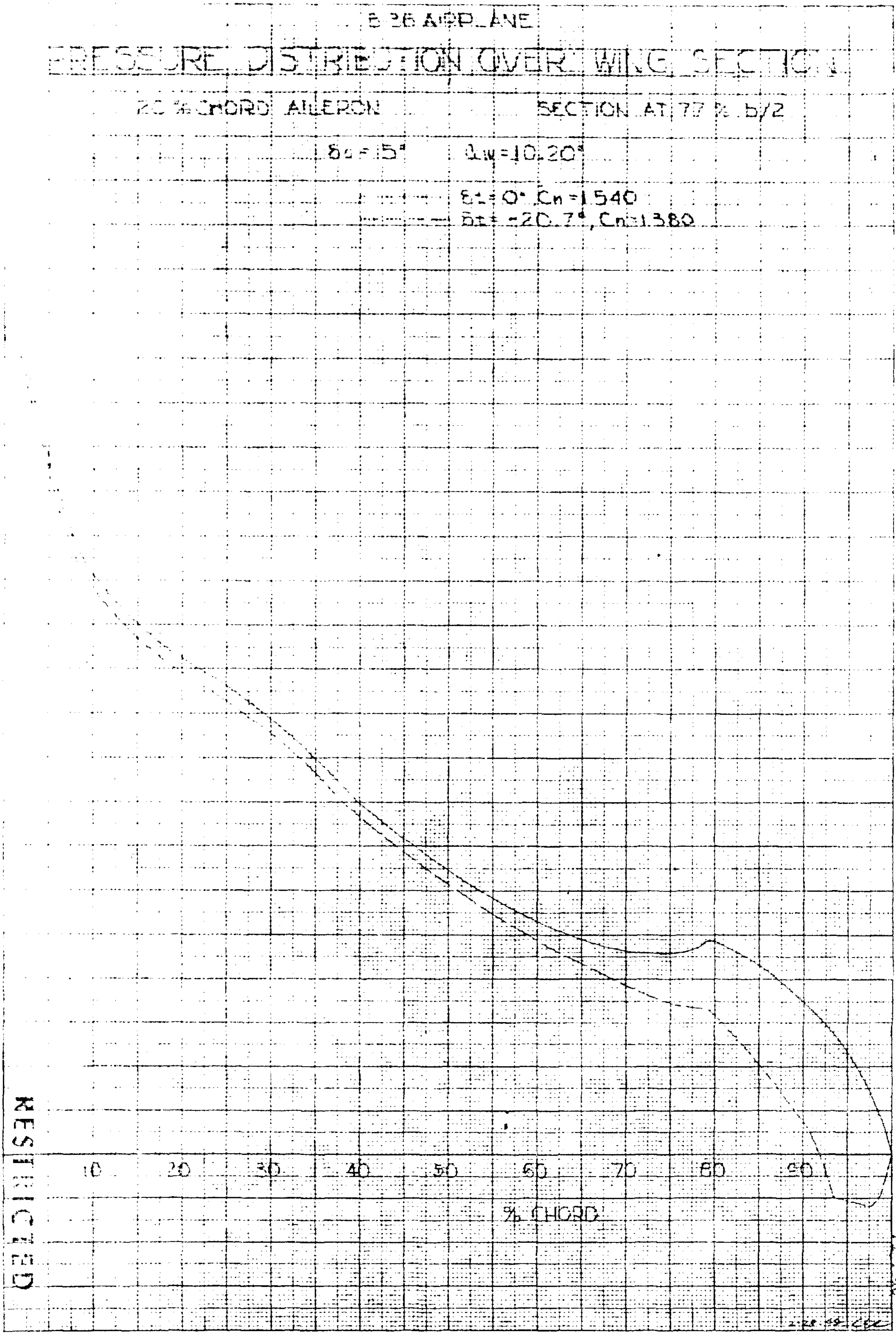

B-36 AIRPLANE
PRESSURE DISTRIBUTION OVER WING SECTION
20 % CHORD AILERON
SECTION AT 77 % b/2
δa = 15°   αw = -.25°
δt = 0°, Cn = .810
δt = 0.6°, Cn = .815
10
20
30
40
50
60
70
80
90
% CHORD
3-8-44


B-36 AIRPLANE
PRESSURE DISTRIBUTION OVER WING SECTION
20% CHORD AILERON
SECTION AT 77 % b/2
δa = 15° αw = 4.50°
δt = 0° , Cn = 1.148
δt = -16.3°, Cn = 1.020
10
20
30
40
50
60
70
80
90
% CHORD


B-26 AIRPLANE
PRESSURE DISTRIBUTION OVER WING SECTION
20 % CHORD AILERON
SECTION AT 77 % b/2
δa = 15°
αw = 10.20°
δt = 0°, Cn = 1.540
δt = -20.7°, Cn = 1.380
10
20
30
40
50
60
70
80
90
% CHORD

B-36 AIRPLANE

PRESSURE DISTRIBUTION OVER WING SECTION

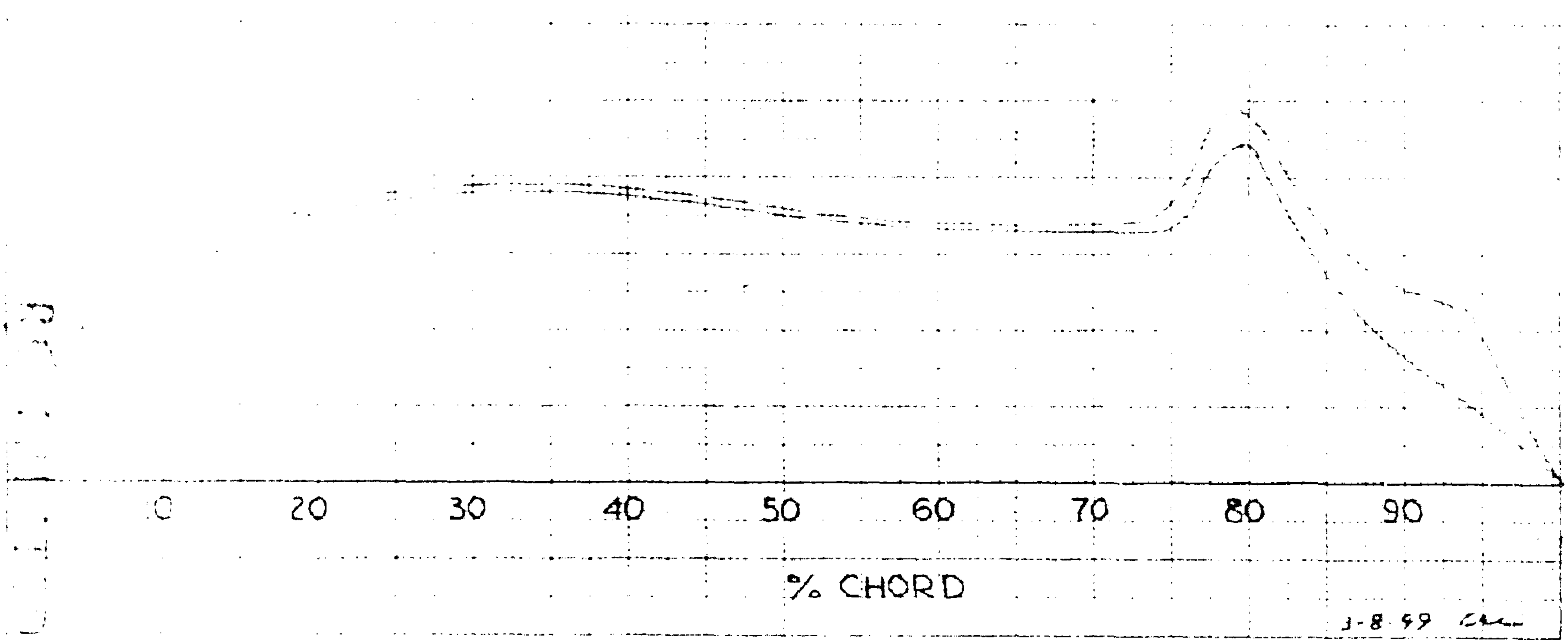
20 % CHORD AILERON

SECTION AT 77 % b/2

$\delta a = 10°$ $\alpha w = -.40°$

——— $\delta t = 0°$, $C_n = .613$

—+— $\delta t = 4.2°$, $C_n = .646$



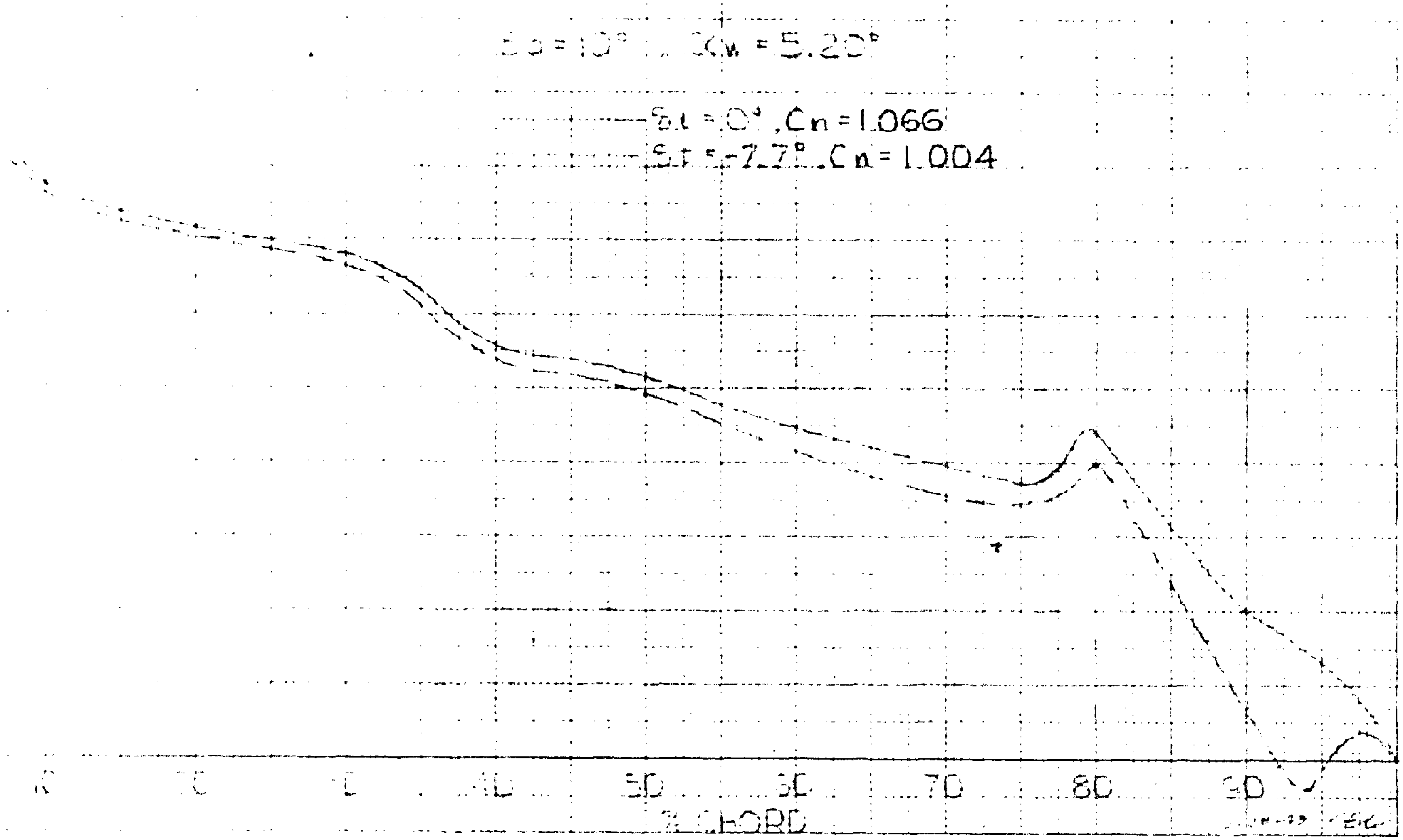
B-36 AIRPLANE

...URE DISTRIBUTION OVER WING SECTION

... CHORD AILERON

SECTION AT 77 % b/2

$\delta_a = 10°$, $\alpha_w = 5.20°$



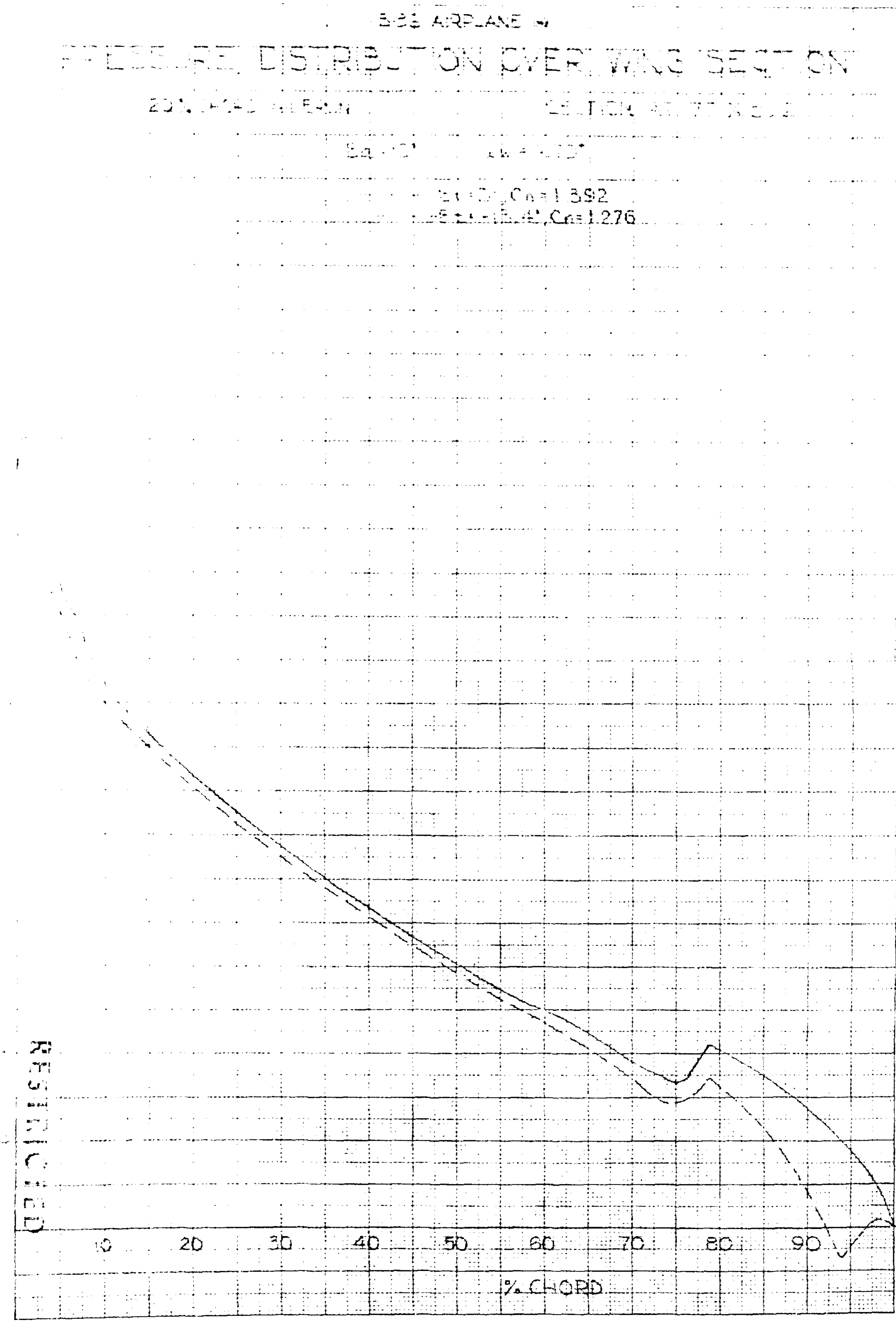


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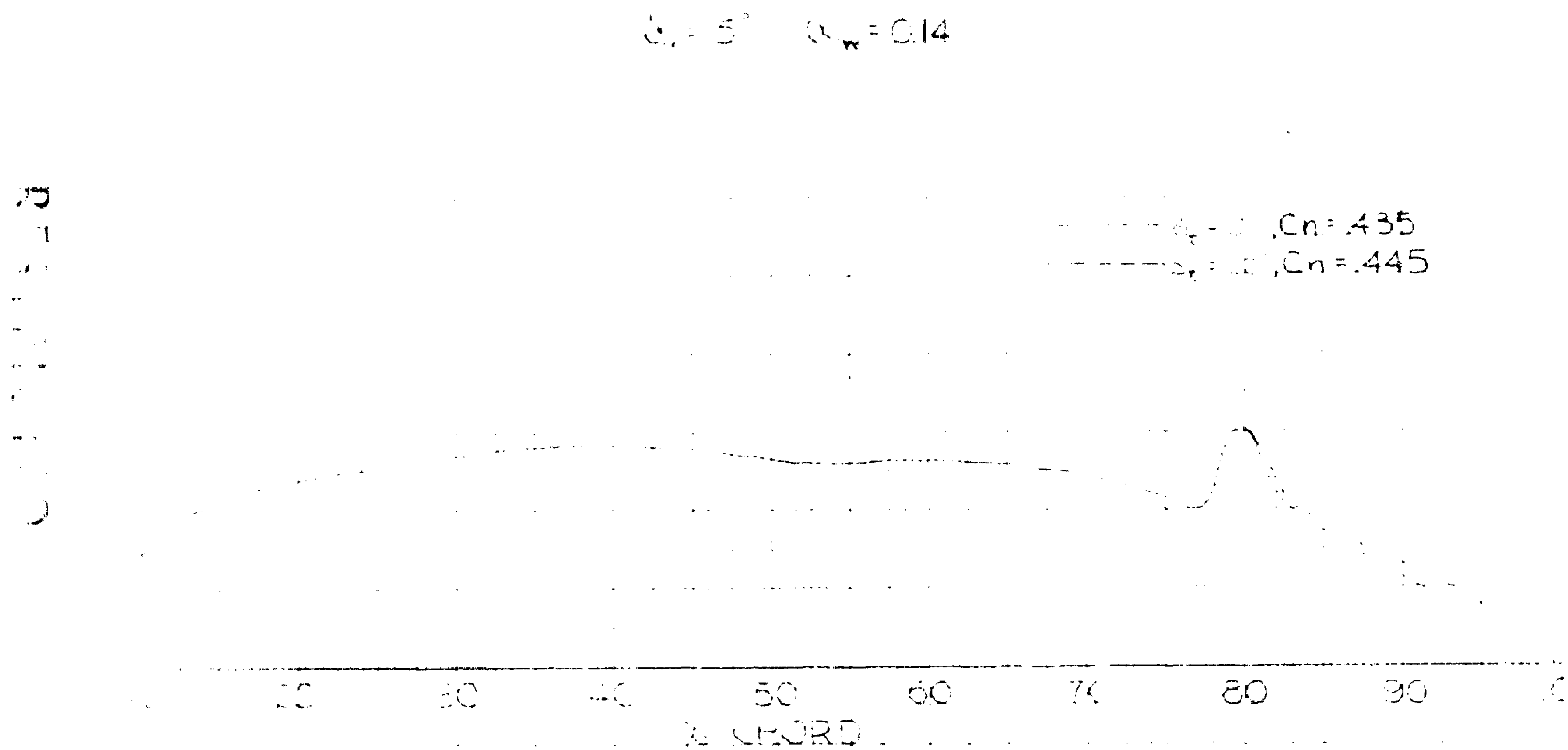
FIG. 25

PRESSURE DISTRIBUTION OVER WING SECTION

AILERON SECTION AT 0.77



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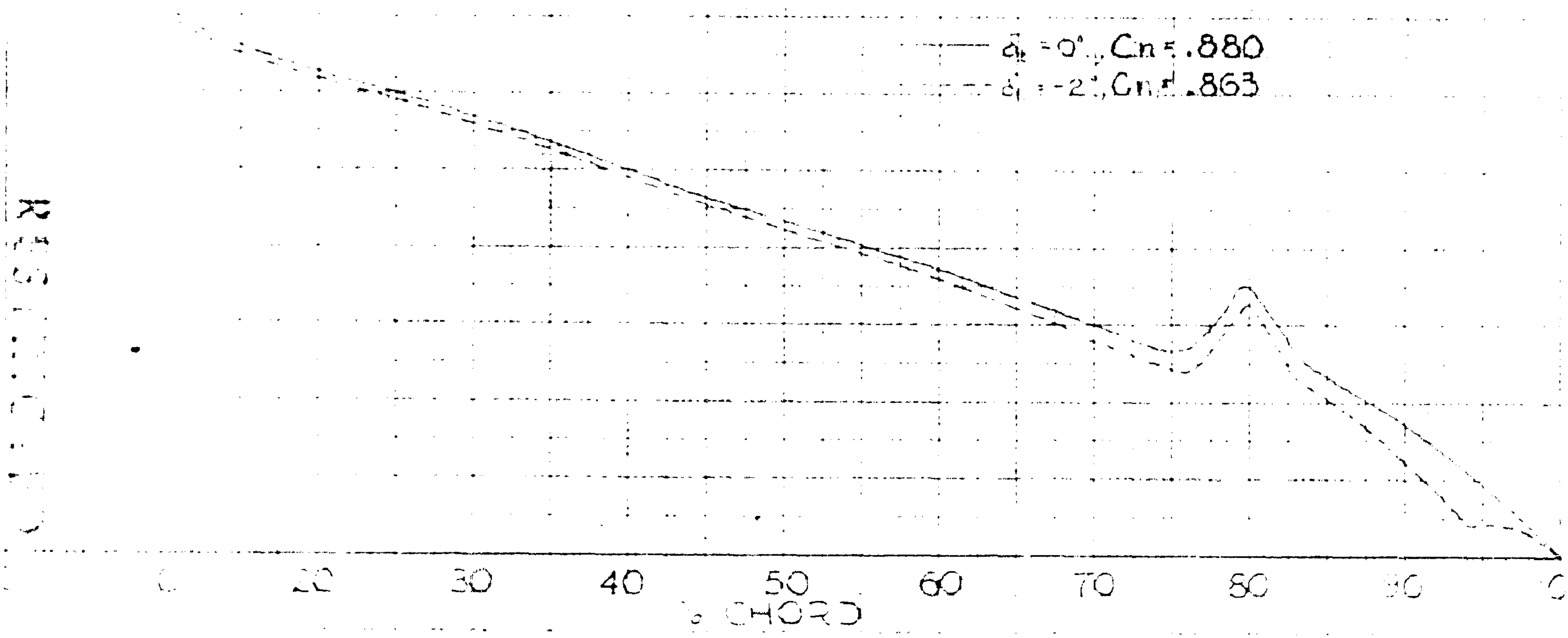
AIRPLANE

PRESSURE DISTRIBUTION OVER WING SECTION

20% CHORD AILERON   SECTION AT 0.77 b/2

$\delta_a = 5°$ $\alpha_w = 4.8$



B-36 AIRPLANE

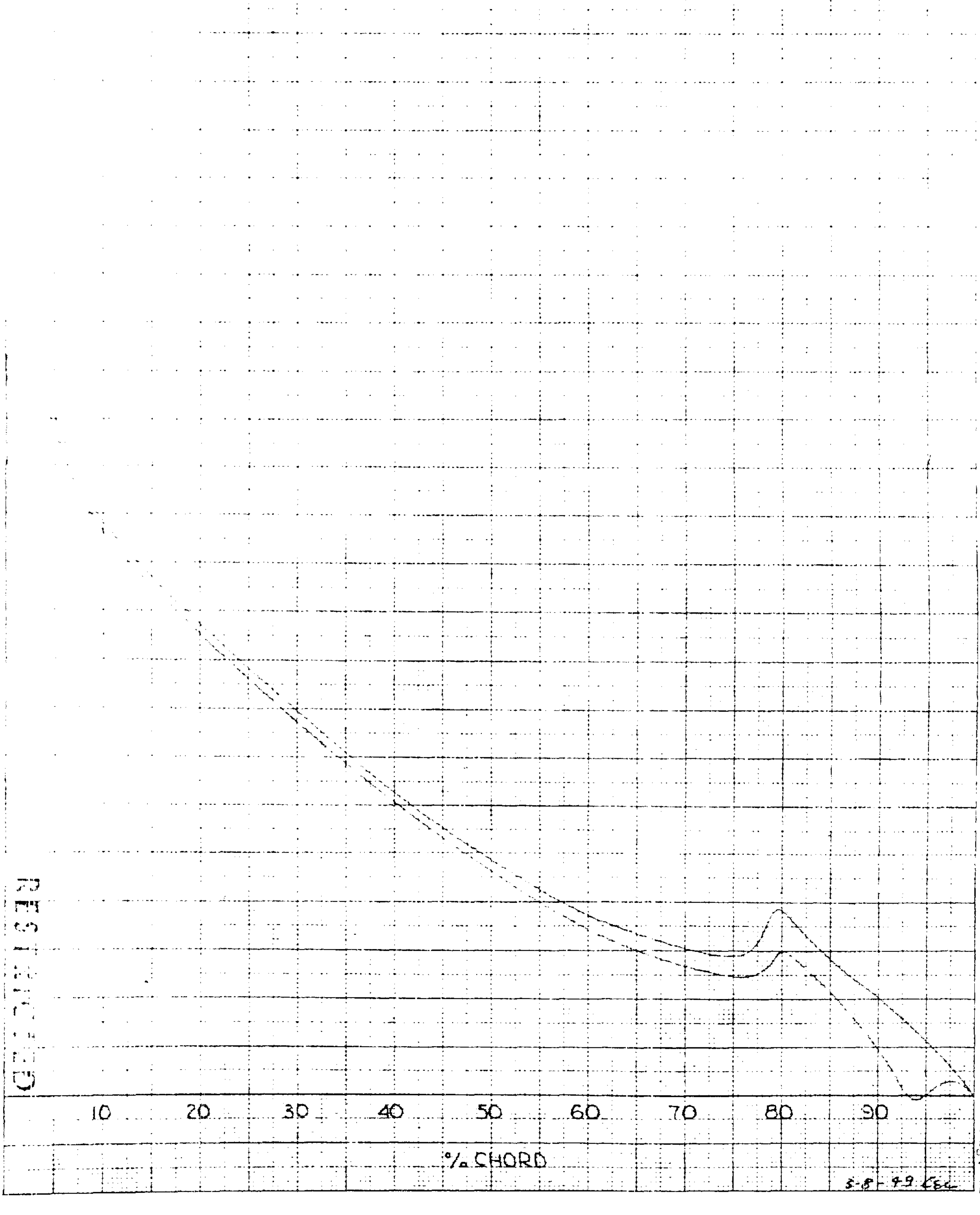
PRESSURE DISTRIBUTION OVER WING SECTION

20% CHORD AILERON SECTION AT 77% b/2

$\delta_a = 5°$ $\alpha_w = 8.60°$

——— $\delta_t = 0°$, $C_n = 1.231$

— — — $\delta_t = +5.6°$, $C_n = 1.186$



B-36 AIRPLANE

PRESSURE DISTRIBUTION OVER WING SECTION

20% CHORD AILERON SECTION AT 77 % b/2

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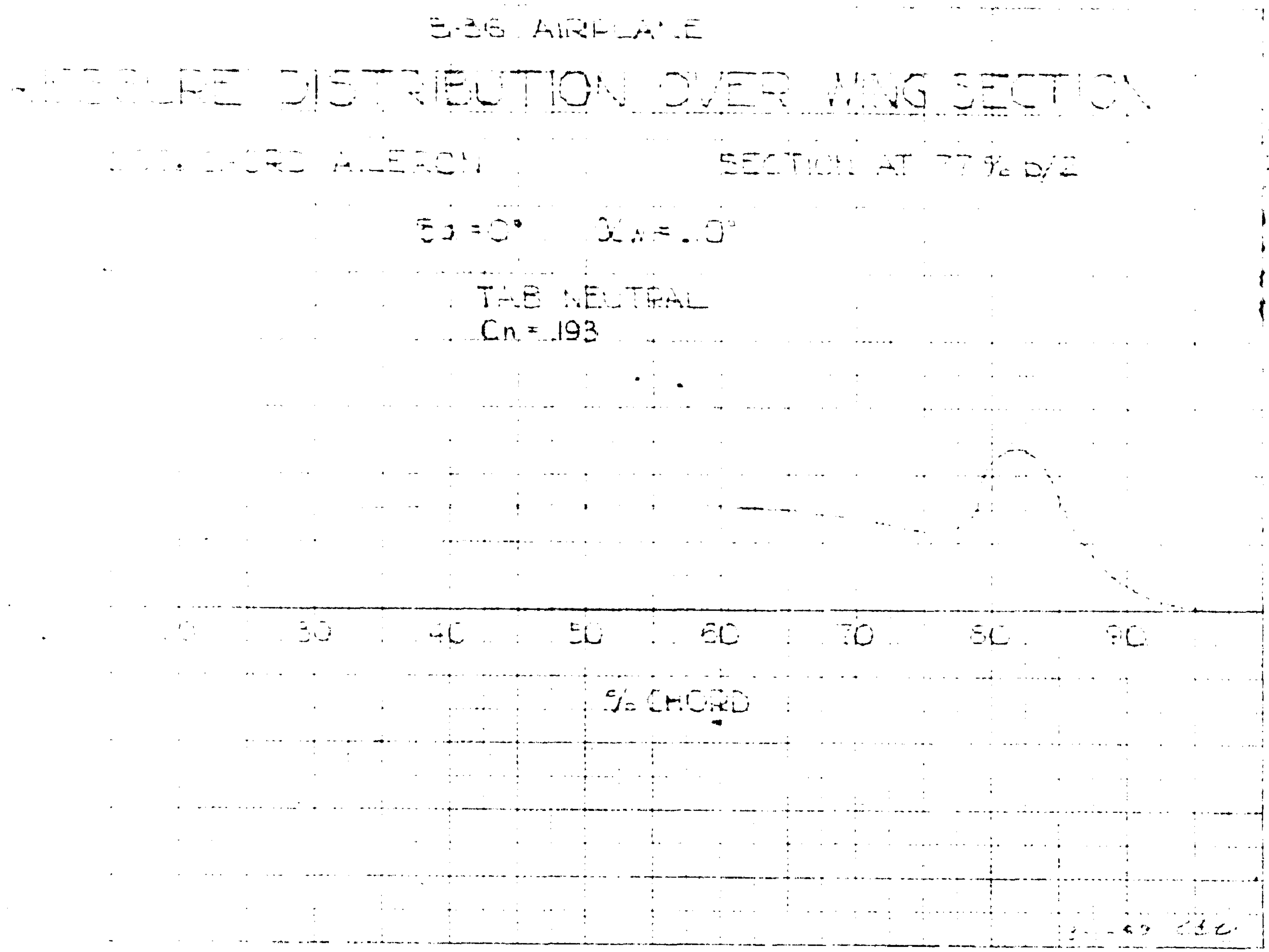

SECTION AT 77 % b/2
TAB NEUTRAL
Cn = .193
30
40
50
60
70
80
90
% CHORD

AIRPLANE

DISTRIBUTION OVER WING SECTION

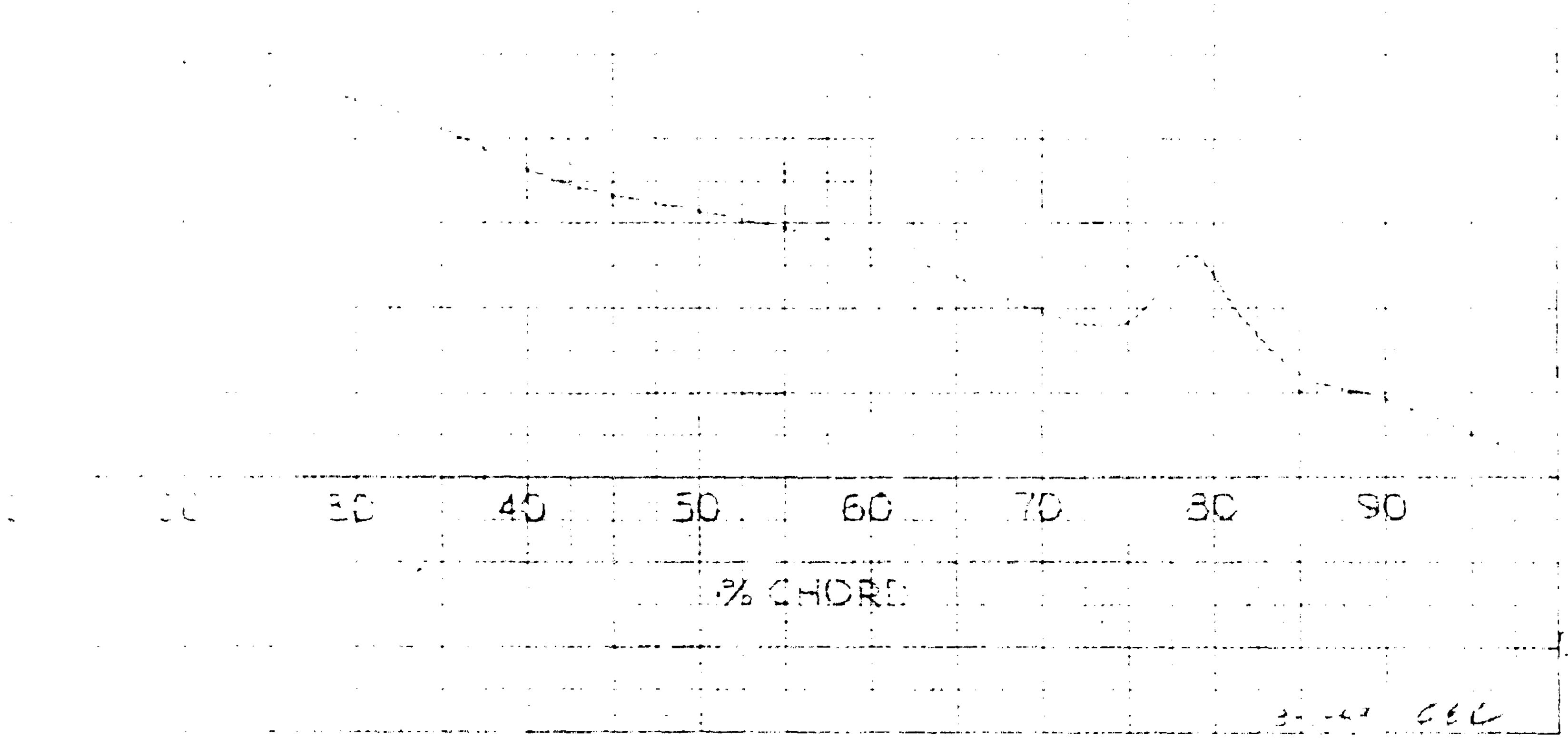
AILERON

SECTION AT

$\delta_a = 0°$

TAB NEUTRAL

$C_n = .653$



B-36 AIRPLANE

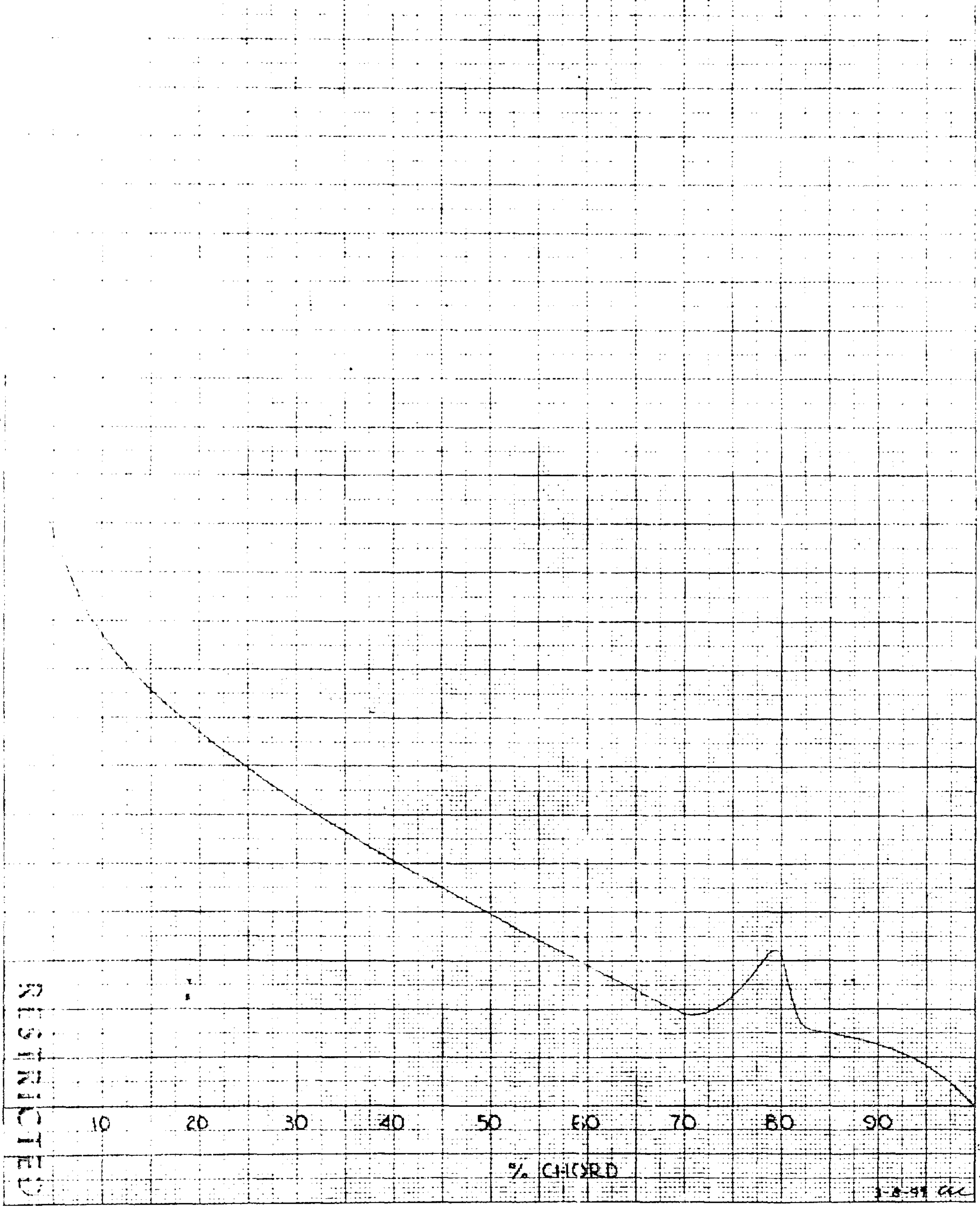
PRESSURE DISTRIBUTION OVER WING SECTION

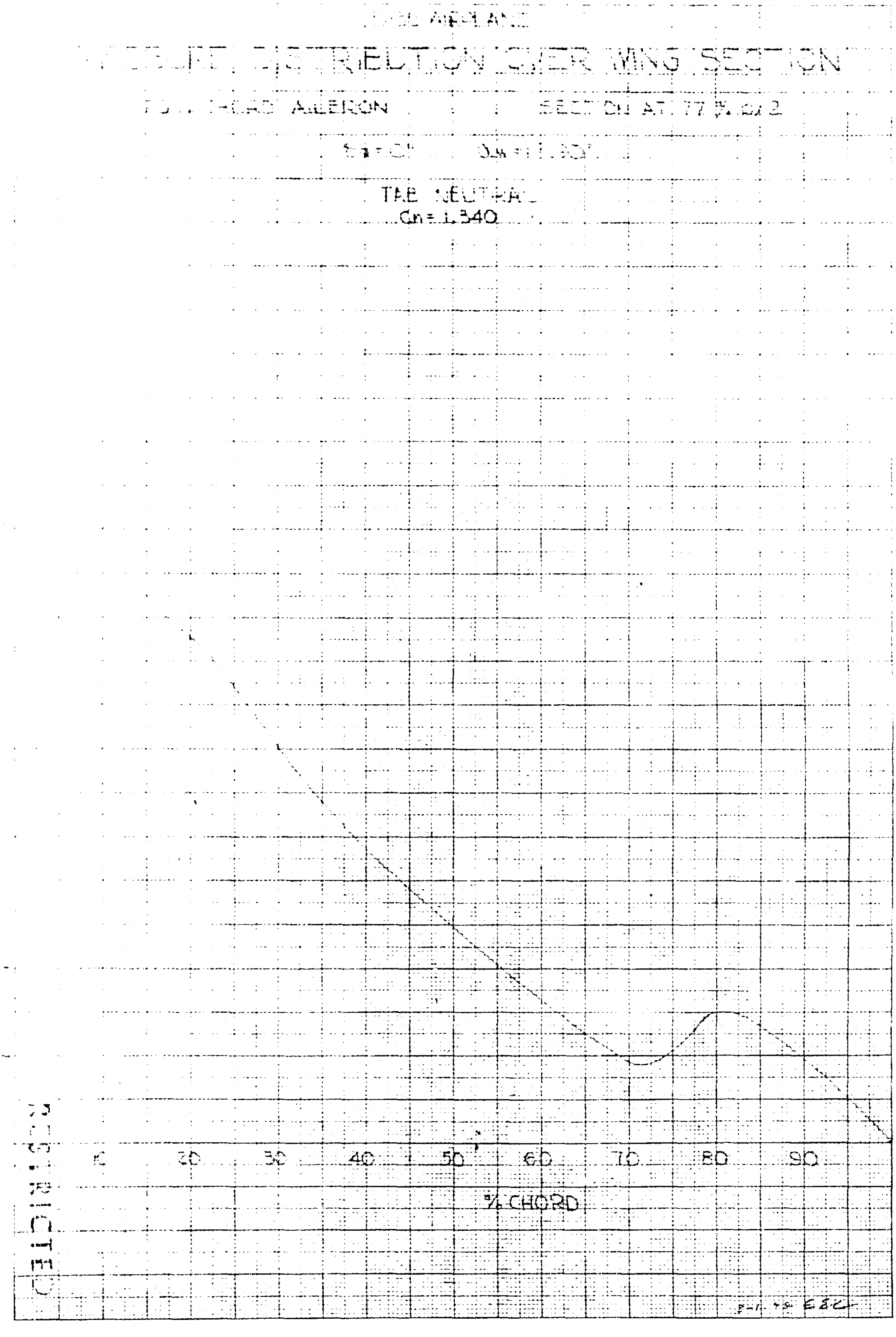
20 % CHORD AILERON SECTION AT 77 % b/2

$\delta_a = 0°$ $\alpha_w = 7°70'$

TAB NEUTRAL

$C_n = .982$





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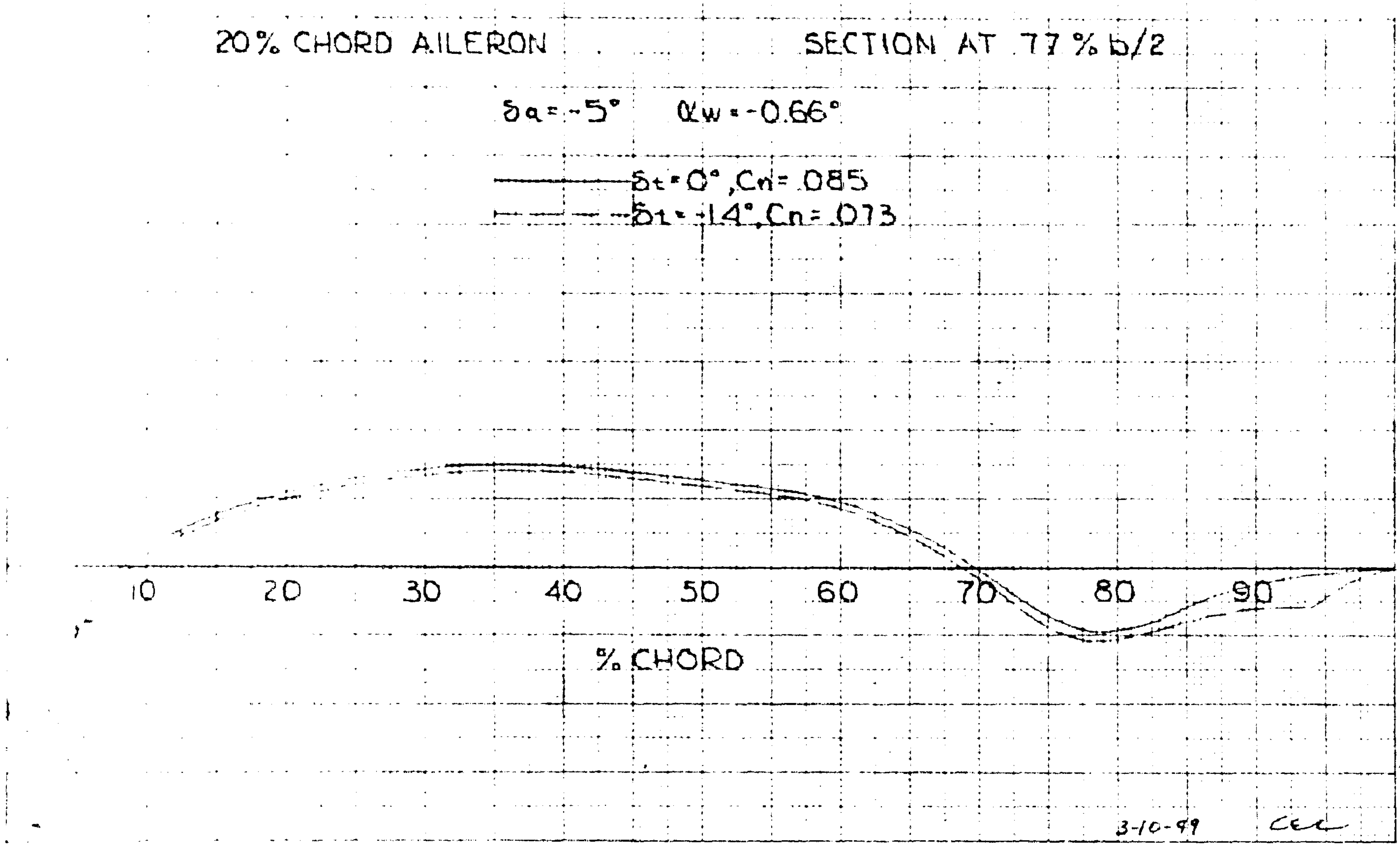
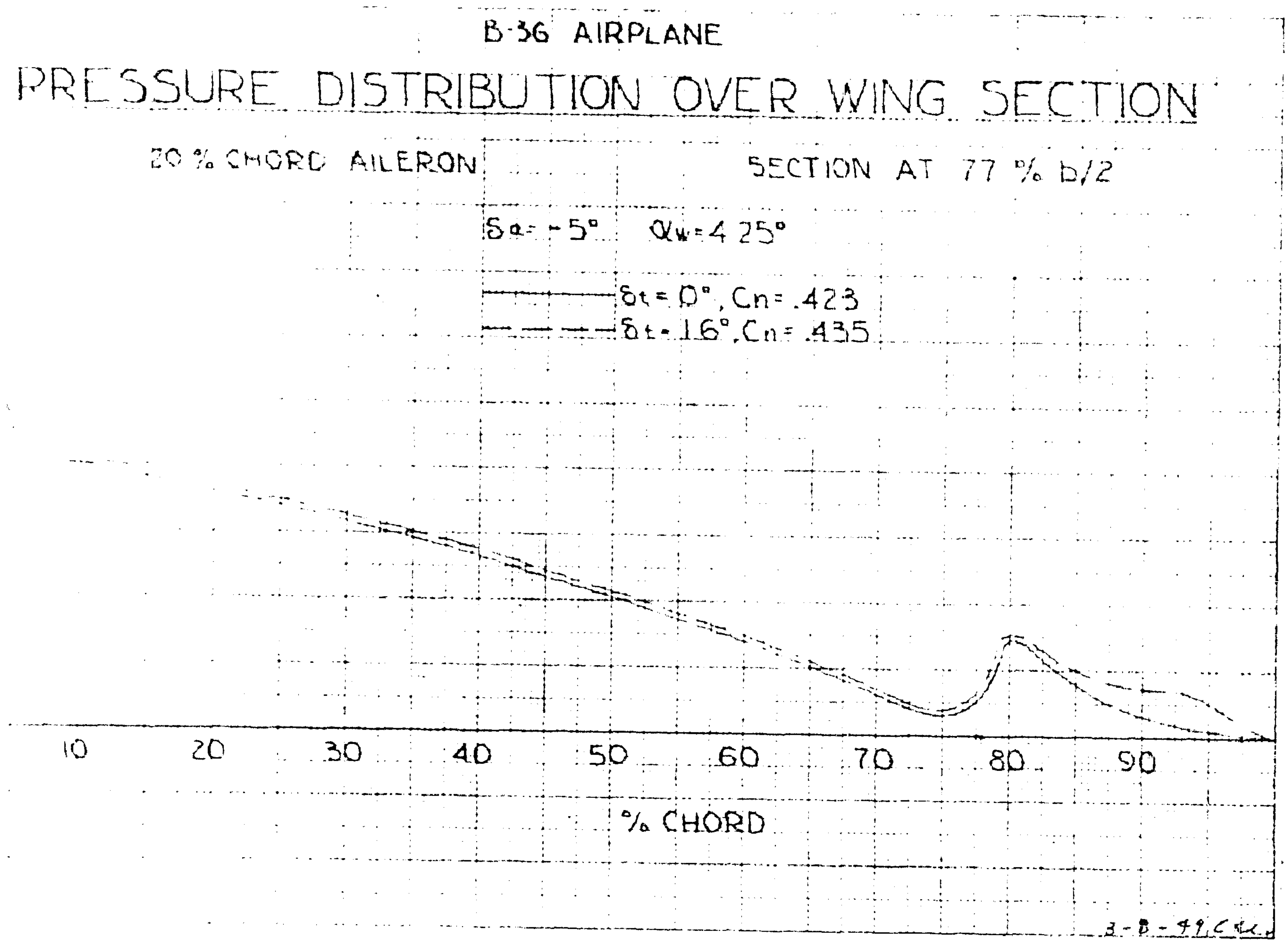
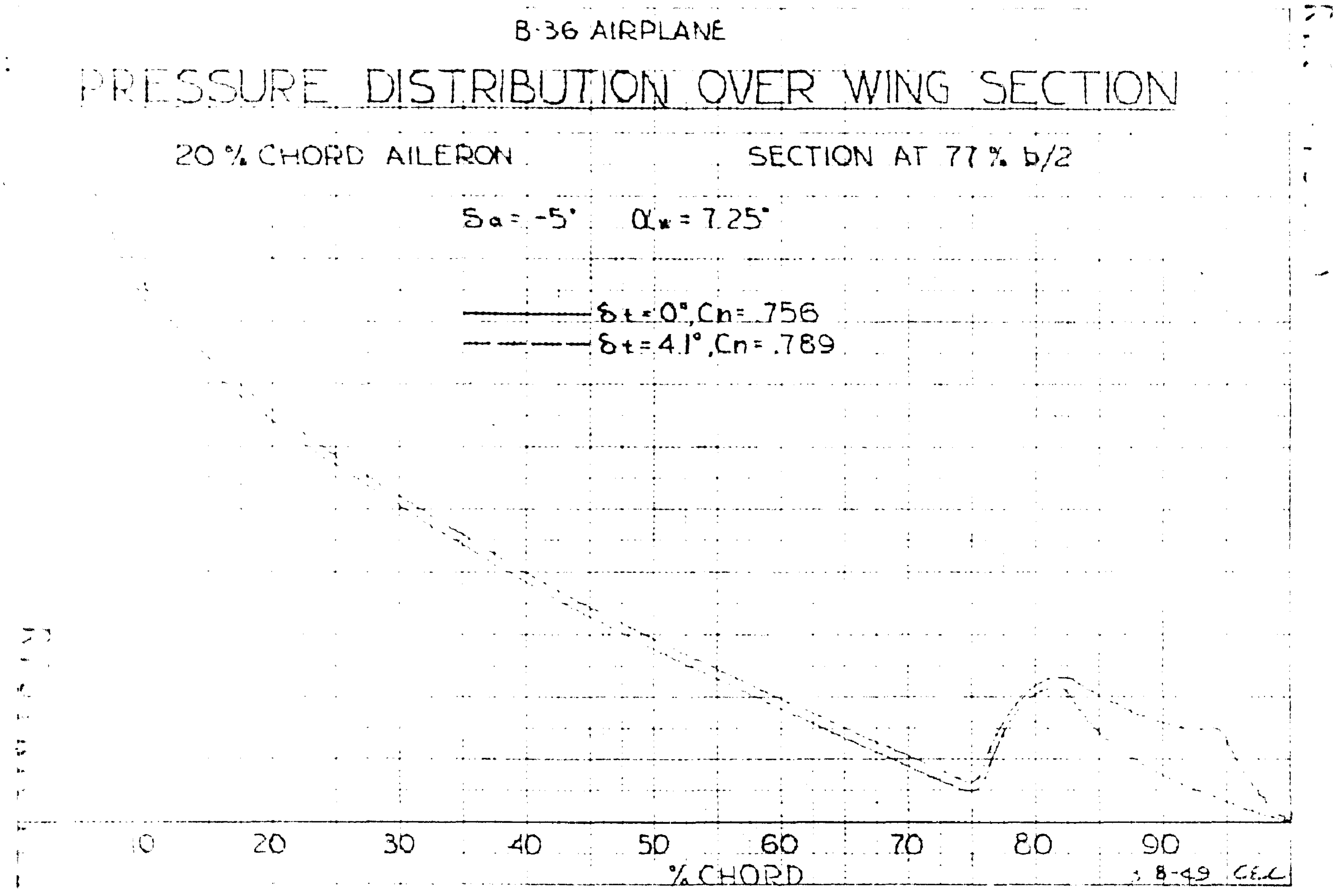
B-36 AIRPLANE

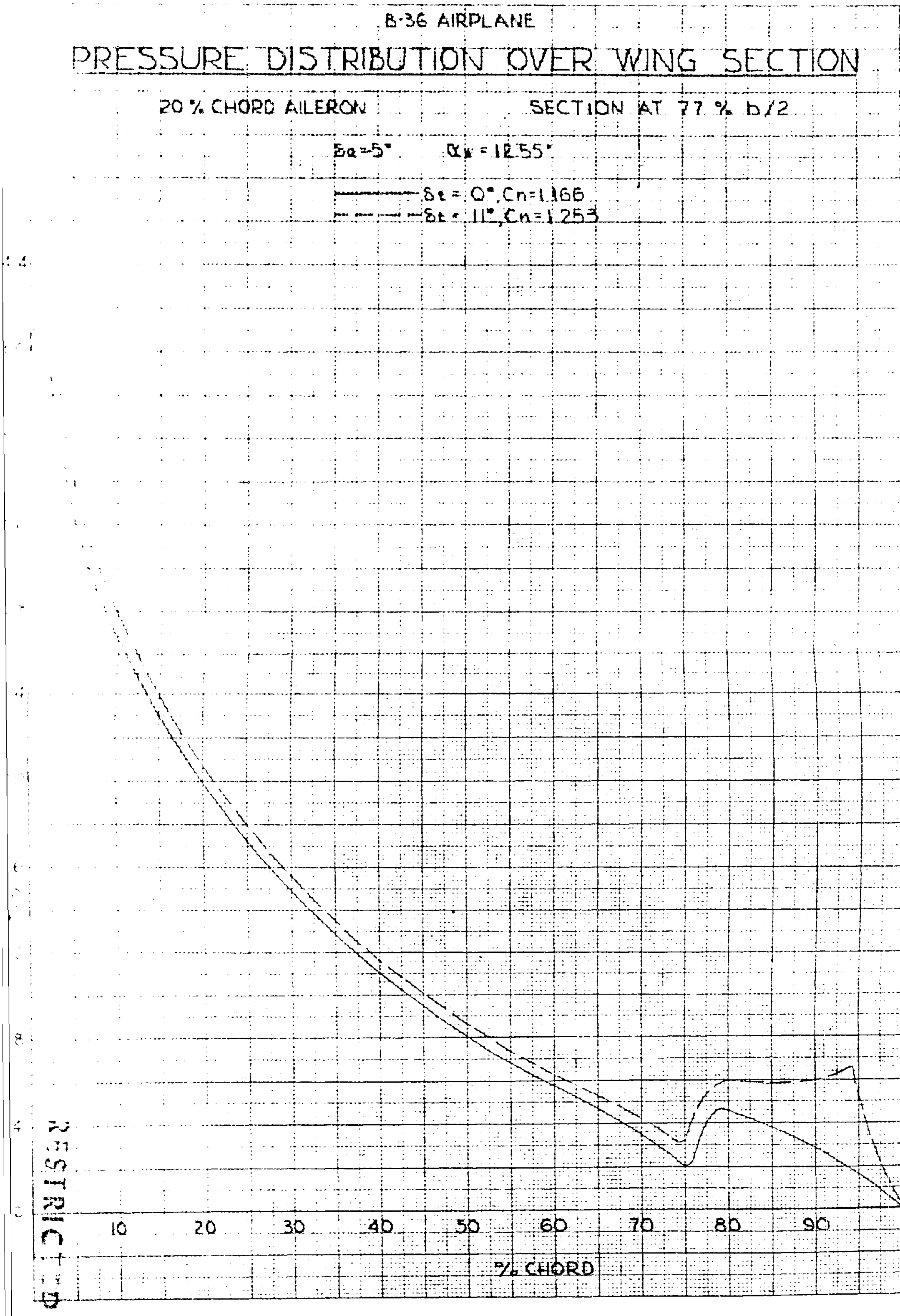
PRESSURE DISTRIBUTION OVER WING SECTION





B-36 AIRPLANE
PRESSURE DISTRIBUTION OVER WING SECTION
20 % CHORD AILERON
SECTION AT 77 % b/2
$\delta_a = -5°$ $\alpha_w = 4.25°$
$\delta_t = 0°$, $C_n = .423$
$\delta_t = 16°$, $C_n = .435$
10
20
30
40
50
60
70
80
90
% CHORD
3-8-49 C


B-36 AIRPLANE
PRESSURE DISTRIBUTION OVER WING SECTION
20 % CHORD AILERON
SECTION AT 77 % b/2
δa = -5°   α = 7.25°
δt = 0°, Cn = .756
δt = 4.1°, Cn = .789
10
20
30
40
50
60
70
80
90
% CHORD
8-49 C.E.C.


B-36 AIRPLANE
PRESSURE DISTRIBUTION OVER WING SECTION
20 % CHORD AILERON
SECTION AT 77 % b/2
δa=5°
αw = 12.55°
δt = 0°, Cn=1.166
δt = 11°, Cn=1.253
10
20
30
40
50
60
70
80
90
% CHORD

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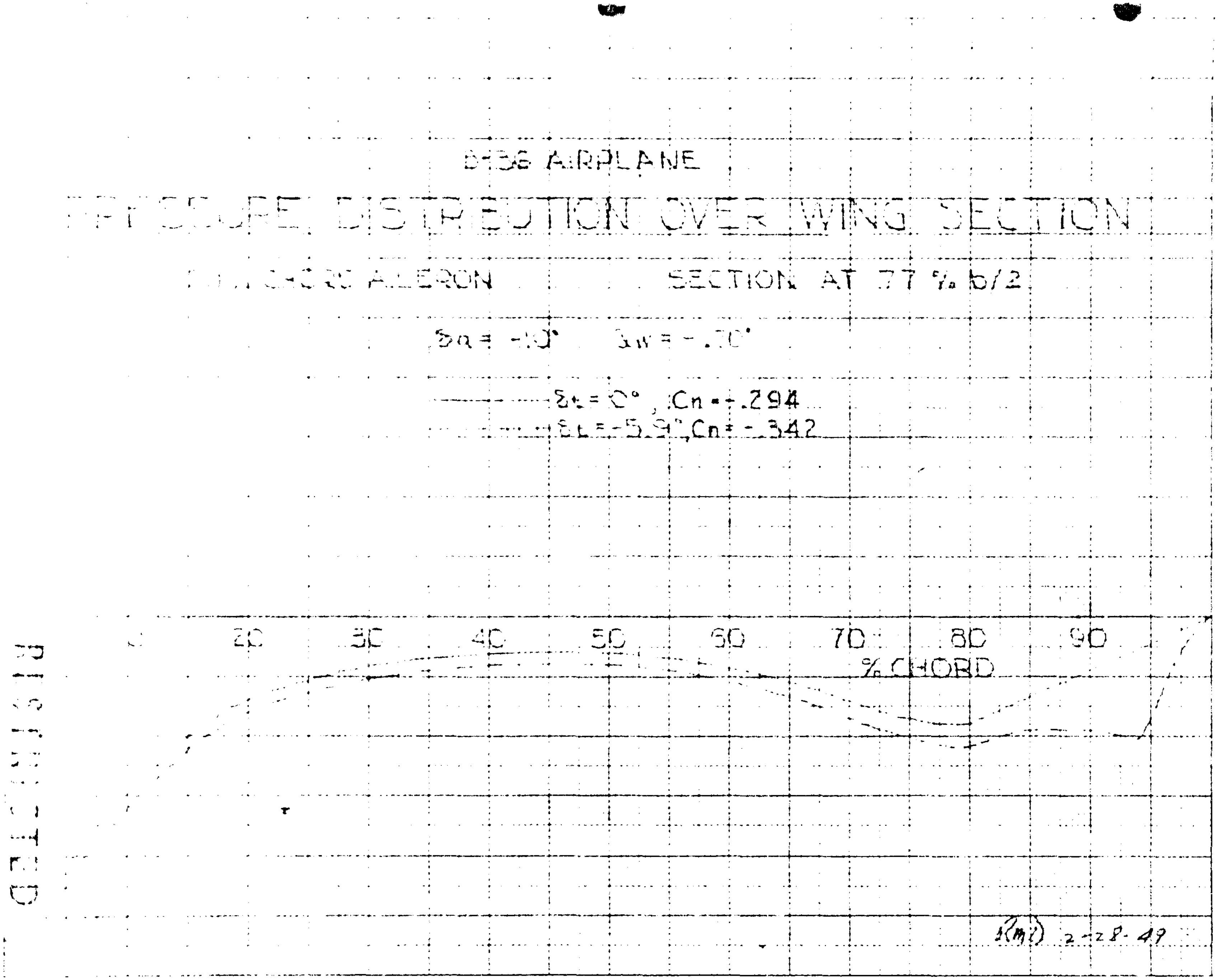

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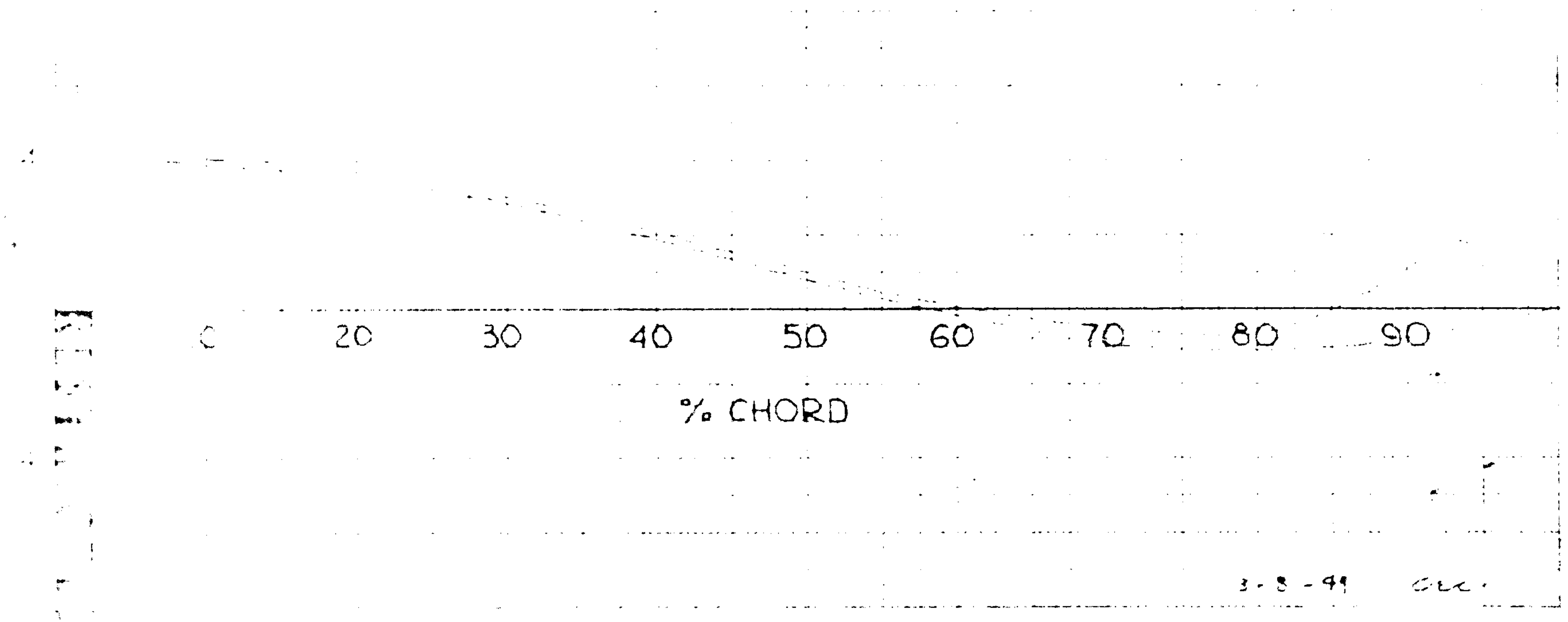
B-36 AIRPLANE

PRESSURE DISTRIBUTION OVER WING SECTION

20% CHORD AILERON　　　　SECTION AT 77 % b/2

$\delta_a = -10°$　　$\alpha_w = 3.30°$

———— $\delta_t = 0°, C_n = .126$
– – – – $\delta_t = 3.9°, C_n = .157$



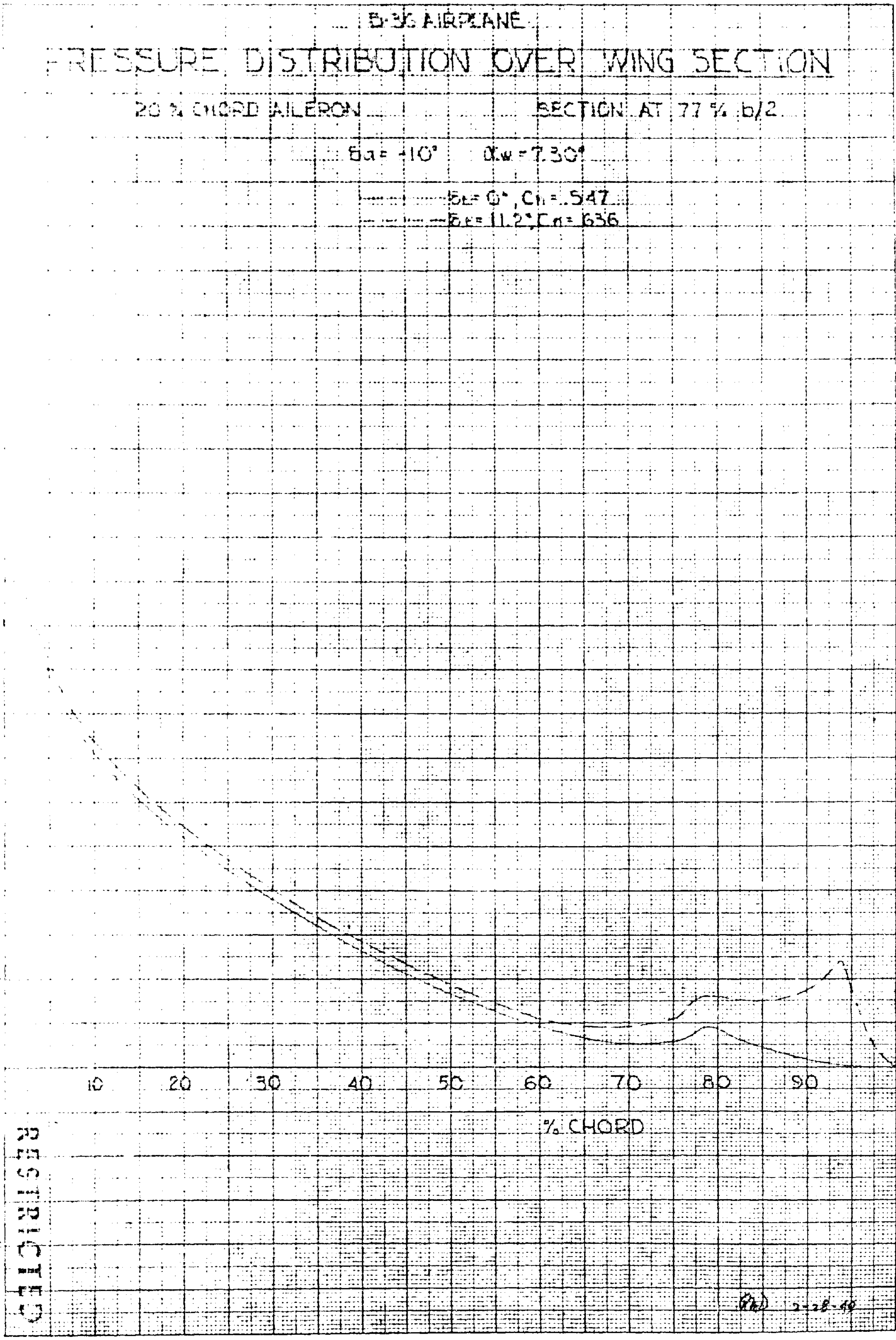


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FIG. 40
9c

B-36 AIRPLANE

PRESSURE DISTRIBUTION OVER WING SECTION

20% CHORD AILERON   SECTION AT 77% b/2

$\delta_a = -10°$ $\alpha_w = 11.60°$

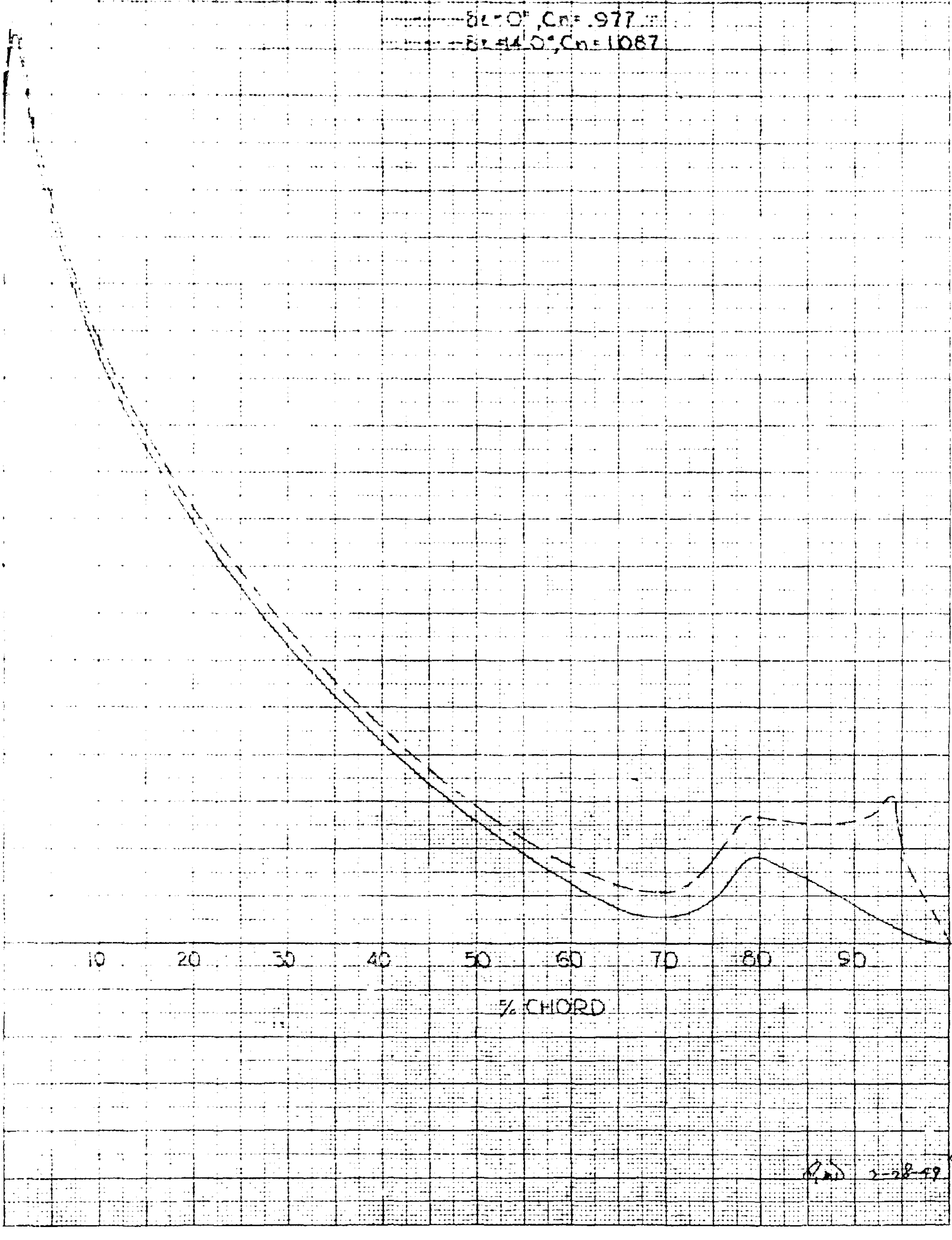

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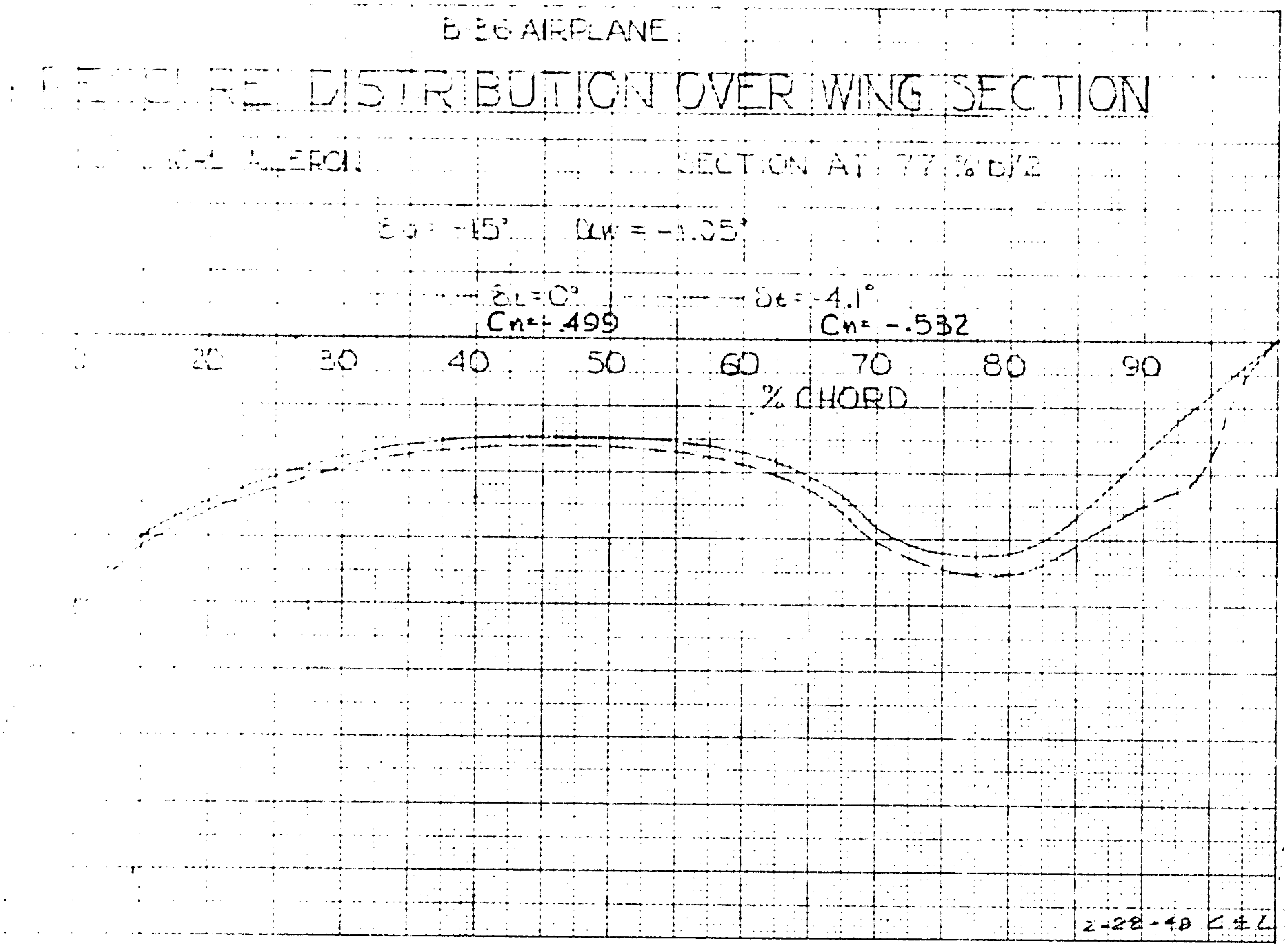
FIG. 41


B-36 AIRPLANE
DISTRIBUTION OVER WING SECTION
SECTION AT 77 % b/2
αw = -1.05°
δL = 0°
δt = -4.1°
Cn= .499
Cn= -.532
20
30
40
50
60
70
80
90
% CHORD
2-28-48

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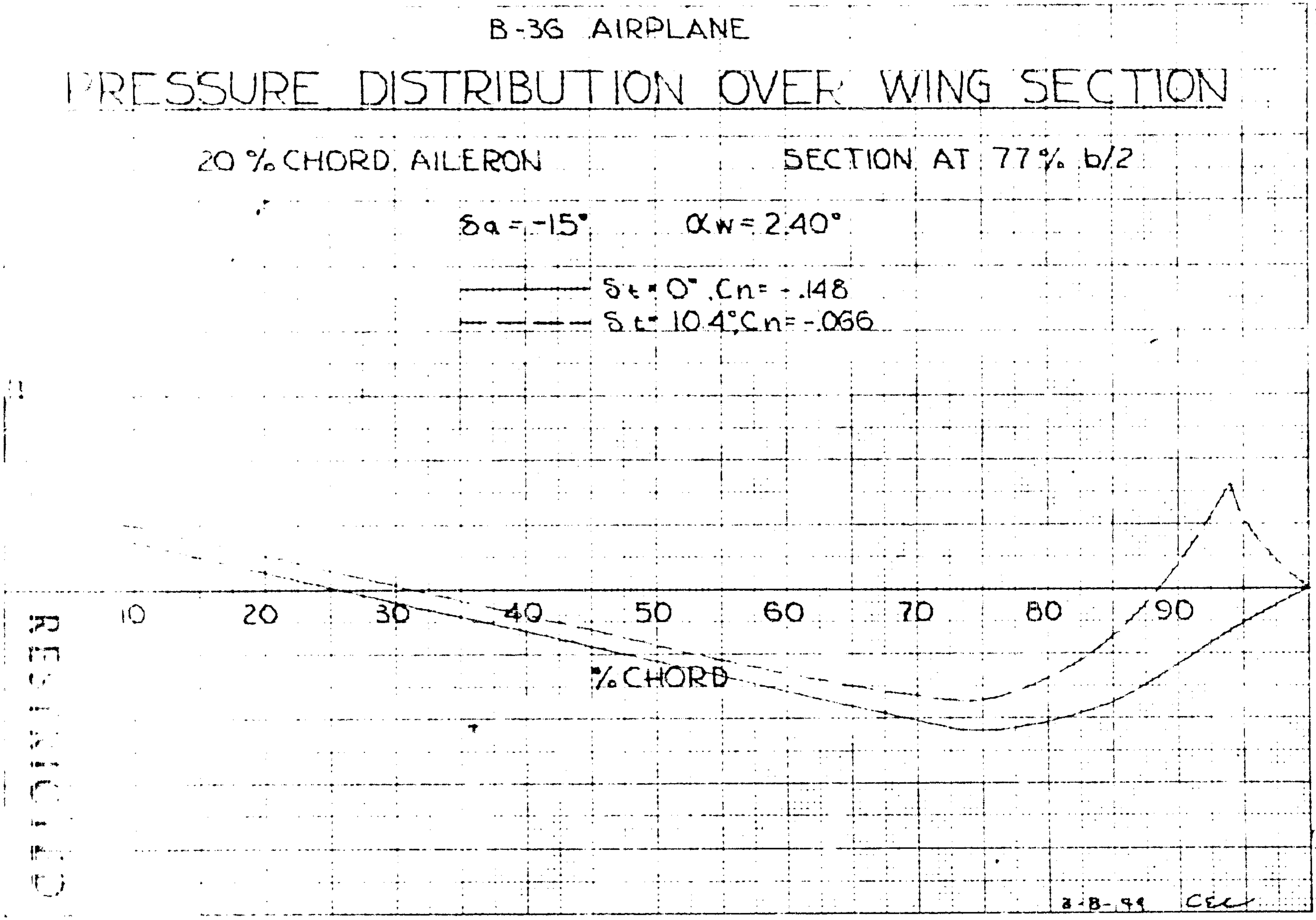

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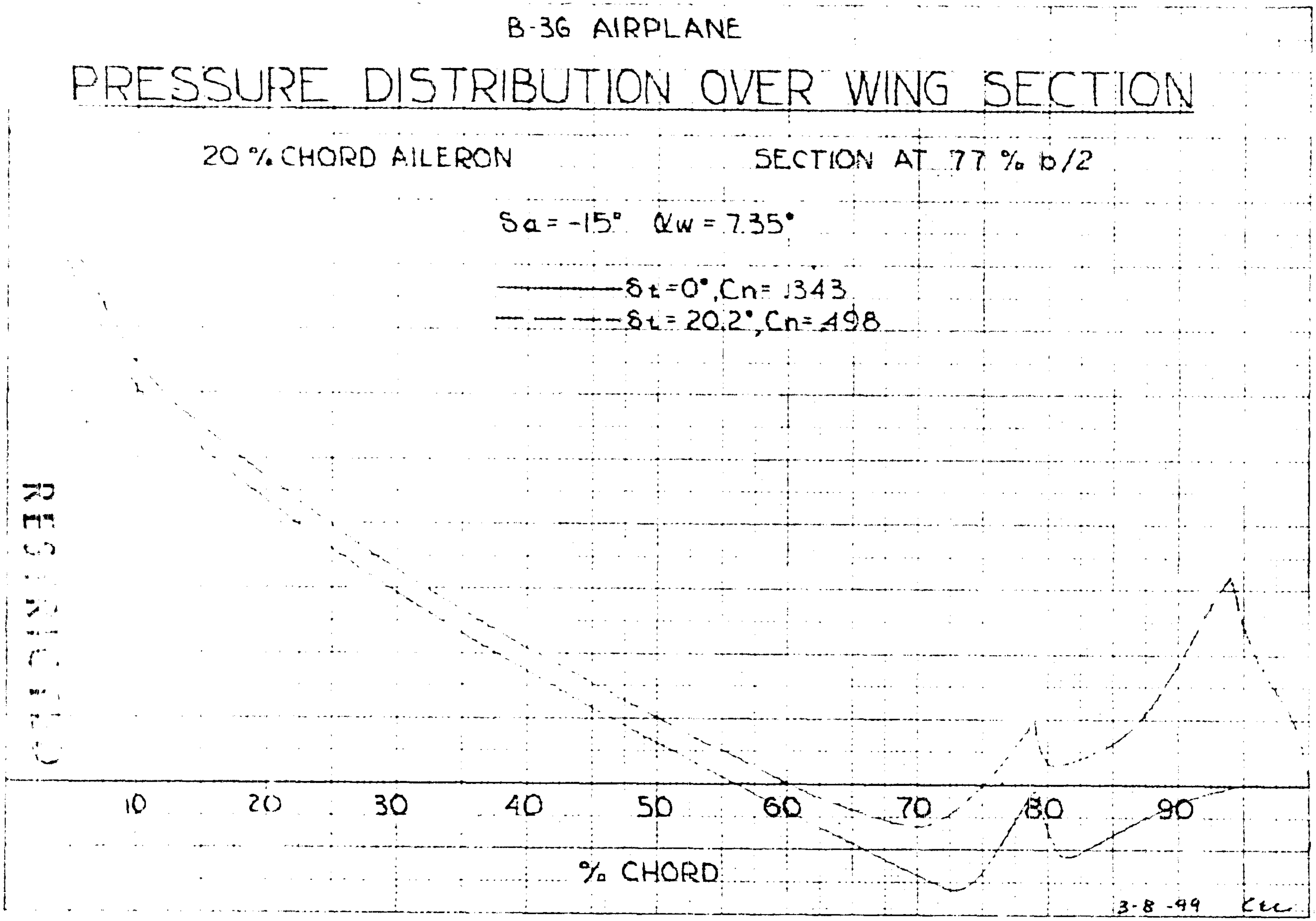
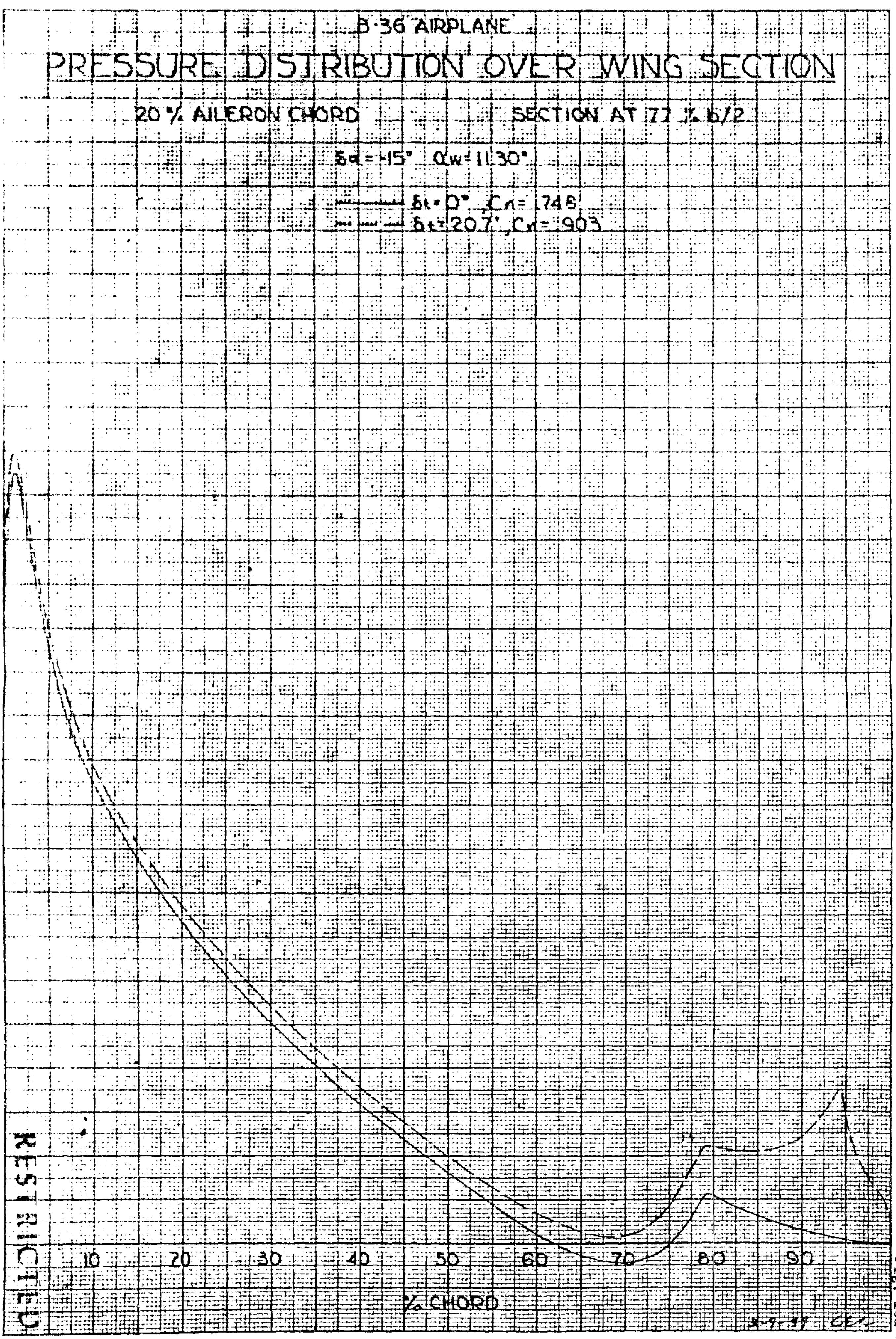
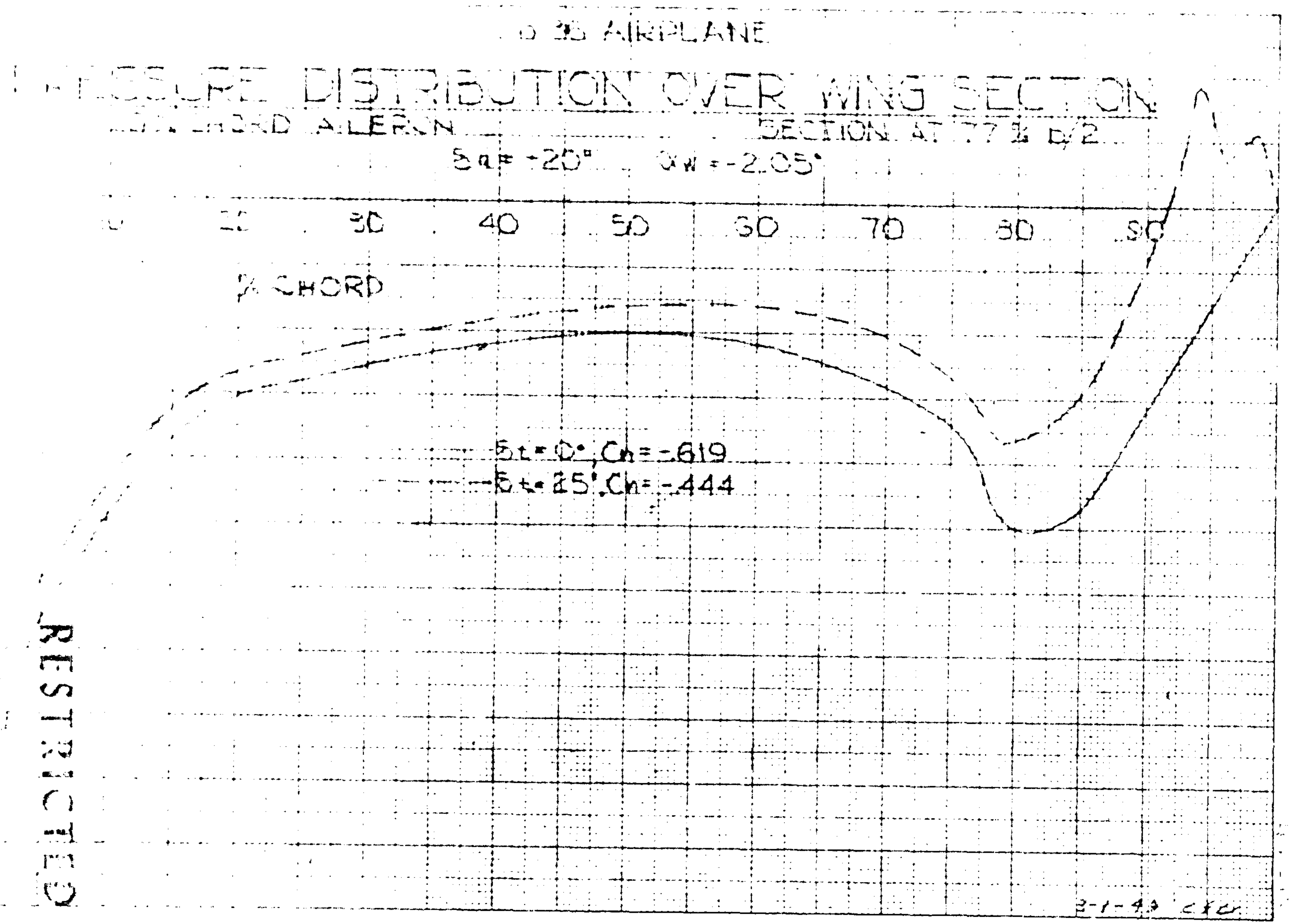

B-36 AIRPLANE
PRESSURE DISTRIBUTION OVER WING SECTION
20 % CHORD AILERON
SECTION AT 77 % b/2
δa = -15° αw = 7.35°
δt = 0°, Cn = .1343
δt = 20.2°, Cn = .498
10
20
30
40
50
60
70
80
90
% CHORD
3-8-49



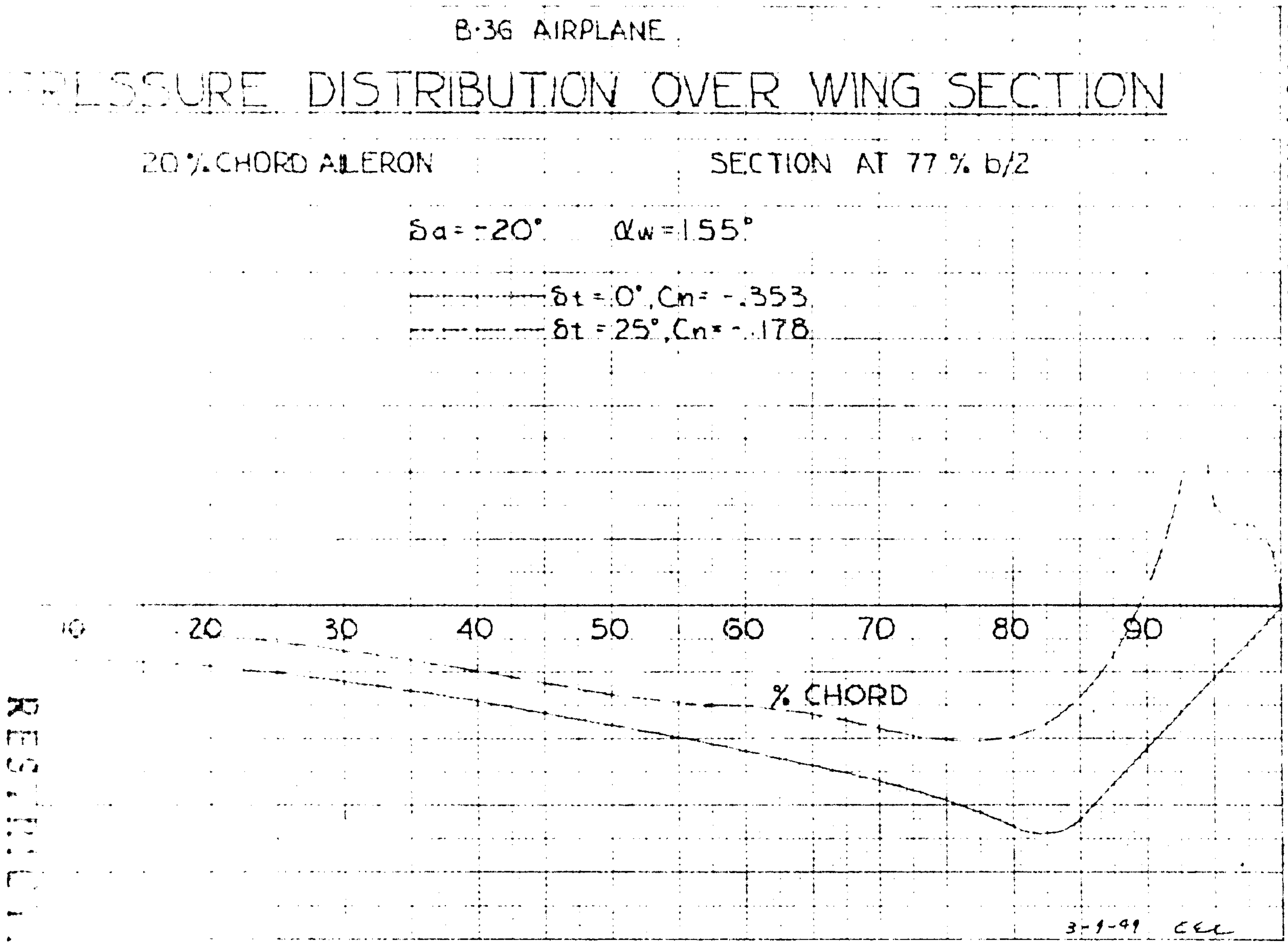
B-36 AIRPLANE
PRESSURE DISTRIBUTION OVER WING SECTION
20 % AILERON CHORD
SECTION AT 77 % b/2
δa = +15° αw = 11.30°
δt = 0°, Cn = .748
δt = 20.7°, Cn = .903
3.6
3.2
2.8
2.4
2.0
1.6
1.2
ΔP/q
.8
.4
0
10
20
30
40
50
60
70
80
90
% CHORD
RESTRICTED
RESTRICTED

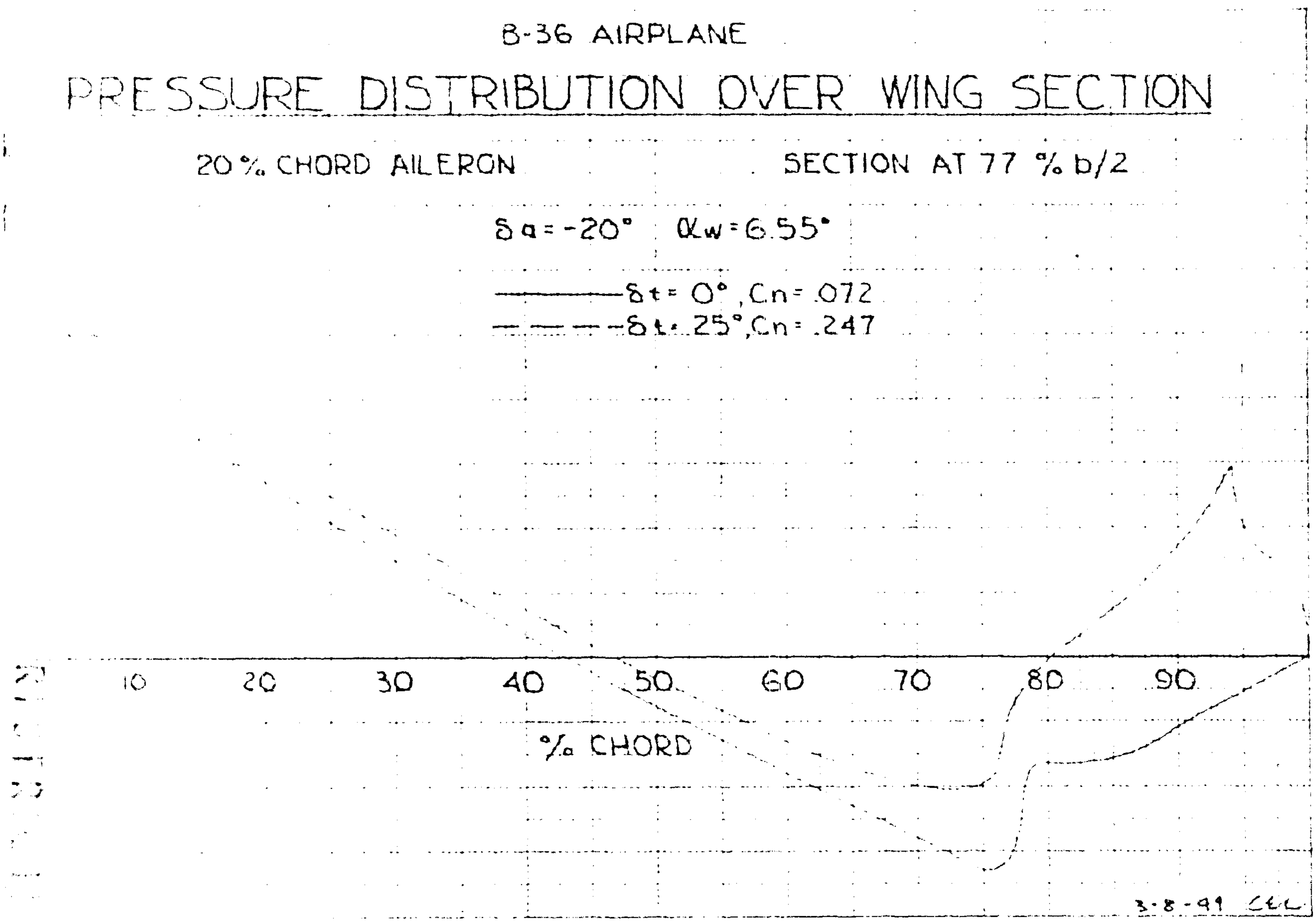
Fig. 45



B 35 AIRPLANE
PRESSURE DISTRIBUTION OVER WING SECTION
CHORD AILERON
SECTION AT 77 % b/2
δa = +20°   αw = -2.05°
10 20 30 40 50 60 70 80 90
% CHORD
δt = 0°, Cn = -.619
δt = 25°, Cn = -.444
3-1-43

RESTRICTED


B-36 AIRPLANE
PRESSURE DISTRIBUTION OVER WING SECTION
20% CHORD AILERON
SECTION AT 77% b/2
δa = -20°   αw = 1.55°
δt = 0°, Cn = -.353
δt = 25°, Cn = -.178
10
20
30
40
50
60
70
80
90
% CHORD
3-9-49 CCL


B-36 AIRPLANE
PRESSURE DISTRIBUTION OVER WING SECTION
20 % CHORD AILERON
SECTION AT 77 % b/2
$\delta a = -20°$ $\alpha w = 6.55°$
$\delta t = 0°$, $Cn = .072$
$\delta t = 25°$, $Cn = .247$
10
20
30
40
50
60
70
80
90
% CHORD
3-8-49 CEL

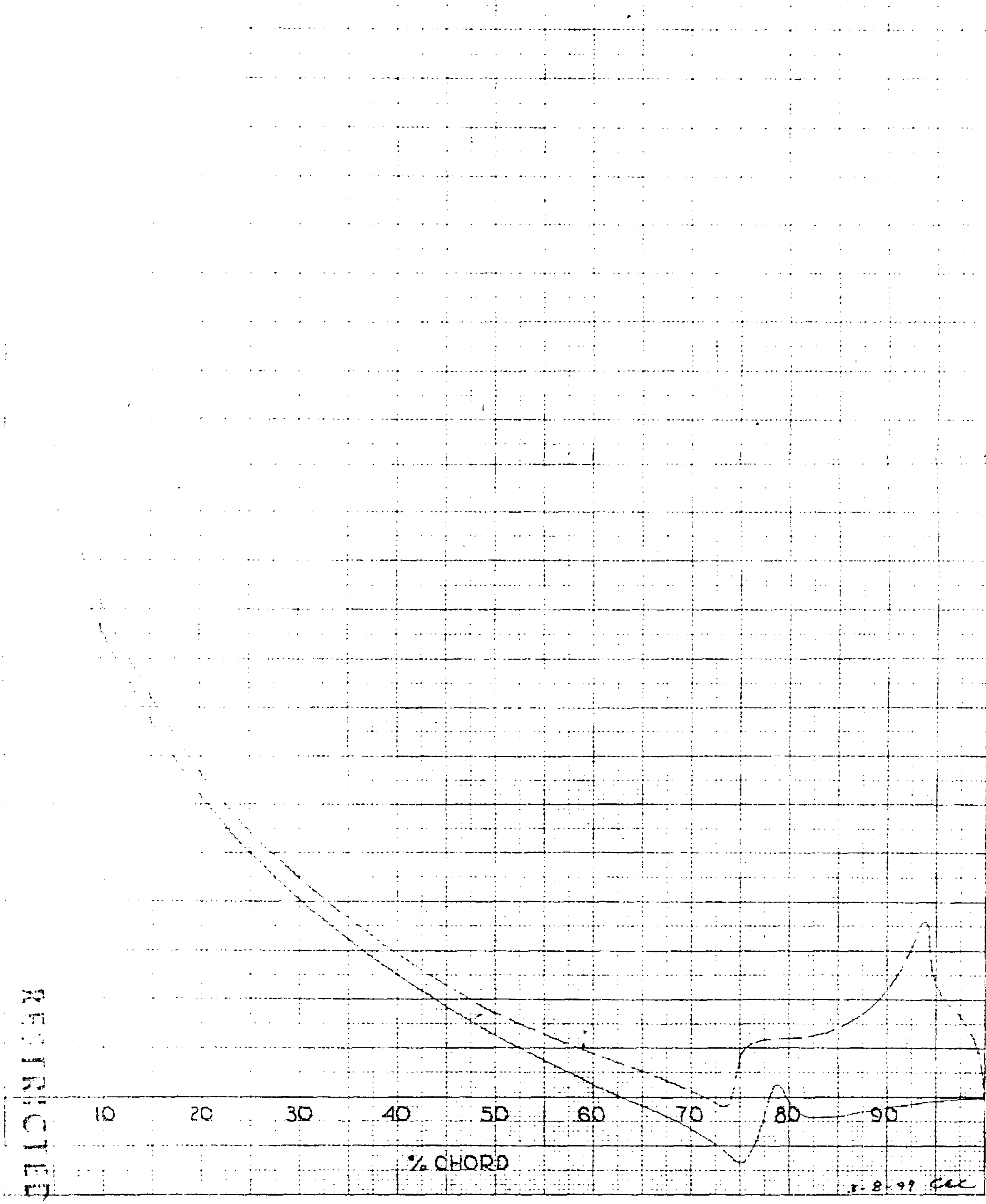
B-36 AIRPLANE

PRESSURE DISTRIBUTION OVER WING SECTION

20 % CHORD AILERON — SECTION AT 77.% b/2

$\delta_a = +20°$ $\alpha_w = 11.60°$

———— $\delta_t = 0°$, $C_n = .610$
— — — $\delta_t = 25°$, $C_n = .785$

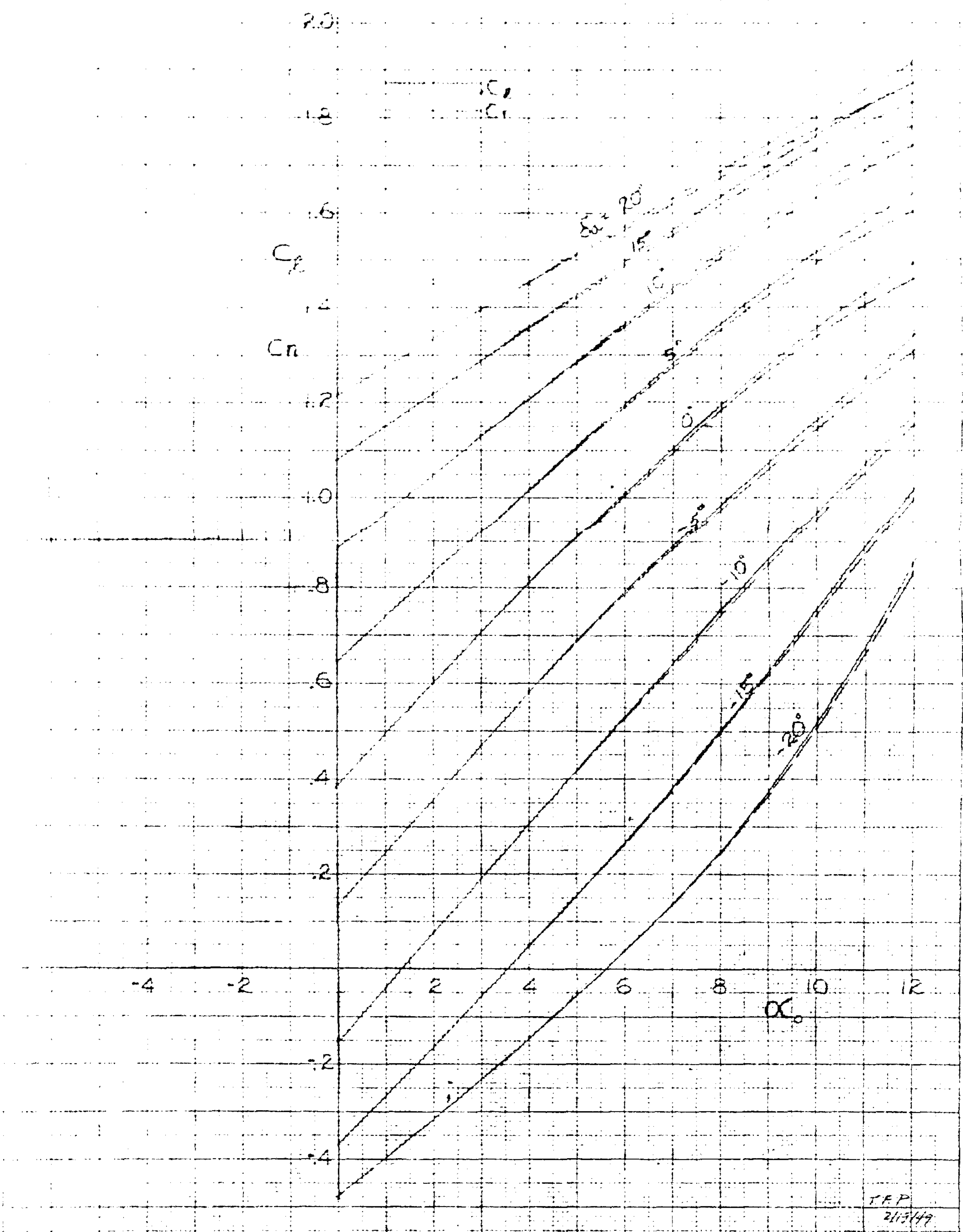


1-8-49 GCK

B-35 AIRPLANE

SECTION LIFT CURVES

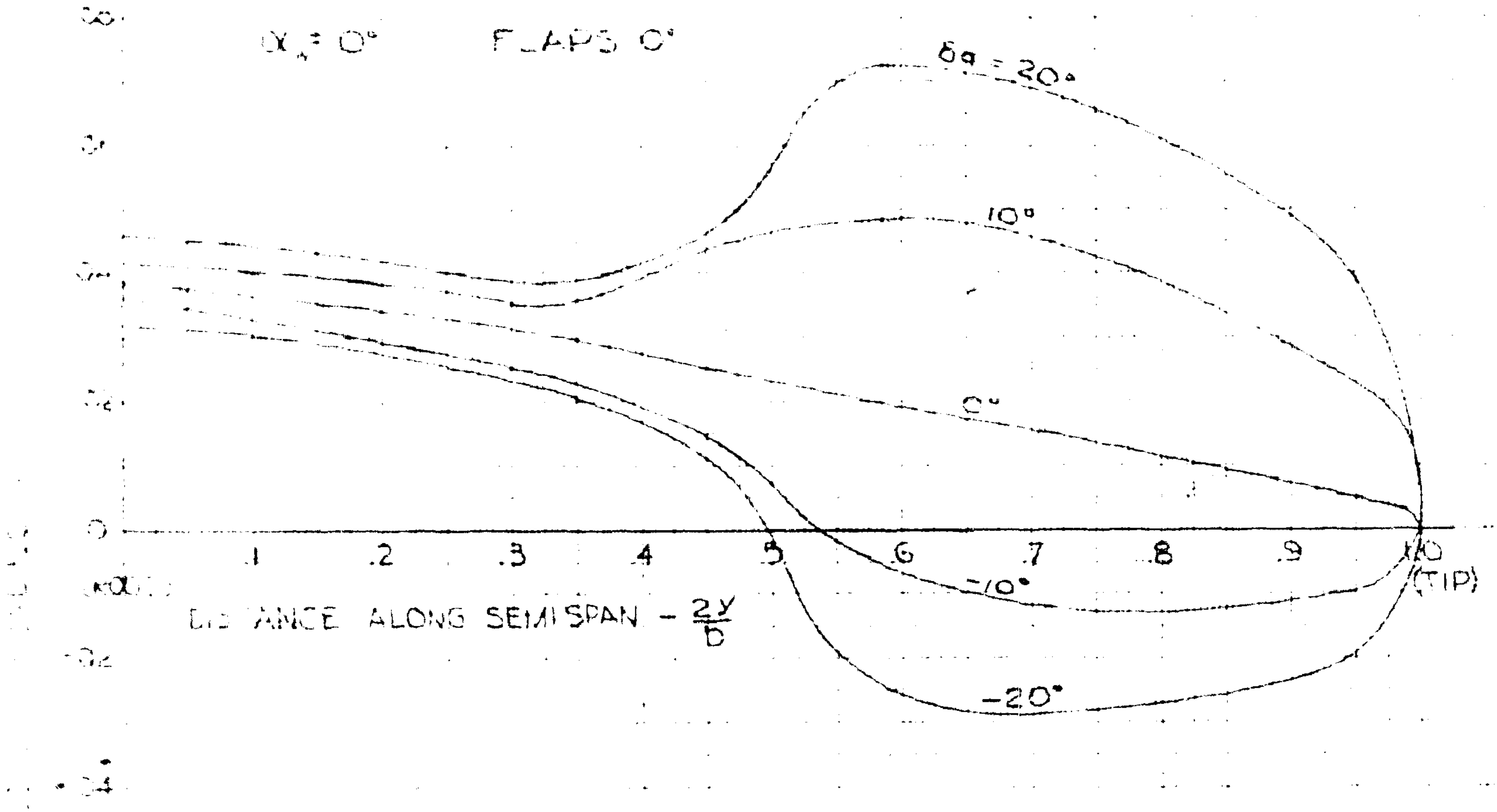
20% CHORD AILERON SECTION AT 77.5 b/2



B-35 AIRPLANE

SPAN LOADINGS FOR VARIOUS AILERON DEFLECTIONS

$\alpha_s = 0°$ FLAPS 0°



Tom
2/22/49

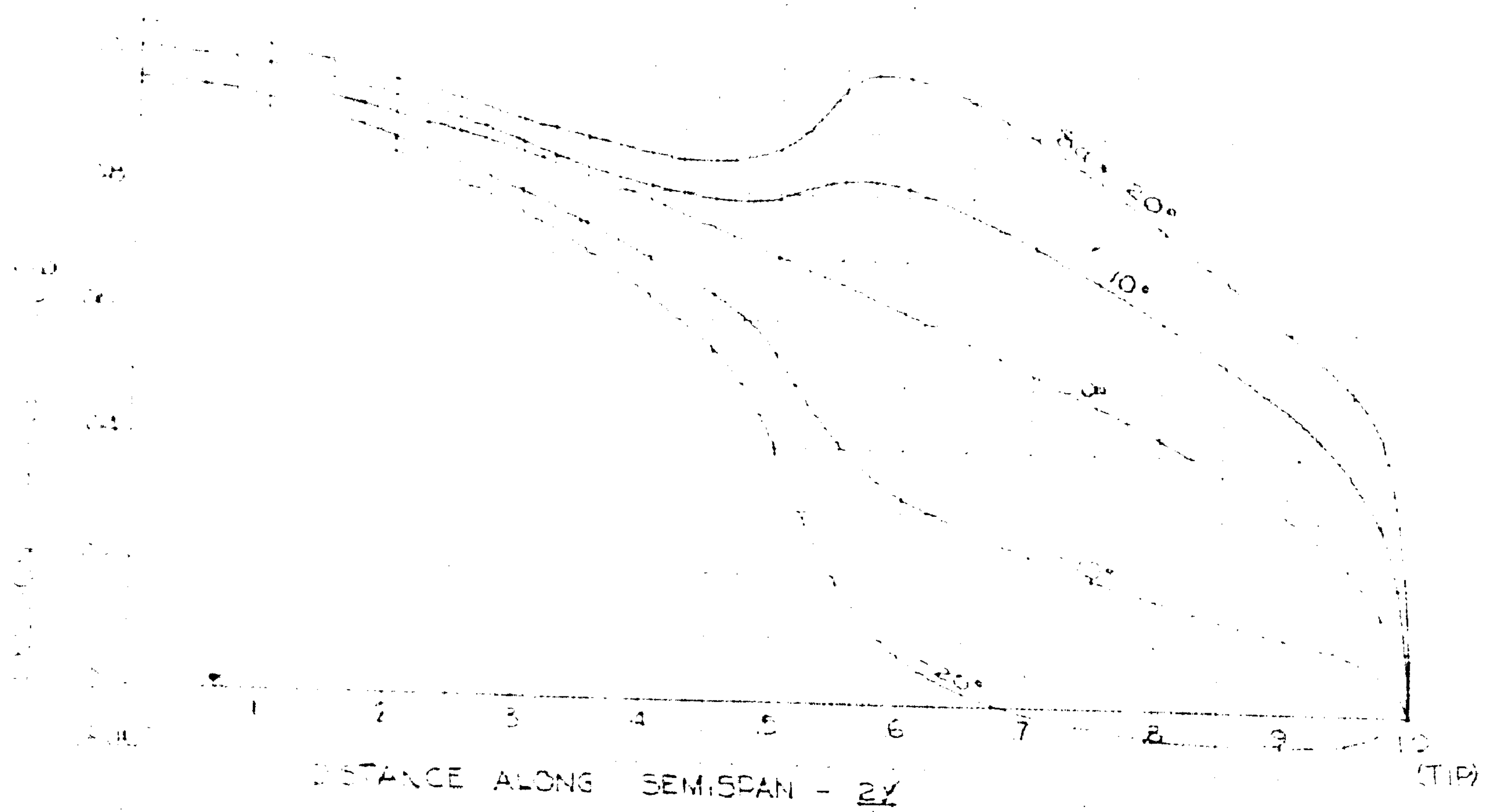
3

B-2? AIRPLANE

LOADINGS FOR VARIOUS AILERON DEFLECTIONS

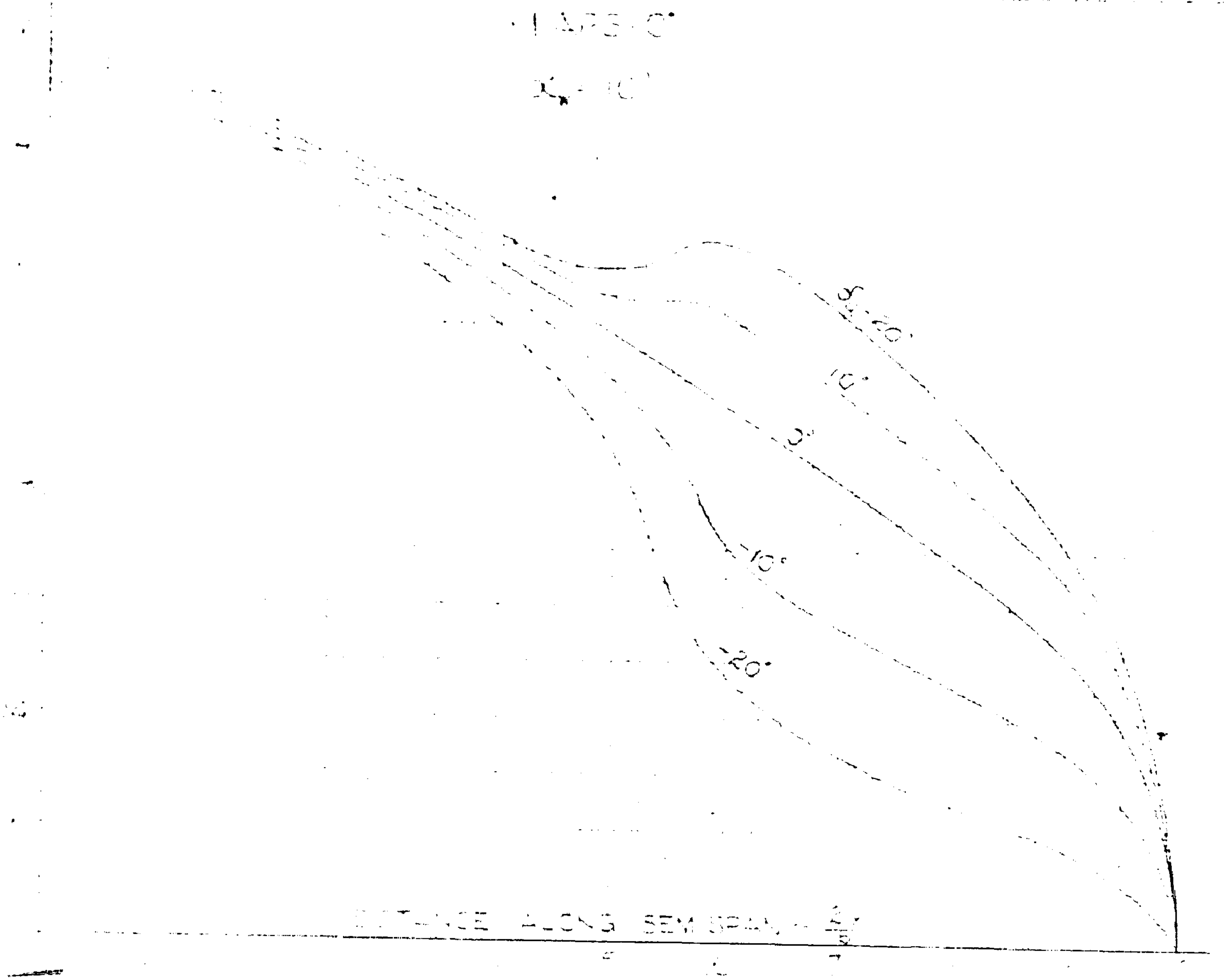
α_w 5°

FLAPS 0°



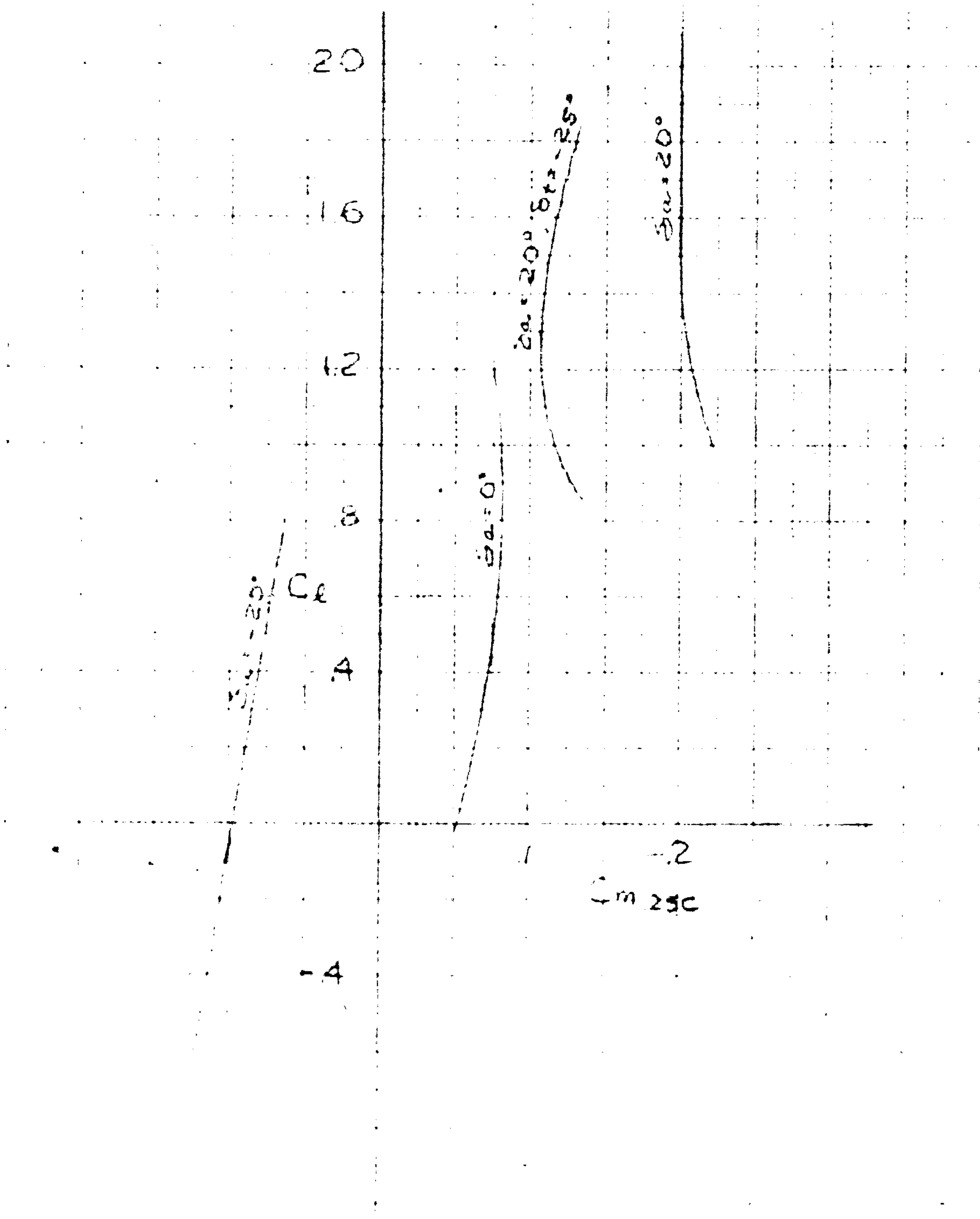
2-23-49 C.E.C.

... FOR VARIOUS AILERON DEFLECTIONS



SECTION PITCHING MOMENTS

SECTION AT 77% b/2 TAB NEUTRAL



RESTRICTED

27 June 1949

E. H. Watts

R. H. Widmer

Data Required for Structure Analyses, B-36D

(a) Memo E. H. Watts to R. H. Widmer, dated 14 June 1949

Enclosure (A) Variation of Section Angle for Zero Lift across the Wing Span.

I. The minimum amount of fuel and oil consumed in going from sea level to the specified altitude for 357,500 lb. take-off gross weight:

Altitude	Fuel and Oil Consumed
27,500 feet	18,400 #
35,000 feet	26,100 #

II. The spanwise variation of section angle for zero lift is attached, Enclosure (A).

R. H. Widmer

VC:lsc

cc:
Engr. Files
Aero. Files (w/encl)
Perf. Files (w/encl)

RES...

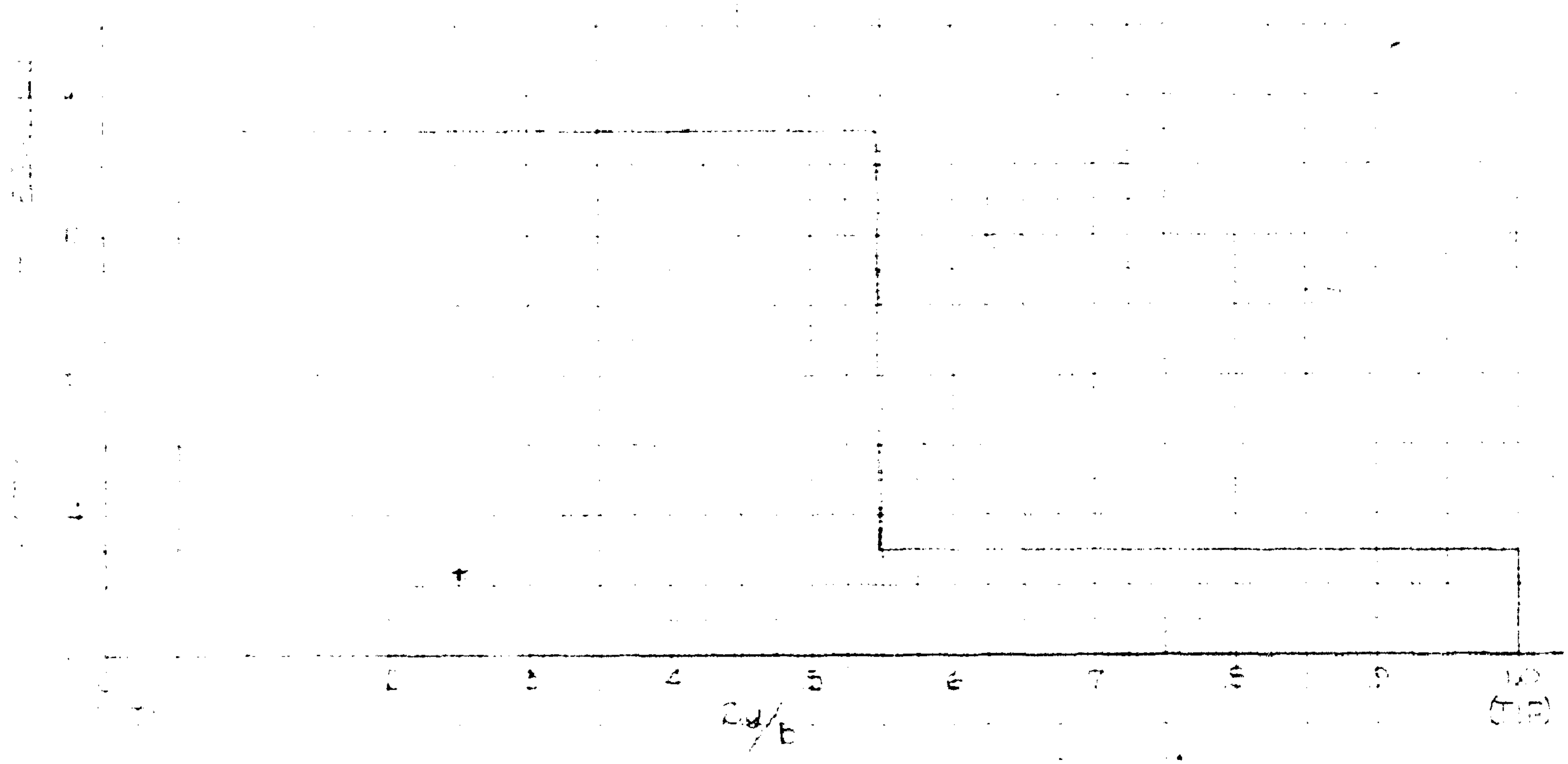
RESTRICTED

56

Fig 17a

VARIATION OF SECTION ANGLE FOR ZERO LIFT ACROSS THE WING SPAN

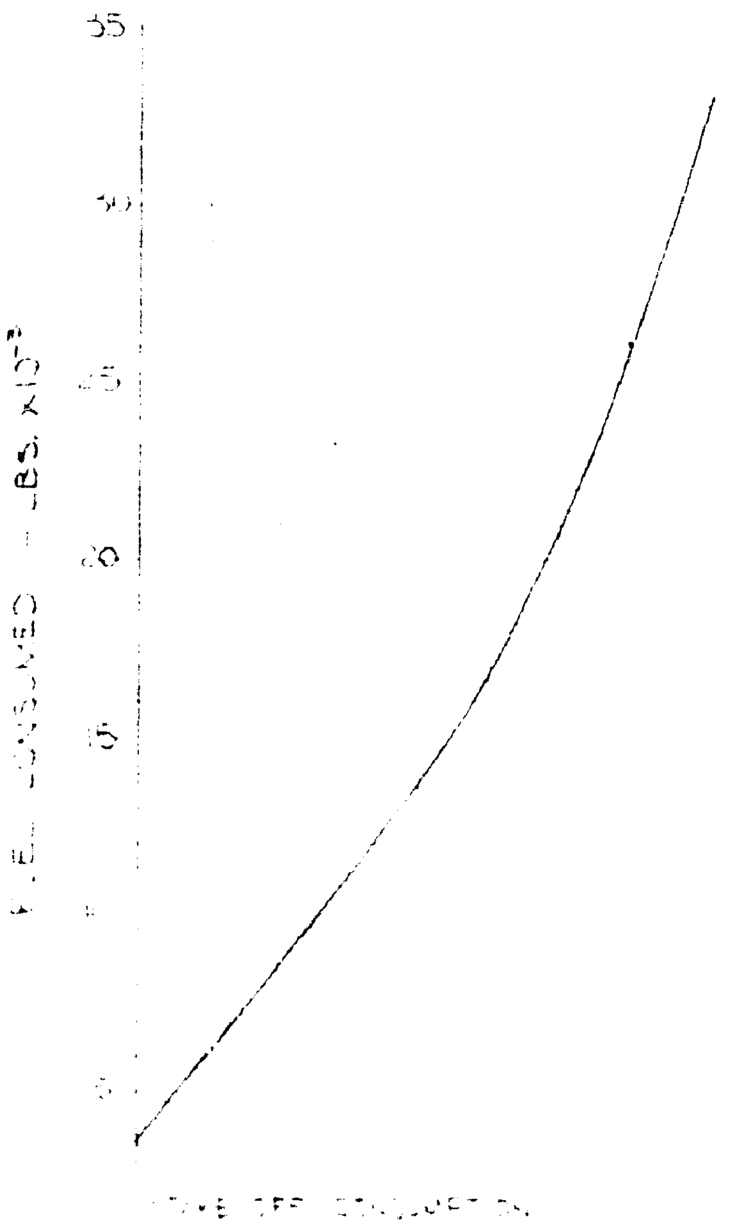
FLAPS DEFLECTED 30°



FUEL CONSUMED TO CLIMB TO ALTITUDE

TAKE OFF GROSS WEIGHT = 357,500 LBS.

REF FZA-36-134 P.G 55



RESTRICTED

31 October 1949

To: E. H. Watts

From: R. H. Widmer

Subject: Data Required for Final Analysis, B-36D

Reference: (a) Memo to R. H. Widmer from E. H. Watts of October 28 concerning above subject.

Enclosure: (A) Span Load Distribution, B-36 Airplane.

In accordance with the request of Reference (a) the span load distribution for the B-36 airplane at $C_L = 1.128$, $b_a = \pm 20°$ and full servo tab deflection has been determined and is forwarded herewith as Enclosure (A).

An effort was made to check the rolling moment coefficients resulting from the computed span loads against those obtained in tests of the 4/29-scale semi-span model. For the aileron-up condition, the tests showed an average rolling moment coefficient of -.0274 and for the aileron-down condition, the value was .0171; while the computed values were -.0289 and .0231 respectively. It is believed that the discrepancy between the two sets of values can be reduced if consideration is given to Reynolds number effects. The test Reynolds number was approximately 8,900,000 and there was evidence of early stall effects over the inboard end of the aileron, which caused the rolling moment curves to deviate from a straight line trend. It is probably that the higher Reynolds numbers encountered in flight would straighten out the curves to some degree and give higher values than the wind tunnel tests show at the points in question.

For this reason, it is believed that the computed rolling moment coefficients, and thus the given span loads, are sufficiently accurate and realistic, and are not as conservative as a comparison with present test data would indicate.

R. H. Widmer

GPB:vb
cc: Engr. File
Aero. File

RESTRICTED

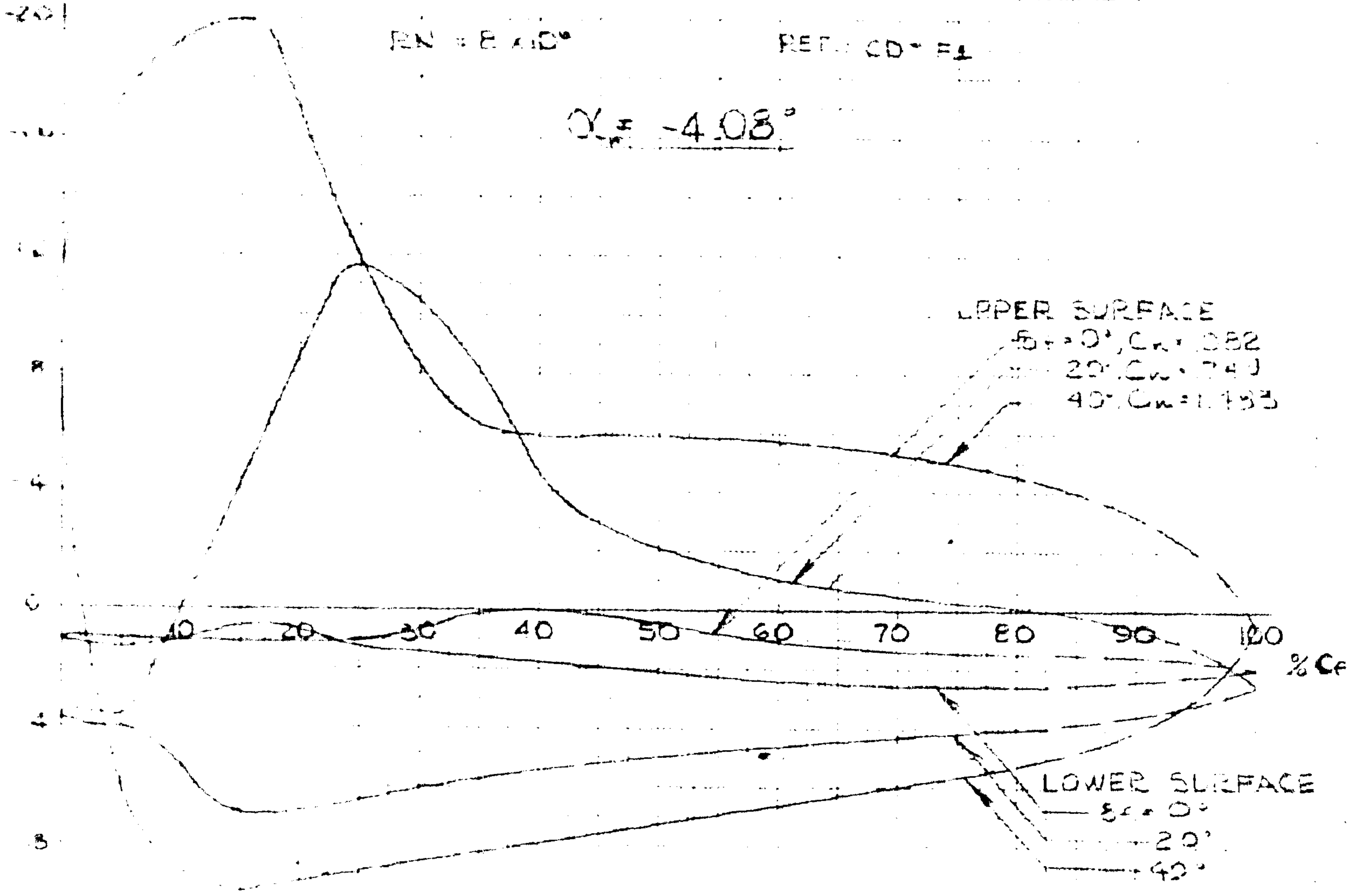
RESTRICTED

B-36 AIRPLANE

PRESSURE DISTRIBUTION OVER THE FLAP

RN = 8 x 10^6 REF: CD-F1

$\alpha_F = -4.08°$



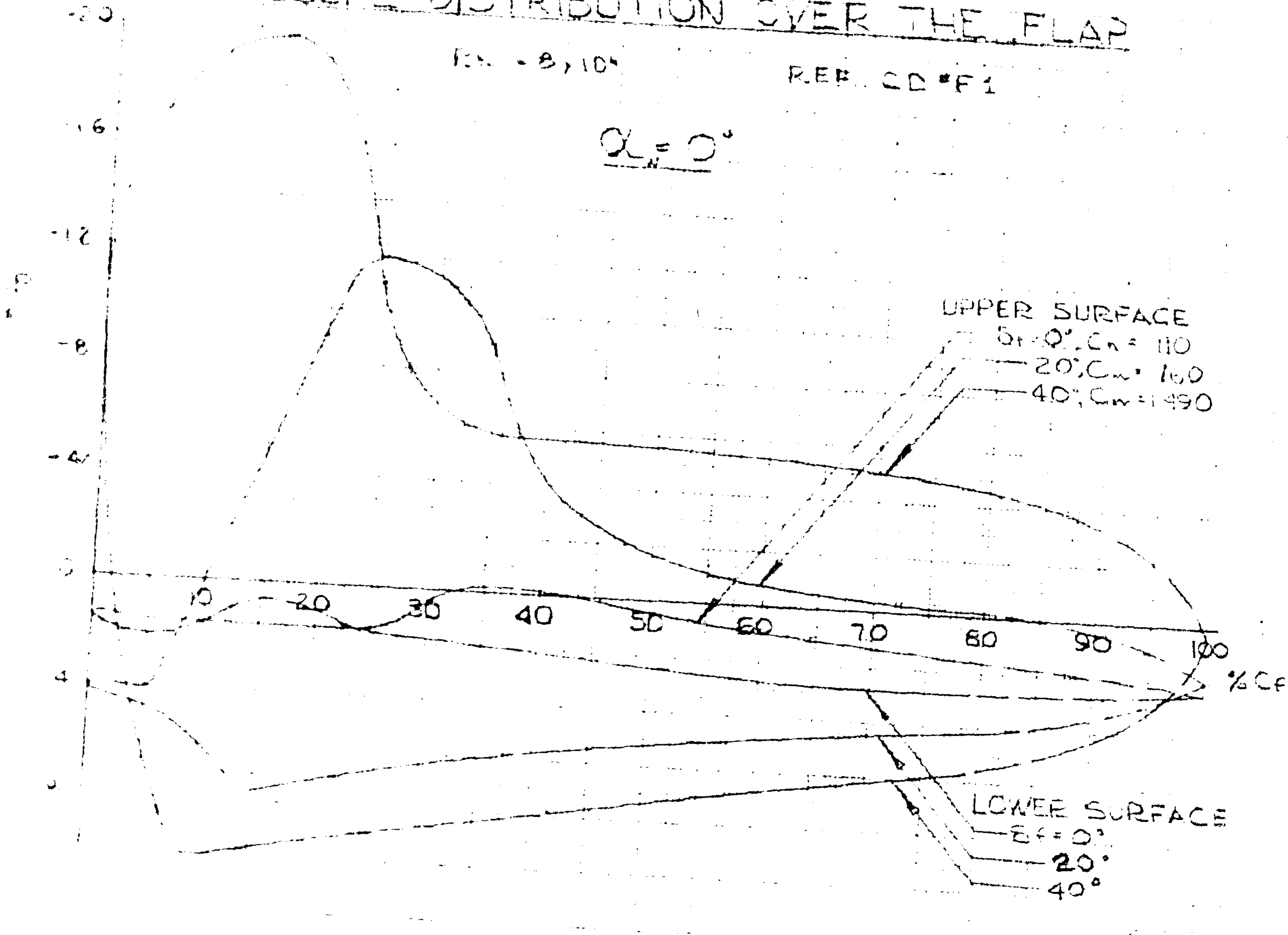
12/19/49

B-36 AIRPLANE

PRESSURE DISTRIBUTION OVER THE FLAP

$R_N = 8 \times 10^6$ REF. CD #F1

$\alpha_N = 0°$

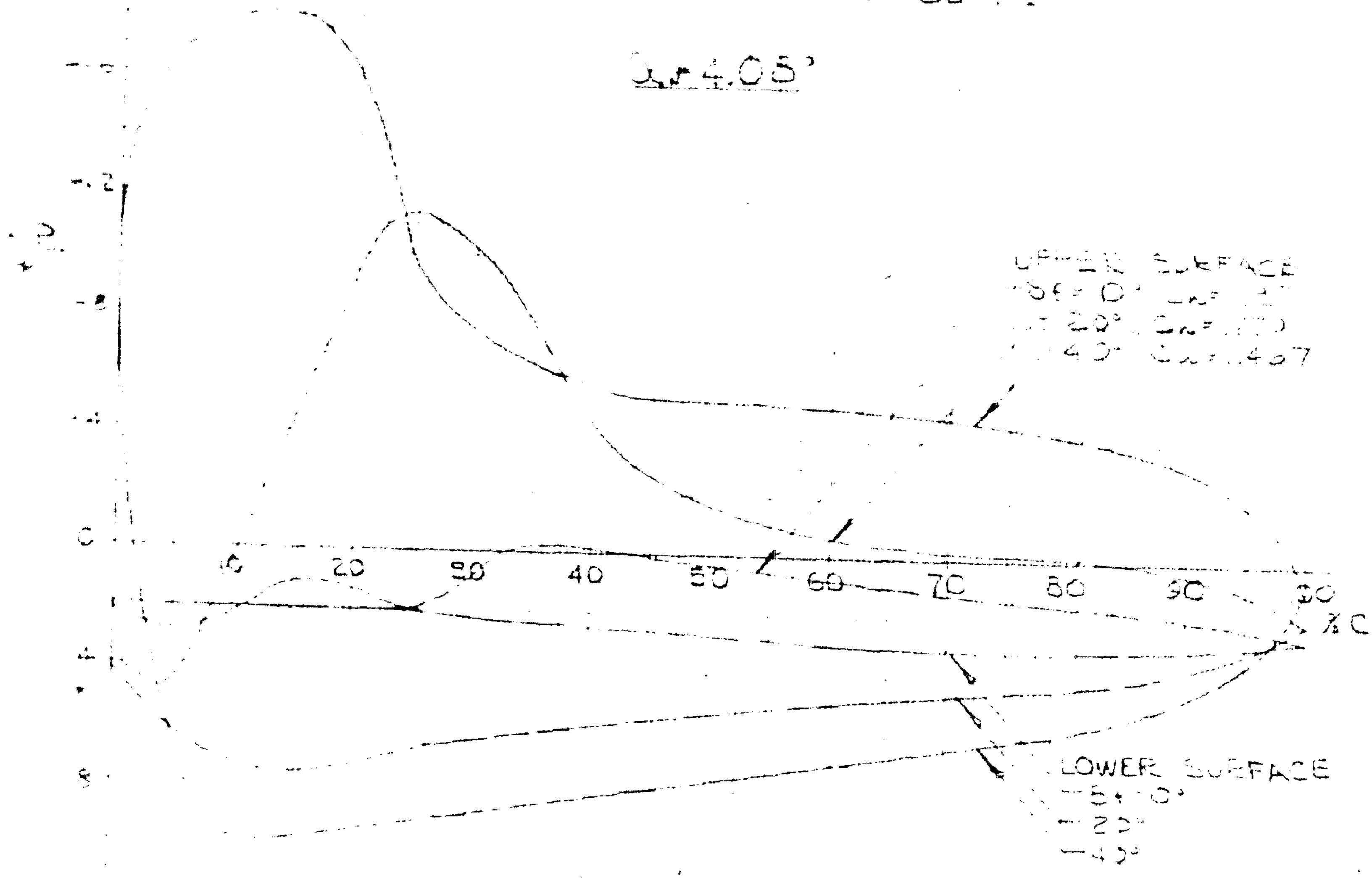


12/9/49 CEW

B-58 AIRPLANE

...URE DIST...BUTION OVER THE FLAP

REF 03-F1



RESTRICTED

AIRPLANE

DISTRIBUTION OVER THE FLAP

REF CD-F1

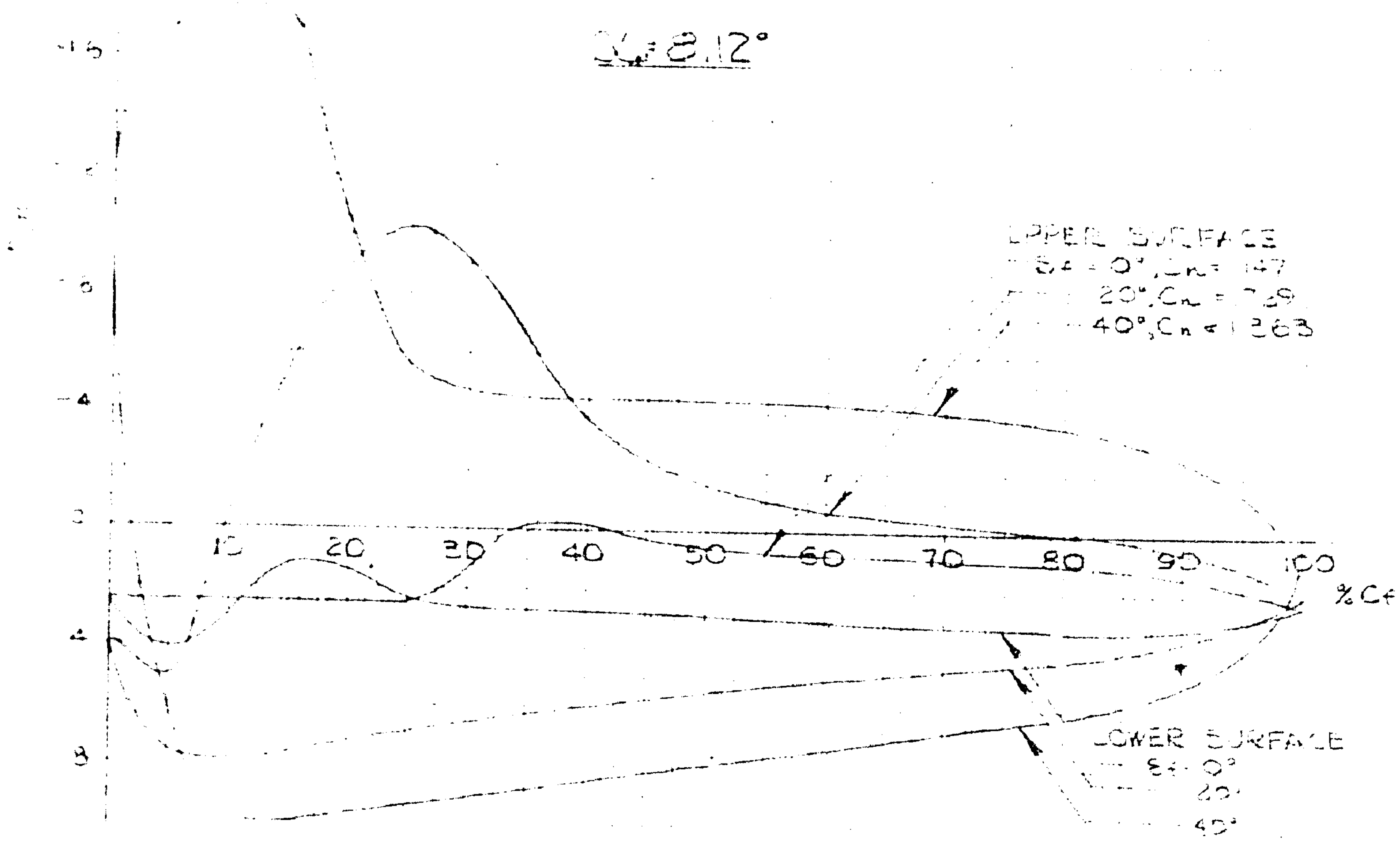


Fig. 23

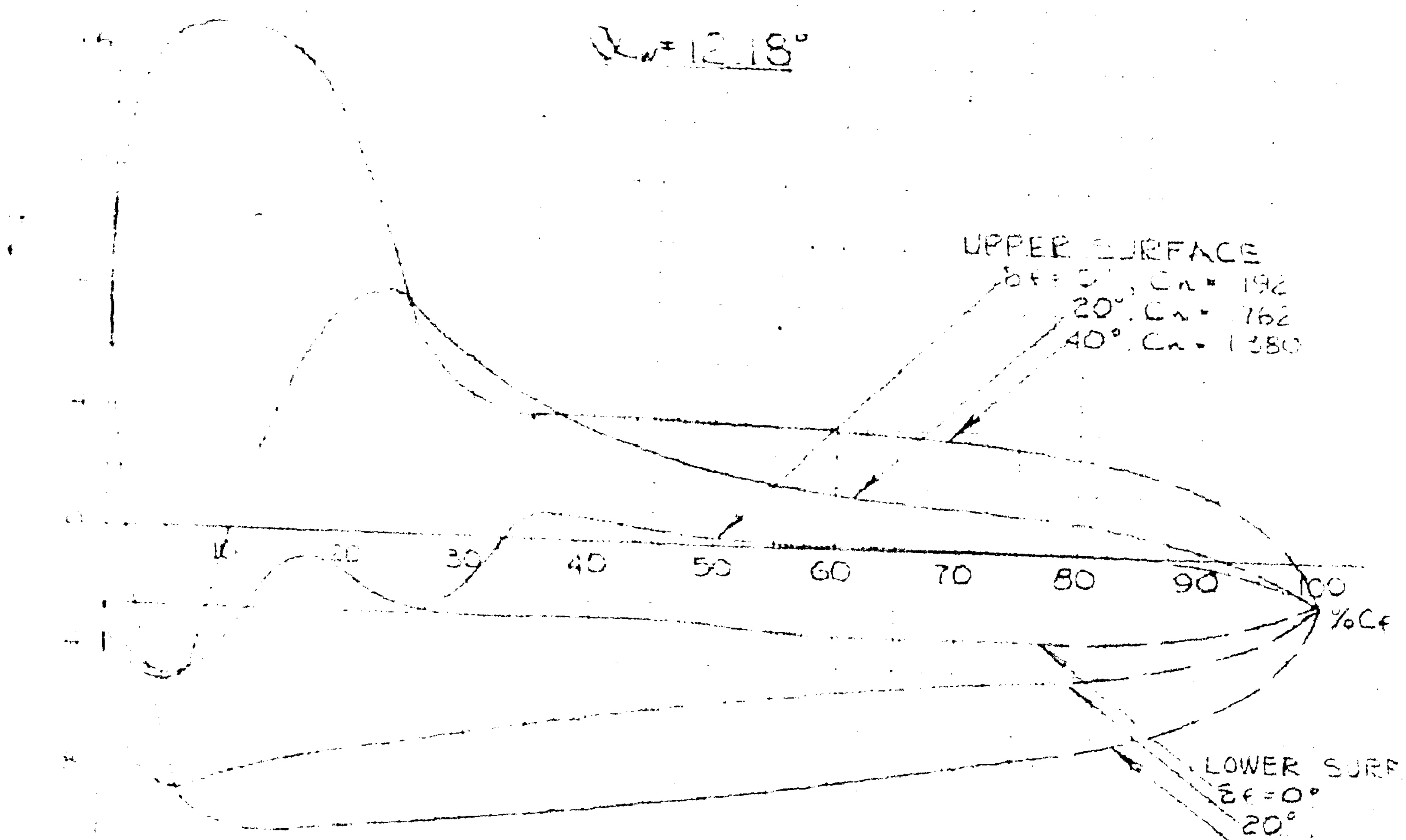
RE[illegible]

[illegible] 36 AIRPLANE

[illegible]SSURE DIS[illegible]RIBUTION OVER THE FLAP

[illegible] 3 - 10°

REF CD # F1



B-36 AIRPLANE

PRESSURE DISTRIBUTION OVER THE FLAP

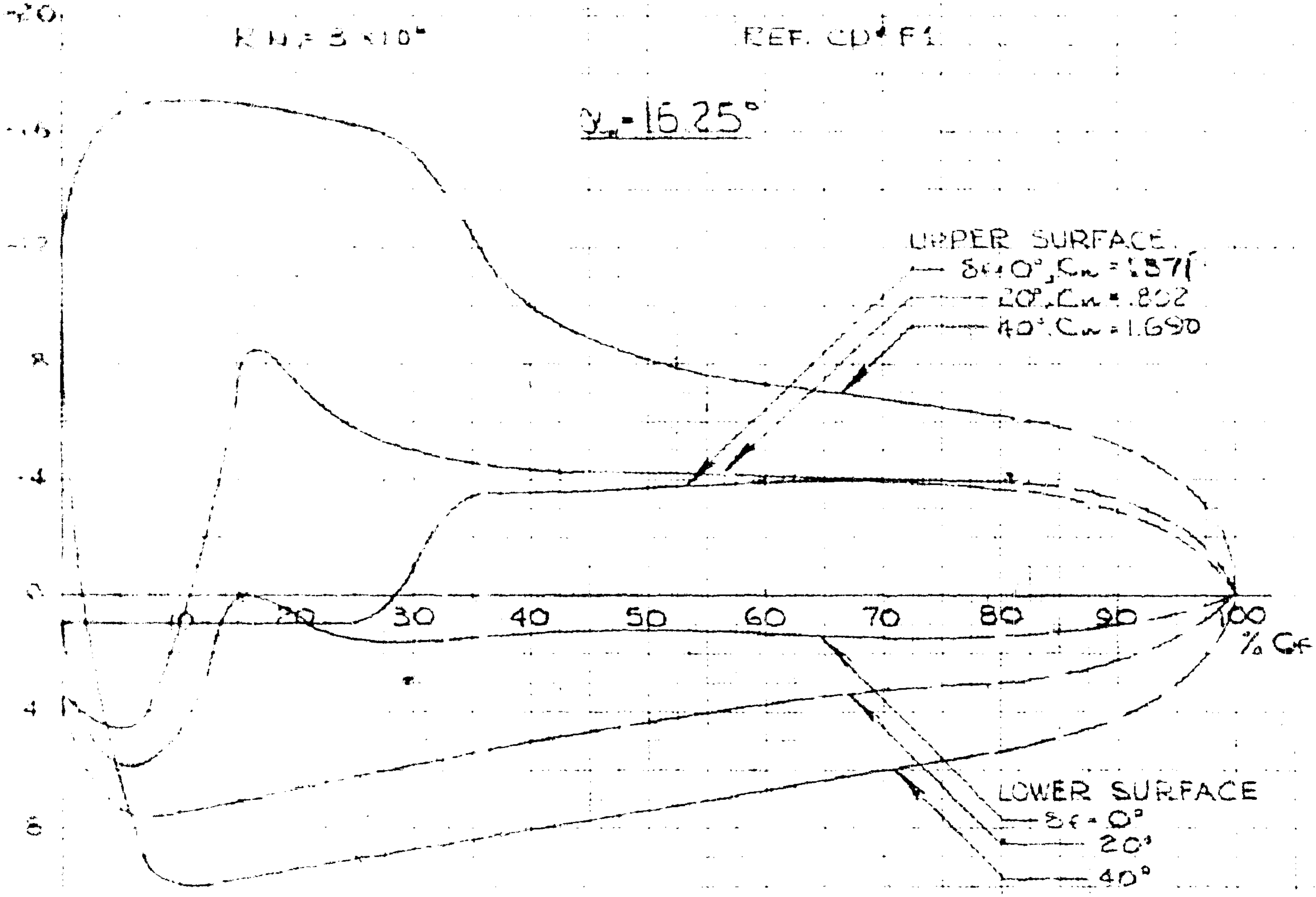


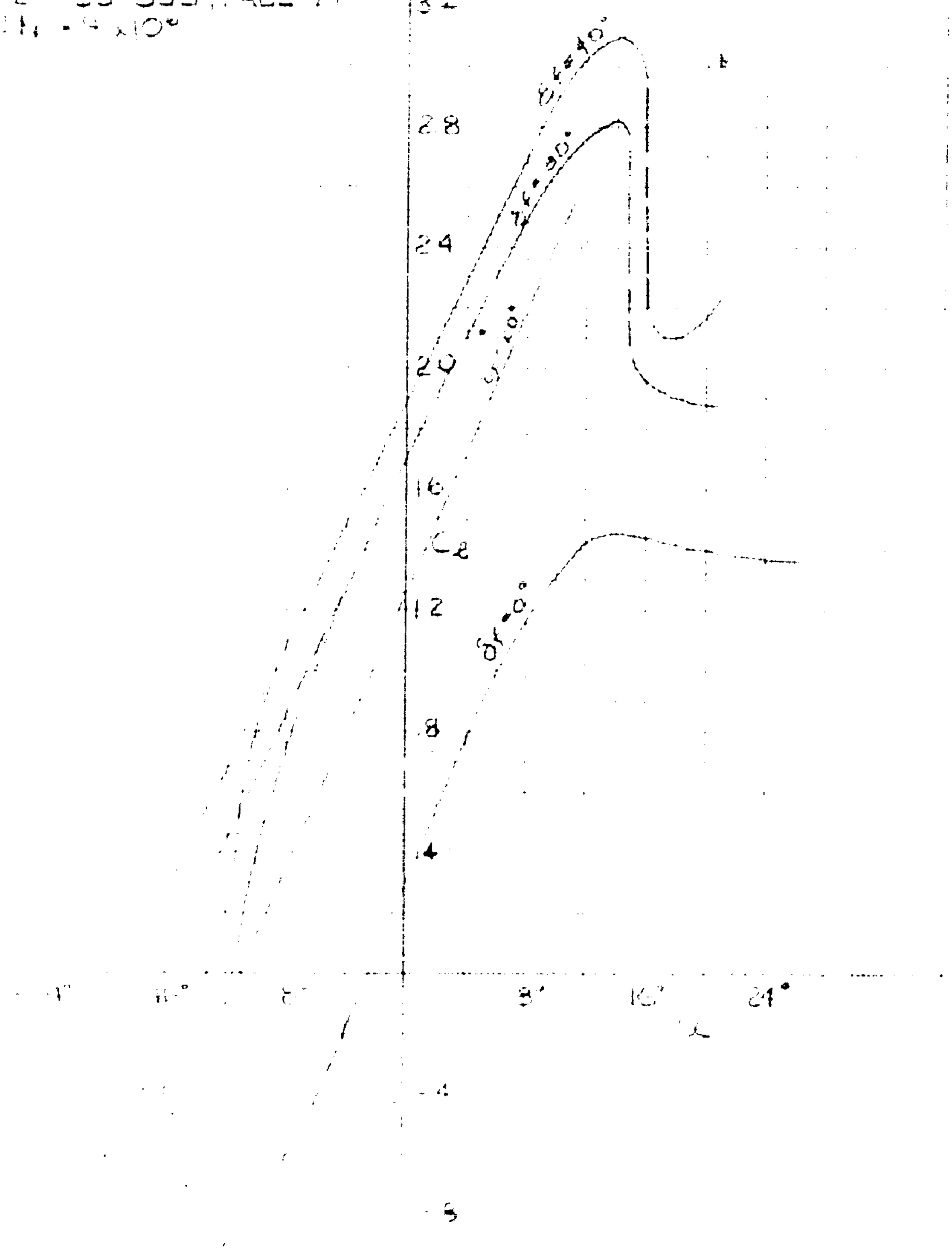
FIG. 24

12/9/49

KL

B-36 INBOARD WING SECTION

REF. ZT-36-005, PAGE 77
R.N. = 9 x 10⁶

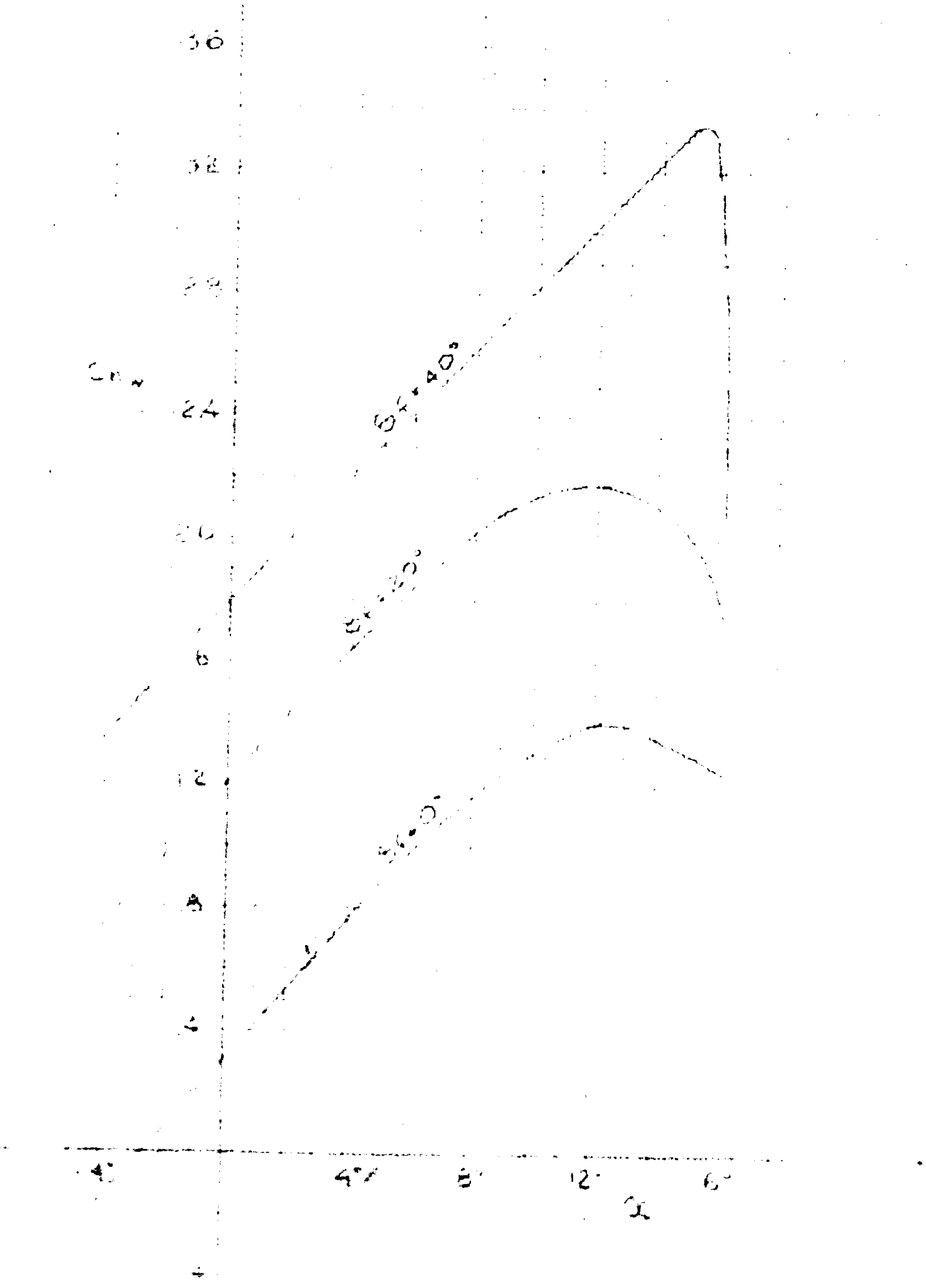


RE[illegible]

B-56 INBOARD WING NORMAL FORCE

REF. [illegible] F1, FIG. 21

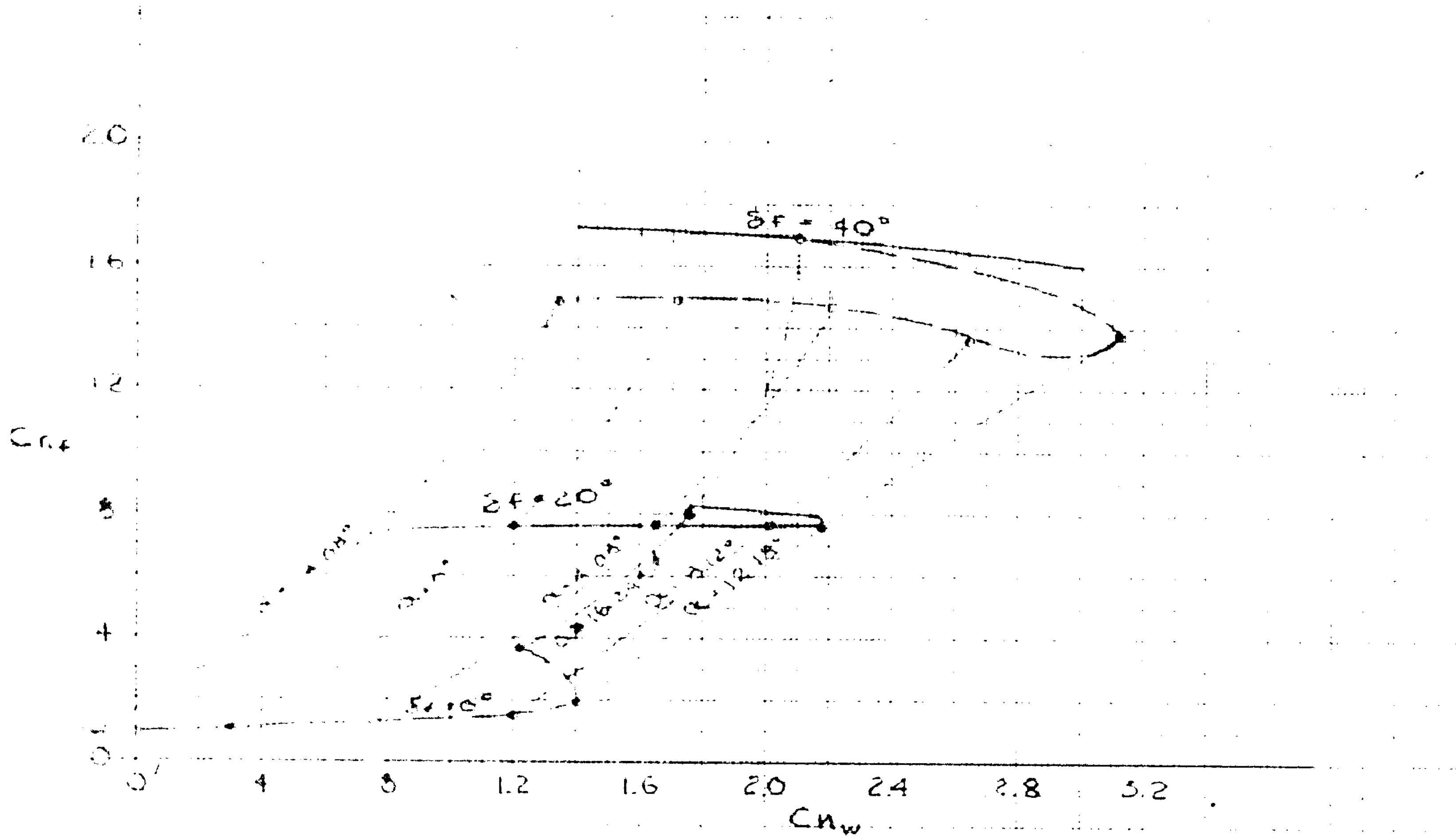
R.N. = 6 x 10^6



RE[illegible]

B-36 FLAP NORMAL FORCE

REF ZT-36-005 PAGE 85
INTEGRATION OF PRESSURE DISTRIBUTION CURVES OF CD-F1
RN = 7.98 × 10⁶



12/6/49 CEL

RESTRICTED

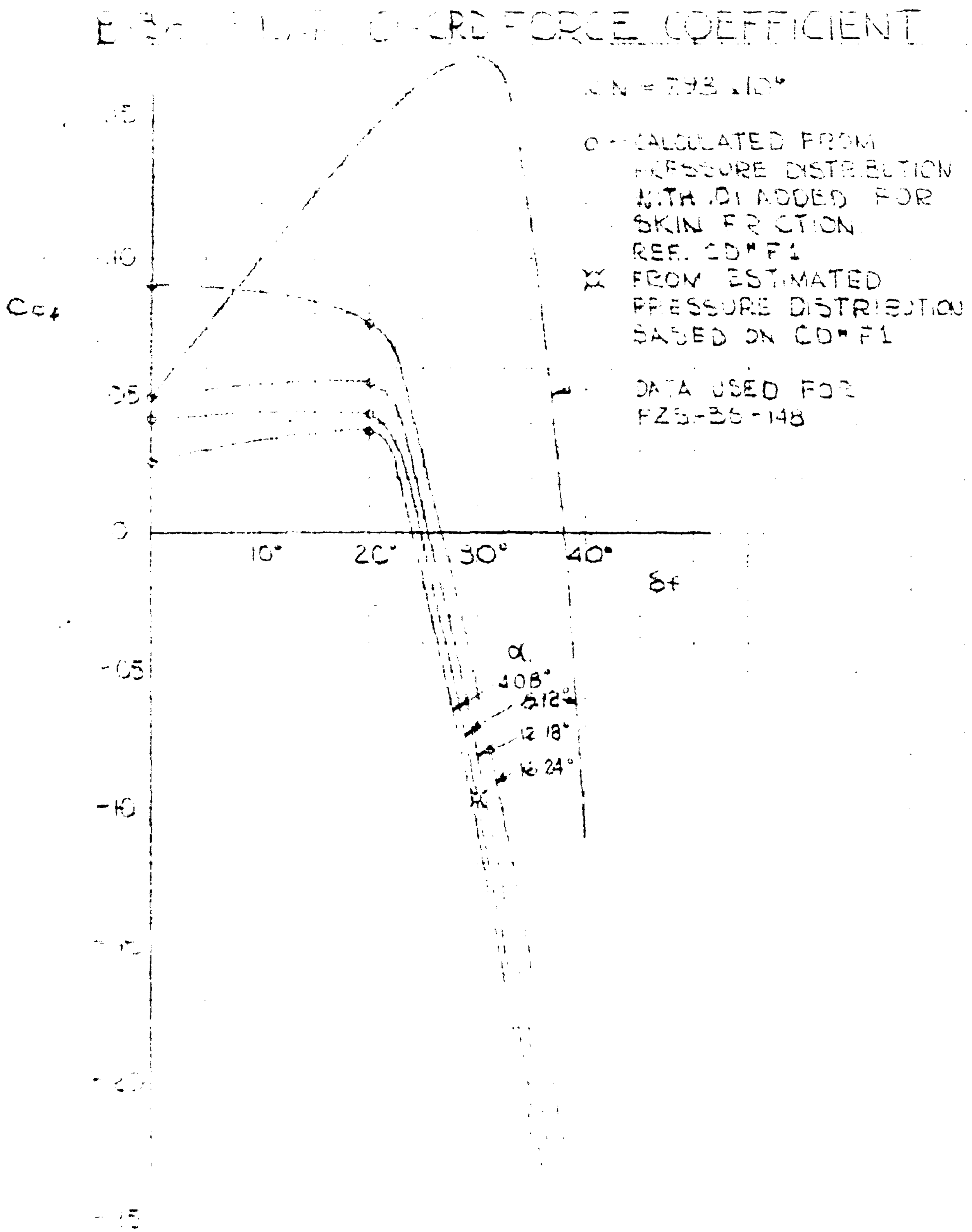
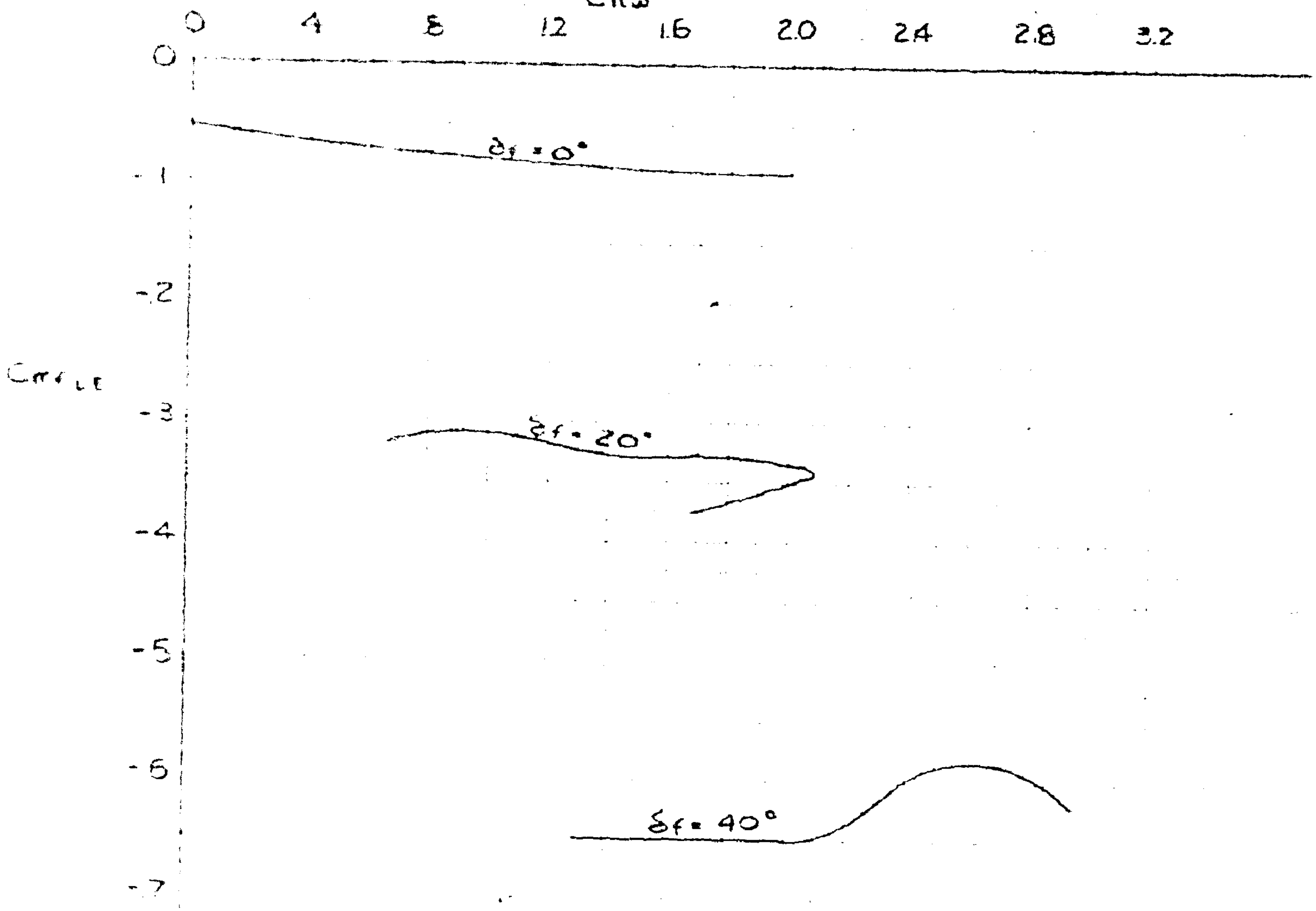

CHORD FORCE COEFFICIENT
R.N. = 7.98 x 10⁶
○ CALCULATED FROM PRESSURE DISTRIBUTION WITH .01 ADDED FOR SKIN FRICTION REF. CD-F1
✕ FROM ESTIMATED PRESSURE DISTRIBUTION BASED ON CD-F1
DATA USED FOR FZS-35-148
C_{c_f}
δ_f
α
10°
20°
30°
40°
.10
.05
0
-.05
-.10
-.15
-.20
-.25

Fig. 29

B-36 INBOARD WING SECTION

REF. ZT-36-005 $R_N = 7.98 \times 10^6$



[illegible] AIRPLANE

CHORDWISE LOAD DISTRIBUTION OVER HORIZONTAL TAIL

ELEVATOR NOSE NO. 3B

M = 0.3

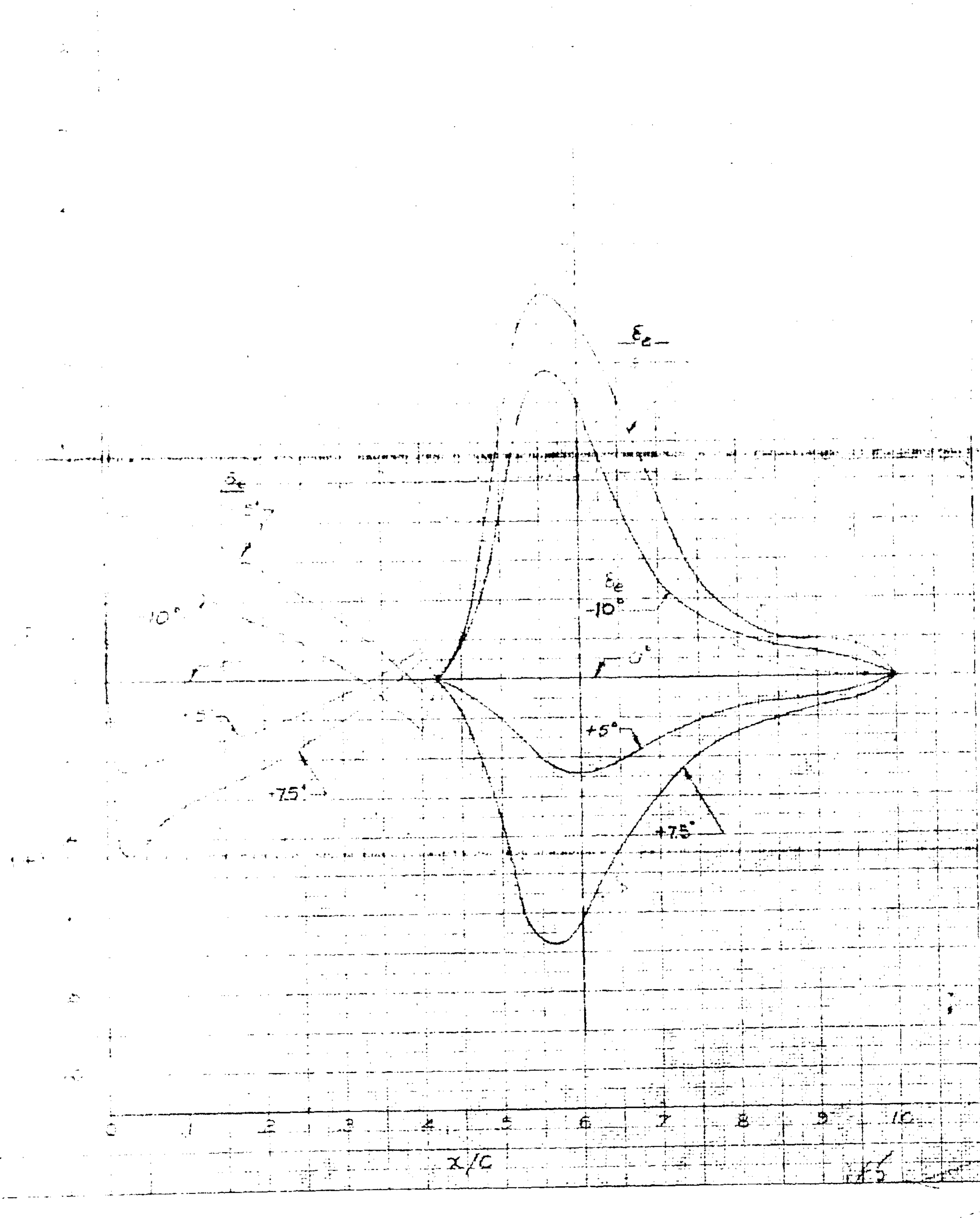


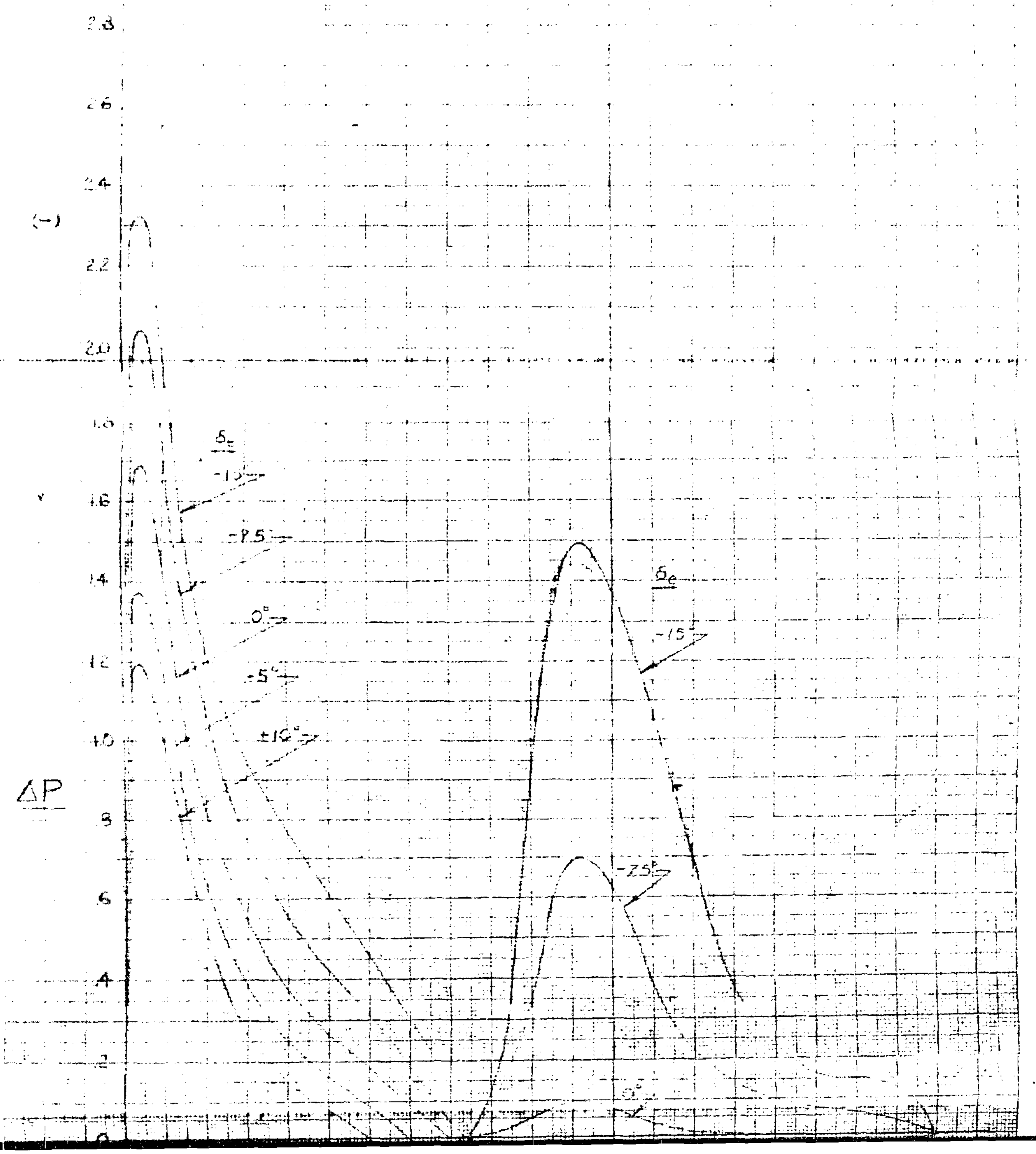
Fig. 30

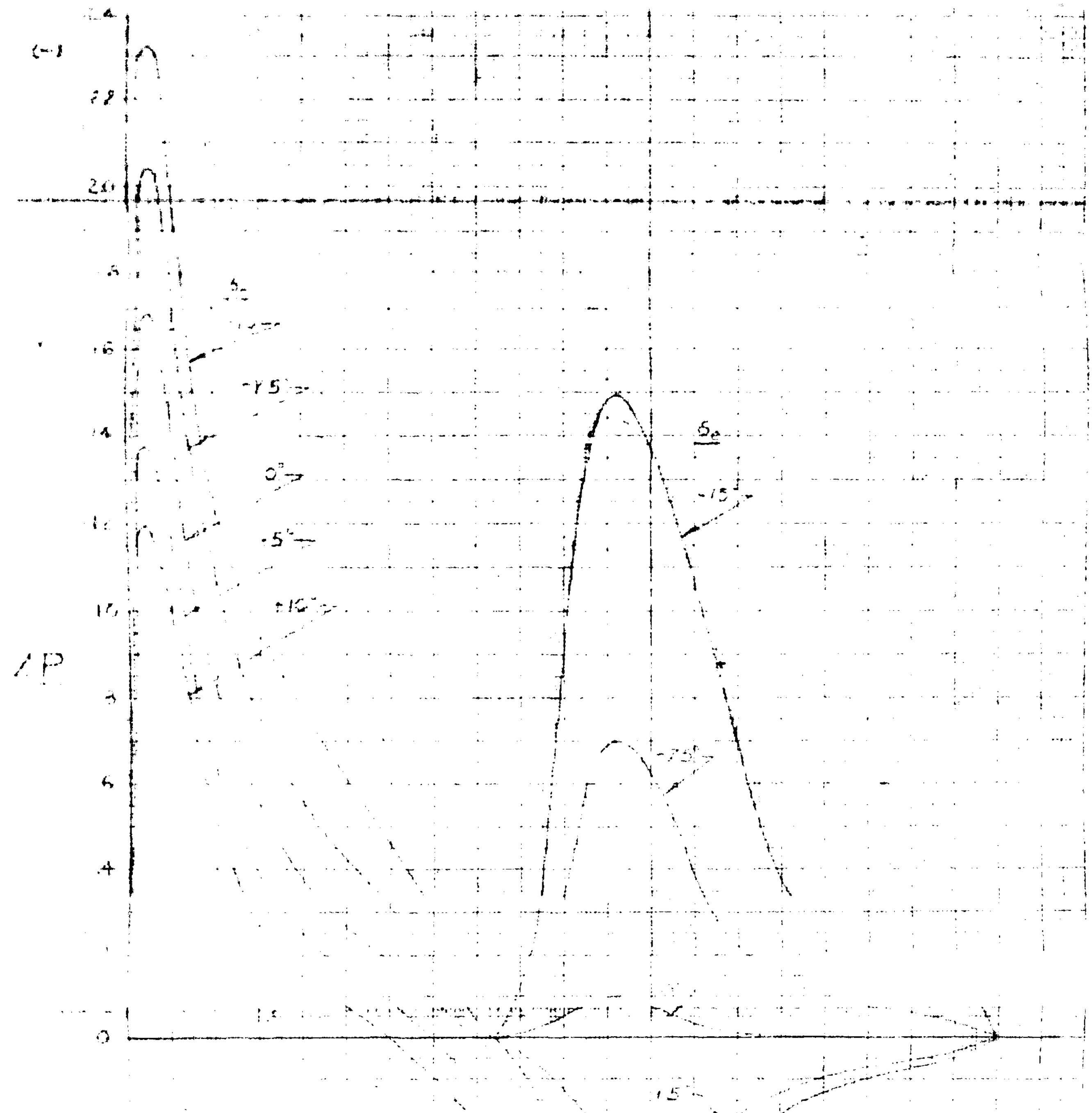
B-36 AIRPLANE

CHORDWISE LOAD DISTRIBUTION OVER THE HORIZONTAL TAIL

ELEVATOR NOSE NO.35

$\alpha_H = 4.2°$ $N = 0.3$





RESTRICTED

Fig. 81

72

B-36 AIRPLANE

CHORDWISE LOAD DISTRIBUTION OVER THE HORIZONTAL TAIL

ELEVATOR NOSE NO 35

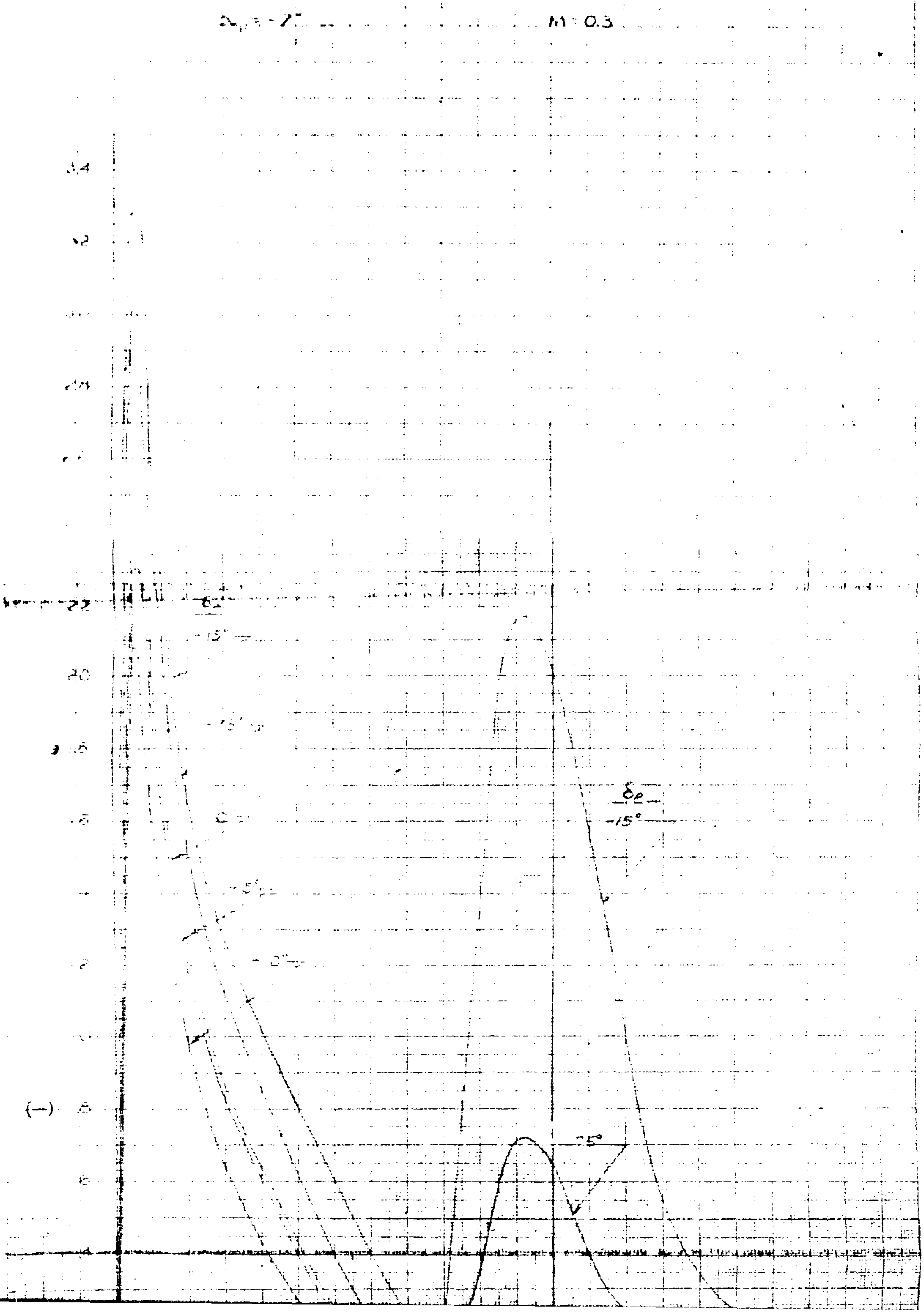
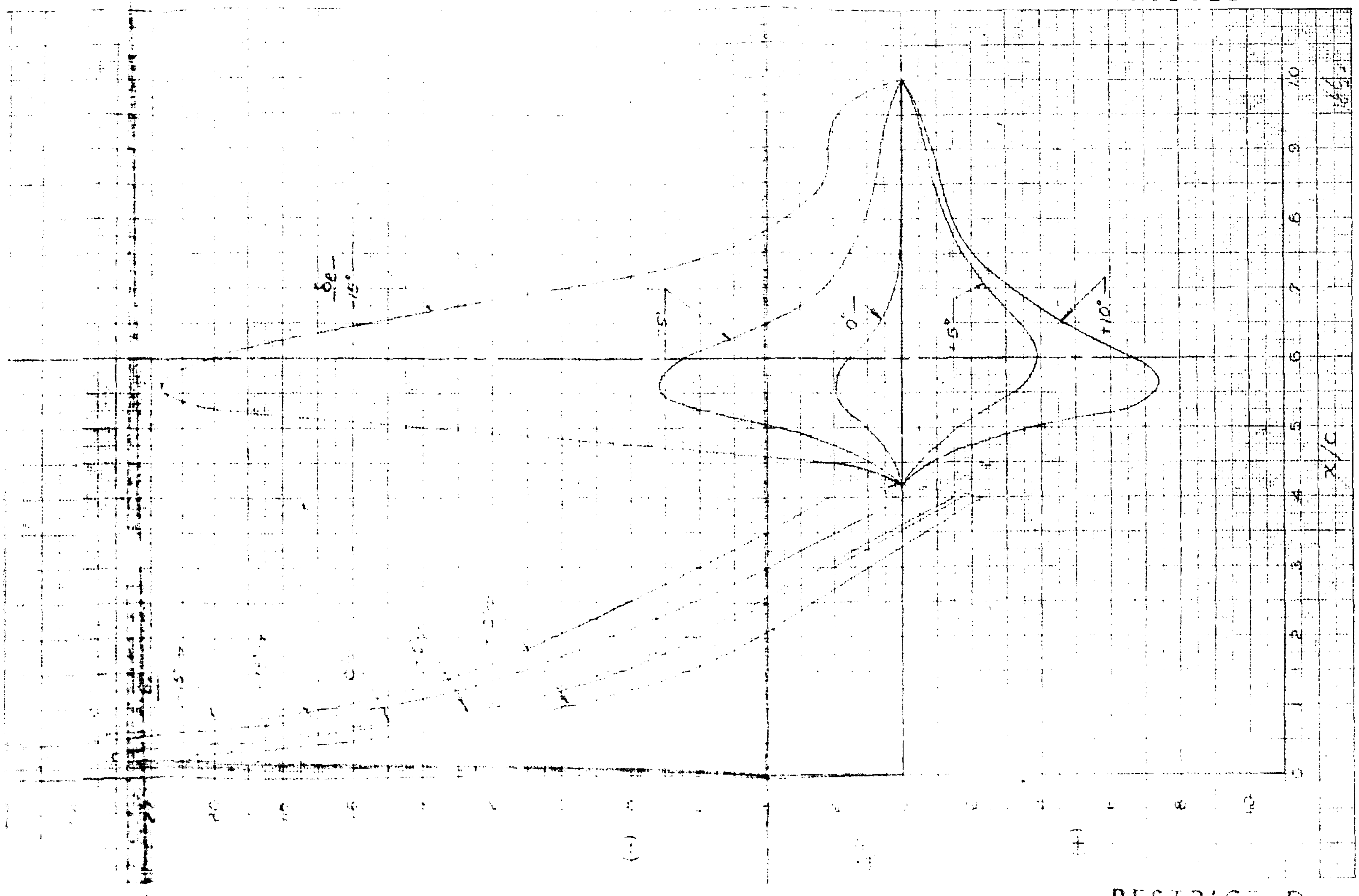


Fig. 32

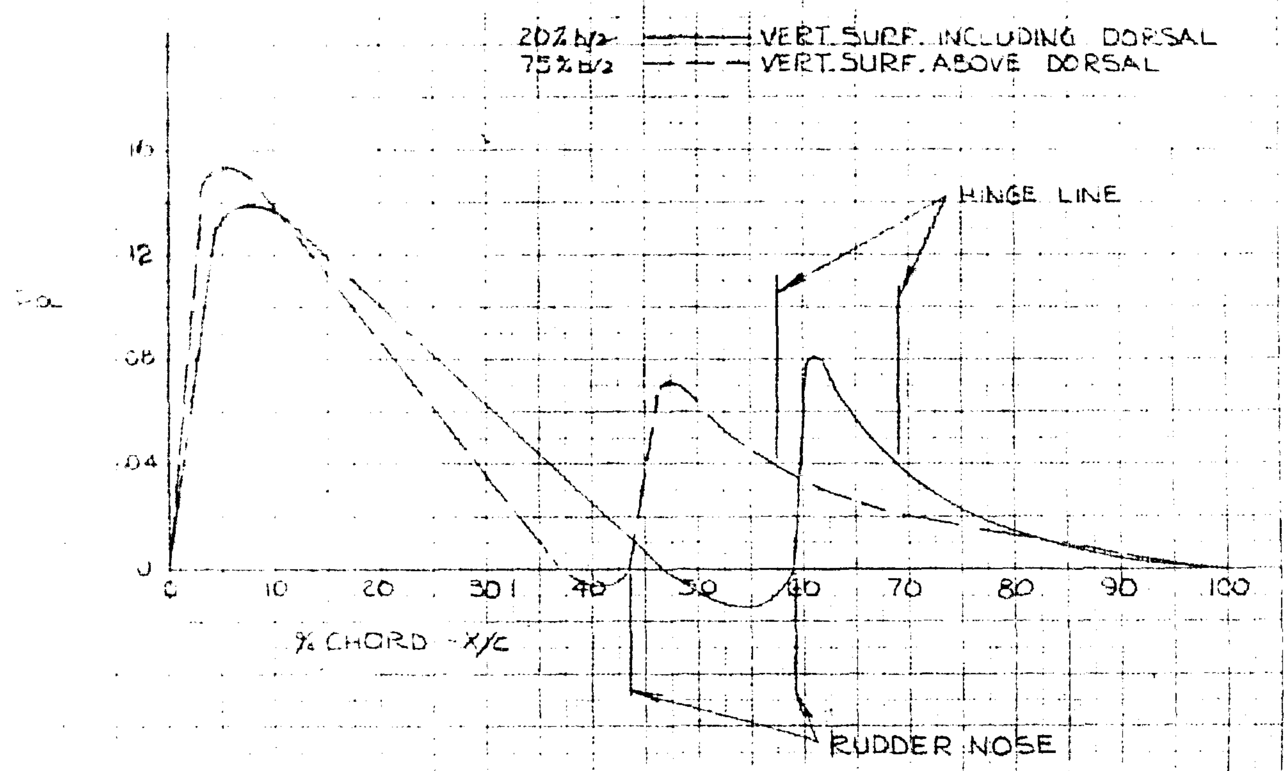


B-56 AIRPLANE

PRESSURE DISTRIBUTION OVER VERTICAL TAIL

25 % BALANCE - ROUND NOSE RUDDER   M = .5

BASED ON 1/11 SCALE DATA



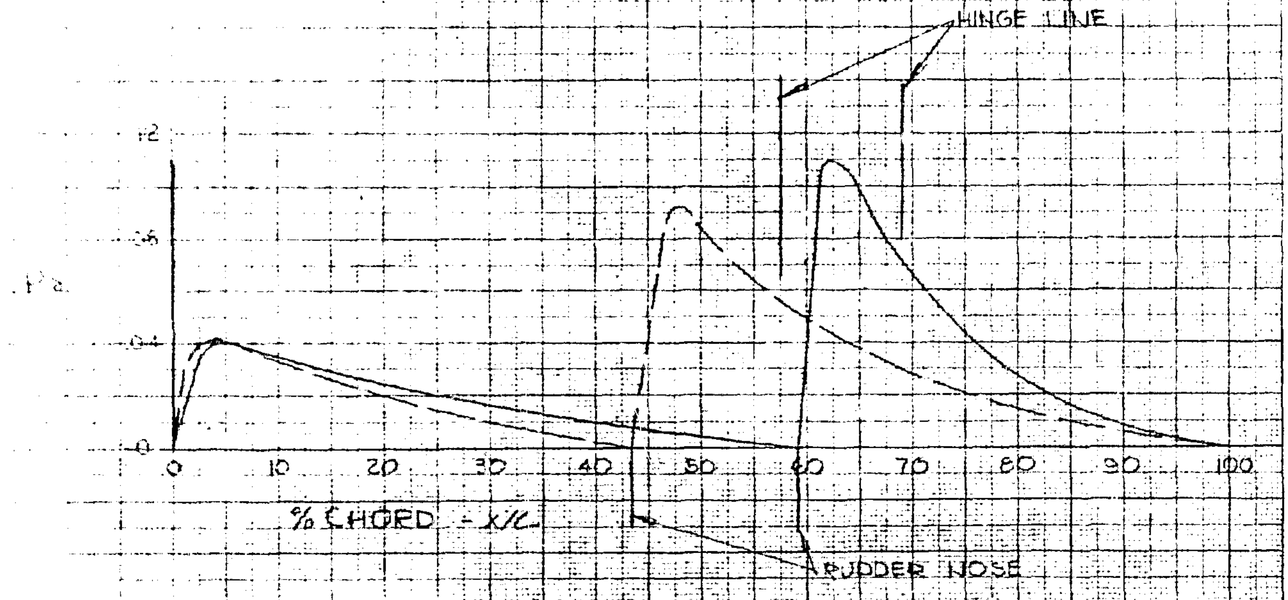
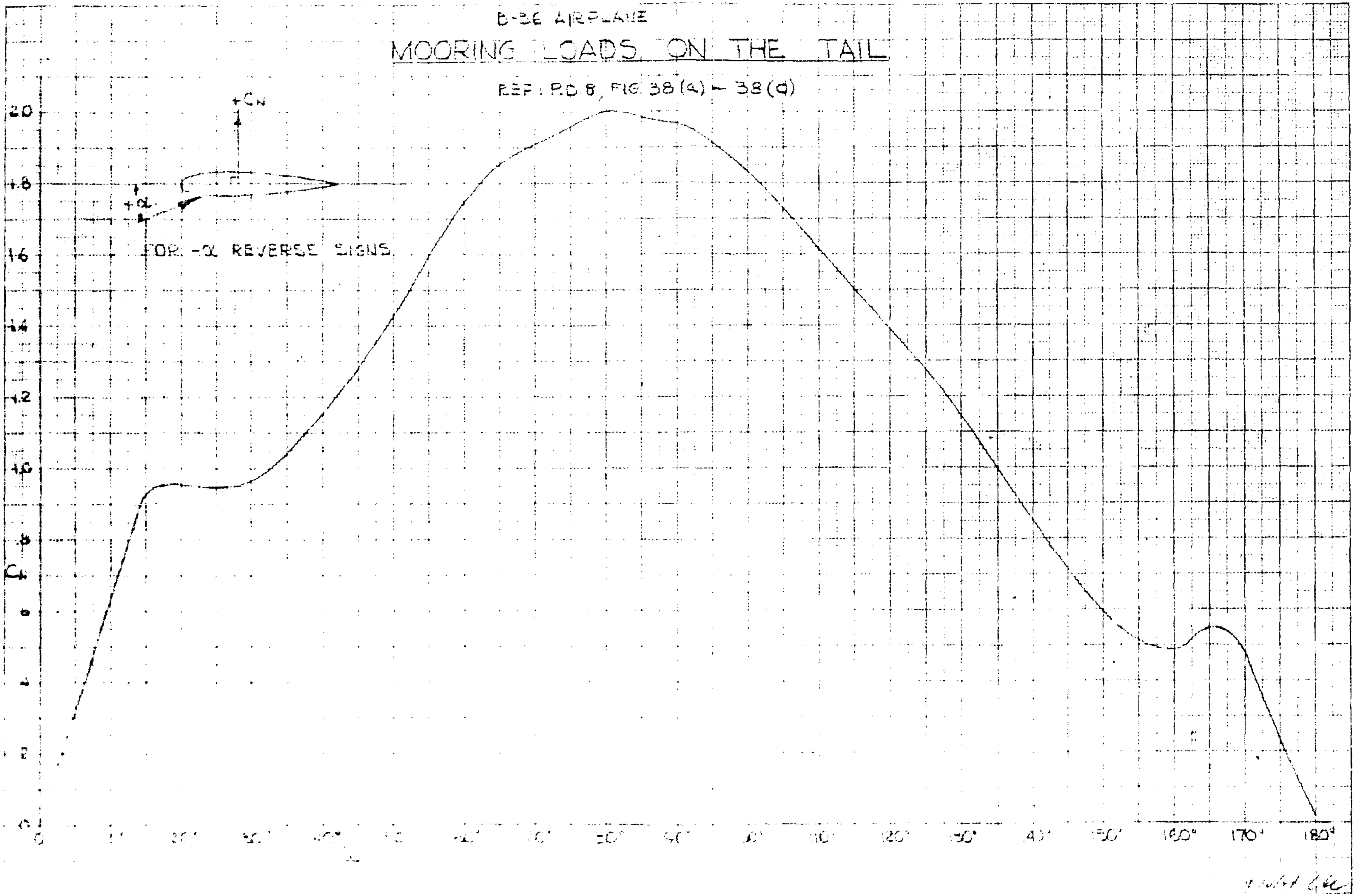
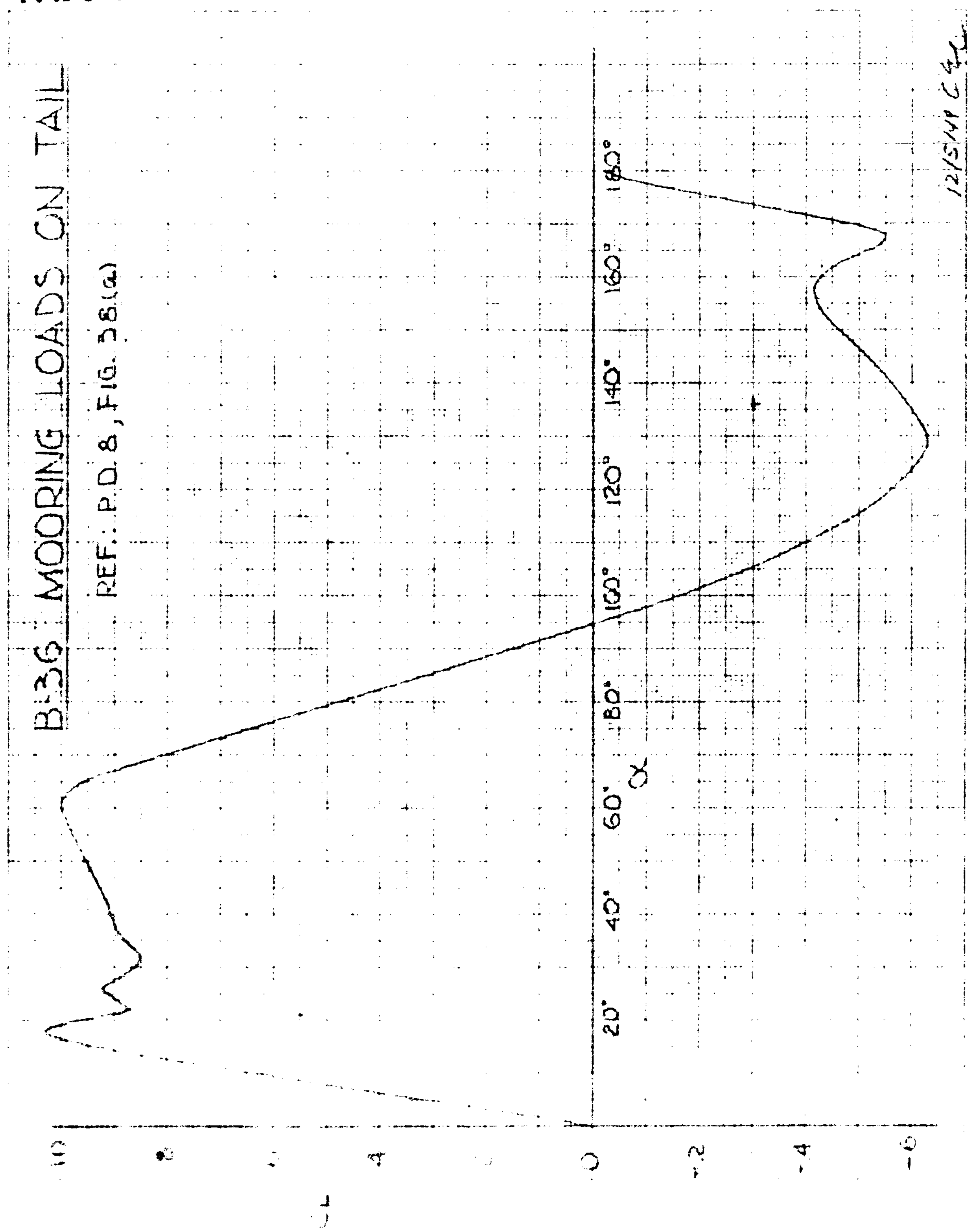


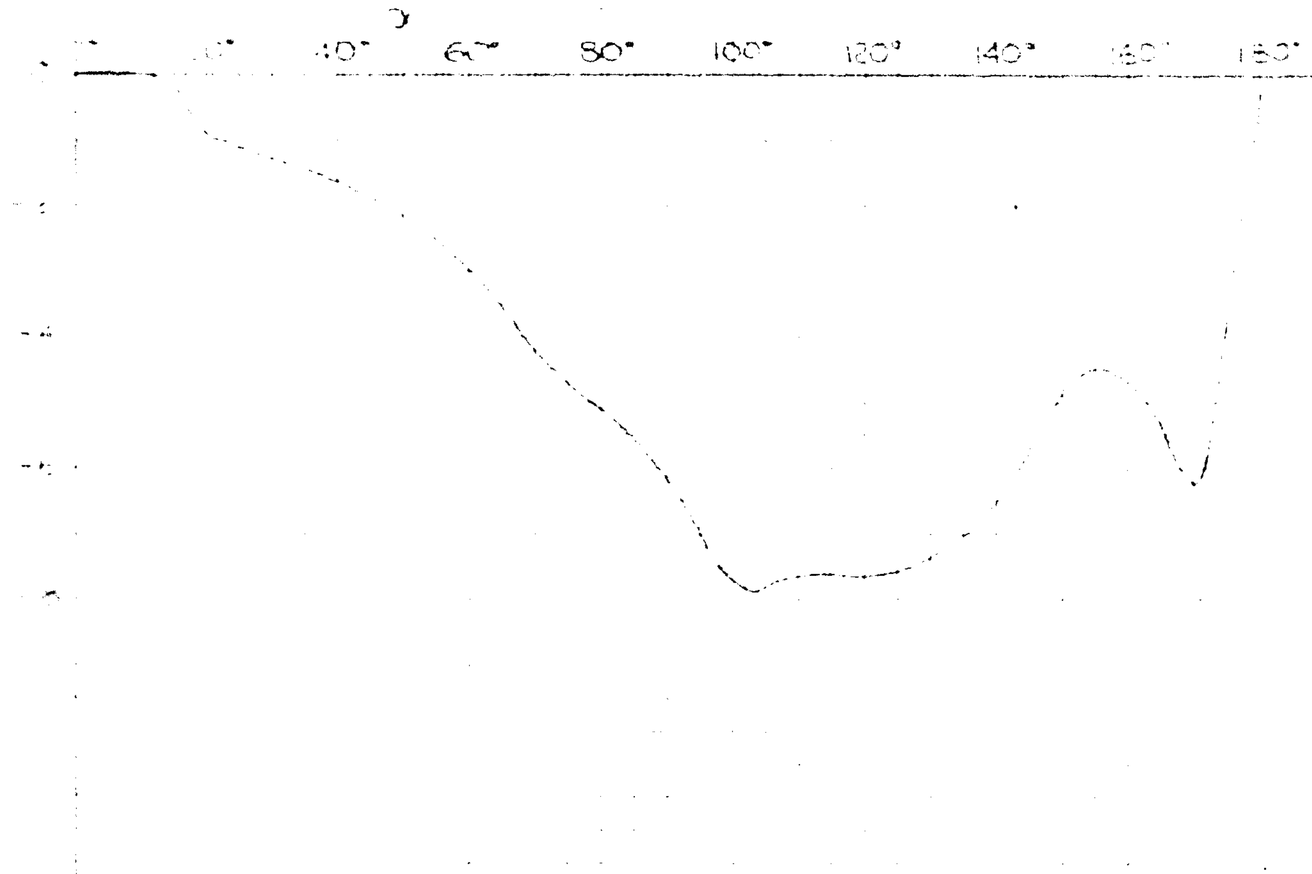
FIG 40


B-36 AIRPLANE
MOORING LOADS ON THE TAIL
REF: P.D. 8, FIG. 38(a) – 38(d)
+CN
+α
FOR -α REVERSE SIGNS
2.0
1.8
1.6
1.4
1.2
1.0
.8
.6
.4
.2
0
CL
0
180°
170°
160°


B-36 MOORING LOADS ON TAIL
REF: P.D. 8, FIG. 38(a)
20°
40°
60°
80°
100°
120°
140°
160°
180°
α
10
8
4
0
-2
-4
-6
12/5/41

E 36 MOORING LOADS ON TAIL

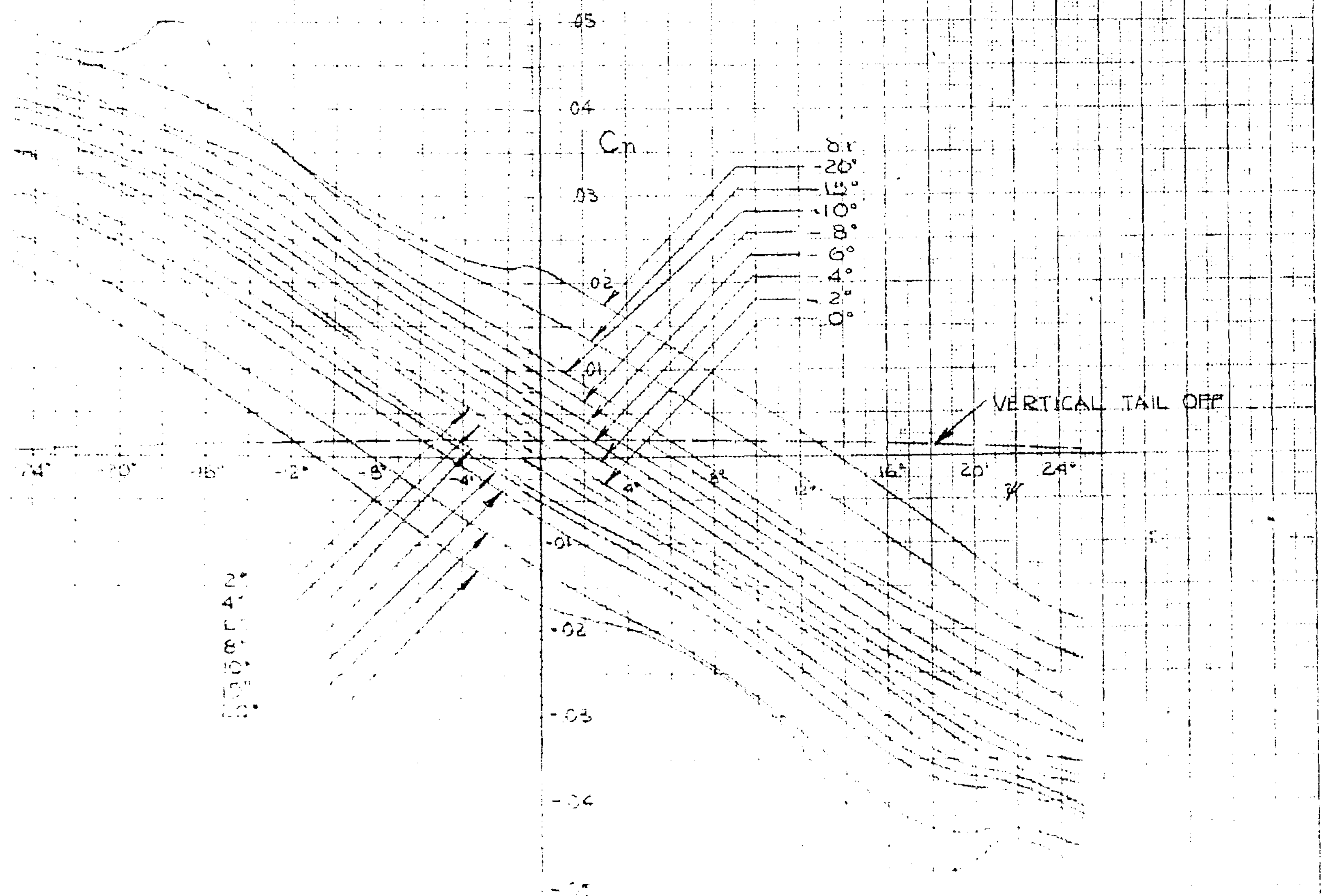
(REF. R.D.8, FIG. 58(a))

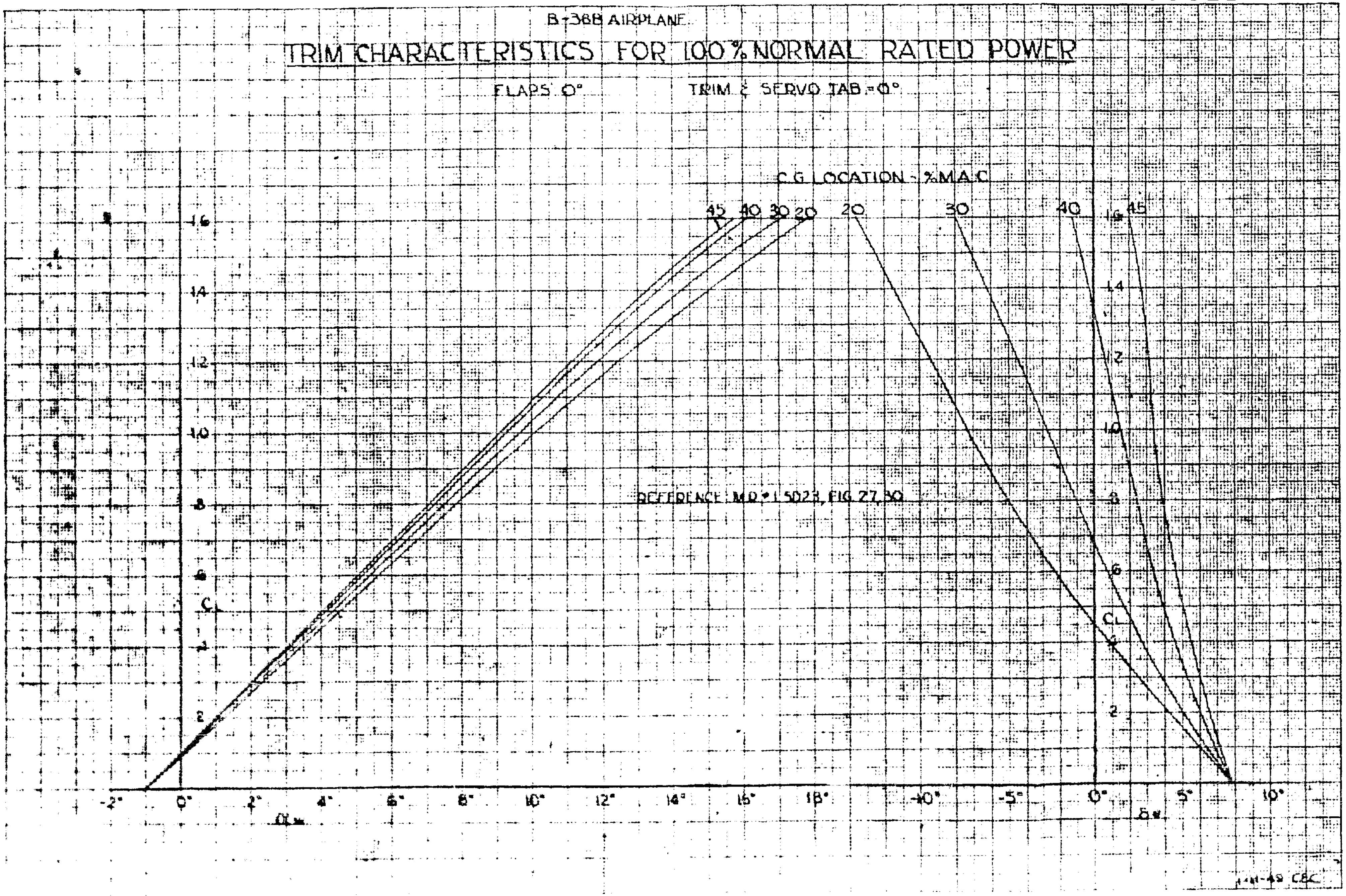


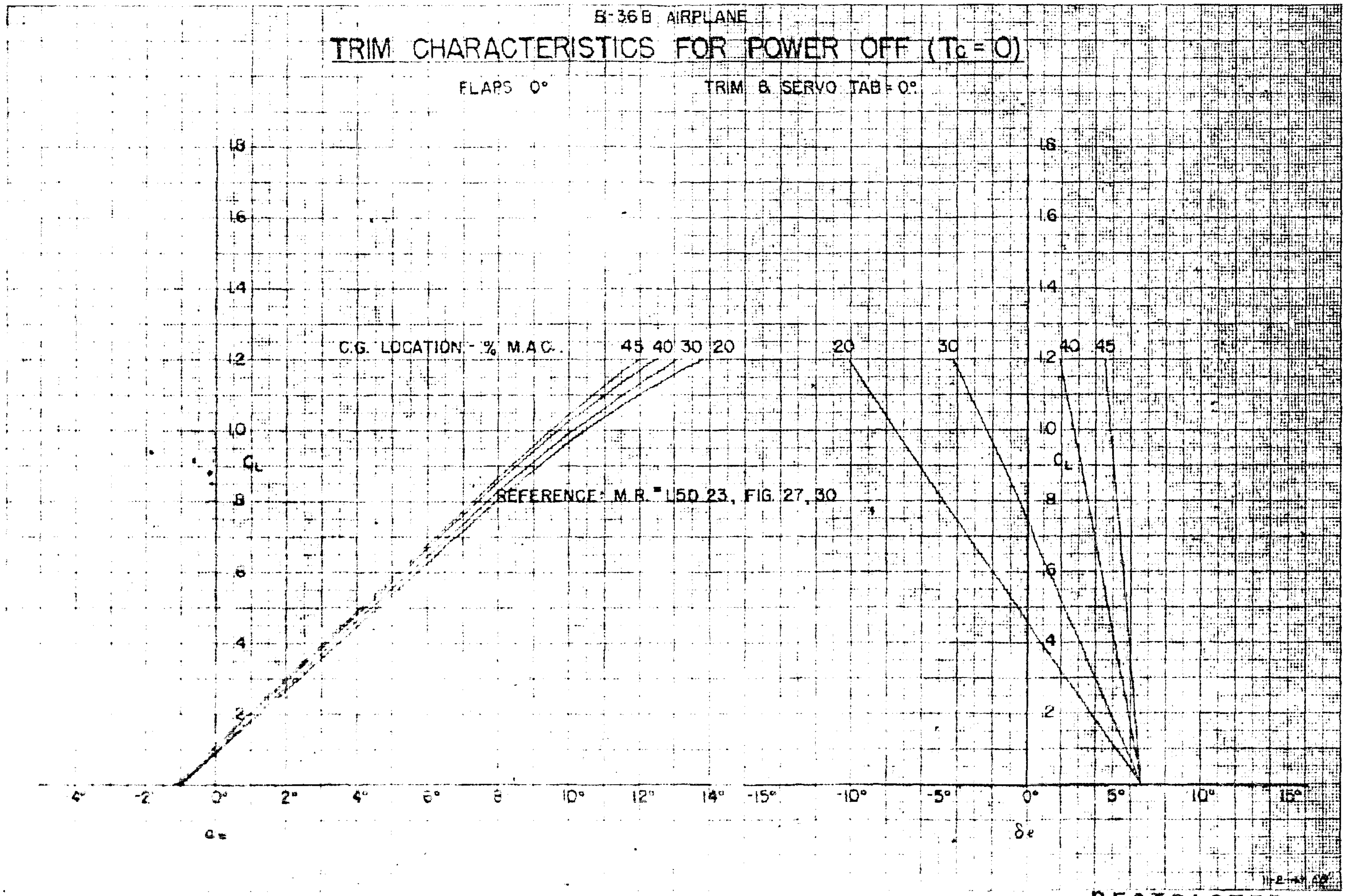
B-36 AIRPLANE

VARIATION OF YAWING MOMENT COEFFICIENT WITH ANGLE OF YAW

WEP FLAPS 0°, α = 5.9°, δe = 5.5° REF. FZT-36-16II, FIG. 2



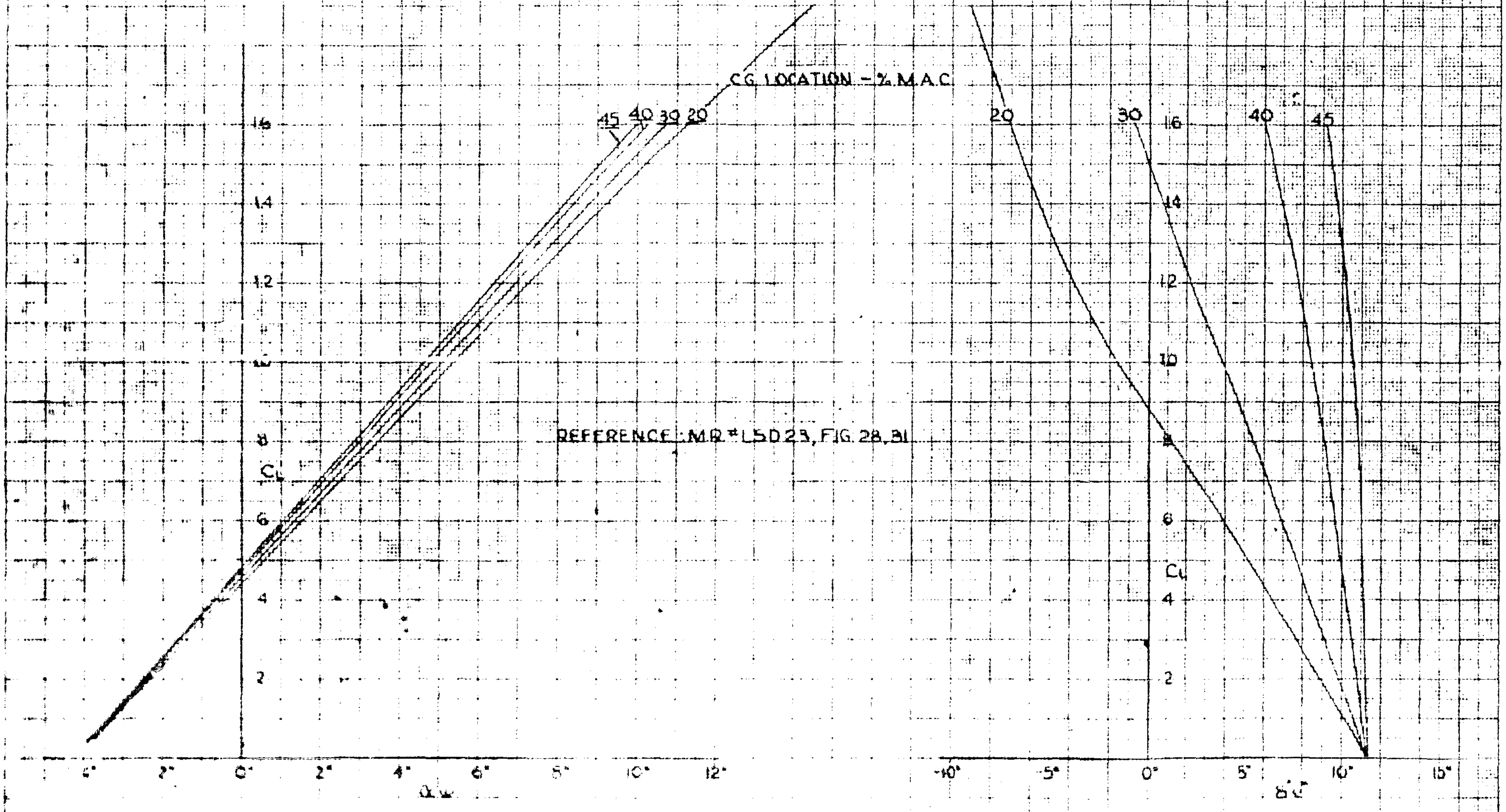

B-36B AIRPLANE
TRIM CHARACTERISTICS FOR 100% NORMAL RATED POWER
FLAPS 0°
TRIM & SERVO TAB = 0°
C.G. LOCATION - % M.A.C.
45 40 30 20
20 30 40 45
REFERENCE: M.R. # 1 5023, FIG. 27,30
C_L
.2 .4 .6 .8 1.0 1.2 1.4 1.6
-2° 0° 2° 4° 6° 8° 10° 12° 14° 16° 18°
α
-10° -5° 0° 5° 10°
δe
1-11-48 CBC

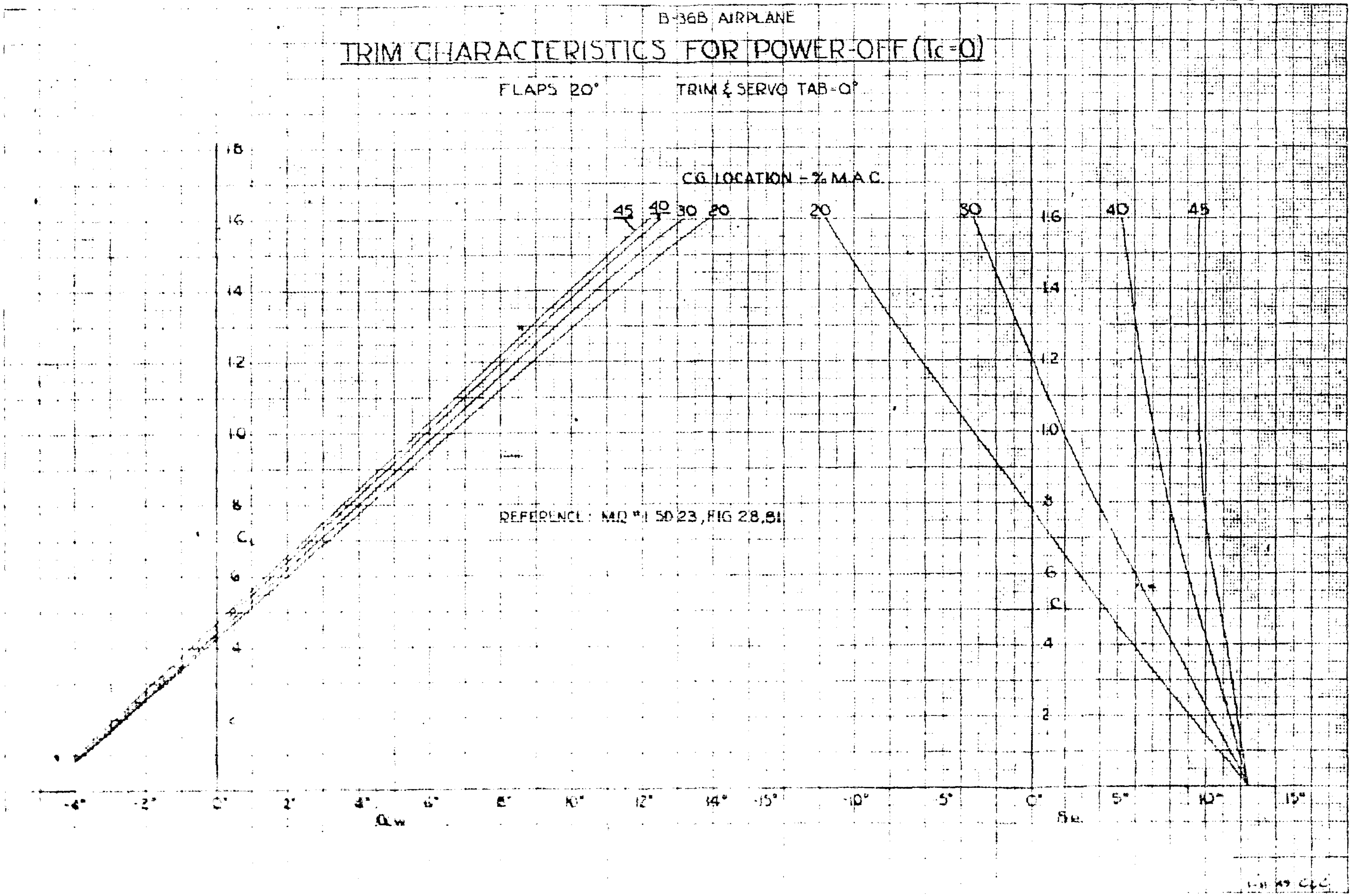

B-36B AIRPLANE
TRIM CHARACTERISTICS FOR POWER OFF (T_c = 0)
FLAPS 0°
TRIM & SERVO TAB = 0°
C.G. LOCATION - % M.A.C.
45 40 30 20
20 30 40 45
REFERENCE: M.R. - LSD 23, FIG. 27, 30
C_L
α
δ_e

B-36B AIRPLANE

TRIM CHARACTERISTICS FOR MILITARY POWER

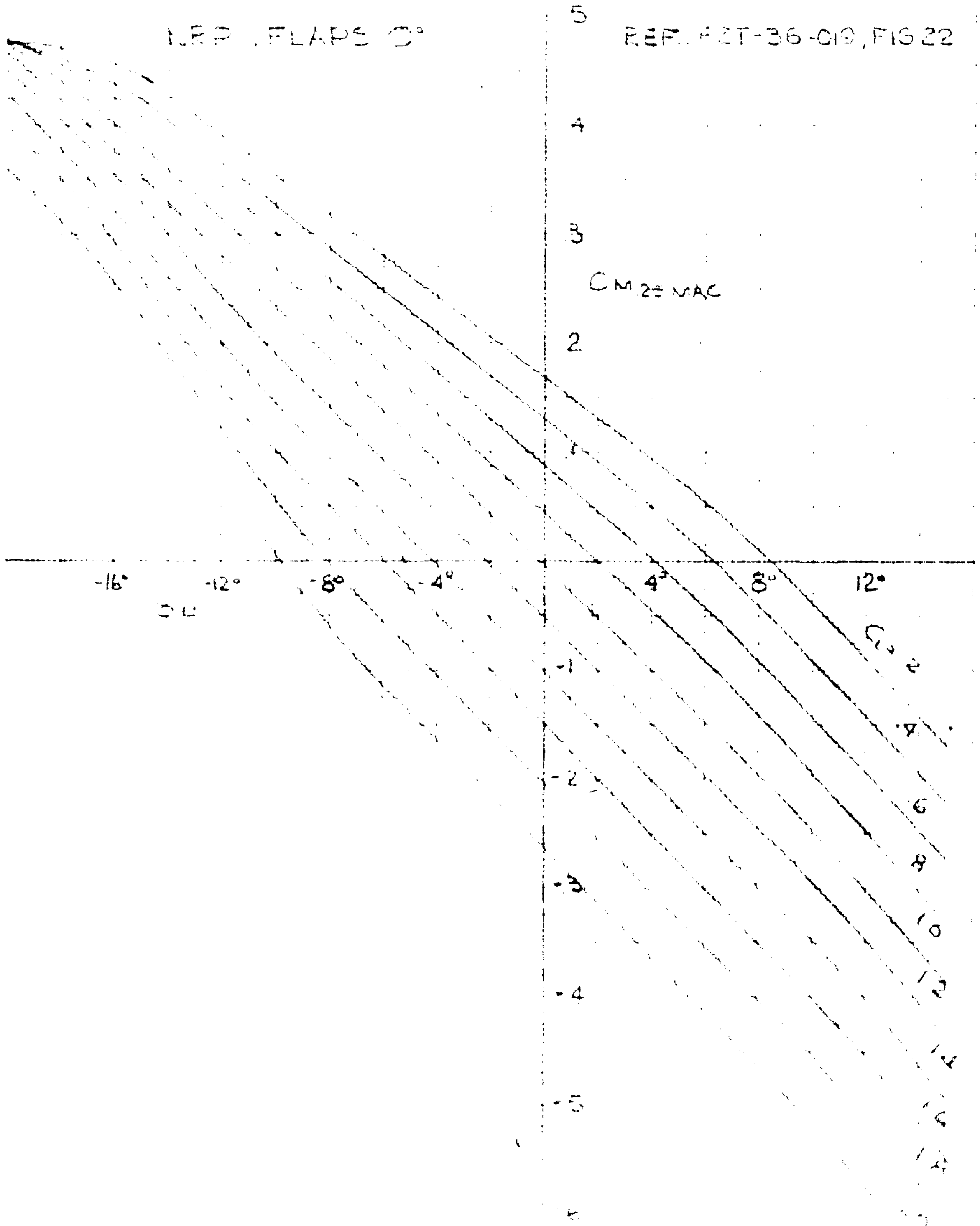
FLAPS 20° TRIM & SERVO TAB = 0°




B-36B AIRPLANE
TRIM CHARACTERISTICS FOR POWER-OFF (Tc=0)
FLAPS 20°
TRIM & SERVO TAB=0°
CG LOCATION - % M.A.C.
45
40
30
20
20
30
40
45
REFERENCE: MR #1 5023, FIG 28,81
C_L
α_w
δ_e
1.6
1.4
1.2
1.0
.8
.6
.4
.2
-4°
-2°
0°
2°
4°
6°
8°
10°
12°
14°
-15°
-10°
-5°
0°
5°
10°
15°

B-35 AIRPLANE

ELEVATOR EFFECTIVENESS IN PITCH

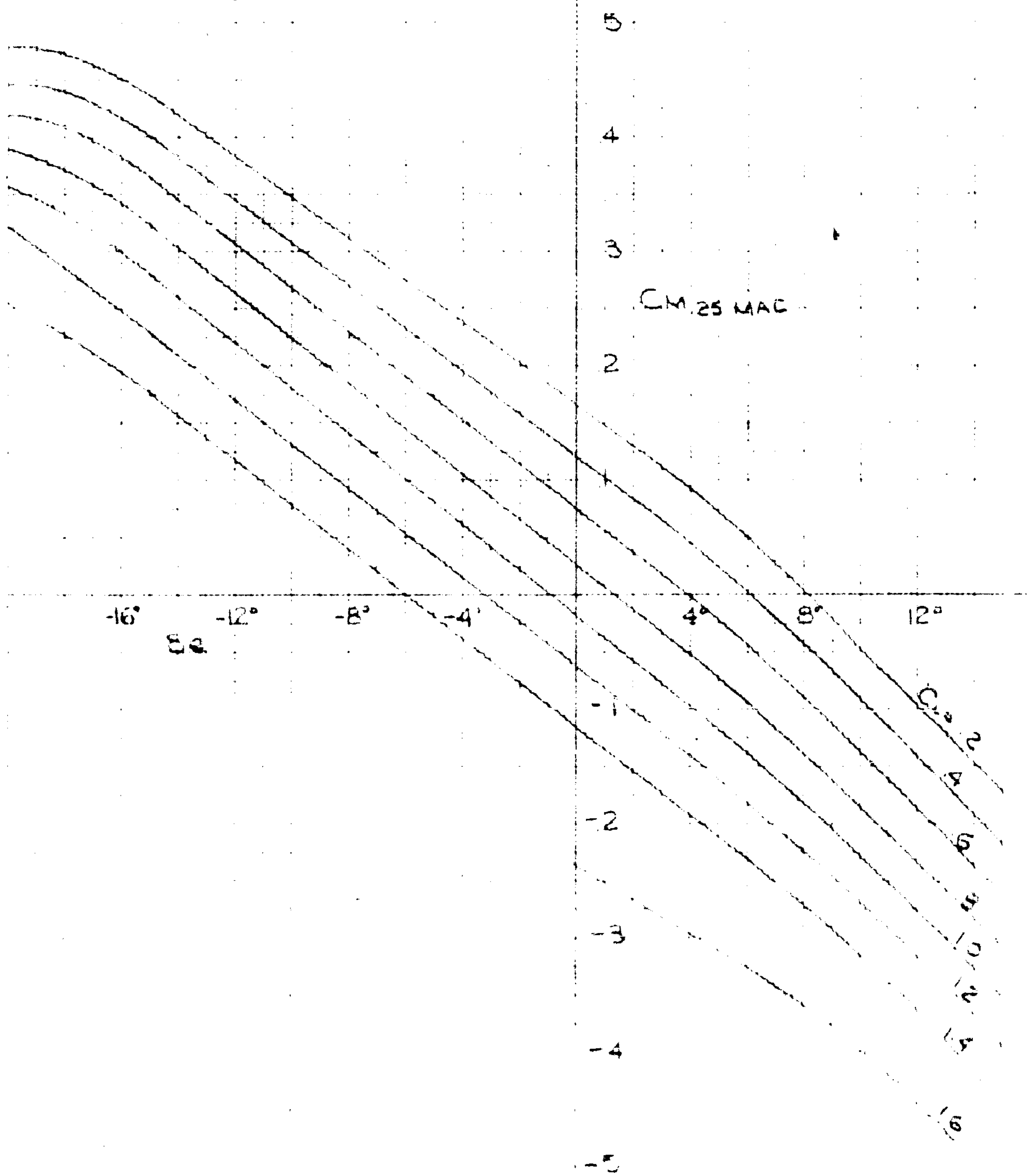


B-35 AIRPLANE

ELEVATOR EFFECTIVENESS IN PITCH

Tc=0 , FLAPS 0°

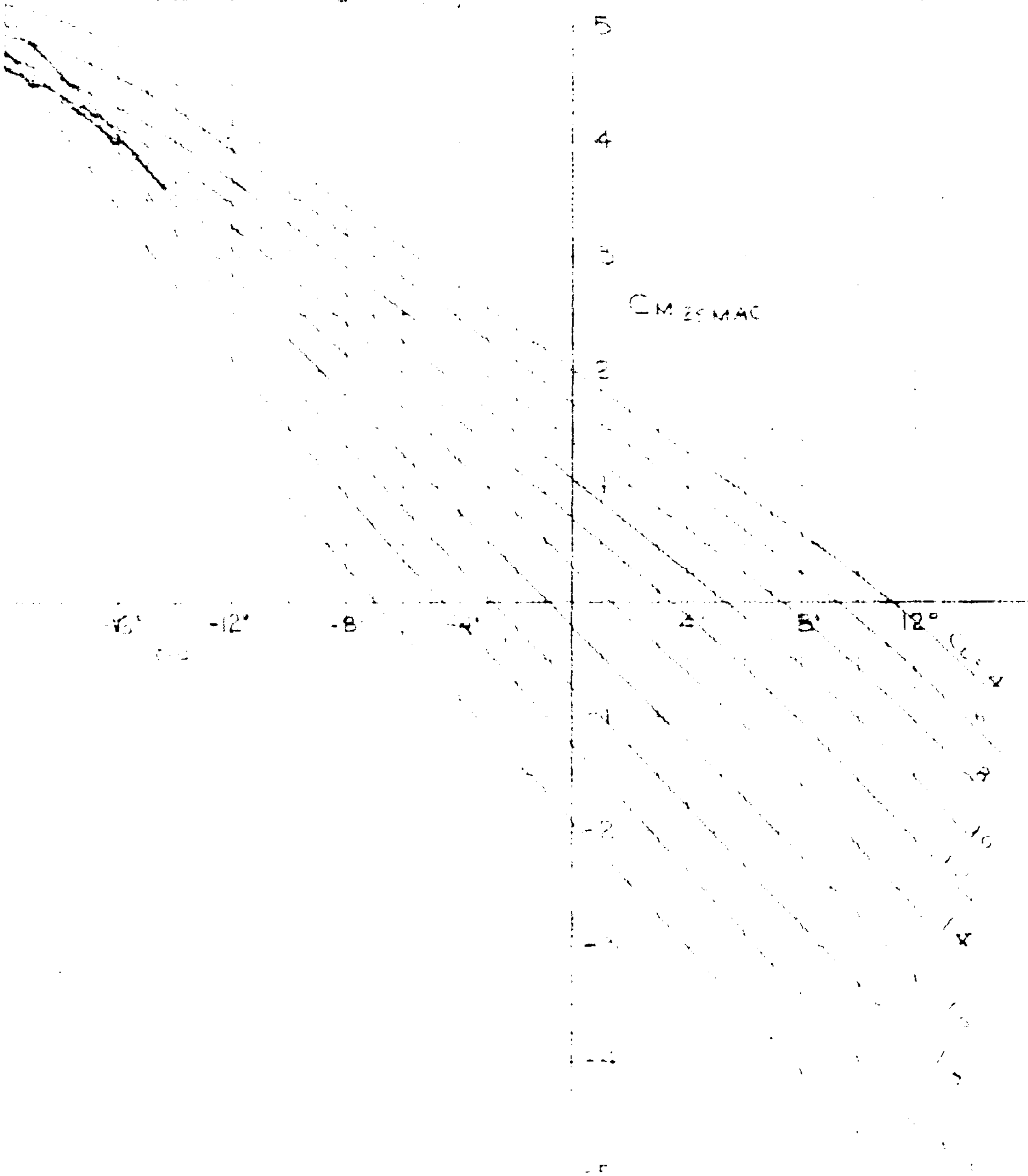
REF. FZT-36-019, FIG. 23

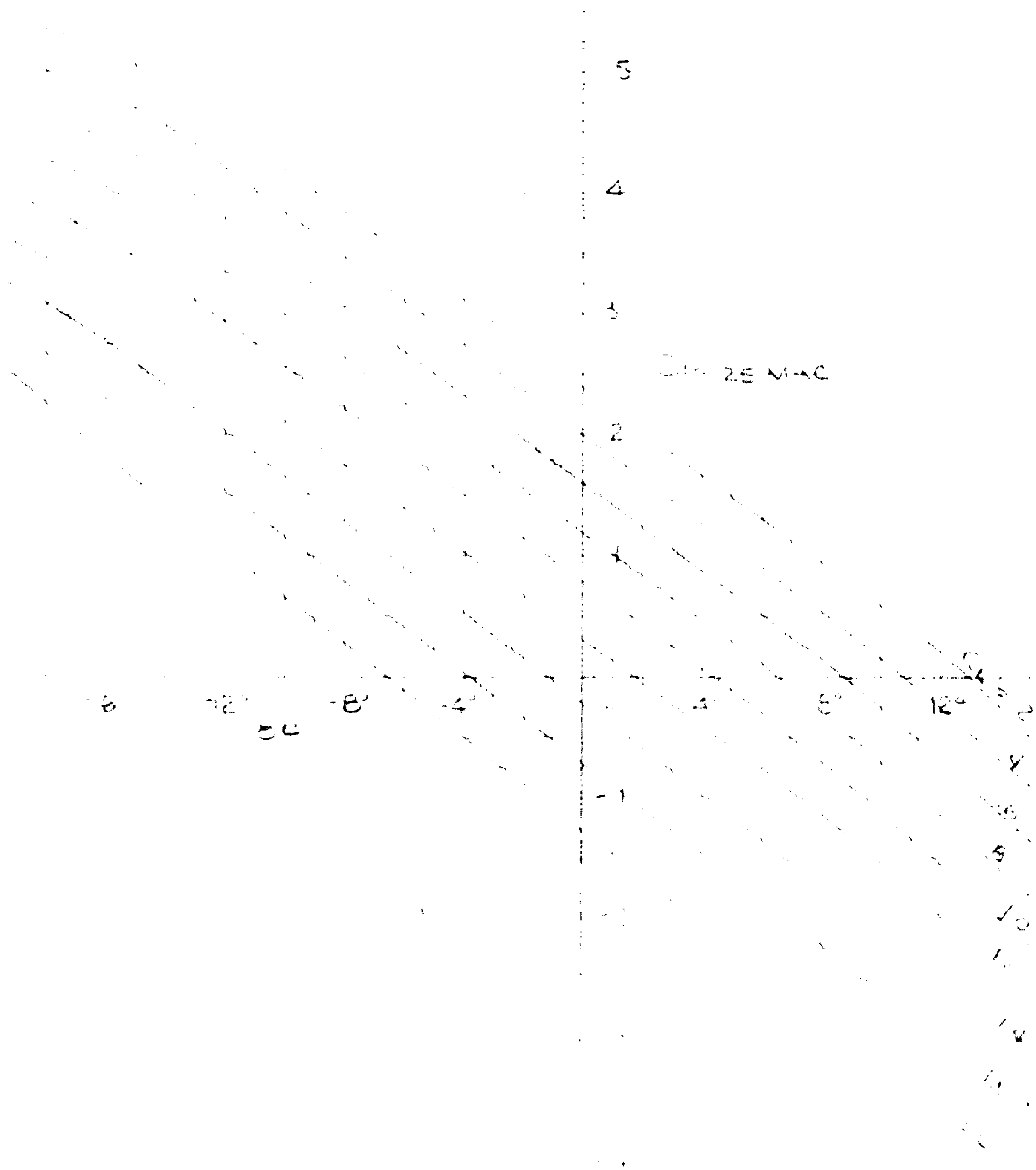


AIRPLANE

ELEVATOR EFFECTIVENESS IN PITCH

MILITARY POWER, FLAPS 20° REF. FZT-53-019, FIG 24

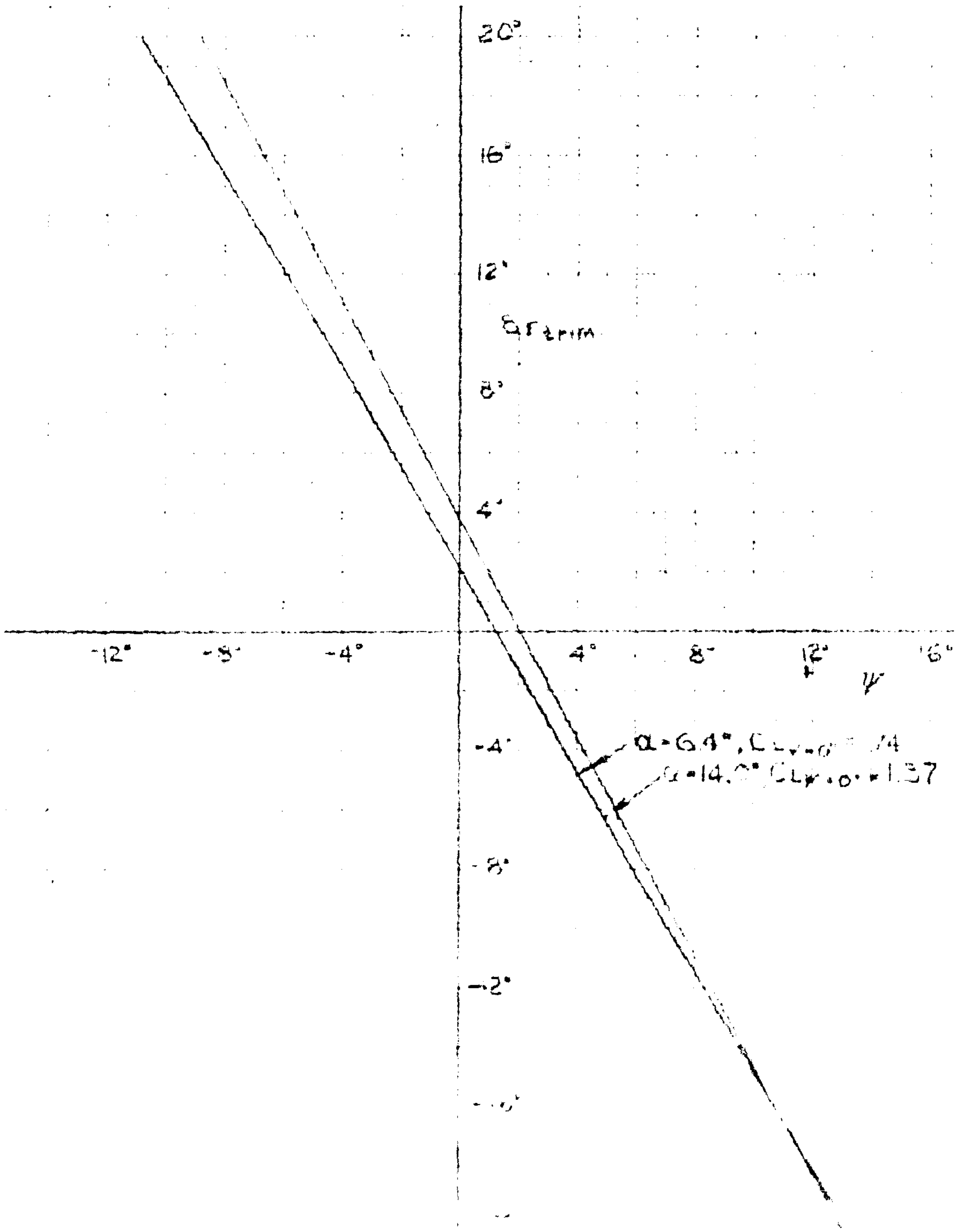



5
4
3
2
2.5 MAC
-8°
-4°
4°
8°
12°
-1

B-36 AIRPLANE

RUDDER EFFECTIVENESS

NRP FLAPS 0°
REF. NACA MR L5D23A, FIG. 15(a)



ANALYSIS
PREPARED BY
CHECKED BY
REVISED BY

Consolidated Vultee Aircraft Corporation
FORT WORTH DIVISION
FORT WORTH, TEXAS

PAGE 95
REPORT NO.
MODEL
DATE

RESTRICTED

27 June 1949

E. W. Watts

R. H. Widmer

Information Required for XB-36 and B-36D Basic Flight Criteria.

(a) Memo from E. W. Watts to R. H. Widmer dated 2 June 1949.
(b) B-36B Proposal Study with Four TG-190B Turbo Jet Assist Engines; FZA-36-104; October 1948.
(c) Green, C. H. and MacCarthy, W. D.; The Effects of High Speed Operation on the B-36 Airplane; FZA-36-103; October 1948.
(d) Peters, C. J. and Russell, [illegible] T.; Tests of a 4/20-Scale Partial-Span Model of the XB-36 Airplane in the Langley 19-foot Pressure Tunnel - I - Aerodynamic Characteristics of the Wing and Conventional Ailerons; NACA MR L6A11.

As requested in reference (a), the following information is enclosed:

I. C_D vs. Mach number for wing alone. This curve is a copy of Fig. 20 presented in reference (b).

II. Wing Critical Mach number vs. wing lift coefficient for both lift and drag through the range of $-C_{L_{max}}$ to $+C_{L_{max}}$. The enclosed figure of critical Mach number based on lift divergence supersedes Fig. 6 of reference (c).

III. Wing alone Characteristics (low speed) with 30° flaps and gear extended. These data were derived from reference (d). The position of the wing [illegible] is estimated to be at approximately 33% MAC.

It should be pointed out that the Aerodynamic Characteristics presented in Fig. III are representative of wing alone (nacelles on and gear extended) and not the complete airplane less tail which could be used directly for determining balancing tail loads.

[illegible]

[illegible]

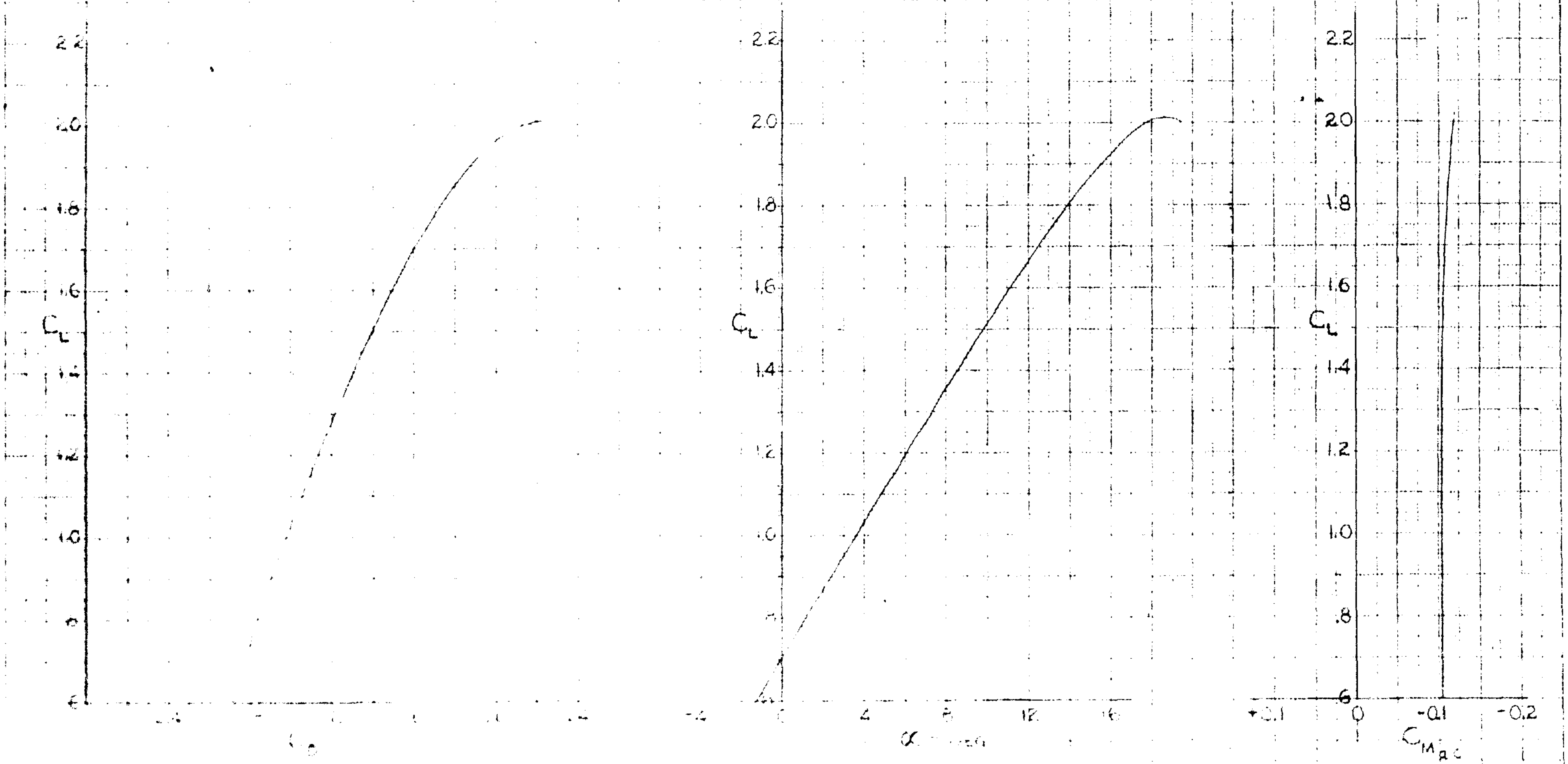
[illegible]
[illegible]

AERODYNAMIC CHARACTERISTICS OF B-36 AIRPLANE - WING ALONE

NACELLES ON - LANDING GEAR EXTENDED

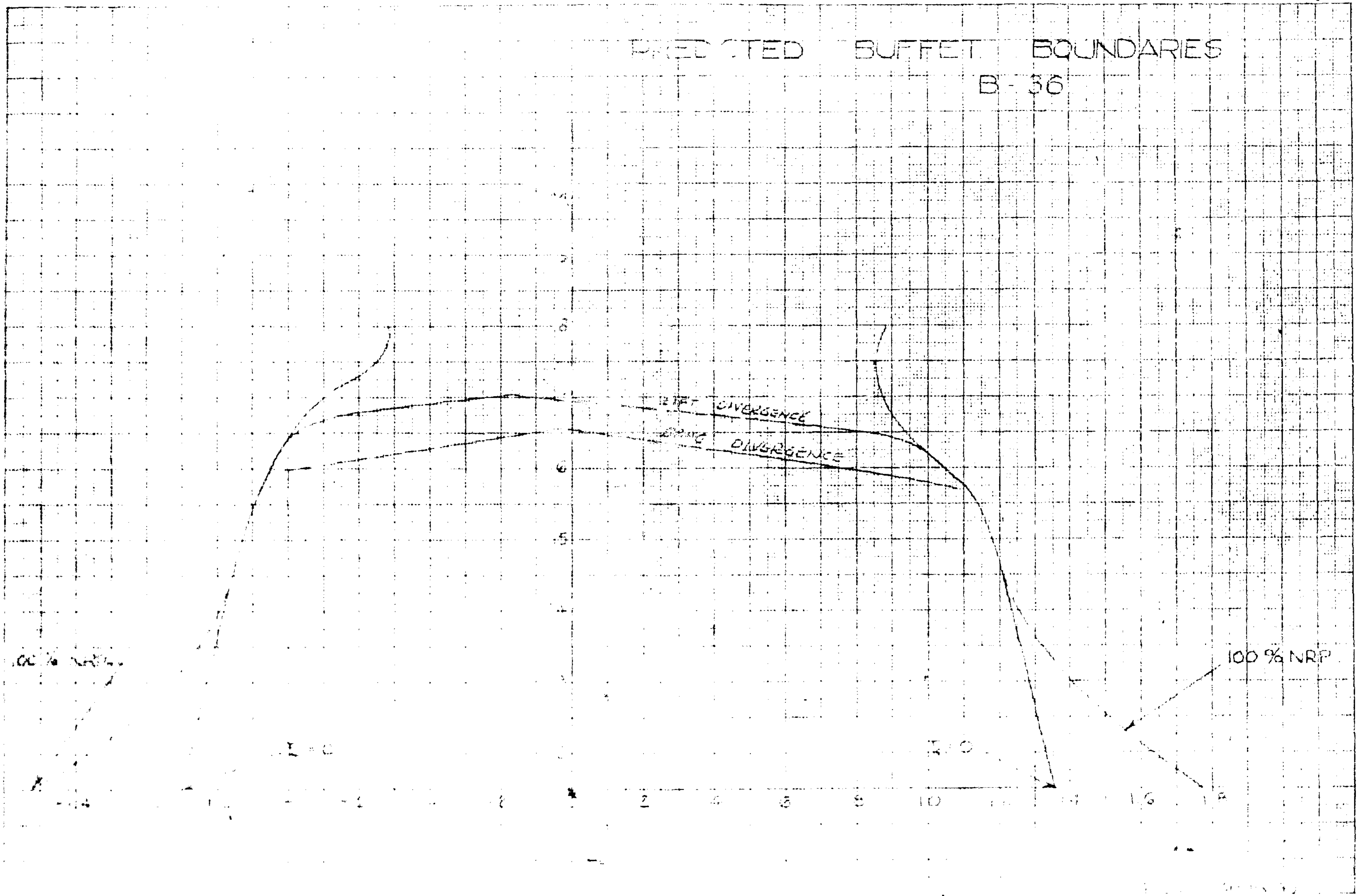
FLAPS 30°

a.c @ APPROX. 33% M.A.C.



TFP 6-28-43

Fig. 55



PREDICTED BUFFET BOUNDARIES
B-36
BUFFET DIVERGENCE
DRAG DIVERGENCE
100 % NRP

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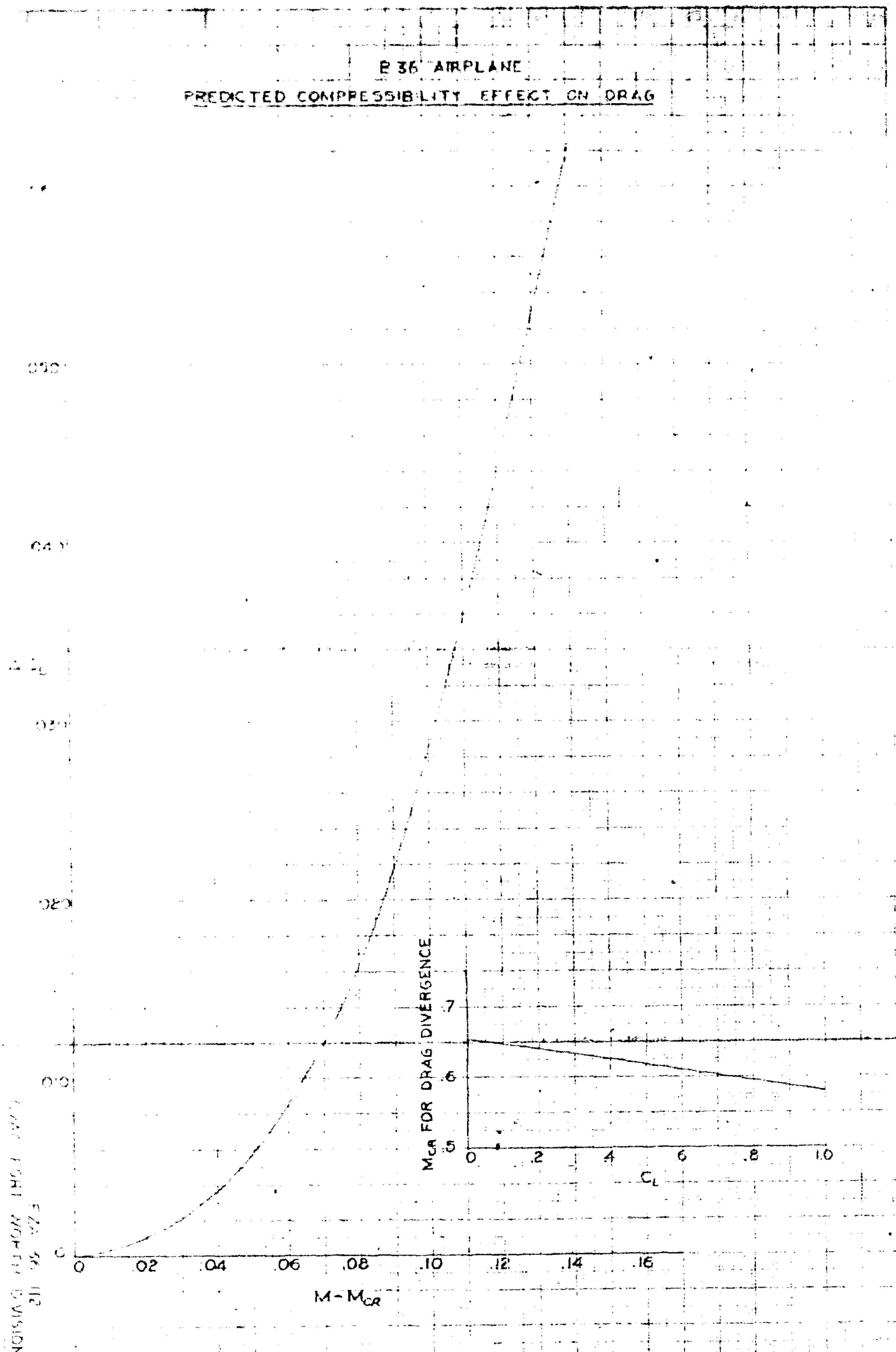

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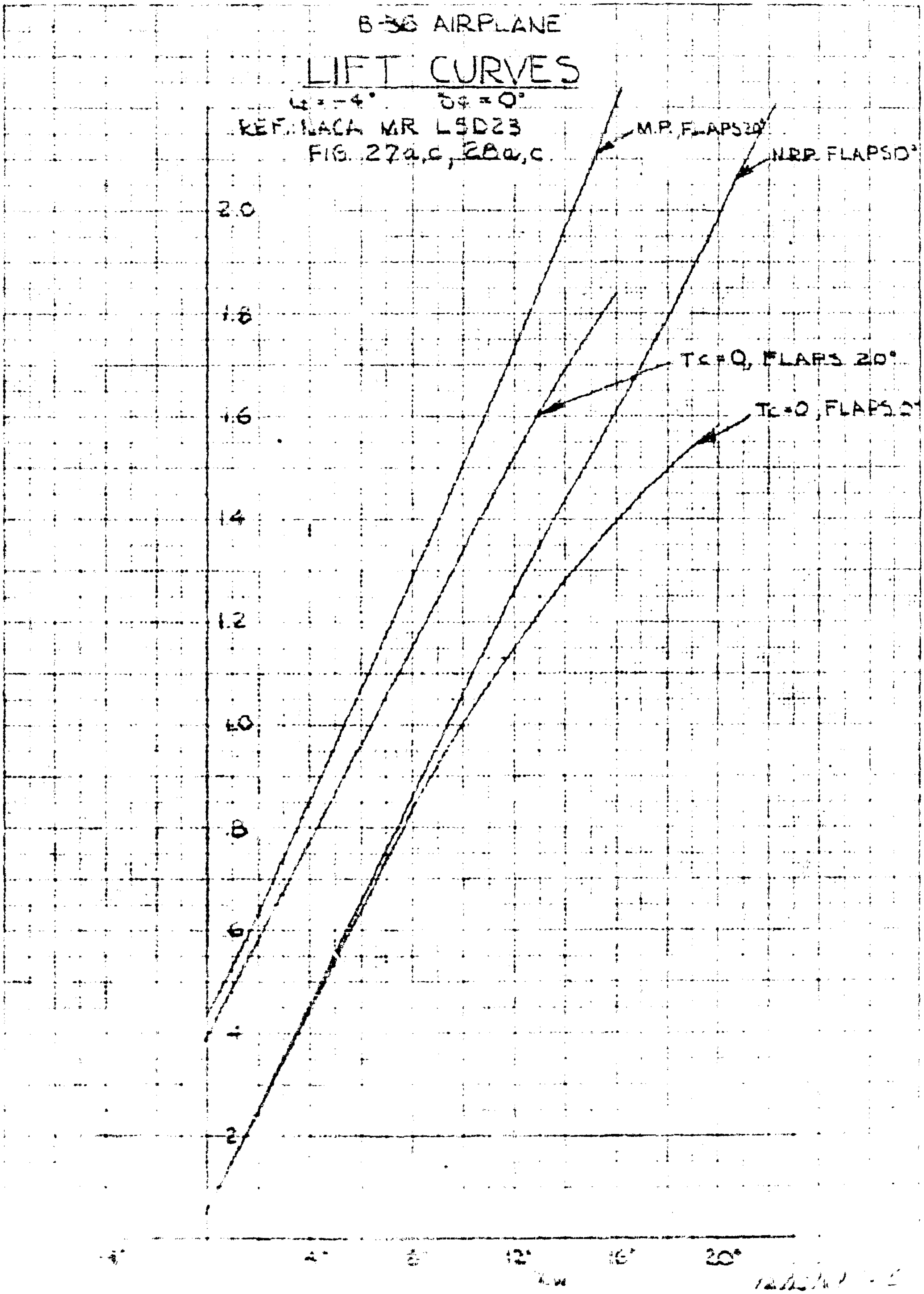
B-36 AIRPLANE
LIFT CURVES
$i_t = -4°$ $\delta_e = 0°$
REF. NACA MR L5D23
FIG. 27a,c, 28a,c
M.P. FLAPS 20°
N.R.P. FLAPS 0°
Tc = 0, FLAPS 20°
Tc = 0, FLAPS 0°
2.0
1.8
1.6
1.4
1.2
1.0
.8
.6
.4
.2
-4°
4°
8°
12°
16°
20°

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Consolidated Vultee Aircraft Corp., Fort Worth Div., Tex. (Report FZA-36-154)
SUMMARY OF AERODYNAMIC DATA FOR STRUCTURAL ANALYSIS OF THE B-36 AIRPLANE, by C.E. Calvert. 22 Feb '50 (Revision 1, 1 June '50), 99 pp incl. graphs. ~~RESTRICTED~~

(Not abstracted)

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