C-105

7/0500/7
Issue 2

MAIN A/C STATIC TESTS

SECRET

A. V ROE CANADA LIMITED

MALTON · ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

AIRCRAFT:

REPORT NO & 7/0500/7

FILE NO:

NO. OF SHEETS 43

TITLE:

SECRET

MAIN A/C STATIC TESTS

SECRET

PREPARED BY DATE

CHECKED BY DATE

SUPERVISED BY DATE

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ISSUE NO.	REVISION NO.	REVISED BY	APPROVED BY	DATE	REMARKS
2	72	J O'Doherty		Mar. '56	Additional Information

FORM 1316A

AVRO AIRCRAFT LIMITED
MALTON - ONTARIO
TECHNICAL DEPARTMENT

REPORT No 7/0500/7
SHEET No

AIRCRAFT:		PREPARED BY	DATE
		J.D. O'Doherty	
		CHECKED BY	DATE

SECRET

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AIRCRAFT		PREPARED BY	DATE
C-105	MAIN A/C STATIC TESTS	J.D. O'Doherty	
		CHECKED BY	DATE

SECTION 1

Purpose of Tests

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1. To substantiate the structural integrity of the C-105 A/C

   Since the C-105 A/C is primarily a limit design A/C, most of the testing will be up to limit loads only. A large number of strain gauges will be required to prove that the yield stresses of the structural material is not exceeded at the limit load condition.

2. To substantiate the theoretical analysis

   The C-105 airframe is a complex redundant structure. Strain gauges will be positioned to give a complete plan of the load distribution throughout the structure in order to verify the calculations.

3. To comply with the requirements of MIL-S-5710

SECTION 11

Test Article

The static test article shall be a structurally complete A/C. In particular the following may be omitted:-

Radar Nose
Air Brakes
Armament Pack
Floating Ducts
Engines
Dorsal Fairing
Instruments
Accessories
Equipment
Control Circuits

Although control circuits are omitted, the linkage system to all control surfaces must be included, and rigid struts used in place of the actuating jacks.

All undercarriages will be required, together with their tires, operating jacks, doors and fairings.

SECRET

/continued .....

SECRET

SECTION 11

Test Article (contd.)

The test A/C shall be of the same quality of workmanship as the flight A/C. All deviations from the structure drawings shall be recorded on Material Review Board forms and shall receive the approval of the Inspection and Engineering Members of the Board.

All fuel tanks and both cockpits shall be capable of being pressurised.

SECTION 111

Method of Test

A. Combined aerodynamic and inertia loads will be applied to the wing by a linkage system loading rubber patches attached to the wing skin.
Positions of chordwise rows of patches (arranged to clear strain-gauges) is shown on Sheet 4.

B. Vertical inertia loads will be applied to the fuselage by a linkage system applying loads to:-

1. A cantilever structure attached to the fuselage at Sta. 120.
2. A system of straps at formers 129.33; 137.0; 147.0; 157.33; 166.66; 176.0; 255.0; 267.9; 280.9; 291.9; 303.4; 485.
3. Blocks in fuselage fuel tanks and on formers Nos. 538.77; 591.65; 644.43; 663.65; 697.28; 712.34; 717.36; 742.50.
4. The missile pack hoisting pick-ups at Stns. 337.53 and 425.53.
5. Rubber patches between Stns. 742.5 and 888.
6. Missile pack pick-ups at Stns. 295.23 and 482.5.
7. Dummy engines picking up J.75 engine mountings.

SECRET

/continued .....

SECRET

SECTION 111

Method of Test (contd.)

B. (contd.)

Vertical aerodynamic loads will be applied by a linkage system applying loads to:-

8. A block inside each duct intake with a loading point at Stn. 208.

9. A system of rubber patches between Stns. 224 and 485. See Sht.5

10. The dorsal pick-ups at Stns. 268, 292, 317, 363.06, 385.125, 409.938, 418.062, 442.875, 473.48.

11. The aircraft slinging fitting at Stn. 256.125.

Combined aerodynamic and lateral loads are applied to the fuselage by a linkage system loading:-

12. Rubber patches along the fuselage sides.

13. Missile pack pick-ups at Stns. 295.23 and 482.5.

14. Dummy engines picking up the J.75 engine mountings

C. Vertical inertia loads will be applied to the fin and rudder by straps at the centre of load, passing through holes in the fuselage.

D. Combined aerodynamic and inertia lateral loads on fin and rudder are applied by a linkage system loading a system of rubber patches attached to the skin of these surfaces.

Note:- It is proposed that the linkage systems loading the fuselage and the fin laterally be attached to a rigid foundation. The engine and missile-pack lateral loads would then be the only loads applied by jacks.

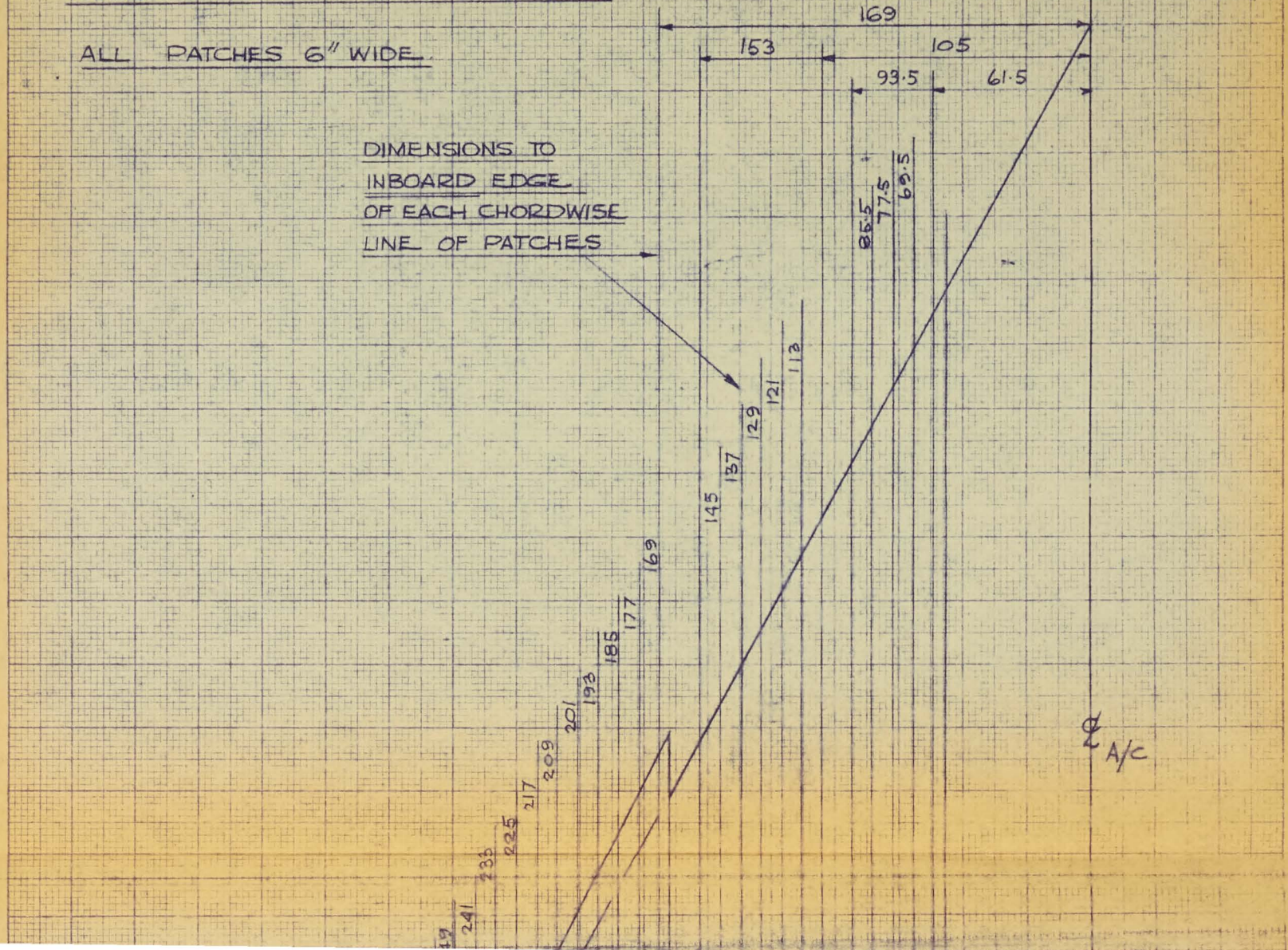
The test article will be tied down at the nose U/C pivot. (Stn. 215.65) and at the main U/C pivot position.

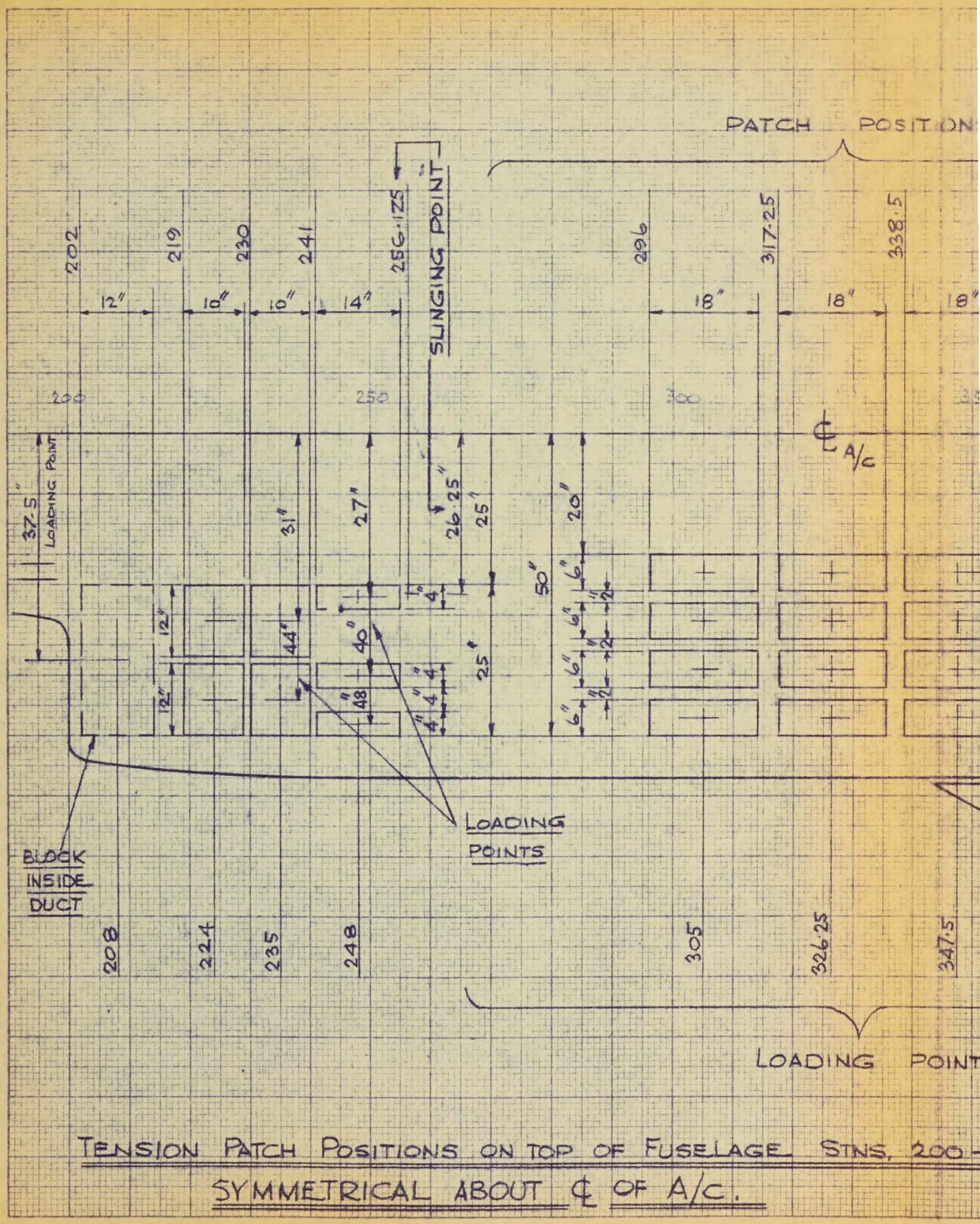
SECRET

/continued .....

RUBBER PATCH POSITIONS ON WING

ALL PATCHES 6" WIDE.





TENSION PATCH POSITIONS ON TOP OF FUSELAGE STNS. 200 –

SYMMETRICAL ABOUT ℄ OF A/C.

SECRET

SECTION 1V

Loading Cases

1. Rolling Pull-Out (Assymetric)

   This case will be given top priority. Assymetric loads shall be applied to the wing and the rolling moment reacted by loads applied to the fin. The side load on the fin shall be reacted by loads distributed along the fuselage.

2. Symmetric Case with Pitch

   All loads are symmetric. Pitch effects will be simulated by variations in the loads applied. This case gives the critical case on the aft part of the wing and fuselage.

3. Symmetric Case - No Pitch

   This case gives the highest bending moment on the nose fuselage and the highest loads on the forward part of the wing.

4. Held in Abeyance

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SECRET

SECTION V

Test Loads

1. Rolling Pull-out Case

The aeroplane in this case is under a normal acceleration factor of 4.89 g (limit); there is no pitch.
For loads representing fuselage vertical inertia to be applied as per 1. 2. 3. 4. 5. 6. and 7 of Section III B, see Sheet 8.to 10 inclusive.
For loads representing fuselage vertical aerodynamic loads as per 8. 9. 10. and 11. of Section 111 B, see Sheet 11 to 15 inc.

There is an aerodynamic load on the fin and rudder of 36,500 lb. (limit) acting on test from Starboard (R.H.) to Port (L.H. and a side aerodynamic load on the fuselage acting in the same direction (this being the most severe direction for the nose fuselage structure). The yawing acceleration due to this load system is balanced by inertia and the direct side load by direct side inertia.

For loads representing fuselage combined side aerodynamic and inertia forces to be applied as per 12. 13. & 14 of Section 111 B, see Sheet 16.
For loads representing fin loads as per section 111 C & D, see Sheet 17 to 21 inc.

The Port (L.H. wing is rising and the Starboard (R.H.) wing falling so that the aerodynamic load on each wing is different by the effects of aileron and damping. The rolling effect of the fin load deccelerates this movement of the wing and induces rolling inertia forces on the wings so that the aeroplane is instantaneously in balance.

For loads representing wing combined aerodynamic and inertia forces to be applied as per Section 111 A, see Sheet 22 to 42 inc.
For concentrated loads see Sheet 43.

Pressurisation

Pilots and Navigator's Cockpits are to be pressurized to 5.75 psi (limit).

Fuselage fuel tanks are to be pressurized to 10 psi (limit).

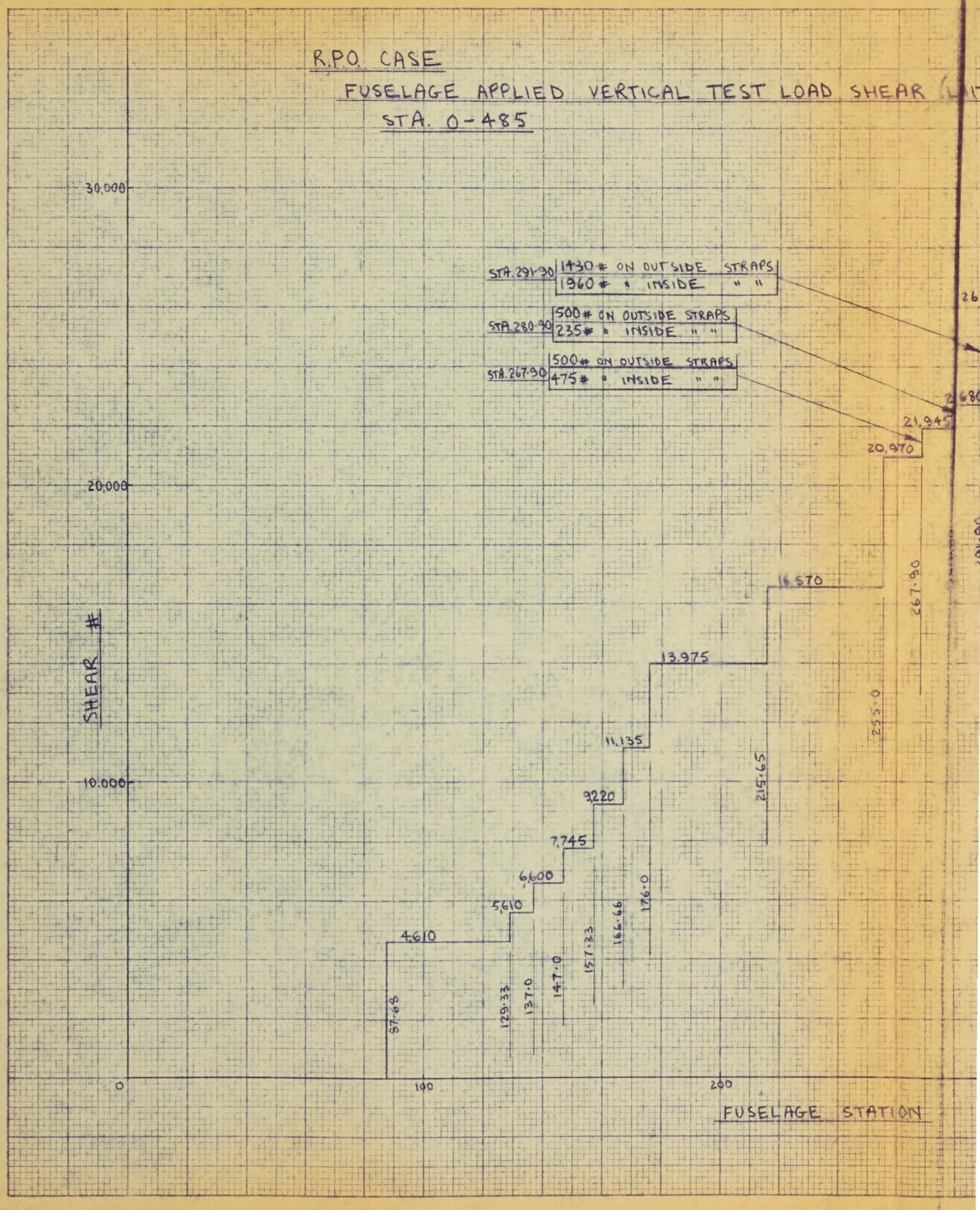
Wing fuel tanks are to be pressurized to 21 psi (limit).

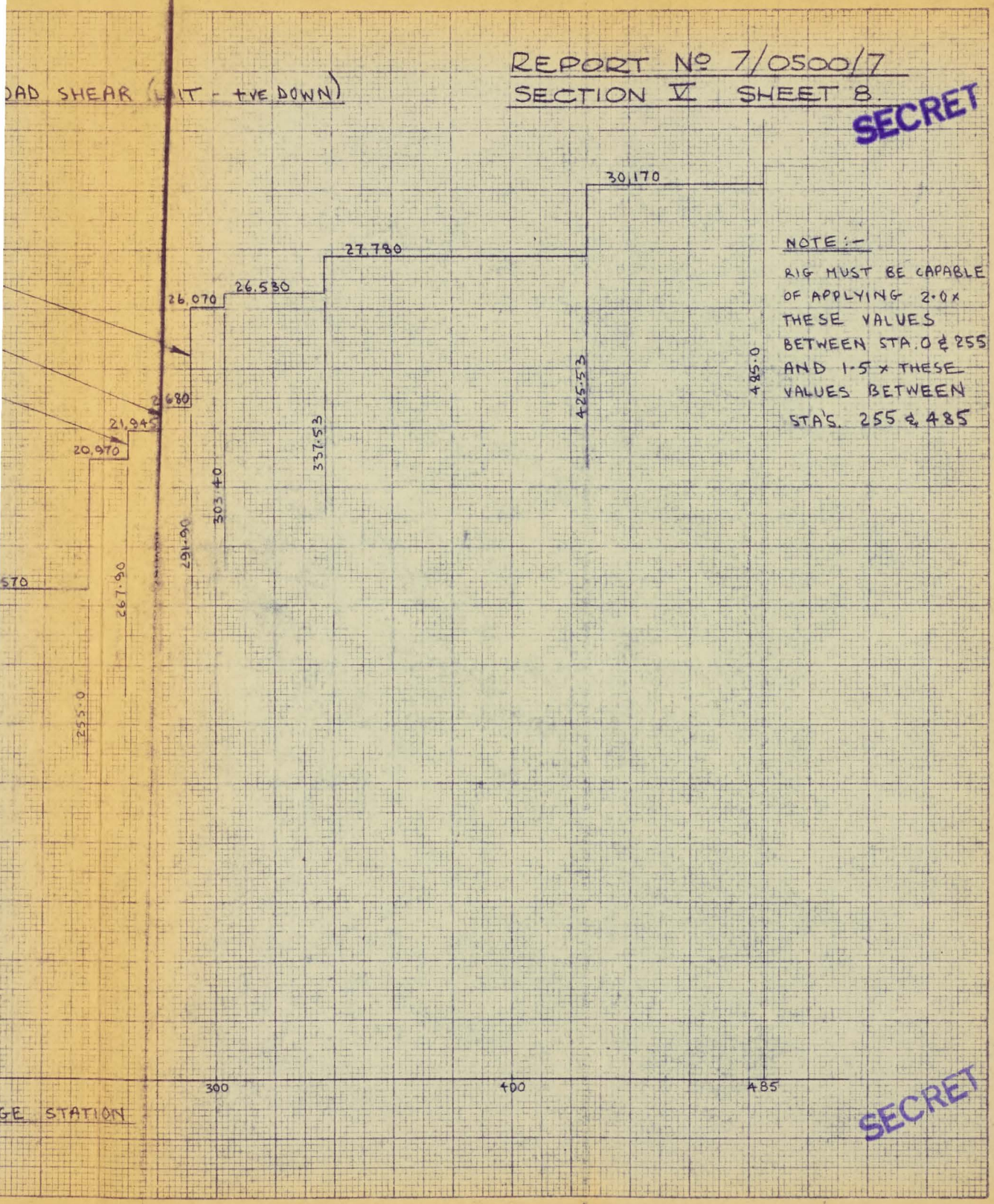
SECRET

R.P.O. CASE

FUSELAGE APPLIED VERTICAL TEST LOAD SHEAR

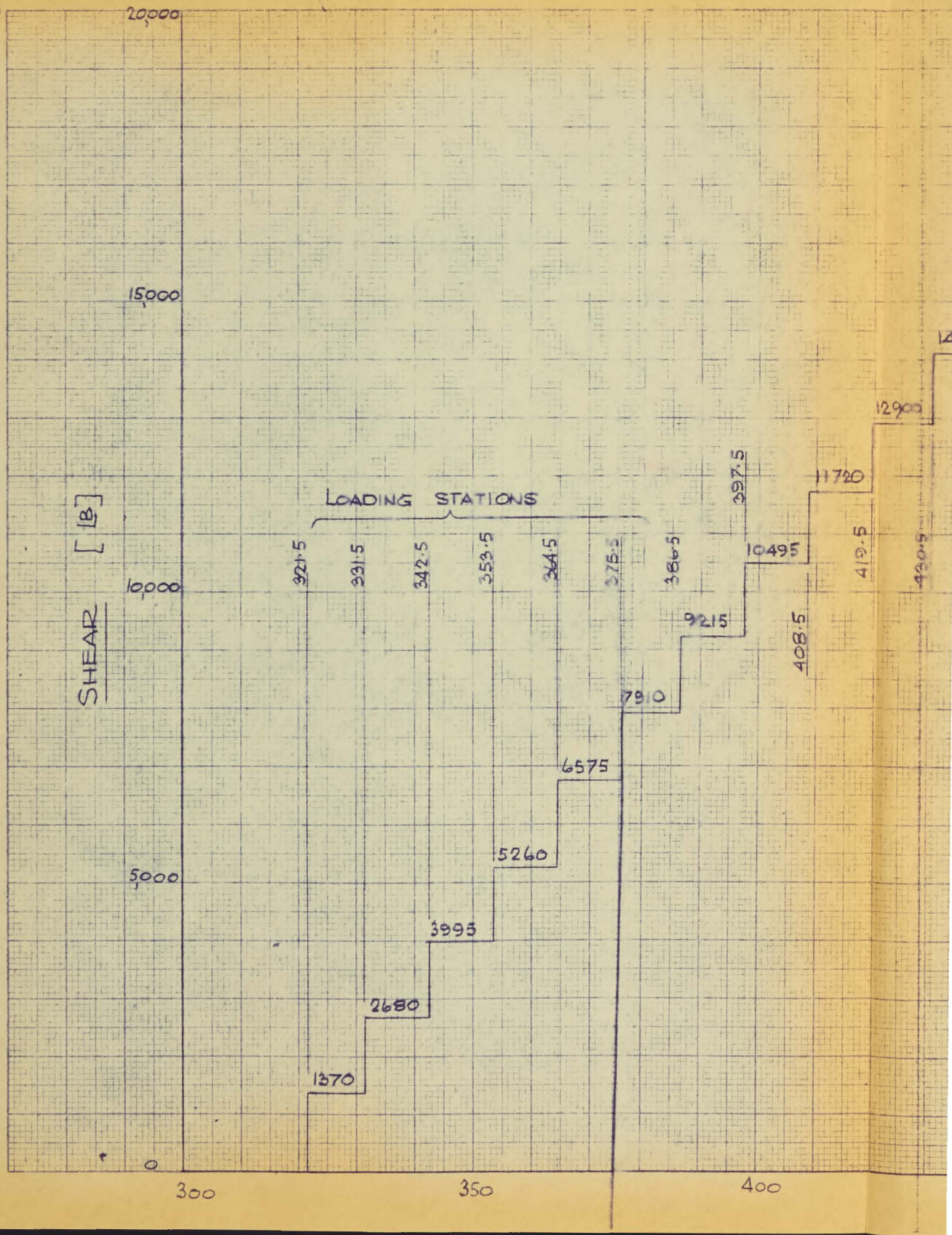
STA. 0-485





NOTE:-

RIG MUST BE CAPABLE OF APPLYING 2·0 × THESE VALUES BETWEEN STA. 0 & 255 AND 1·5 × THESE VALUES BETWEEN STA'S. 255 & 485



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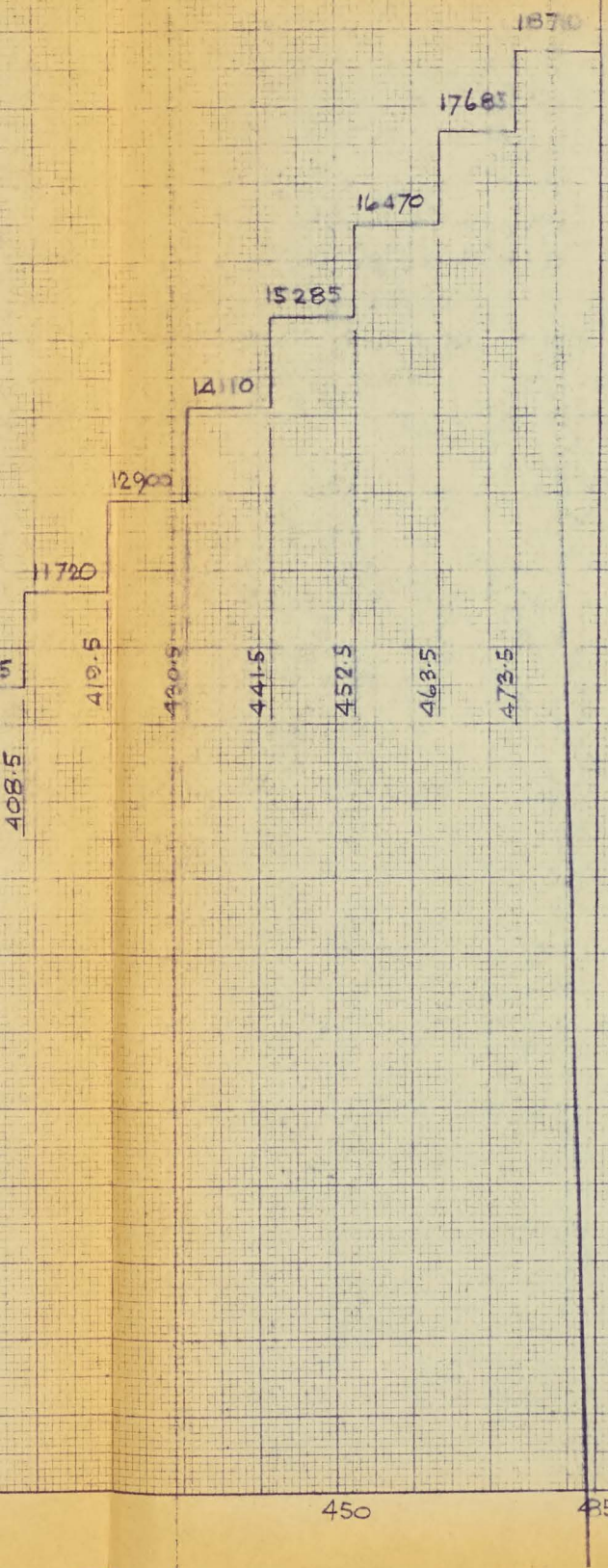
SECTION V. SHEET 9.
R.P.O CASE.

SECRET

SHEAR FORCE FROM LOADS APPLIED TO FUSELAGE FUEL TANK [LIMIT].

NOTES:- LINKAGE MUST BE CAPABLE OF APPLYING 1·8 x THESE VALUES AS LIMIT LOADS FOR FUTURE CASES

VALUES QUOTED ARE NETT I.E NO ALLOWANCE HAS BEEN MADE FOR WEIGHT OF WATER & TEST EQUIPMENT IN TANK.



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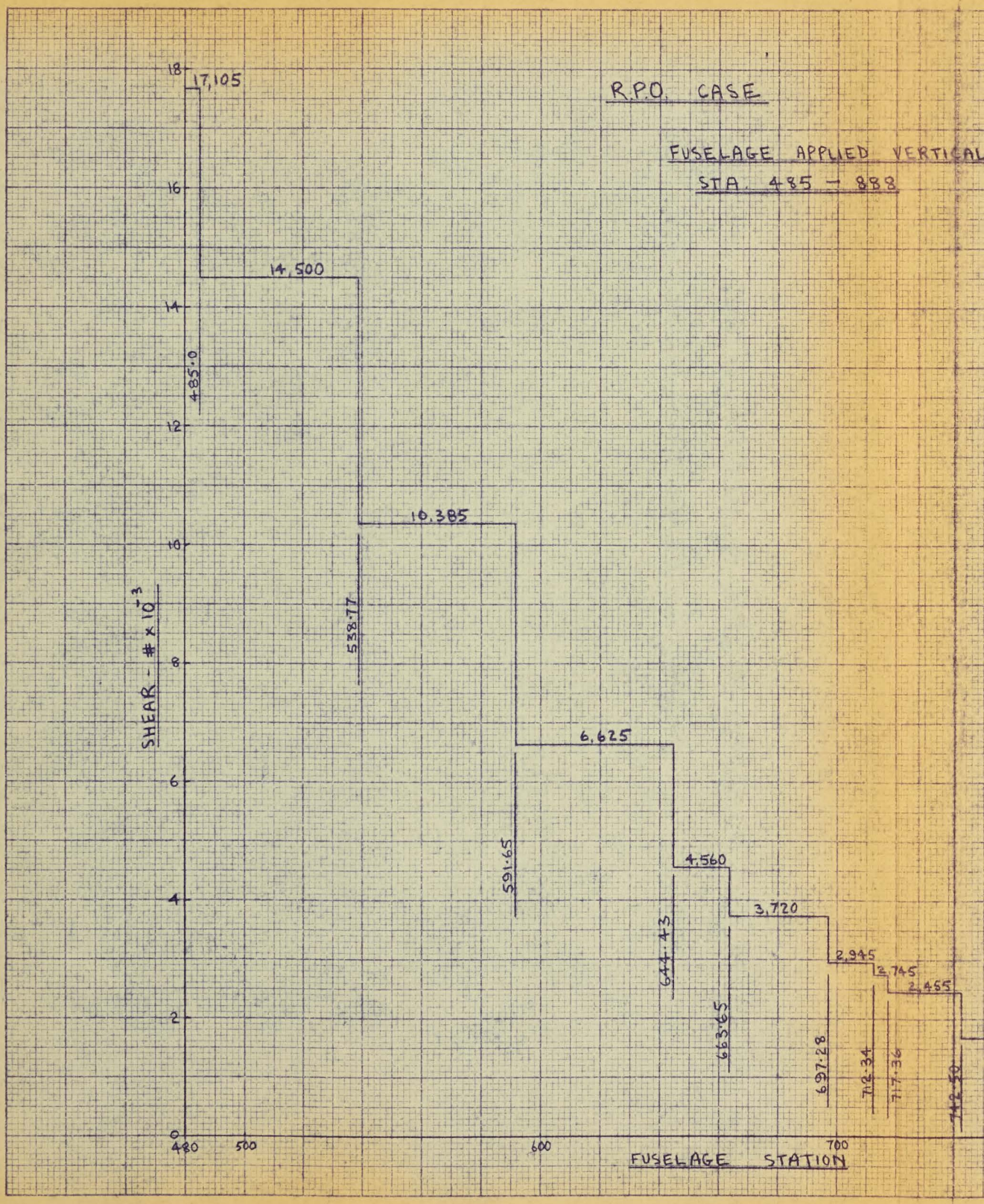
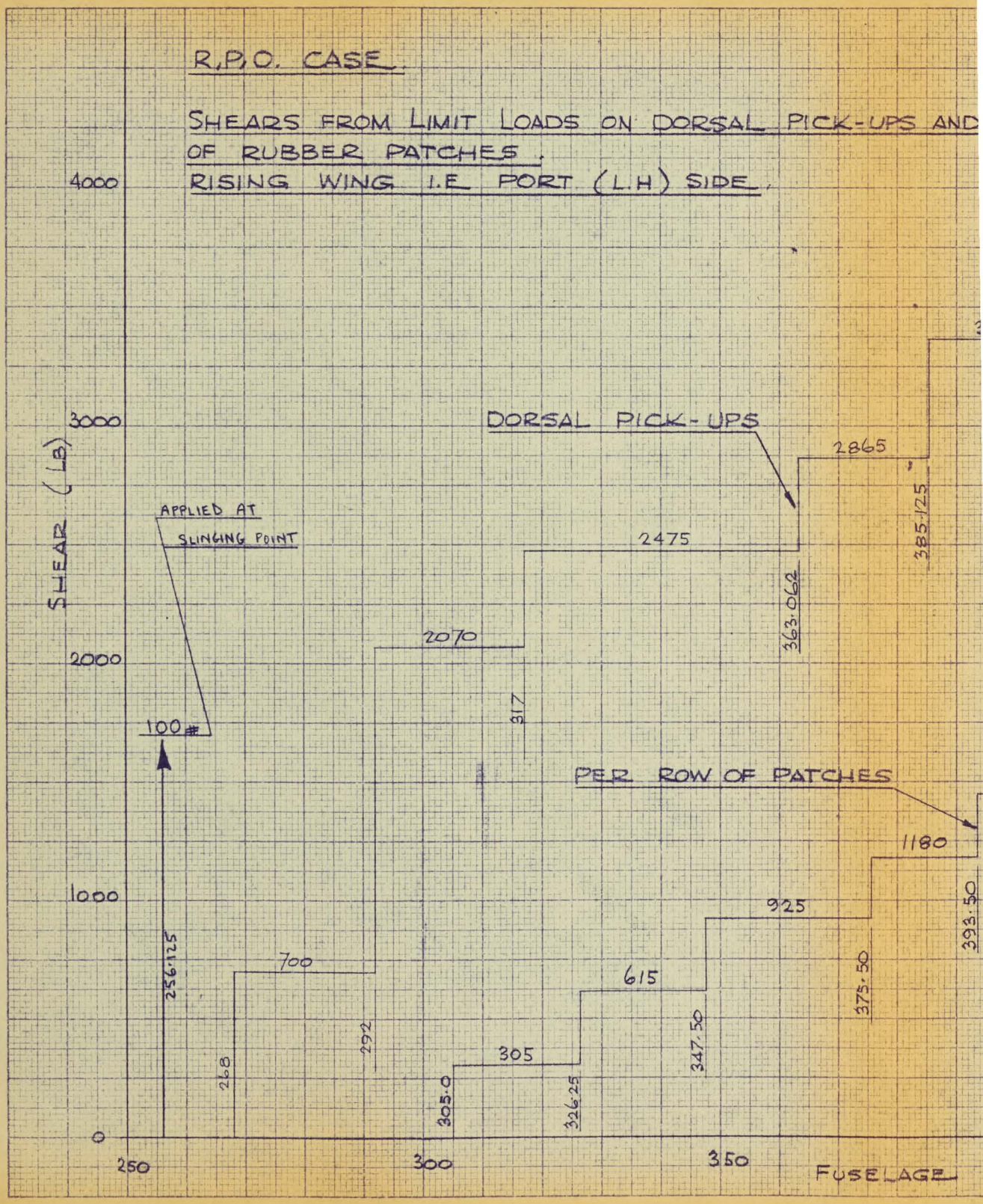
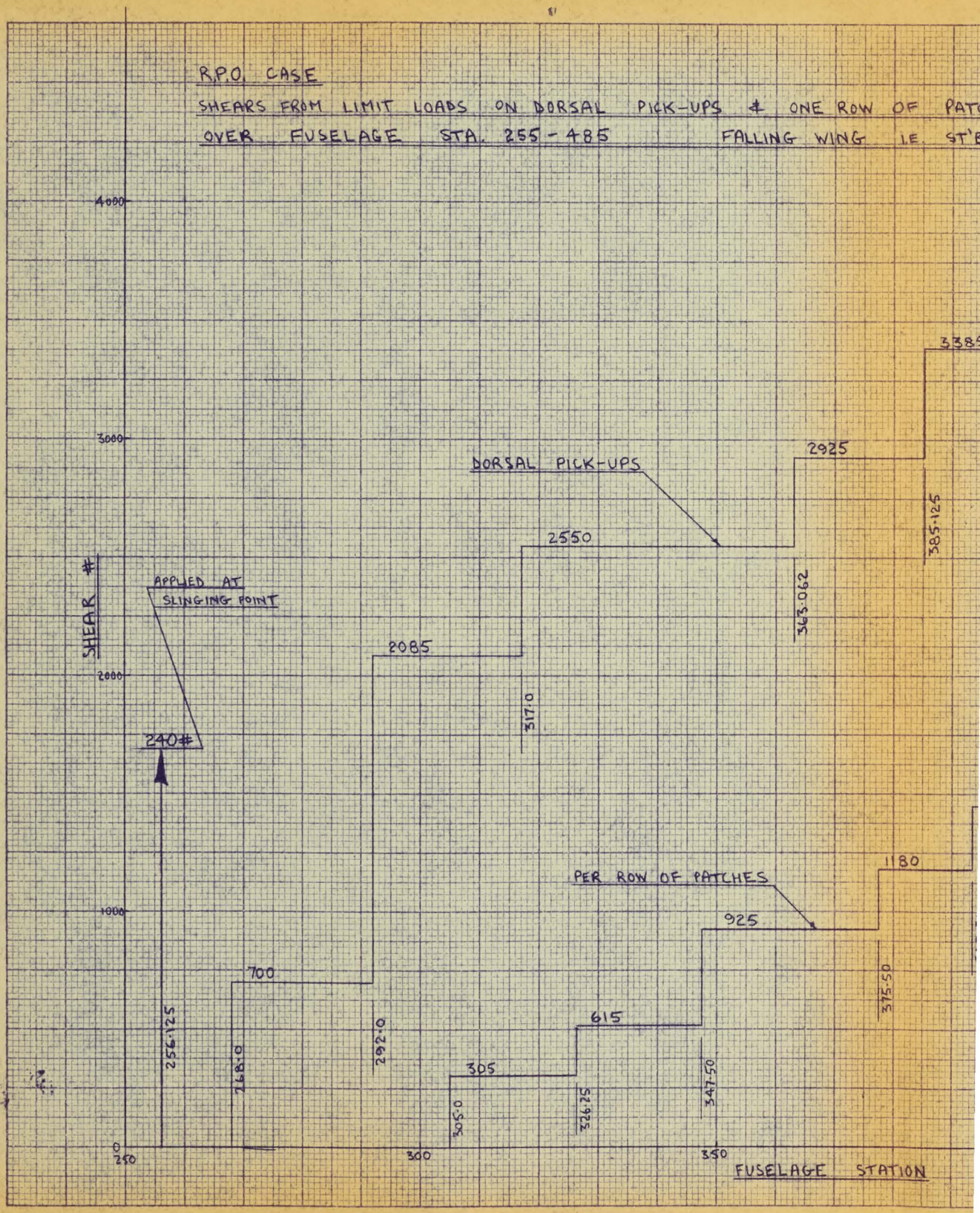


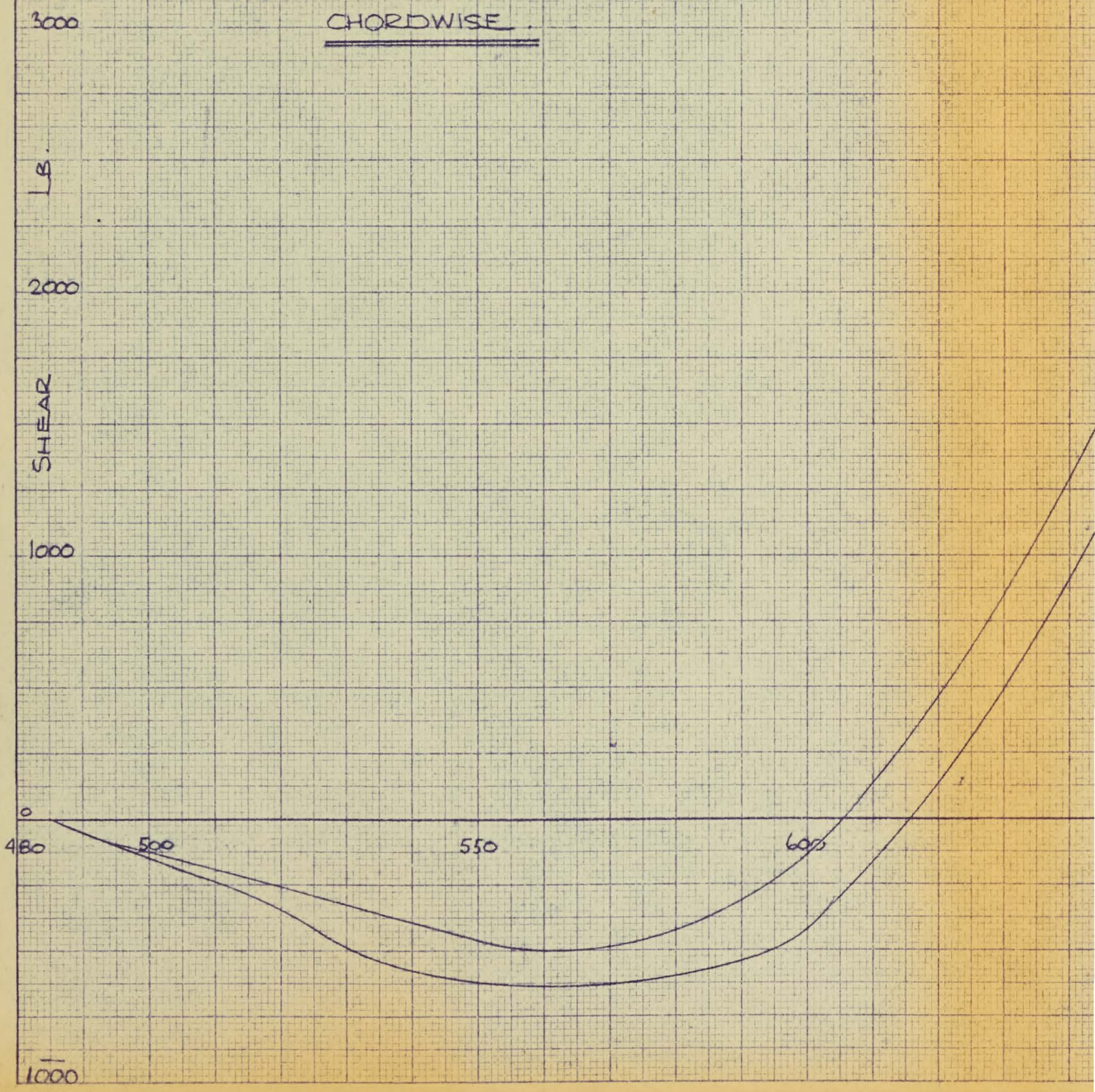


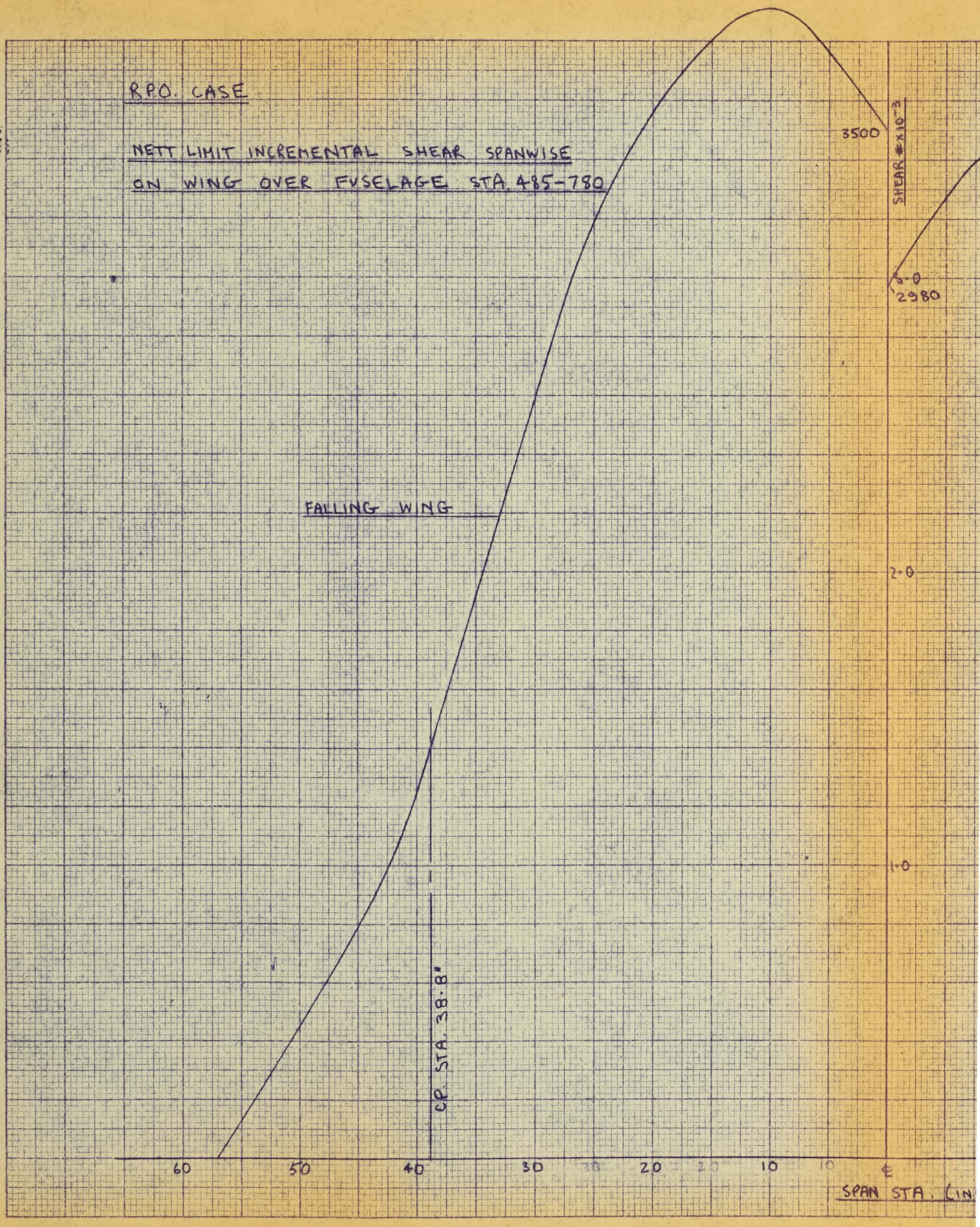

R.P.O. CASE
SHEARS FROM LIMIT LOADS ON DORSAL PICK-UPS & ONE ROW OF PAT
OVER FUSELAGE STA. 255 - 485 FALLING WING LE ST'
4000
3000
2000
1000
0
SHEAR #
APPLIED AT SLINGING POINT
240#
DORSAL PICK-UPS
2925
2550
2085
700
615
925
1180
PER ROW OF PATCHES
256.125
268.0
292.0
305
305.0
326.25
347.50
363.062
385.125
375.50
317.0
250
300
350
FUSELAGE STATION

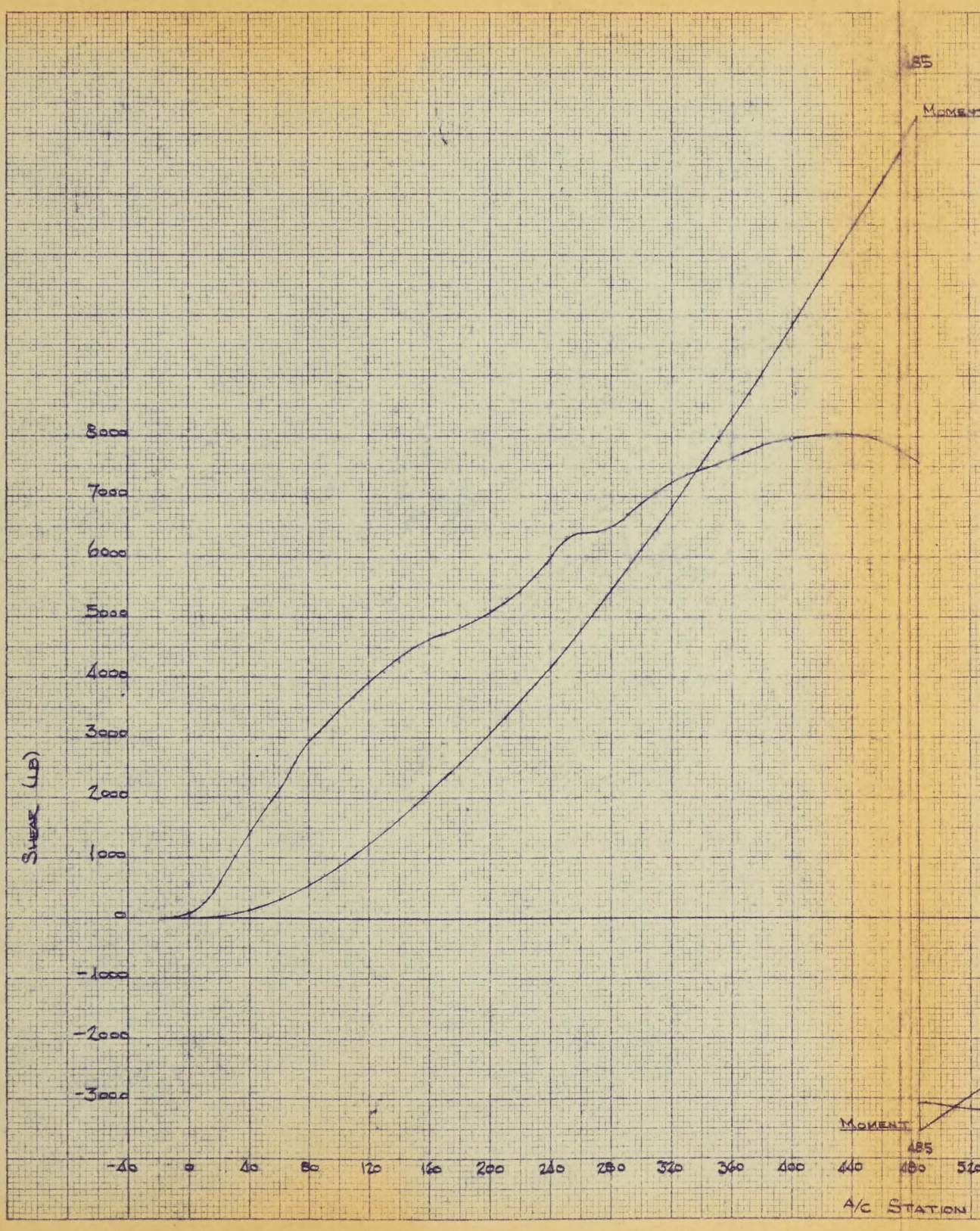
R.P.O. CASE

NETT LIMIT INCREMENTAL SHEAR (STNS. 485-780) ON WING

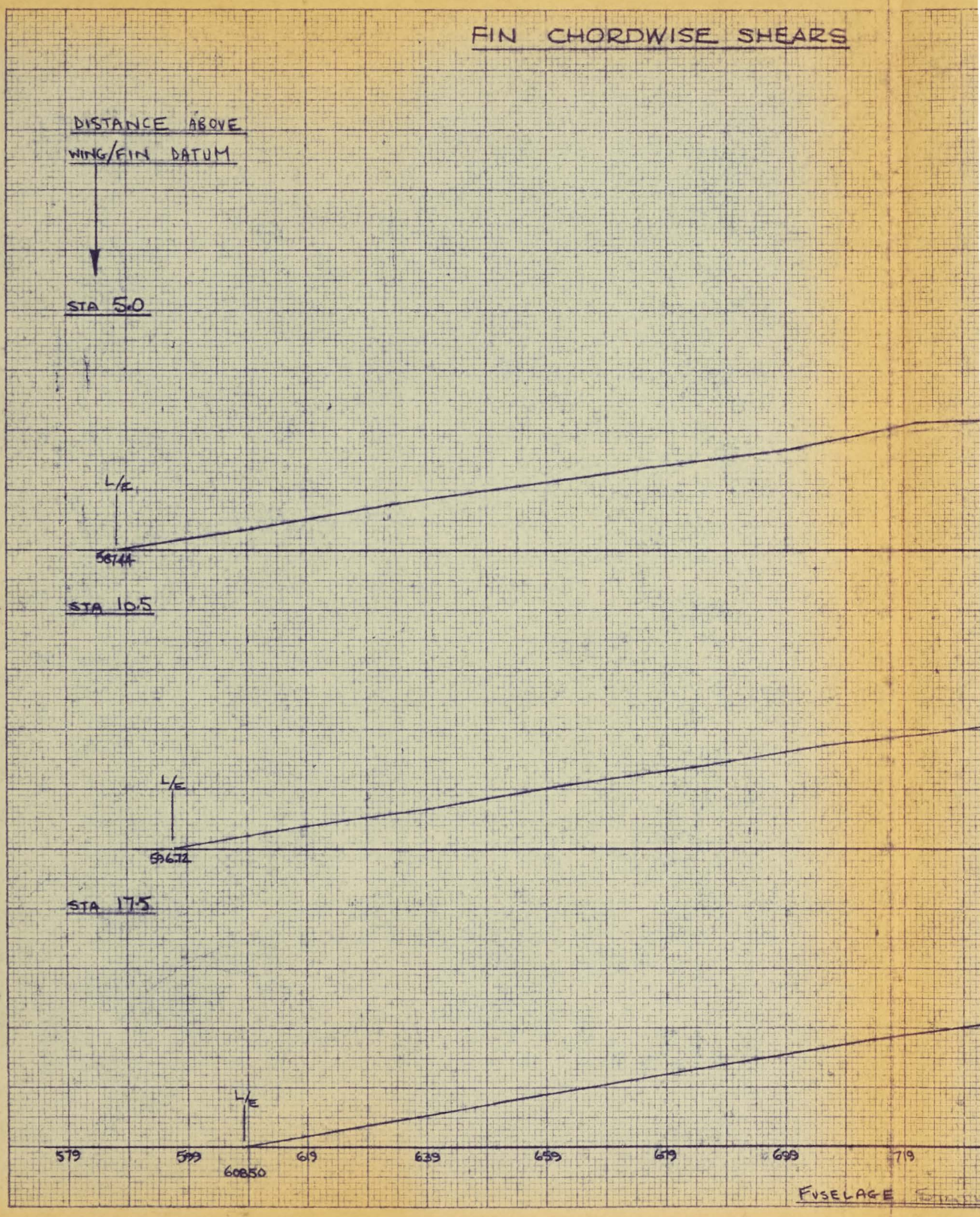
CHORDWISE.





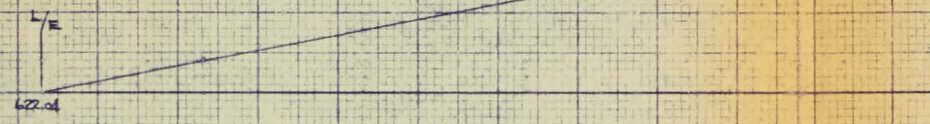


FIN CHORDWISE SHEARS

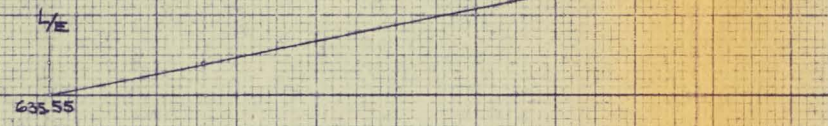


FIN CHORDWISE SHEARS

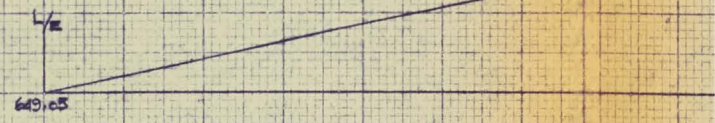
STA. 25.5



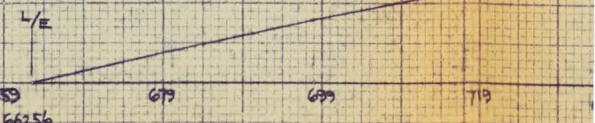
STA. 33.5



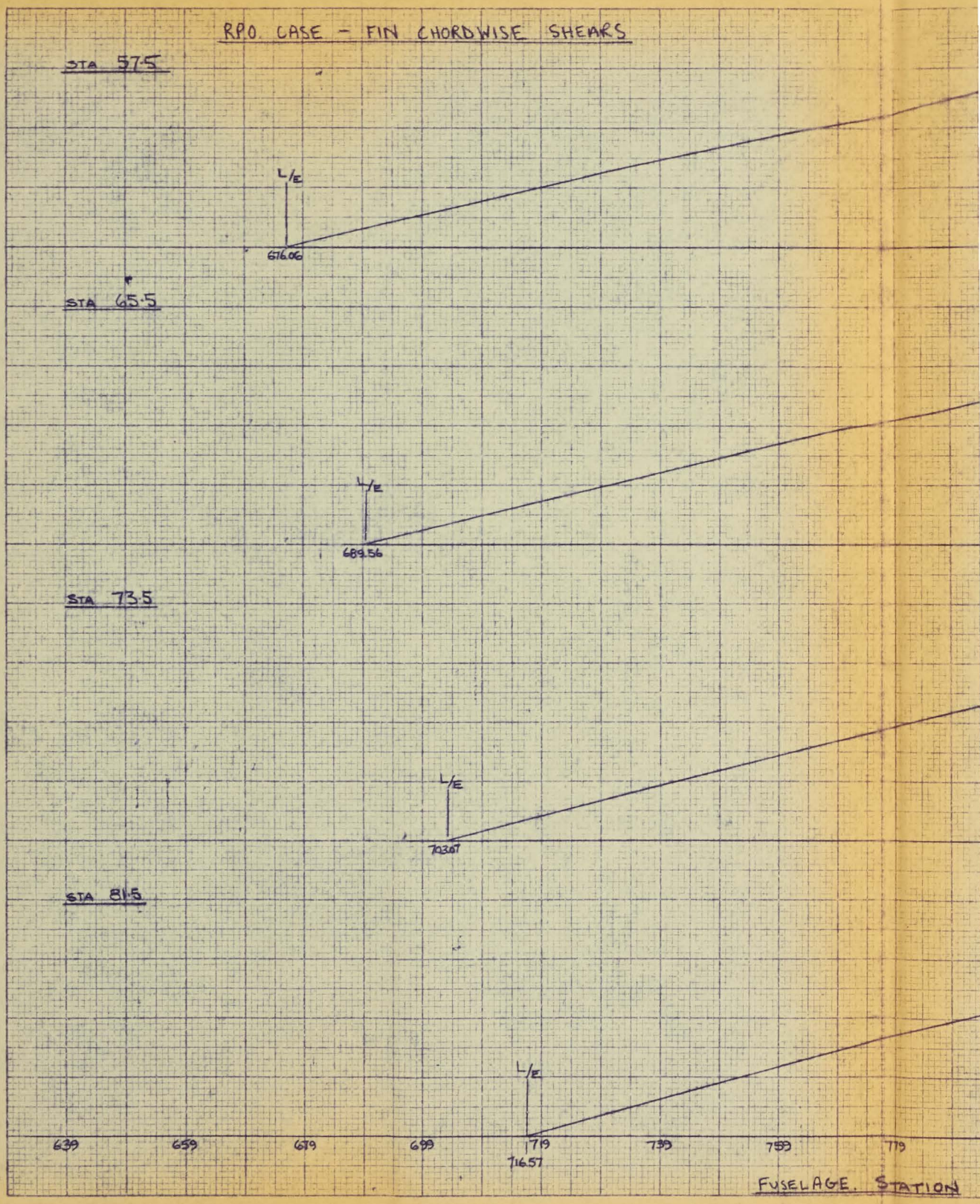
STA 41.5



STA 49.5



RPO. CASE - FIN CHORDWISE SHEARS



R.P.O. CASE – FIN CHORDWISE SHEARS

STA 121.5

STA 129.5

STA 137.5

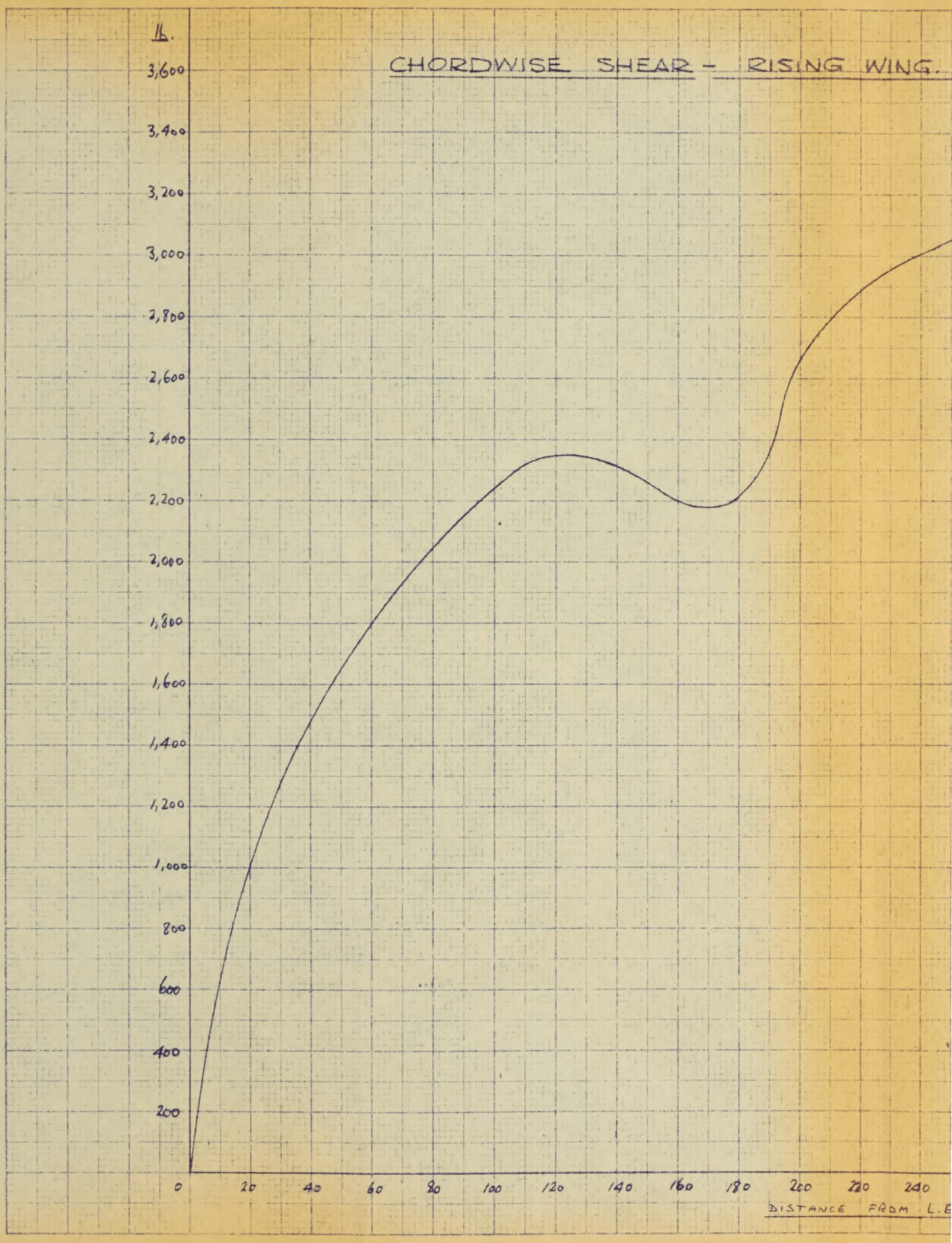
STA 142.5

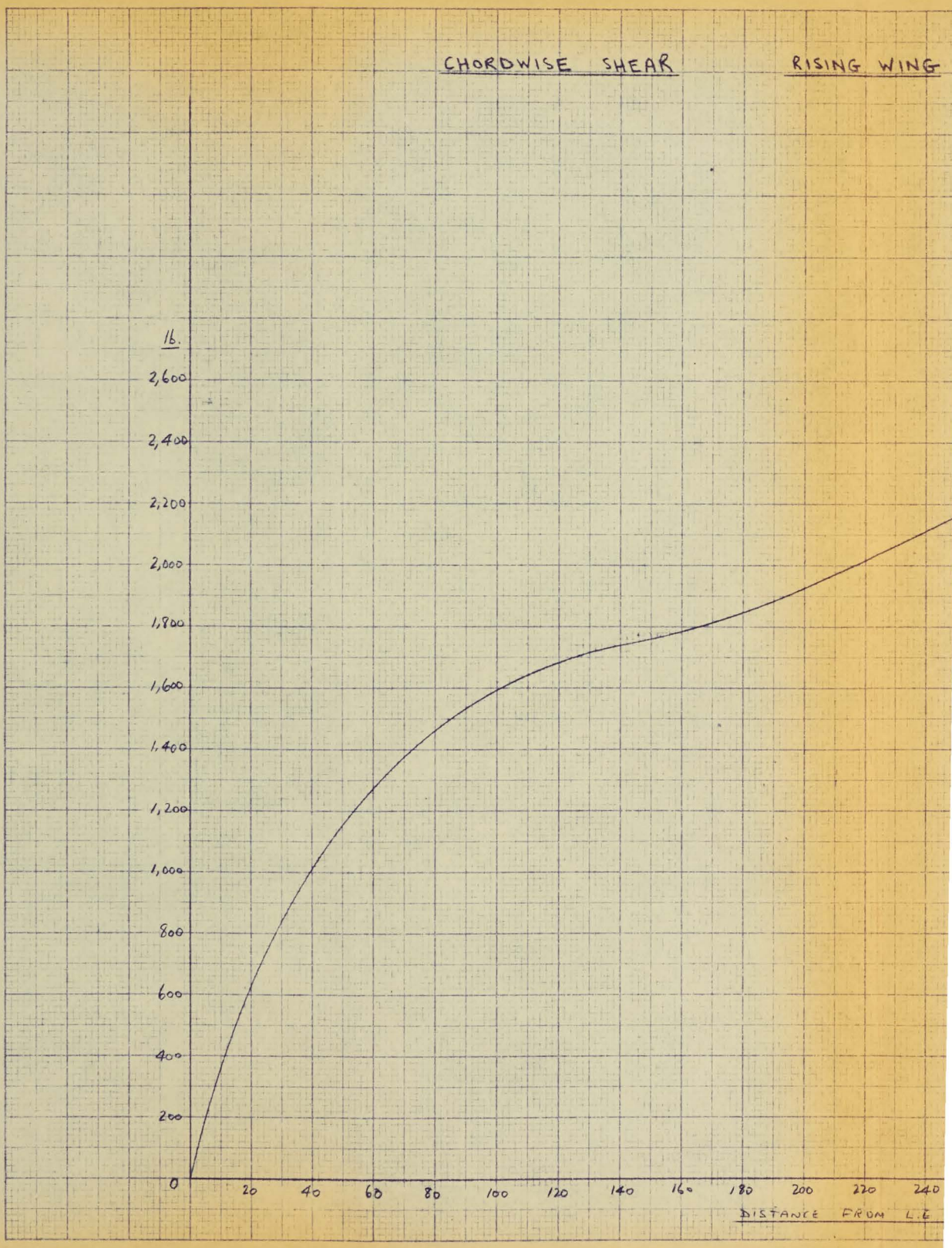
L/E

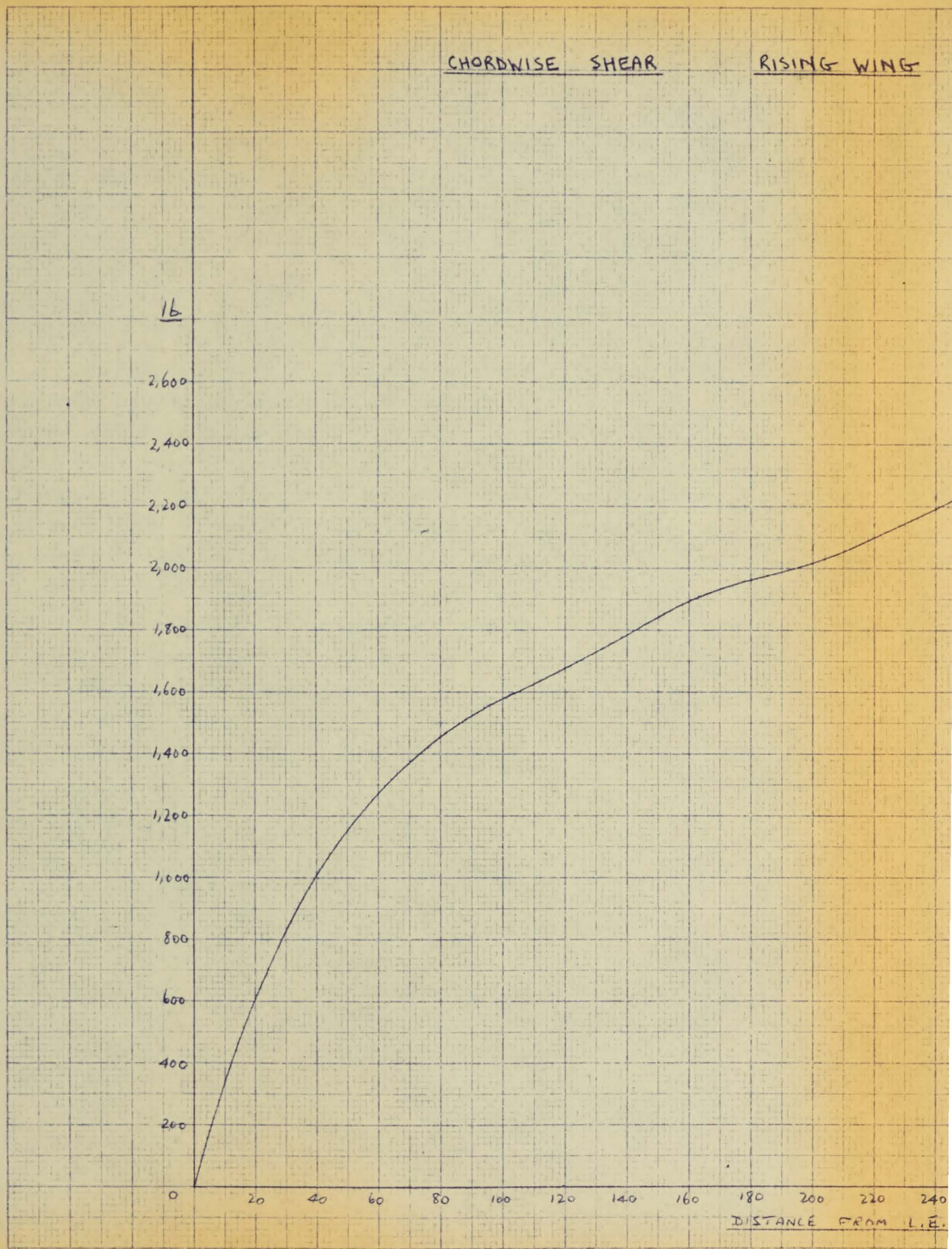
784.09

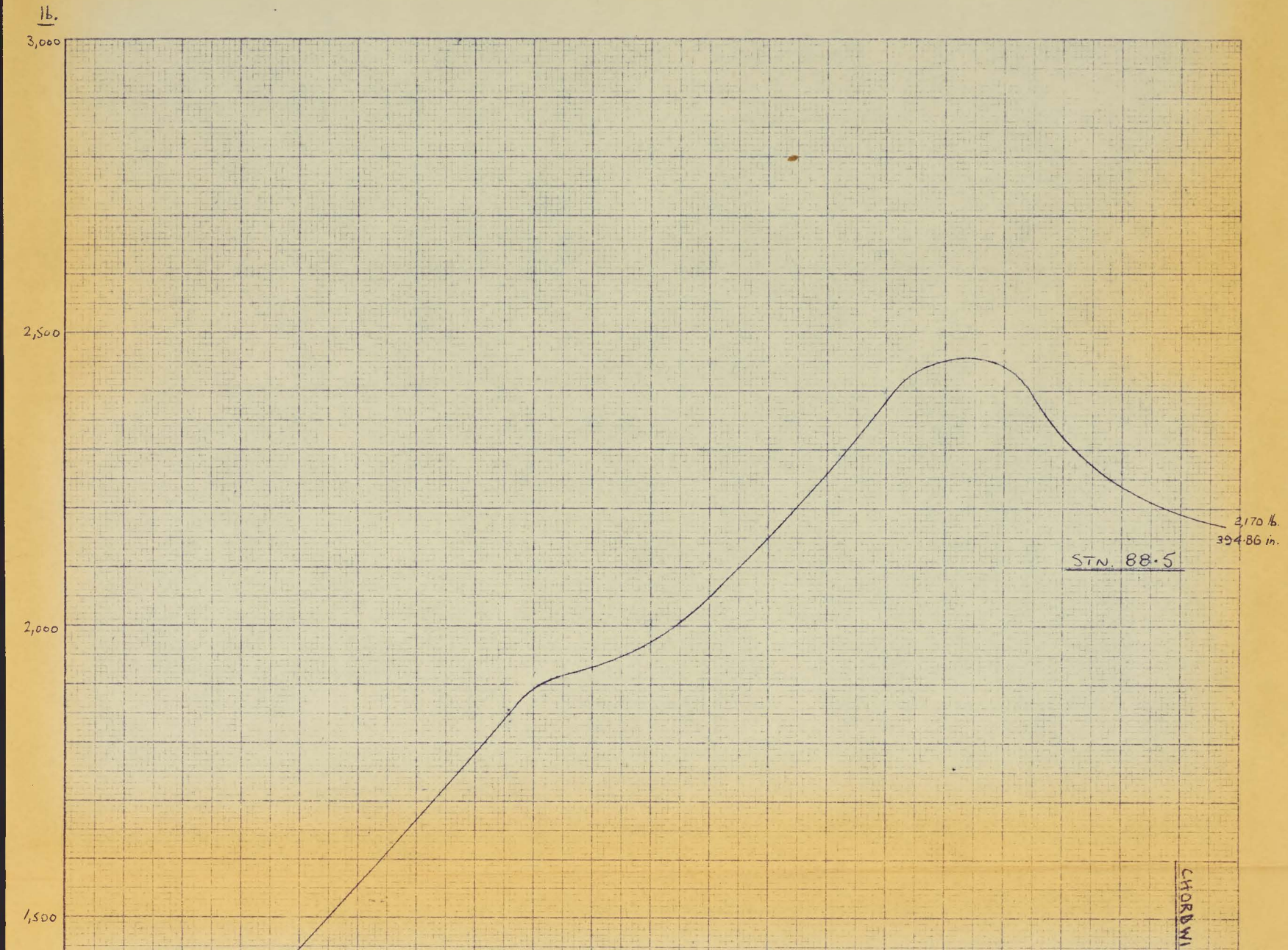
639 679 719 759 779

FUSELAGE STATION









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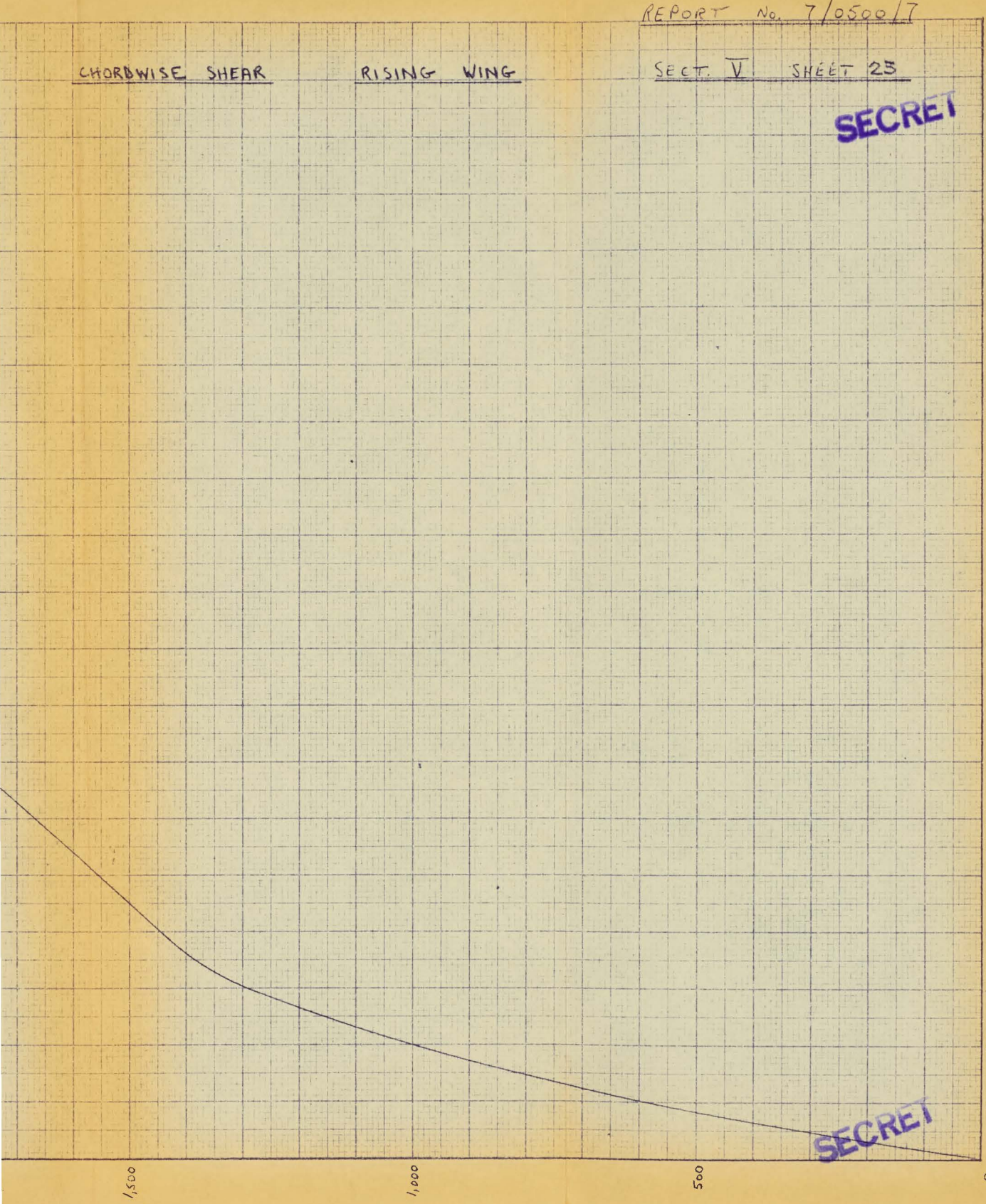
CHORDWISE SHEAR RISING WING

SECT. V SHEET 25

SECRET



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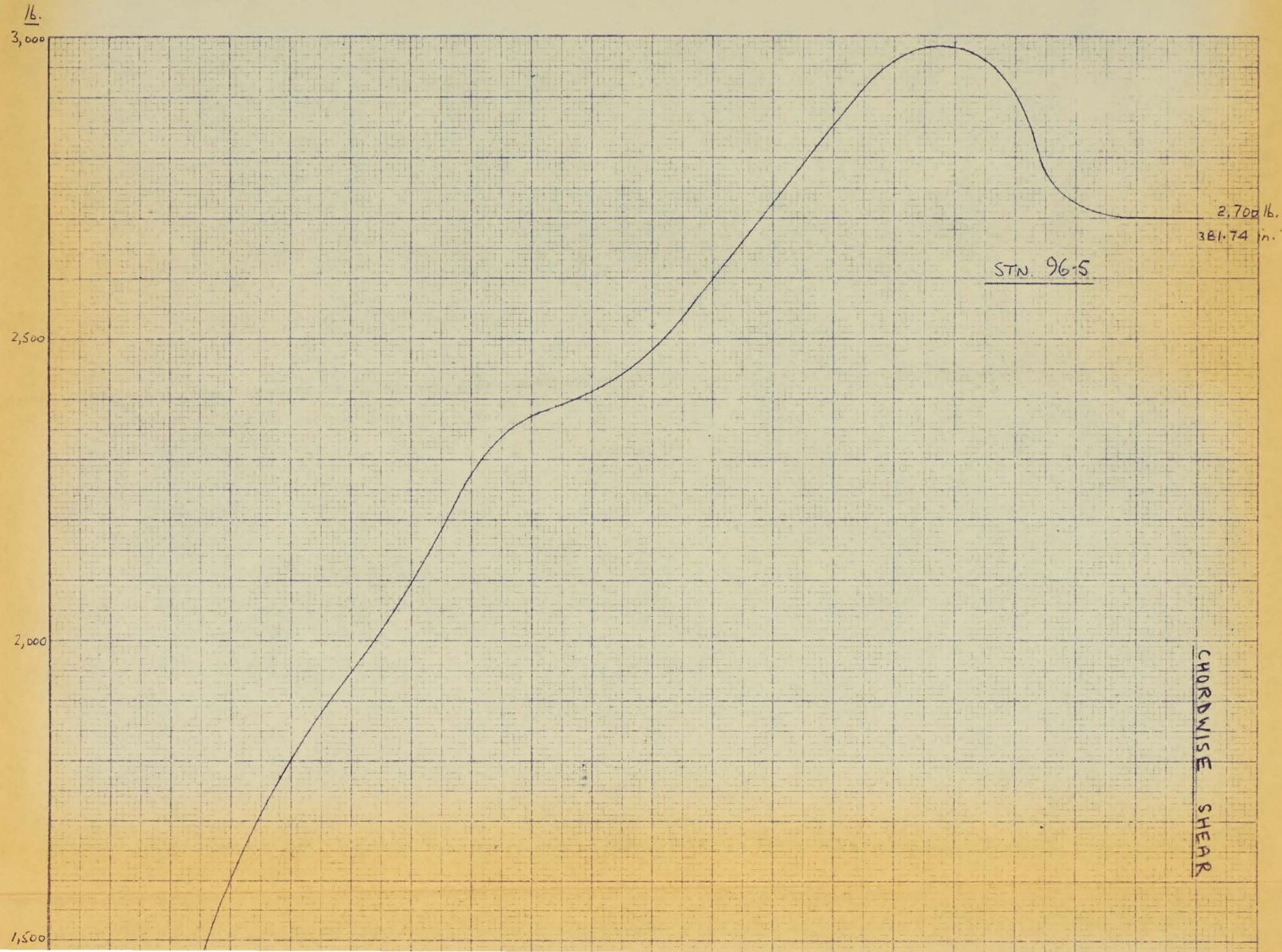


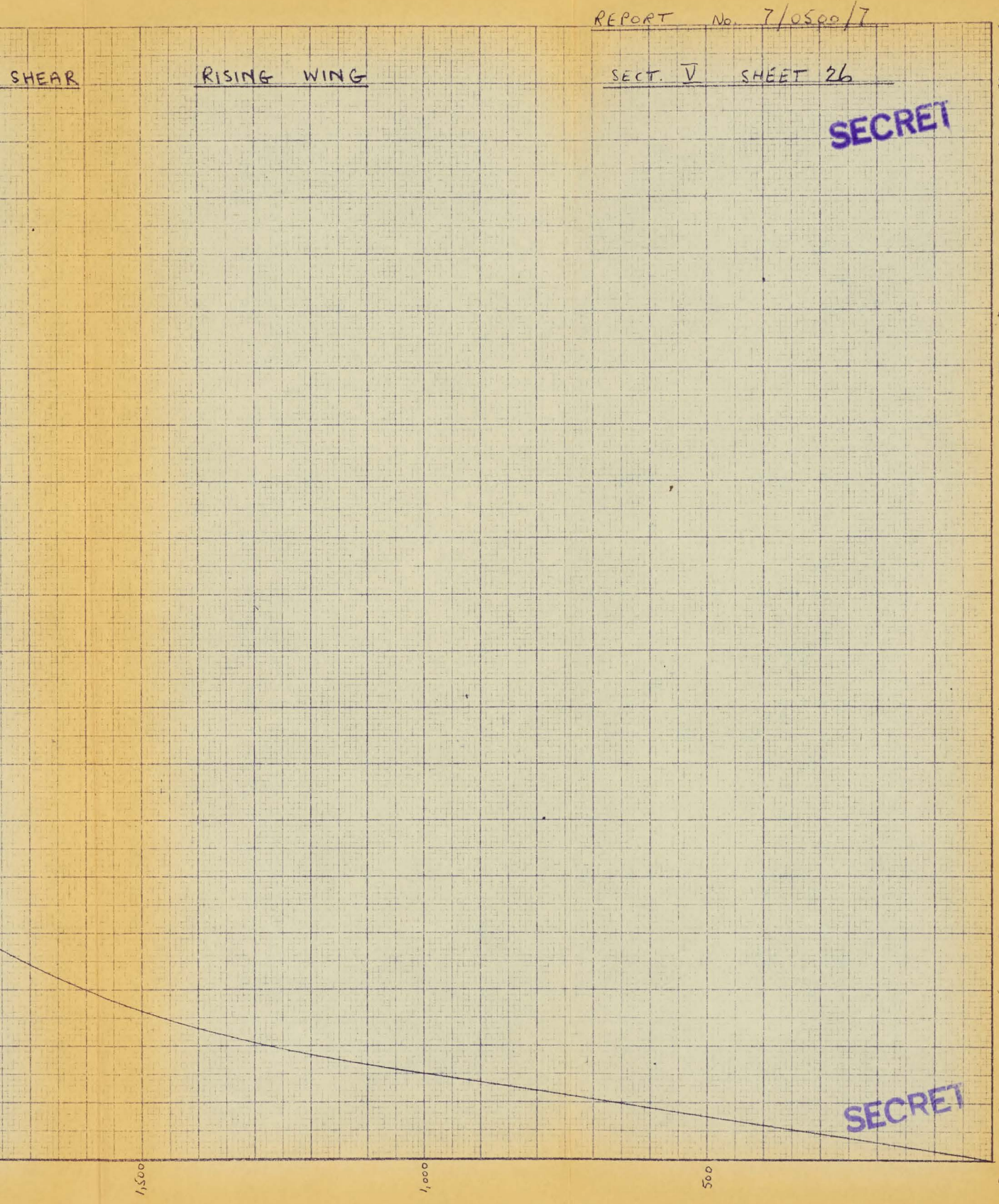
REPORT No. 7/0500/17

SHEAR

RISING WING

SECT. V SHEET 26

SECRET



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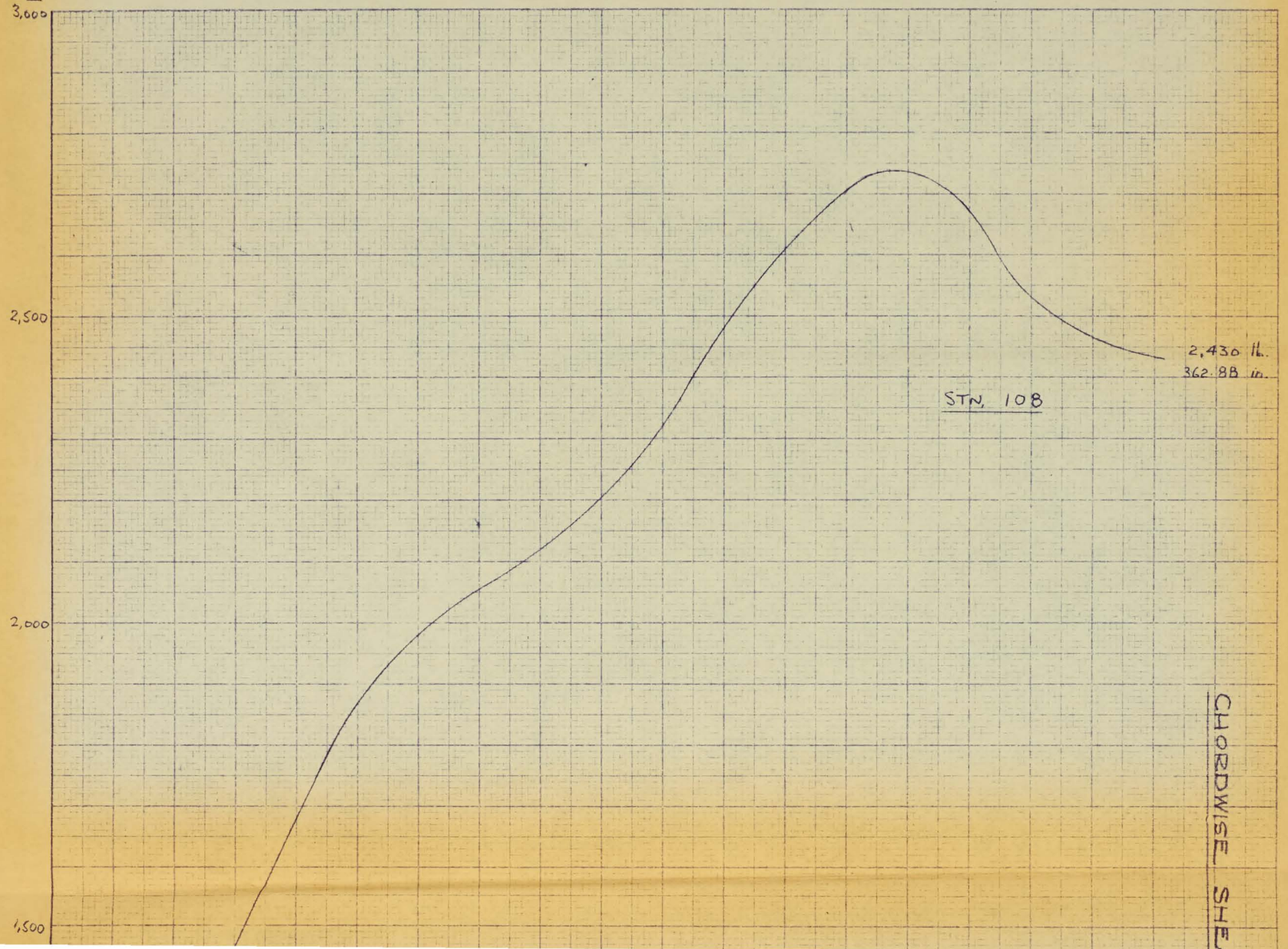
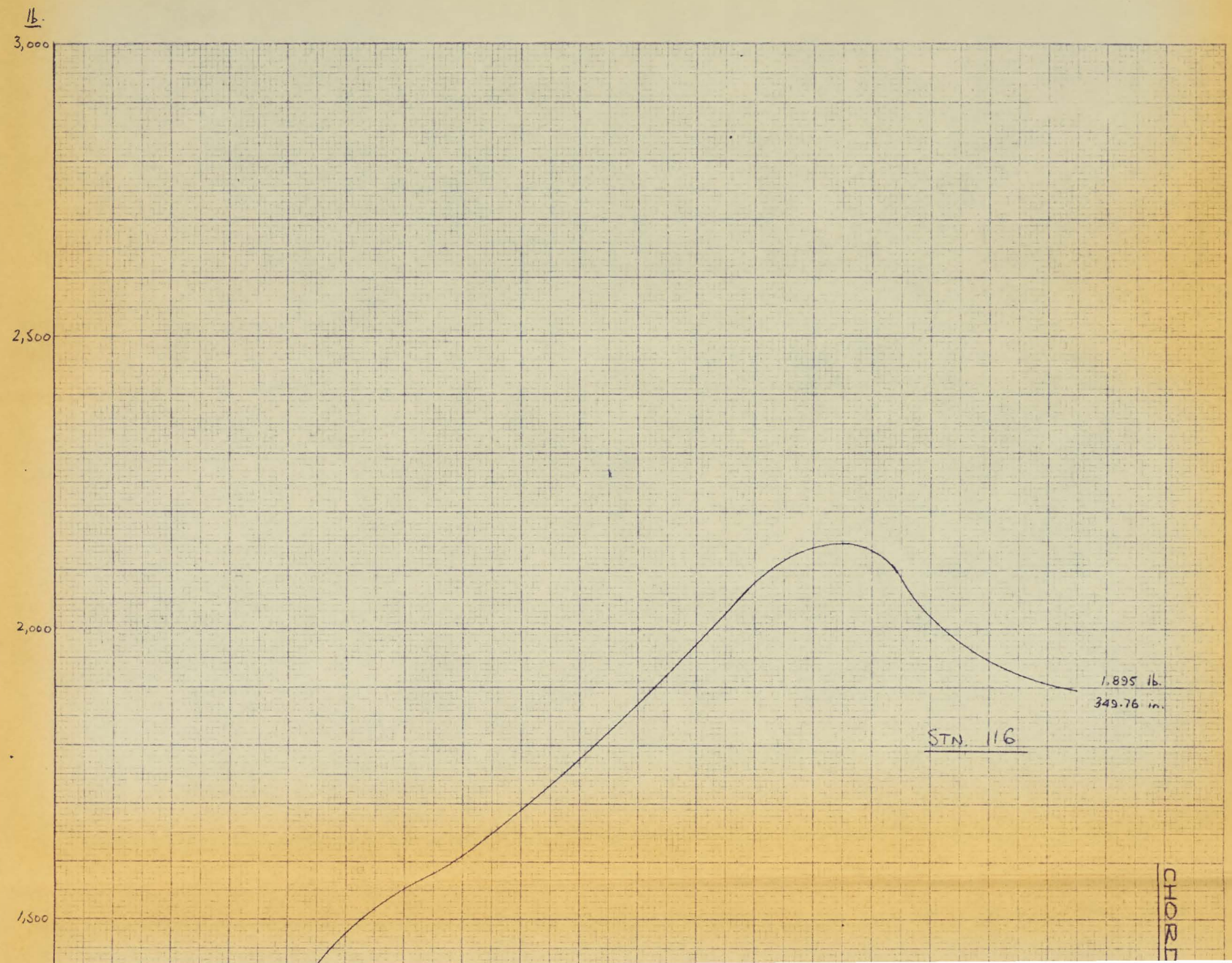
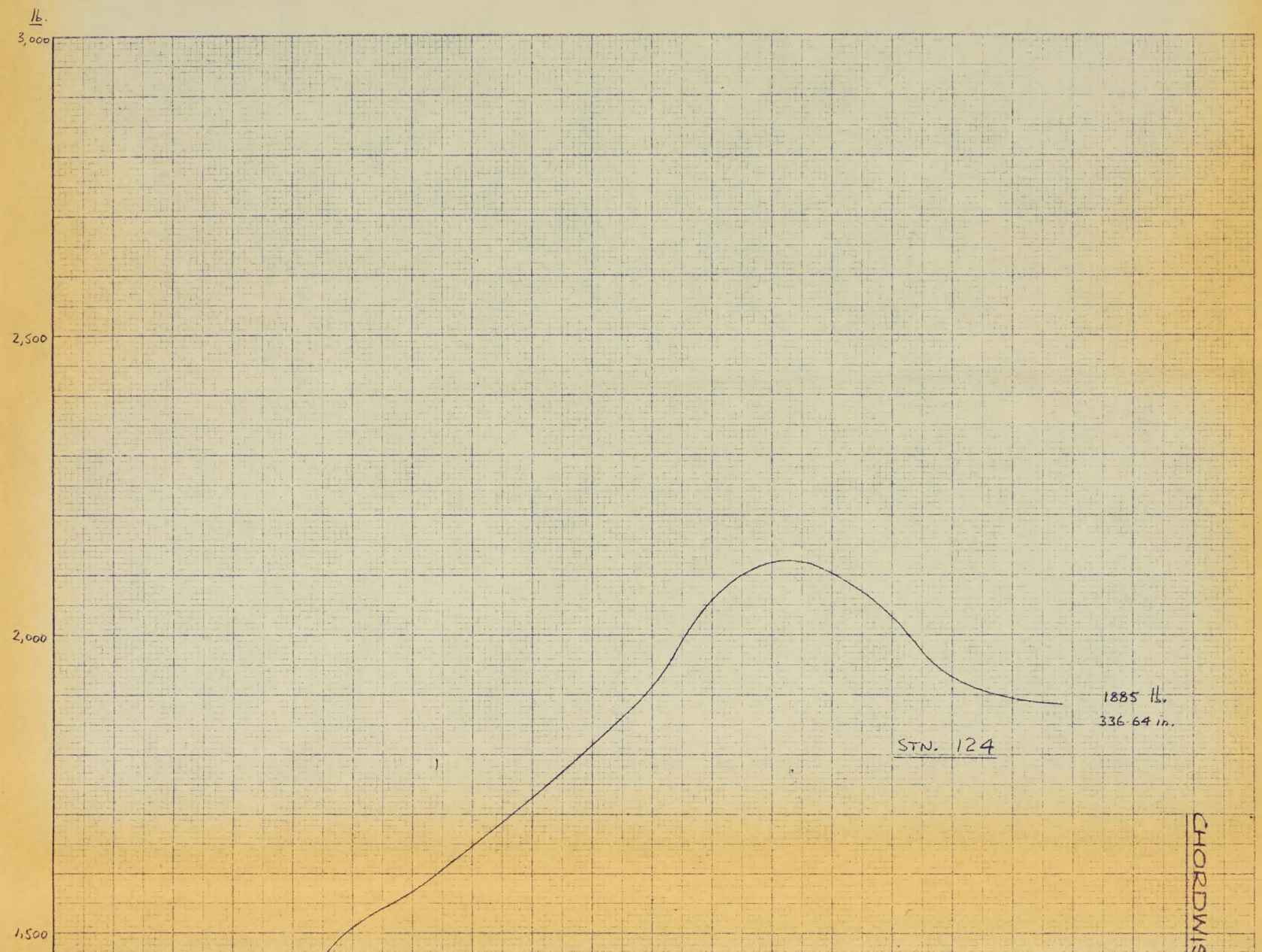
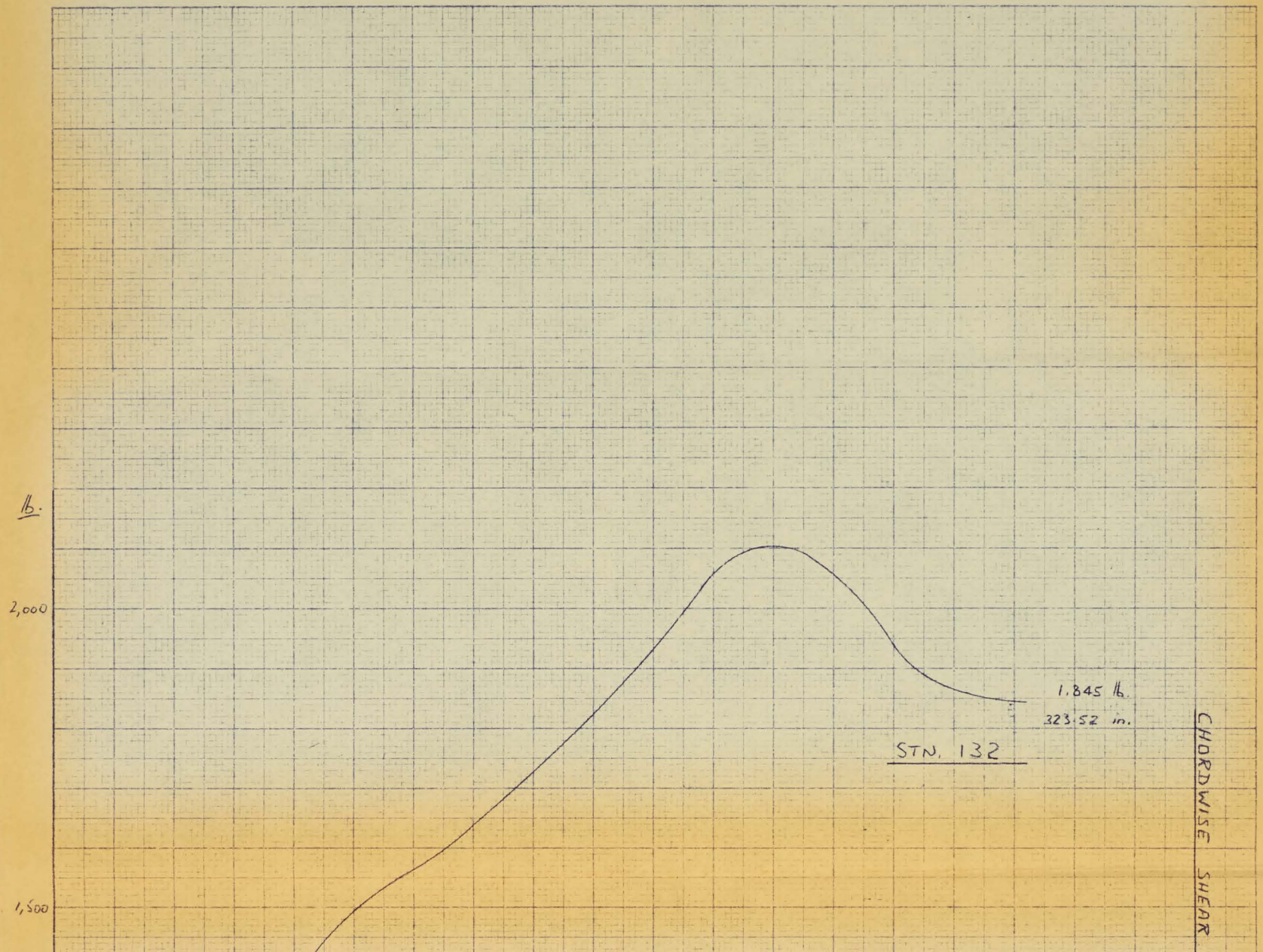
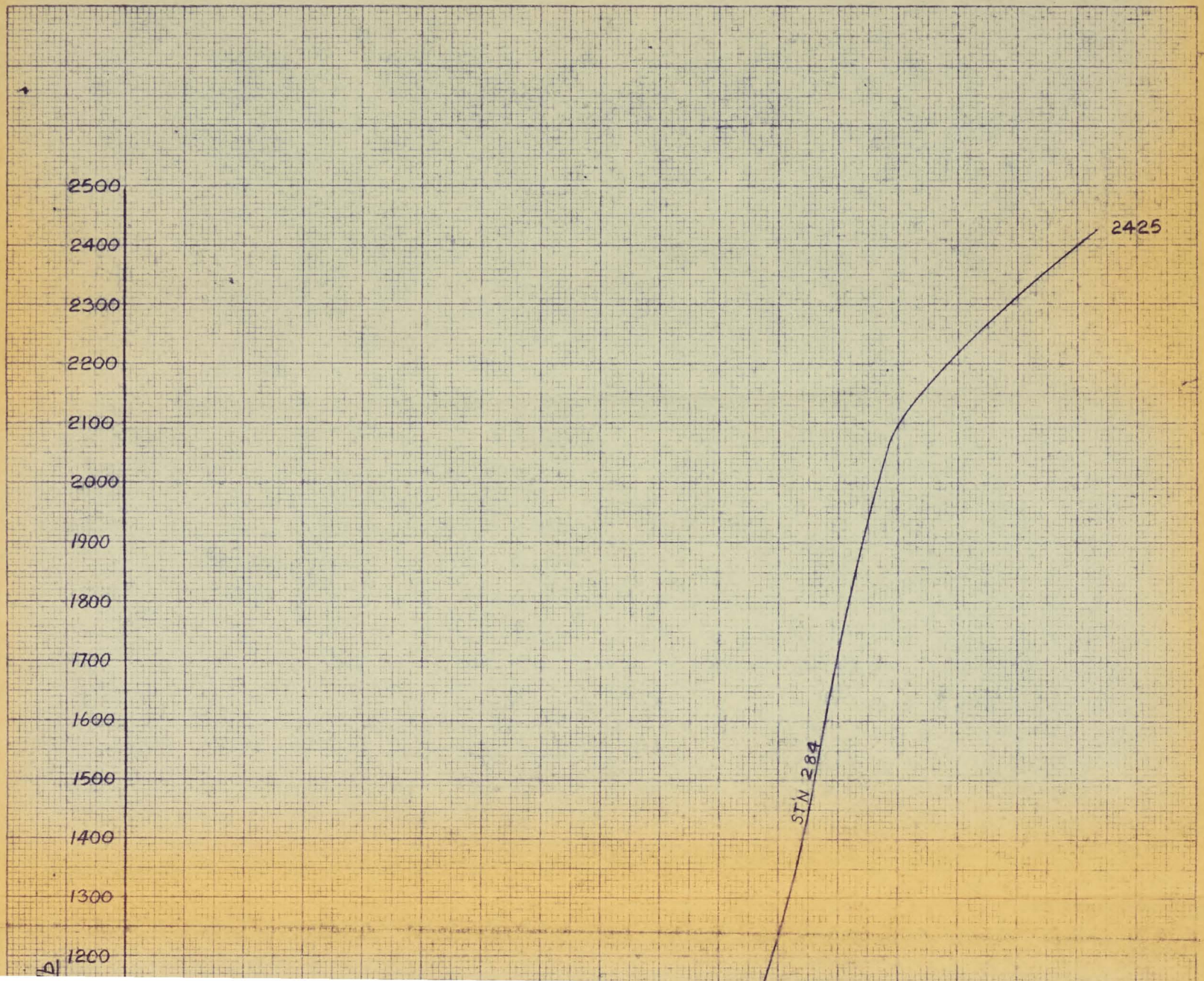




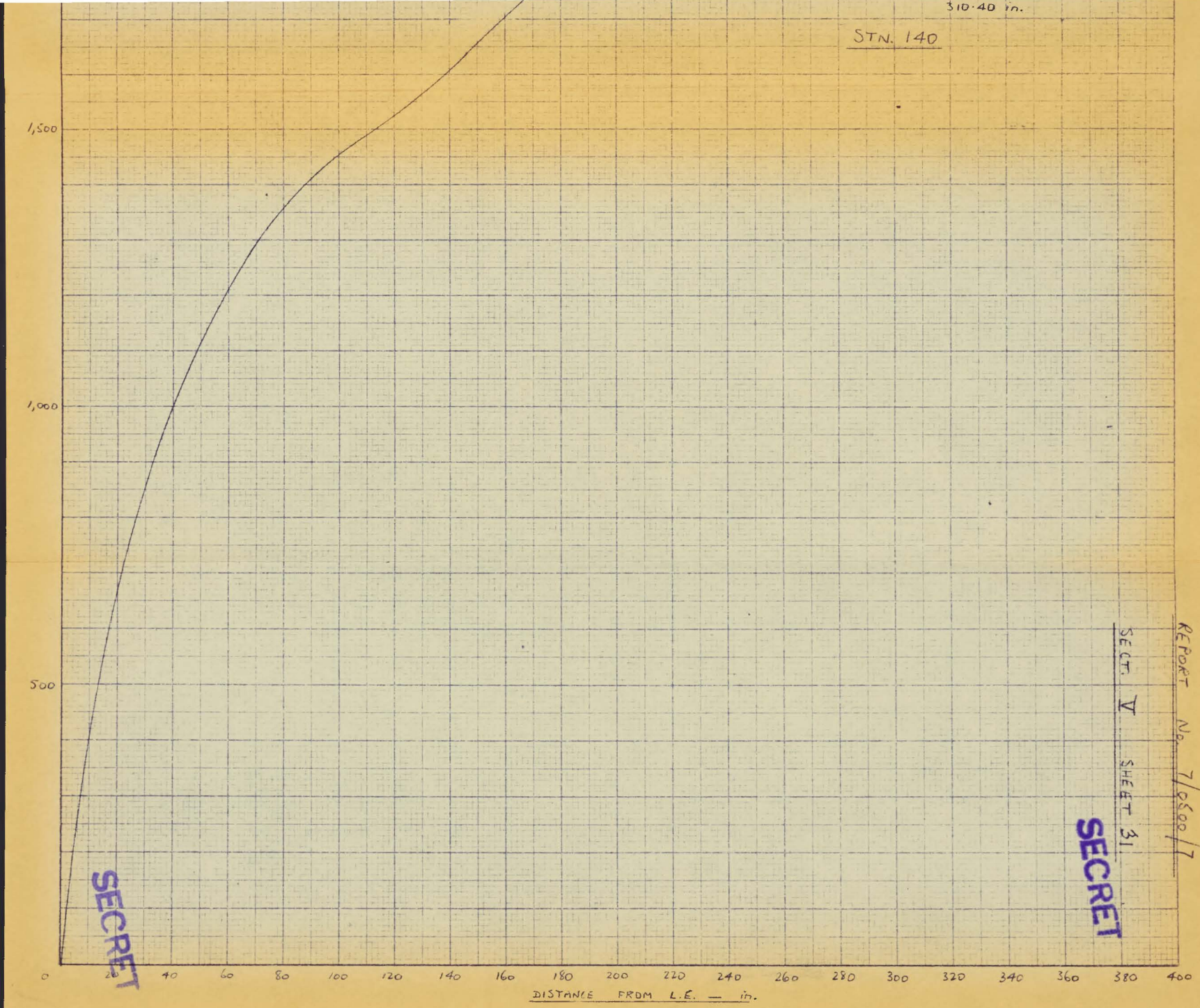






310·40 in.

STN. 140



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SECT. V SHEET 31.

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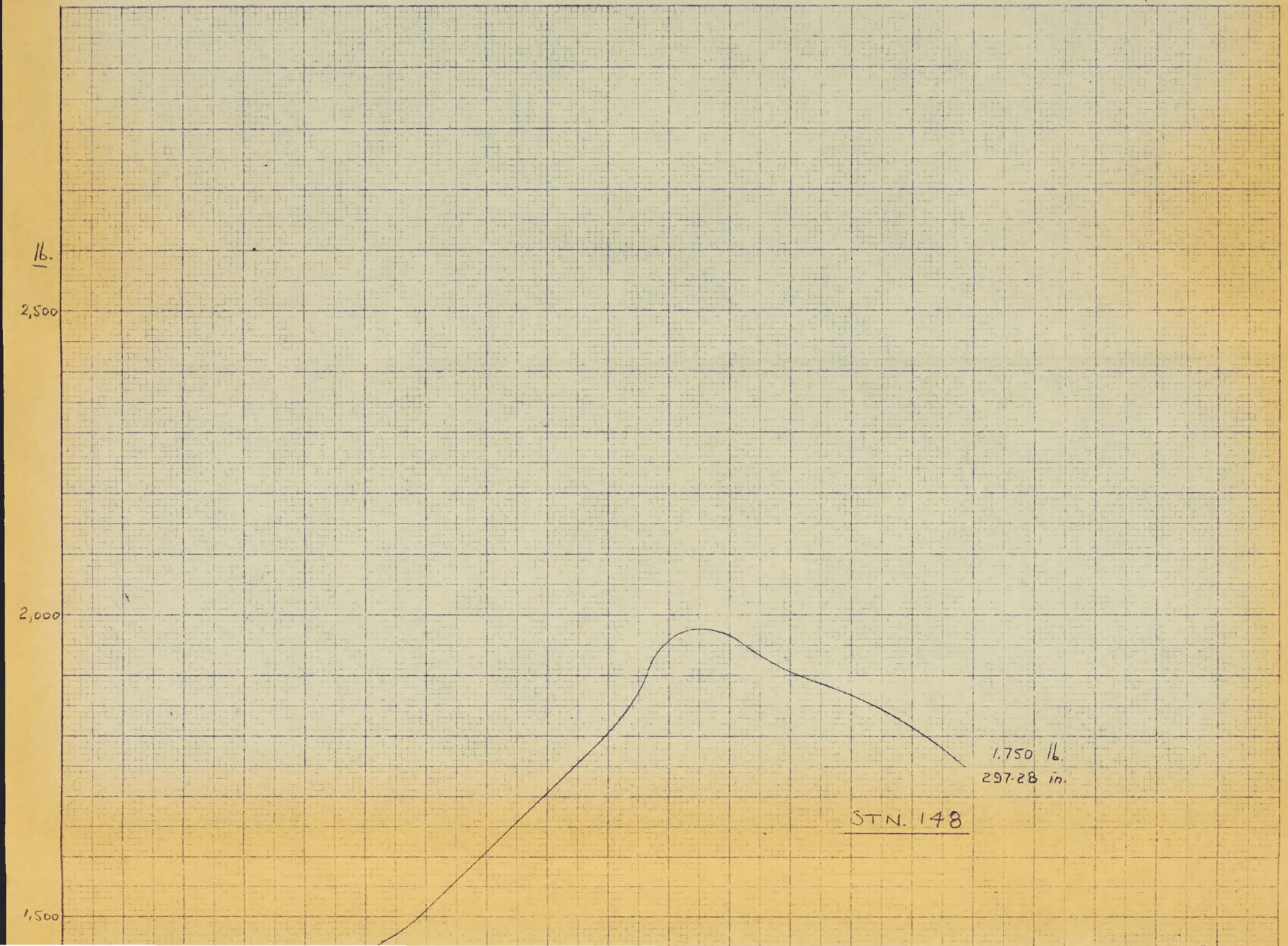

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29.28 in.

STN. 148

400 380 360 340 320 300 280 260 240 220 200 180 160 140 120 100 80 60 40 20

DISTANCE FROM L.E. — ins.

1,500 1,000 500 0

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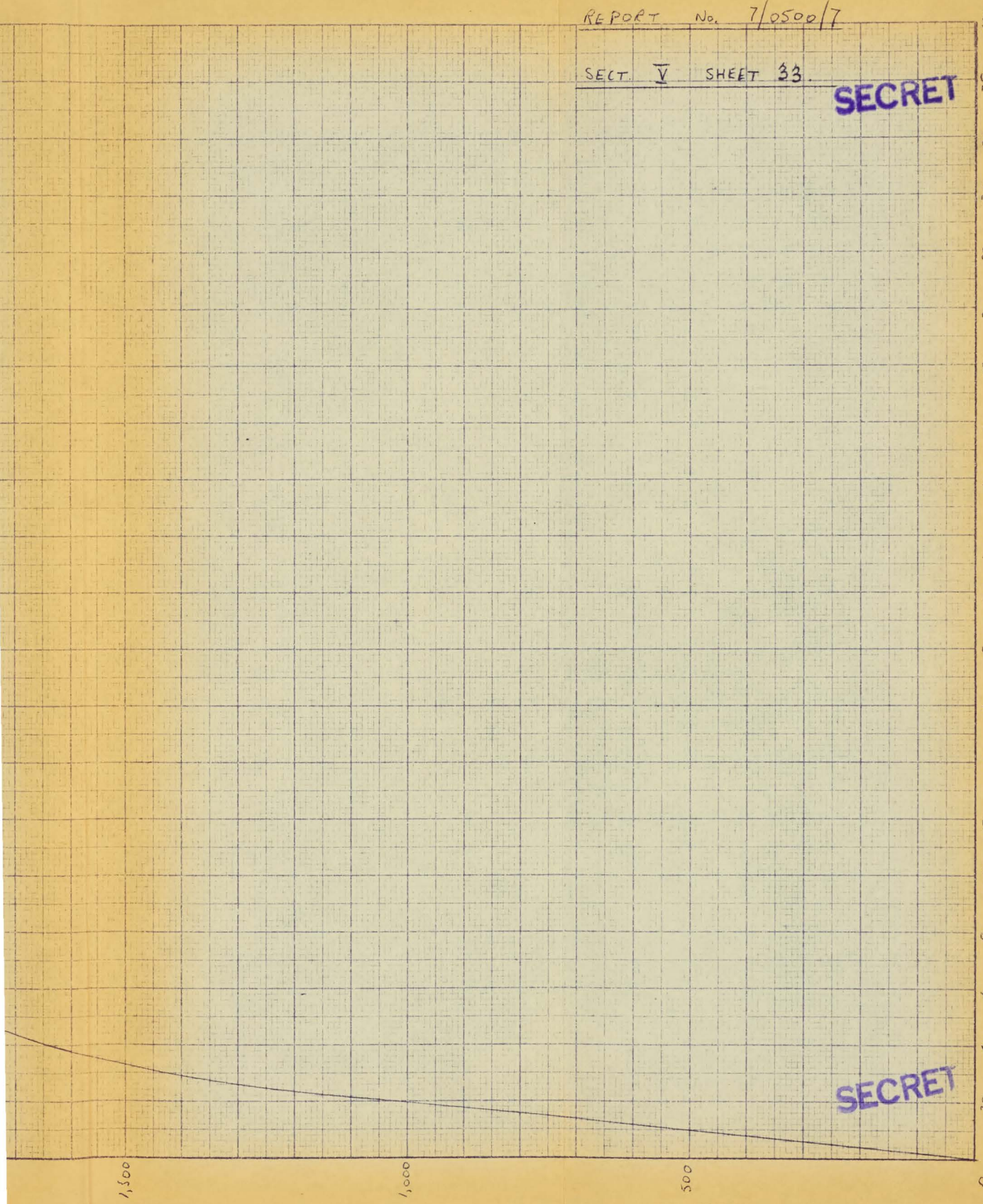
SECT. V SHEET 33.

SECRET



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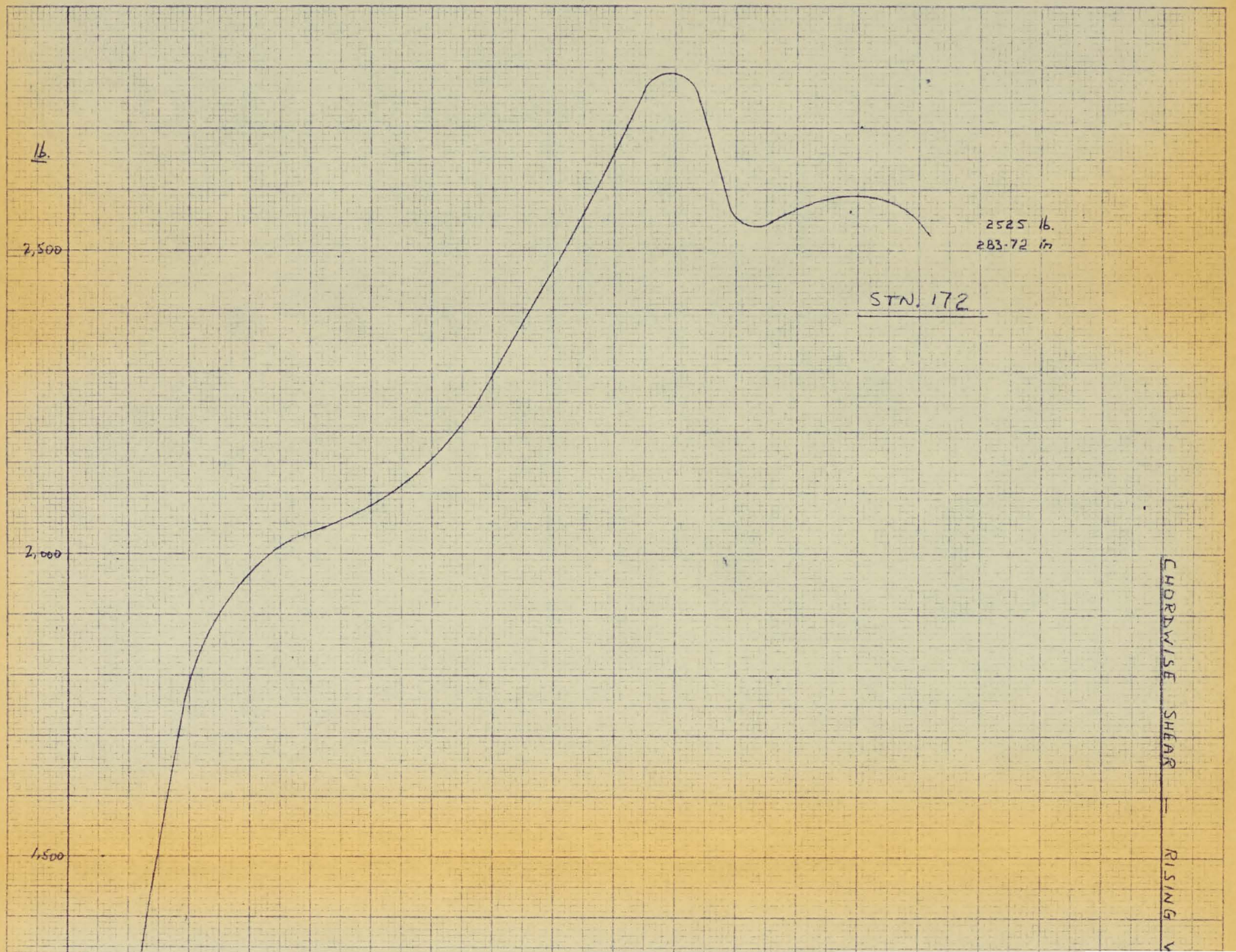
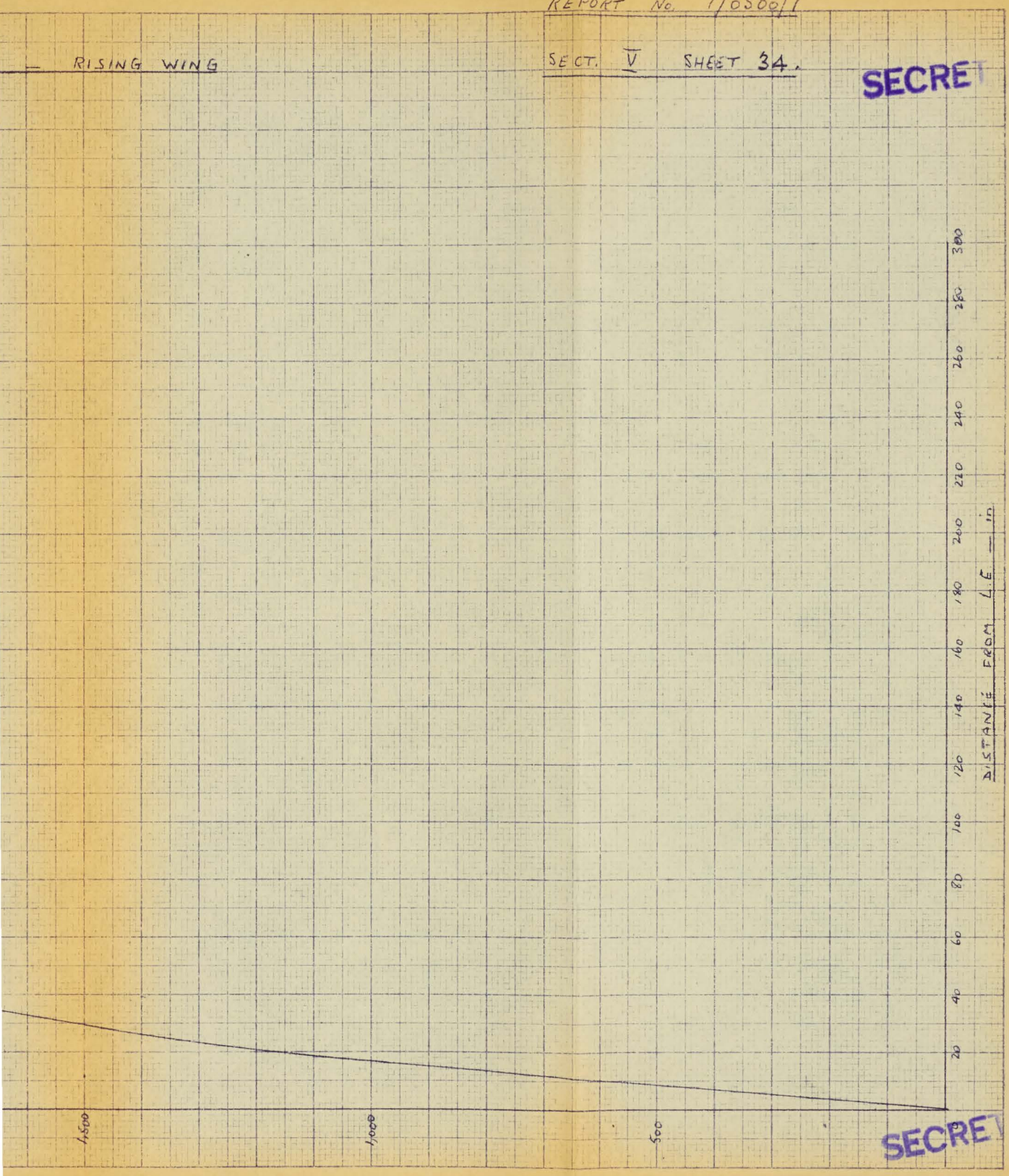
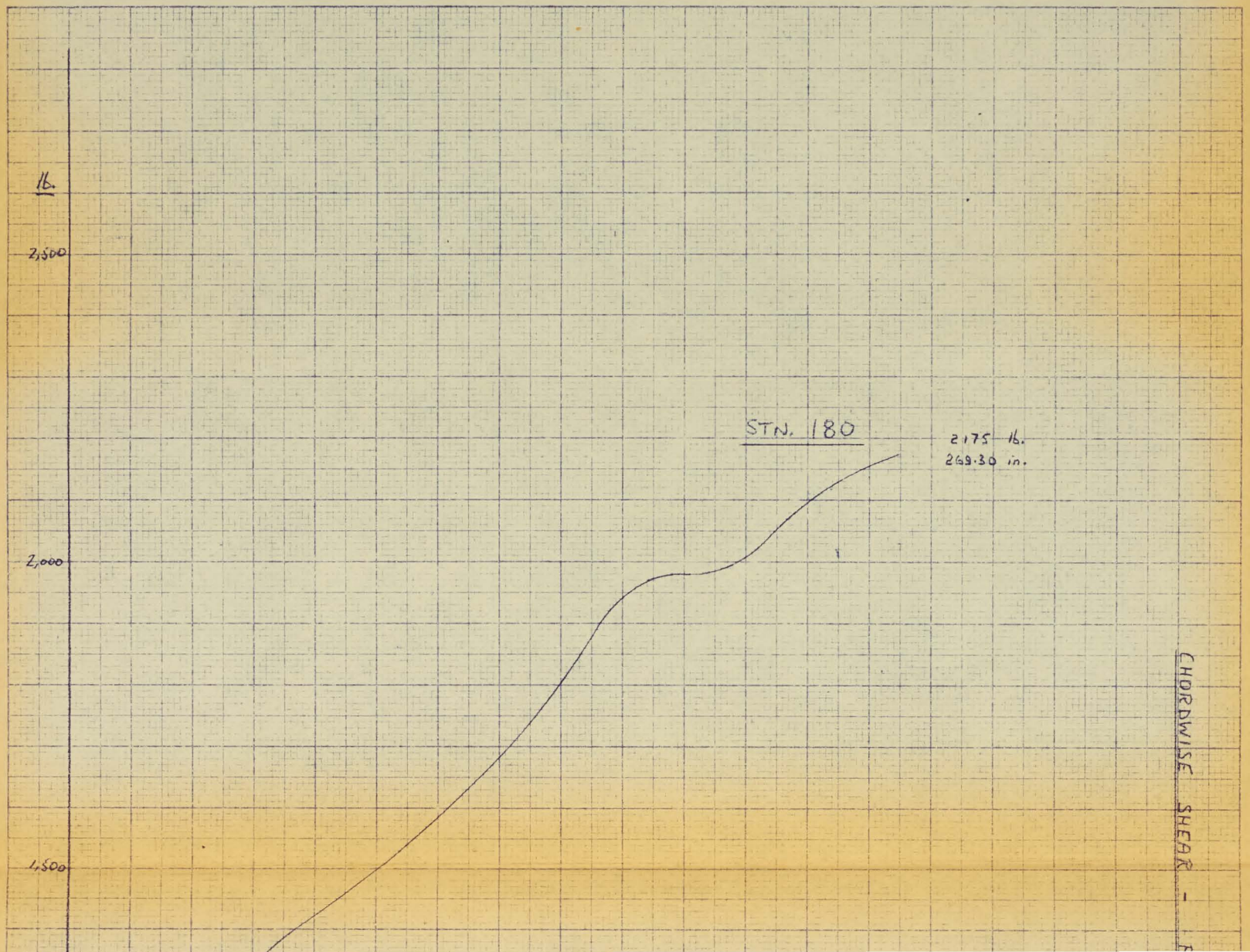
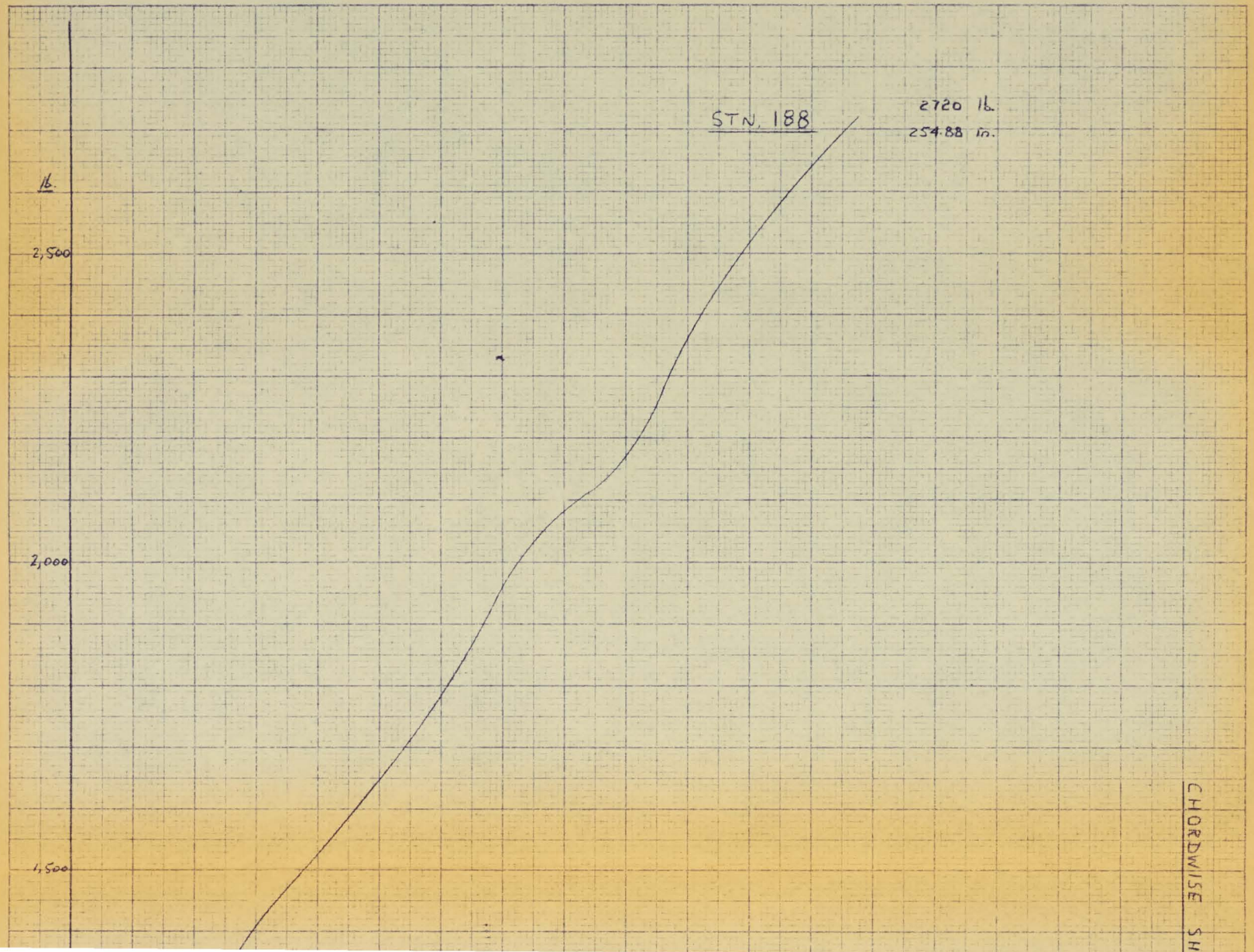
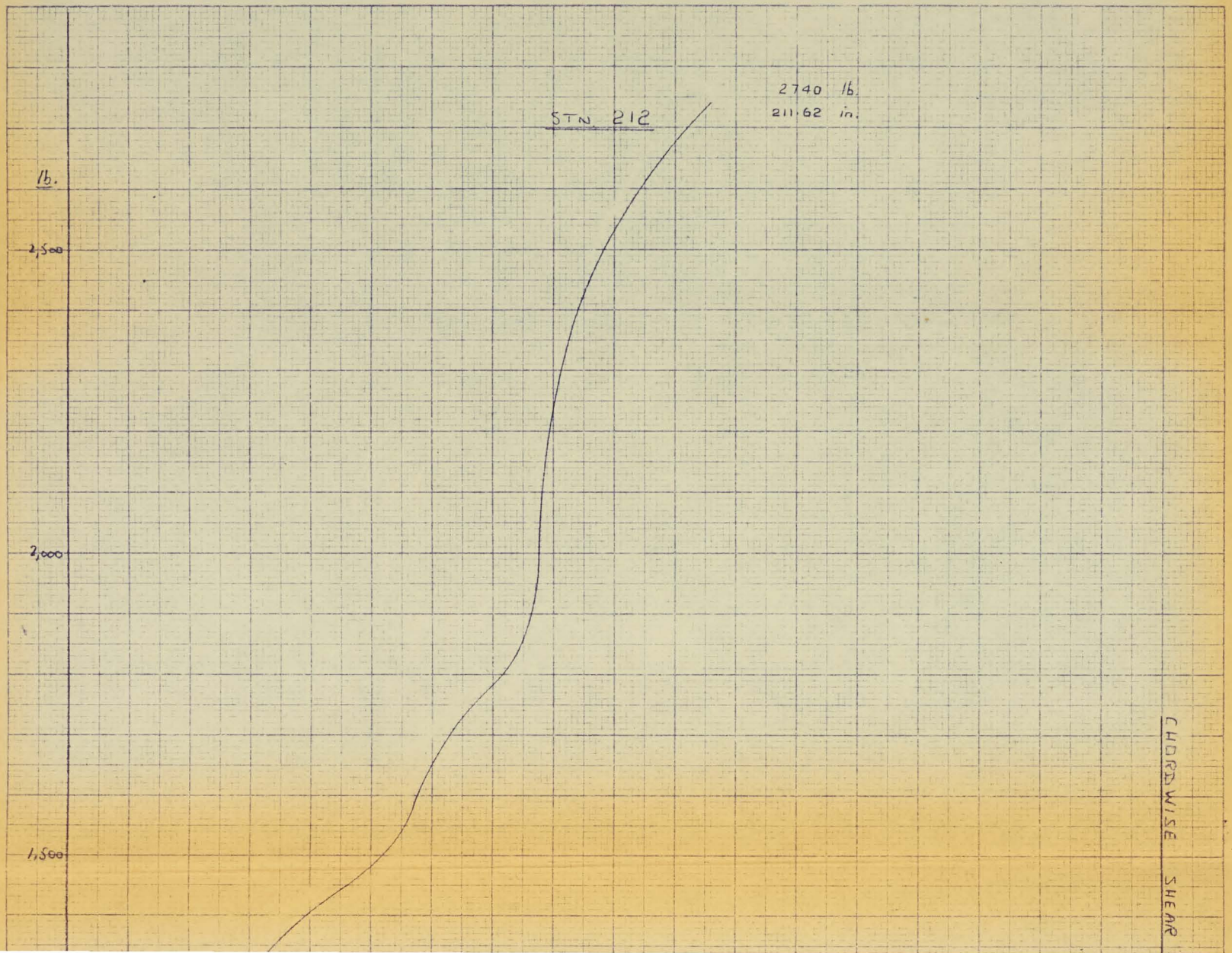


RISING WING

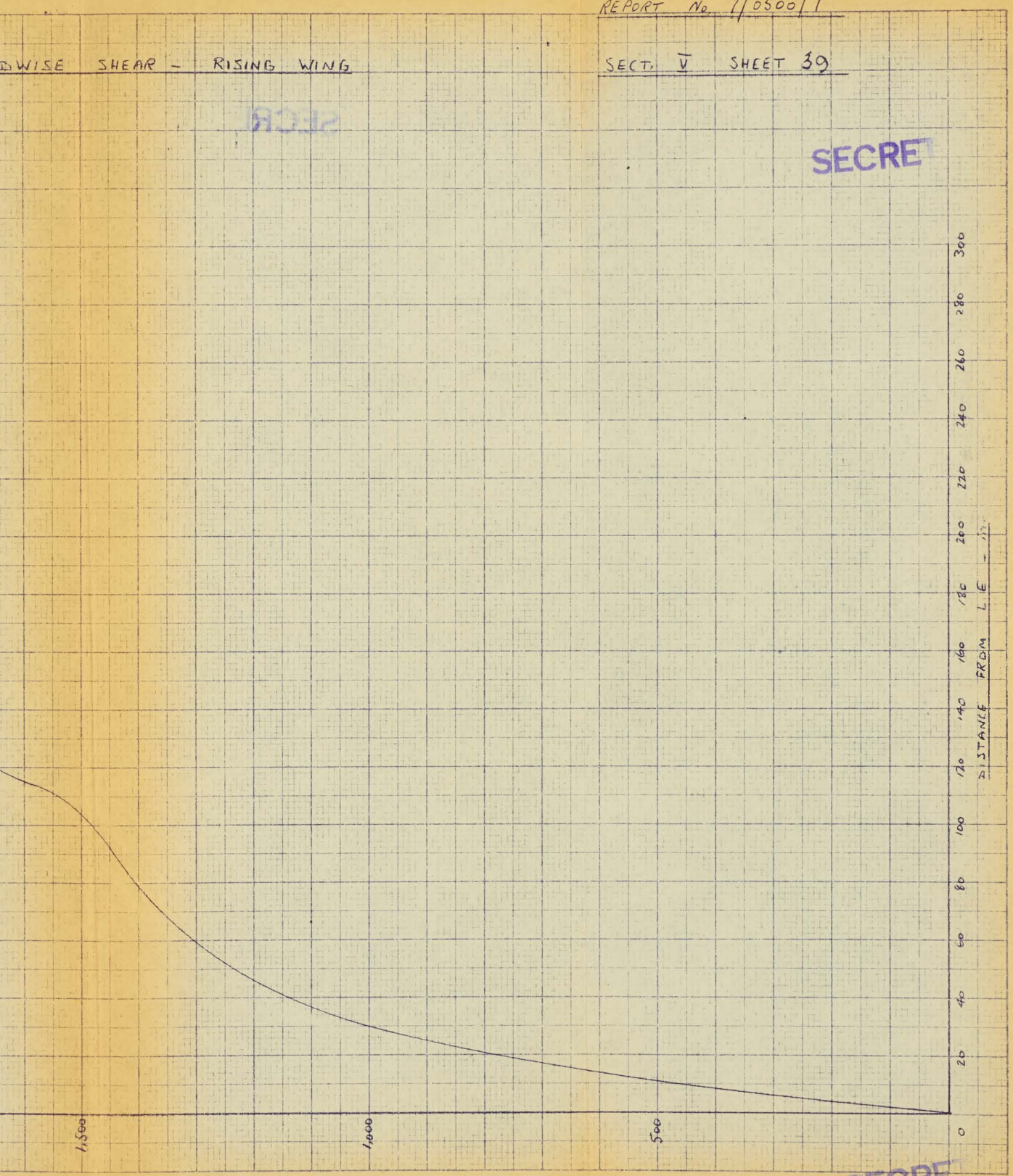


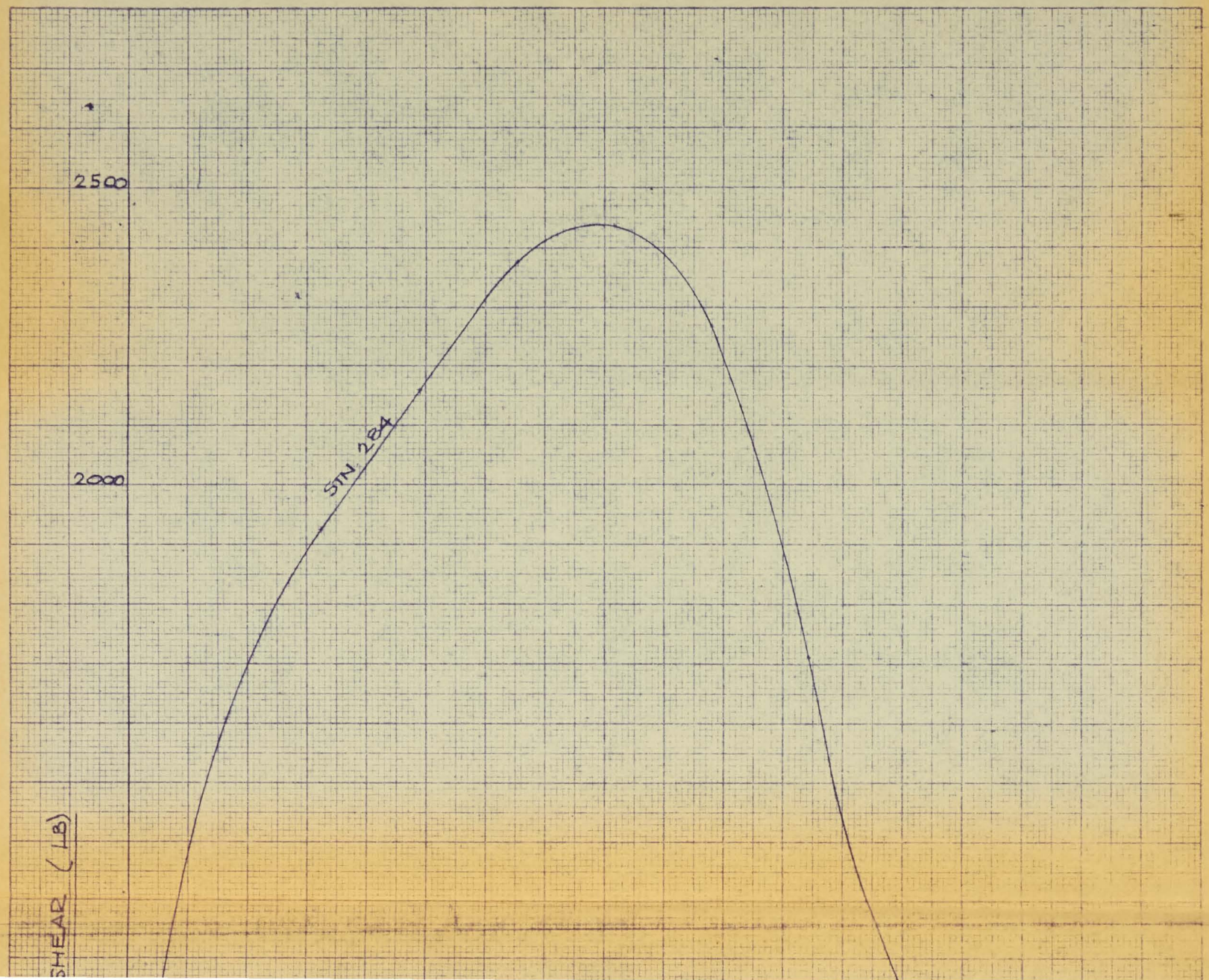


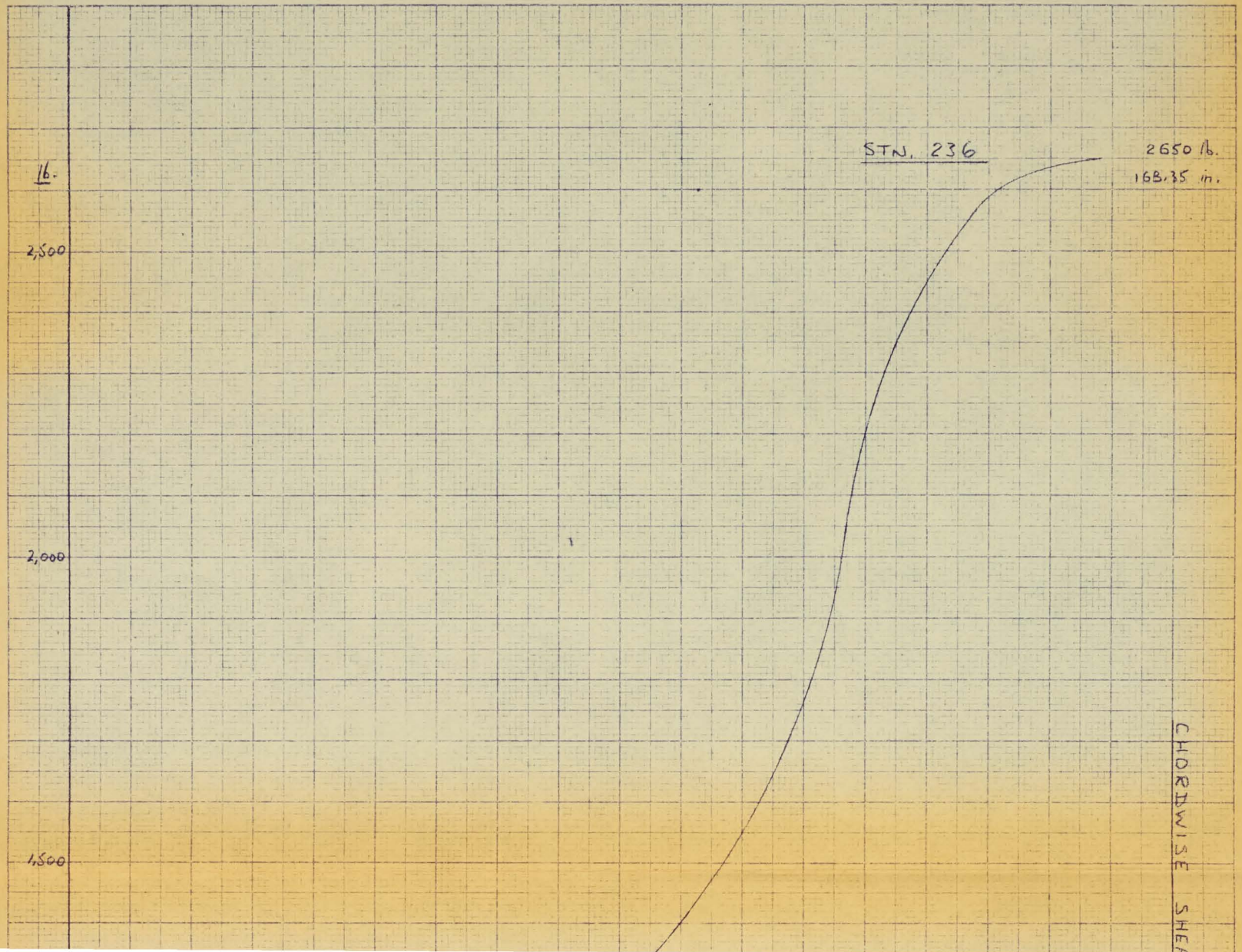




DWISE SHEAR - RISING WING







AVRO AIRCRAFT LIMITED
MALTON ONTARIO
TECHNICAL DEPARTMENT

REPORT NO 7/0500/7
SHEET NO SECTION V - 13

AIRCRAFT		PREPARED BY	DATE
C105	R.P.O. CASE. NET LOADING MISSLE PACK & ENGINES, FIN & RUDDER	B. CORSE	6-3-56
		CHECKED BY	DATE

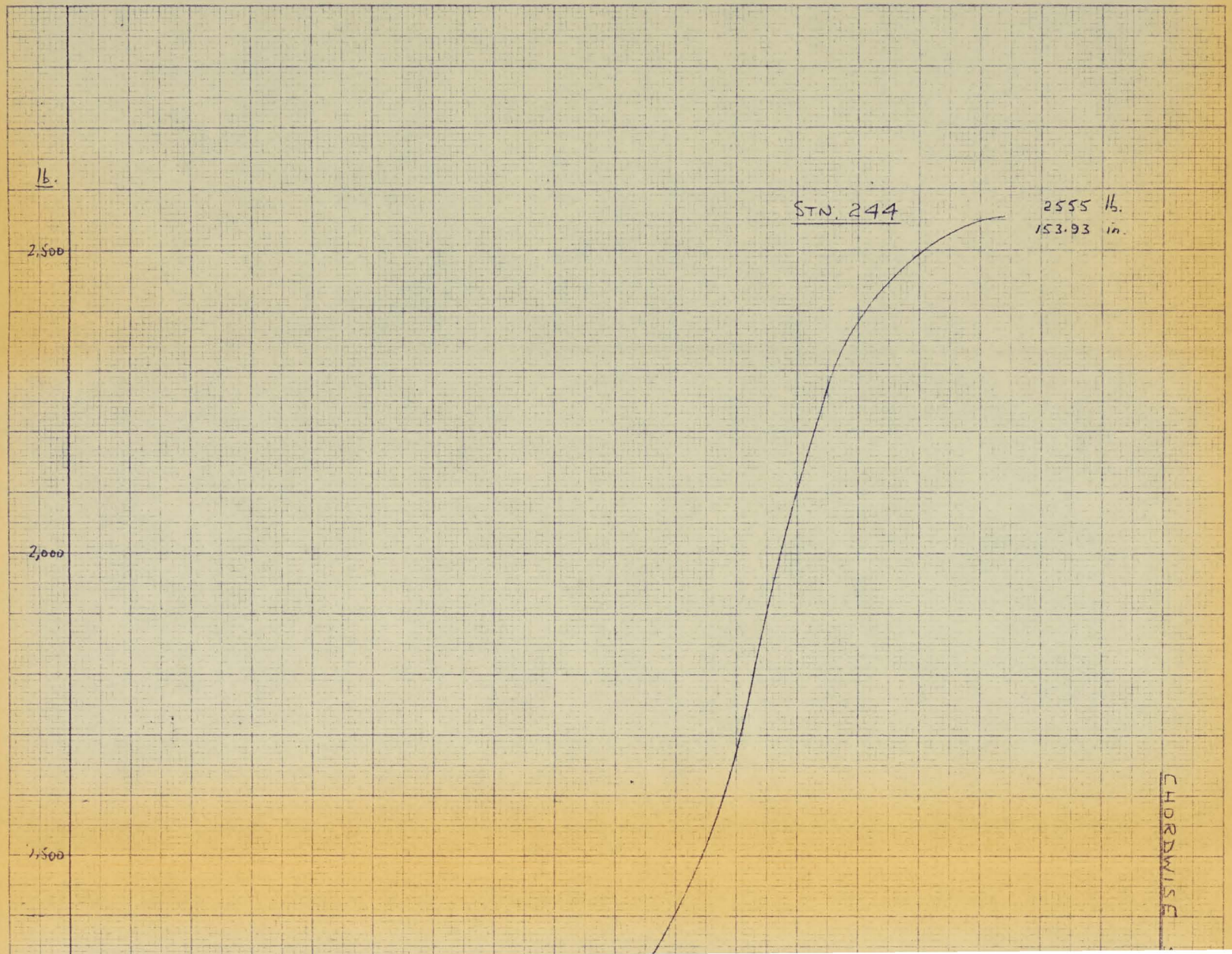
SECRET

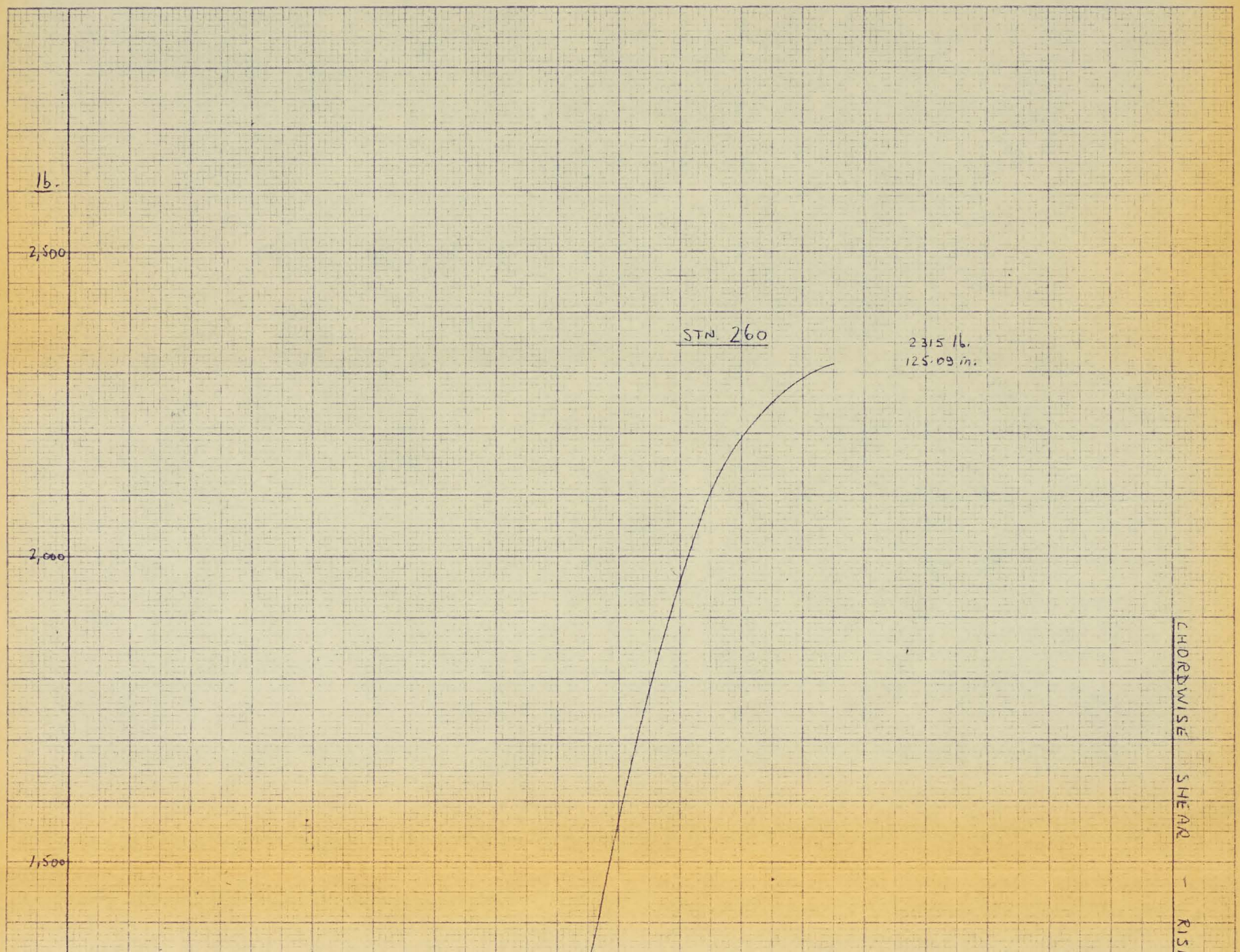
LOAD		FUS STA (IN)	VERT LOAD (LB) ↓	HOR. LOAD (LB) PORT (L.H) → STBD (R.H)
STARB'D ENG. (6		663.25 *	33725	18230
PORT ENG (6		663 25 *	32010	18230
FWD. PACK P/L		295 23	7495	1025
AFT PACK P/L		48250	7130	920
FIN & RUDDER		757.98	5325	[-33,300 STBD TO PORT SEE SEPARATE SHEAR CURVES]
MAIN U/C CG	STARBD	535.23 †	4865	0
	PORT	535.23 †	4035	0

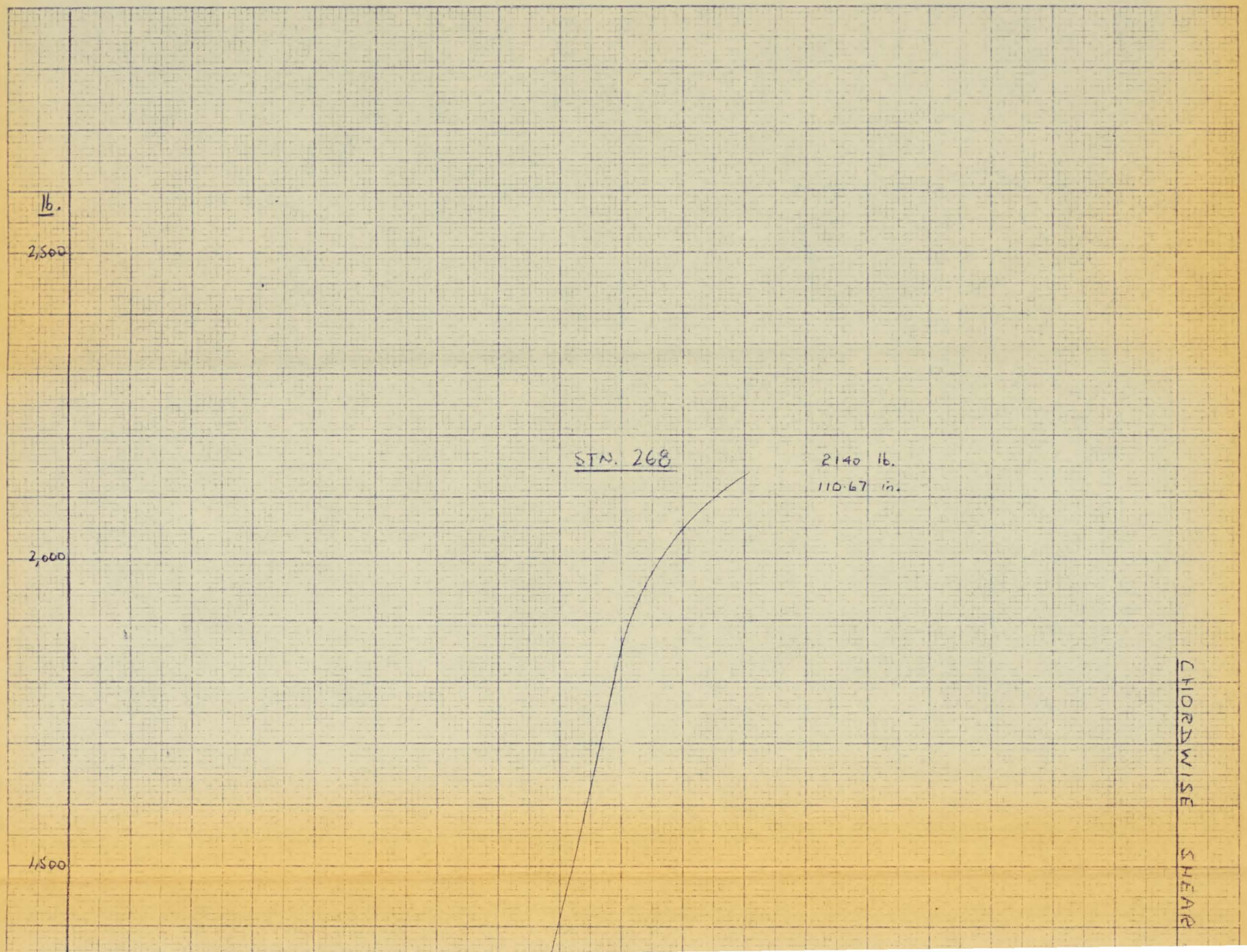
* C.G OF ENGINES & POINT OF APPLICATION OF ENGINE SIDE LOAD IS 2.16" BELOW FUSGE DATUM.

† DISTANCE FROM ℄ OF A/C TO C.G OF MAIN U/C = 108.734"

SECRET







16.

2,500

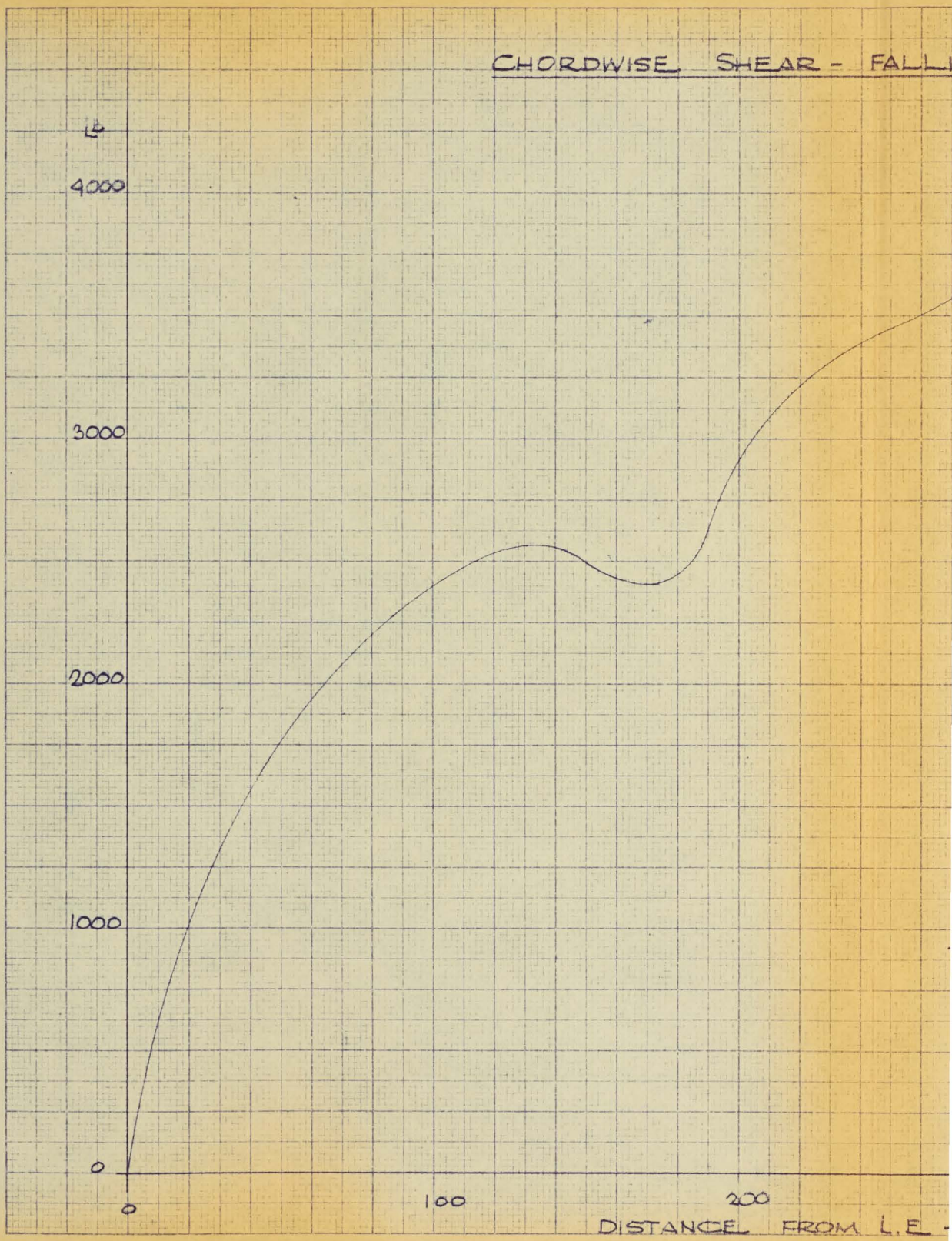
2,000

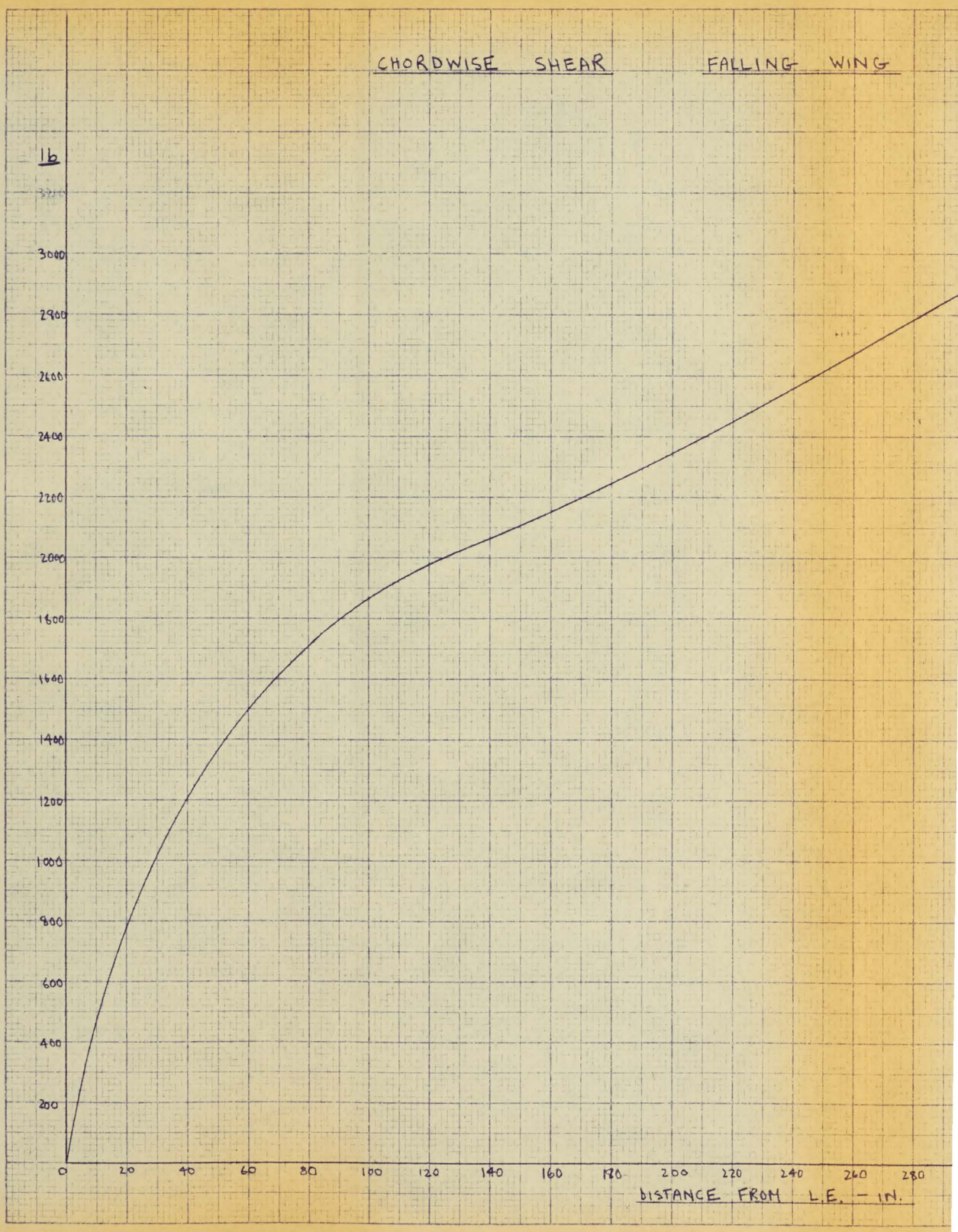
1,500

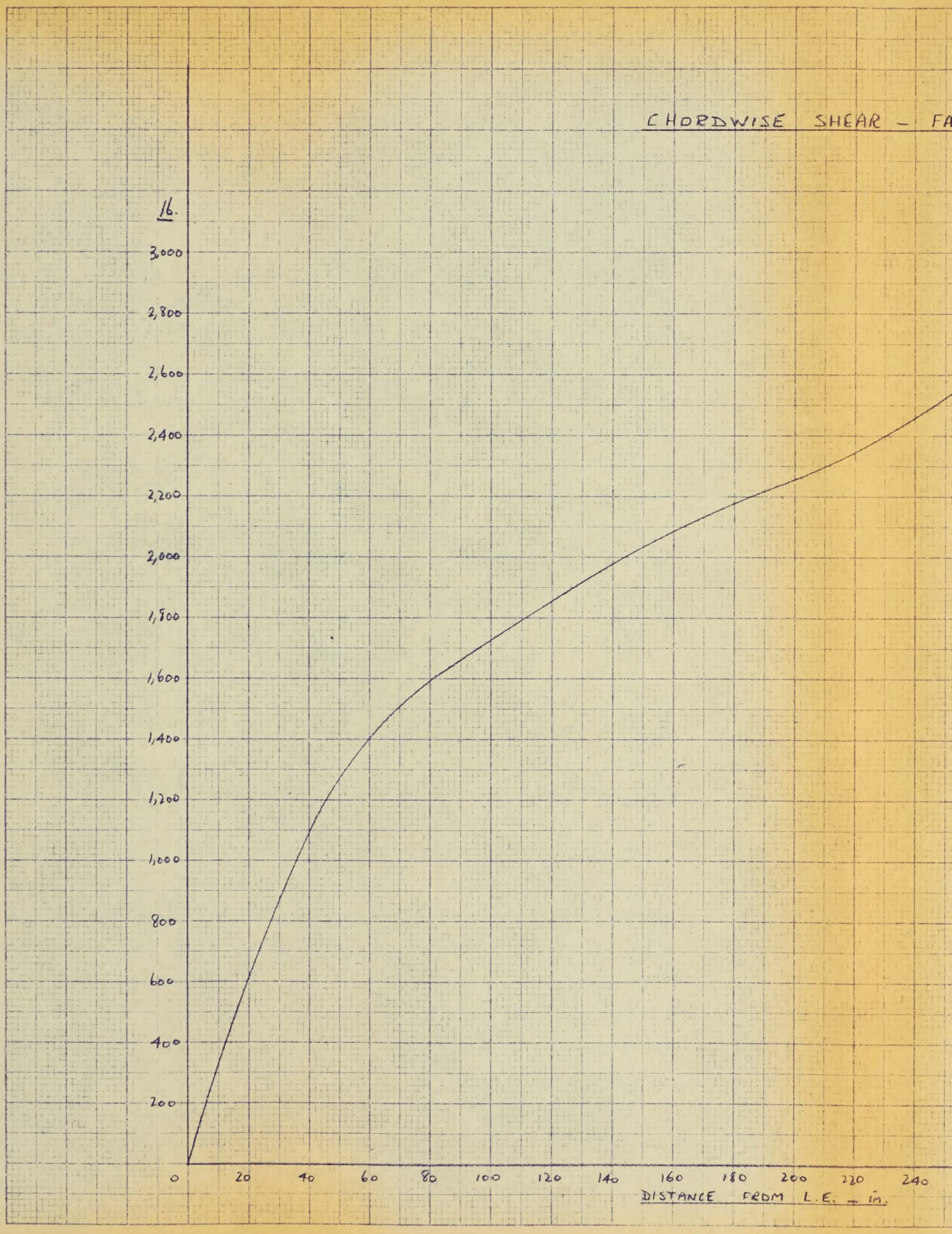
STN. 276

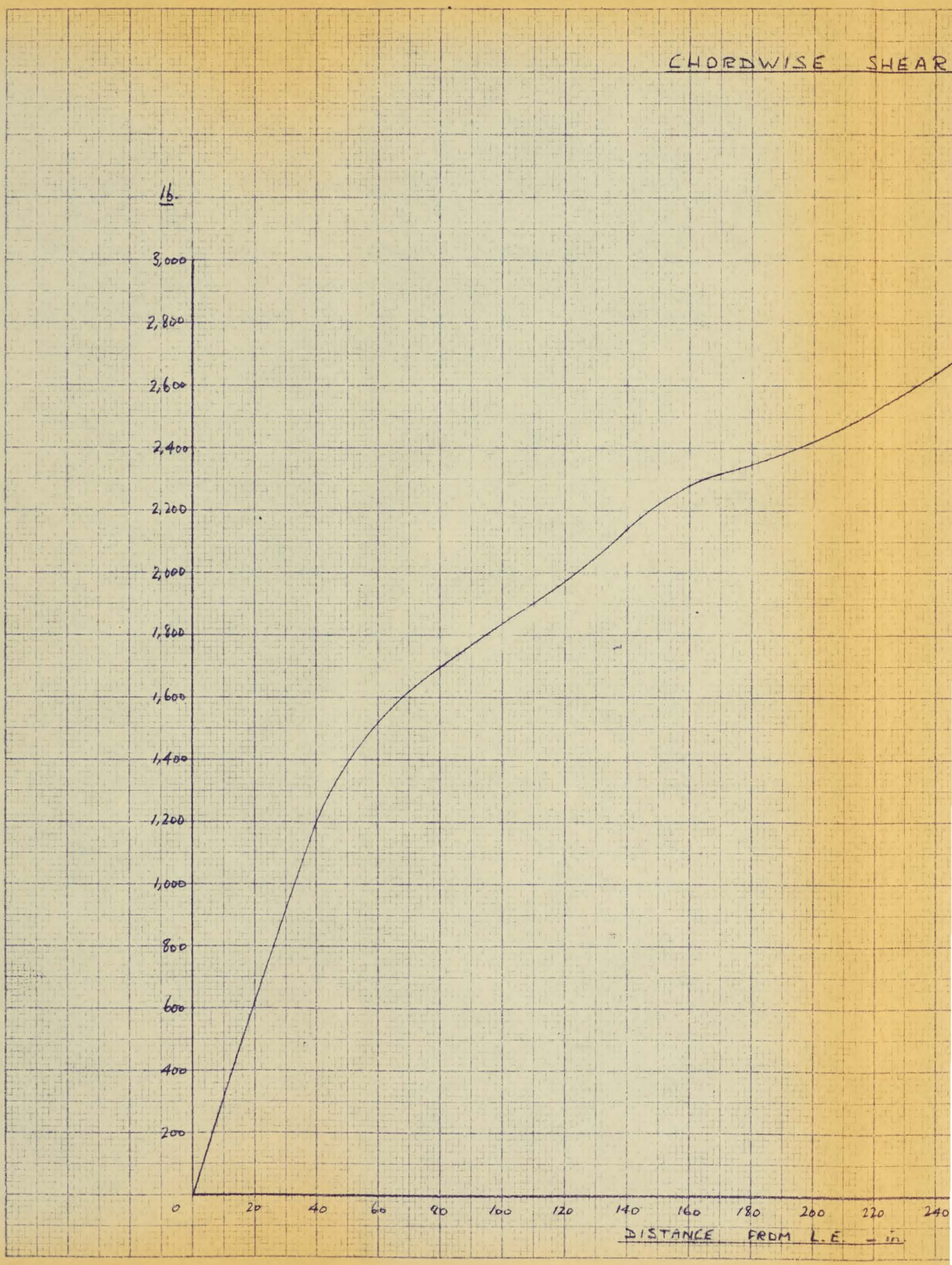
1770 lb.
96.25 in.

CHORDWISE SHEAR I









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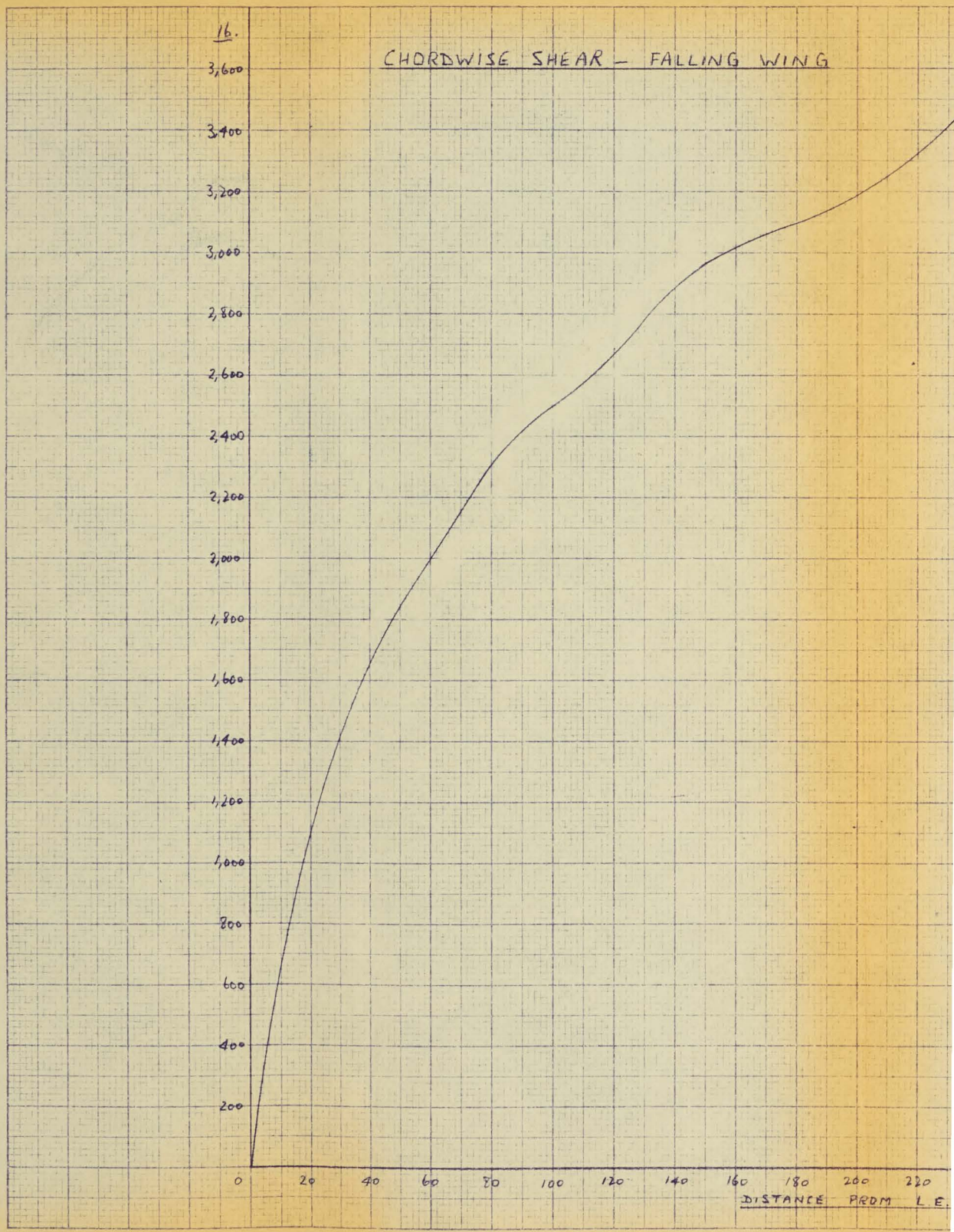

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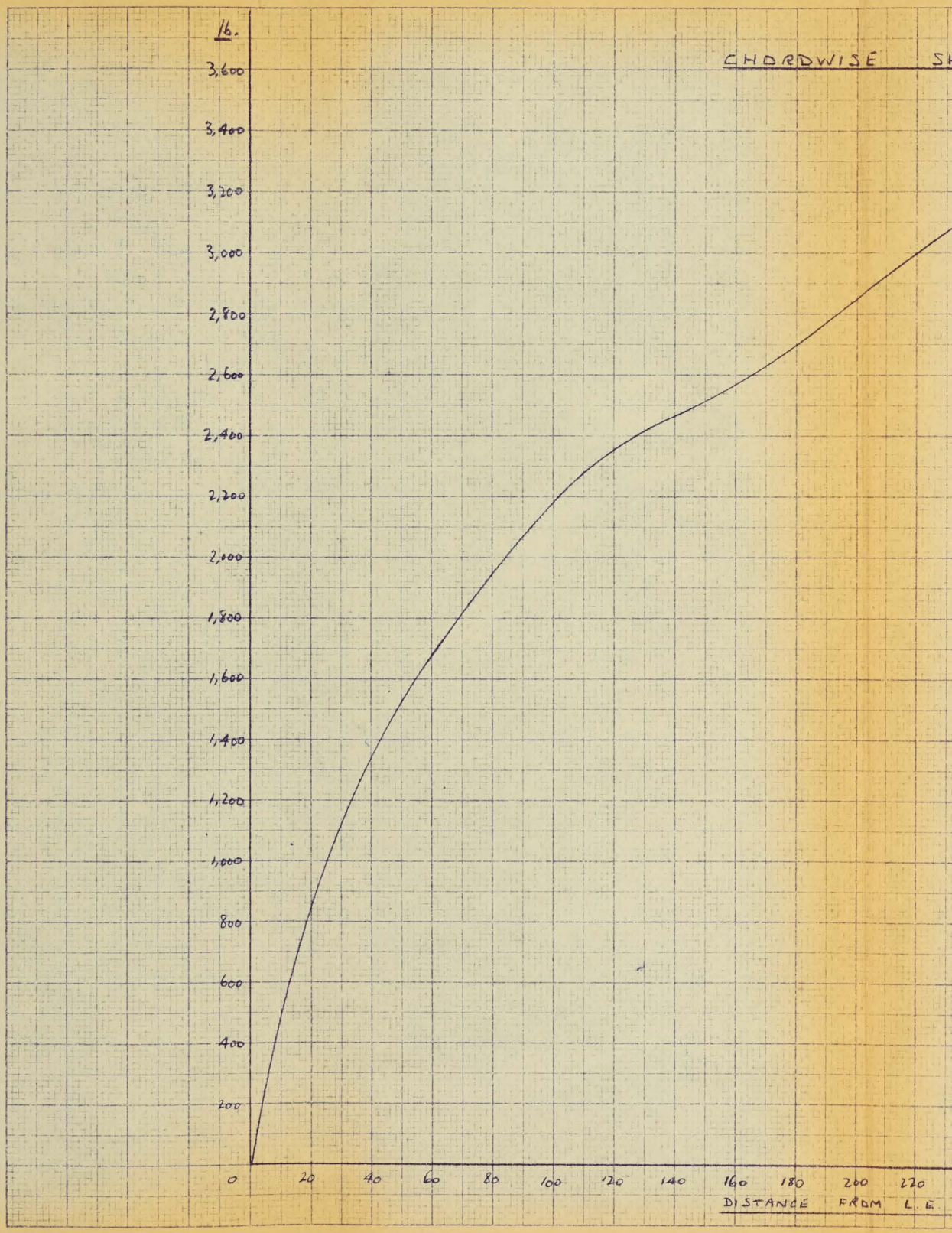

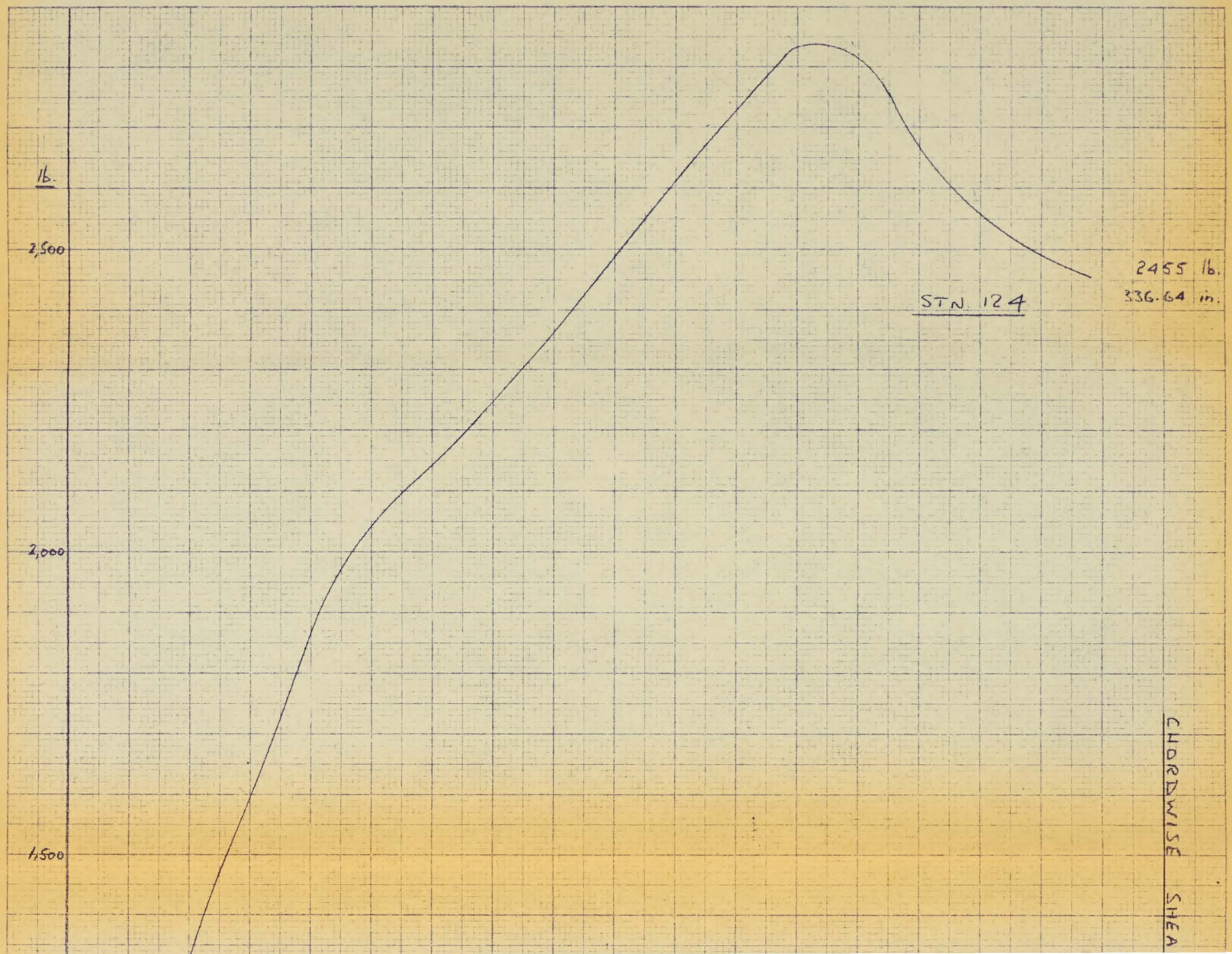

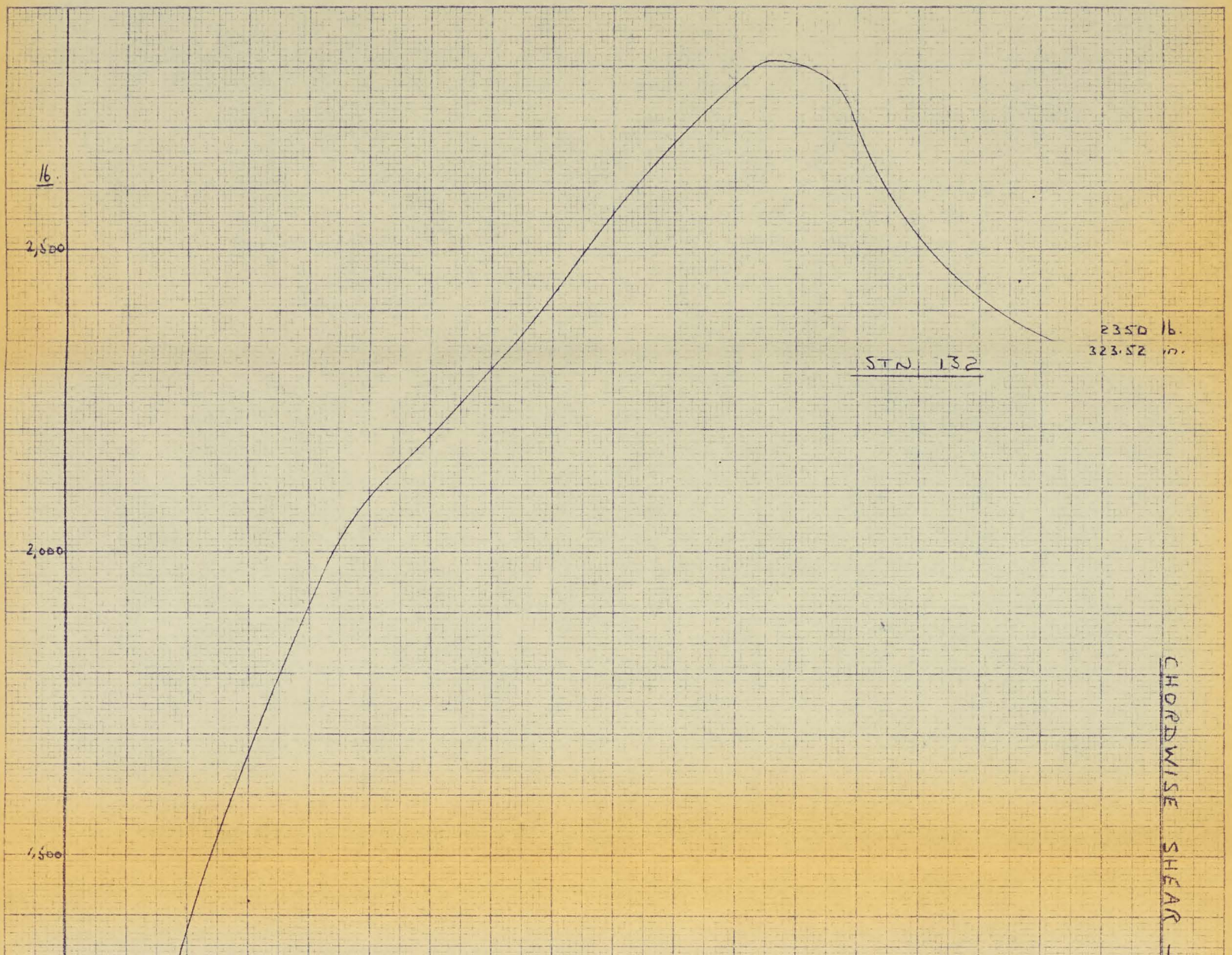

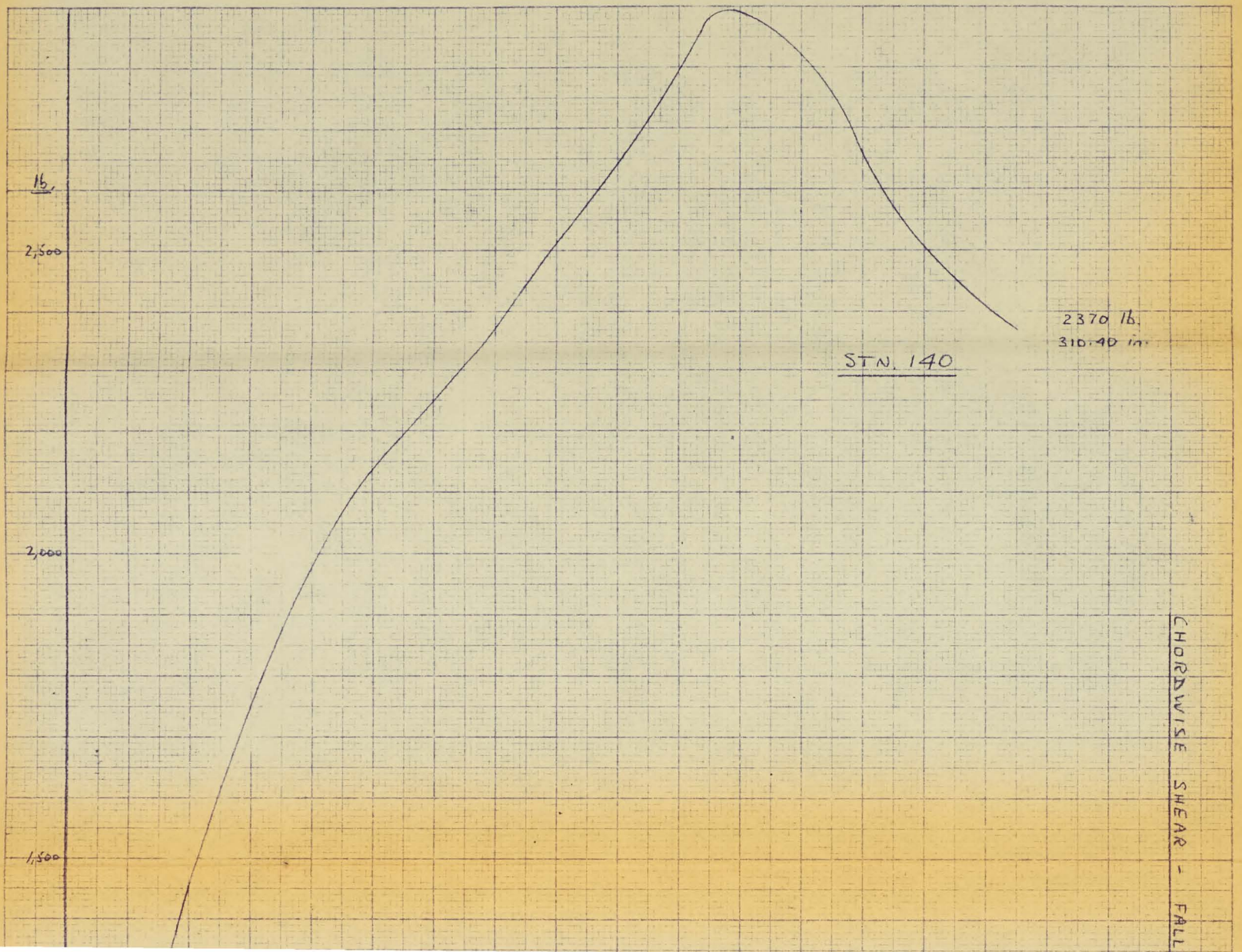

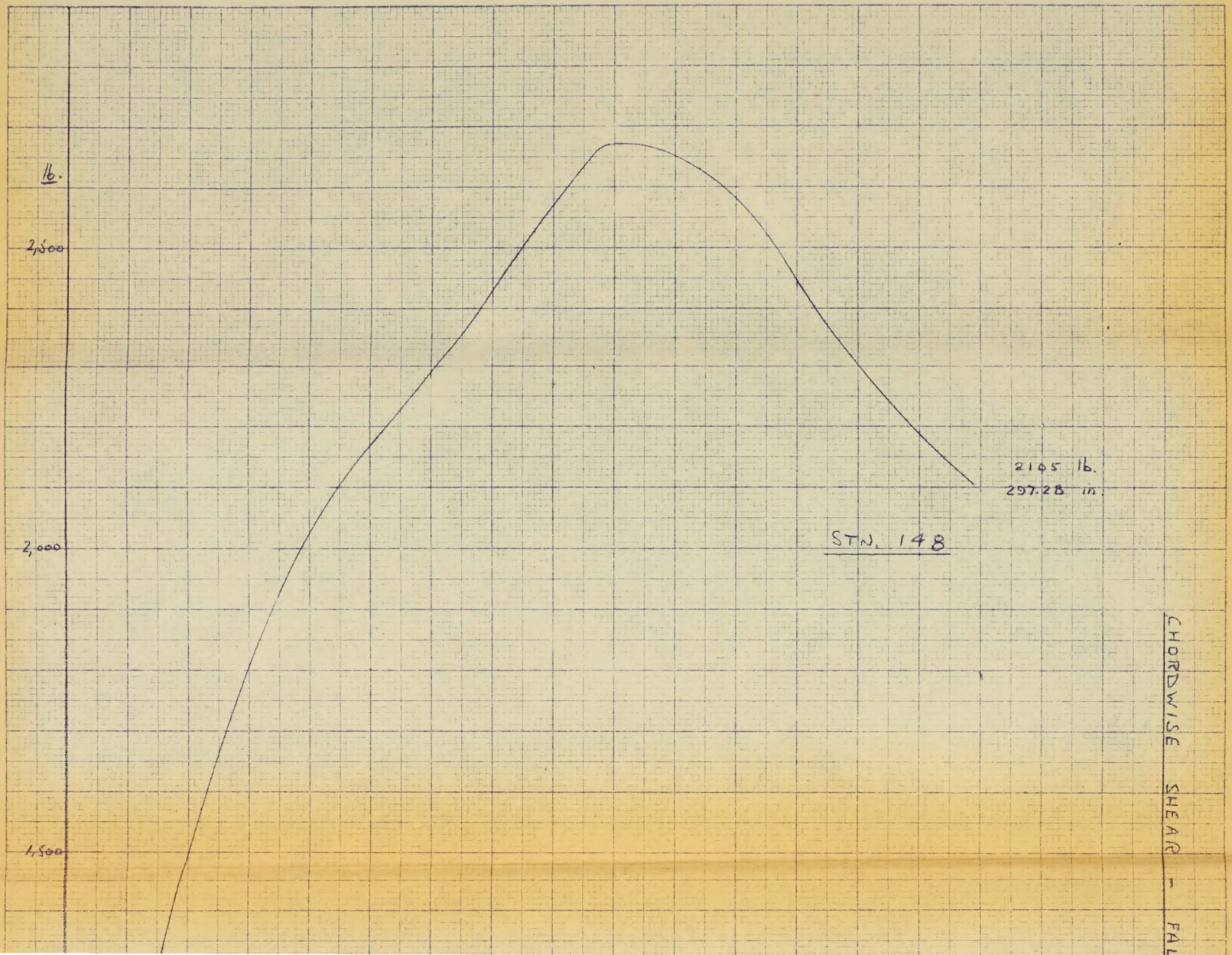

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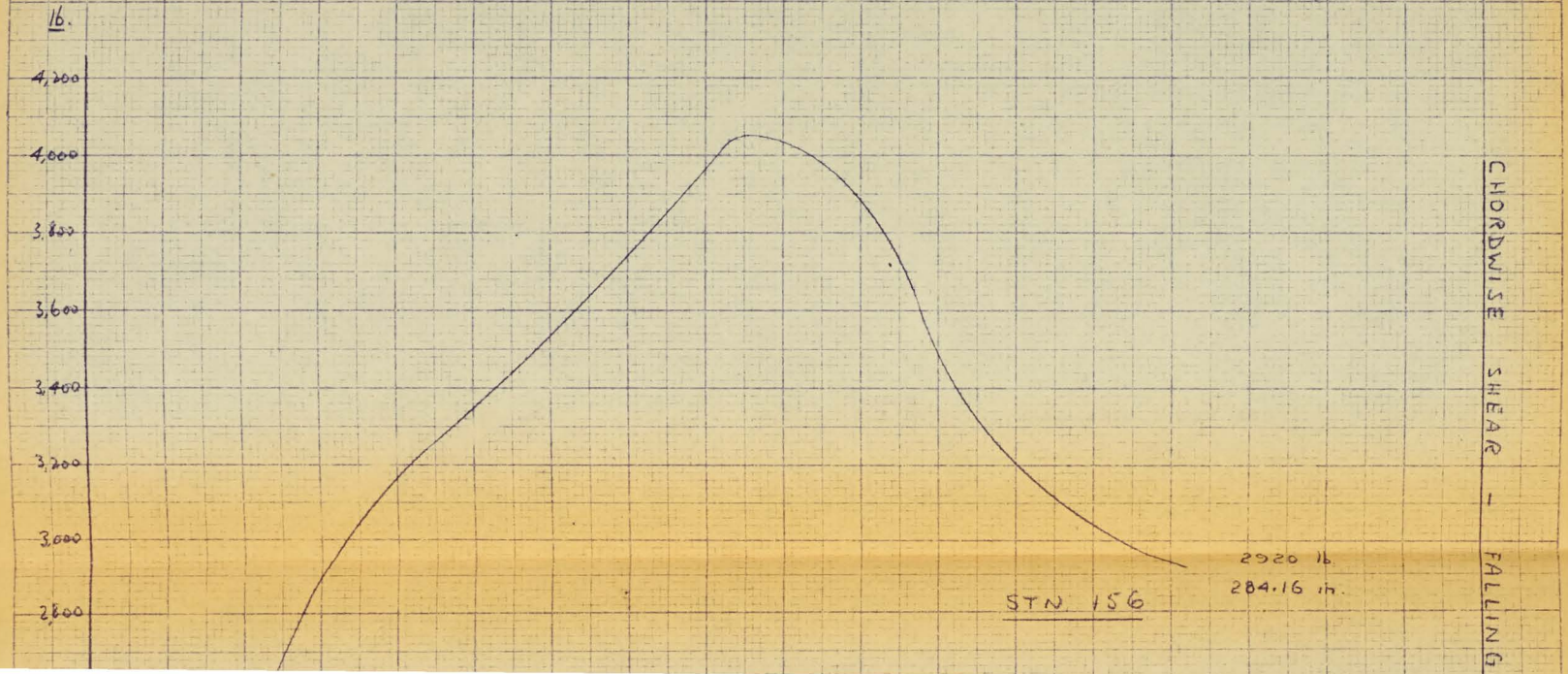
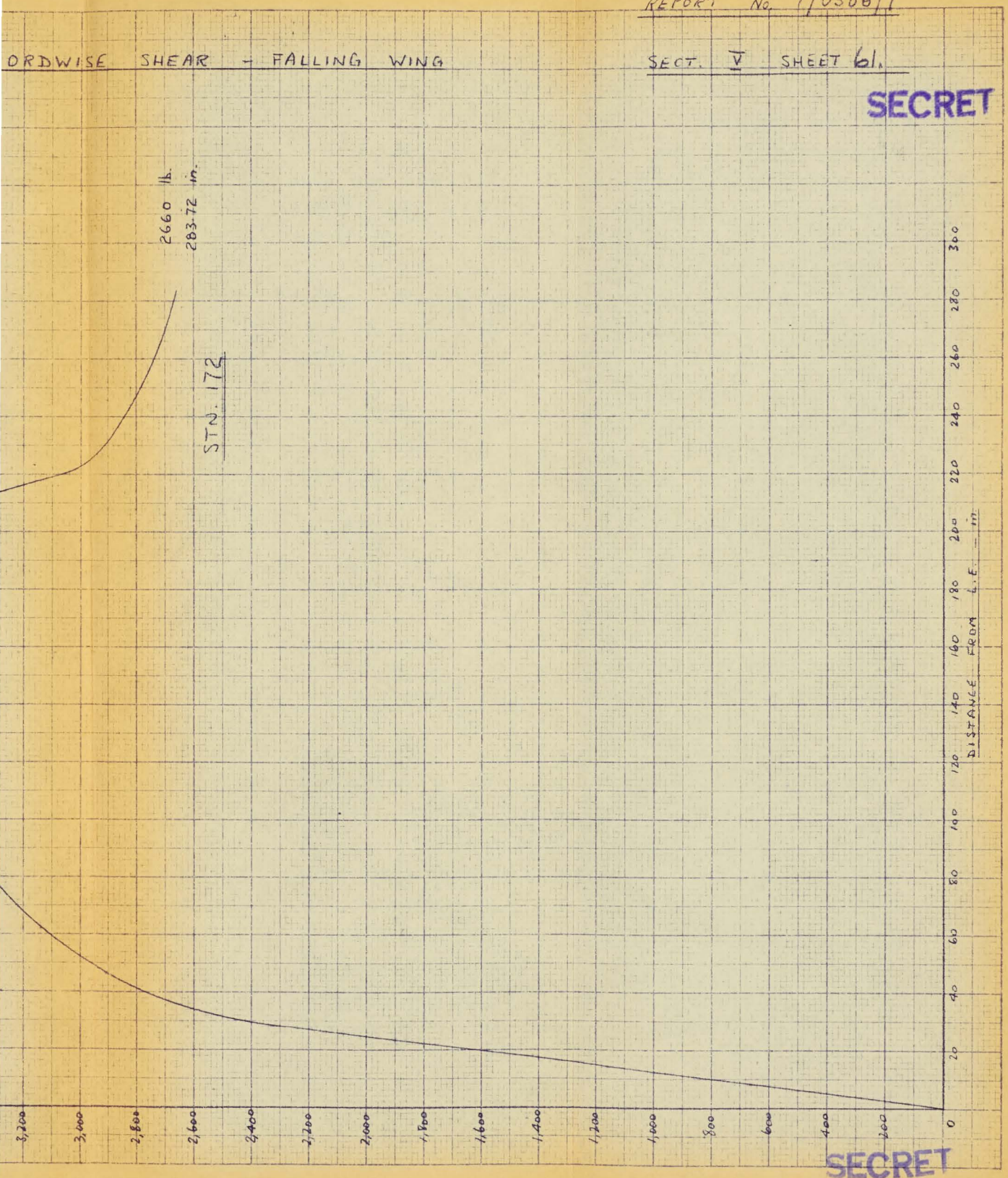


REPORT No. 7/0508/7

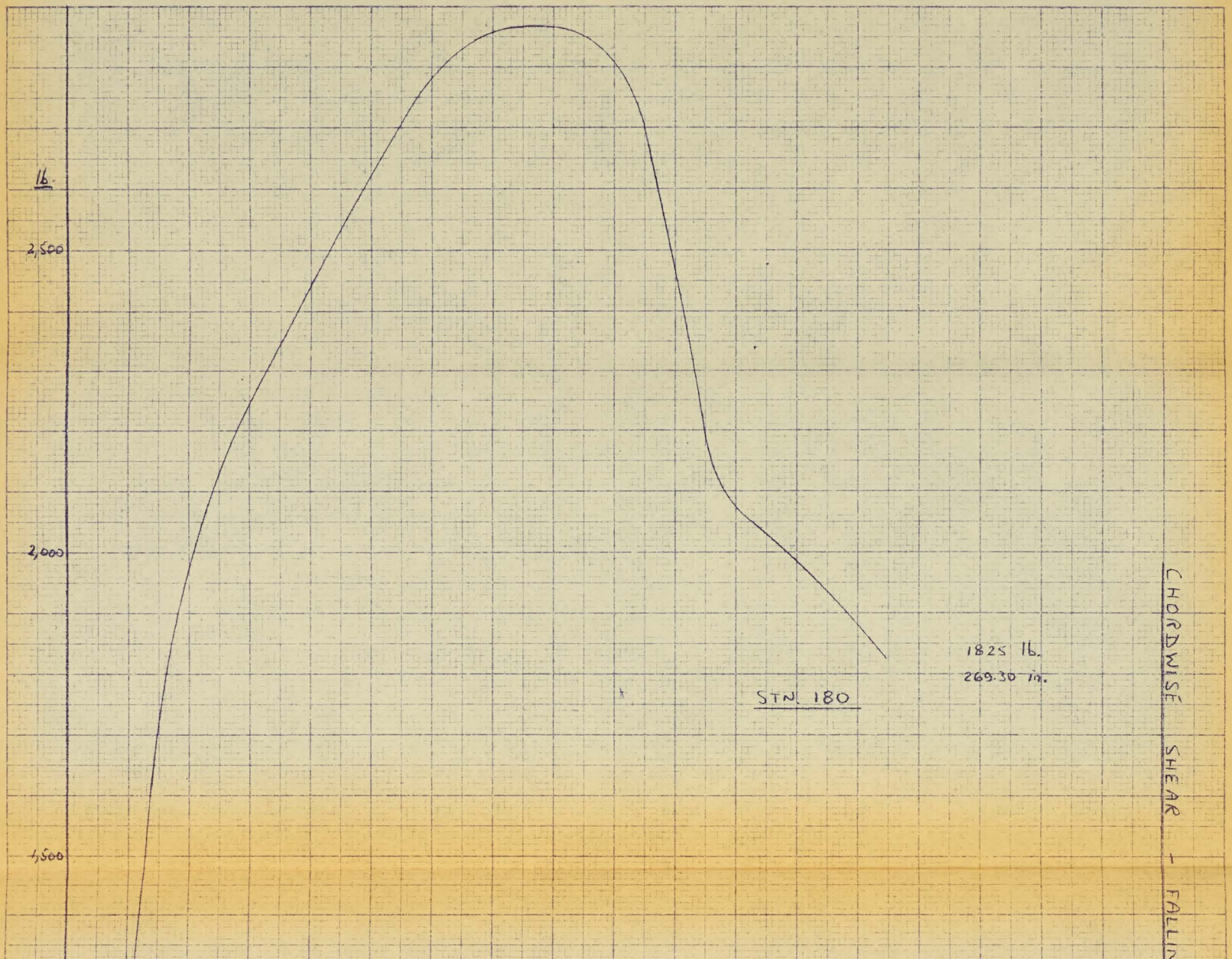
SECT. V SHEET 61.

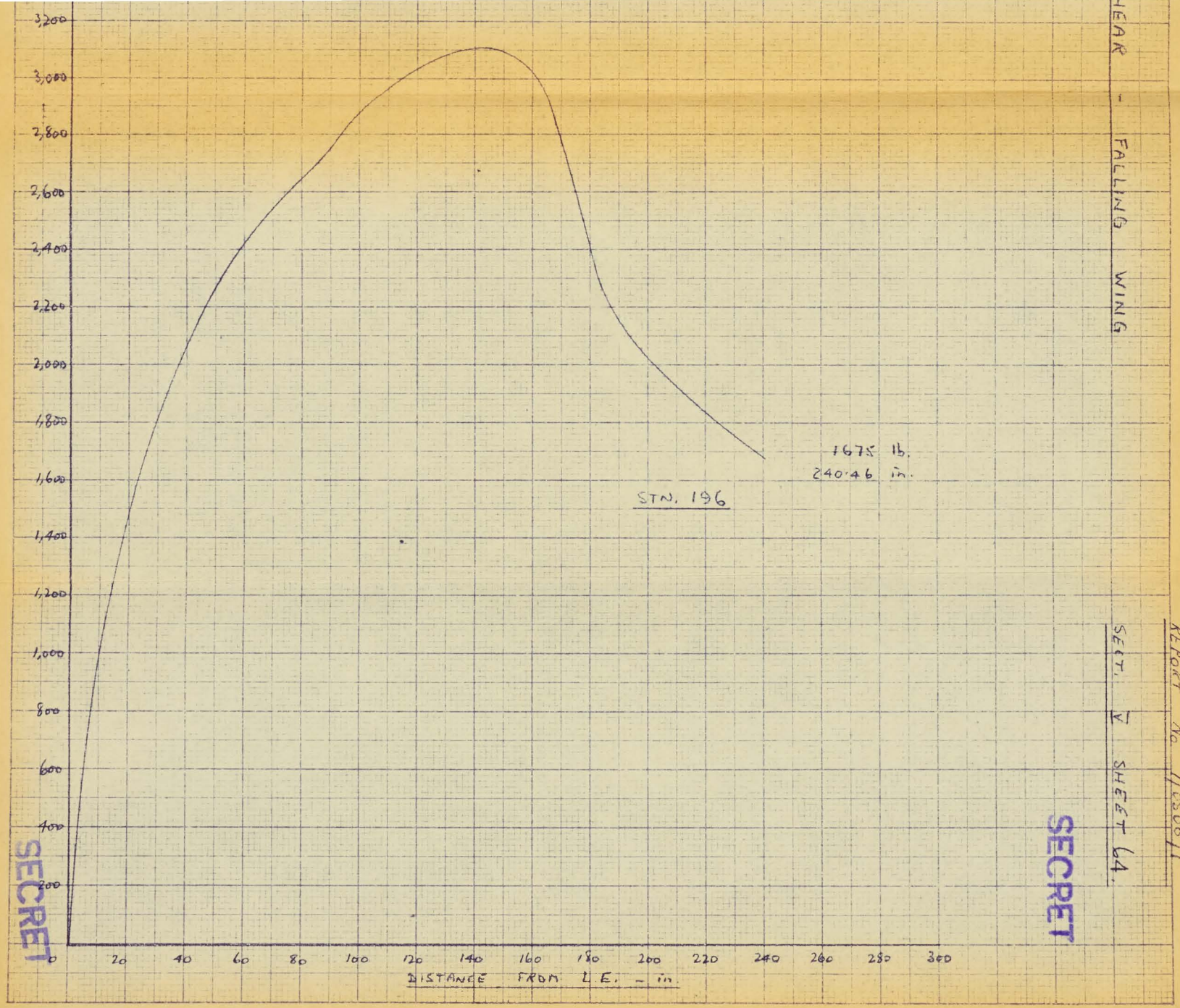
SECRET

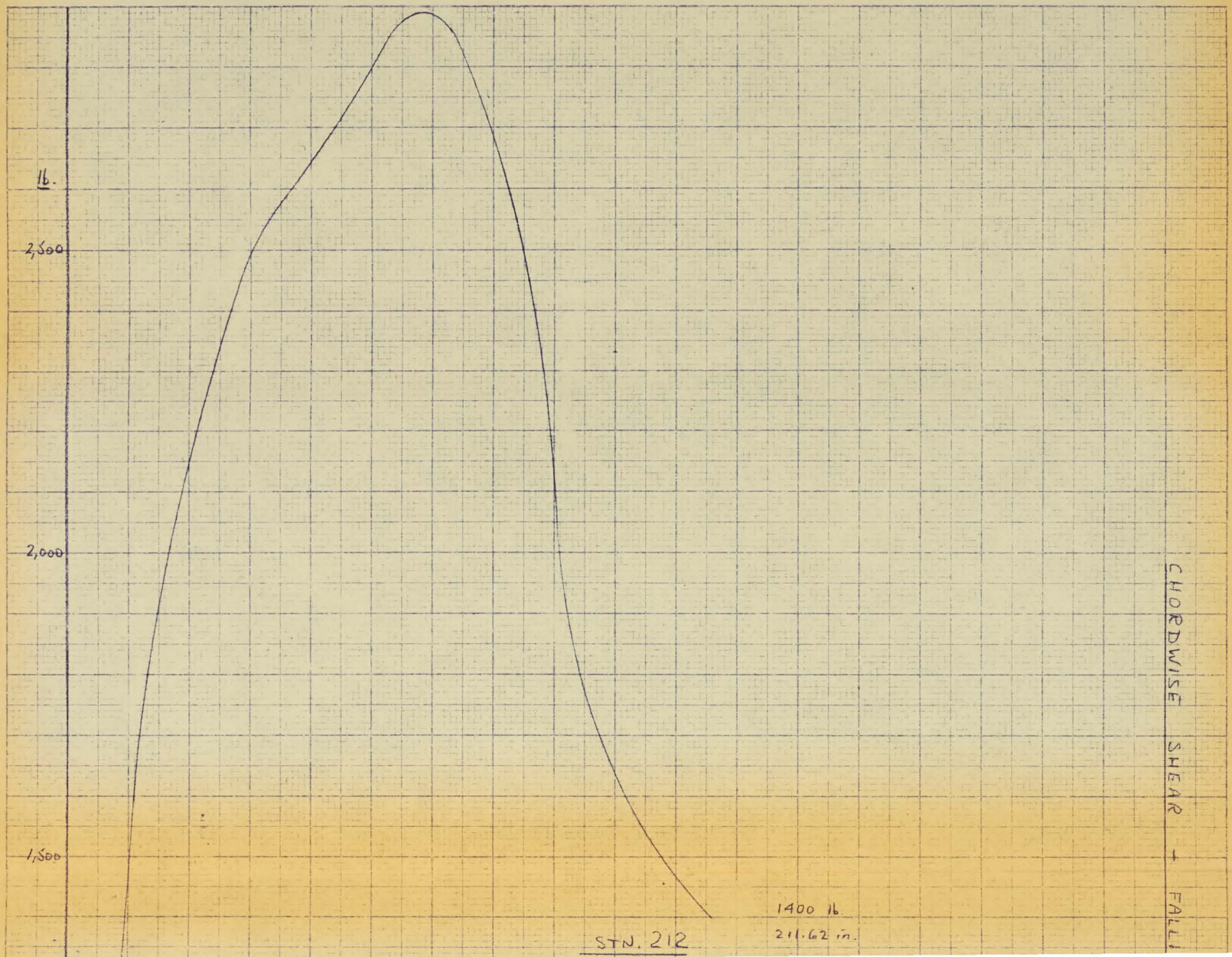
ORDWISE SHEAR - FALLING WING

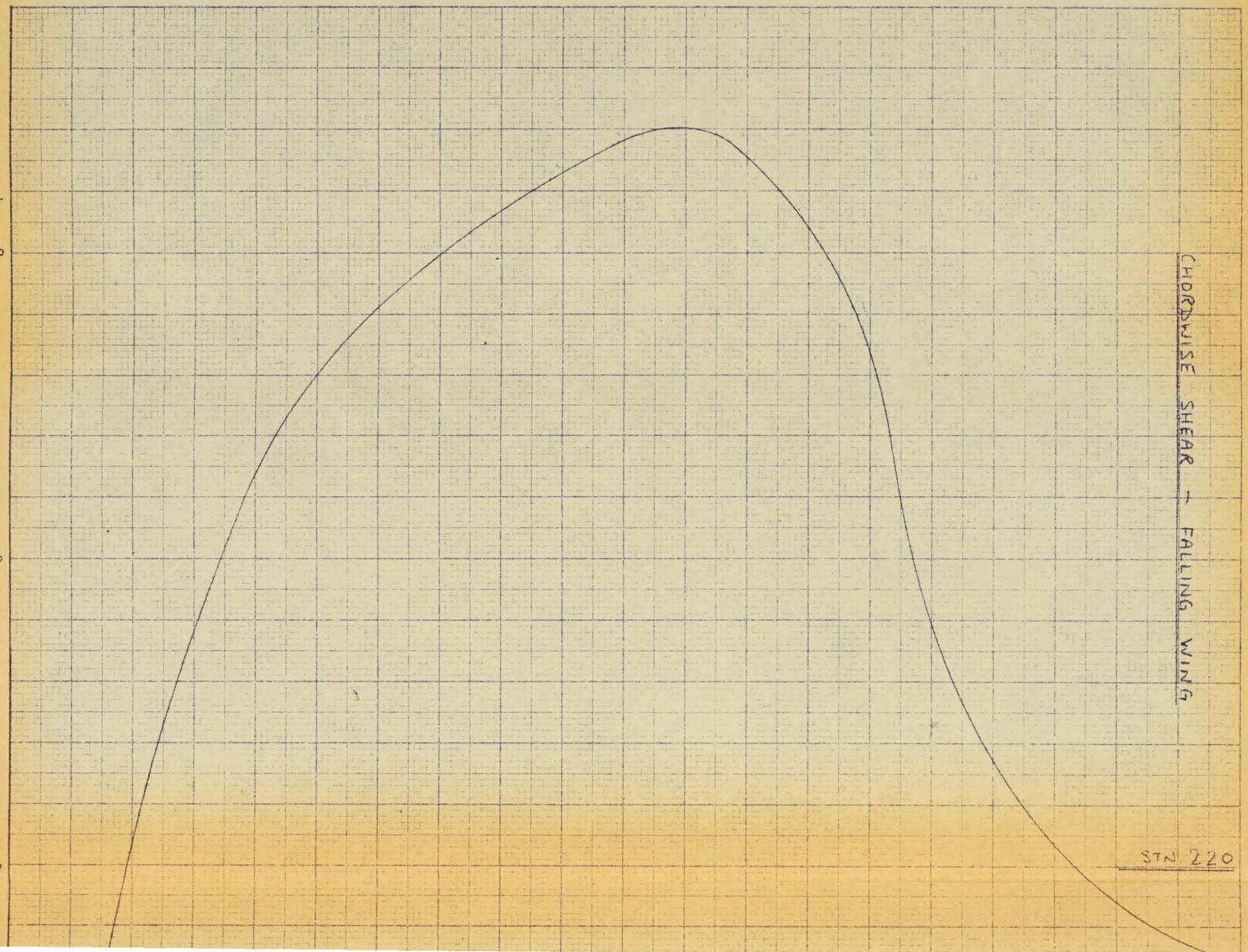


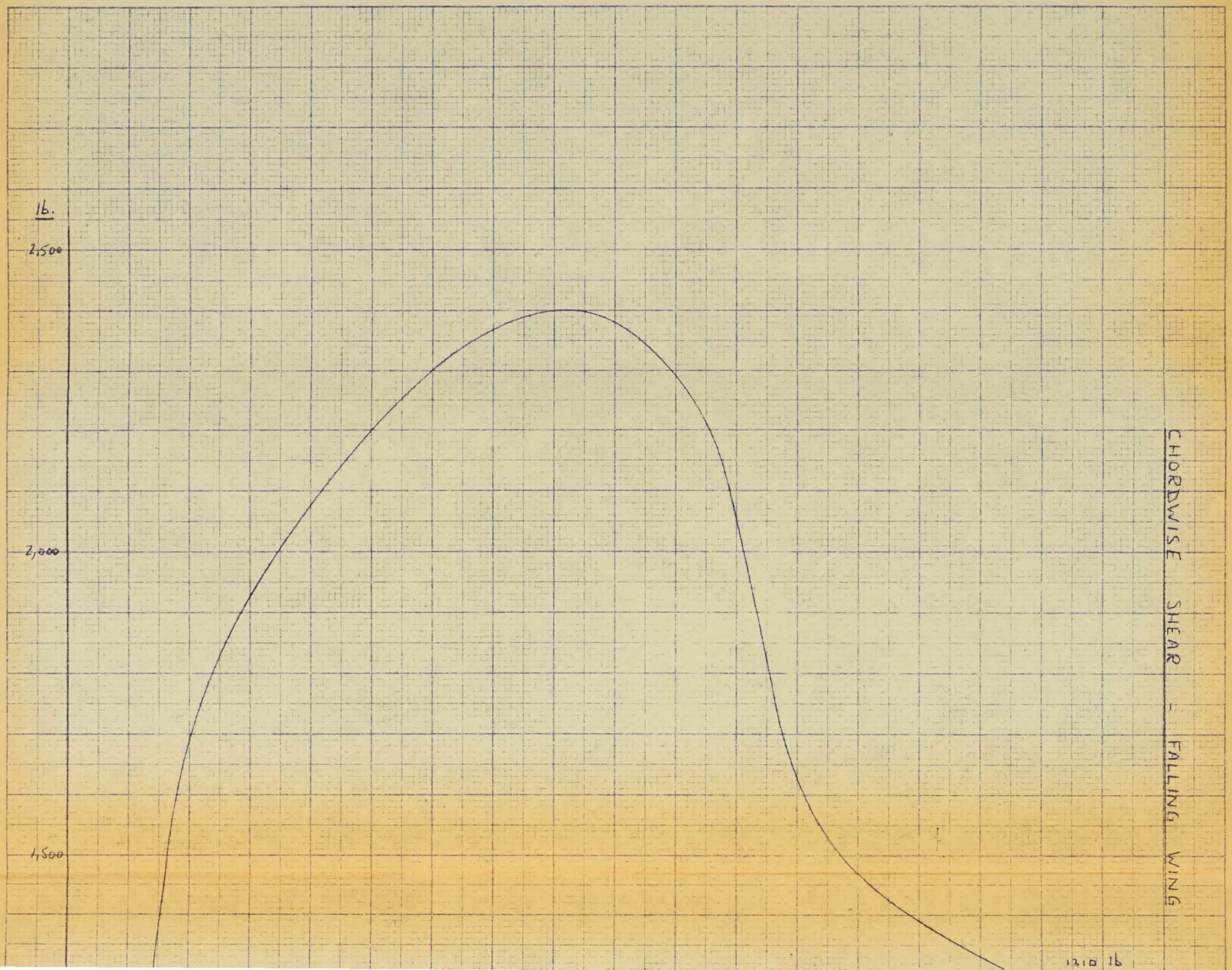
SECRET




SHEAR - FALLING WING
3,200
3,000
2,800
2,600
2,400
2,200
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
20
40
60
80
100
120
140
160
180
200
220
240
260
280
300
DISTANCE FROM L.E. - in.
167 lb.
240.46 in.
STN. 196
SECT. V SHEET 64.
REPORT No. 7/0500/17
SECRET
SECRET







A. V ROE CANADA LIMITED
MALTON - ONTARIO
TECHNICAL DEPARTMENT (Aircraft)

REPORT NO 7/0500/7
SHEET NO

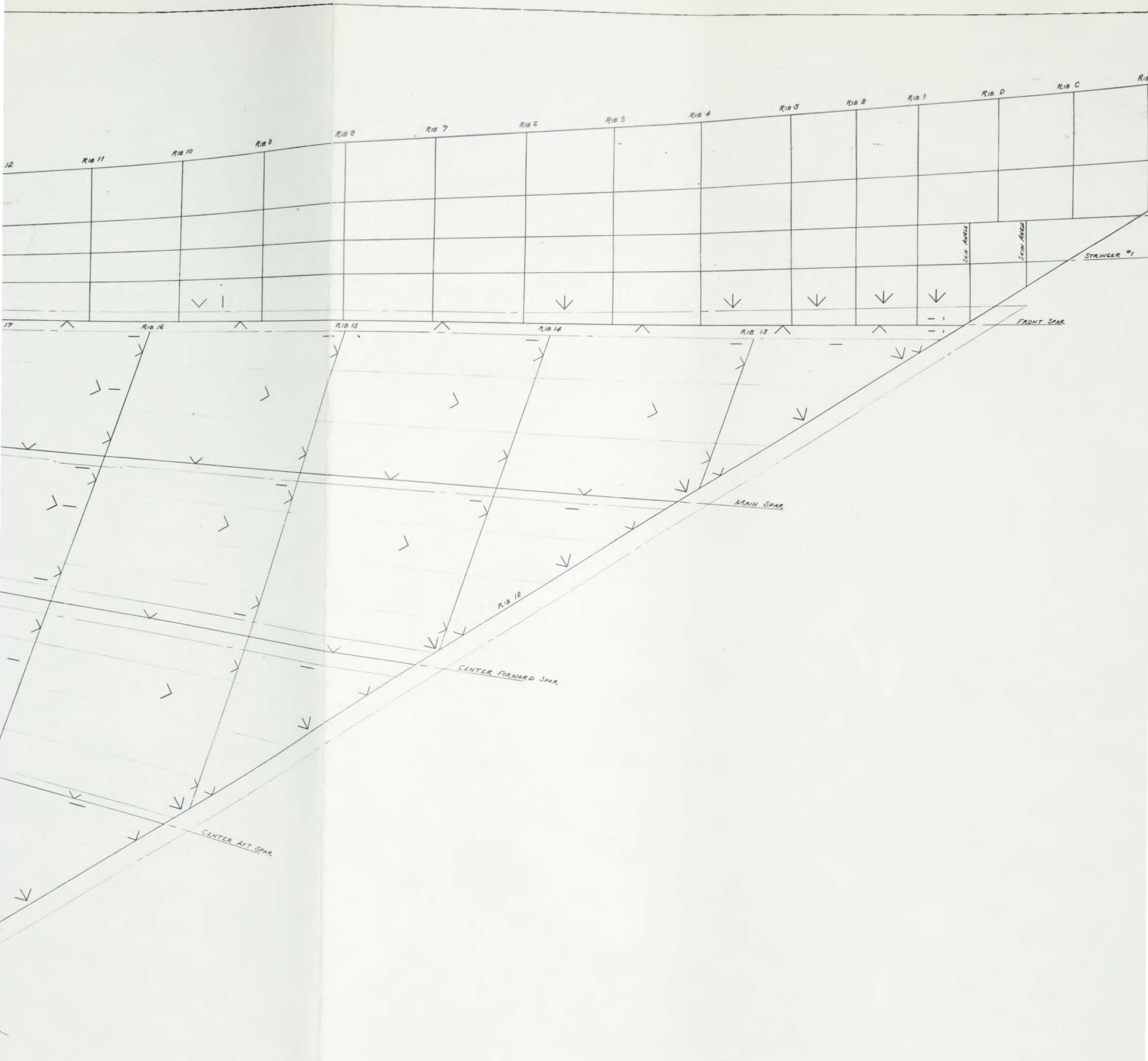
AIRCRAFT		PREPARED BY	DATE
		CHECKED BY	DATE

SECRET

SECTION VI

STRAIN GAUGE POSITIONS

SECRET



ISSUE NO.											
MOD. NO.											
DRAWN BY / DATE	S. GROBER APRIL 25 1958										

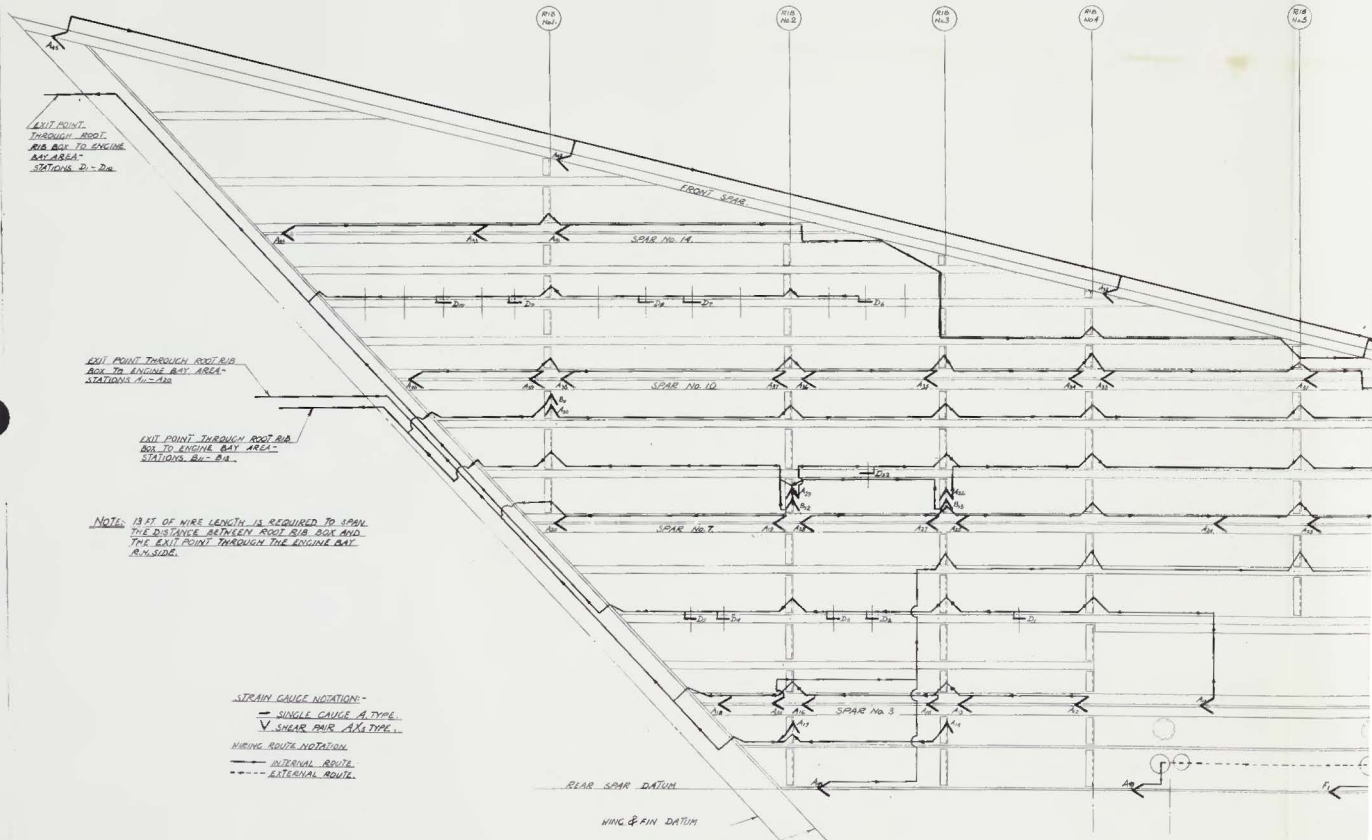
DESCRIPTION

STRAIN GAU…

OUTER…

A.V. ROE

MALTON



EXIT POINT THROUGH ROOT RIB BOX TO ENGINE BAY AREA - STATIONS D1 - D10

EXIT POINT THROUGH ROOT RIB BOX TO ENGINE BAY AREA - STATIONS A11 - A12

EXIT POINT THROUGH ROOT RIB BOX TO ENGINE BAY AREA - STATIONS B11 - B12

NOTE: 13 FT OF WIRE LENGTH IS REQUIRED TO SPAN THE DISTANCE BETWEEN ROOT RIB BOX AND THE EXIT POINT THROUGH THE ENGINE BAY R.H. SIDE.

STRAIN GAUGE NOTATION:-

— SINGLE GAUGE A TYPE.

V SHEAR PAIR AX2 TYPE.

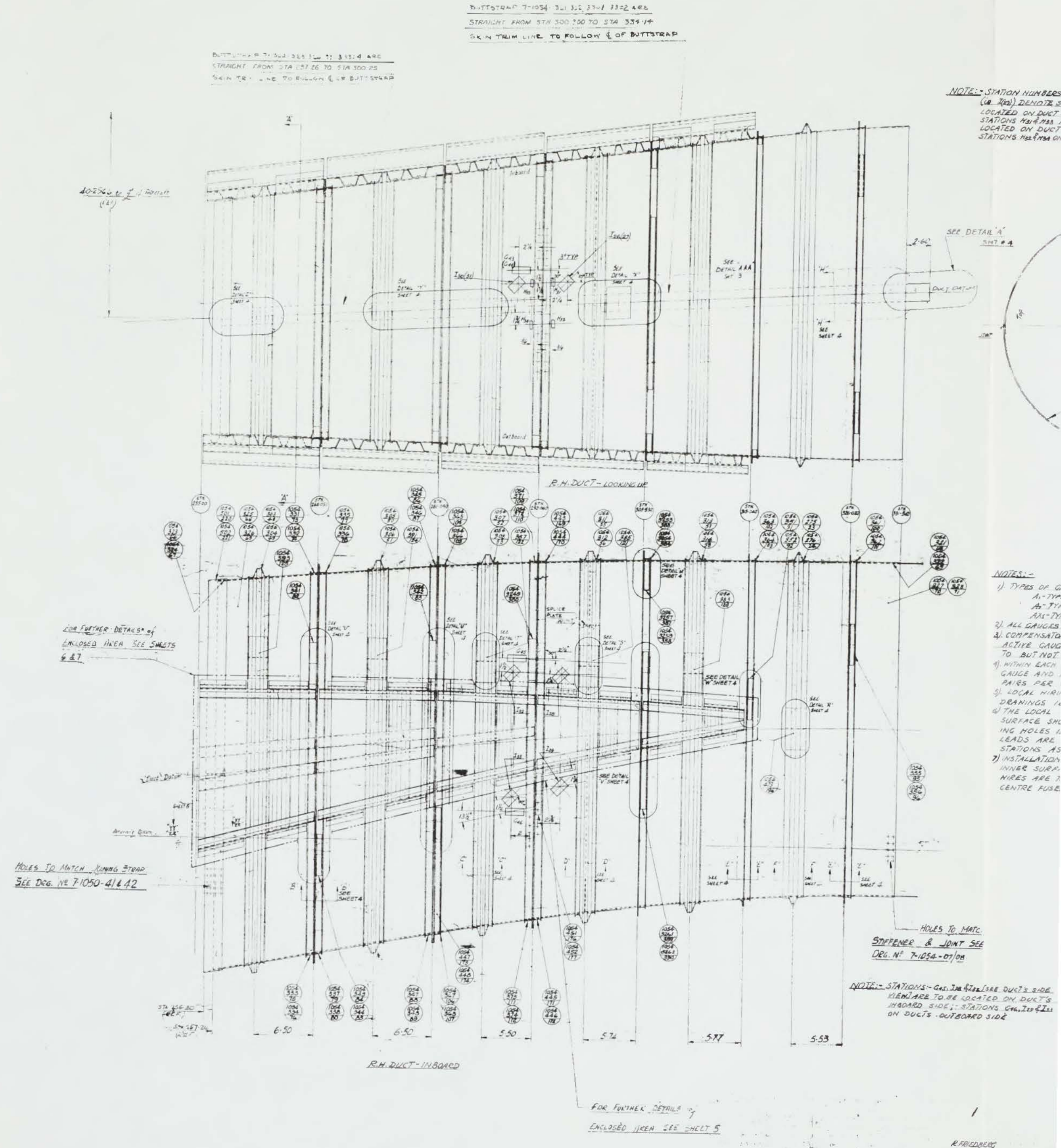
WIRING ROUTE NOTATION

——— INTERNAL ROUTE.

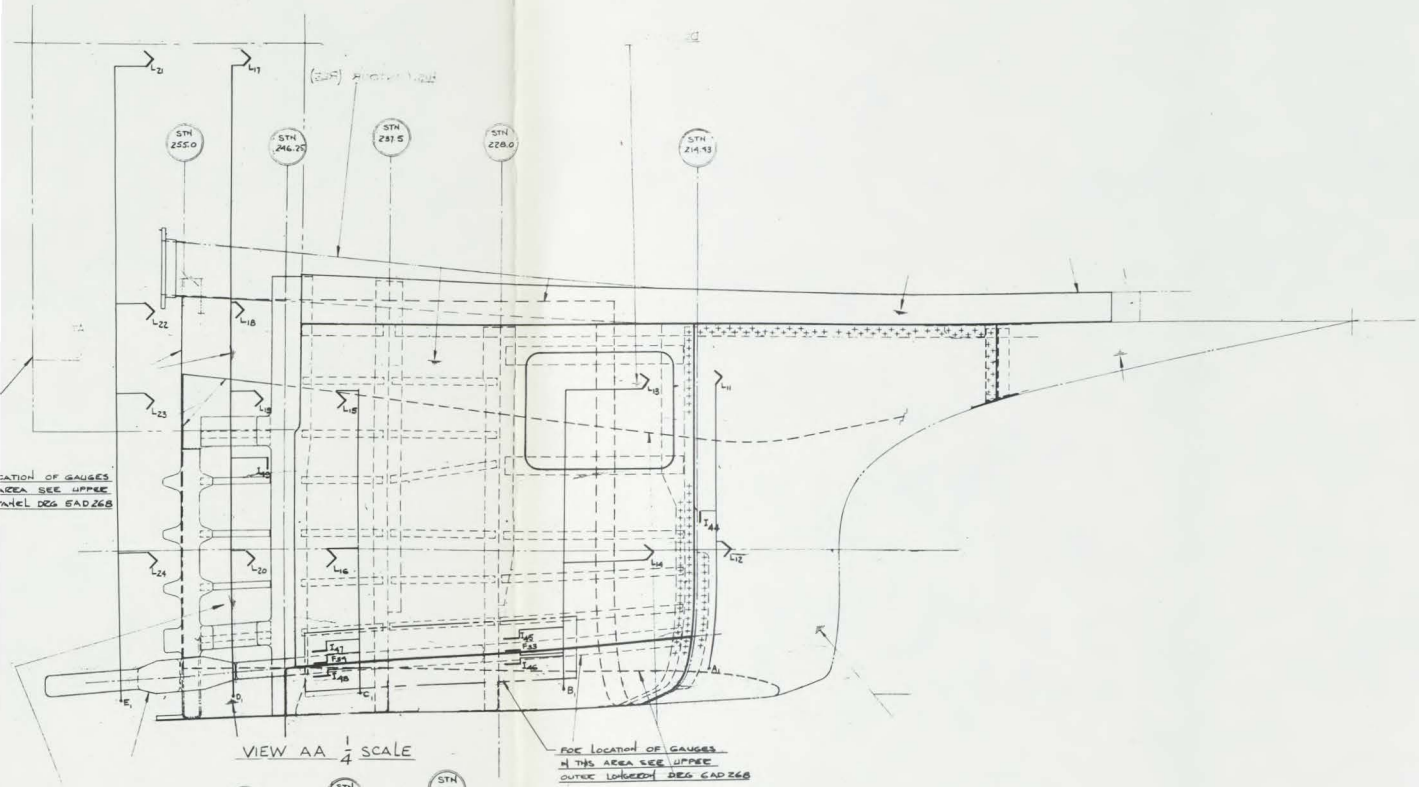
- - - - - EXTERNAL ROUTE.

STRAIN GAUGE L

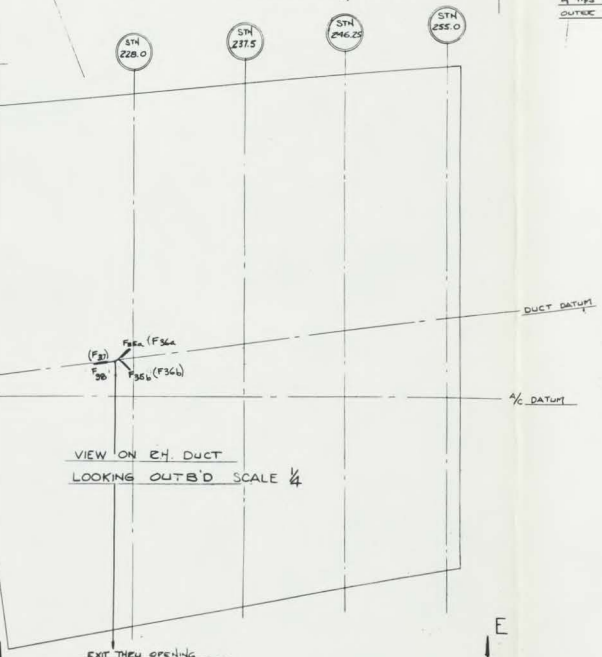
INTERNA



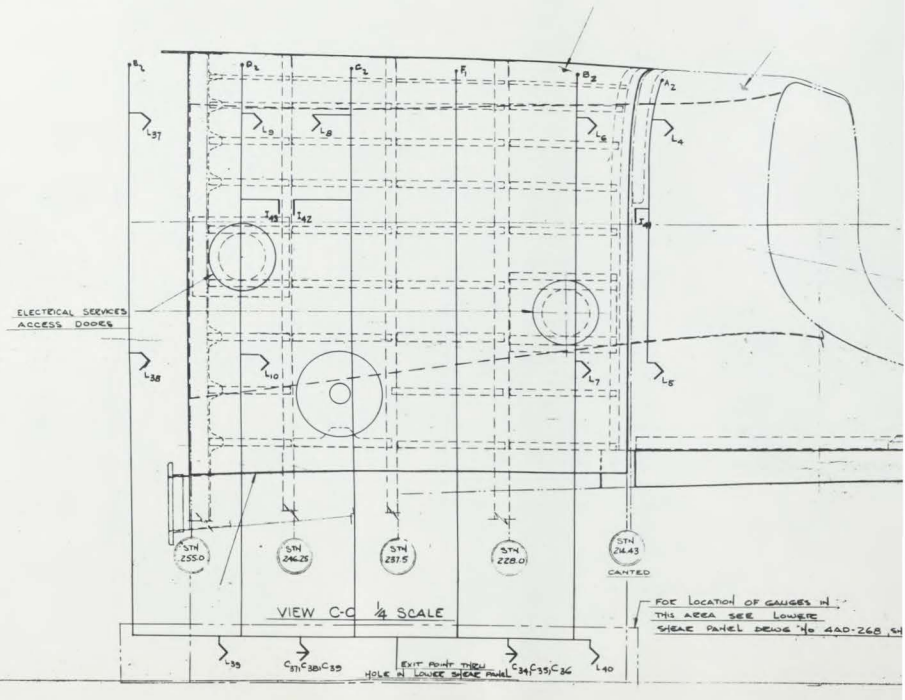
BUTTSTRAP 7-1054-321, 322, 3301, 3302 ARE STRAIGHT FROM STA 300.200 TO STA 334.14
SKIN TRIM LINE TO FOLLOW ℄ OF BUTTSTRAP
STRAIGHT FROM STA 257.26 TO STA 300.25
40.2564 to ℄ A/ Datum
NOTE:- STATION NUMBERS
(ie. 7(ex)) DENOTE S
LOCATED ON DUCT
LOCATED ON DUCT
SEE DETAIL "A" SHT # 4
2.60
Duct Datum
Inboard
Outboard
R.H. DUCT - LOOKING UP
NOTES:-
1) TYPES OF G
2) ALL GAUGES
3) COMPENSATO
ACTIVE GAUG
TO BUT NOT
4) WITHIN EACH
GAUGE AND
PAIRS PER
5) LOCAL WIRI
DRAWINGS
6) THE LOCAL
SURFACE SHO
ING HOLES
LEADS ARE
STATIONS AS
7) INSTALLATION
INNER SURF
WIRES ARE
CENTRE FUSE
FOR FURTHER DETAILS of ENCLOSED AREA SEE SHEETS 6 & 7
SPLICE PLATE
SEE DETAIL "W" SHEET 4
SEE DETAIL "V" SHEET 4
Duct Datum
Aircraft Datum
HOLES TO MATCH JOINING STRAP SEE DRG. No 7-1050-41 & 42
HOLES TO MATC
STIFFENER & JOINT SEE DRG. No 7-1054-07/08
NOTE:- STATIONS - ARE TO BE LOCATED ON DUCT'S INBOARD SIDE; STATIONS ON DUCTS OUTBOARD SIDE
6.50
6.50
5.50
5.74
5.77
5.53
R.H. DUCT - INBOARD
FOR FURTHER DETAILS ENCLOSED AREA SEE SHEET 5
R. FRIEDBERG
FEB. 7.1956
DESIGN APP



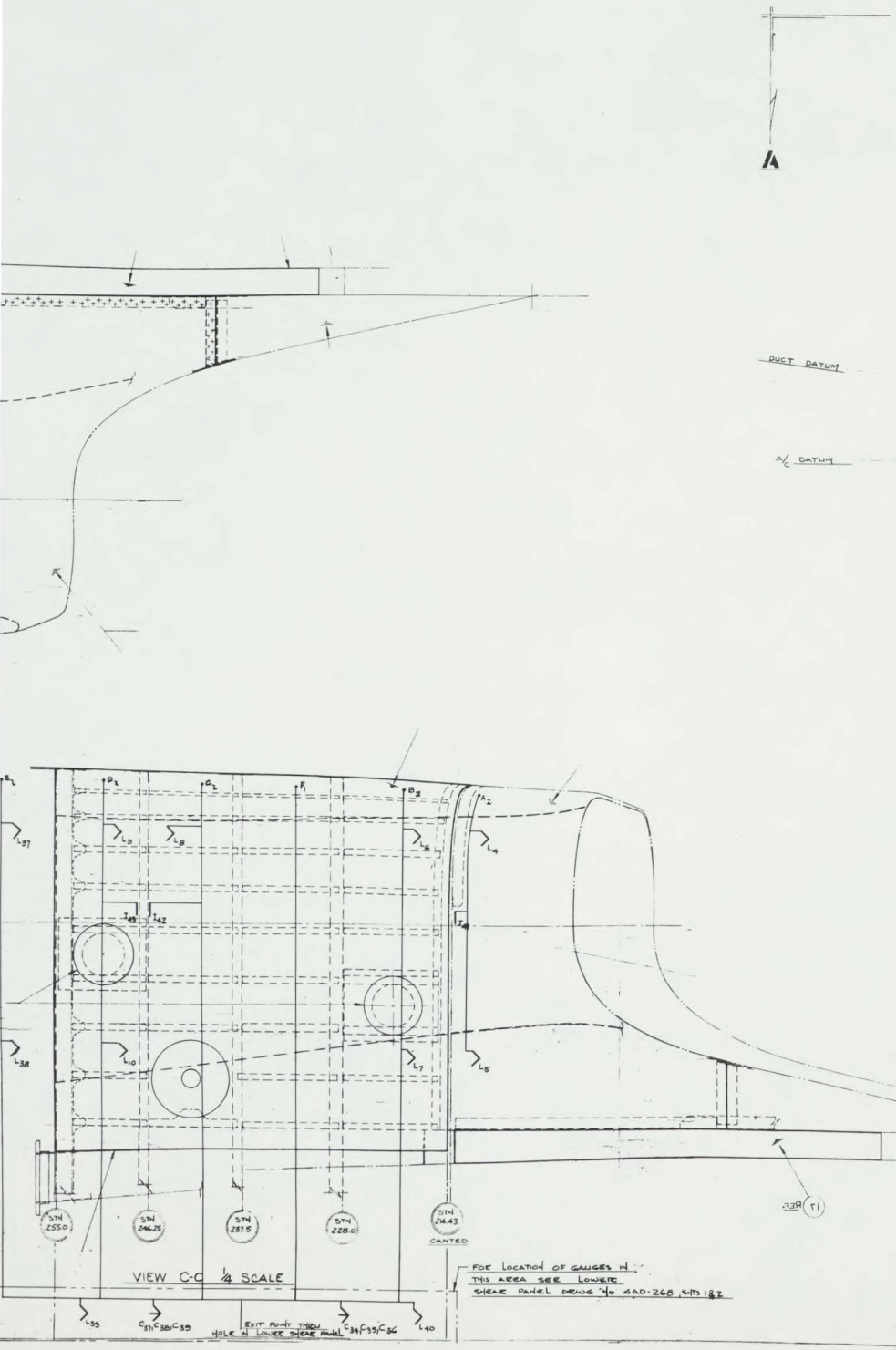
VIEW AA 1/4 SCALE

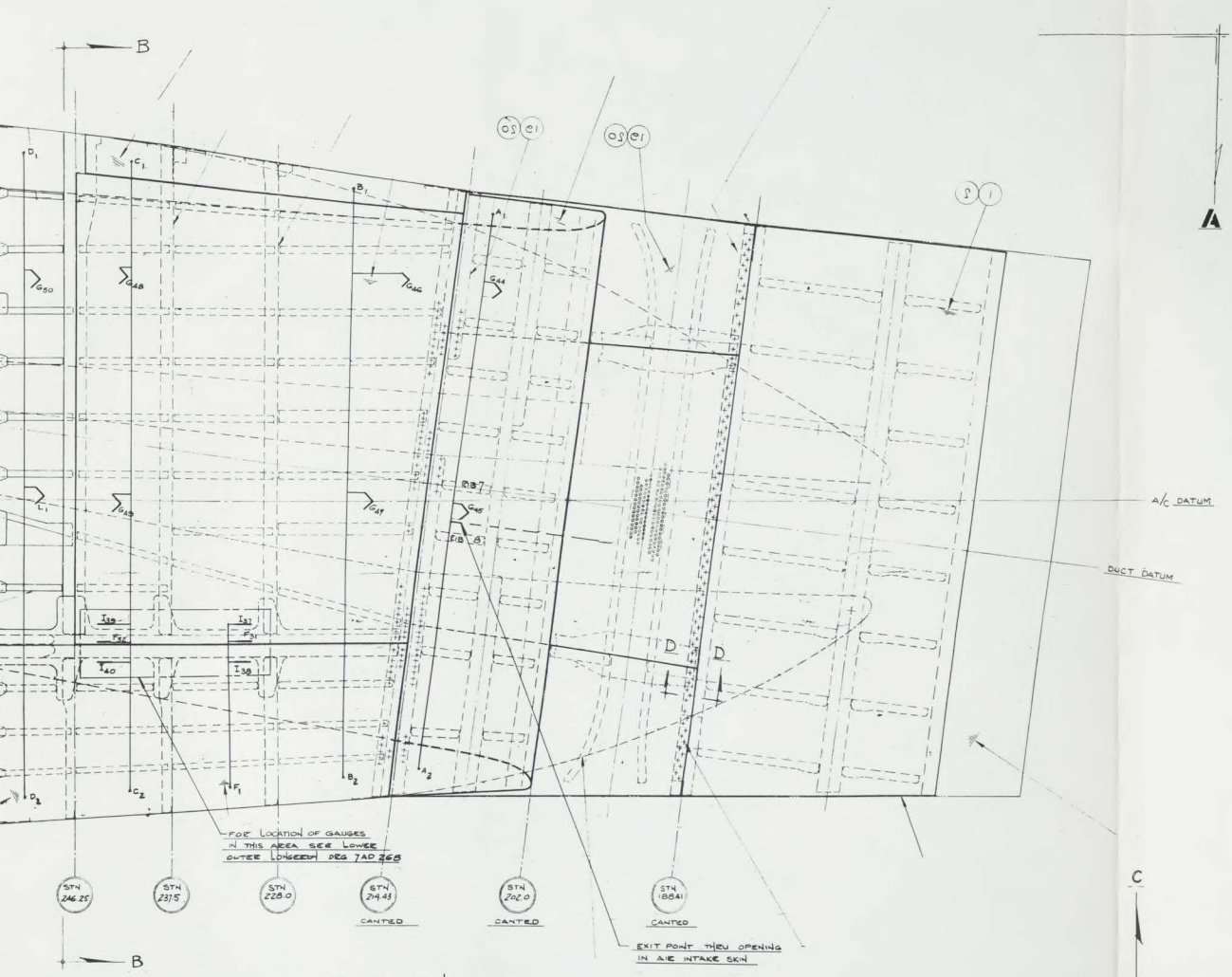


VIEW ON EH. DUCT LOOKING OUTB'D SCALE 1/4



VIEW C-C 1/4 SCALE





VIEW LOOKING INB'D R.H. SIDE ¼ SCALE

STRAIN GAUGE NOTATION

— SINGLE GAUGE A, OR A7 TYPE

> SHEAR PAIR AX5 TYPE

⟩ ROSETTE AE1 TYPE

WIRING ROUTE NOTATION

→ INTERNAL ROUTE

– – EXTERNAL ROUTE

→ A_1 INDICATES THAT WIRING RUN CONTINUED ELSEWHERE ON CONTINUATION IS MARKED

LIST OF INSTALLATION

2AD-268 NACELLE

3AD-268 DUCT

4AD-268 LOWER SH

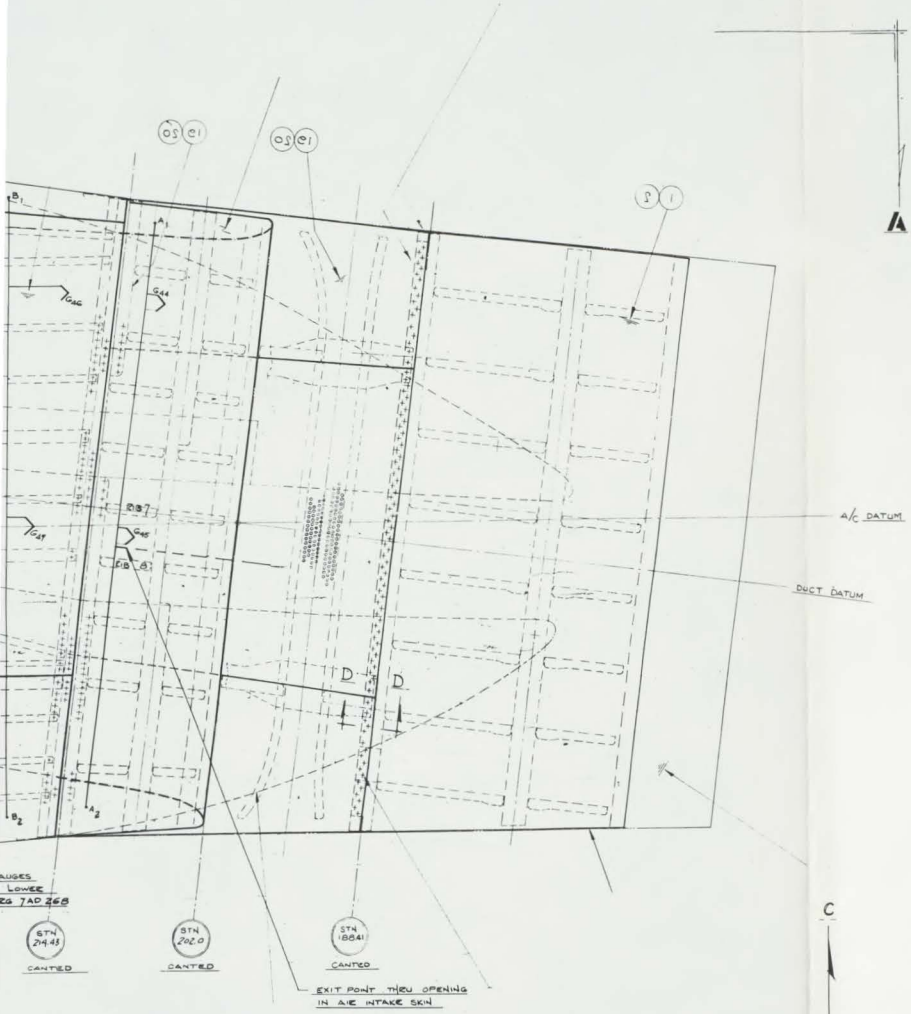
5AD-268 UPPER SHEA

6AD-268 UPPER OUT

7AD-268 OUTER LOW

ISSUE NO	DESCRIPTION
1	G.A. STRAIN GAUGE INSTALLATION FRONT FUSELAGE

A.V. ROE CANADA LTD.
MALTON ONTARIO



'D R.H. SIDE 1/4 SCALE

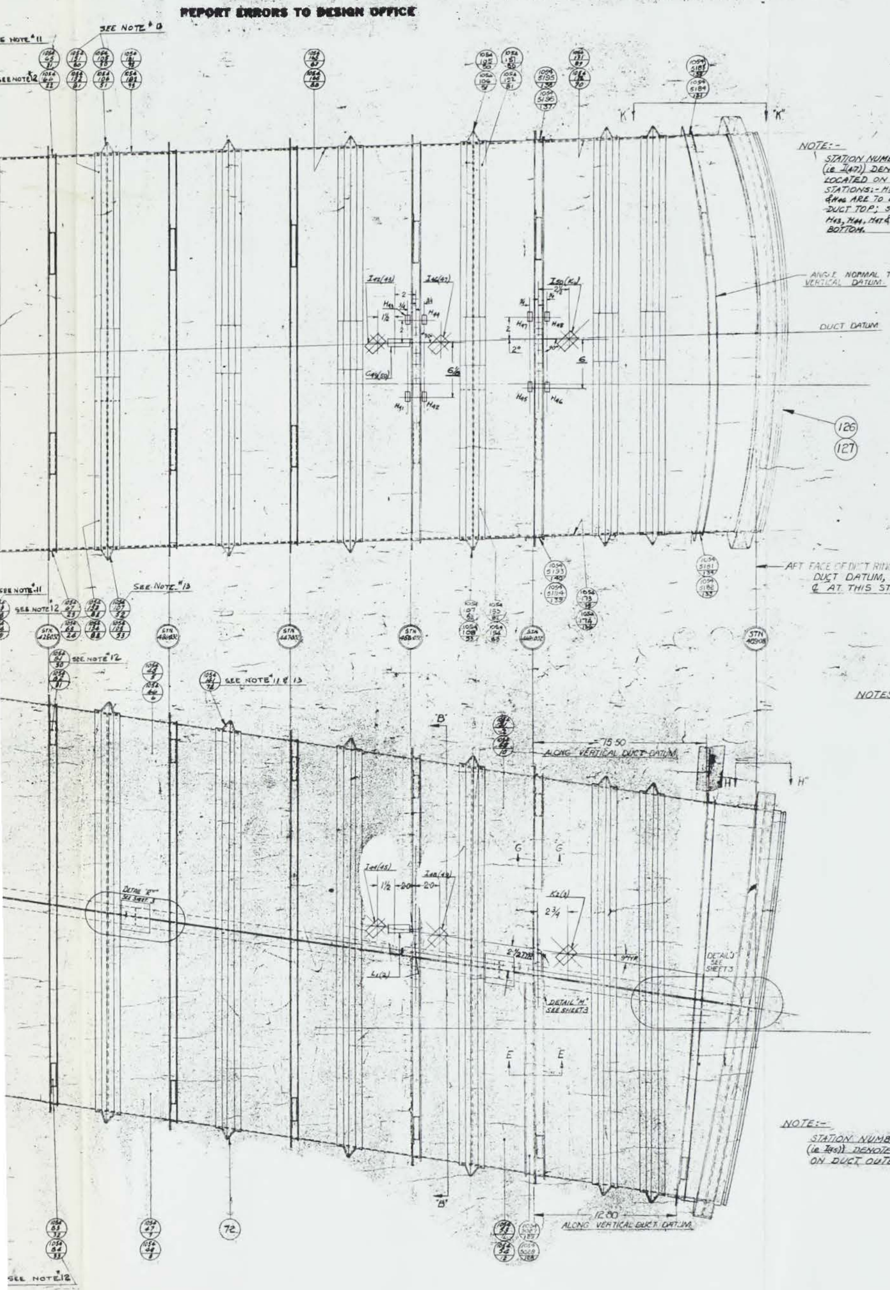
STRAIN GAUGE NOTATION
— SINGLE GAUGE A_1 OR A_2 TYPE
⟩ SHEAR PAIR AX_5 TYPE
→ ROSETTE AR_1 TYPE

WIRING ROUTE NOTATION
—— INTERNAL ROUTE
– – – EXTERNAL ROUTE
→A, INDICATES THAT WIRING RUN IS CONTINUED ELSEWHERE ON DRAWING. CONTINUATION IS MARKED SIMILARLY

LIST OF INSTALLATION DRAWINGS
2AD-268 NACELLE SKINNING
3AD-268 DUCT
4AD-268 LOWER SHEAR PANEL (2 SHTS)
5AD-268 UPPER SHEAR PANEL
6AD-268 UPPER OUTER LONGERON
7AD-268 OUTER LOWER LONGERON

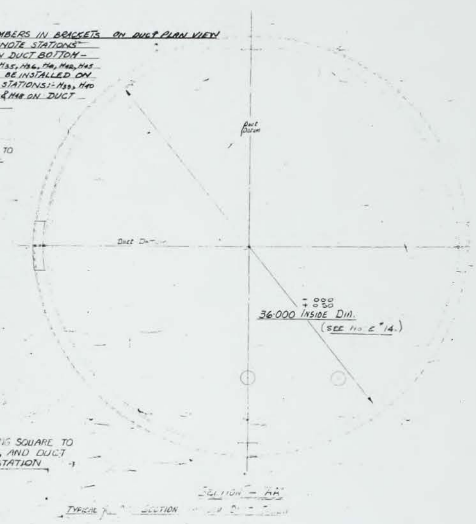
ISSUE NO	DESCRIPTION	REFERENCE DWG	SUPERSEDES DWG
1	G.A. STRAIN GAUGE INSTALLATION FRONT FUSELAGE		
	A.V. ROE CANADA LTD. MALTON ONTARIO	LOFT NUMBER	AD-268

REPORT ERRORS TO DESIGN OFFICE



NOTE:-

STATION NUMBERS IN BRACKETS ON DUCT PLAN VIEW (ie I(47)) DENOTE STATIONS LOCATED ON DUCT BOTTOM – STATIONS:- H35, H36, H41, H42, H45 & H46 ARE TO BE INSTALLED ON DUCT TOP; STATIONS:- H39, H40 H43, H44, H47 & H48 ON DUCT BOTTOM.



NOTES:-

1) TYPES OF GAUGES TO BE INSTALLED AT POSITIONS INDICATED ARE:
   A_1-TYPE GAUGES; STATIONS:- G_{47-50} & L_{1-2}
   A_7 TYPE GAUGES; – STATIONS:- H_{35-48}
   AXs-TYPE GAUGES; – STATIONS:- I_{34-50} & K_{1-3}
2). ALL GAUGES ARE TO BE BACKED WITH SIMILAR GAUGES
3). COMPENSATOR GAUGES ARE TO BE PROVIDED FOR EACH A_1 & A_7 TYPES ACTIVE GAUGE. THE COMPENSATORS ARE TO BE CEMENTED AJACENT TO, BUT NOT CLOSER THAN 2" FROM THEIR ACTIVE GAUGES.
4) WITHIN EACH SHEAR PAIR ONE GAUGE IS TO BE WIRED AS AN ACTIVE GAUGE AND THE OTHER GAUGE AS A COMPENSATOR. – TWO SHEAR PAIRS PER STATION.
5) LOCAL WIRING OF GAUGES IS TO BE CARRIED OUT ACCORDING TO DRAWINGS 1D & 3D - RD2123 FOR A_1, A_7 & AXs TYPE GAUGES, RESPECTIVELY.
6) THE LOCAL WIRES OF GAUGES LOCATED ON THE DUCT OUTER SURFACE SHOULD BE ROUTED, THROUGH A SERIES OF LIGHTENING HOLES IN THE FORMERS, TOWARDS THE DUCT BAY. – THE LEADS ARE TO BE CLAMPED AT SEVERAL INTERMEDIATE STATIONS AS INDICATED ON DRAWING 1 AD264.
7) INSTALLATION AND WIRING OF GAUGES LOCATED ON THE DUCT INNER SURFACE, AS WELL AS SOLDERING OF LOCAL TO GAUGE WIRES ARE TO BE EXECUTED AFTER FINAL ASSEMBLY OF THE CENTRE FUSELAGE.

NOTE:-

STATION NUMBERS IN BRACKETS ON DUCT SIDE VIEW (ie I(45)) DENOTE STATIONS LOCATED ON DUCT OUTBOARD SIDE.

REF	PART No	DESCRIPTION	No.OFF
	C_1-RD2105	COMPENSATOR TAG	28
	A_7	SINGLE GAUGE COMPS	28
	A_7	SINGLE GAUGE	28
	B_1-RD2105	COMPENSATOR TAG	12
	AXs	SHEAR PAIR	40
	A_1	SINGLE GAUGE COMPS	12
	A_1	SINGLE GAUGE	12

DRAWING PARTS LIST

STRAIN GAUGE INSTALLATION
R.H. DUCT - STA. 331.54-485 — C/F

R. FRIEDBERG
FEB. 7. 1956

SHED CHK APP.
DESIGN APP.

14 AD 264.

SECRET