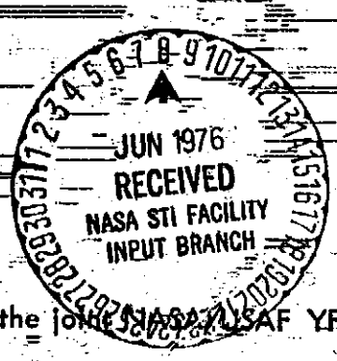
NASA CR-144972
JAN 9, 1976

# YF-12 LOCKALLOY VENTRAL FIN PROGRAM FINAL REPORT

## VOLUME 2

By R. J. Duba, A. C. Haramis, R. F. Marks, L. Payne and R. C. Sessing




Prepared for the joint NASA/USAF YF-12 Project by

LOCKHEED-CALIFORNIA COMPANY
A division of Lockheed Aircraft Corporation
ADVANCED DEVELOPMENT PROJECTS
Burbank, Calif.

for

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

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NASA CR-144972
JAN 9, 1976

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NATIONAL AERONAUTICS
AND SPACE ADMINISTRATION

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# BIBLIOGRAPHY OF EXISTING

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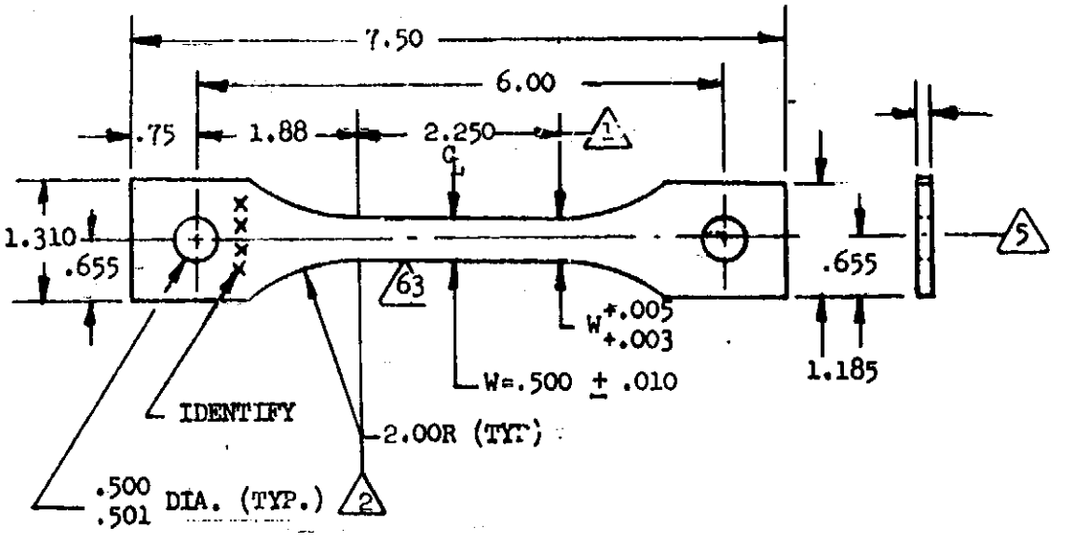
LMSC-DIC-173, August 1963
(LOCKHEED PRIVATE DATA)

# APPENDIX B

## TEST SPECIMEN CONFIGURATIONS

| REV. | DATE | CHANGE |
|---|---|---|
| A | 10-9-75 | REVISED (1) AND (2) |
| | | NOTES. |




TENSION COUPON - 2 INCH GAGE LENGTH

NOTE: (1) DIMENSION AT ENDS OF THIS GAGE LENGTH MUST BE LARGER BY +.003 TO +.005 INCHES THAN THE W = .500 ±.010 INCHES AT CENTERLINE. RADIUS TAPER FROM ENDS TO CENTERLINE REQUIRED.

(2) NO MISMATCH ALLOWED.

3. USE FOR ELEVATED TEMPERATURE TESTS

4. LEAVE ALL EDGES SHARP

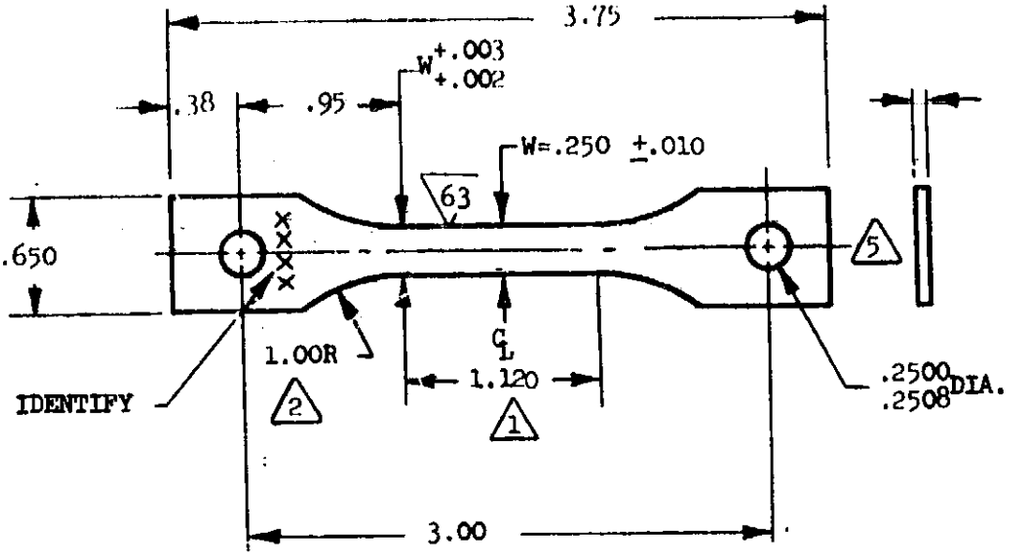
(5) SYMMETRICAL TOLERANCE ±.001

4-9-64

S7 | A

1404

| REV. | DATE | CHANGE |
|---|---|---|
| A | 10/9/75 | 1 Note Revised |
| | | |




TENSION COUPON - 1 INCH GAGE LENGTH

NOTE: 1. DIMENSION AT ENDS OF THIS GAGE LENGTH MUST BE LARGER BY +.002 TO +.003 INCHES THAN THE W = .250 ± .010 INCHES AT CENTERLINE. RADIUS TAPER FROM ENDS TO CENTERLINE REQUIRED.

2. NO MISMATCH ALLOWED

4. USE FOR ELEVATED TEMPERATURE

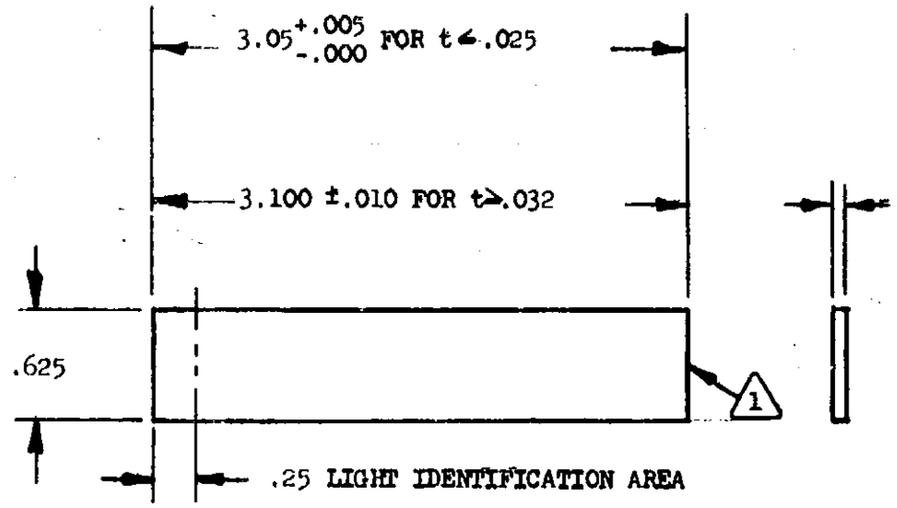
5. SYMMETRICAL TOLERANCE ±.001

4-9-64

S12 A

1404

| REV. | DATE | CHANGE |
|---|---|---|
| | | |
| | | |




COMPRESSION COUPON - SHEET

NOTE: (1) ALL EDGES TO BE GROUND TO 63 FINISH AND MUST BE FLAT, SQUARE, AND PARALLEL

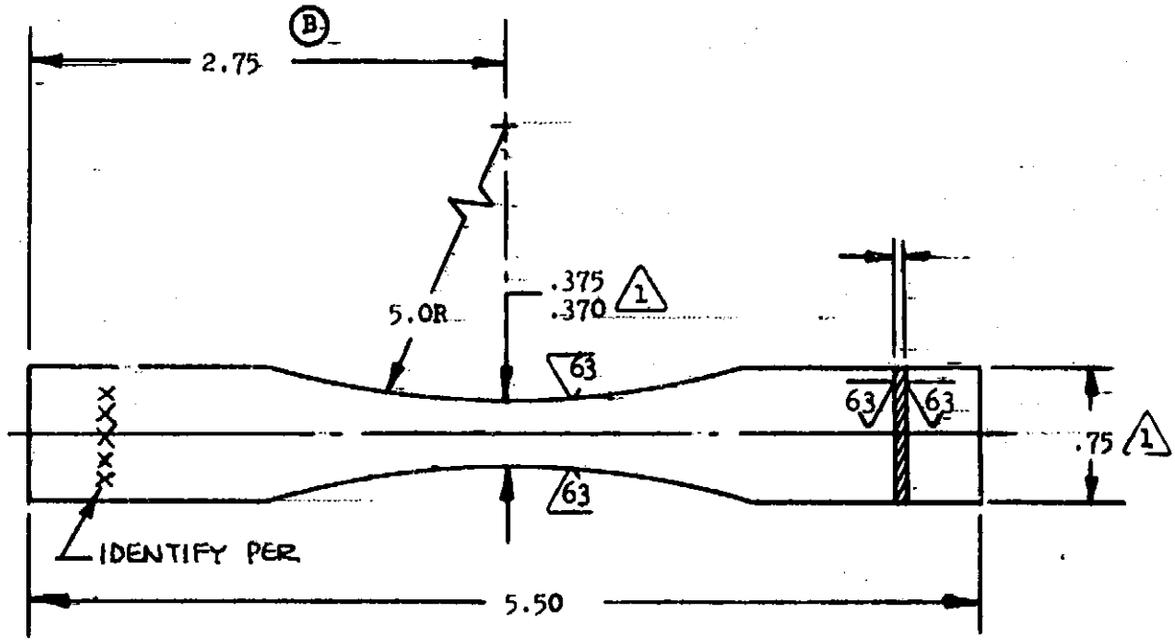
2 LEAVE ALL EDGES SHARP

4-9-64

S13

1404

| REV. | DATE | CHANGE |
|---|---|---|
| A | 11-23-64 | ADDED △5 |
| B | 3-09-65 | ADDED 2.75 |
| C | 7-16-74 | △1 ±.003 WAS ±.010 |




FATIGUE COUPON - UNNOTCHED

NOTE:

△1 TO BE SYMMETRICAL ABOUT CENTERLINE WITHIN ±.003 INCHES Ⓒ

2. THIS COUPON $K_t$ = 1.0

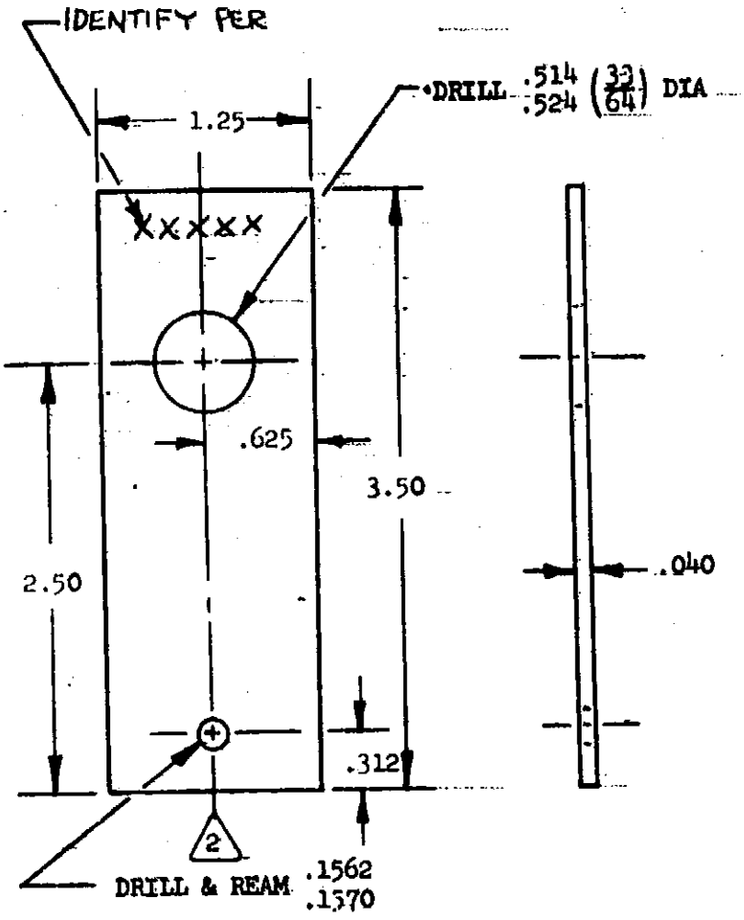
3. ENDS MAY BE SHEARED, ALL OTHER SURFACES TO BE 63

4-9-64

S29

1404

| REV. | DATE | CHANGE |
|---|---|---|
| A | 7-16-74 | (2) ±.003 WAS ±.010 |
| | | |




BEARING COUPON - ED = 2.0

NOTES:

1. SURFACE FINISH TO BE 63

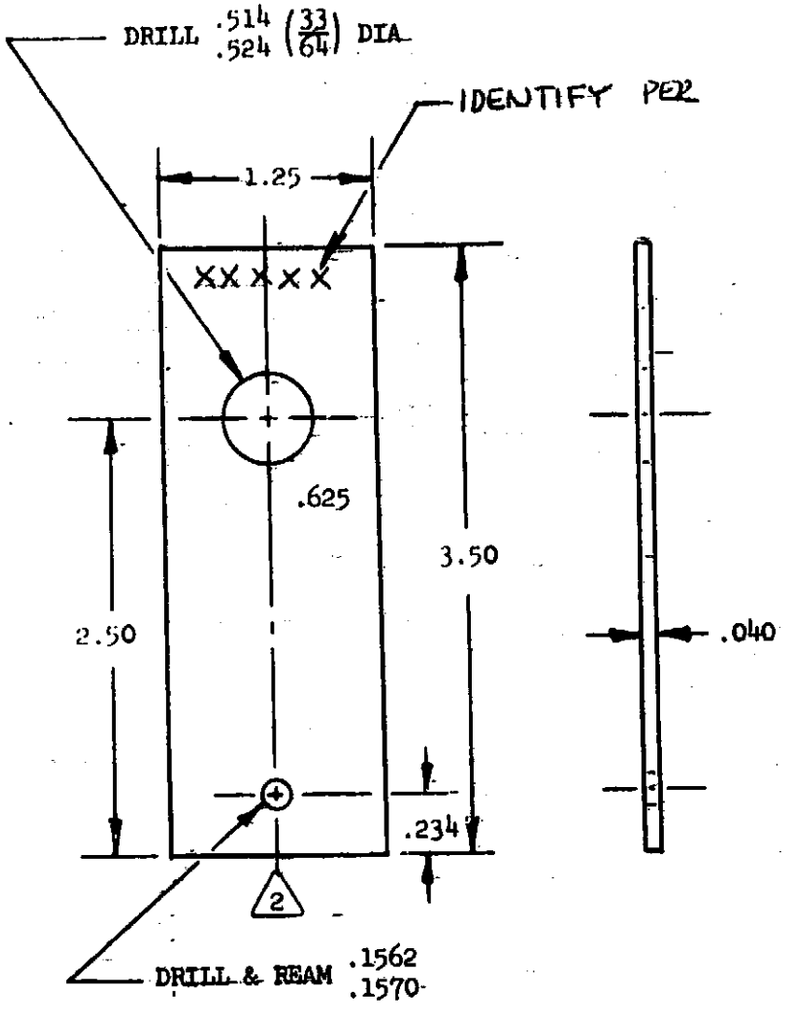
(2) TO BE SYMMETRICAL ABOUT CENTERLINE WITHIN ±.003 INCHES (A)

4-9-64

S35

1404

| REV. | DATE | CHANGE |
|---|---|---|
| A | 7-16-74 | (2) ±.003 WAS ±.010 |
| | | |




BEARING COUPON - ED = 1.5

NOTES:

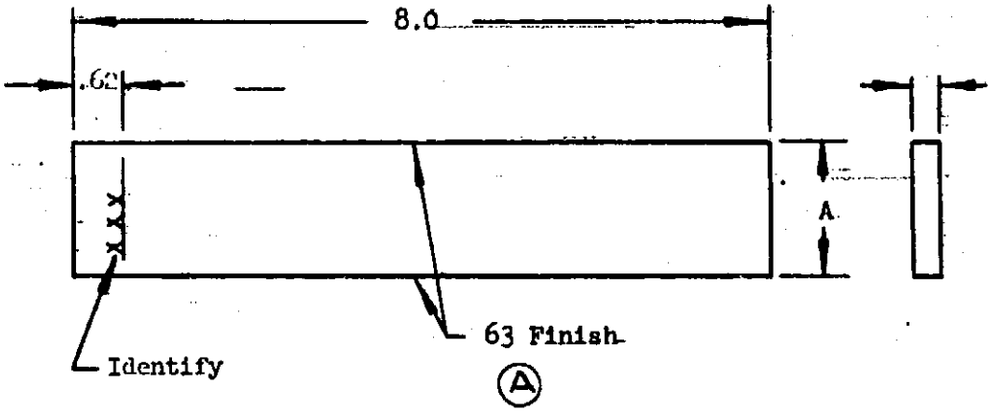
1. SURFACE FINISH TO BE √63
2. TO BE SYMMETRICAL ABOUT CENTERLINE WITHIN ±.003 INCHES (A)

4-9-64

536

1404

| REV. | DATE | CHANGE |
|---|---|---|
| A | 3-24-75 | |
| | | |




| SHEET THICKNESS | A |
|---|---|
| Up to & Incl. .100 | 1.00 |
| Over .100 | 1.50 |

UN-NOTCHED BEND COUPON

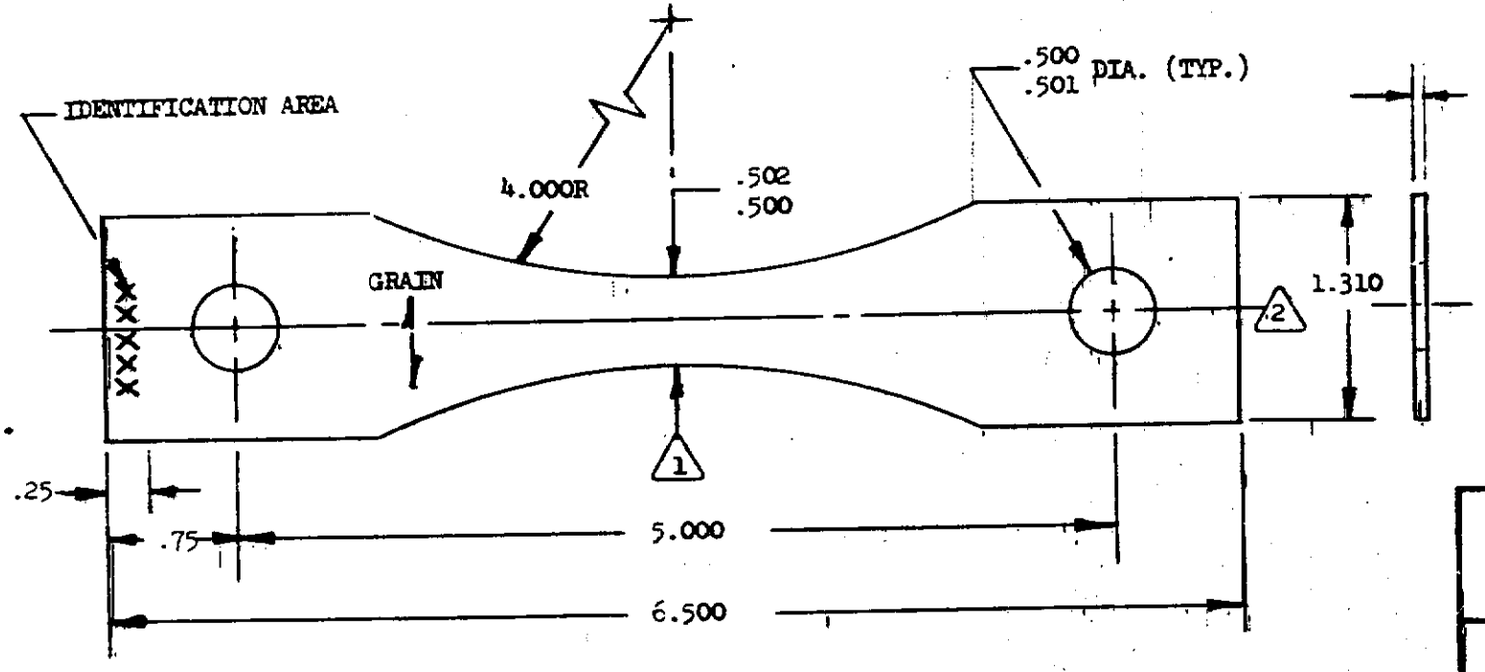
3-26-73

S46 A

1404

6-13-69

## STRESS CORROSION COUPON



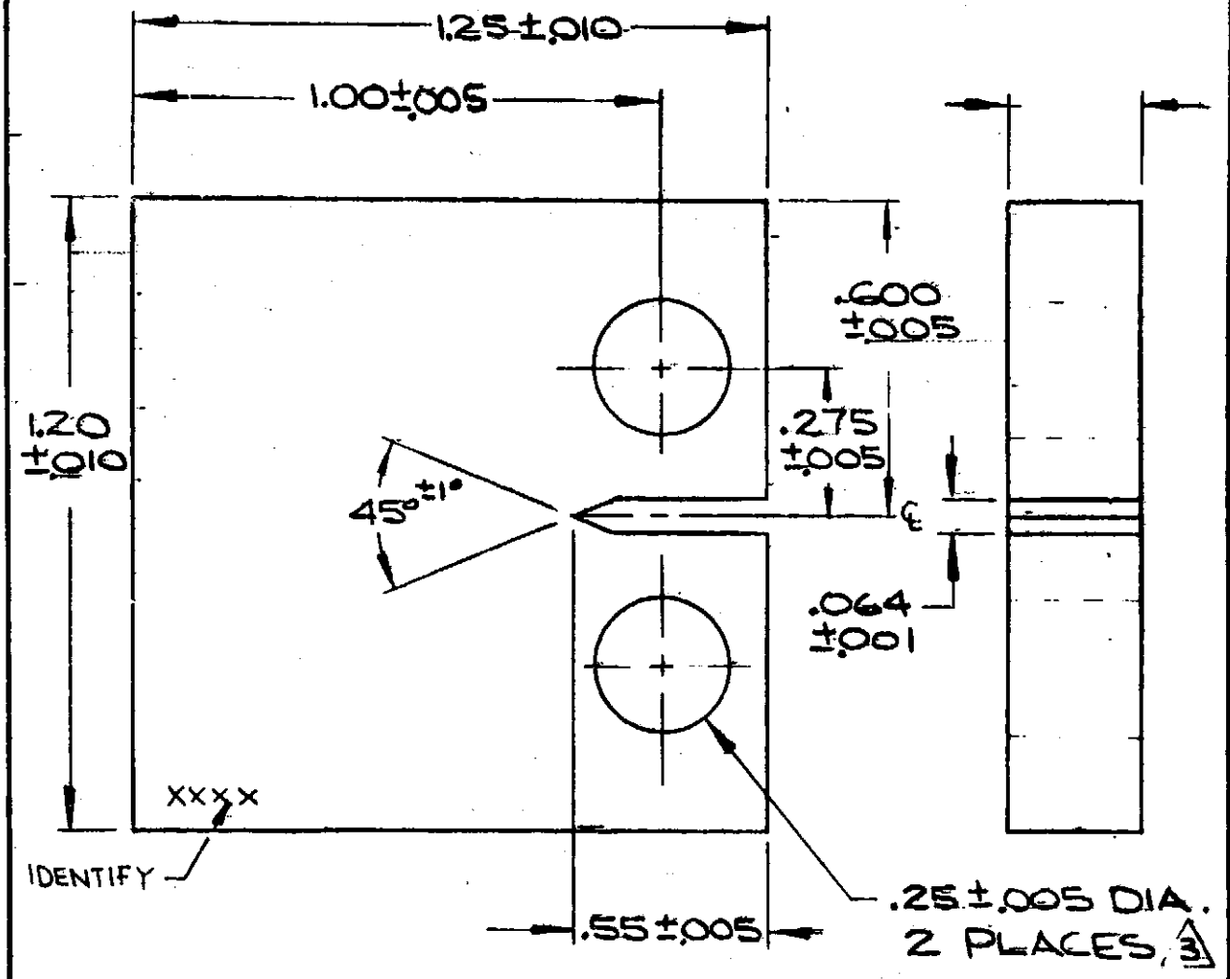

NOTE: ⚠1 LEAVE EDGES SHARP ON THESE SURFACES - NO BURRS. HOLD 63 FINISH.

⚠2 TO BE SYMMETRICAL ABOUT CENTERLINE WITHIN ±.003 INCHES.

| REV. | DATE | CHANGE |
|---|---|---|
| | | |

S47

| REV. | DATE | CHANGE |
|---|---|---|
| | | |
| | | |

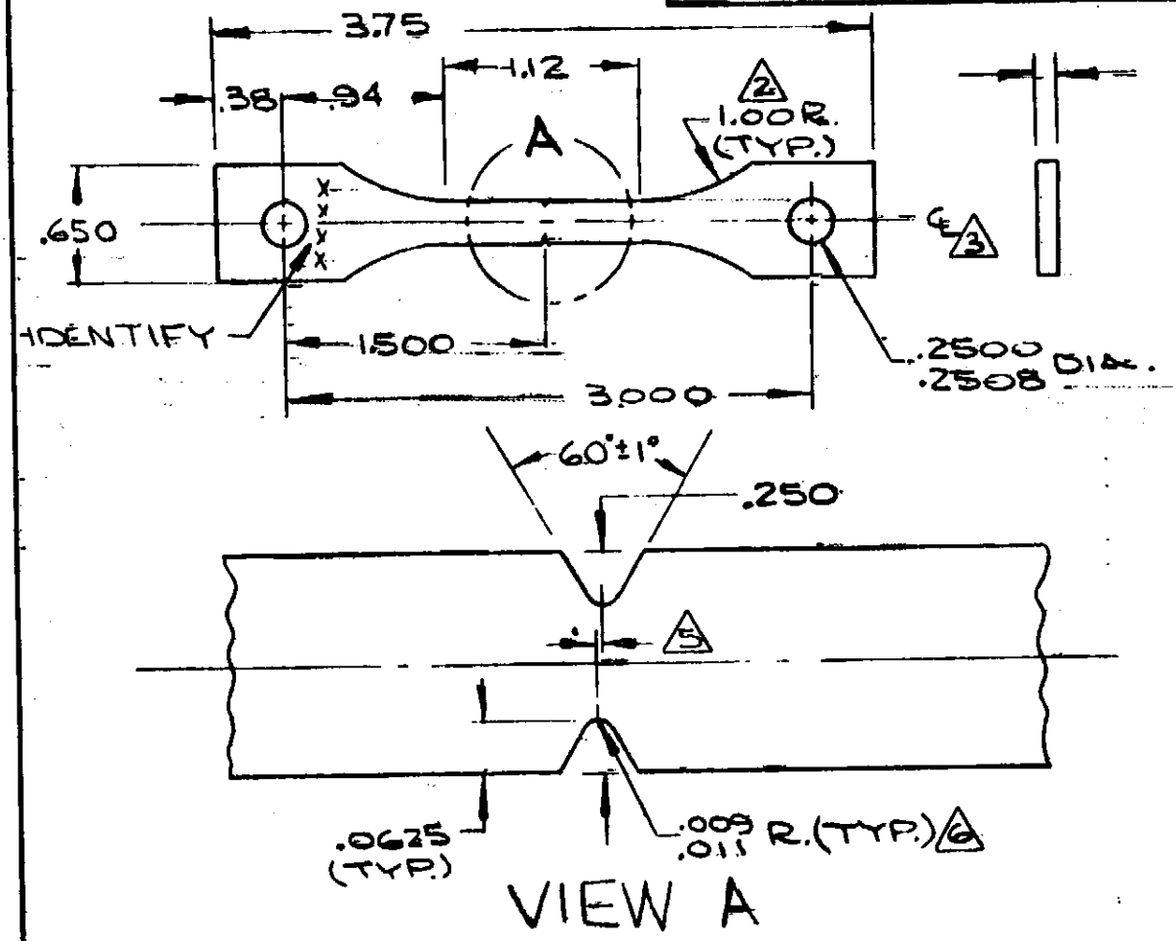



FRACTURE TOUGHNESS COUPON ($K_{Ic}$)

NOTE:
1. LEAVE ALL EDGES SHARP
2. ALL SURFACES TO BE 32
3. MUST BE PERPENDICULAR TO SURFACES

S-48

| REV. | DATE | CHANGE |
|---|---|---|
| | | |
| | | |




NOTCHED TENSION COUPON $K_T = 3.0$

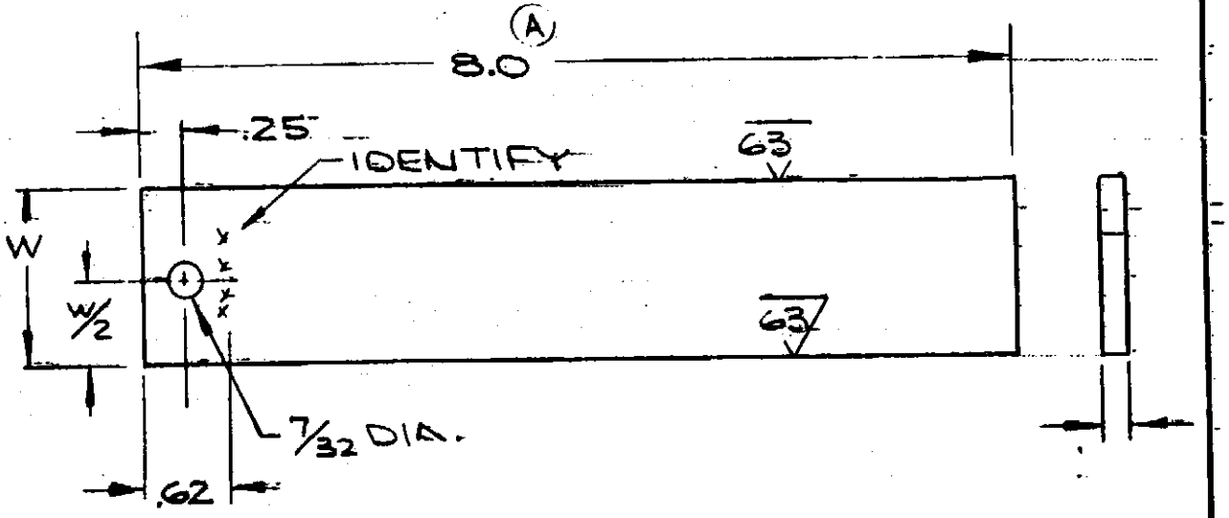
NOTE:

2. NO MISMATCH ALLOWED
3. SYMMETRICAL TOLERANCE ±.001
4. LEAVE ALL EDGES SHARP
5. .005 MAX. MISALIGNMENT OF NOTCHES
6. 63 FINISH ON ALL NOTCH AREA

S-49

1404

| REV. | DATE | CHANGE |
|---|---|---|
| A | 3-24-75 | |
| | | |




| SHEET THICKNESS | W Ⓐ |
|---|---|
| UP TO .100 | 1.00 |
| OVER .100 | 1.50 |

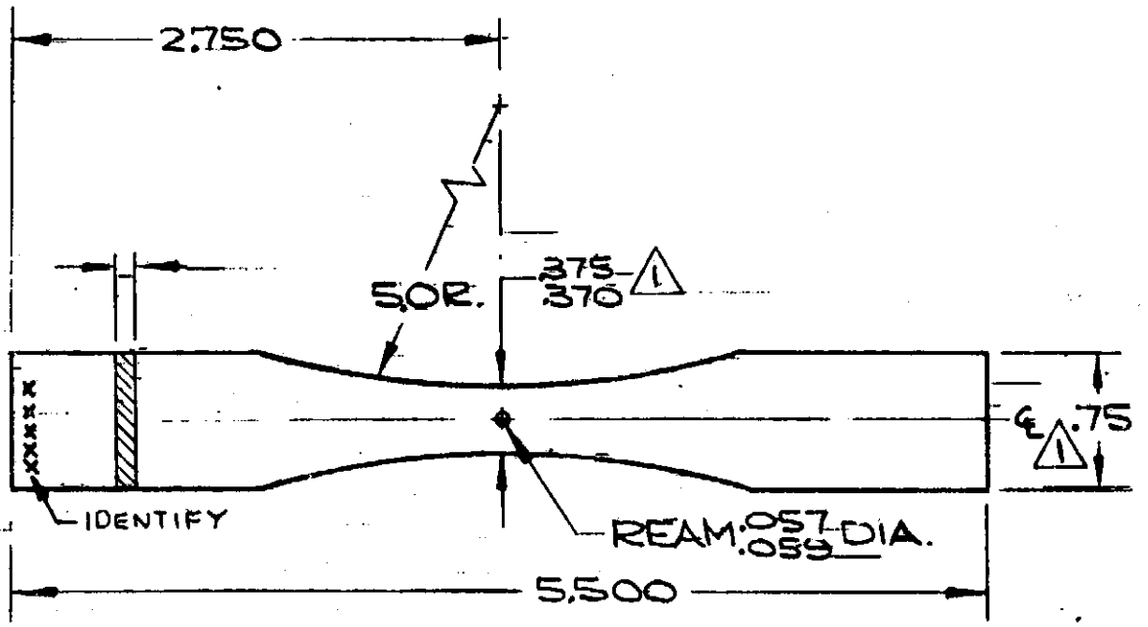
## UN-NOTCHED BEND COUPON

NOTE:

2. LEAVE ALL EDGES SHARP

S-50 | A

| REV. | DATE | CHANGE |
|---|---|---|
| | | |
| | | |




## FATIGUE COUPON - NOTCHED

NOTE:-

1. SYMMETRICAL ABOUT ℄ WITHIN ±.001
2. THIS COUPON $K_t$ = 2.6
3. ALL SURFACES TO BE 63
4. LEAVE ALL EDGES SHARP

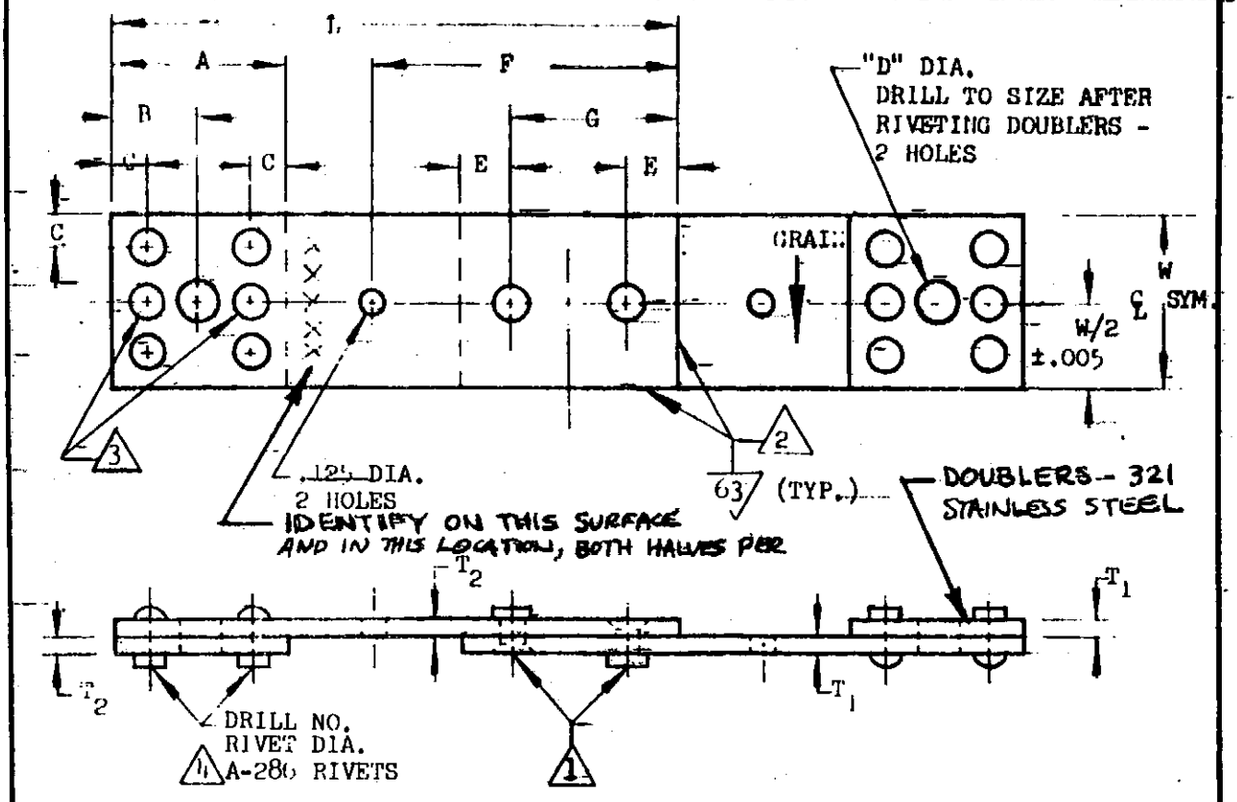
S-51

1404

# SINGLE SHEAR LAP JOINT
## TEST COUPON - 2 FASTENER

(REF: MIL-STD-1312 LENGTH & SPOTWELDS EXCEPTED)

| REV. | DATE | CHANGE |
|---|---|---|
| A | 6-2-75 | L & F DIMENSIONS REV. |
| | | |

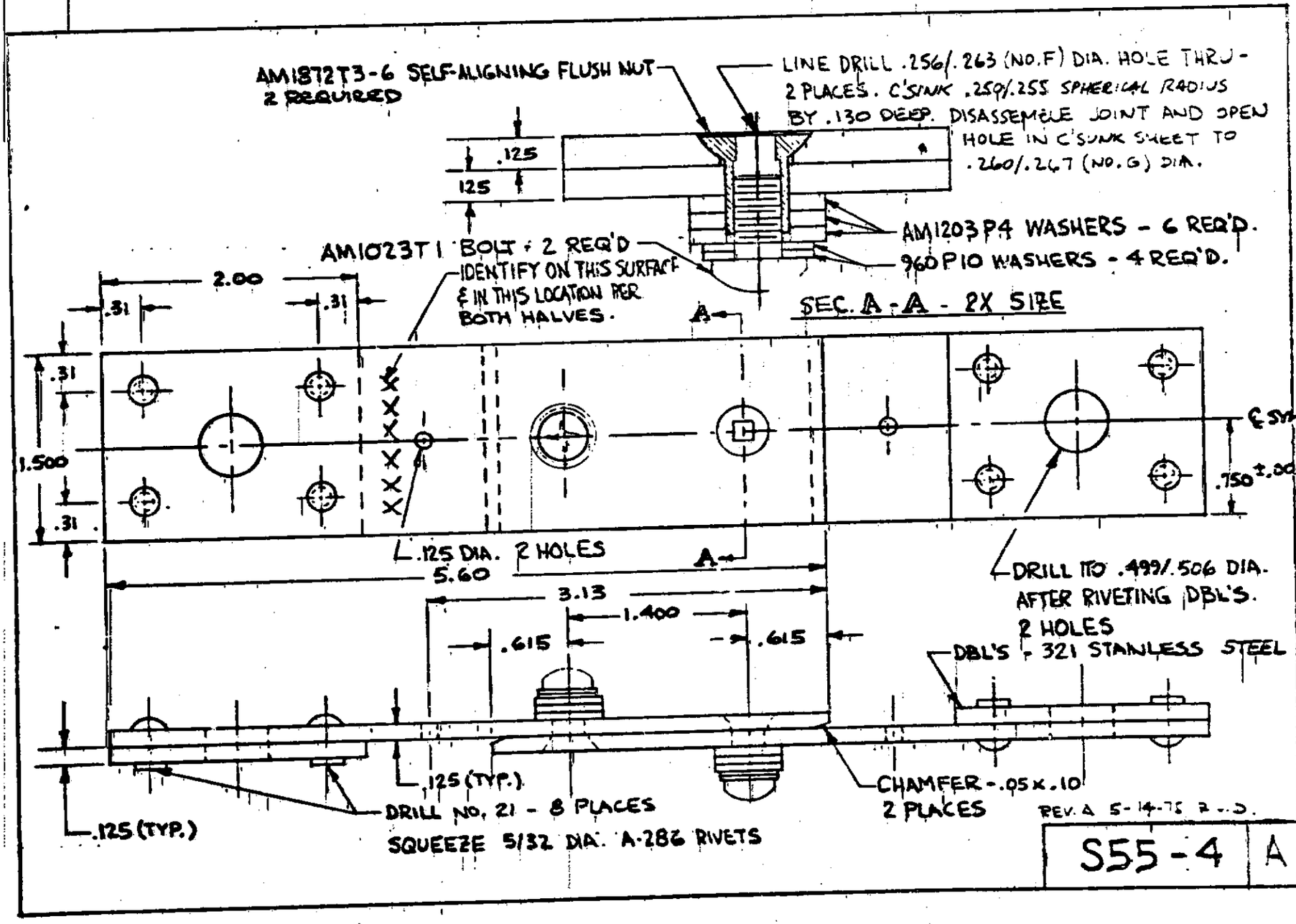



| DASH NO. | FAST. SIZE | W | A | B | L | C | F | E | G | "D" DIA. | RIVET DIA. | DRILL NO. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| -1 | 3/32 | .75 | 1.50 | .75 | 3.375 | .19 | 1.375 | .188 | .564 | .251<br>.258 | 3/32 | 41 |
| -2 | 1/8 | 1.00 | 1.50 | .75 | 3.50 | .25 | 1.50 | .250 | .750 | .376<br>.383 | 1/8 | 30 |
| -3 | 5/32 | 1.25 | 2.00 | 1.00 | 4.125 | .31 | 1.625 | .312 | .936 | .499<br>.506 | 5/32 | 21 |
| -4 | 3/16 | 1.50 | 2.00 | 1.00 | 4.50 | .31 | 1.75 | .375 | 1.125 | .499<br>.506 | 5/32 | 21 |
| -5 | 1/4 | 2.00 | 2.50 | 1.25 | 6.00 | .31 | 3.00 | .500 | 1.500 | .624<br>.633 | 5/32 | 21 |
| -6 | 5/16 | 2.50 | 3.00 | 1.50 | 6.75 | .38 | 3.25 | .625 | 1.875 | .749<br>.758 | 3/16 | 11 |
| -7 | 3/8 | 3.00 | 3.50 | 1.75 | 7.50 | .38 | 3.50 | .750 | 2.250 | .999<br>1.010 | 3/16 | 11 |

1. FASTENER HOLES DRILLED PERPENDICULAR TO SHEET SURFACE WITHIN 1 DEGREE.
2. SHEARED EDGES NOT PERMISSABLE.
3. CENTER RIVETS REQ'D ON -5, -6, AND -7.
4. SQUEEZE A-286 RIVETS - DO NOT GUN DRIVE.

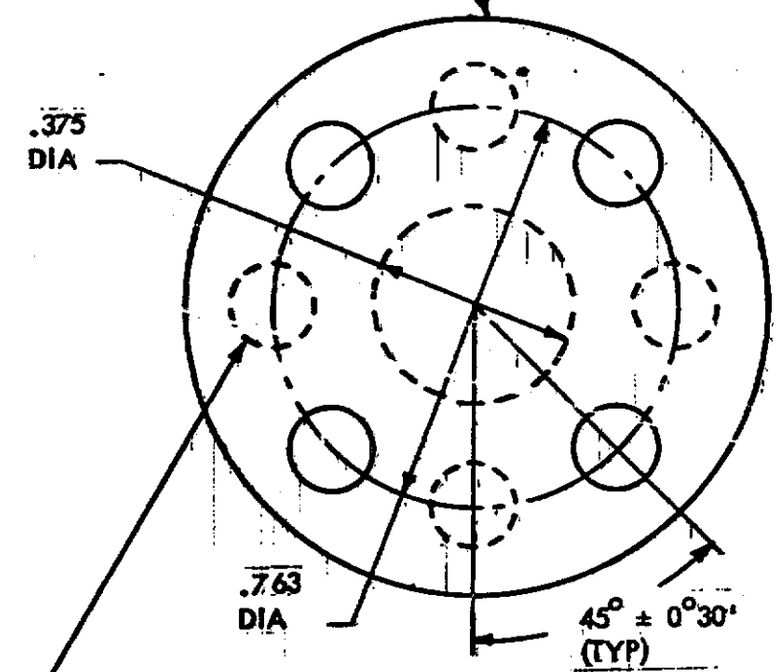
S54 | A

1404


AM1872T3-6 SELF-ALIGNING FLUSH NUT
2 REQUIRED
LINE DRILL .256/.263 (NO.F) DIA. HOLE THRU - 2 PLACES. C'SINK .259/.255 SPHERICAL RADIUS BY .130 DEEP. DISASSEMBLE JOINT AND OPEN HOLE IN C'SUNK SHEET TO .260/.267 (NO.G) DIA.
.125
.125
AM1023T1 BOLT - 2 REQ'D
AM1203P4 WASHERS - 6 REQ'D.
960P10 WASHERS - 4 REQ'D.
IDENTIFY ON THIS SURFACE & IN THIS LOCATION PER BOTH HALVES.
SEC. A-A - 2X SIZE
2.00
.31
.31
.31
.31
1.500
.750 ±.005
℄ SYM.
.125 DIA. 2 HOLES
5.60
3.13
1.400
.615
.615
DRILL TO .499/.506 DIA. AFTER RIVETING DBL'S. 2 HOLES
DBL'S - 321 STAINLESS STEEL
.125 (TYP.)
DRILL NO. 21 - 8 PLACES
SQUEEZE 5/32 DIA. A-286 RIVETS
.125 (TYP.)
CHAMFER - .05 x .10
2 PLACES
REV. A 5-14-75 R.D.
S55-4
A

(-3) TENSILE SPECIMEN ASSY

(-5) TENSILE SPECIMEN ASSY



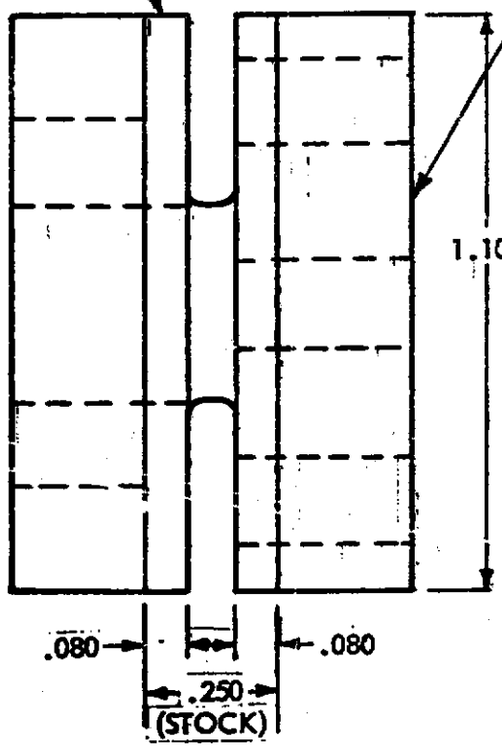

.165
.171 (NO 19) DIA-HOLE-8 PLACES (-1 & -4)

.171
.177 (11/64 DIA

(-1) SPECIMEN-1 REQ
LOCKALLOY

(-4) SPECIMEN -1 REQ'D - 5
.250 7075-T6 AL (STOCK)

(-2) PLATE - 2 REQ'D -3 AND -5 1/4" STEEL (COLD ROLLED) BOND TO -1 AND -4




NOTE

2. FILLET RADII .03
1. 160 ROUGHNESS - ALL MACHINED SURFACES EXCEPT AS NOTED.

# APPENDIX C

## RESEARCH NOTEBOOK

## TEST DATA

TO: B. B. DUBA
FROM: T. SATO
MODEL:
DATE: Dec 26 '75

LOCKHEED-CALIFORNIA COMPANY
A DIVISION OF LOCKHEED AIRCRAFT CORPORATION
RESEARCH NOTEBOOK
Nº 361009

SUBJECT: TR 1421 TENS. TEST OF BE 43AL NOTCHED SPECIMEN AT R.T.
REF:
W.O. 31-2525
EWA 03287

CONTINUED FROM R.N. #
PART NO. AND SER.

| CONTROL DENT | WIDTH | THICK | AREA | U.L.T. LBS | U.L.T. KSI |
|---|---|---|---|---|---|
| 1-N1L | .1283 | .2514 | .0323 | 1750 | 54.18 |
| 1-N2L | .1302 | .2510 | .0327 | 1810 | 55.35 |
| 1-N3L | .1290 | .2517 | .0325 | 1800 | 55.38 |
| 1-N1T | .1302 | .2514 | .0327 | 1580 | 48.32 |
| 1-N2T | .1297 | .2502 | .0324 | 1610 | 4969 |
| 1-N3T | .1286 | .2502 | .0322 | 1720 | 5342 |

PER BENET WEAP'S DATA FOR ALUMINUM LOW ELONGATION

CONTINUED ON R.N. #
SIGNATURE

TO D. PETTIT
FROM C.A WALDON
MODEL

DATE 12 9 75

LOCKHEED CALIFORNIA COMPANY
A DIVISION OF LOCKHEED AIRCRAFT CORPORATION
RESEARCH NOTEBOOK

Nº 529771

SUBJECT BEARING TEST TENSION @ R.T.

REF:

W.O. EWA

CONTINUED FROM R.N. & PART NO. AND SER. ALC 3M4

| COUPON ID | PIN DIA-IN. | THICK IN | AREA IN² | EDGE DIST-IN. | ULTIMATE LBS | ULTIMATE KSI | BEARING LBS | BEARING KSI | YIELD I |
|---|---|---|---|---|---|---|---|---|---|
| 3B1.5-1T | .156 | .1367 .1367 | .0097 | .158 | 439.0 | 77.0 | 380 | 66.6 | |
| -2T | | .1276 | .0089 | .160 | 485.0 | 77.6 | 406 | 68.8 | |
| -3T | | .1282 | .0080 | .160 | 463.5 | 72.2 | 406 | 67.7 | |
| 3B1.5-1L | | .0208 | .0032 | .151 | 245.6 | 76.6 | 231 | 72.2 | |
| -2L | | .0260 | .0040 | .155 | 302.2 | 75.5 | 232 | 58.0 | |
| -3L | | .0207 | .0052 | .146 | 363.0 | 69.8 | 346 | 66.5 | |
| 3B1.5-7T | | .1267 | .0098 | .160 | 471.5 | 81.2 | 337 | 58.1 | |
| -8T | | .1333 | .0092 | .154 | 367.5 | 70.7 | 341 | 65.6 | |
| -9T | | .1301 | .0097 | .157 | 360.0 | 76.6 | 311 | 66.2 | |
| 3B1.5-7L | | .0433 | .0068 | .152 | 523.0 | 76.9 | 419 | 61.6 | |
| -8L | | .1347 | .0094 | .154 | 447 | 62.8 | 359 | 66.5 | |
| -9L | | .1412 | .0094 | .156 | 475 | 74.2 | 415 | 64.8 | |
| 3B2.0-1T | | .1370 | .0098 | .237 | 519.5 | 81.5 | 414 | 71.4 | |
| -2T | | .1332 | .0080 | .235 | 542.0 | 90.3 | 437 | 72.8 | |
| -3T | | .1110 | .0064 | .236 | 606 | 94.7 | 470 | 73.4 | |
| 3B2.0-1L | | .1195 | .0071 | .237 | 666 | 93.8 | 540 | 76.0 | |
| -2L | | .1460 | .0072 | .235 | 646 | 89.7 | 446 | 61.9 | |
| -3L | | .1337 | .0052 | .235 | 526 | 101.2 | 375 | 72.1 | |
| 3B2.0-7T | | .1405 | .0063 | .239 | 664 | 105.4 | 482 | 76.5 | |
| -6T | | .1302 | .0097 | .238 | 484 | 102.0 | 348 | 74.0 | |
| -9T | | .1264 | .0097 | .237 | 530 | 92.9 | 392 | 68.8 | |
| 3B2.0-7L | | .1376 | .0098 | .235 | 570 | 98.3 | 464 | 80.0 | |
| -8L | | .1356 | .0096 | .235 | 538 | 96.1 | 444 | 79.3 | |
| -9L | .156 | .1314 | .0061 | .235 | 636 | 104.3 | 475 | 77.9 | |

CONTINUED ON R.N. #

SIGNATURE

FORM 6584-1

TO: D PETIT | DATE: 12

FROM: L SILVAS | 16

MODEL: 75 | 10

LOCKHEED CALIFORNIA COMPANY
A DIVISION OF LOCKHEED AIRCRAFT CORPORATION

RESEARCH NOTEBOOK

Nº 529772

SUBJECT: BEARING TEST @ 600°F

REF:

W.O. EWA

CONTINUED FROM R.N. #

PART NO. AND SER.

AUK 344

| Coupon ID | Pin Dia | Thick IN | Area IN² | Edge Distance | Ultimate LBS | Ultimate KSI | Bearing LBS | Bearing KSI |
|---|---|---|---|---|---|---|---|---|
| 3B1.5-4T | .1557 | .0370 | .0052 | .157 | 240 | 41.2 | 215 | 37.1 |
| 5T | | .0378 | .0059 | .156 | 240 | 41.7 | 232 | 39.3 |
| 6T | | .0292 | .0056 | .158 | 222 | 39.6 | — | |
| 3B1.5-4L | | .0318 | .0053 | .152 | 191 | 36.0 | 181 | 34.1 |
| 5L | | .0426 | .0063 | .155 | 225 | 35.7 | 208 | 33.0 |
| 6L | | .0289 | .0044 | .155 | 153 | 34.8 | 192 | 43.6 |
| 3B1.5 10L | | .0423 | .0066 | .156 | 240 | 36.4 | 237 | 35.9 |
| 11L | | .0326 | .0052 | .153 | 178 | 34.2 | 166 | 31.9 |
| 12L | | .0320 | .0050 | .152 | 209 | 41.8 | 205 | 41.0 |
| 3B1.5-10T | | .0410 | .0064 | .151 | 233 | 36.4 | 219 | 34.2 |
| 11T | | .0282 | .0044 | .153 | 157 | 36.1 | 151 | 34.3 |
| 12T | | .0353 | .0055 | .147 | 205 | 37.3 | 187 | 34.0 |
| 3B2-4L | | .0390 | .0061 | .235 | 275 | 45.1 | 257 | 42.1 |
| 5L | .0458 | .0457 | .0071 | .233 | 314 | 44.2 | 257 | 40.7 |
| 6L | .0416 | .0412 | .0065 | .233 | 292 | 44.9 | 262 | 40.5 |
| 3B2-T4 | | .0378 | .0058 | .233 | 257 | 44.3 | 230 | 39.7 |
| T5 | | .0416 | .0065 | .234 | 290 | 44.6 | 266 | 40.9 |
| T6 | | .0408 | .0064 | .236 | 280 | 43.8 | 260 | 40.6 |
| 3B2-10L | | .0487 | .0070 | .235 | 316 | 45.1 | 291 | 41.4 |
| 11L | .0424 | .0411 | .0065 | .234 | 286 | 44.0 | 268 | 40.6 |
| 12L | .0445 | .0445 | .0069 | .234 | 323 | 46.8 | 285 | 42.8 |
| 3B2-10T | | .0400 | .0062 | .234 | 300 | 48.4 | 283 | 45.6 |
| 11T | .0424 | .0427 | .0067 | .235 | 323 | 48.2 | 296 | 44.2 |
| 12T | | .0409 | .0062 | .235 | 288 | 46.4 | 269 | 43.4 |

CONTINUED ON R.N. #

SIGNATURE

FORM 9884-1

LOCKHEED-CALIFORNIA COMPANY
A DIVISION OF LOCKHEED AIRCRAFT CORPORATION

RESEARCH NOTEBOOK

№ 529773

TO D. PETIT

FROM L. TEED

MODEL

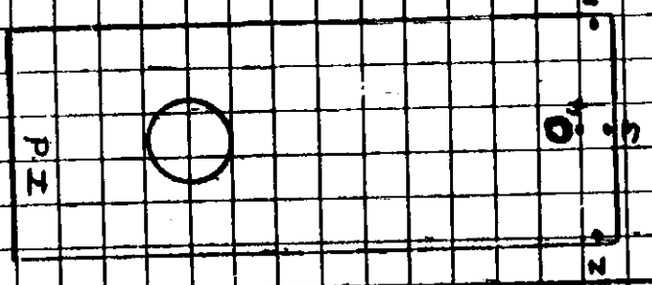
DATE 12 22 75

SUBJECT MEASUREMENTS OF BEARINGS.

REF:

W.O. / EWA

CONTINUED FROM R.N. # 529771 & 529772 PART NO. AND SER.




| Id | T1 | T2 | T3 | T4 | Id | T1 | T2 | T3 | T4 |
|---|---|---|---|---|---|---|---|---|---|
| 382.5T | .0442 | .0250 | .0360 | .0330 | 365.3T | .0410 | .0422 | .0365 | .0370 |
| -1T | .0446 | .0250 | .0378 | .0380 | -2T | .0410 | .0439 | .0270 | .0283 |
| -2T | .0432 | .0420 | .0348 | .0370 | -1T | .0420 | .0440 | .0293 | .0311 |
| -4L | .0432 | .0400 | .0335 | .0346 | -1L | .0305 | .0376 | .0195 | .0220 |
| -5L | .0438 | .0445 | .0421 | .0350 | -2L | .0323 | .0414 | .0250 | .0270 |
| -6L | .0431 | .0263 | .0270 | .0300 | -3L | .0378 | .0431 | .0236 | .0338 |
| -10L | .0465 | .0436 | .0426 | .0420 | -7T | .0420 | .0 | .0263 | .0276 |
| -11L | .0442 | .0210 | .0322 | .0350 | -8T | .0360 | .0 | .0231 | .0336 |
| -12L | .0316 | .0 | .0261 | .0280 | -9T | .0380 | .0 | .0260 | .0302 |
| -10T | .0465 | .0442 | .0417 | .0402 | -7L | .0302 | .0462 | .0437 | .0427 |
| -11T | .0340 | .0222 | .0246 | .0297 | -8L | .0423 | .0463 | .0344 | .0350 |
| -12T | .0370 | .0350 | .0350 | .0256 | -9L | .0463 | .0423 | .0418 | .0406 |
| 382.0 | | | | | 382.0 | | | | |
| -1L | .0337 | .0317 | .0392 | .0388 | -1T | .0463 | .0428 | .0270 | .0270 |
| 1L | .0437 | .0422 | .0437 | .0427 | -2T | .0362 | .0364 | .0280 | .0384 |
| 2L | .0423 | .0422 | .0412 | .0420 | -3T | .0463 | .0439 | .0465 | .0465 |
| 1T | .0459 | .0443 | .0432 | .0377 | -1L | .0468 | .0474 | .0453 | .0453 |
| 9T | .0460 | .0428 | .0423 | .0410 | -2L | .0453 | .0440 | .0432 | .0387 |
| 6T | .0441 | .0412 | .0407 | .0390 | -3L | .0382 | .0 | .0331 | .0330 |
| 10T | .0445 | .0451 | .0405 | .0325 | -7T | .0385 | .0400 | .0400 | .0410 |
| 11T | .0474 | .0433 | .0443 | .0420 | -8T | .0383 | .0 | .0302 | .0302 |
| 12T | .0395 | .0350 | .0397 | .0462 | -9T | .0380 | .0450 | .0365 | .0364 |
| 10L | .0436 | .0470 | .0459 | .0424 | -7L | .0395 | .0388 | .0360 | .0390 |
| 11L | .0431 | .0428 | .0404 | .0443 | -8L | .0393 | .0393 | .0340 | .0373 |
| 12L | .0436 | .0495 | .0450 | .0440 | -9L | .0440 | .0430 | .0396 | .0393 |

CONTINUED ON R.N. #

SIGNATURE

FORM 0884-1

TO: Dura
FROM: Fat. Lab
MODEL: 75

DATE: 12-23-75

LOCKHEED-CALIFORNIA COMPANY
A DIVISION OF LOCKHEED AIRCRAFT CORPORATION
RESEARCH NOTEBOOK

No. 529774

SUBJECT: ~~S-N Test~~ TEST
S.G.C. & Creep.

REF!

W.O. EWA

CONTINUED FROM R.N. #

PART NO. AND SER.

| -T.C. | Thickness In. | Area In² | Stress Ksi | LOADED DATE | LOADED TIME | UNLOADED DATE | UNLOADED TIME | Hours |
|---|---|---|---|---|---|---|---|---|
| ~~3SC-2T .1468 .502 .0737 12.5 11-3~~ | | | | | | | | |
| 3SC-12T | .1455 | .501 | .0727 | 10 | 11-18 | 2012 0242 | 11-21 | 50 |
| 3SC-17T | .1433 | .501 | .0718 | 10 | 11-18 | 1958 | 11-21 | 50 |
| 3SC-1T | .1459 | .499 | .0731 | 10 | 11-18 | 1950 | 11-21 | 50 |
| 3SC-1T | .1465 | .501 | .0734 | 35 | 11-19 | 1936 | 11-21 | 50 |
| 3SC-11T | .1448 | .499 | .0723 | 10 | 11-21 | 2320 | 11-26 0745 | 104.2 |
| 3SC-NT | .1437 | .501 | .0720 | 10 | 11-21 | 2340 | 11-26 0745 | 102.9 |
| 3SC-5T | .1452 | .500 | .0732 | 10 | 11-21 | 2320 | 11-26 0745 | 103.2 |
| 3SC-3T | .1458 | .500 | .0734 | 35 | 11-21 | 2342 | 11-26 0745 | 103.5 |
| 3SC-3T | .1466 | .501 | .0734 | 35 | 11-24 | 0855 | 11-26 1916 | 10.4 |
| 3SC-1T | .1456 | .501 | .0729 | 10 | 11-26 | 0850 | 11-26 1950 | 10.0 |
| 3SC-NT | .1441 | .500 | .0724 | 10 | 11-26 | 0857 | 11-26 1957 | 10.0 |
| 3SC-1ST | .1461 | .502 | .0733 | 10 | 11-26 | 0956 | 11-26 1956 | 10.0 |
| 3SC-7T | .1455 | .501 | .0729 | 35 | 11-26 | 2115 | 12-1 0800 | 106.4 |
| 3SC-3T | .1471 | .501 | .0738 | 35 | 11-26 | 2120 | 12-1 0800 | 106.3 |
| 3SC-1T | .1411 | .500 | .0726 | 35 | 12-1 | 1148 | 12-3 1354 | 50.1 |
| 3SC-1T | .1464 | .501 | .0733 | 35 | 12-1 | 1446 | 12-3 [illegible] | 10.0 |
| 3SC-2T | .1427 | .500 | .0728 | 35 | 12-1 | 0840 | 12-3 1255 | 52.3 |
| 3SC-3T | .1456 | .500 | .0729 | 35 | 12-1 | 1445 | 12-1 2045 | 10.0 |
| 3CR-2T | .1465 | .502 | .0735 | 20 | 12-2 | 0930 | 12-2 [illegible] | [illegible] |
| 3CR-1L | .1465 | .502 | .0735 | 20 | 12-3 | 1030 | 12-3 1445 | 11 Shift |
| 3CR-2L | .1464 | .502 | .0735 | 12.5 | 12-3 | 1526 | 12-4 1005 | 18.8 Hr |
| 3CR-2T | .1465 | .502 | .0737 | 12.5 | 12-3 | 1445 | 12-4 1945 | 35 Hr |
| 3CR-3T | .1468 | .5228 | .0738 | 8.0 | 12-5 | 935 | 1-5-76 | 455.4 |
| 3CR-2L | .1466 | .502 | .0736 | 8.0 | 12-5 | 945 | 1-5-76 | 561.3 |

CONTINUED ON R.N. #

SIGNATURE

LOCKHEED CALIFORNIA COMPANY
A DIVISION OF LOCKHEED AIRCRAFT CORPORATION

RESEARCH NOTEBOOK

Nº 529775

TO D. C. A.
FROM [illegible]
MODEL

DATE 12 22 7-

SUBJECT [illegible] Test

REF.

W.O. EWA

CONTINUED FROM R.N. #

PART NO. AND SER.

| | No. | Thickness | Width | Area | Stress | Temp. | Cycles | Date Started |
|---|---|---|---|---|---|---|---|---|
| | | In. | In. | In² | KSI | °F | | |
| 34F-1T | .1171 | .374 | .0551 | 35 | RT | 109620 | 11-18 |
| -2T | .1476 | .373 | .0550 | 30 | RT | 2575060 | 11-20 |
| -3T | .1466 | .373 | .0548 | 25 | RT | 1151400 | 11-26 |
| -1L | .1112 | .373 | .0525 | 35 | RT | 941.30 | 11-18 |
| -2L | .1471 | .374 | .0551 | 20 | RT | 4478630 | 11-24 |
| -3L | .1473 | .373 | .0551 | 20 | RT | 10⁷ | 12-1 |
| -4T | .1466 | .373 | .0547 | 20 | 600° | 203770 | 11-19 |
| -5T | .1466 | .373 | .0546 | 15 | 600° | 1.56 210 | 11-20 |
| -6T | .1115 | .373 | .0517 | 10 | 600° | 10⁷ | 12-2 |
| -4L | .1472 | .373 | .0549 | 10 | 600° | 10⁷ | 11-21 |
| -5L | .1111 | .371 | .0557 | 15 | 600° | 10×10⁶ | 11-25 |
| -6L | .1196 | .373 | .0538 | 20 | 600° | 2855975 | 12-1 |
| -7L | .1454 | .373 | .0555 | 30 | RT | 1316230 | 12-10 |
| -7T | .1412 | .374 | .0526 | 30 | RT | 1330370 | 12-10 |
| -9L | .1472 | .373 | .0549 | 15 | 600 | 1460572 | 12-10 |
| -10T | .1465 | .374 | .0552 | 15 | 600 | 11112616 | 12-14 |
| -11L | .1413 | .374 | .0529 | 20 | 600 | 100 792 | 12-19 |
| -11T | .1447 | .374 | .0541 | 20 | 600 | 112362 | 12-17 |
| -1L | .1166 | .375 | .0550 | 17.5 | 600 | 495-672 | 12-22 |
| -8L | .1173 | .375 | .0532 | 25 | RT | 1494000 | 12-12 |
| -8T | .1452 | .374 | .0543 | 25 | RT | 1800 | 12-18 |
| -9T | .1452 | .373 | .0541 | 25 | RT | 1613610 | 12-19 |
| -12T | .1 | | | | | | |



CONTINUED ON R.N. #

SIGNATURE

FORM 6884-1

LOCKHEED-CALIFORNIA COMPANY
A DIVISION OF LOCKHEED AIRCRAFT CORPORATION
RESEARCH NOTEBOOK

№ 529776

TO DLBA
FROM FAT LAB
MODEL

DATE 12 23 57

SUBJECT F,T, TESTS

REF:

W.O. EWA

CONTINUED FROM R.N. #

PART NO. AND SER.

| | | W | W/L | AREA IN² | STRESS KSI | TEMP °F | CYCLES | NOTE |
|---|---|---|---|---|---|---|---|---|
| 2NF | -1T | .1432 | .374 | .0554 | 20 | RT | 941,270 | 11-20 |
| | -2T | .1452 | .377 | .0558 | 15 | | $10^7$ | 11-24 |
| | -3T | .1445 | .374 | .0534 | 17.5 | | $11 \times 10^6$ | 12-5 |
| | -1L | .1462 | .374 | .0547 | 20 | | 6,902 | 12-21 |
| | -2L | .1462 | .371 | .0547 | 17.5 | | $10^7$ | 12-1 |
| | -3L | | | | | RT | | |
| | -4T | .1477 | .373 | .0552 | 15 | 600° | BUCKLED-NO TEST | 11-20 |
| | -5T | .1476 | .375 | .0551 | 12.5 | | $10^7$ | 12-1 |
| | -6T | .1461 | .375 | .0551 | 15 | | 477,180 | 12-12 |
| | -4L | .1464 | .374 | .0545 | 15 | | 145,189 | 11-20 |
| | -5L | .1453 | .375 | .0547 | 10 | | 13,860,000 | 11-24 |
| | -6L | .1453 | .373 | .0544 | 12.5 | 600° | 8,930,400 | 12-8 |
| | -7T | .1456 | .374 | .0545 | 15 | 600 | 154,192 | 12-12 |
| | -7L | .1453 | .373 | .0542 | 15 | 600 | 143,012 | 12-8 |
| | -11T | .1449 | .374 | .0540 | 10 | 600 | 11,831,466 | 12-14 |
| | -11L | .1432 | .375 | .0543 | 10 | 600 | 10,330,452 | 12-22 |
| | - | | | | | | | |

CONTINUED ON R.N. #

SIGNATURE

FORM 858A-1

TO: DLRA

FROM: FAT. LAB.

MODEL:

DATE:

LOCKHEED CALIFORNIA COMPANY
A DIVISION OF LOCKHEED AIRCRAFT CORPORATION

RESEARCH NOTEBOOK

Nº 529780

SUBJECT: FATIGUE DATA

REF:

W.O. EWA

CONTINUED FROM R.N. #

PART NO. AND SER.

| Fd | Thick (in) | Width (in) | Area (in²) | Stress KSI | Temp °F | Σ N | Date Started | Failed YES | Failed NO |
|---|---|---|---|---|---|---|---|---|---|
| 3UF-5L | .1485 | .375 | .0557 | 15 | 600 | 18,117,246 | 11-25-75 | | ✓ |
| 3UF-6L | .1480 | .373 | .0548 | 20 | 600 | 2,854,515 | 12-1-75 | ✓ | |
| 3UF-6T | .1465 | .375 | .0549 | 10 | 600 | 44,345,100 | 12-2 | | ✓ |
| 3UF-9L | .1453 | .373 | .0542 | 15 | 600 | 143,012 | 12-8 | ✓ | |
| 3UF-10L | .1473 | .373 | .0549 | 15 | 600 | $1.4 \times 10^7$ | 12-10 | | ✓ |
| 3UF-10T | .1418 | .374 | .0542 | 15 | 600 | $1.2 \times 10^7$ | 12-14 | | ✓ |
| 3UF-14L | .1411 | .374 | .0549 | 20 | 600 | 100,792 | 12-19 | ✓ | |
| 3UF-14T | .1447 | .374 | .0541 | 20 | 600 | 113,362 | 12-19 | ✓ | |
| 3UF-12L | .1466 | .375 | .0550 | 17.5 | 600 | 495,072 | 12-22 | ✓ | |
| 3UF-12T | .1446 | .375 | .0542 | 17.5 | 600 | FAILURE SURF. AREA | 12-23 | ✓ | NAVE DID NOT |
| 3NF-7L | .1453 | .372 | .0542 | 20 | R.T. | 209,843 | 1-5-76 | ✓ | |
| 3NF-8L | .1454 | .373 | .0542 | 15 | R.T. | $1 \times 10^7$ | 1-5-76 | | |
| 3NF-11T | .1411 | .374 | .0549 | 10 | 600 | $1.1 \times 10^7$ | 12-1-75 | | ✓ |
| 3NF-11L | .1450 | .375 | .0543 | 10 | 600 | $1.0 \times 10^7$ | 12-22 | | ✓ |
| 3NF-12T | .1453 | .375 | .0545 | 12.5 | 600 | 5,893,095 | 12-23 | ✓ | |
| 3NF-12L | .1452 | .373 | .0542 | 12.5 | 600 | 6,546,538 | 1-5-76 | ✓ | |
| 3NF-9L | .1452 | .375 | .0544 | 12.5 | R.T. | 4,616,820 | 1-8-76 | | |
| 3NF-1T | .1450 | .374 | .0544 | 20 | R.T. | 941,270 | 11-20-75 | ✓ | |
| 3NF-1L | .1462 | .374 | .0547 | 20 | R.T. | 619,012 | 11-21-75 | ✓ | |
| 3NF-2T | .1482 | .375 | .0554 | 15 | R.T. | $1 \times 10^7$ | 11-24-75 | | ✓ |
| 3NF-2L | .1462 | .374 | .0547 | 17.5 | R.T. | $1.1 \times 10^7$ | 12-1-75 | | ✓ |
| 3NF-3L | .1458 | .374 | .0545 | 12.5 | R.T. | 1,539,079 | 1-5-76 | ✓ | |
| 3NF-5T | .1451 | .372 | .0541 | 25 | R.T. | 28,160 | 1-7-76 | ✓ | |
| 3NF-4T | .1457 | .373 | .0544 | 21 | R.T. | 152,745 | 1-8-76 | ✓ | |
| 3UF-8L | .1473 | .375 | .0552 | 25 | R.T. | $1 \times 10^7$ | 12-12-75 | | ✓ |
| 3UF-8T | .1452 | .374 | .0543 | 25 | R.T. | 1800 | 12-18-75 | ✓ | |
| 3UF-9T | .1450 | .373 | .0541 | 25 | R.T. | $1 \times 10^7$ | 12-15-75 | | ✓ |
| 3UF-9L | .1473 | .373 | .0549 | 27.5 | R.T. | $1.5 \times 10^7$ | 12-23-75 | | ✓ |
| 3NF-7T | .1466 | .375 | .0550 | 20 | R.T. | $1 \times 10^7$ | 1-5-76 | | |

CONTINUED ON R.N. #

SIGNATURE

TO: D. PETTIT
FROM L. REED
MODEL

DATE 9 22 75

LOCKHEED-CALIFORNIA COMPANY
A DIVISION OF LOCKHEED AIRCRAFT CORPORATION
RESEARCH NOTEBOOK

№ 538886

SUBJECT BEARING PIN TEST - TENSION - RM TEMP.

REF:

W.O. SWA

CONTINUED FROM R.N. #

PART NO. AND SER.

| I.d | Pin Dia-in | Thick in | Area in² | Edge Dist-in | Ult Load Lbs | Ult Stress Ksi | Bearing Lbs | Bearing Yield Ksi |
|---|---|---|---|---|---|---|---|---|
| 6B2-1T | .155 | .0382 | .0059 | ~~.625~~ .3125 | 563 | 95.4 | — | — |
| -2T | | .0400 | .0062 | ~~.625~~ .3125 | 660 | 106.4 | 483 | 77.9 |
| -9T | | .0390 | .0056 | ~~.554~~ .3125 | 554 | 98.9 | 442 | 78.9 |
| -8T | | .0387 | .0060 | ~~.620~~ .3125 | 620 | 103.3 | 472 | 78.7 |
| 6B65- | | | | | | | | |
| -1T | | .0386 | .0060 | ~~.490~~ .233 | 490 | 81.7 | 424 | 70.7 |
| -2T | | .0385 | .0060 | ~~.510~~ .233 | 510 | 85.0 | 446 | 74.3 |
| -7T | | .0412 | .0064 | ~~.504~~ .233 | 506 | 79.1 | 443 | 69.2 |
| -8T | | .0418 | .0065 | ~~.528~~ .233 | 528 | 81.2 | 451 | 69.4 |
| 6B2-3T | | .0348 | .0054 | ~~.534~~ .3125 | 524 | 97.1 | 403 | 74.6 |
| -9T | | .0408 | .0063 | ~~.550~~ .3125 | 550 | 87.3 | 439 | 69.7 |
| 6B65-3T | | .0405 | .0063 | ~~.515~~ .233 | 515 | 81.7 | 460 | 73.0 |
| -9T | .155 | .0398 | .0062 | ~~.510~~ .233 | 510 | 82.2 | 447 | 72.1 |

CONTINUED ON R.N. #

SIGNATURE

FORM 888A

LOCKHEED CALIFORNIA COMPANY
A DIVISION OF LOCKHEED AIRCRAFT CORPORATION
RESEARCH NOTEBOOK

№ 538887

TO: D. LITTLE
FROM: L. WEED
MODEL:
DATE: 4/23/75
SUBJECT: BEARING PIN TEST TENSION - 600° F
REF:
W.O. EWA

CONTINUED FROM R.N. #

| PART NO. AND SER. | PIN DIA IN | THICK IN | AREA $IN^2$ | EDGE DIST IN | ULTIMATE LBS | ULTIMATE KSI | YIELD* LBS | YIELD* KSI |
|---|---|---|---|---|---|---|---|---|
| 6B1.5 -4T | .155 | .0431 | .0067 | .233 | 270 | 40.3 | 267 | 39.8 |
| -5T | | .0403 | .0062 | | 269 | 43.4 | 260 | 41.9 |
| -6T | | .0407 | .0063 | | 275 | 43.6 | 273 | 43.3 |
| -10T | | .0410 | .0064 | | 270 | 42.2 | 265 | 41.4 |
| -11T | | .0410 | .0064 | | 276 | 43.1 | 271 | 42.3 |
| -12T | | .0391 | .0061 | .233 | 260 | 42.6 | 257 | 42.1 |
| 6B2-4T | | .0381 | .0059 | .235 (1.0 T 75) | 305 | 51.7 | 275 | 46.6 |
| -5T | | .0373 | .0058 | .312 | 294 | 50.7 | 266 | 45.9 |
| -6T | | .0304 | .0047 | | 240 | 51.1 | 203 | 43.2 |
| -10T | | .0378 | .0058 | | 307 | 53.3 | 270 | 46.6 |
| -11T | | .0380 | .0059 | | 308 | 52.2 | 267 | 45.2 |
| -12T | .155 | .0403 | .0062 | .233 | 324 | 52.2 | 271 | 43.7 |

CONTINUED ON R.N. #

SIGNATURE

FORM 888A-1

TO: 1265 A
FROM: FAIL LAB
MODEL:
DATE: 10 / 28 / 75

LOCKHEED CALIFORNIA COMPANY
A DIVISION OF LOCKHEED AIRCRAFT CORPORATION
RESEARCH NOTEBOOK
№ 538894

SUBJECT: STRESS CORROSION TEST.
REF
W.O.
FWA

CONTINUED FROM R.N. #

| | | MEASURED | | AREA | STRESS | LOADED | | UNLOADED | | HOURS |
|---|---|---|---|---|---|---|---|---|---|---|
| | | TH. | WD. | IN | KSI | DATE | TIME | DATE | TIME | TO FAIL |
| | 6SC-1T | .255 | .504 | .1285 | 7.5 | 10-2-75 | 1450 | 10-8-75 | 1400 | 143.6 NF |
| ① | 6SC-2T | .2558 | .505 | .1292 | 43.75 | 10-2-75 | 1520 | 10-3-75 | 1500 | 23.4 F |
| ① | 6SC-3T | .2551 | .504 | .1287 | 37.5 | 10-2-75 | 0800 | 10-8-75 | 1400 | 114.3 NF |
| | 6SC-6T | .2556 | .500 | .1278 | 9.0 | 10-8-75 | 1400 | 10-13-75 | 1610 | 103.1 NF |
| ① | 6SC-5T | .2556 | .502 | .1284 | 43.75 | 10-8-75 | 1415 | 10-13-75 | 1610 | 121.9 NF |
| | 6SC-4T | .2555 | .500 | .1278 | 10.0 | 10-14-75 | 1055 | 10-20-75 | 0745 | 140.8 NF |
| ① | 6SC-7T | .255 | .500 | .1275 | 43.75 | 10-14-75 | 1310 | 10-24-75 | 0745 | 135.5 NF |
| | 6SC-10T | .2552 | .500 | .1276 | 10.0 | 10-20-75 | 0945 | 10-22-75 | 1150 | 50.1 NF |
| ① | 6SC-8T | .2560 | .500 | .1280 | 43.75 | 10-20-75 | 0857 | 10-22-75 | 1057 | 50.0 NF |
| ① | 6SC-12T | .2550 | .506 | .1305 | 43.75 | 10-22-75 | 1500 | 10-24-75 | 1400 | 47.0 F |
| | 6SC-17T | .2586 | .506 | .1308 | 10.0 | 10-22-75 | 1609 | 10-27-75 | 0730 | 97.3 NF |
| | 6SC-16T | .2573 | .504 | .1297 | 10.0 | 10-23-75 | 1130 | 10-27-75 | 1429 | 100.0 NF |
| | 6SC-11T | .2561 | .502 | .1286 | 10.0 | 10-23-75 | 1050 | 10-27-75 | 1426 | 100.7 NF |
| | 6SC-18T | .2578 | .505 | .1302 | 10.0 | 10-24-75 | 1110 | 10-26-75 | 1910 | 57.0 NF |
| ① | 6SC-14T | .2596 | .505 | .1311 | 43.75 | 10-24-75 | 1420 | 10-28-75 | 0632 | 88.1 F |
| | 6SC-13T | .2558 | .502 | .1284 | 10.0 | 10-27-75 | 0930 | 10-22-75 | 2000 | 10.5 NF |
| ① | 6SC-9T | .2555 | .503 | .1285 | 43.75 | 10-28-75 | 0935 | 10-28-75 | 0030 | 14.9 NF |
| ① | 6SC-15T | .2590 | .505 | .1308 | 43.75 | 10-28-75 | 0926 | 10-28-75 | 0050 | 16.4 NF |

① TESTED AT ROOM TEMP ALL REST TESTED AT 600° F.



CONTINUED ON R.N. #

SIGNATURE

FORM 888A-1

TO: OUBA
FROM FAT LAB
MODEL 75

DATE 10 29

LOCKHEED CALIFORNIA COMPANY
A DIVISION OF LOCKHEED AIRCRAFT CORPORATION
RESEARCH NOTEBOOK

SUBJECT CREEP TEST @ 600° F

No. 538895

REF:

W.O. EWA

CONTINUED FROM R.N. #

PART NO. AND SER.

| Id | MEASUREMENT Th. | Wi. | AREA IN² | STRESS KSI | LOADED DATE | LOADED TIME | UNLOADED DATE | UNLOADED TIME | HOURS | |
|---|---|---|---|---|---|---|---|---|---|---|
| 6CR-1T | .2550 | .506 | .1290 | 20.0 | 9-19-75 | 1335 | 9-19-75 | 1402 | 0.45 | F |
| 6CR-2L | .2565 | .503 | .1290 | 12.5 | 9-19-75 | 1700 | 9-24-75 | 2400 | 102.6 | F |
| 6CR-2T | .2552 | .505 | .1288 | 7.5 | 9-22-75 | 1610 | 10-2-75 | 1055 | 714.7 | NF |
| 6CR-3L | .2560 | .503 | .1288 | 7.5 | 9-23-75 | 1255 | 10-2-75 | 1055 | 693.8 | NF |
| 6CR-1L | .256 | .503 | .1288 | 20.0 | 9-24-75 | 1028 | 9-24-75 | 1100 | 0.7 | F |
| 5CR-1T | .255 | .505 | .1288 | 12.5 | 9-24-75 | 1503 | 9-29-75 | 0800 | 50.0 | F |

CONTINUED ON R.N. #

SIGNATURE

FORM C89A-1

TO: DUBA
FROM: FAT. LAB.
MODEL: 75
DATE: 10 29

LOCKHEED CALIFORNIA COMPANY
A DIVISION OF LOCKHEED AIRCRAFT CORPORATION
RESEARCH NOTEBOOK
№ 538896

SUBJECT: FATIGUE TESTS
REF:
W.O. EWA

CONTINUED FROM R.N. #

PART NO. AND SER.

| Test | Measured Width | | Area | Stress | Date Started | Cycles | Failure | Temp |
|---|---|---|---|---|---|---|---|---|
| | Th. | Wd. | In² | Ksi | | | | |
| 6UF1L | .255 | .376 | .0959 | 20 | 9-9-75 | 1X10⁷ | NO | RT |
| 6UF1L | .254 | .375 | .0951 | 20 | 9-24-75 | 1,384,204 | YES | 600° |
| 6UF2L | .255 | .373 | .0951 | 35 | 9-5-75 | 1,384,204 | YES | 600° |
| 6UF-1L | [illegible] | | [illegible] | 17.5 | 10-8-75 | 10,175,410 | NO | 600° |
| 6NF1L | .255 | .376 | .0959 | 20 | 9-9-75 | 1,135,890 | YES | RT |
| 6NF-1L | .2571 | [illegible] | [illegible] | 12.5 | 10-2-75 | 96,[illegible] | YES | 600 |
| 6NF2L | .256 | .376 | .0963 | 15 | 9-10-75 | 1X10⁷ | NO | RT |
| 6N[illegible] | [illegible] | | [illegible] | 10 | 9-11-75 | 1X10⁷ | NO | 600° RT |
| 6UF3L | .255 | .375 | .0956 | 17.5 | 9-15-75 | 2,100 | YES | FAILED AT LANDING. |
| 6N[illegible] | [illegible] | | [illegible] | 15 | 10-9-75 | CYCLES ADDED | | NO TEST. |
| 6UF-7L | .253 | .376 | .0951 | 30 | 9-12-75 | 1X10⁷ | NO | RT |
| 6N[illegible] | [illegible] | | [illegible] | 15 | [illegible] | [illegible] | YES | 600° |
| 6NF8L | .255 | .376 | .0959 | 20 | 9-[illegible] | 1X10⁷ | NO | RT |
| 6N[illegible] | [illegible] | | [illegible] | 10 | 10-1-75 | [illegible] | NO | 600° |
| 6UF-3L | .255 | .376 | .0959 | 32.5 | 9-19-75 | 555,040 | YES | RT |
| 6U[illegible] | .25[illegible] | | [illegible] | 15 | 10-4-75 | [illegible] | YES | 600° |
| 6UF-9L | .255 | .376 | .0959 | 31 | 9-19-75 | 1,484,574 | YES | RT |
| 6U[illegible] | [illegible] | | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| 6NF-9L | .255 | .376 | .0959 | 25 | 9-[illegible] | 1[illegible] | YES | 600°T |
| 6UF-6L | [illegible] | | [illegible] | 15 | 10-8-75 | 16,184,709 | NO | 600° |
| 6NF-7L | .255 | .375 | .0956 | 15 | | 91X10⁷ | NO | 600° |
| 6UF-8L | .255 | .375 | .0958 | 32.5 | | 214,000 | YES | 600° |
| 6UF-4L | .255 | .376 | .0959 | 20 | | 1,119,000 | YES | 600° |
| 6UF-1L | .254 | .375 | .0960 | 20 | | 164,850 | YES | 600° |
| 6UF-9L | .255 | .376 | .0959 | 25 | 9-22-75 | 57,902 | YES | RT |
| 6UF-1L | .2548 | .375 | .0956 | 15 | 9-24-75 | 1X10⁷ | NO | 600° |

ORIGINAL PAGE IS OF POOR QUALITY

CONTINUED ON R.N. #

SIGNATURE

FORM 888A 1

LOCKHEED CALIFORNIA COMPANY
A DIVISION OF LOCKHEED AIRCRAFT CORPORATION

RESEARCH NOTEBOOK

No. 550454

TO Bob Duba
FROM GN
MODEL
DATE 6-5-75
SUBJECT TR 1419 BE-A3, A4 Lockalloy Joints
REF W.O. 31-25415 EWA 03826
CONTINUED FROM R.N. #
PART NO. AND REV.

| | COUPON IDENT. | ULTIMATE LBS. | ULTIMATE LB/IN | .012 YIELD LBS | YIELD LBS/IN | GAGE IN. | TEST TEMP. | REMARKS TYPE FAIL |
|---|---|---|---|---|---|---|---|---|
| 3/16 | 1J3.15-1A,1B | 4840 | 2420 | 3140 | 1570 | 2.5 | R.T. | FAST SHEAR (2) THRU THD. (TENSION) |
| | 1J3.15-2A,2B | 4045 | 2472 | 3000 | 1500 | 2.5 | R.T. | FAST SHEAR (2) THD SEC. (TENSION) |
| | 2J3.125-1A,1B | 4450 | 2225 | 2685 | 1342 | 2.5 | R.T. | NET SEC (1A & 1B) |
| | 2J3.125-2A,2B | 4445 | 2222 | 2770 | 1385 | 2.5 | R.T. | BEARING (2A) & FAST SHEAR |
| 1/4 | 1J4.15-1A,1B | 7150 | 3575 | 4390 | 2195 | 3.0 | R.T. | BEARING AND/OR NET SECTION |
| * | 1J4.15-2A,2B | 6950 | 3475 | 4360 | 2180 | 3.0 | R.T. | NET SEC. - DID NOT FAIL THRU HOLE |
| 3/16 ▲ | 2J3.125-3A,3B | 4100 | 2050 | 2700 | 1350 | 3.6 | R.T. | FAILED SELF-DRILL NUT HEAD |
| ▲ | 2J3.125-4A,4B | 4515 | 2258 | 2075 | 1038 | 3.6 | R.T. | FAILED SELF-DRILL NUT HEAD |
| | 1J3.15-3A,3B | 3375 | 1688 | 2145 | 1072 | 2.5 | 600°F | BEARING FAIL |
| 3/16 | 1J3.15-4A,4B | 3380 | 1690 | 2245 | 1122 | 2.5 | | |
| | 1J4.15-3A,3B | 4850 | 2175 | 2750 | 1375 | 3.0 | | |
| 1/4 | 1J4.15-4A,4B | 4285 | 2142 | 3360 | 1680 | 3.0 | 600°F | BEARING FAIL |

PRE-LOADED TO 100-LBS - THRU TORQUED SCREWS (FLUSH SIDE)
300 IN-LBS - 3/16 DIA. & 65 IN-LB - 1/4 DIA
▲ TORQUED NUT (FLUSH SIDE)

* MARD'S SURFACE - C'SUNK SIDE WITH SCREWDRIVER -

CONTINUED ON R.N. #
SIGNATURE

FORM 9884-1

LOCKHEED CALIFORNIA COMPANY
A DIVISION OF LOCKHEED AIRCRAFT CORPORATION

RESEARCH NOTEBOOK

№ 550474

TO R. DUBA
FROM GW
MODEL

DATE 7-29-75

SUBJECT TENS. - 1"GL - R.T. BE. AZA. LOCKALLOY (AS RECEIVED)

REF. W.O. 31-2925 EWA 0587

CONTINUED FROM R.N. #

PART NO. AND BER.

| COUPON IDENT | WIDTH IN. | THICK IN. | AREA IN² | ULTIMATE LBS | ULTIMATE KSI | .2% YIELD LBS | .2% YIELD KSI | %E 1"GL | E MSI |
|---|---|---|---|---|---|---|---|---|---|
| 1-T2L | .2522 | .2522 | .0636 | 3400 | 53.5 | 2720 | 42.8 | 10 | 29.5 |
| -2L | .2528 | .2528 | .0639 | 3380 | 52.9 | 2595 | 40.6 | 9 | 27.5 |
| -3L | .2520 | .2527 | .0637 | 3375 | 53.0 | 2580 | 40.5 | 10 | 29.1 |
| | | | | AVG | 53.1 | | 41.3 | 10 | 28.7 |
| 1-T4L | .2518 | .2523 | .0635 | 3375 | 53.1 | 2550 | 40.2 | 10 | 30.7 |
| -5L | .2527 | .2522 | .0637 | 3315 | 52.0 | 2585 | 40.6 | 10 | 31.0 |
| -6L | .2524 | .2529 | .0638 | 3310 | 51.9 | 2580 | 40.4 | 10 | 29.2 |
| | | | | AVG | 52.3 | | 40.4 | 10 | 30.3 |
| 1-T7L | .2536 | .2519 | .0639 | 3020 | 47.3* | 2710 | 42.4 | 4* | ▲ |
| -8L | .2504 | .2517 | .0630 | 3120 | 49.5* | 2655 | 42.1 | 4* | ▲ |
| -9L | .2512 | .2516 | .0635 | 3370 | 53.1 | 2770 | 43.6 | 7 | ▲ |
| 1-T1T | .2513 | .2511 | .0631 | 3220 | 51.0 | 2560 | 40.6 | 7 | 31.7 |
| 2T | .2536 | .2510 | .0636 | 3255 | 51.2 | 2565 | 40.3 | 7 | ▲ |
| 3T | .2531 | .2513 | .0636 | 3200 | 50.3 | 2575 | 40.5 | 6 | ▲ |
| | | | | AVG | 50.8 | | 40.5 | 7 | |

▲ NOT OBTAINABLE
* FAILED @ EXTENSOMETER KNIFE EDGE

SIGNATURE

CONTINUED ON R.N. #

FORM 888A-1

.005 in/in/min.
.005 in/in/min.
.05 in/in/min.
.5 in/in/min.
1 in/in/min
1 in/in/min
1 in/in/min
10 in/in/min

LOCKHEED-CALIFORNIA COMPANY
A DIVISION OF LOCKHEED AIRCRAFT CORPORATION
RESEARCH NOTEBOOK

No. 550475

TO: DUBA
FROM GN
MODEL

DATE 7 29

SUBJECT TENS.-1"GL. R.T. BE-.53 AL LOCKALLOY 75 STRESS RELIEVED 1HR @ 1050°F

REF:

W.O. EWA

CONTINUED FROM R.N. #

PART NO. AND SER.

| COUPON IDENT. | WIDTH IN. | THICK IN. | AREA IN² | ULTIMATE LBS | ULTIMATE KSI | .2% YIELD LBS | .2% YIELD KSI | %E 1"GL | E x 10⁶ PSI |
|---|---|---|---|---|---|---|---|---|---|
| LTG1 | .2532 | .2518 | .0636 | 3390 | 53.3 | 2620 | 41.2 | 8 | 31.2 |
| -11L | .2522 | .2518 | .0634 | 3410 | 53.8 | 2630 | 41.5 | 10 | 30.9 |
| -12L | .2523 | .2519 | .0636 | 3386 | 52.6 | 2655 | 41.7 | 8 | 31.2 |
| | | | | AVG | 53.2 | | 41.5 | 9 | 31.1 |
| LTAT | .2530 | .2500 | .0632 | 3260 | 51.6 | 2550 | 40.3 | 7 | 30.6 |
| -5T | .2515 | .2501 | .0629 | 3305 | 52.5 | 2530 | 40.2 | 8 | 29.3 |
| -6T | .2515 | .2506 | .0630 | 3265 | 51.8 | 2575 | 40.9 | 7 | 29.2 |
| | | | | AVG | 52.0 | | 40.5 | 7 | 29.7 |

ITEM 2

ITEM 4

CONTINUED ON R.N. #

SIGNATURE

FORM 918A-1

LOCKHEED-CALIFORNIA COMPANY
A DIVISION OF LOCKHEED AIRCRAFT CORPORATION
RESEARCH NOTEBOOK

Nº 550476

TO: DuBa
FROM: GEN
MODEL:
DATE: 7 / 29 / 75
SUBJECT: TENS. - 1"GL - R.T. BE-A3AL Lockalloy
REF:
W.O. 31-2925
EWA 03867

CONTINUED FROM R.N. #
PART NO. AND SER.

| Coupon Ident | Width In. | Thick. In. | Area In.² | Ultimate Lbs | Ultimate KSI | .2% Yield Lbs | .2% Yield KSI | %E 1"GL | Ec x10⁶ PSI |
|---|---|---|---|---|---|---|---|---|---|
| | (.2515) | (.2521) | (.0634) | | | | | (4.8) | |
| L-T1L | .2450 | .2465 | .0604 | 3340 | 52.7 | 2510 | | 10 | 31.0 |
| | (.2515) | (.2517) | (.0633) | | | | | (4.6) | |
| L-T22L | .2454 | .2467 | .0605 | 3360 | 53.1 | 2960 | 46.8 | 9 | 28.6 |
| | (.2552) | (.2518) | (.0643) | | | | | (4.2) | |
| L-T23L | .2504 | .2473 | .0619 | 3355 | 52.2 | 2960 | 46.0 | 7 | 24.7 |
| | | | | AVG | 52.7 | | 46.4 | 9 | 28.1 |
| | (.2506) | (.2521) | (.0632) | | | | | (5.9) | |
| L-T25L | .2427 | .2457 | .0596 | 2695 | 42.6 | 2250 | 35.6 | 8 | 28.2 |
| | (.2511) | (.2523) | (.0634) | | | | | (5.8) | |
| L-T26L | .2439 | .2460 | .0600 | 2990 | 47.2 | 2270 | 35.8 | 10 | 21.5 |
| | (.2515) | (.2524) | (.0635) | | | | | (4.6) | |
| L-T27L | .2454 | .2471 | .0606 | 3165 | 49.8 | 2230 | 35.1 | 11 | 25.4 |
| | | | | AVG | 46.5 | | 35.5 | 10 | 25.0 |
| | .2518 | .2524 | (.0636) | | | | | (5.4) | |
| | .2409 | .2466 | .0604 | | | | | (4.4) | |
| L-T28L | .2383 | .2470 | .0577 | 2895 | 45.5 | 2230 | 35.1 | 14 | 22.1 |
| L-T29L | .2509 | .2509 | .0630 | 3020 | 47.9* | 2500 | 39.7 | 4 | 21.7 |

* FAILED @ GAGE PT (UNSTRETCH) DURING
SAME GAGE PT USED - .010 RAD. (60°)

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | .2516 | .2515 | .0633 | | | | | (4.4) | |
| | .2454 | .2465 | .0605 | | | | | (4.6) | |
| L-T30L | .2396 | .2427 | .0582 | 2995 | 47.3 | 2200 | 34.8 | 16 | 21.7 |
| | | | | AVG OF (2) | 46.4 | | 35.0 | 15 | 21.9 |

STRETCH 5% 1 HR @ 150°F

STR. 5% 1 HR @ 150°F

TWICE { STRETCH 5% STRESS REL. 1 HR @ 150°F

NEW

NEW

NEW

CONTINUED ON R.N. #

SIGNATURE

FORM 888A-1

LOCKHEED CALIFORNIA COMPANY
A DIVISION OF LOCKHEED AIRCRAFT CORPORATION

RESEARCH NOTEBOOK

No. 550477

TO: DLABA
FROM: GH
MODEL:
DATE: 8 4 75
SUBJECT: TENS. 1"GL RT. Be-Cu SOL LOCKALLOY PLATE STRETCHED @ R.T.
REF:
W.O. EWA

CONTINUED FROM R.N. #
PART NO. AND SER.

| Coupon Ident | Width in | Thick in. | Area in² | Ult. Load Lbs | Ult. Stress KSI | .2% Yield Load Lbs | .2% Yield Stress KSI | % Elong in 1" Gage | E x 10⁻⁶ psi |
|---|---|---|---|---|---|---|---|---|---|
| | (.2555) | (.2514) | (.0642) | | | | | (5.0) | |
| | .2490 | .2463 | .0613 | | | | | (4.5) | |
| | .2430 | .2423 | .0589 | | | | | (4.5) | |
| 1-T31L | .2367 | .2376 | .0562 | 2770 | 43.1 | 2180 | 34.0 | 18 | 19.6 |
| | (.2528) | (.2514) | (.0636) | | | | | (4.8) | |
| 1-T32L | .2464 | .2462 | .0607 | 3005* | 47.2* | 2175 | 34.2 | 9 | 22.9 |
| | (.2560) | (.2508) | (.0642) | | | | | 5.1 | |
| | .2496 | .2458 | .0614 | | | | | 5.5 | |
| 1-T33L | .2422 | .2408 | .0583 | 2945 ⊛ | 45.9 ⊛ | [illegible] | [illegible] | 15 | [illegible] |
| | | | | | | 2170 | 33.8 | | 20.1 |

DO THREE (STRETCH 5% TIMES (STRESS RUT @ 1/4 OFF)

ITEM 7

* FAILED DURING 2ND 5% STRETCH
⊛ FAILED DURING 3RD 5% STRETCH

CONTINUED ON R.N. #

SIGNATURE

FORM 8884-1

LOCKHEED CALIFORNIA COMPANY
A DIVISION OF LOCKHEED AIRCRAFT CORPORATION

**RESEARCH NOTEBOOK** Nº 550478

TO DUBA. | DATE 8 6 75 | REF:

FROM GUN | W.O. F.W.A.

MODEL

SUBJECT TENS. - 1"GL - R.T. BE-43AL LOCKALLOY PLATE STRETCH @ 1050°F

CONTINUED FROM R.N. # | PART NO. AND SER.

| COUPON IDENT | WIDTH IN. | THICK. IN. | AREA IN² | ULTIMATE LBS | ULTIMATE KSI | 2% YIELD LBS | 2% YIELD KSI | %e 1"GL | %e Ktot PSI |
|---|---|---|---|---|---|---|---|---|---|
| | (.2500) | (.2500) | (.0625) | | | | | (4.45) | |
| 1-T35L | .2478 | .2446 | .0606 | 2845* | 45.5* | 2420 | 38.7 | 9 | 30.6 |
| | (.2520) | (.2491) | (.0628) | | | | | (5.4) | |
| 1-T36L | .2498 | .2483 | .0608 | 2585* | 41.2* | 2455 | 39.1 | 7 | 28.8 |
| | (.2508) | (.2500) | (.0627) | | | | | (4.8) | |
| 1-T40L | .2487 | .2483 | .0605 | 2780 | 44.3 | 2430 | 38.8 | 8 | 30.5 |
| | | | | AVG | 43.7 | | 38.9 | 8 | 30.0 |
| | (.2510) | (.2504) | (.0629) | | | | | 5.2 | |
| 1-T37L | .2478 | .2483 | .0603 | 2530* | 40.2* | 2460 | 39.1 | 7 | 20.0 |
| | (.2501) | (.2503) | (.0626) | | | | | 4.6 | |
| 1-T38L | .2491 | .2441 | .0608 | 2600* | 41.5* | 2500 | 39.9 | 7 | 22.0 |
| | (.2504) | (.2502) | (.0627) | | | | | 4.4 | |
| 1-T39L | .2485 | .2482 | .0607 | 2965 | 47.3 | 2490 | 39.7 | 11 | 23.7 |
| | | | | AVG | 43.0 | | 39.6 | 8 | 21.9 |
| | (.2509) | (.2497) | (.0626) | | | | | 5.0 | |
| 1-T-7T | .2487 | .2431 | .0604 | 2820 | 45.0 | 2415 | 38.6 | 10 | 28.0 |
| | (.2520) | (.2497) | (.0632) | | | | | 5.0 | 24.2 |
| 1-T25T | .2505 | .2431 | .0609 | 2760 | 43.7 | 2460 | 38.9 | 9 | [illegible] |
| | (.2512) | (.2503) | (.0629) | | | | | 4.8 | |
| 1-T9T | .2484 | .2440 | .0606 | 2795 | 44.4 | 2445 | 38.9 | 9 | 29.1 |
| | | | | AVG | 44.4 | | 38.8 | 9 | 27.1 |

STRETCH 5% STRESS REL (1 HR @ 1050°F) — ITEM 7.1

STRETCH 5% STRESS REL (1 HR @ 1050°F) — ITEM 8

STRETCH 5% STRESS REL (1 HR @ 1050°F) — ITEM 12

* FAILED @ GAGE POINT INDICATIONS

CONTINUED ON R.N. # | SIGNATURE

FORM 8884-1

LOCKHEED-CALIFORNIA COMPANY
A DIVISION OF LOCKHEED AIRCRAFT CORPORATION

RESEARCH NOTEBOOK

No. 550479

TO: DUBA
FROM GDM
MODEL
DATE 2 6 75
SUBJECT TENS. - 1"GL - R.T. BE-43 & LOCKALLOY PLATE STRETCHED @ 1050°F
REF:
W.O. EWA
CONTINUED FROM R.N. #
PART NO. AND SER.

| COUPON IDENT. | WIDTH IN. | THICK. IN. | AREA IN² | ULTIMATE LBS | ULTIMATE KSI | .2% YIELD LBS | .2% YIELD KSI | % E 1"GL | E MODULUS PSI |
|---|---|---|---|---|---|---|---|---|---|
| | (.2531) | (.2513) | (.0636) | | | | | (3.6) | |
| | .2501 | .2461 | .0615 | | | | | (6.8) | |
| 1-TAL | .2467 | .2382 | .0585 | 23330* | 396.6* | 2245 | 35.6 | 12 | 17.4 |
| | (.2504) | (.2501) | (.0626) | | | | | (4.6) | |
| | .2484 | .2438 | .0606 | | | | | (6.2) | |
| 1-TAL | .2443 | .2369 | .0579 | 2405 | 38.4 | 2075 | 33.4 | 14 | 20.7 |
| | (.2511) | (.2500) | (.0628) | | | | | (4.7) | |
| | .2491 | .2432 | .0607 | | | | | (5.7) | |
| 1-TAL | .2465 | .2375 | .0583 | 2355 | 37.5 | 2220 | 35.4 | 12 | 20.3 |
| | | | | AVG | 37.5 | | 34.5 | 13 | 20.8 |

ITEM 9

-100 {STRETCH 5% TWICE / STRESS REL (1 HR @ 1050°F)}

* FAILED AT EXTENSOMETER GAGE POINT INDENTATION

CONTINUED ON R.N. #

SIGNATURE

FORM 888A-1

TO: DLBA
FROM GN
MODEL

DATE 8 8 75

LOCKHEED-CALIFORNIA COMPANY
A DIVISION OF LOCKHEED AIRCRAFT CORPORATION
RESEARCH NOTEBOOK

No. 550480

SUBJECT TELLS - 1" GL - 1050°F BE-43AL LOCKALLOY PLATE (As Received)

REF.

W.O. EWA

CONTINUED FROM R.N. #

PART NO. AND SER.

| Coupon Identif. | Width W | Thick (in) | Area in² | Ultimate Lbs | Ultimate Ksi | .2% Yield Lbs | .2% Yield Ksi | %E 1" GL | %E Xtal Plane |
|---|---|---|---|---|---|---|---|---|---|
| .050 in/in/min. | | | | | | | | | |
| 1-T3L | .2511 | .2504 | .0629 | 202.5 | 3.2 | 130.0 | 2.1 | 17 | 2.4 |
| 1AL | .2508 | .2513 | .0630 | 142.5 | 2.3 Δ | 133.0 | 2.1 | 20 Δ | 1.8 |
| 1BL | .2522 | .2514 | .0634 | 136.5 | 2.2 Δ | 111.0 | 1.8 | 21 Δ | 1.9 |
| .005 in/in/min. | | | | | | | | | |
| 1-T16L | .2565 | .2514 | .0645 | 76.0 | 1.2 | 70.0 | 1.1 | 27 | 2.0 [redacted] |
| 1TL | .2528 | .2516 | .0636 | 190.0 ΔΔ | 3.0 ΔΔ | 59.0 | .95 | 15 Δ | 2.1 [redacted] |
| 1BL | .2528 | .2514 | .0636 | 197.5 ΔΔ | 3.1 ΔΔ | 61.0 | .96 | 20 Δ | Not obtained |
| .050 in/in/min. | | | | | | | | | |
| 1-T19L | .2528 | .2514 | .0636 | 346 Δ | 5.4 Δ | 309 | 4.8 | 15 Δ | 2.1 |
| 2AL | .2533 | .2515 | .0637 | 308 Δ | 4.8 Δ | 276 | 4.3 | 19 Δ | 2.0 |
| 2BL | .2518 | .2514 | .0633 | 307 | 4.8 | 273 | 4.3 | 19 | 2.0 |
| | | | | AVG | 5.0 | | | | |

Item 3

(*) NOTE: Coupon 1-T3L loaded at 0.2-0.5 in/in/min.

* Increased to 1.5" GL after Yield at (15 Tests)

Δ Failed in Extensometer Gage Point

CONTINUED ON R.N. #

SIGNATURE

TO B. DUBA | DATE 9 | LOCKHEED-CALIFORNIA COMPANY, A DIVISION OF LOCKHEED AIRCRAFT CORPORATION | Nº. 550489

FROM | 23 | RESEARCH NOTEBOOK | REF:

MODEL | 75 | SUBJECT D937 R.T. TEST | W.O. 31-292 EWA 0302

CONTINUED FROM R.N. # | PART NO. AND SER.

| COUPON NO | WIDTH IN | THICK IN | AREA IN² | ULT LBS | ULT KSI | YIELD KSI | YIELD LBS | %e IN/IN | E x10⁶ PSI |
|---|---|---|---|---|---|---|---|---|---|
| D937L | | | | | | | | | |
| -1 | 2489 | 2499 | 0622 | 5080 | 81.67 | 74.67 | 4645 | 15 | 10.3 |
| -2 | 2500 | 2499 | 0625 | 5080 | 81.28 | 75.52 | 4720 | 15 | 10.2 |
| -3 | 2457 | 2500 | 0614 | 4985 | 81.19 | 75.32 | 4625 | 15 | 10.2 |
| D937T | | | | | | | | | |
| -4 | 2478 | 2499 | 0619 | 5175 | 83.60 | 72.46 | 4485 | 14 | 10.3 |
| -5 | 2508 | 2498 | 0627 | 5190 | 82.78 | 71.77 | 4500 | 14 | 10.2 |
| -6 | 2477 | 2498 | 0619 | 5200 | 84.00 | 73.02 | 4520 | 14 | 10.2 |
| D937L | | | | | | | | | |
| -7 | 1250 | 2500 | 0312 | 3025 | 97.0 | | | | |
| -8 | 1250 | 2499 | 0312 | 3000 | 96.2 | | | | |
| -9 | 1250 | 2497 | 0312 | 3000 | 96.2 | | | | |
| D937T | | | | | | | | | |
| -10 | 1315 | 2493 | 0328 | 3085 | 94.0 | | | | |
| -11 | 1294 | 2493 | 0322 | 3060 | 95.0 | | | | |
| -12 | 1205 | 2497 | 0301 | 2900 | 96.3 | | | | |

CONTINUED ON R.N. # | SIGNATURE

LOCKHEED-CALIFORNIA COMPANY
A DIVISION OF LOCKHEED AIRCRAFT CORPORATION
RESEARCH NOTEBOOK

No. 550490

TO R. DUBA
FROM GN
MODEL

DATE 9 25 75

SUBJECT NOTCHED TENSION (RM & 600°F) AL REED BE-38AL ALLOY (PLATE)

REF:
W.O.
EWA

CONTINUED FROM R.N. #

PART NO. AND SER.

| COUPON IDENT. | WIDTH IN | THICK. IN. | AREA IN² | ULTIMATE LBS | ULTIMATE KSI | REMARKS |
|---|---|---|---|---|---|---|
| SNT-1L | ~~.1290~~ .1290 | .2544 | .0328 | 1720 | 52.4 | R.T. |
| -2L | .1292 | .2557 | .0330 | 1715 | 52.0 | |
| -3L | .1291 | .2562 | .0331 | 1700 | 51.4 | R.T. |
| | | | | AVG | 51.9 | |
| -4L | .1293 | .2560 | .0331 | 1105 | 33.4 | 600°F |
| -5L | .1288 | .2558 | .0329 | 1110 | 33.7 | |
| -6L | .1292 | .2548 | .0329 | 1115 | 33.9 | 600°F |
| | | | | AVG | 33.7 | |
| SNT-1T | .1303 | .2560 | .0334 | 1670 | 50.0 | R.T. |
| -2T | .1320 | .2553 | .0337 | 1675 | 49.7 | |
| -3T | .1287 | .2555 | .0329 | 1665 | 50.6 | R.T. |
| | | | | AVG | 50.1 | |
| -4T | .1305 | .2556 | .0333 | 1015 | 30.5 | 600°F |
| -5T | .1304 | .2558 | .0334 | 1080 | 32.3 | |
| -6T | .1302 | .2552 | .0332 | 1065 | 32.1 | 600°F |
| | | | | AVG | 31.6 | |

CONTINUED ON R.N. #

SIGNATURE

FORM 6988-T

LOCKHEED CALIFORNIA COMPANY
A DIVISION OF LOCKHEED AIRCRAFT CORPORATION
RESEARCH NOTEBOOK

No. 550491

TO: DUBA
FROM: GM
MODEL:

DATE: 10 / 10 / 75

SUBJECT: SHEET SHEAR * R.T. & 600°F BE-38AL

REF:

W.O. / SWA

CONTINUED FROM R.N. #

PART NO. AND SER.

| Coupon Ident. | Thick. (t) in | Dia. (D) in | (πDt) Area in² | Ultimate Lbs | Ultimate Ksi | Test Temp. | Mtl. Cond |
|---|---|---|---|---|---|---|---|
| 6B1.5 -1T | .0389 | .499 | .0610 | 2325 | 38.1 | R.M | As Rec'd |
| 2T | .0372 | | .0583 | 2260 | 38.6 | R.M | |
| 3T | .0373 | | .0585 | 2350 | 40.2 | R.M | |
| | | | | Avg. | 39.0 | | |
| 4T | .0394 | | .0618 | 1270 | 20.6 | 600°F | |
| 5T | .0382 | | .0599 | 1220 | 20.4 | 600°F | |
| 6T | .0380 | | .0596 | 1250 | 21.0 | 600°F | |
| | | | | Avg. | 20.7 | | |
| 7T | .0372 | | .0583 | 2190 | 37.6 | R.M | 100Hrs @ 600°F |
| 8T | .0386 | | .0605 | 2208 | 36.5 | R.M | |
| 9T | .0374 | | .0586 | 2175 | 37.1 | R.M | |
| | | | | Avg. | 37.1 | | |
| 10T | .0376 | | .0589 | 1210 | 20.5 | 600°F | |
| 11T | .0390 | | .0611 | 1175 | 19.2 | 600°F | |
| 12T | .0383 | | .0600 | 1015 | 16.9 | 600°F | |
| | | | | Avg. | 18.9 | | |

▲ THICKNESS VARIES — AVG VALUES

* NOTE: PREVIOUS COUPONS ([redacted] S36)

SIGNATURE

CONTINUED ON R.N. #

FORM 88041

TO: DATA 9 DATE 4-29-75

FROM GAL

MODEL

SUBJECT Comp. 2" Gal. Sq. Bar Long Plate

LOCKHEED-CALIFORNIA COMPANY
A DIVISION OF LOCKHEED AIRCRAFT CORPORATION

RESEARCH NOTEBOOK

No. 550492

W.O. EWA

REF.

PART NO. AND SER.

CONTINUED FROM P.A. #

CONTINUED ON P.A. #

| Coupon Ident | Width IN. | Thick IN. | Area IN² | .2% Yield LBS | .2% Yield KSI | F.to Sec. LBS | Mod. KSI | F.85 Sec. LBS | Mod. KSI | E KSI×10⁻³ | n |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **As Received (No Soak)** | | | | | | | | | | | |
| * SC -11 | .625 | .2561 | .1601 | 5350 | 33.4 | 3850 | 24.0 | 2900 | 18.1 | 22.7 | 4.1 |
| (R.T.) -21 | .625 | .2558 | .1599 | 5430 | 34.0 | 4090 | 25.6 | 3130 | 19.6 | 20.8 | 4.3 |
| -31 | .623(T) | .2561 | .1596 | 5380 | 33.7 | 3975 | 24.9 | 2950 | 18.5 | [illegible] 22.8 | 4.0 |
| | | | | AVG 33.7 | | | 24.8 | | 18.7 | 21.9 | 4.1 |
| (600°F) -41 | .626 | .2556 | .1600 | 3700 | 23.1 | 3160 | 19.8 | 2580 | 16.1 | 18.1 | 5.4 |
| -51 | .626 | .2560 | .1602 | 3615 | 22.6 | 2740 | 17.1 | 2080 | 13.0 | 21.7 | 4.2 |
| -61 | .626 | .2550 | .1596 | 3490 | 21.9 | 2990 | 18.7 | 2670 | 16.8 | 17.2 | 6.2 |
| | | | | AVG 22.5 | | | 18.5 | | 15.0 | 19.0 [illegible] | 5.3 |
| **Soaked 100 Hrs @ 600°F** | | | | | | | | | | | |
| SC 71 | .625 | .2558 | .1599 | 5350 | 33.4 | 3525 | 22.0 | 2400 | 15.0 | 25.7 | 3.3 |
| (R.T.) 81 | .625(T) | .2547 | .1592 | 5485 | 34.8 | 4270 | 26.8 | 3120 | 19.6 | 21.1 | 3.8 |
| 91 | .625(T) | .2564 | .1602 | 5570 | 34.8 | 4320 | 27.0 | 3220 | 20.1 | 20.8 | 4.0 |
| | | | | AVG 34.3 | | | 25.3 | | 18.2 | 22.5 | 3.7 |
| (600°F) +101 | .625 | .2548 | .1592 | 3485 | 21.9 | 2815 | 17.7 | 2480 | 15.6 | 21.8 | 8.0 |
| +111 | .625 | .2560 | .1600 | 3570 | 22.3 | 2945 | 18.4 | 2325 | 14.5 | 19.2 | 4.8 |
| +121 | .625 | .2552 | .1595 | 3575 | 22.4 | 3165 | 19.8 | 2755 | 17.3 | 17.4 | 7.4 |
| | | | | AVG 22.2 | | | 18.6 | | 15.8 | 19.5 | 6.7 |

NOTE: (T) TAPERED - AVG

$$n = 1 + \frac{.3853}{\text{LOG}_{10} P.70/P.85}$$

M.C. STO-1312

LOCKHEED CALIFORNIA COMPANY
A DIVISION OF LOCKHEED AIRCRAFT CORPORATION

RESEARCH NOTEBOOK

No. 550493

TO Bob DuBois
FROM GN
MODEL

DATE 10 13 75

SUBJECT Joint Test - Rm & 600°F
Be-38Al Alloy

REF.
W.O.
EWA

CONTINUED FROM R.N. #

PART NO. AND SER.

| Coupon Identif. | Ultimate Lbs | Ultimate Lbs/in | 0.2 Yield Lbs | 0.2 Yield Lbs/in | Gl. in. | Test Temp. | Remarks Type Fail. |
|---|---|---|---|---|---|---|---|
| 313.125-1A,1B | 4430 | 2665 | 2840 | 1420 | 2.0 | RM | BEARING ALLOW NOT SEC.? |
| -2A,2B | 4255 | 2128 | 2830 | 1415 | | RM | SAME AS 1A,1B MACHED TO 1.0 (NO EFFECT) |
| -3A,3B | 3625 | 1812 | 2910 | 1455 | | RM | MACHED TO 1.0 FAILED THRU MACH. |
| -4A,4B | 2550 | 1275 | 2045 | 1022 | | 600°F | BEARING ON THRD. OUT |
| -5A,5B | 2535 | 1468 | 2090 | 1045 | | 600°F | " |
| -6A,6B | 2470 | 1235 | 1950 | 975 | | 600°F | " |
| 413.125-1A,1B | 4235 | 2118 | 2680 | 1340 | 3.6 | RM | FAILED SELF-ALIGN NUT (SHEAR)? |
| -2A,2B | 4445 | 2222 | 2755 | 1378 | | RM | |
| -3A,3B | 4500 | 2250 | 2765 | 1382 | | RM | |
| -4A,4B | 3680 | — | 1810 | 905 | | 600°F | NET SEC. SCORES RM. VALUES IN LOT WOULD CONTINUE PLATES |
| -5A,5B | 3525 | — | 1720 | 860 | | 600°F | |
| -6A,6B | 3600 | — | 1905 | 952 | | 600°F | |

PRE-LOADED FROM 100# THEN TORQUED TO 50 IN-LBS (3/16 DIA.)

CONTINUED ON R.N. #

SIGNATURE

FORM 6881-1

TO Dura
FROM GN
MODEL

DATE 10 17 75

LOCKHEED CALIFORNIA COMPANY
A DIVISION OF LOCKHEED AIRCRAFT CORPORATION
RESEARCH NOTEBOOK

No. 550494

SUBJECT Joint Test of Be-38Al Alloy (R.T. & 600°F)

REF:
W.O.
EWA

CONTINUED FROM R.N. #

PART NO. AND SER.

| Coupon Ident | Ultimate Lbs | Ultimate Lbs/F | 0.2% Lbs | Yield Lbs/F | GL In. | Test Temp | Remarks Type Fail. |
|---|---|---|---|---|---|---|---|
| 5A3..15.1A,1B | 4825 | 2417 | 3530 | 1765 | 2.0 | RT | Net Section (1A & 1B) |
| 2A,2B (3/4) | 4655 | 2328 | 3210 | 1605 | 2.0 | RT | Same as 1A,1B Marred to L.D. (No Effect) |
| 3A,3B | 4425 | 2212 | 3345 | 1672 | 2.0 | RT | Same as 1A,1B except failed thru Mar[illegible] Marred to L.D. |
| 4A,4B | 2985 | 1492 | 2235 | 1118 | 2.0 | 600°F | Bearing or Tear-out |
| 5A,5B | 3050 | 1525 | 2015 | 1208 | 2.0 | 600°F | 1 |
| 6A,6B | 2910 | 1455 | 2155 | 1078 | 2.0 | 600°F | 11 |
| 5A..15-1A,1B | 4900 | 2450 | 3335 | 1668 | 4.0 | RT | Bearing & Net Sec. |
| 2A,2B (1/4) | 4810 | 2405 | 3200 | 1600 | | RT | Tear-out (Net Sec.)? (1 Mar) |
| 3A,3B | 4575 | 2288 | 3325 | 1662 | | RT | Bearing & Tear & Net Sec. (11 Mar) |
| 4A,4B | 3105 | 1555 | 2280 | 1140 | | 600°F | Bearing or Tear-out |
| 5A,5B | 3155 | 1578 | 2280 | 1140 | | 600°F | 1 |
| 6A,6B | 3140 | 1570 | 2465 | 1232 | | 600°F | 11 |

e.d = 1.5

Pre-loaded To 100# 5A3 Tested 30 1/2 5A4 45 Lbs.

CONTINUED ON R.N. #

SIGNATURE

FORM 6888-1

TO: R DUBA
FROM: D RUNNER
MODEL:
DATE: 10/27/75

LOCKHEED-CALIFORNIA COMPANY
A DIVISION OF LOCKHEED AIRCRAFT CORPORATION
RESEARCH NOTEBOOK

No. 550495

SUBJECT: TENSILE TEST RT. P.E ALUM

REF:
W.O.
EWA

CONTINUED FROM R.N. #
PART NO. AND SER.

| SPECIMEN I.D. | WIDTH IN. | THICK IN. | AREA IN² | ULTIMATE LBS. | ULTIMATE KSI | YIELD LBS | YIELD KSI | % E IN/IN | E x 10⁶ PSI |
|---|---|---|---|---|---|---|---|---|---|
| ST-1L | .2318 | .2560 | .0614 | 3170 | 51.63 | 2235 | 36.40 | 9 | 29.1 |
| ST-2L | .2433 | .2559 | .0622 | 3200 | 51.45 | 2275 | 36.58 | 9 | 28.9 |
| ST-3L | .2406 | .2562 | .0617 | 3140 | 50.89 | 2250 | 36.47 | 9 | 28.6 |
| ST-7L | .2426 | .2558 | .0621 | 3210 | 51.69 | 2320 | 37.36 | 9 | 29.8 |
| ST-8L | .2410 | .2560 | .0617 | 3245 | 52.59 | 2330 | 37.76 | 12 | 30.0 |
| ST-9L | .2380 | .2560 | .0610 | 3205 | 52.54 | 2205 | 36.15 | 12 | 25.0 |
| ST-1T | .2412 | .2595 | .0624 | 3100 | 49.68 | 2250 | 36.05 | 8 | 26.6 |
| ST-2T | .2437 | .2551 | .0622 | 3125 | 50.24 | 2250 | 36.17 | 9 | 29.4 |
| ST-3T | .2432 | .2552 | .0621 | 3080 | 49.60 | 2250 | 36.20 | 9 | 30.2 |
| ST-7T | .2451 | .2551 | .0625 | 3180 | 49.92 | 2220 | 35.52 | 10 | 29.4 |
| ST-8T | .2412 | .2540 | .0613 | 3055 | 49.84 | 2225 | 35.60 | 9 | 27.1 |
| ST-9T | .2404 | .2551 | .0613 | 3053 | 49.84 | 2215 | 35.89 | 9 | 28.0 |

CONTINUED ON R.N. #

SIGNATURE

FORM 9884-1

TO: R. DUBA
FROM: D. RUNNER
MODEL:
DATE: 10/28/25

LOCKHEED-CALIFORNIA COMPANY
A DIVISION OF LOCKHEED AIRCRAFT CORPORATION
RESEARCH NOTEBOOK

**No. 550496**

SUBJECT: TENSILE TEST - 600°F
2.9 ALUM LOCKALLOY

REF:
W.O.
EWA

CONTINUED FROM R.N. #

PART NO. AND SER.

| SPECIMEN I.D. | WIDTH IN. | THICK IN. | AREA IN² | ULTIMATE LBS | ULTIMATE KSI | YIELD LBS | YIELD KSI | %e INCH | E $\times 10^6$ |
|---|---|---|---|---|---|---|---|---|---|
| ST-4L | .3435 | .2558 | .0628 | 1555 | 24.76 | 1450 | 23.27 | 9 | 19.9 |
| ST-5L | .2450 | .2558 | .0627 | 1535 | 24.48 | 1475 | 23.52 | 7 | 29.9 |
| ST-6L | .2442 | .2544 | .0621 | 1545 | 24.88 | 1510 | 24.32 | 12 | — |
| | | | | | | | | | 24.9 |
| ST-10L | .2412 | .2560 | .0617 | 1530 | 24.80 | 1485 | 24.07 | 11 | 30.7 |
| ST-11L | .2423 | .2549 | .0618 | 1540 | 24.92 | 1475 | 23.87 | 12 | 23.8 |
| ST-12L | .2420 | .2550 | .0617 | 1525 | 24.72 | 1385 | 22.45 | 11 | 17.6 |
| ST-4T | .3437 | .2550 | .0621 | 1490 | 24.00 | 1450 | 23.35 | 9 | 19.8 |
| ST-5T | .2438 | .2556 | .0623 | 1500 | 24.08 | 1465 | 23.52 | 10 | 23.6 |
| ST-6T | .2461 | .2557 | .0629 | 1540 | 24.48 | 1480 | 23.53 | 10 | 17.3 |
| | | | | | | | | | 20.2 |

CONTINUED ON R.N. #

SIGNATURE

FORM 838A-1

TO R. Rund
FROM D. Runner
MODEL

DATE 10/30/75

LOCKHEED-CALIFORNIA COMPANY
A DIVISION OF LOCKHEED AIRCRAFT CORPORATION
RESEARCH NOTEBOOK

No. 550497

SUBJECT RT TENSILE TEST
BE 3841 LOKALLOY

REF:
W.O.
EWA

CONTINUED FROM R.N. #

PART NO. AND SER.

| SPEC. I.D. | WIDTH IN | THICK IN | AREA IN² | ULTIMATE LBS | ULTIMATE KSI | YIELD LBS | YIELD KSI | %e IN. | E x10⁻⁶ PSI |
|---|---|---|---|---|---|---|---|---|---|
| ST-13L | .2468 | .2554 | .0630 | 3260 | 51.75 | 2340 | 37.14 | 8.0 | 25.1 |
| ST-14L | .2462 | .2545 | .0629 | 3245 | 51.75 | 2340 | 37.32 | 9.0 | 37.1 |
| ST-15L | .2458 | .2553 | .0626 | 3255 | 52.00 | 2360 | 37.70 | 10.0 | 26.9 |
| ST-16L | .2450 | .2552 | .0625 | 3205 | 51.28 | 2270 | 36.32 | 9.0 | 38.0 |
| ST-17L | .2462 | .2554 | .0624 | 3080 | 49.36 | 2270 | 36.38 | 8.0 | 38.2 |
| ST-18L | .2450 | .2548 | .0624 | 3215 | 51.52 | 2310 | 37.02 | 12.0 | 31.6 |
| ST-19L | .2450 | .2543 | .0623 | 3240 | 52.01 | 2390 | 38.36 | 7.0 | 34.4 |
| ST-20L | .2455 | .2552 | .0626 | 3200 | 51.12 | 2310 | 37.84 | 7.0 | 35.5 |
| ST-21L | .2440 | .2558 | .0624 | 3250 | 52.08 | 2380 | 37.98 | 8.0 | 34.3 |
| ST-22L | .2452 | .2549 | .0625 | 3330 | 53.28 | 2350 | 37.60 | 13.0 | 36.9 |
| ST-23L | .2439 | .2551 | .0622 | 3300 | 53.05 | 2340 | 37.62 | 13.0 | 35.9 |
| ST-24L | .2460 | .2558 | .0629 | 3300 | 52.46 | 2255 | 36.14 | 14.0 | 40.7 |
| ST-31L | .2467 | .2510 | .0619 | 3185 | 51.45 | 2865 | 46.28 | 8.0 (3.0) | 29.1 |
| ST-35L | .2460 | .2510 | .0618 | 3315 | 53.64 | 2920 | 47.25 | 10.0 (5.0) | 24.5 |
| ST-36L | .2462 | .2521 | .0621 | 3325 | 53.54 | 2870 | 46.22 | 10 (5.0) | 24.2 |

.005 in/in/min — ITEM #1
.0005 in/in/min — ITEM #2
.05 in/in/min — ITEM #3
.005 in/in — ITEM #4 FINAL

CONTINUED ON R.N. #

SIGNATURE

FORM 6868-1

LOCKHEED-CALIFORNIA COMPANY
A DIVISION OF LOCKHEED AIRCRAFT CORPORATION

RESEARCH NOTEBOOK

**Nº. 550498**

TO: R D 38A
FROM: D RUNCK
MODEL:
DATE: 10/31/75
SUBJECT: R.T. TENSILE
BE 38AL LOCKALLOY
REF:
W.O. EWA

CONTINUED FROM R.N. #:
PART NO. AND SER.

| SPECIMEN IDENT | WIDTH IN | THICK IN | AREA IN² | ULTIMATE LBS | ULTIMATE KSI | YIELD LBS | YIELD KSI | %e INCH | E PSI×10⁶ | |
|---|---|---|---|---|---|---|---|---|---|---|
| 5T-10T | .2446 | .2550 | .0624 | 3170 | 50.80 | 2240 | 35.90 | 11.0 | 33.1 | (ITEM # 11) |
| 5T-11T | .2412 | .2543 | .0616 | 3090 | 50.16 | 2205 | 35.80 | 10.0 | 33.8 | |
| 5T-12T | .2467 | .2550 | .0629 | 3125 | 49.68 | 2240 | 35.61 | 10.0 | 36.1 | |
| PRE STRAINED 5% - STRESS RELIEVED 1050° 1HR | | | | | | | | | | |
| 5T-31L | .2403 | .2546 | .0612 | 3105 | 50.7 | | 34.5 | 9% | 30.4 | |
| FAIL | .2322 | .2496 | .0580 | | ~~53.68~~ | 2110 | ~~36.4~~ | ~~10%~~ | ~~32.1~~ | ① |
| 5T-38L | .2440 | .2555 | .0623 | | 49.7 | | 35.9 | | 28.1 | |
| | .2368 | .2510 | .05941 | 3095 | ~~52.14~~ | 2115 | ~~35.6~~ | 8% | ~~29.5~~ | ① |
| 5T-31L | .2445 | .2555 | .0625 | | 51.0 | | 34.2 | | 29.4 | |
| | .2379 | .2512 | .0598 | 3190 | ~~53.34~~ | 2135 | ~~35.4~~ | 10 | ~~29.6~~ | ① |
| PRE STRAINED 5% - S.R 1050 1HR RELATED CYCLE, TEST | | | | | | | | | | |
| ~~5T 40L .2324 .2482~~ | | | | | | | | | | |
| ~~5T 41L .2348 .2478~~ | | | | | | | | | | |
| ~~5T 42L .2321 .2467~~ | | | | | | | | | | |
| 5T.40L | .2458 | .2566 | (.0631) | | | | | 5.0 | | |
| | .2385 | .2522 | | | | | | 4.8 | | |
| | .2324 | .2480 | .0576 | 2825 | 49.0 | 2150 | 37.3 | 4 (14) | 31.2 | |
| 5T.41L | .2470 | .2564 | (.0633) | | | | | 4.9 | | |
| | .2403 | .2520 | | | | | | 5.0 | | |
| | .2342 | .2478 | .0582 | 3120 | 53.6 | 2170 | 37.3 | 9 (19) | 27.0 | |
| 5T.42L | .2456 | .2552 | (.0627) | | | | | 5.0 | | |
| | .2389 | .2508 | | | | | | 4.9 | | |
| | .2321 | .2467 | .0572 | 3115 | 54.4 | 2170 | 37.9 | 9 (19) | 31.2 | |

① MODULUS & YIELD DETERMINED BY SECANT MODULUS @ ONE HALF OF ULTIMATE

ITEM # 5 TEN

CONTINUED ON R.N. #:
SIGNATURE



FORM 888A-1

TO BOB DUBA
FROM D RUNNER
MODEL

DATE 11/6/75

LOCKHEED-CALIFORNIA COMPANY
A DIVISION OF LOCKHEED AIRCRAFT CORPORATION
RESEARCH NOTEBOOK

No. 550499

SUBJECT Be-38 Al Lockalloy
TESTED @ 1050°F

REF:
W.O.
EWA

CONTINUED FROM R.N. #

PART NO. AND SER.

| SPEC IDENT | WIDTH IN | THICK IN | AREA $IN^2$ | ULTIMATE LBS | ULTIMATE KSI | YIELD LBS | YIELD KSI | % e IN/IN | E $\times 10^6$ PSI |
|---|---|---|---|---|---|---|---|---|---|
| APPROX .005 IN/IN/MIN STRAIN RATE, ACTUAL HEAD TRAVEL RATE = .050 IN/MIN. | | | | | | | | | |
| ST 25 L | .2457 | .2559 | .0629 | 249 | 3.96 | 221 | 3.51 | 21 | — * |
| ST 26 L | .2470 | .2553 | .0631 | 350 | 5.55 | 299 | 4.74 | 15 | 15.8 |
| ST 27 L | .2456 | .2552 | .0627 | 338 | 5.39 | 291 | 4.64 | 15 | 15.7 |
| APPROX .005 IN/IN/MIN STRAIN RATE, ACTUAL HEAD TRAVEL RATE = .008 IN/MIN | | | | | | | | | |
| ST 28 L | .2459 | .2543 | .0625 | 170 | 2.72 | 141 | 2.30 | 21 | 10.4 |
| ST 29 L | .2457 | .2554 | .0628 | 175 | 2.79 | 155 | 2.47 | 20 | 8.38 |
| ST 30 L | .2460 | .2562 | .0630 | 198 | 3.14 | 169 | 2.68 | 20 | 9.92 |
| APPROX .050 IN/IN/MIN STRAIN RATE, ACTUAL HEAD TRAVEL RATE = .5 IN/MIN. | | | | | | | | | |
| ST 31 L | .2478 | .2564 | .0635 | ~~>2000~~ | ~~>31.5~~ | — | — | 9. | 13.5 |
| ST 32 L | .2408 | .2550 | .0614 | 715 | 11.6 | 640 | 10.4 | 9. | 13.2 |
| ST 33 L | .2453 | .2568 | .0630 | 695 | 11.0 | 640 | 10.2 | | — |

* RUN @ APPROX .001 IN/IN/MIN

CONTINUED ON R.N. #

SIGNATURE

FORM 838A-1

TO: DUBA
FROM: GW
MODEL:
DATE: 11 / 11 / 75

LOCKHEED-CALIFORNIA COMPANY
A DIVISION OF LOCKHEED AIRCRAFT CORPORATION
RESEARCH NOTEBOOK
No. 550510

SUBJECT: TENS. - R.T. - 1" GL BE-38 AL Alloy PLATE
REF:
W.O. EWA

CONTINUED FROM R.N. #
PART NO. AND BER.

| COUPON IDENT. | WIDTH IN | THICK. IN | AREA IN² | ULTIMATE LBS | ULTIMATE KSI | .2% YIELD LBS | .2% YIELD KSI | %E | E | |
|---|---|---|---|---|---|---|---|---|---|---|
| STRETCH 5% @ 105°F - 2 DAY | | | | | | | | | | |
| ST-46L | .2456 | .2552 | .0627 | | | | | 5.8 | | |
| | .2412 | .2483 | .0598 | 2835 | 47.4 | 2725 | 37.2 | 6 (12) | 19.4 | |
| ST-47L | .2451 | .2559 | .0627 | | | | | 4.6 | | |
| | .2415 | .2502 | .0604 | 2965 | 49.1 | 2280 | 37.7 | 7 (12) | 18.4 | |
| ST-48L | .2449 | .2551 | .0625 | | | | | 5.1 | | |
| | .2402 | .2485 | .0597 | 2835 | 47.5 | 2235 | 37.4 | 6 (11) | 22.7 | |
| STRETCH 5% @ 150°F - DELAY, STRESS RELIEVE, REHEAT CYCLE TWICE | | | | | | | | | | |
| ST-49L | .2423 | .2544 | | | | | | 5.0 | | |
| | .2355 | .2499 | | | | | | 5.0 | | |
| | .2337 | .2458 | | — | — | — | — | 4.2* (14) | — | |
| ST-50L | .2453 | .2542 | | | | | | 5.0 | | |
| | .2378 | .2489 | | | | | | 5.0 | | |
| | .2312 | .2458 | | | | | | 4.7 | | |
| | .2252 | .2416 | .0544 | 2425 | 44.6 | 2170 | 39.9 | 2 (17) | 17.7 | |
| ST-51L | .2440 | .2565 | | | | | | 5.0 | | |
| | .2370 | .2515 | | | | | | 5.0 | | |
| | .2302 | .2475 | | | | | | 4.8 | | |
| | .2238 | .2434 | .0545 | 2780 | 51.0 | 2130 | 39.1 | 4 (19) | 21.2 | |

* FAILED DURING STRETCHING

CONTINUED ON R.N. #
SIGNATURE

ITEM 7.1

ITEM 7

FORM 9884-1

DATE 11 3 75

TO BOB DUBA

FROM T. SATO PMR

MODEL

LOCKHEED-CALIFORNIA COMPANY
A DIVISION OF LOCKHEED AIRCRAFT CORPORATION

RESEARCH NOTEBOOK

Nº 568560

SUBJECT LOCKALLOY QUAL.

REF

W.O
FWA

CONTINUED FROM R N #

PART NO. AND SER.

| COUP ID. | WIDTH IN. | THICK IN. | AREA IN² | ULTIMATE LBS | ULTIMATE KSI | .2% YIELD KSI | YIELD LBS | %/c 1"GL | E x10⁶ PSI |
|---|---|---|---|---|---|---|---|---|---|
| 137-4 | | | | | | | | | |
| -1A | 2.57 | 1.278 | .0328 | 1796 | 54.75 | 39.15 | 1234 | 9 | 28.6 |
| -2A | 2.57 | 1.278 | .0328 | 1762 | 53.72 | 38.05 | 1248 | 4 * | 30.0 |
| -1B | 2.58 | 1.266 | .0327 | 1700 | 51.99 | 37.12 | 1214 | 7 | 26.2 |
| -2B | 2.57 | 1.269 | .0326 | 1690 | 51.84 | 36.38 | 1180 | 8 | 30.7 |
| 137-5 | | | | | | | | | |
| -1A | 2.58 | 1.203 | .0310 | 1694 | 54.64 | 39.42 | 1222 | 9 | 27.8 |
| -2A | 2.57 | 1.198 | .0308 | 1616 | 52.47 | 38.51 | 1186 | 8 | 26.5 |
| -1B | 2.57 | 1.203 | .0309 | 1604 | 51.91 | 38.19 | 1180 | 7 | 26.4 |
| -2B | 2.57 | 1.206 | .0310 | 1718 | 55.42 | 39.48 | 1224 | 10 | 31.7 |
| 197-2 | | 1.528 | .0393 | | | | | | |
| -1A | 2.57 | 1.478 | .0328 | 2024 | 51.50 | 34.36 | 1350 | 11 | 32.7 |
| -2A | 2.57 | 1.497 | .0329 | 2046 | 52.17 | 34.78 | 1360 | 11 | 27.4 * |
| | | 1.521 | .0391 | | | | | | |
| 197-3 | | | | | | | | | |
| -1A | 2.58 | 1.235 | .0319 | 1668 | 52.29 | 34.86 | 1176 | 9 | 29.2 |
| -2A | 2.58 | 1.232 | .0318 | 1756 | 55.45 | 37.86 | 1204 | 11 | 31.4 ⊙ |
| 197-3 | | | | | | | | | |
| ✓ -1B | 2.57 | 1.231 | .0316 | 1694 | 53.61 | 37.02 | 1170 | 10 | 40.8 |
| ✓ -2B | 2.57 | 1.229 | .0316 | 1646 | 52.09 | 36.77 | 1162 | 9 | 27.1 |
| 197-4 | | | | | | | | | |
| -1A | 2.57 | 1.282 | .0329 | 1712 | 52.04 | 32.22 | 1060 | 11 | 29.0 * |
| -2A | 2.57 | 1.283 | .0330 | 1726 | 52.30 | 31.64 | 1044 | 13 | 31.4 |

✓ CHATTER MARKS FROM END MILL GOING DIAGONALLY ACROSS COUPON.

2 * FAILED OUTSIDE GAGE POINT.

⊙ FAILED ON SCRIBE LINE

CONTINUED ON R N #

SIGNATURE

DATE

TO BOB DUBA 11

FROM T. SATO 4/12 4

MODEL 75

SUBJECT LOCKALLOY QUAL.

RESEARCH NOTEBOOK

No 568563

REF

W.O. FWA

CONTINUED FROM R.N. #

PART NO. AND SER.

| COUP ID | WIDTH IN | THICK IN | AREA IN² | WT LBS | 4 PT. YIELD KSI | YIELD KSI | YIELD LBS | %e 1"GL | E x10⁶ PSI | |
|---|---|---|---|---|---|---|---|---|---|---|
| 227-1 | | | | | | | | | | |
| -1A | 257 | 1542 | 0396 | 2038 | 5146 | 34.41 | 1442 | 9 | 30.8 | |
| -2A | 257 | 1545 | 0397 | 2042 | 5169 | 37.28 | 1480 | 10 | 28.0 | |
| -1B | 257 | 1540 | 0396 | 2002 | 50.56 | 35.30 | 1398 | 10 | 27.6 | |
| -2B | 256 | 1533 | 0392 | 1956 | 49.90 | 35.56 | 1394 | 8 | 27.7 | |
| 227-2 | | | | | | | | | | |
| -1A | 257 | 1265 | 0325 | 1632 | 5175 | 35.38 | 1150 | 10 | 28.4 | |
| -2A | 257 | 1267 | 0326 | 1632 | 5160 | 35.77 | 1166 | 10 | 28.2 | |
| -1B | 258 | 1262 | 0326 | 1634 | 5166 | 35.21 | 1148 | 10 | 33.5 | |
| -2B | 257 | 1261 | 0324 | 1636 | 51.11 | 35.37 | 1146 | 8 | 34.6 | |
| 227-3 | | | | | | | | | | |
| -1A | 258 | 1529 | 0394 | 2032 | 5157 | 35.02 | 1380 | 9 | 28.5 | |
| -2A | 257 | 1531 | 0393 | 1990 | 50.79 | 34.50 | 1354 | 9 | 26.8 | |
| -2B | 256 | 1523 | 0390 | 2034 | 52.15 | 33.95 | 1324 | 12 | 31.7 | * |
| 227-4 | | | | | | | | | | |
| -1A | 257 | 1266 | 0325 | 1692 | 5225 | 37.36 | 1214 | 10 | 34.7 | * |
| -2A | 257 | 1268 | 0326 | 1750 | 53.68 | 37.91 | 1236 | 11 | 38.1 | |
| -1B | 257 | 1265 | 0325 | 1744 | 5366 | 32.89 | 1264 | 10 | 30.1 | |
| -2B | 257 | 1267 | 0326 | 1740 | 53.37 | 38.16 | 1244 | 10 | 34.7 | |

ORIGINAL PAGE IS OF POOR QUALITY

* FAILED NEAR GAGE POINT

CONTINUED ON R.N. #

SIGNATURE

LOCKHEED CALIFORNIA COMPANY
A DIVISION OF LOCKHEED AIRCRAFT CORPORATION
RESEARCH NOTEBOOK

No 568564

TO: BOB DUBA
FROM T. SATO
MODEL
DATE 11 5 75
SUBJECT LOCKALLOY QUAL,
REF.
W.O. EWA

CONTINUED FROM R.N. #
PART NO. AND SER.

| COUP ID. | WIDTH IN | THICK IN | AREA IN² | ULT. LBS | ULT. KSI | YIELD KSI | YIELD LBS | %Elong 1" GL | Fatigue PSI |
|---|---|---|---|---|---|---|---|---|---|
| 161-1 | | 1312 | | | | | | | |
| -1A | 258 | [illegible] | 0328 | 1710 | 52.37 | 39.41 | 1332 | 8 | 25.1 * |
| -2A | 258 | [illegible] | 0327 | 1776 | 52.70 | 39.88 | 1344 | 10 | 34.4 |
| | | 1305 | | | | | | | |
| -1B | 257 | 1314 | 0328 | 1780 | 52.66 | 39.41 | 1332 | 9 | 34.8 |
| -2B | 257 | 1324 | 0340 | 1764 | 51.88 | 39.53 | 1344 | 8 | 25.9 |
| 161-2 | | | | | | | | | |
| -1A | 256 | 1533 | 0392 | 2116 | 53.98 | 38.78 | 1520 | 11 | 25.3 |
| -2A | 257 | 1534 | 0394 | 2094 | 53.15 | 38.02 | 1498 | 10 | 25.8 |
| -1B | 257 | 1533 | 0394 | 2064 | 52.38 | 37.92 | 1494 | 11 | 27.9 |
| -2B | 257 | 1530 | 0393 | 2060 | 52.52 | 38.42 | 1510 | 11 | 28.5 |
| 161-4 | | | | | | | | | |
| -1A | 257 | 1539 | 0396 | 1072 | 27.07 | —— | —— | 0 | 26.4 * |
| -2A | 257 | 1552 | 0399 | 2142 | 53.68 | 39.35 | 1570 | 12 | 27.6 |
| -1B | 257 | 1560 | 0401 | 2124 | 52.97 | 38.90 | 1560 | 8.5 | 29.3 * |
| -2B | 258 | 1561 | 0403 | 2102 | 52.10 | 39.20 | 1580 | 7.5 | 27.8 |
| 161-5 | | | | | | | | | |
| -1A | 257 | 1292 | 0332 | 1742 | 52.41 | 33.86 | 1124 | 11 | 29.4 |
| -2A | 257 | 1276 | 0328 | 1714 | 52.26 | 33.72 | 1106 | 11 | 26.4 |
| -1B | 258 | 1298 | 0335 | 1664 | 49.67 | 32.90 | 1072 | 9 | 29.7 |
| -2B | 257 | 1283 | 0320 | 1686 | 51.09 | 34.79 | 1148 | 10 | 29.4 |
| 243-2 | | | | | | | | | |
| -1A | 257 | 1526 | 0392 | 2056 | 52.45 | 36.68 | 1438 | 9 | 24.3 X |
| -2A | 256 | 1524 | 0390 | 2026 | 51.95 | 36.00 | 1404 | 9 | 25.0 |

X FAILED OUTSIDE OF GAGE POINT
* FAILED ON GAGE POINT
(*) FAILED NEAR GAGE POINT

CONTINUED ON R.N. #

LOCKHEED-CALIFORNIA COMPANY
A DIVISION OF LOCKHEED AIRCRAFT CORPORATION
RESEARCH NOTEBOOK

№ 568565

TO: BOB DUBA
FROM T. SATO AP.
MODEL 75
DATE 11 7
SUBJECT LOCKALLOY QUAL.
REF:
W.O. EWA

CONTINUED FROM R.N. #
PART NO. AND SER.

| COUP ID | WIDTH IN | THICK IN | AREA IN² | ULT. LBS | ULT. KSI | YIELD KSI | YIELD LBS | %e 1"GL | E x 10⁶ PSI |
|---|---|---|---|---|---|---|---|---|---|
| 160-3 | | 1291 | | | | | | | |
| -1A | 258 | [illegible] | .0330 | 1772 | 53.70 | 38.91 | 1284 | 11 | 26.8 |
| -2A | 258 | 1285 | .0331 | 1746 | 52.75 | 38.61 | 1278 | 9.5 | 25.5 |
| -1B | 258 | 1302 | .0336 | 1746 | 51.96 | 37.50 | 1260 | 9 | 24.3 |
| -2B | 257 | 1272 | .0327 | 1684 | 51.50 | 37.51 | 1220 | 8 | 26.9 |
| 160-4 | | | | | | | | | |
| -1A | 257 | 1569 | .0403 | 2134 | 52.95 | 36.97 | 1490 | 12.5 | 27.7 |
| -2A | 257 | 1575 | .0405 | 2104 | 51.95 | 36.30 | 1470 | 11 | 27.4 |
| -1B | 258 | 1568 | .0404 | 2082 | 51.53 | 36.53 | 1476 | 8.5 | 27.8 * |
| -2B | 258 | 1556 | .0401 | 2070 | 51.62 | 36.36 | 1458 | 9.5 | 34.9 |
| 146-2 | | | | | | | | | |
| -1A | 257 | 1279 | .0330 | 1814 | 54.97 | 40.2 | 1324 | 9.5 | 29.6 |
| -2A | 257 | 1282 | .0329 | 1792 | 54.47 | 39.82 | 1310 | 8.5 | 25.9 * |
| 146-3 | | | | | | | | | |
| -1A | 257 | 1269 | .0326 | 1764 | 54.11 | 39.82 | 1298 | 8 | 30.2 |
| -2A | 257 | 1270 | .0326 | 1742 | 53.44 | 40.49 | 1320 | 7 | 28.2 |
| 146-3 | | | | | | | | | |
| -1B | 257 | 1268 | .0327 | 1734 | 53.03 | 39.27 | 1284 | 7.5 | 31.1 ⊙ |
| -2B | 257 | 1265 | .0325 | 1728 | 53.48 | 39.20 | 1274 | 8 | 30.4 |

* FAILED OUTSIDE OF GAGE POINT
⊙ FAILED NEAR GAGE POINT ID. END

CONTINUED ON R.N. #
SIGNATURE

TO BOB DUBA | DATE 11 10 75

FROM T. SATO RDR.

MODEL

RESEARCH NOTEBOOK

No 568566

SUBJECT LOCKALLOY QUAL.

REF

W.O.

EWA

CONTINUED FROM R N #

PART NO. AND SER

| COUP ID. | WIDTH IN. | THICK IN | AREA IN2 | ULT. LBS | ULT. KSI | YIELD KSI | YIELD LBS | %e 1"GL | E x10^6 PSI |
|---|---|---|---|---|---|---|---|---|---|
| 127-3 | | | | | | | | | |
| -1A | 2.57 | 1.500 | .0386 | 1954 | 50.62 | 38.34 | 1480 | 6 | 27.6 |
| -2A | 2.57 | 1.497 | .0385 | 1922 | 49.92 | 38.39 | 1478 | 6 | 29.4 ⊡ |
| -1B | 2.56 | 1.491 | .0382 | 1993 | 52.30 | 40.73 | 1556 | 4 | 28.8 ⊡ |
| -2B | 2.57 | 1.499 | .0385 | 2042 | 53.54 | 39.90 | 1536 | 9 | 28.1 |
| 231-2 | | | | | | | | | |
| -1A | 2.56 | 1.513 | .0387 | 2020 | 52.20 | 37.78 | 1462 | 8 | 24.5 |
| -2A | 2.56 | 1.512 | .0387 | 2036 | 52.61 | 37.83 | 1464 | 9 | 26.5 |
| 1B | 2.57 | 1.503 | .0386 | 2058 | 53.32 | 37.41 | 1444 | 10 | 28.1 |
| 2B | 2.57 | 1.501 | .0386 | 2067 | 53.42 | 37.56 | 1450 | 11 | 27.6 |
| 227-3 | | | | | | | | | |
| -1B | 2.57 | 1.522 | .0391 | 2022 | 51.71 | 34.32 | 1342 | 13 | 24.4 |



⊡ FAILED NEAR GAGE PNT. OPP ID END

CONTINUED ON R N #

SIGNATURE

TO DUBA
FROM GN
MODEL

DATE 11 13 75

RESEARCH NOTEBOOK

№ 568952

TENS. R.T. - 1" GL
BE-38AL ALLOY PLATE

R.E.F.
W.O.
EWA

CONTINUED FROM R.N. #

PART NO. AND SER.

| COUPON IDENT | WIDTH IN | THICK IN. | AREA IN² | ULTIMATE LBS | ULTIMATE KSI | .2% YIELD LBS | .2% YIELD KSI | %E 1" GL | E 10⁶ PSI |
|---|---|---|---|---|---|---|---|---|---|
| STRETCH 5% @ 1050°F - STRESS RELIEVE | | | | | | | | | |
| ST-1ST | .2558 | .2A87 | | | | | | 5.1 | |
| | .2A86 | .2A17 | .0601 | 2550 ▲ | A2.A ▲ | 2150 | 35.8 | 4 (9) * | 19.9 |
| 1AT | .2550 | .2A60 | | | | | | 5.0 | |
| | .2A81 | .2A20 | .0600 | 2865 | A7.8 | 2165 | 36.1 | 7 (12) | 19.7 |
| 1ST | .2553 | .2A61 | | | | | | 4.9 | |
| | .2A85 | .2A23 | .0602 | 2835 | A7.1 | 2160 | 35.9 | 8 (13) | 19.5 |
| STRETCH 5% @ 1050°F. - STRESS RELIEVE | | | | | | | | | |
| ST-4DL | .2A45 | .2553 | | | | | | 5.1 | |
| | .2A03 | .2A2A | .0597 | 3000 | 50.2 | 2225 | 37.3 | 8 * (13) | 23.2 |
| 5DL | .2A45 | .2550 | | | | | | 4.6 | |
| | .2393 | .2A83 | .059A | 3070 | ▲51.7 | 2265 | 38.1 | 10 (15) | 24.8 |
| 5IL | .2A40 | .25A7 | | | | | | 4.8 | |
| | .2A00 | .2A87 | .0597 | 2905 | A8.6 | 2260 | 37.8 | 7 (12) | 18.8 |

ITEM 12

ITEM 8

▲ FLAW (DRUG) @ BREAK

* FOIL

CONTINUED ON R.N. #

SIGNATURE

FORM 888A-1

TO: DUBS
FROM: GN
MODEL:
DATE: 11 14 75

LOCKHEED-CALIFORNIA COMPANY
A DIVISION OF LOCKHEED AIRCRAFT CORPORATION
RESEARCH NOTEBOOK
No 568953
SUBJECT: TQLS. R.T. - 1"GL BE-38 ALL Alloy PLATE
REF.
W.O. EWA

CONTINUED FROM R N #
PART NO. AND SER.

| COUPON IDENT | WIDTH IN. | THICK IN. | AREA IN² | ULTIMATE LBS | ULTIMATE KSI | .2% YIELD LBS | .2% YIELD KSI | %e 1"GL | E |
|---|---|---|---|---|---|---|---|---|---|
| ST-48L | .2423 | .2504 | | | | | | 5.0 | |
| | .2355 | .2499 | | | | | | 5.0 | |
| | .2337 | .2458 | | | | — | — | 4.2* | — |
| 44L | .2453 | .2542 | | | | | | | |
| | .2378 | .2499 | | | | | | | |
| STRETCH | 5% @ 1050°F - STRESS RELIEVE - RETEST CYCLE | | | | | | | | |
| ST-52L | .2454 | .2560 | | | | | | 4.8 | |
| | .2413 | .2497 | | | | | | 5.2 | |
| | .2370 | .2437 | .0578 | 2205 | 38.1 | 2015 | 34.9 | 2 (12) | 33.0 |
| 58L | .2447 | .2550 | | | | | | 4.8 | |
| | .2405 | .2487 | | | | | | 5.5 | |
| | .2359 | .2428 | .0573 | 2240 | 39.1 | 1990 | 34.7 | 2 (12) | 33.2 |
| 54L | .2445 | .2554 | | | | | | 4.9 | |
| | .2403 | .2488 | | | | | | 5.3 | |
| | .2361 | .2432 | .0574 | 2310 | 40.2 | 1980 | 34.5 | 4 (14) | 17.1 |

ITEM 9

CONTINUED ON R N #
SIGNATURE

FORM 0384-1

TO: DUBA
FROM: GIM
MODEL:

DATE: 11 17 75

LOCKHEED-CALIFORNIA COMPANY
A DIVISION OF LOCKHEED AIRCRAFT CORPORATION

RESEARCH NOTEBOOK

№ 568954

SUBJECT: TENS. R.T. - 1"GL

REF:

W.O. 31-2922
EWA

CONTINUED FROM R N. #

PART NO. AND SER.

| Coupon Ident. | Width In. | Thick. In. | Area In² | Ultimate Lbs | Ultimate Ksi | .2% Yield Lbs | .2% Yield Ksi | e 1"GL | E Ksi ×10⁻⁶ Psi |
|---|---|---|---|---|---|---|---|---|---|
| BIAS | | | | | | | | | |
| TEN | | | | | | | | | |
| -1L | .2580 | .1482 | .0382 | 1885 | 49.3 | 1260 | 33.0 | 10 | 27.6 |
| -2L | .2581 | .1497 | .0386 | 1850 | 47.9 | 1260 | 32.6 | 9 | 26.9 |
| -3L | .2578 | .1479 | .0381 | 1885 | 49.5 | 1255 | 32.9 | 14 | 26.2 |
| -1T | .2582 | .1471 | .0380 | 1900 | 50.0 | 1250 | 32.9 | 12 | 29.2 |
| -2T | .2583 | .1471 | .0380 | 1900 | 50.0 | 1250 | 32.9 | 14 | 30.4 |
| -3T | .2580 | .1468 | .0379 | 1885 | 49.7 | 1260 | 33.2 | 13 | 29.3 |

NOTE: USED 600 LB LOAD RANGE TO DETERMINE E& VALUES

CONTINUED ON R N. #

SIGNATURE

FORM 8384-1

LOCKHEED CALIFORNIA COMPANY
LOCKHEED AIRCRAFT CORPORATION

RESEARCH NOTEBOOK

Nº 568955

TO DUBA 11
FROM GN 19
MODEL 75

JOINTS - RM & 600°F
BE-38 AL PLATE

REF
W.O.
EWA

CONTINUED FROM R N #

PART NO. AND SER

| COUPON IDENT. | ULTIMATE LBS | ULTIMATE LBS/IN | .012 YIELD LBS | .012 YIELD LBS/IN | GL IN. | TEST TEMP. | REMARKS TYPE FAIL |
|---|---|---|---|---|---|---|---|
| 6JA.15 -1A (1B) | 6550 | 3275 | 3585 | 1792 | 4.1 | RM | NET SEC. (1A&1B) |
| 1/4 DIP -2A (2B) | 6450 | 3225 | 3160 | 1580 | | | NET SEC. 2A & FACT. TENS. MARRED 1 TO LOAD (NO EFFECT) |
| -3A (3B) | 6475 | 3238 | 3670 | 1835 | | RM | NET SEC (3A&3B) MARRED 1 TO LOAD |
| -4A (4B) | 4600 | 2300 | 3110 | 1555 | | 600°F | BEARING & BR. TEAR OUT |
| -5A (5B) | 4210 | 2105 | 2725 | 1362 | | | BEARING MARRED 1 TO LOAD NO EFFECT |
| -6A (6B) | 4520 | 2260 | 2680 | 1340 | 4.1 | 600°F | BEARING MARRED 1 TO LOAD (NO EFFECT)? |

PRE-LOADED TO 100 LBS & TORQUED TO 65 IN.LB

CONTINUED ON R N #

SIGNATURE

FORM 8884-1

DATE 11 24 75

TO DUBA
FROM GN
MODEL

LOCKHEED-CALIFORNIA COMPANY
A DIVISION OF LOCKHEED AIRCRAFT CORPORATION

RESEARCH NOTEBOOK

SUBJECT TENS. - 1"GL - R.T.

No 568956

REF

W.O.
EWA

CONTINUED FROM R N #

PART NO. AND SER.

| CARBON IDENT. | WIDTH IN. | THICK IN. | AREA IN² | ULTIMATE LBS | ULTIMATE KSI | .2% YIELD LBS | .2% YIELD KSI | %ε 1"GL | Et x10⁶ PSI |
|---|---|---|---|---|---|---|---|---|---|
| 3 NAS 769-1L | .2585 | .1389 | .0359 | 1775 | 49.4 | 1205 | 33.6 | 12 | 27.8 |
| -2L | .2588 | .1390 | .0360 | 1785 | 49.6 | 1195 | 33.2 | 12 | 26.9 |
| -3L | .2588 | .1393 | .0360 | 1745 | 48.5 | 1205 | 33.5 | 9 | 25.6 |
| -1T | .2583 | .1412 | .0365 | 1840 | 50.4 | 1235 | 33.8 | 10 | 29.4 |
| -2T | .2590 | .1415 | .0366 | 1855 | 50.7 | 1235 | 33.7 | 11 | 28.6 |
| -3T | .2590 | .1417 | .0367 | 1855 | 50.5 | 1245 | 33.9 | 11 | 27.2 |

CONTINUED ON R N #

SIGNATURE

FORM 8584-1

LOCKHEED CALIFORNIA COMPANY
A DIVISION OF LOCKHEED AIRCRAFT CORPORATION

RESEARCH NOTEBOOK

№ 568957

TO DUBA
FROM GIN
MODEL

DATE 11 25 75

SUBJECT TENS. 1"GL - R.T.
BE-3SAL (.150 THICK)

REF
W.O.
EWA

CONTINUED FROM R N. #

PART NO. AND SER.

| Coupon Ident | Width in. | Thick in. | Area in² | Ultimate lbs | Ultimate ksi | .2% Yield lbs | .2% Yield ksi | % E 1" GL | E x 10⁻⁶ psi |
|---|---|---|---|---|---|---|---|---|---|
| 3T-1L | .2512 | .1440 | 0362 | 1705 | 47.1 | 1355 | 37.4 | 5 | 24.7 |
| 2L | .2497 | .1450 | 0362 | 1855 | 51.2 | 1345 | 37.2 | 10 | 29.1 |
| 3L | .2504 | .1455 | 0364 | 1860 | 51.1 | 1345 | 37.0 | 10 | 27.9 |
| 3T-1T | .2504 | .1440 | 0360 | 1845 | 51.2 | 1255 | 34.9 | 10 | 28.7 |
| 2T | .2498 | .1439 | 0359 | 1845 | 51.4 | 1255 | 35.0 | 10 | 29.8 |
| 3T | .2482 | .1438 | 0357 | 1835 | 51.4 | 1250 | 35.0 | 11 | 24.7 |
| 3T-7L | .2498 | .1460 | 0365 | 1875 | 51.4 | 1340 | 36.7 | 11 | 27.4 |
| 8L | .2503 | .1460 | 0366 | 1885 | 51.5 | 1340 | 36.6 | 12 | 27.3 |
| 9L | .2492 | .1457 | 0363 | 1870 | 51.5 | 1323 | 36.5 | 12 | 28.3 |
| 3T-7T | .2483 | .1438 | 0358 | 1840 | 51.4 | 1255 | 35.0 | 11 | 25.8 |
| 8T | .2493 | .1438 | 0358 | 1855 | 51.8 | 1245 | 34.8 | 13 | 25.8 |
| 9T | .2469 | .1437 | 0355 | 1835 | 51.7 | 1235 | 34.8 | 13 | 24.8 |

SOAKED 100 HRS @ 600°F

ITEM 1

CONTINUED ON R N. #

SIGNATURE

FORM 64641

DUBA 11
GM 25
75

RESEARCH NOTEBOOK

№ 568958

REF

W O
EWA

TENS. 1"GL - R.T.
BE-38AL (.150 THICK)

| COUPON IDENT | WIDTH IN. | THICK IN. | AREA $IN^2$ | ULTIMATE LBS | ULTIMATE KGS | .2% YIELD LBS | .2% YIELD KGS | %E 1"GL | EXTEN PSI |
|---|---|---|---|---|---|---|---|---|---|
| 3T-13L | .2518 | .1448 | 0365 | 1876 | 51.2 | 1300 | 35.6 | 10 | 26.1 |
| -14L | .2498 | .1445 | 0361 | 1845 | 51.1 | 1290 | 35.7 | 10 | 24.7 |
| -15L | .2526 | .1450 | 0366 | 1850 | 50.5 | 1295 | 35.4 | 9 | 26.6 |
| 16L | .2532 | .1442 | 0365 | 1850 | 50.7 | 1325 | 36.3 | 9 | 24.5 |
| 17L | .2524 | .1445 | 0365 | 1805 | 49.4 | 1330 | 36.4 | 7 | 27.2 |
| 18L | .2500 | .1442 | 0360 | 1855 | 51.5 | 1315 | 36.5 | 10 | 27.8 |
| 19L | .2523 | .1444 | 0364 | 1855 | 51.0 | 1280 | 35.2 | 12 | 24.2 |
| 20L | .2496 | .1440 | 0359 | 1820 | 50.7 | 1245 | 34.7 | 10 | 39.8 |
| 21L | .2531 | .1438 | 0364 | 1846 | 50.5 | 1275 | 35.0 | 10 | 32.3 |
| 3T-13T | .2500 | .1444 | 0361 | 1840 | 51.0 | 1215 | 33.6 | 11 | 37.8 |
| 14T | .2508 | .1442 | 0362 | 1855 | 51.2 | 1230 | 34.0 | 13 | 34.5 |
| 15T | .2531 | .1440 | 0364 | 1860 | 51.1 | 1240 | 34.1 | 11 | 27.0 |

AS RECD SPEC RATE 0.005 IN/IN/MIN

AS RECD STD RATE 0.050 IN/IN/MIN

STRESS RELIEVE 1HR @ 1050°F

STRESS RELIEVE 1HR @ 1050°F

1 WD. TEW 18

1 WD. TEW 15

TEW 16

SIGNATURE

№ 568959

DuBA 12
GIN 1
75

NOTCH TENSION
549 - BE-38AL (.150 THICK)
(RM & 600°F)

| COUPON IDENT. | WIDTH IN. | THICK IN. | AREA $IN^2$ | ULTIMATE LBS | ULTIMATE KSI | TEST TEMP. | |
|---|---|---|---|---|---|---|---|
| 3LT - 1L | .1273 | .1455 | .0185 | 884 | 47.8 | RM | |
| 2L | .1269 | .1450 | .0184 | 880 | 47.8 | RM | |
| 3L | .1265 | .1450 | .0183 | 891 | 48.7 | RM | |
| 1T | .1240 | .1457 | .0181 | 527 | 29.1 | 600°F | |
| 2T | .1239 | .1454 | .0180 | 530 | 29.4 | 600°F | |
| 3T | .1262 | .1457 | .0184 | 533 | 29.0 | 600°F | |

AS REQ'D

1 ITEM 12

DATE 12-1-75

TO DUBA
FROM GN
MODEL

LOCKHEED-CALIFORNIA COMPANY
A DIVISION OF LOCKHEED AIRCRAFT CORPORATION
RESEARCH NOTEBOOK

No 568960

SUBJECT TENS – 1"GL – 600°F BE-38 AL (.150 THICK.)

REF
W.O.
EWA

CONTINUED FROM R N. #

PART NO. AND SER.

| COUPON IDENT. | WIDTH IN. | THICK IN. | AREA IN² | ULTIMATE LBS | ULTIMATE KSI | .2% YIELD LBS | .2% YIELD KSI | %E 1"GL | E x 10⁶ PSI |
|---|---|---|---|---|---|---|---|---|---|
| 3T-AL | .2529 | .1458 | 0369 | 890 | 24.1 | 838 | 22.7 | 10 | 16.3 |
| 5L | .2490 | .1462 | 0364 | 907 | 24.9 | 857 | 23.5 | 9 | 16.5 |
| 6L | .2537 | .1463 | 0371 | 911* | 24.6 | 859 | 23.2 | 9* | 20.2 |
| | | | | AVG | 24.5 | | 23.1 | 9 | 17.6 |
| AT | .2497 | .1440 | 0360 | 840 | 23.3 | 772 | 21.4 | 11 | 15.2 |
| 5T | .2495 | .1439 | 0359 | 836* | 23.3 | 769 | 21.2 | 10* | 17.8 |
| 6T | .2474 | .1437 | 0356 | 828 | 23.2 | 755 | 21.2 | 9 | 18.7 |
| | | | | AVG | 23.3 | | 21.3 | 10 | 17.2 |
| 3T-6L | .2512 | .1456 | 0366 | 885 | 24.2 | 817 | 22.3 | 11 | 20.5 |
| 11L | .2510 | .1450 | 0364 | 870 | 23.9 | 794 | 21.8 | 11 | 18.3 |
| 12L | .2498 | .1450 | 0362 | 864 | 24.4 | 811 | 22.4 | 11 | 17.0 |
| | | | | AVG | 24.2 | | 22.2 | 11 | 18.6 |
| 6T | .2475 | .1437 | 0356 | 832 | 23.4 | 753 | 21.2 | 10 | 19.2 |
| 11T | .2483 | .1442 | 0358 | 834 | 23.3 | 755 | 21.2 | 10 | 21.5 |
| 12T | .2483 | .1441 | 0358 | 835 | 23.3 | 761 | 21.2 | 10 | 19.0 |
| | | | | AVG | 23.3 | | 21.2 | 10 | 19.9 |

As Recd

Soak 100 Hrs @ 600°F

New 1

* FAILURE @ GAGE POINT

CONTINUED ON R N #

SIGNATURE

FORM 6384-1

TO DUBA
FROM GLN
MODEL

DATE 12 3 75

LOCKHEED CALIFORNIA COMPANY
A DIVISION OF LOCKHEED AIRCRAFT CORPORATION
RESEARCH NOTEBOOK

No 568961

SUBJECT TENS. - 1"GL - 1050°F
BG-38 AL (.150 THICK)

REF
W.O.
EWA

CONTINUED FROM R N. #

PART NO. AND SER.

| Coupon Identification | Width In. | Thick In. | Area In² | Ultimate Lbs | Ultimate Ksi | .2% Yield Lbs | .2% Yield Ksi | %e 1"GL | Et x 10⁶ psi |
|---|---|---|---|---|---|---|---|---|---|
| 3T-22L | .2505 | .1433 | .0862 | 196.25* | 5.45* | 123.0 | 3.42* | 14▲ | 4.63 |
| -23L | .2520 | .1437 | .0862 | 201.75* | 5.57* | 121.5 | 3.36 | 17▲ | 5.28 |
| -24L | .2522 | .1437 | .0862 | 200.5* | 5.54* | 127.0 | 3.51 | 13 | 5.71 |
| | | | | AVG | 5.52 | | 3.43 | 15 | 5.21 |
| -25L | .2515 | .1436 | .0861 | 188.75* | 5.23* | 60.25 | 1.67 | 13▲ | 3.54 |
| -26L | .2522 | .1437 | .0862 | 192.5* | 5.32* | 59.0 | 1.63 | 11▲ | 3.19 |
| -27L | .2513 | .1437 | .0861 | 192.5* | 5.33* | 47.5 | 1.32 | 15▲ | 3.96 |
| | | | | AVG | 5.29 | | 1.54 | 13 | 3.56 |
| -28L | .2507 | .1436 | .0860 | 197.0 | 5.47 | 147 | 4.64 | 13▲ | 7.25 |
| -29L | .2510 | .1439 | .0861 | 229 | 6.34 | 202 | 5.60 | 13▲ | 7.10 |
| -30L | .2533 | .1441 | .0865 | 262 | 7.18 | 231 | 6.33 | 11▲ | 8.88 |
| | | | | AVG. | 6.33 | | 5.52 | 12 | 7.74 |

.005 in/in/min

.005 in/in/min

.050 in/in/min

Coupons 25L & 26L Loaded Too Fast
" 22L & 29L " " Slow

Strain Rates Are Avg (0-.002) in/in

▲ Failure occurred @ Gage Point (Upper)
* = .050 in/in/min No Yld. To Fail

CONTINUED ON R N. #

SIGNATURE

FEH 16

FORM 0384-1

TO: DLUBA
FROM: GN
MODEL:
DATE: 12 5 75

LOCKHEED CALIFORNIA COMPANY
A DIVISION OF LOCKHEED AIRCRAFT CORPORATION
RESEARCH NOTEBOOK
No. 568962

SUBJECT: STRETCH 5% @ 105°F
STRESS RELIEVE (1) HR @ 1050°F
TENS. TEST - 1" GL - R.T.
BG-38 BAR (1/8" THICK)

REF
W.O.
EWA

CONTINUED FROM II N. #
PART NO. AND SER.

| COUPON IDENT | WIDTH IN. | THICK IN. | AREA IN² | ULTIMATE LBS | ULTIMATE KSI | .2% YIELD LBS | .2% YIELD KSI | %e 1" GL | Es x10⁻⁶ PSI |
|---|---|---|---|---|---|---|---|---|---|
| ⊛ 3T-31L | .2520 | .1443 | 0364 | | | | | 5.8* | |
| | .2474 | .1404 | 0347 | 1490 | 42.9 | 1210 | 34.9 | 5 | 16.8 |
| ▲ -32L | .2500 | .1443 | 0361 | | | | | 6.3* | |
| | .2448 | .1403 | 0343 | 1465 | 42.7 | 1155 | 33.7 | 5 | 28.7 |
| ● -33L | .2514 | .1448 | 0364 | | | | | 5.0* | |
| | .2474 | .1413 | 0350 | 1560 | 44.6 | 1215 | 34.7 | 6 | 29.6 |
| | | | | | | | | | |
| | | | | | | | | | |
| ● 3T-16T | .2508 | .1451 | 0364 | | | | | 5.2* | |
| | .2466 | .1418 | 0350 | 1485 | 42.4 | 1165 | 33.3 | 5 | 26.4 |
| ● -17T | .2510 | .1448 | 0363 | | | | | 5.0* | |
| | .2470 | .1417 | 0350 | 1535 Δ | 43.8 | 1120 | 32.0 | 6 Δ | 41.8 |
| ● -18T | .2502 | .1450 | 0363 | | | | | 5.1* | |
| | .2460 | .1417 | 0348 | 1495 | 43.0 | 1170 | 33.6 | 5 | 25.4 |

MEM 17

MEM 19

Δ FAILED OUTSIDE OF GAGE LENGTH - DID NOT FAIL THRU SCRIBED LINES

* ELONGATION AFTER STRETCH

⊛ TIGHT FITTING PINS - HOLE DEFL .108 - TOO DIFFICULT TO REMOVE

▲ LOOSE FTG PINS - HOLE DEFL .109 - TOOL OVERSHOT TO ~~.200~~ .205

● " " " - " " .105 -

CONTINUED ON # N. #

SIGNATURE

FORM 888A-1

$$n = 1 + \frac{.3853}{\log_{10}(P_{.70}/P_{.85})}$$

| Coupon Ident. | Width In. | Thick In. | Area In² | .2% Yield Lbs | .2% Yield Ksi | F.T. Sec. Mod. Lbs | F.T. Sec. Mod. Ksi | F.B.S. Sec. Mod. Lbs | F.B.S. Sec. Mod. Ksi | Ec x10-6 Psi | n |
|---|---|---|---|---|---|---|---|---|---|---|---|
| As Received (No Soak) | | | | | | | | | | | |
| 3C-1L | .621 | .1440 | .0894 | 2900 | 32.4 | 1855 | 20.7 | 1240 | 13.9 | 27.1 | 3.2 |
| -2L | .622 | .1440 | .0896 | 2890 | 32.2 | 1900 | 21.2 | 1375 | 15.3 | 26.3 | 3.7 |
| -3L | .623 | .1439 | .0896 | 2895 | 32.3 | 1760 | 19.6 | 1280 | 14.3 | 28.8 | 3.8 |
| | | | | Avg | 32.3 | | 20.5 | | 14.5 | 27.4 | 3.6 |
| 3C-1T | .623 | .1448 | .0902 | 2905 | 32.2 | 1825 | 20.2 | 1250 | 13.8 | 30.6 | 3.3 |
| -2T | .623 | .1447 | .0901 | 2905 | 32.2 | 1860 | 20.6 | 1300 | 14.4 | 26.1 | 3.5 |
| -3T | .623 | .1445 | .0900 | 2840 | 31.6 | 1520 | 16.9 | 1030 | 11.4 | 34.2 | 3.3 |
| | | | | Avg | 32.0 | | 19.2 | | 13.2 | 30.3 | 3.4 |
| Soaked 100 Hrs @ 600°F | | | | | | | | | | | |
| 3C-7L | .624 | .1442 | .0900 | 2890 | 32.1 | 1760 | 19.6 | 1035 | 11.5 | 26.1 | 2.7 |
| -8L | .624 | .1443 | .0900 | 2870 | 31.9 | 1700 | 18.9 | 1070 | 11.9 | 26.9 | 2.9 |
| -9L | .623 | .1445 | .0900 | 2940 | 32.7 | 1570 | 17.4 | 1020 | 11.3 | 30.6 | 3.0 |
| | | | | Avg | 32.2 | | 18.6 | | 11.6 | 27.9 | 2.9 |
| 3C-7T | .623 | .1442 | .0898 | 2880 | 32.1 | 1840 | 20.5 | 1270 | 14.1 | 25.4 | 3.4 |
| -8T | .624 | .1439 | .0898 | 2870 | 32.0 | 1560 | 17.4 | 880 | 9.8 | 27.8 | 2.5 |
| -9T | .623 | .1442 | .0898 | 2930 | 32.6 | 1750 | 19.5 | 1075 | 12.0 | 27.3 | 2.8 |
| | | | | Avg | 32.2 | | 19.1 | | 12.0 | 27.0 | 2.9 |

Item 2

TO DUBA
FROM GIN
DATE 12 10 75
SUBJECT Compr. 2" GL - B.T. BC-38AL (.150 THICK)
RESEARCH NOTEBOOK No 568963
W.O. EWA REF

Page C-51

$$n = 1 + \frac{.3853}{\text{Log}_{10}(P_{.7}/P_{.85})}$$

| Coupon Ident | Width In. | Thick In. | Area In² | .2% Yield LBS | .2% Yield KSI | F.7 Sec. Mod. LBS | F.7 Sec. Mod. KSI | F.85 Sec. Mod. LBS | F.85 Sec. Mod. KSI | Ex to K PSI | n |
|---|---|---|---|---|---|---|---|---|---|---|---|
| AS RECEIVED (No SOAK) | | | | | | | | | | | |
| 3C-4L | .623 | .1438 | 0896 | 2045 | 22.8 | 1720 | 19.2 | 1395 | 15.6 | 19.1 | 5.2 |
| -5L | .623 | .1440 | 0897 | 2115 | 23.6 | 1840 | 20.5 | 1515 | 17.2 | 18.6 | 6.1 |
| -6L | .623 | .1440 | 0897 | 2050 | 22.8 | 1780 | 19.8 | 1520 | 16.9 | 19.7 | 6.6 |
| | | | | AVG | 23.1 | | 19.8 | | 16.6 | 19.1 | 6.0 |
| 3C-4T | .624 | .1442 | 0900 | 2100 | 23.3 | 1790 | 19.9 | 1485 | 16.5 | 19.7 | 5.7 |
| -5T | .623 | .1444 | 0900 | 2035 | 22.6 | 1630 | 18.1 | 1275 | 14.2 | 20.8 | 4.6 |
| -6T | .623 | .1442 | 0898 | 2010 | 22.4 | 1640 | 18.3 | 1315 | 14.6 | 19.0 | 5.0 |
| | | | | AVG | 22.8 | | 18.8 | | 15.1 | 19.8 | 5.1 |
| SOAKED 100 HRS @ 600°F | | | | | | | | | | | |
| 3C-10L | .623 | .1447 | 0901 | 2055 | 22.8 | 1720 | 19.1 | 1435 | 15.9 | 19.6 | 5.9 |
| -11L | .623 | .1447 | 0901 | 2045 | 22.7 | 1755 | 19.5 | 1475 | 16.4 | 18.5 | 6.1 |
| -12L | .624 | .1447 | 0903 | 2060 | 22.8 | 1740 | 19.3 | 1455 | 16.1 | 18.6 | 6.0 |
| | | | | AVG | 22.8 | | 19.3 | | 16.1 | 18.9 | 6.0 |
| 3C-10T | .623 | .1440 | 0897 | 2010 | 22.4 | 1740 | 19.4 | 1520 | 16.9 | 17.7 | 7.6 |
| -11T | .622 | .1442 | 0897 | 2015 | 22.5 | 1685 | 18.8 | 1395 | 15.6 | 18.9 | 5.7 |
| -12T | .624 | .1437 | 0897 | 2010 | 22.4 | 1685 | 18.8 | 1370 | 15.3 | 17.8 | 5.3 |
| | | | | AVG | 22.4 | | 19.0 | | 15.9 | 18.1 | 6.2 |

CONTINUED ON P.N. #

CONTINUED FROM P.N. #

TO: DUBA
FROM: GTE
MODEL

DATE: 12-11-75

BE-3866 COUPON - 2nd GEN - 600°F (HEAT TREAT)

PART NO. AND SER.

SIGNATURE

W.O. EWA

REF

NO. 568964

RESEARCH NOTEBOOK

LOCKHEED CALIFORNIA COMPANY

FORM 6881

TO DUBA
FROM GN
MODEL

DATE 12 18 75

LOCKHEED CALIFORNIA COMPANY
A DIVISION OF LOCKHEED AIRCRAFT CORPORATION

RESEARCH NOTEBOOK

№ 568966

SUBJECT SHEET SHEAR * RM & 600°F BC-38AL (FROM .15 PLATE)

REF.

W.O. EWA

CONTINUED FROM R N. #

PART NO. AND SER.

| COUPON IDENT. | | THICK IN. | DIA. IN. | AREA IN² | ULTIMATE LBS | ULTIMATE KSI | TEST TEMP. | MTL COND. |
|---|---|---|---|---|---|---|---|---|
| 3815 | -1L | .031 | .500 | 0487 | 1435 | 29.5 | RM | As Rec'd |
| | 2L | .031 | | 0530 | 1635 | 30.6 | | |
| | 3L | .040 | | 0628 | 2030 | 32.3 | RM | |
| | | | | | AVG | 30.8 | | |
| | -1T | .037 | | 0581 | 945 | 16.3 | 600°F | |
| | -2T | .039 | | 0612 | 1075 | 17.6 | | |
| | 3T | .040 | | 0628 | 1035 | 16.5 | 600°F | As Rec'd |
| | | | | | AVG | 16.8 | | |
| 382 | -9L | .039 | | 0612 | 2070 | 33.8 | RM | 113 HRS @ 600°F |
| 3815 | -8L | 039 | | 0612 | 2085 | 34.1 | | |
| | -9L | 042 | | 0659 | 2220 | 33.7 | RM | |
| | | | | | AVG | 33.9 | | |
| | -7T | 040 | | 0628 | 1030 | 16.4 | 600°F | |
| | -8T | 039 | | 0612 | 1030 | 16.8 | | |
| | -9T | 038 | | 0518 | 875 | 16.9 | 600°F | 113 Hrs @ 600°F |
| | | | | | AVG | 16.7 | | |

▲ AVG OF (A) READINGS

* THESE WERE BEARING COUPONS

CONTINUED ON R N #

SIGNATURE

FORM 9884 1

LOCKHEED CALIFORNIA COMPANY
A DIVISION OF LOCKHEED AIRCRAFT CORPORATION
RESEARCH NOTEBOOK — № 568968

TO: DUBA
FROM GN
MODEL
DATE 1 5 76
SUBJECT SHEET SHEAR - R.T. BE-38 Al LOCKALLOY
REF:
W.O. EWA

CONTINUED FROM R.N. #
PART NO. AND SER.

| COUPON IDENT. | THICK. IN. | DIA IN. | AREA IN² | ULTIMATE LBS | ULTIMATE KSI | MTL. COND. |
|---|---|---|---|---|---|---|
| 31A5769-1-1 | .1880 | .500 | .2325 | 8700 | 37.4 | |
| -2 | .1875 | | .2317 | 8650 | 37.3 | |
| -3 | .1877 | | .2320 | 8550 | 36.8 | |
| | | | | AVG | 37.2 | |
| 31A5769-1-1 | .1806 | | .2208 | 8375 | 37.9 | |
| -2 | .1814 | | .2221 | 8375 | 37.7 | |
| -3 | .1813 | | .2220 | 8325 | 37.5 | |
| | | | | AVG | 37.7 | |

CONTINUED ON R.N. #
SIGNATURE

FORM 9304-1

# APPENDIX D

## COMPONENT TESTS FOR LOCKALLOY VENTRAL

## INTRODUCTION

In order to verify the design of the Lockalloy ventral fin (3NA3687) for the YF-12 airplane, several structural component tests were performed. Since the Lockalloy material was not available at the time of these tests, 321 annealed stainless steel, which has similar mechanical properties, was used instead.

The first test was of the Lockalloy skin panel splice joint. This joint was eccentric and proved out to be deficient. Accordingly, a second specimen with greatly reduced eccentricity was tested. This design proved satisfactory.

The last test was a stability check of the compression surfaces of the ventral fin. A specimen box was built which had surface support structure representative of that in the ventral. The box was loaded in bending to failure and compression surface stresses were measured by means of strain gages. This test showed the surface stability stress achieved to be satisfactory.

## JOINT TESTS

The test of specimen number one, which is shown on Fig.'s D-1 and D-2, demonstrated this unsymmetrical design to be deficient. The hoint carried compression load up to 15,865 lbs. (1,476 lb./in.) but there was considerable yielding due to bending in the titanium splice strap before this load was reached. See Fig. D-3 and D-4. Accordingly, an external titanium strap was added to eliminate most of the joint eccentricity. This joint is also shown on Fig. D-3 and Fig.'s D-5 and D-6. This specimen failed at a load of 23,000 lbs. (2,140 lb./in.) and did not exhibit excessive deformation during loading. See Fig.'s D-7 and D-8.

Plots of load and stresses in the basic .156 sheet are shown on Fig. D-9. Stresses were measured from strain gages mounted back-to-back 1-1/2 inches from each edge in the center of the upper panel. The non-linearity exhibited by the strain gage measurements makes the stresses calculated from the load measurements more believable.

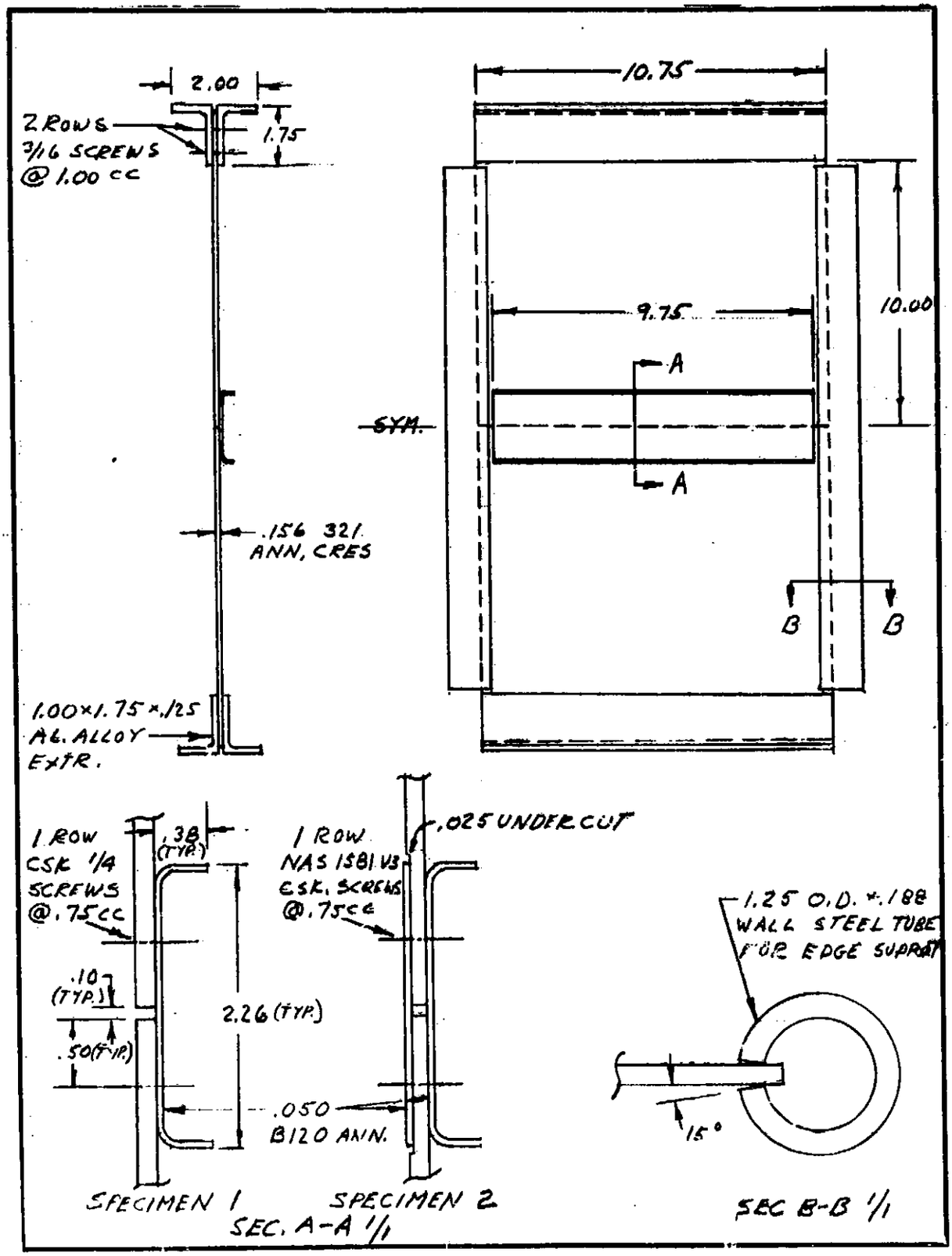
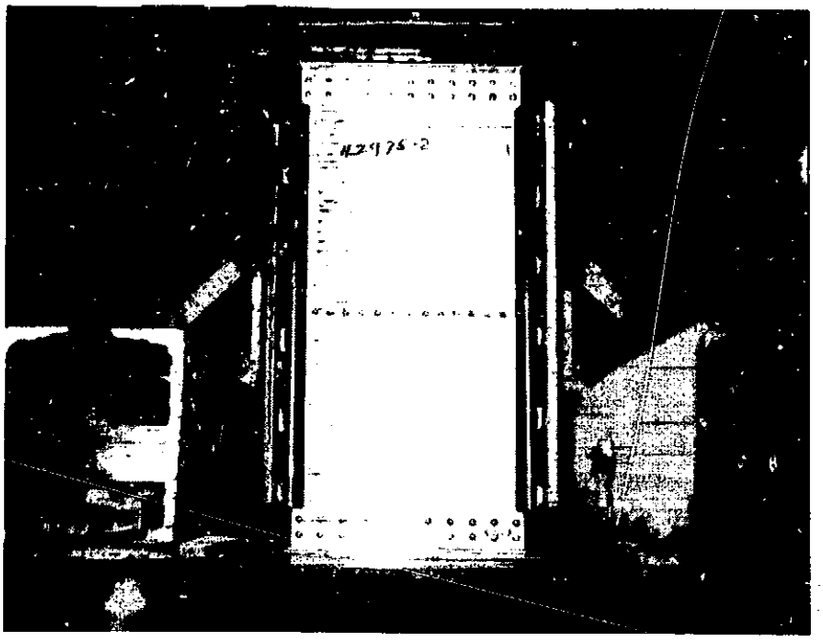
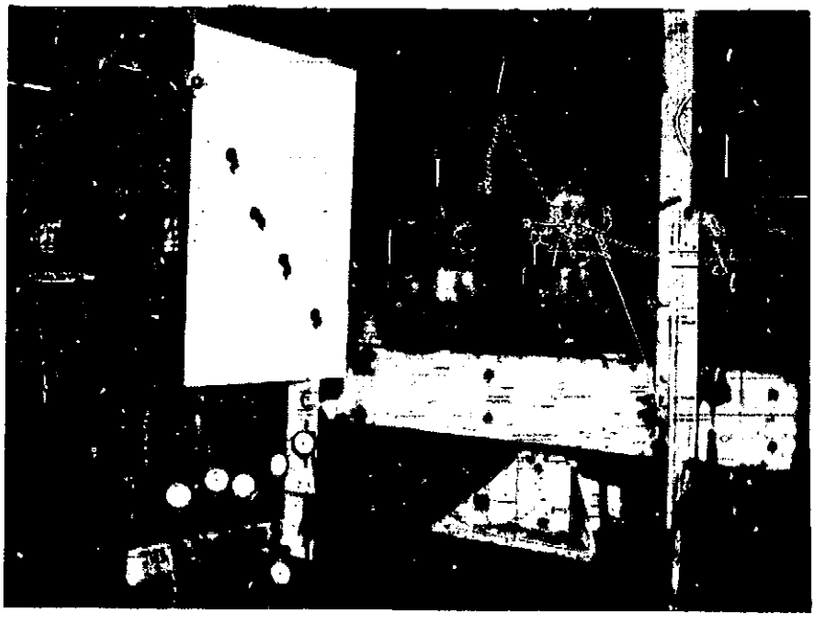



FIG. D-1 COMPRESSION TEST SPECIMENS

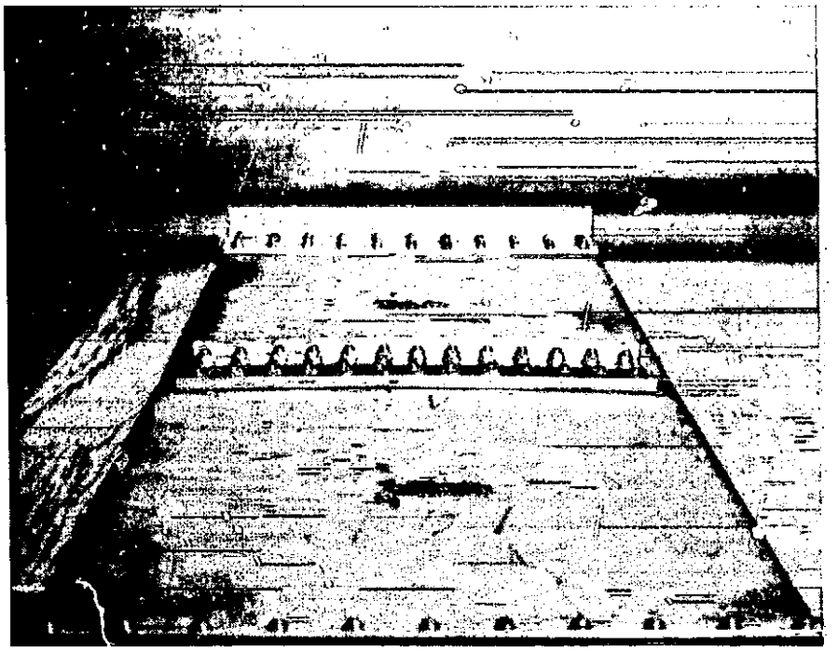


75-5166-4



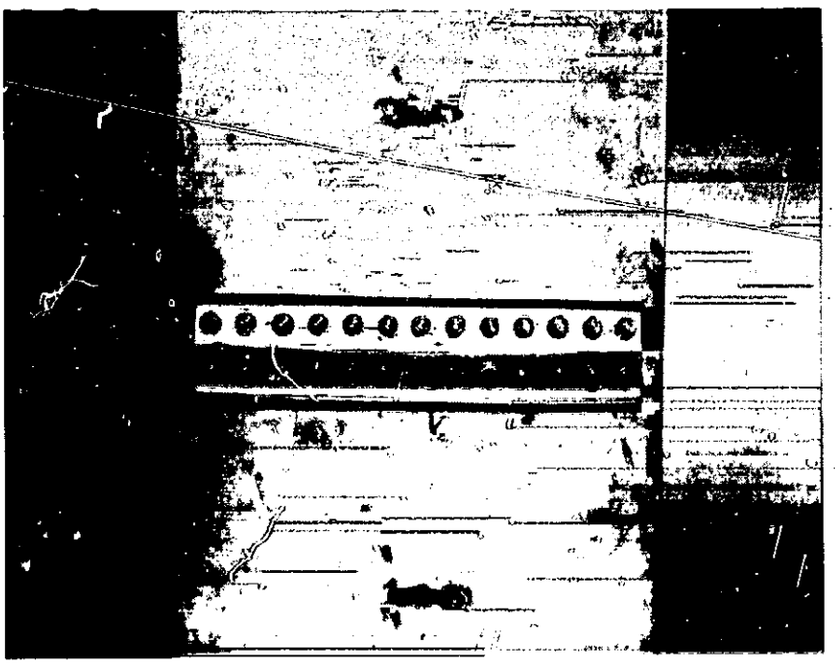
75-5166-2

FIG. D-2 PANEL TEST SETUP FOR
JOINT TEST - SPECIMEN NUMBER ONE



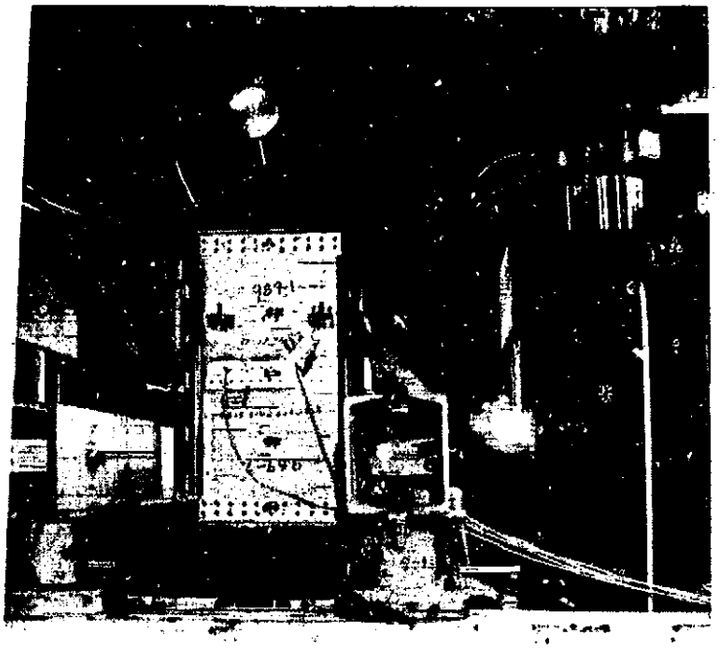
75-5169-4

FIG. D-3 BOWING FAILURE OF SPECIMEN NUMBER ONE



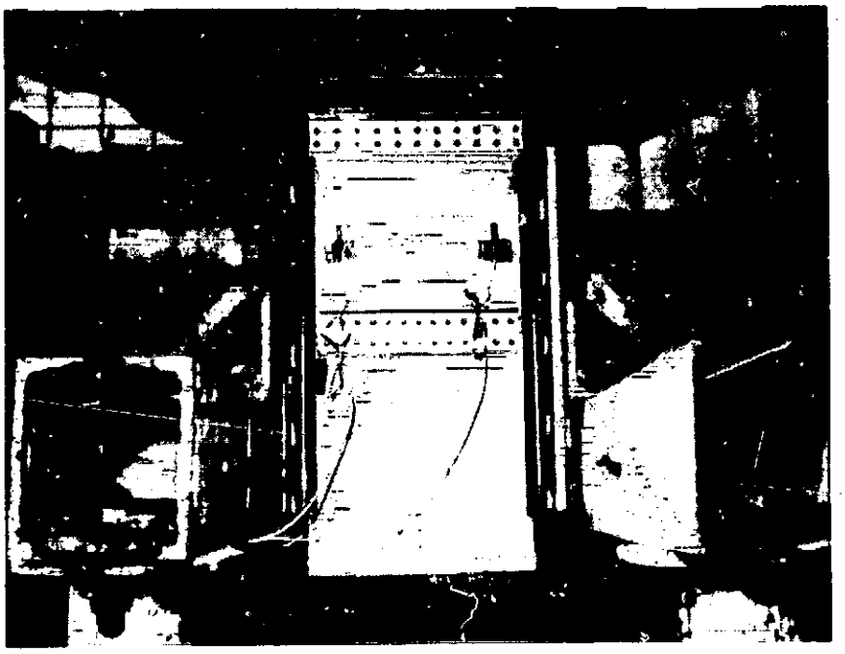
75-5169-1

FIG. D-4 BUCKLING FAILURE OF THE SPECIMEN NUMBER ONE



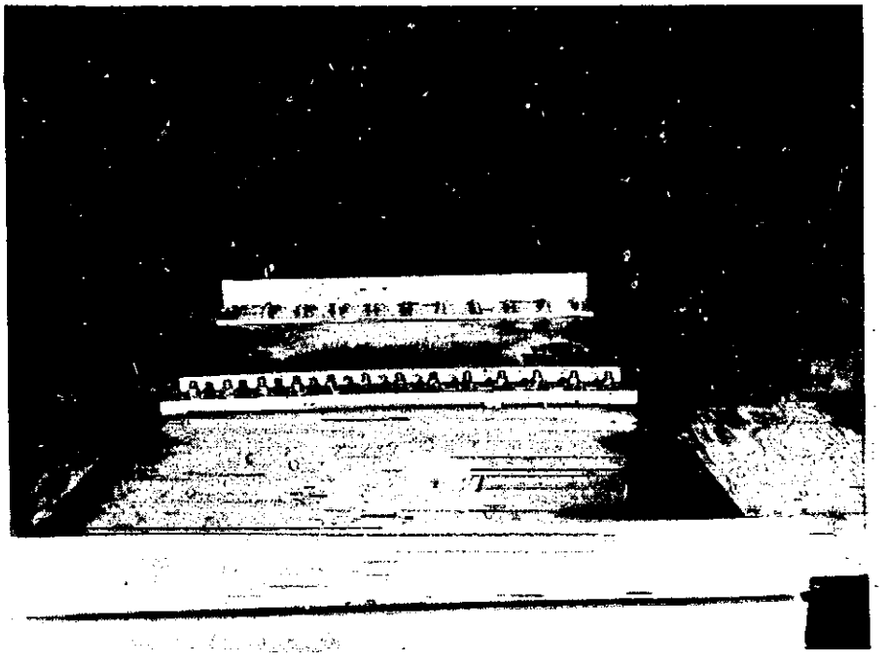
75-5188-2

FIG. D-5 TEST SETUP FOR SPECIMEN NUMBER TWO



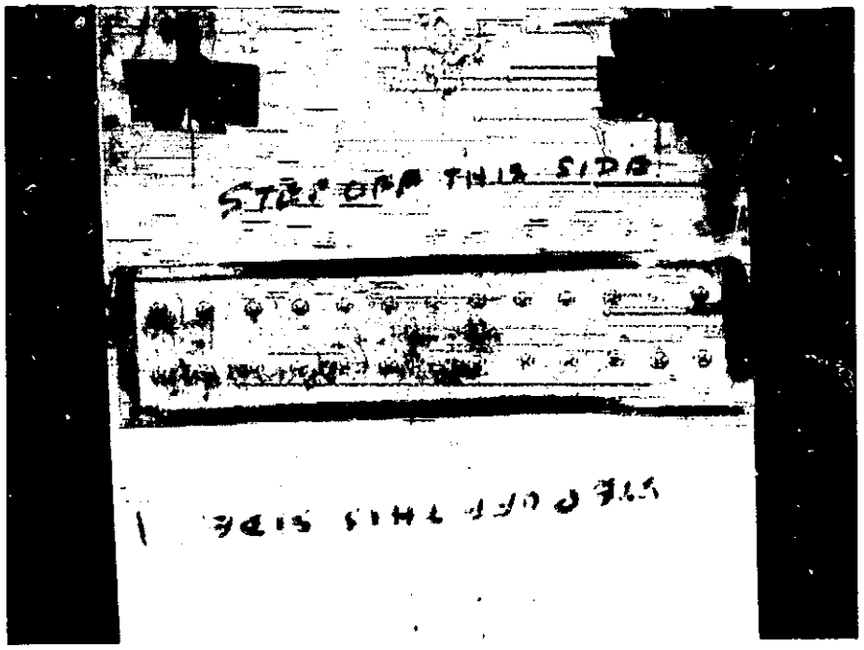
75-5188-5

FIG. D-6 SPECIMEN NUMBER TWO SETUP-NOTE STRAIN GAGES



75-5197-2

FIG. D-7 BOWING FAILURE OF SPECIMEN NUMBER TWO



75-5197-4

FIG. D-8 SCREW FAILURE OF SPECIMEN NUMBER TWO

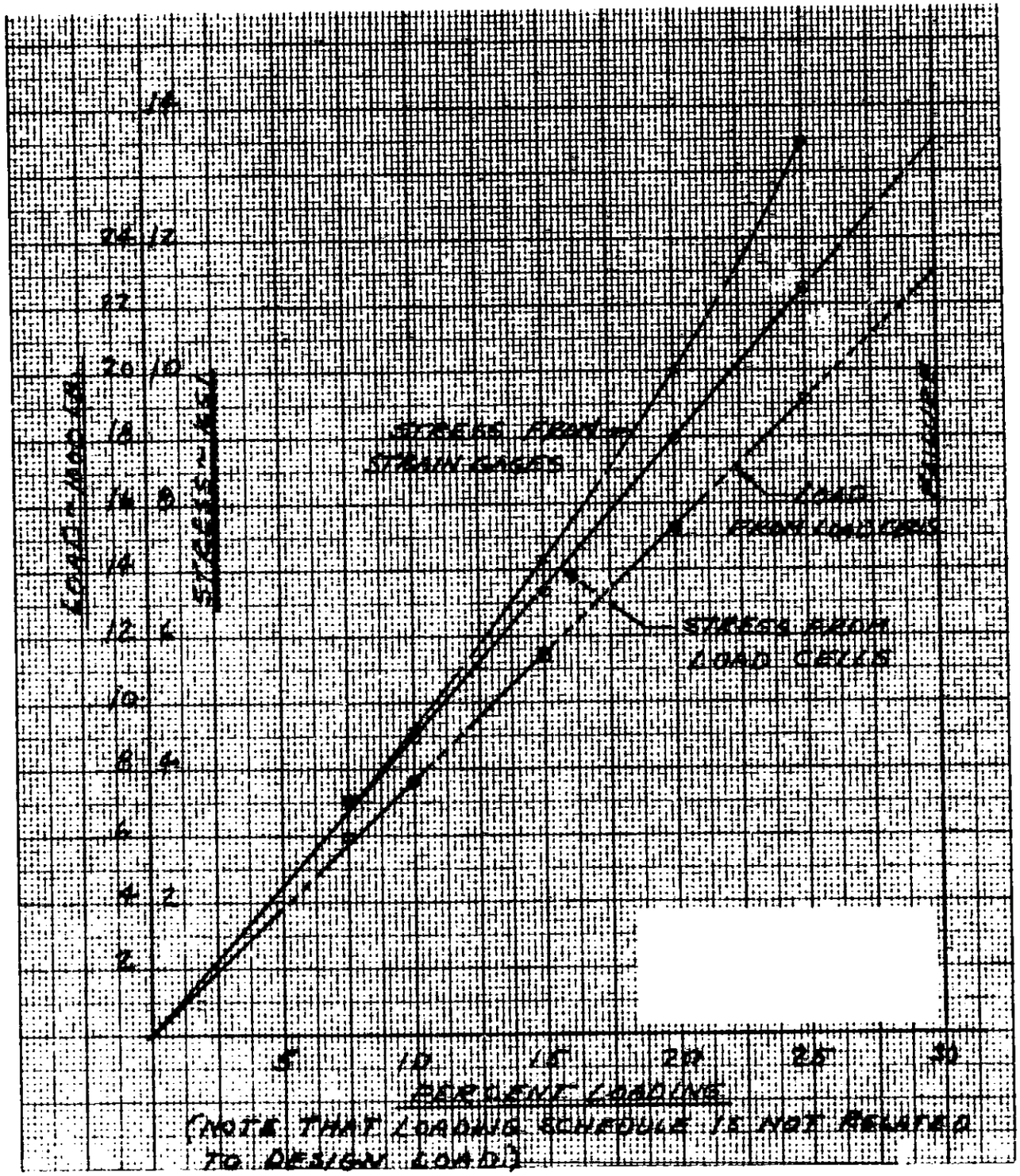



FIG. D-9 LOAD AND STRESS CURVES FROM TEST OF SPECIMEN NUMBER 2.

## COMPRESSION STABILITY TEST

### Discussion

This test was devised to verify the stability of the compression surface of the Lockalloy ventral fin. The specimen consisted of a box with thick steel skins supported by comparatively light titanium substructure. 321 annealed stainless steel was used for the skins because of the unavailability of the Lockalloy at the time of the test. This stainless steel has a modulus of elasticity and a compressive yield strength very close to those of Lockalloy and since the test was performed to check compression panel stability, the material substitution was valid. Table D-1 shows a comparison of mechanical properties.

The upper surface of the box was designed to represent the surface of the Lockalloy ventral fin with the rib and beam spacings giving a comparable b/t ratio. Attachments were the same as for the ventral - NAS1581V3-3/16 small headed countersunk screws with comparable spacing.

A drawing of the test specimen can be seen on Fig. D-10 and photos of the structure on Fig. D-11.

### Test Setup

The specimen was instrumented with 15 sets (back-to-back) of axial strain gages, 2 sets of shear gages, and 9 dial gages for deflection measurements. Strain gage instrumentation and designations are shown on Fig. D-12 and Fig. D-13. Strain gage readings were printed out by a Beckman recorder and deflection readings were recorded manually.

The specimen holding fixture and loading jack arrangement are seen on Fig. D-14. Nominal loads for the approximate strength level desired are shown on Fig. D-10, but these were arbitrarily doubled for the test to take care of any overrun. Thus, the

load schedule against which the stresses and deflection are plotted, is not related to design load.

These loads were applied by metered hydraulic pressure to the loading jacks with an Edison hydraulic load maintainer. Actual jack loads were measured with a load cell on the inboard jack and a pressure gage on the outboard jack. The measured loads differed slightly from the nominal, as applied loads of the load maintainer and are considered more accurate. These loads are plotted on Fig. D-15.

Test Results

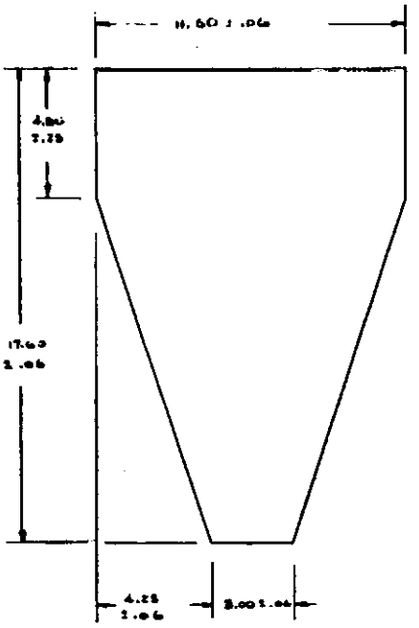
Loads were applied to the specimen in 5% increments until the 15% level was reached. After these readings were taken the load was reduced to zero and readings again taken. Then the load was returned to 15%, readings taken, and then advanced to 20%. In this way the load was progressively increased with zero readings being taken after each new high load. The loads were allowed to stabilize for one minute before readings were taken. After the 65% load level was reached, and 12 seconds had elapsed, the upper surface of the specimen failed in compression. No readings at 65% were obtained so data must be extrapolated to this point.

Stresses calculated from the average strain measurements of the six gages in the center of the center panel of the specimen are plotted on Fig. D-16. The plot is extrapolated to the 65% load level and this shows a stress level of 21,800 psi at specimen failure. There is a slight non-linearity near the failure stress indicating some yielding of the panel. Stresses are calculated using a modulus of elasticity of $28 \times 10^6$ psi. Panel buckling behavior is illustrated by Fig. D-17 which shows individual plots of the two center back-to-back stresses. These curves show panel initial buckling to occur at about a 12,000 psi stress level. Buckling behavior can also be observed on Fig. D-18 which shows individual stress plots for the back-to-back strain gages at the inboard center of the center panel of the specimen.

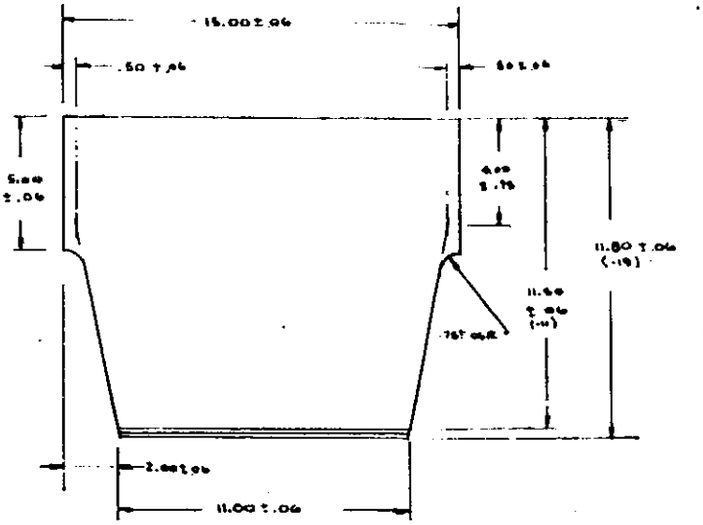
Test Results (Continued)

Deflection and permanent set measurements at the outboard end of the specimen are plotted on Fig. D-19. The plotted points are the average readings of the three outboard dial gages.

Fig. D-20 shows the specimen after failure. Note that the failure occurred adjacent to the inboard load plate. At this point the bending moment is 12% higher than at the center of the specimen.

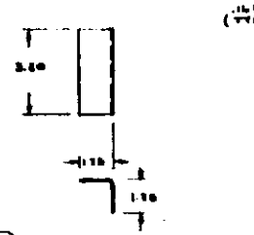



(15) LOWER PLATE 1 REQ.
.156 321 STAINLESS STEEL
AS RECEIVED
SEE ENG. FOR MAT'L
AS SHEARED EDGES OK

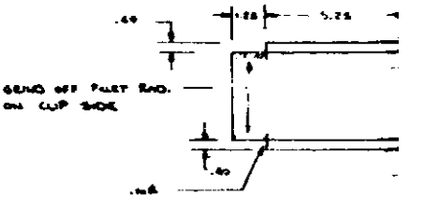



(11) PLATE 1 REQ
.156 321 STAINLESS
STEEL AS RECEIVED
SEE ENG. FOR MAT'L
AS SHEARED EDGES OK

(19) PLATE 1 REQ
SAME AS -11 EXCEPT LENGTH
& FLANGE, 2.E.38 .00 HIGH
FLANGE

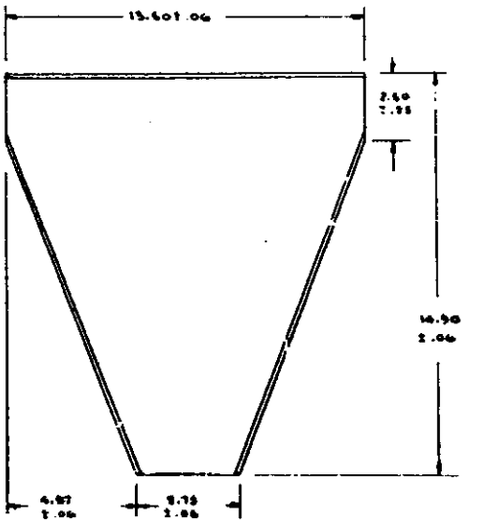



(6) CUP 25 REQ.
.050 DIA AN
B.E. .16

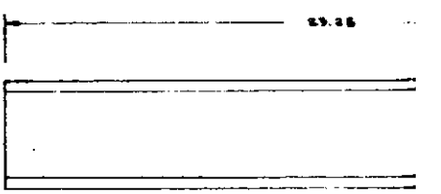



GRIND OFF FILET RAD.
ON CUP SIDE

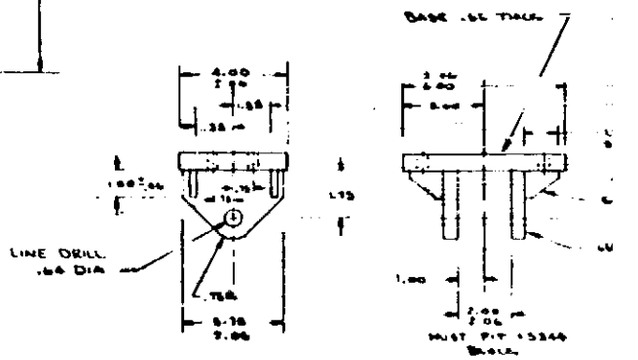
(7) I BEAM 2 REQ
4 x 5.8 STRUCT STEEL
M SHAPE
OR 4 x 13.0 M SHAPE




(12) UPPER PLATE REQ
.156 321 STAINLESS
STEEL AS RECEIVED
SEE ENG. FOR MAT'L
AS SHEARED EDGES OK
B.E. .38
1.00 FLANGES

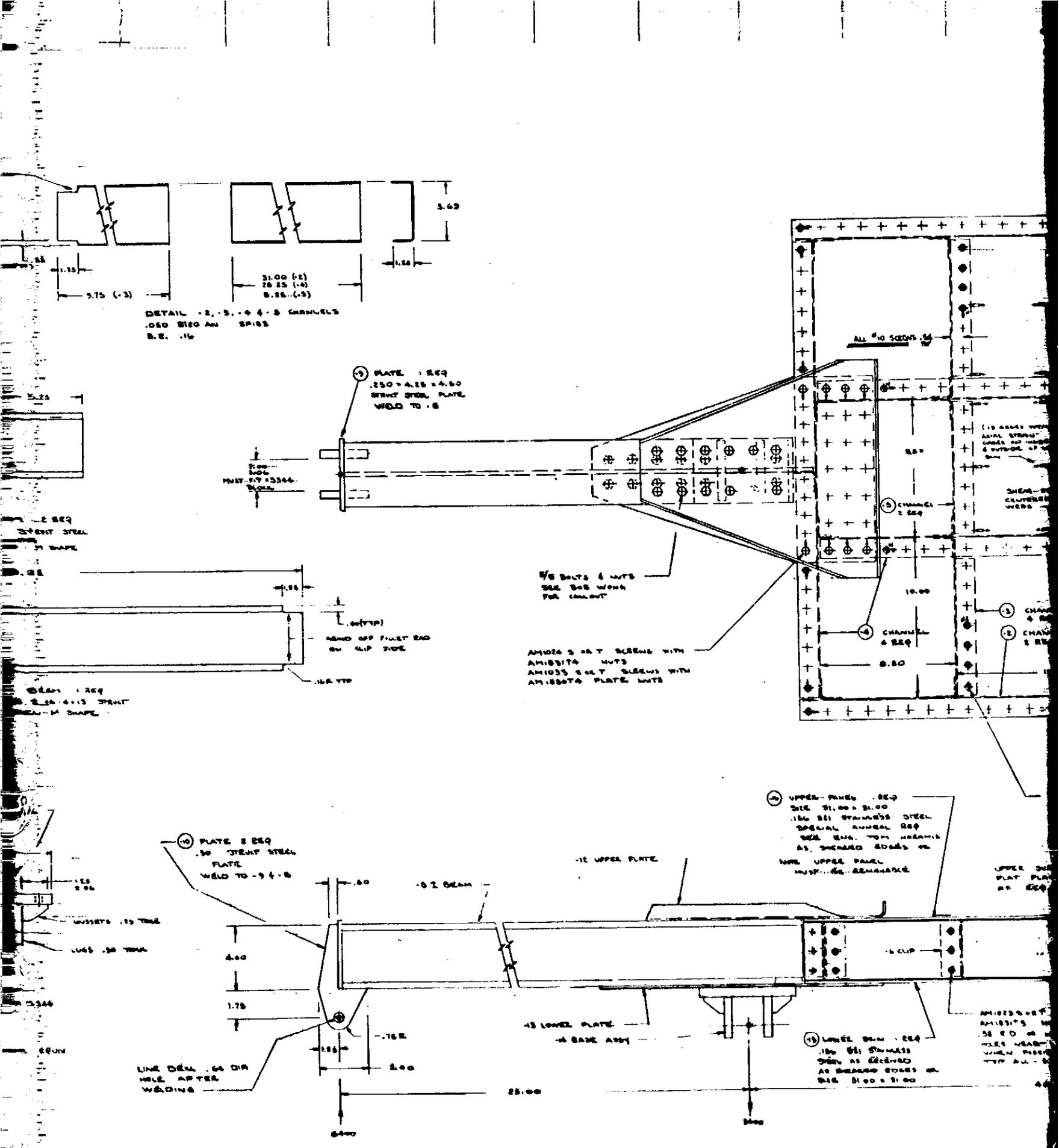



(8) I BEAM
4 x 13.0 M 4 x
STEEL M SH



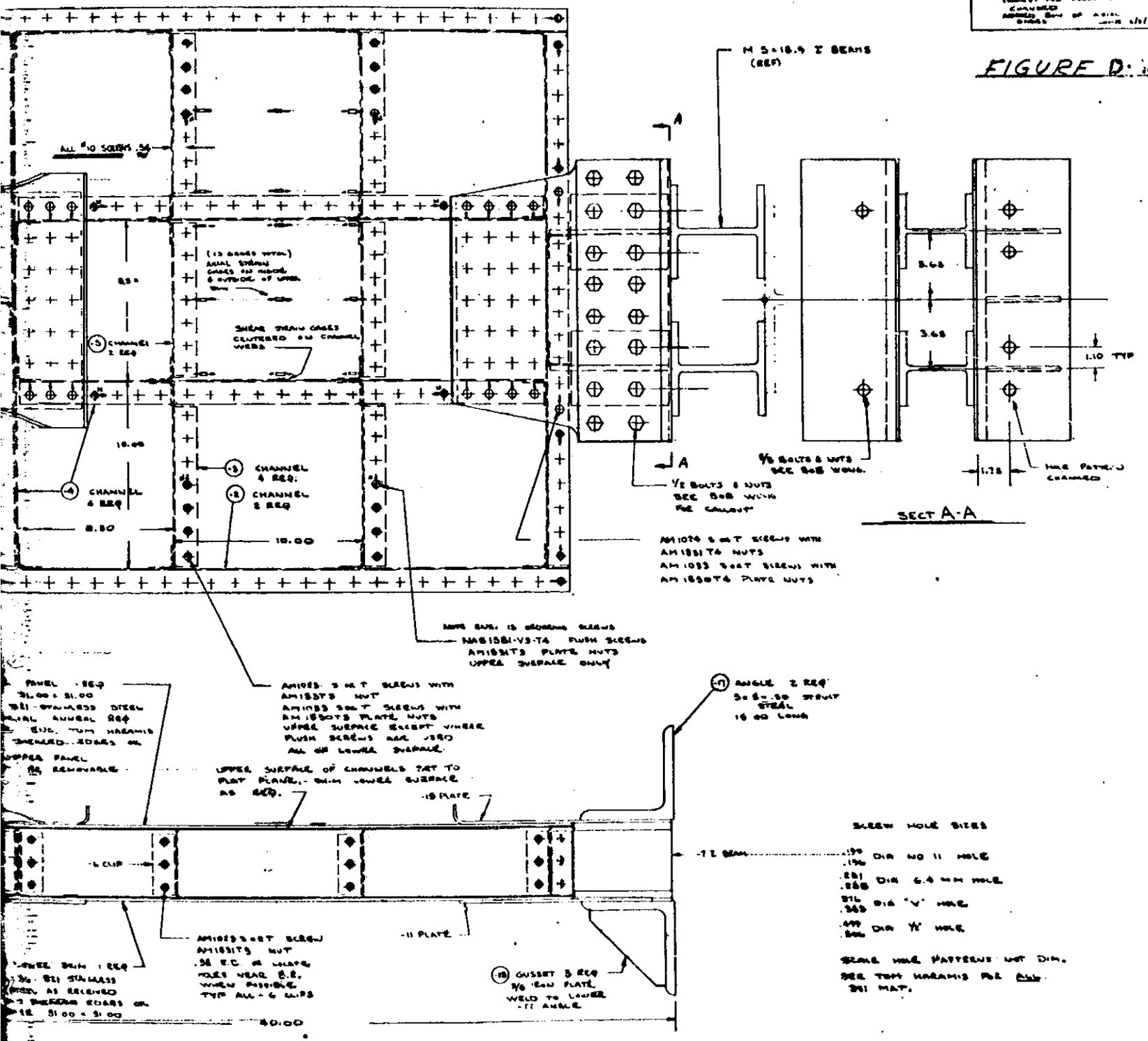

(14) BASE ASSY 1 REQ
ALL PARTS AISI 1018 STEEL M 50 AT
WELD ASSY.

ABOUT FRAME 1

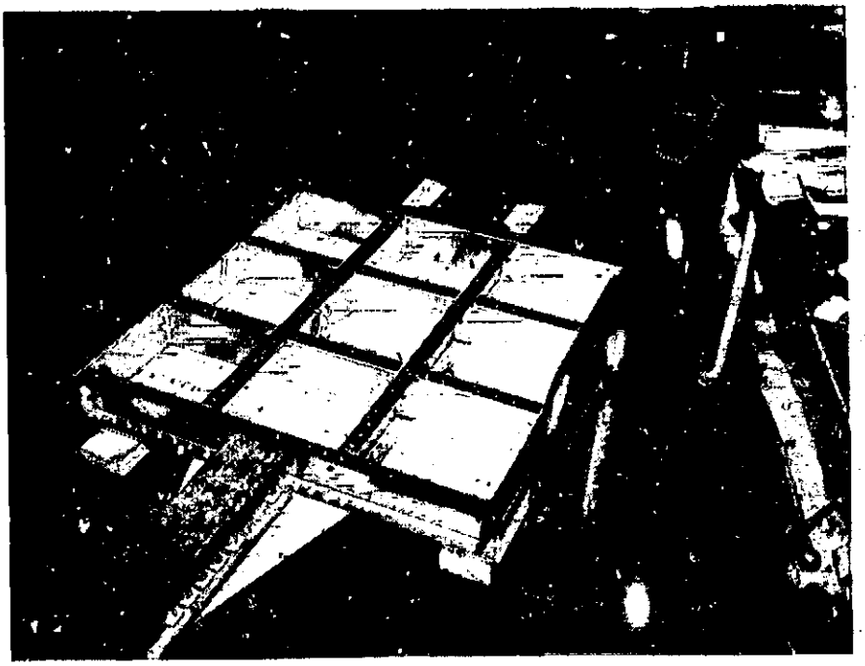



LAYOUT FRAME 2

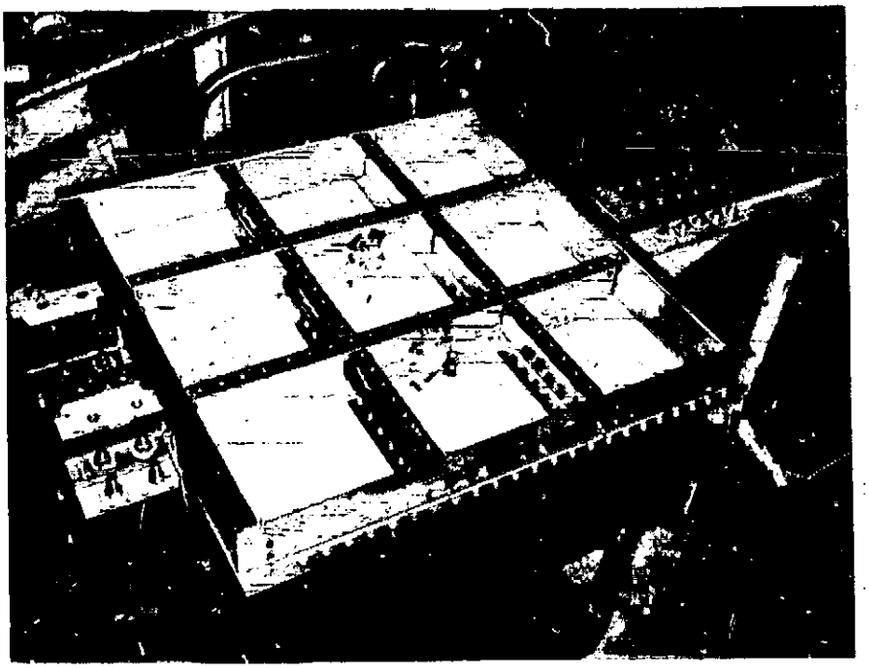
FIGURE D-10




COCKPIT FRAME

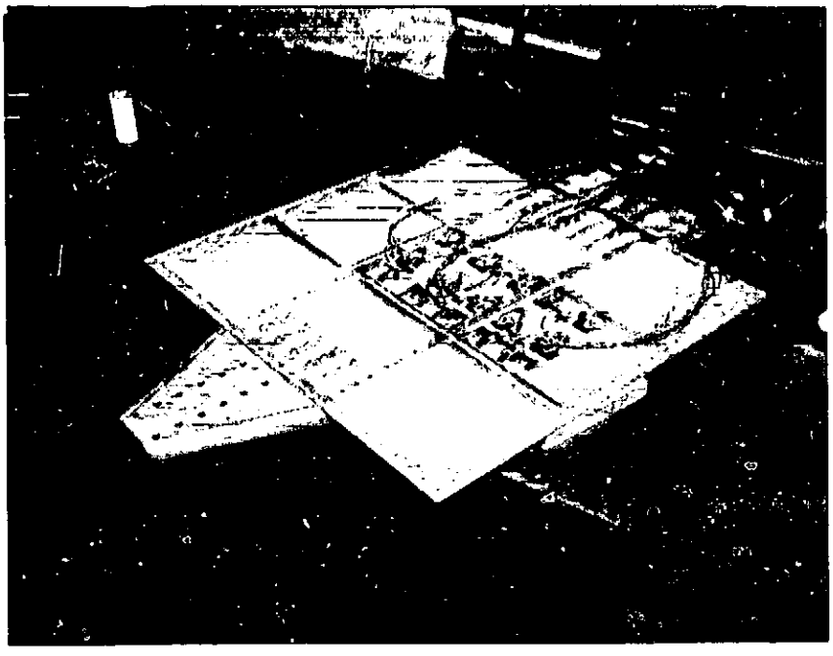


75-5206-3

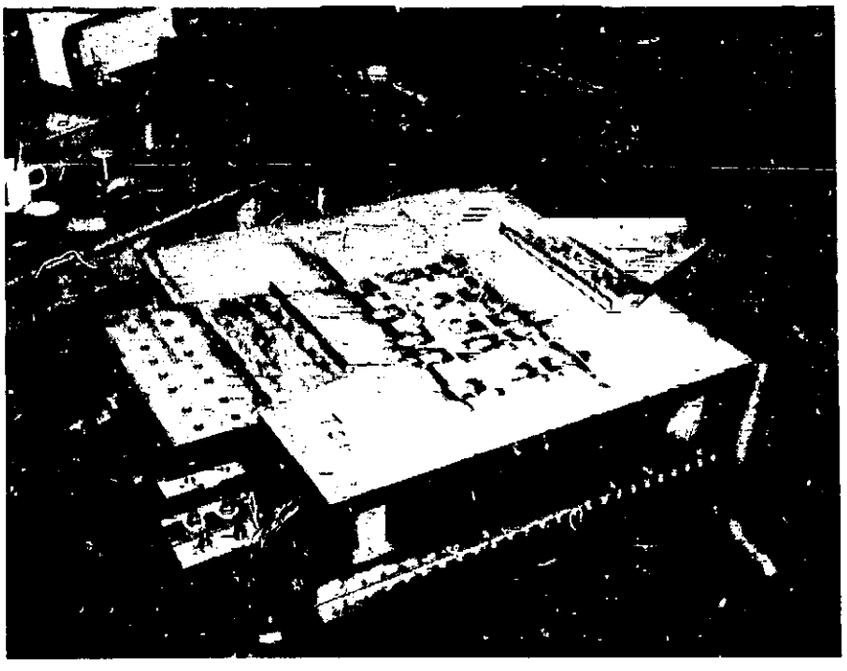


75-5206-4

FIG. D-11 SUBSTRUCTURE OF BENDING BOX SPECIMEN



75-5206-1



75-5206-2

FIG. D-12 BOX COMPRESSION SURFACE
STRAIN GAGE INSTRUMENTATION

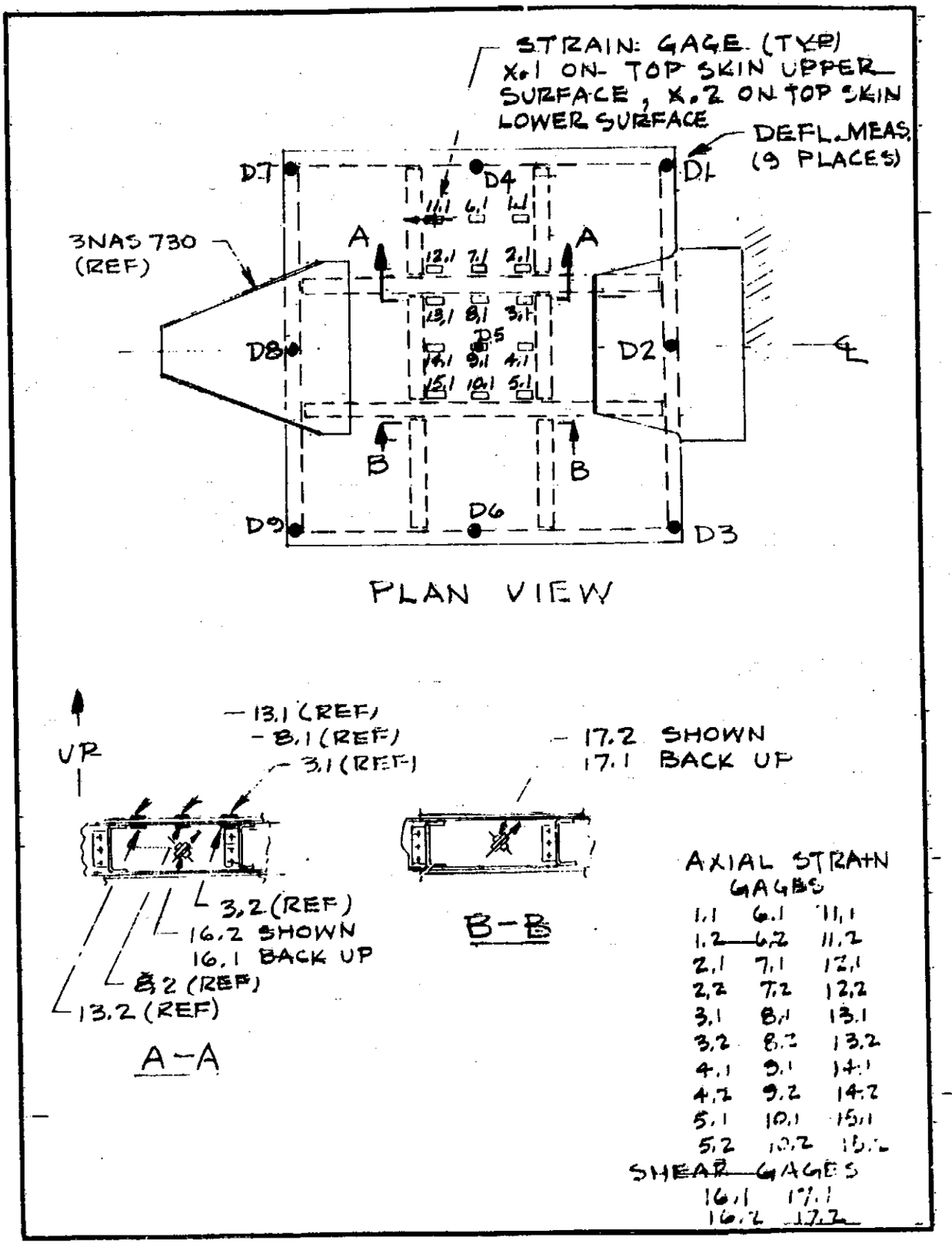
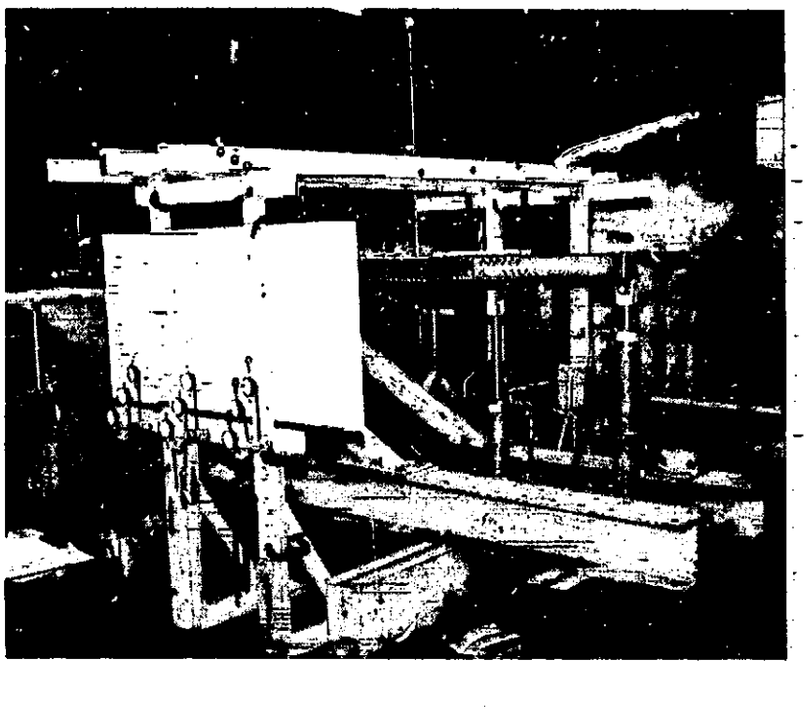


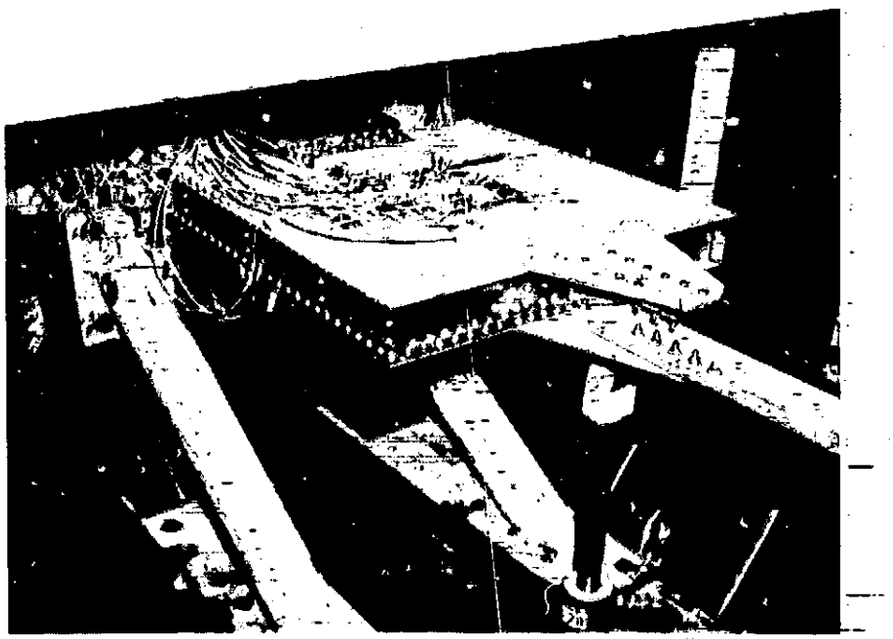

FIG. D-13 INSTRUMENTATION - COMPRESSION TEST BOX, VENTRAL



C-2



75-5209-2



75-5209-4

FIG. D-14 TEST SETUP FOR BOX BENDING TEST

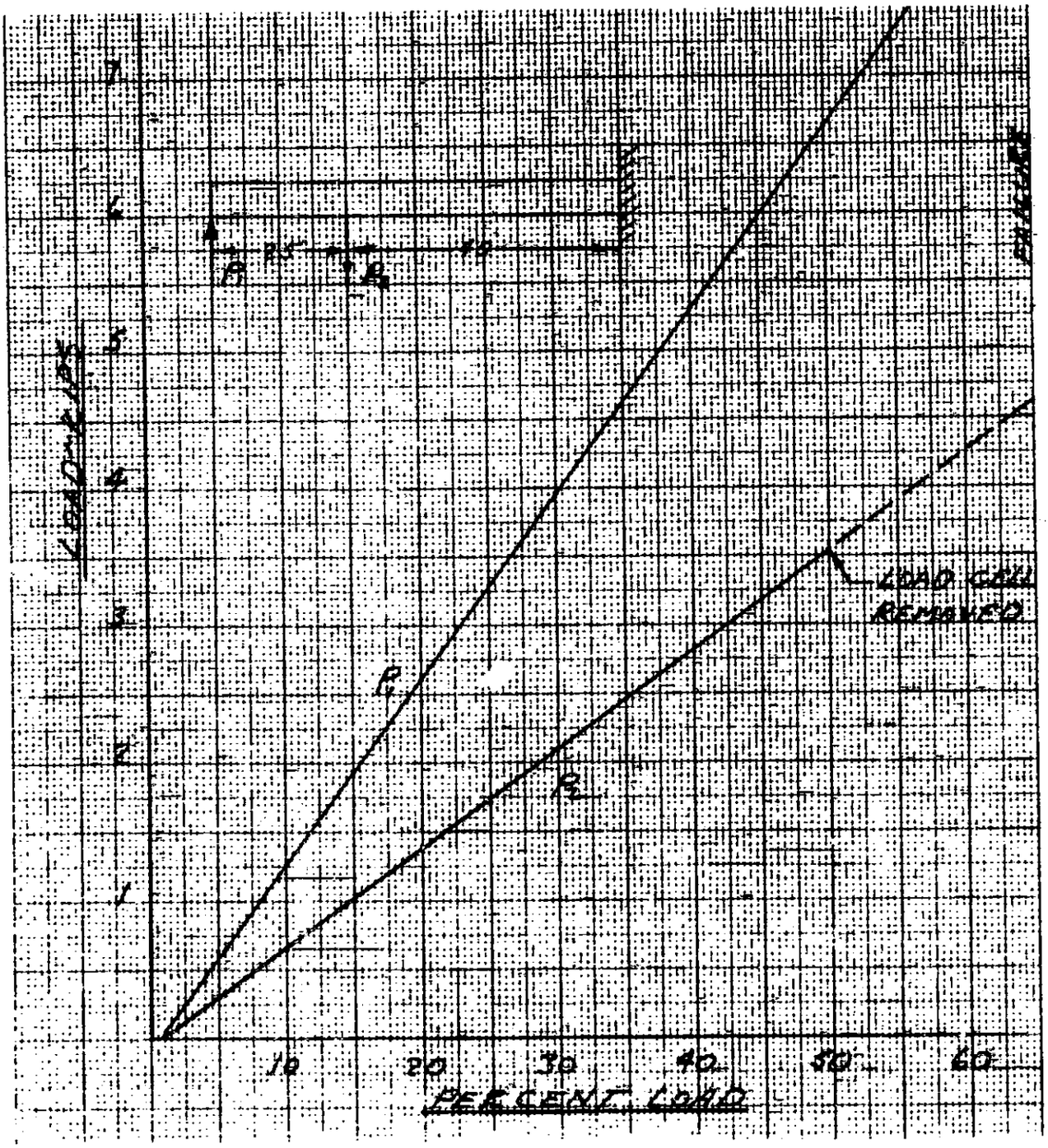



FIG. D-15 MEASURED LOADS APPLIED TO TEST SPECIMEN. $P_1$ MEASURED WITH PRESSURE GAGE - $P_2$ WITH LOAD CELL

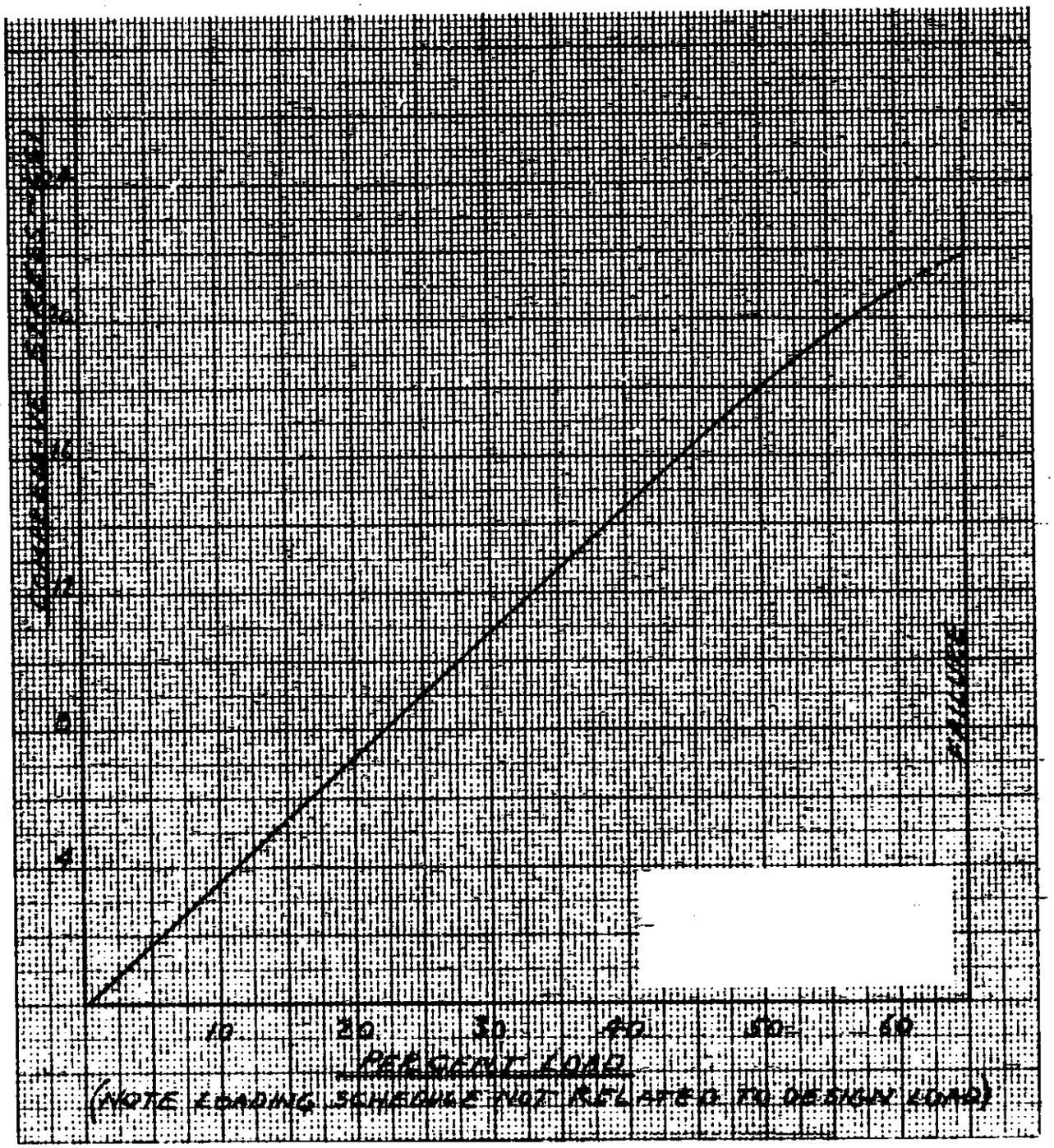



FIG. D-16 MEASURED STRESS FROM THE AVERAGE OF THE READINGS FROM SIX STRAIN GAGES IN THE CENTER OF THE CENTER PANEL. GAGES 8.1, 8.2, 9.1, 9.2, 10.1, AND 10.2.

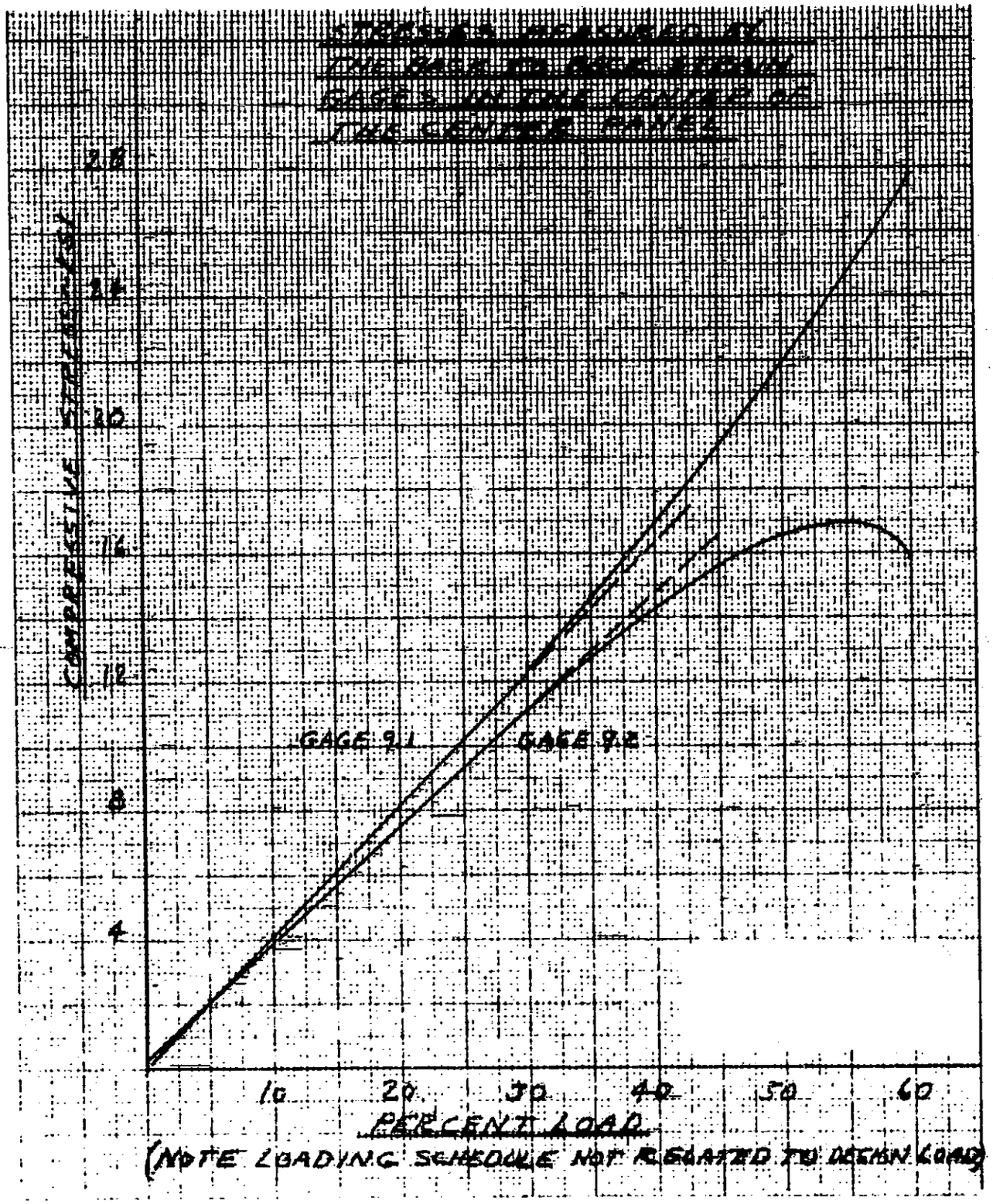



FIG. D-17 BOX BENDING TEST

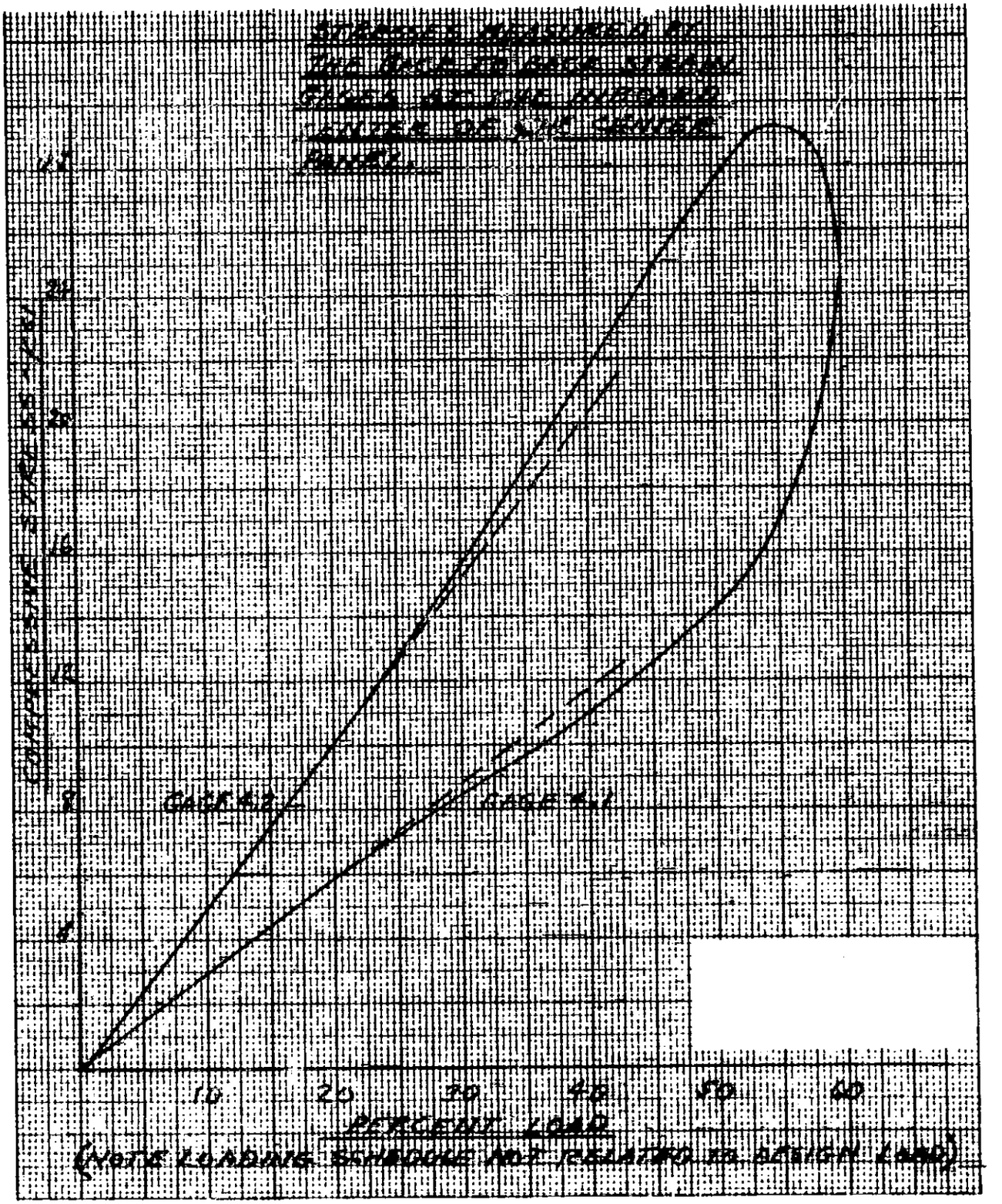



FIG. D-18 BOX BENDING TEST

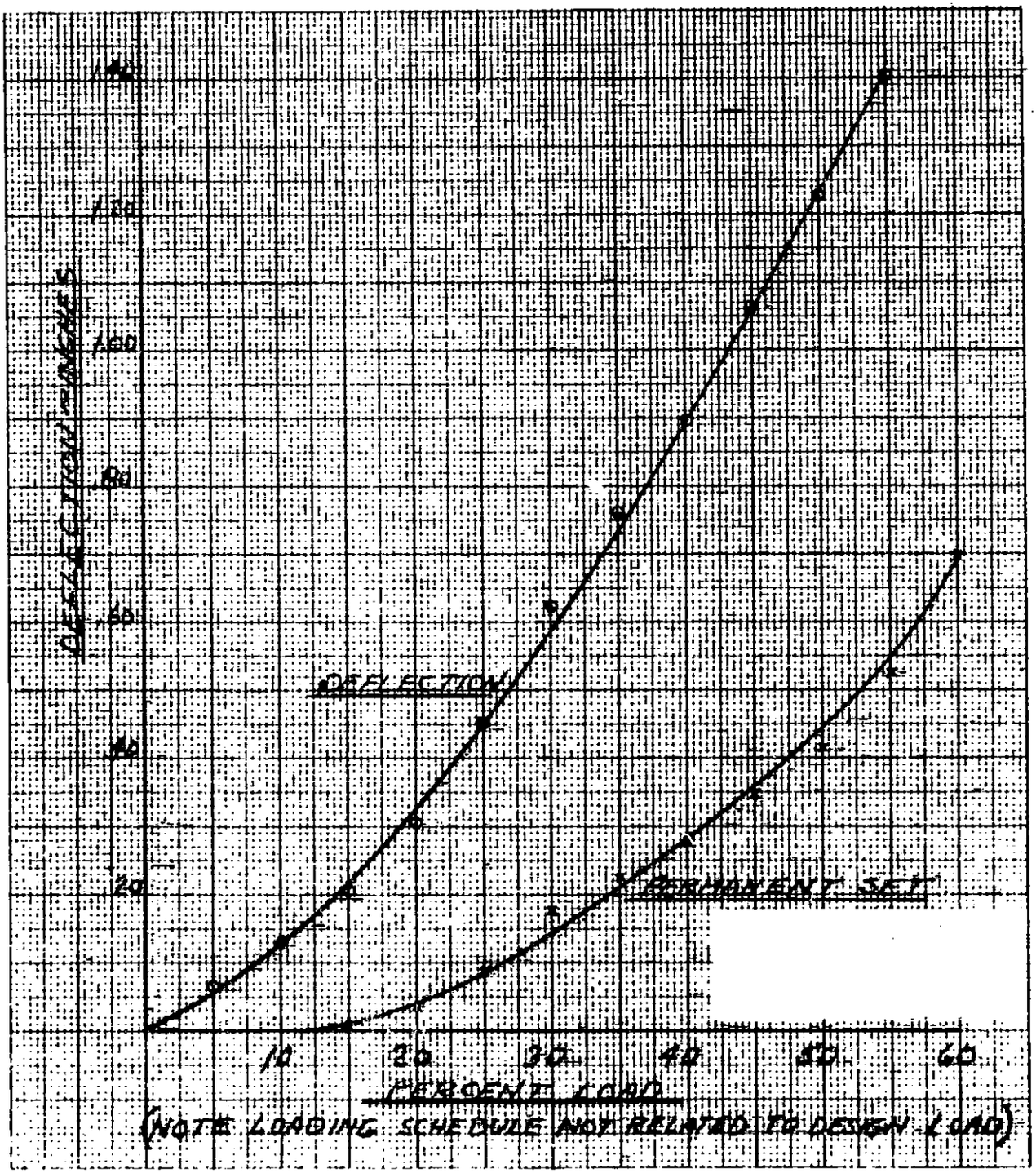
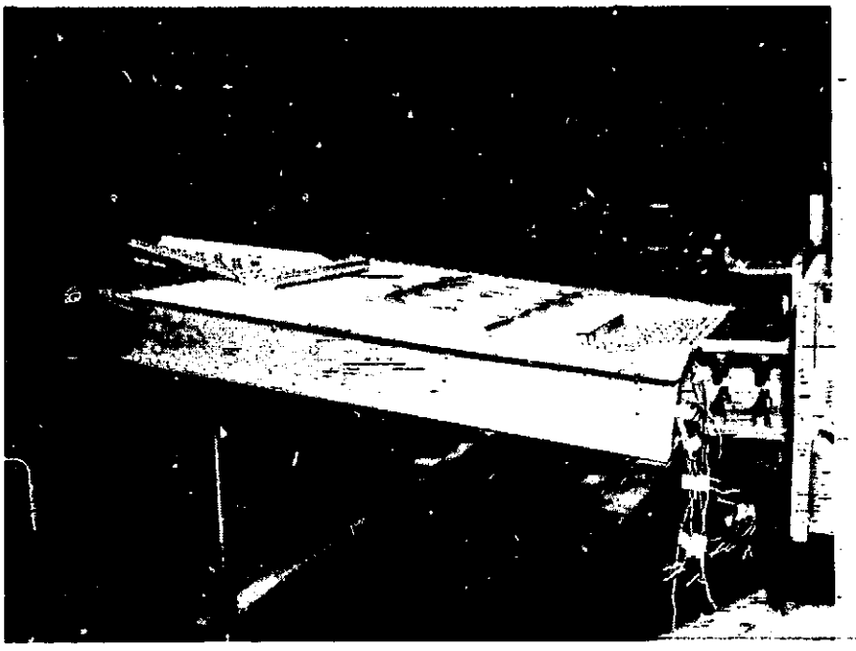
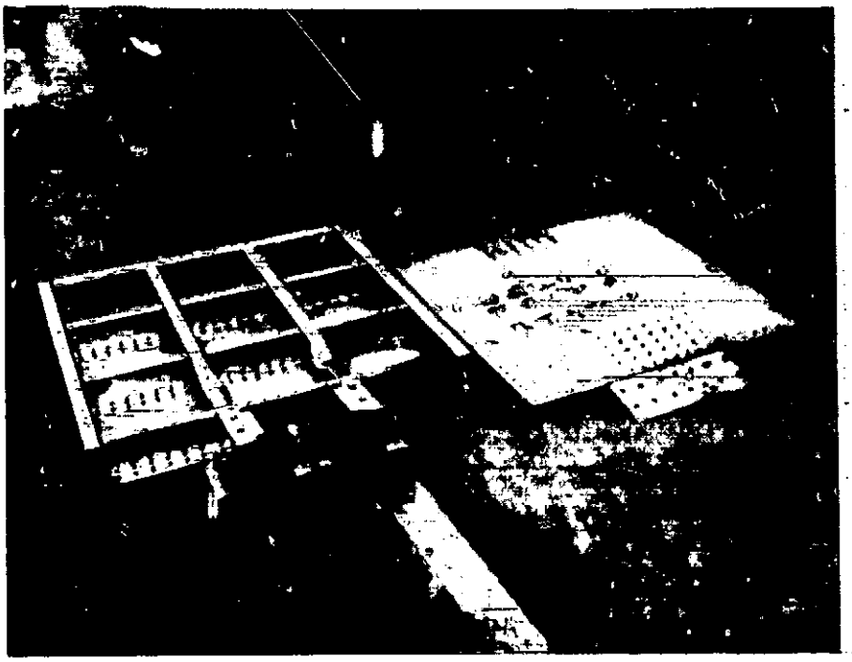



FIG. D-19 DEFLECTION AND PERMANENT SET OF THE OUTBOARD EDGE OF THE BOX SPECIMEN. CURVES ARE AVERAGE OF THE READINGS OF GAGES 7, 8, AND 9.



75-5209-19



75-5209-12



FIG. D-20 BOX SPECIMEN AFTER FAILURE

## TABLE D-I

## MECHANICAL PROPERTIES COMPARISON

1. TEST SPECIMEN COUPON - ANN. 321 CRES

   $F_{TU}$ = 84.4 ksi

   $F_{TY}$ = 34.1 ksi

   e = 47.5%

   $E_T$ = 29.2 msi

2. MIL HANDBOOK 5 VALUES FOR ANN. 321 CRES

   $F_{TU}$ = 75 ksi

   $F_{TY}$ = 30 ksi

   e = 50%

   $E_T$ = 29 msi

   $E_c$ = 28 msi

3. Be38Al LOCKALLOY PROPERTIES (REF. SP-4284)

   $F_{TU}$ 50 ksi

   $F_{TY}$ 35 KSI

   e 7%

   $E_T$ 28 msi

   $E_c$ 28 msi

TABLE D-II STRAIN GAGE READINGS - MICROINCH/INCH

UNLESS NOTED ALL READINGS ARE NEGATIVE

PERCENT LOAD

| GAGE | 0 | 5 | 10 | 15 | 0 | 15 | 20 | 0 | 20 | 25 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1.1 | 5 | 29 | 57 | 83 | 5 | 96 | 115 | 10 | 112 | 141 |
| 1.2 | 3 | 33 | 65 | 94 | 6 | 97 | 129 | 14 | 131 | 161 |
| 2.1 | 10 | 56 | 96 | 130 | 13 | 112 | 191 | 19 | 193 | 238 |
| 2.2 | +5 | 51 | 111 | 164 | +3 | 165 | 225 | 2 | 225 | 280 |
| 3.1 | 6 | 51 | 102 | 154 | 5 | 157 | 212 | 11 | 212 | 267 |
| 3.2 | +2 | 73 | 145 | 221 | 4 | 231 | 307 | 16 | 311 | 385 |
| 4.1 | +4 | 53 | 104 | 156 | 2 | 158 | 210 | 3 | 211 | 257 |
| 4.2 | +5 | 83 | 176 | 268 | +2 | 270 | 357 | 3 | 360 | 453 |
| 5.1 | +7 | 49 | 107 | 163 | +3 | 174 | 233 | 0 | 233 | 290 |
| 5.2 | 8 | 81 | 149 | 218 | 15 | 227 | 294 | 19 | 297 | 373 |
| 6.1 | +12 | 16 | 49 | 81 | +10 | 82 | 113 | +4 | 120 | 152 |
| 6.2 | 0 | 28 | 58 | 84 | +3 | 83 | 110 | +3 | 106 | 134 |
| 7.1 | +7 | 47 | 100 | 155 | +3 | 158 | 217 | 3 | 217 | 274 |
| 7.2 | +10 | 37 | 77 | 121 | +4 | 122 | 168 | 0 | 167 | 211 |
| 8.1 | 9 | 73 | 136 | 199 | 12 | 200 | 265 | 19 | 268 | 337 |
| 8.2 | 4 | 54 | 110 | 161 | 11 | 173 | 230 | 22 | 235 | 285 |
| 9.1 | 6 | 77 | 146 | 215 | 10 | 217 | 290 | 18 | 291 | 365 |
| 9.2 | 10 | 75 | 151 | 225 | 17 | 207 | 270 | 14 | 271 | 332 |
| 10.1 | 1 | 62 | 122 | 182 | 1 | 187 | 251 | 12 | 253 | 322 |
| 10.2 | +10 | 45 | 101 | 157 | 0 | 171 | 227 | 11 | 237 | 292 |
| 11.1 | 2 | 30 | 54 | 90 | 0 | 90 | 107 | 13 | 110 | 132 |
| 11.2 | 3 | 36 | 67 | 16 | 1 | 99 | 130 | 12 | 130 | 161 |
| 12.1 | 6 | 42 | 90 | 133 | 1 | 136 | 183 | 15 | 193 | 228 |
| 12.2 | 7 | 61 | 110 | 160 | 12 | 164 | 214 | 19 | 215 | 266 |
| 13.1 | 6 | 57 | 109 | 160 | 11 | 162 | 215 | 16 | 217 | 266 |
| 13.2 | +3 | 56 | 119 | 177 | 5 | 184 | 248 | 14 | 252 | 314 |
| 14.1 | +2 | 53 | 103 | 164 | 1 | 166 | 225 | 8 | 223 | 278 |
| 14.2 | +8 | 68 | 139 | 211 | 1 | 214 | 284 | 11 | 300 | 378 |
| 15.1 | 1 | 52 | 107 | 170 | 4 | 177 | 238 | 16 | 235 | 291 |
| 15.2 | +13 | 41 | 96 | 149 | +17 | 142 | 197 | +12 | 193 | 255 |
| 16.1 | +5 | 106 | 201 | 299 | +4 | 302 | 349 | +1 | 349 | 496 |
| 16.2 | +5 | 103 | 199 | 314 | +7 | 310 | 391 | 0 | 313 | 491 |
| 17.1 | +8 | 178 | 236 | 344 | +8 | 349 | 443 | +7 | 451 | 555 |
| 17.2 | +17 | 110 | 200 | 304 | +22 | 313 | 410 | +20 | 405 | 499 |

TABLE D-II (CONTINUED)

UNLESS NOTED ALL READINGS ARE NEGATIVE

| | PERCENT LOAD | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| GAGE | 0 | 25 | 30 | 0 | 30 | 35 | 0 | 35 | 40 |
| 6.1 | 15 | 143 | 169 | 16 | 171 | 198 | 14 | 199 | 225 |
| 1.2 | 18 | 163 | 200 | 27 | 201 | 233 | 31 | 234 | 269 |
| 7.1 | 21 | 241 | 292 | 22 | 293 | 341 | 26 | 343 | 395 |
| 2.2 | 5 | 285 | 344 | 12 | 346 | 402 | 19 | 404 | 462 |
| 3.1 | 13 | 266 | 322 | 9 | 322 | 378 | 12 | 381 | 438 |
| 3.2 | 25 | 389 | 464 | 29 | 469 | 542 | 34 | 548 | 623 |
| 4.1 | +12 | 250 | 304 | +27 | 294 | 346 | +40 | 336 | 392 |
| 4.2 | 6 | 460 | 560 | 14 | 565 | 663 | 21 | 665 | 768 |
| 5.1 | 0 | 294 | 348 | +1 | 348 | 405 | +2 | 408 | 465 |
| 5.2 | 26 | 374 | 440 | 25 | 446 | 513 | 30 | 519 | 588 |
| 6.1 | +1 | 155 | 189 | 1 | 193 | 227 | 6 | 232 | 269 |
| 6.2 | +4 | 132 | 165 | 0 | 167 | 195 | 0 | 195 | 224 |
| 7.1 | 7 | 278 | 340 | 14 | 341 | 399 | 20 | 402 | 464 |
| 7.2 | 0 | 214 | 259 | 3 | 261 | 302 | 5 | 306 | 346 |
| 8.1 | 22 | 356 | 408 | 26 | 413 | 479 | 31 | 479 | 550 |
| 8.2 | 27 | 285 | 337 | 28 | 341 | 393 | 32 | 393 | 445 |
| 9.1 | 21 | 368 | 446 | 25 | 446 | 524 | 34 | 526 | 605 |
| 9.2 | 20 | 336 | 348 | 19 | 398 | 456 | 21 | 455 | 508 |
| 10.1 | 17 | 326 | 392 | 26 | 395 | 464 | 36 | 469 | 538 |
| 10.2 | 15 | 295 | 349 | 19 | 350 | 404 | 25 | 408 | 462 |
| 11.1 | 15 | 135 | 159 | 17 | 163 | 186 | 19 | 189 | 213 |
| 11.2 | 15 | 162 | 196 | 20 | 199 | 231 | 24 | 233 | 266 |
| 12.1 | 19 | 230 | 278 | 23 | 280 | 326 | 26 | 329 | 373 |
| 12.2 | 22 | 268 | 318 | 20 | 317 | 368 | 22 | 369 | 420 |
| 13.1 | 16 | 271 | 321 | 16 | 320 | 372 | 17 | 372 | 422 |
| 13.2 | 18 | 315 | 378 | 27 | 379 | 443 | 30 | 446 | 509 |
| 14.1 | 4 | 279 | 332 | 6 | 336 | 382 | 8 | 384 | 431 |
| 14.2 | 17 | 379 | 460 | 18 | 462 | 541 | 30 | 544 | 626 |
| 15.1 | 16 | 293 | 347 | 17 | 349 | 402 | 20 | 401 | 451 |
| 15.2 | +18 | 255 | 317 | +16 | 314 | 381 | +11 | 380 | 439 |
| 16.1 | +2 | 502 | 599 | +3 | 602 | 696 | +10 | 697 | 788 |
| 16.2 | +1 | 495 | 590 | 0 | 592 | 685 | +9 | 687 | 780 |
| 17.1 | +20 | 553 | 644 | +38 | 643 | 741 | +51 | 742 | 847 |
| 17.2 | +39 | 500 | 586 | +45 | 596 | 668 | +50 | 672 | 767 |

TABLE II (CONTINUED)

UNLESS NOTED ALL READINGS ARE NEGATIVE

PERCENT LOAD

| GAGE | 0 | 40 | 45 | 0 | 45 | 50 | 0 | 50 | 55 |
|---|---|---|---|---|---|---|---|---|---|
| 1.1 | 18 | 226 | 255 | 19 | 254 | 289 | 19 | 290 | 332 |
| 1.2 | 35 | 272 | 307 | 40 | 309 | 351 | 41 | 353 | 403 |
| 2.1 | 31 | 398 | 455 | 39 | 456 | 523 | 47 | 528 | 610 |
| 2.2 | 24 | 468 | 534 | 32 | 525 | 582 | 30 | 582 | 632 |
| 3.1 | 18 | 447 | 508 | 32 | 513 | 587 | 42 | 593 | 637 |
| 3.2 | 48 | 627 | 699 | 59 | 701 | 767 | 51 | 764 | 812 |
| 4.1 | 140 | 389 | 445 | +28 | 442 | 512 | +13 | 510 | 608 |
| 4.2 | 36 | 777 | 882 | 57 | 884 | 984 | 61 | 987 | 1045 |
| 5.1 | 1 | 467 | 524 | 10 | 523 | 591 | 11 | 593 | 672 |
| 5.2 | 35 | 591 | 658 | 38 | 657 | 715 | 27 | 716 | 752 |
| 6.1 | 10 | 268 | 309 | 16 | 310 | 353 | 16 | 356 | 406 |
| 6.2 | 0 | 224 | 253 | 7 | 255 | 289 | 6 | 287 | 326 |
| 7.1 | 27 | 467 | 527 | 34 | 526 | 592 | 34 | 598 | 660 |
| 7.2 | 9 | 351 | 392 | 16 | 393 | 431 | 16 | 441 | 487 |
| 8.1 | 36 | 553 | 622 | 46 | 624 | 698 | 46 | 703 | 771 |
| 8.2 | 37 | 444 | 492 | 38 | 488 | 535 | 35 | 539 | 582 |
| 9.1 | 42 | 610 | 693 | 54 | 696 | 784 | 55 | 791 | 885 |
| 9.2 | 22 | 512 | 552 | 21 | 557 | 590 | 11 | 588 | 605 |
| 10.1 | 46 | 547 | 616 | 57 | 618 | 690 | 63 | 698 | 770 |
| 10.2 | 28 | 460 | 509 | 23 | 500 | 547 | 18 | 546 | 578 |
| 11.1 | 21 | 214 | 239 | 20 | 236 | 261 | 18 | 262 | 286 |
| 11.2 | 28 | 268 | 304 | 34 | 306 | 347 | 36 | 342 | 395 |
| 12.1 | 30 | 372 | 420 | 34 | 420 | 463 | 33 | 465 | 507 |
| 12.2 | 25 | 423 | 475 | 24 | 477 | 530 | 28 | 532 | 589 |
| 13.1 | 17 | 426 | 471 | 18 | 471 | 512 | 13 | 514 | 556 |
| 13.2 | 35 | 515 | 574 | 41 | 576 | 639 | 40 | 644 | 706 |
| 14.1 | 9 | 435 | 474 | 14 | 474 | 511 | 9 | 511 | 538 |
| 14.2 | 35 | 632 | 712 | 42 | 715 | 779 | 40 | 805 | 891 |
| 15.1 | 23 | 456 | 502 | 25 | 500 | 542 | 18 | 544 | 582 |
| 15.2 | +6 | 450 | 509 | 7 | 515 | 577 | 3 | 577 | 640 |
| 16.1 | +21 | 789 | 874 | +27 | 875 | 962 | +45 | 966 | 1038 |
| 16.2 | +16 | 781 | 870 | +19 | 875 | 971 | +33 | 979 | 1071 |
| 17.1 | +57 | 843 | 944 | +52 | 944 | 1046 | +57 | 1050 | 1142 |
| 17.2 | +56 | 764 | 848 | +57 | 863 | 945 | +53 | 951 | 1015 |

TABLE II (CONTINUED)

UNLESS NOTED ALL READINGS ARE NEGATIVE

| | PERCENT LOAD | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| GAGE | 0 | 55 | 60 | 0 | 0 | 60 | 65 | 0 |
| 1.1 | 33 | 338 | 415 | 69 | 77 | 445 | | 247 |
| 1.2 | 53 | 408 | 476 | 73 | 81 | 499 | | 37 |
| 2.1 | 76 | 623 | 777 | 139 | 142 | 836 | | 180 |
| 2.2 | 28 | 630 | 641 | 0 | 5 | 628 | | +178 |
| 3.1 | 75 | 705 | 900 | 165 | 167 | 983 | | 475 |
| 3.2 | 44 | 808 | 756 | +6 | 8 | 728 | | +349 |
| 4.1 | 34 | 625 | 872 | 196 | 193 | 956 | | 1085 |
| 4.2 | 51 | 1032 | 892 | +60 | +53 | 792 | | +683 |
| 5.1 | 35 | 687 | 854 | 104 | 111 | 930 | | 311 |
| 5.2 | 14 | 748 | 699 | +44 | +35 | 676 | | +224 |
| 6.1 | 27 | 411 | 478 | 46 | 53 | 498 | | 103 |
| 6.2 | 14 | 327 | 374 | 24 | 23 | 373 | | 12 |
| 7.1 | 43 | 665 | 729 | 49 | 54 | 740 | | +2 |
| 7.2 | 24 | 491 | 547 | 34 | 37 | 563 | | +25 |
| 8.1 | 52 | 776 | 830 | 48 | 51 | 835 | | +24 |
| 8.2 | 38 | 582 | 626 | 43 | 58 | 653 | | 8 |
| 9.1 | 68 | 894 | 992 | 76 | 81 | 1006 | | 100 |
| 9.2 | 5 | 596 | 567 | +3 | 4 | 556 | | +74 |
| 10.1 | 75 | 778 | 858 | 86 | 93 | 873 | | 57 |
| 10.2 | 18 | 575 | 585 | 13 | 31 | 596 | | +51 |
| 11.1 | 20 | 288 | 313 | 22 | 32 | 323 | | 33 |
| 11.2 | 45 | 399 | 463 | 61 | 66 | 475 | | 90 |
| 12.1 | 40 | 510 | 547 | 45 | 49 | 556 | | 2 |
| 12.2 | 29 | 590 | 652 | 34 | 36 | 660 | | +1 |
| 13.1 | 16 | 557 | 685 | 17 | 20 | 588 | | +55 |
| 13.2 | 41 | 710 | 770 | 46 | 60 | 791 | | 14 |
| 14.1 | 12 | 542 | 536 | 15 | 19 | 537 | | +56 |
| 14.2 | 50 | 596 | 995 | 66 | 80 | 1023 | | 63 |
| 15.1 | +236* | 329 | 346 | +232 | +220 | 365 | | +304 |
| 15.2 | 4 | 642 | 706 | 7 | 5 | 706 | | +38 |
| 16.1 | +62 | 1048 | 1107 | +80 | +85 | 1116 | | 208 |
| 16.2 | +42 | 1081 | 1200 | +38 | +45 | 1234 | | 287 |
| 17.1 | +58 | 1155 | 1264 | +36 | +44 | 1292 | | 270 |
| 17.2 | +54 | 1023 | 1073 | +48 | +47 | 1093 | | 261 |

SPECIMEN FAILED BEFORE READINGS FOUND BE TAKEN

* GAGE SLIPPED

TABLE III POINT DEFLECTIONS

DIAL GAGE NUMBERS

| %LOAD | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 5 | .007 | .005 | .004 | .031 | .032 | .034 | .068 | .062 | .070 |
| 10 | .017 | .016 | .010 | .065 | .065 | .064 | .132 | .128 | .134 |
| 15 | .030 | .026 | .020 | .109 | .106 | .109 | .206 | .206 | .206 |
| 0 | .007 | .005 | .001 | .013 | .006 | .008 | .016 | .012 | .002 |
| 15 | .031 | .027 | .020 | .112 | .108 | .110 | .208 | .208 | .206 |
| 20 | .043 | .038 | .029 | .162 | .158 | .160 | .302 | .312 | .306 |
| 0 | .006 | .005 | .004 | .024 | .018 | .018 | .042 | .038 | .030 |
| 20 | .044 | .039 | .030 | .171 | .162 | .165 | .310 | .320 | .314 |
| 25 | .053 | .051 | .048 | .237 | .231 | .243 | .458 | .460 | .450 |
| 0 | .007 | .005 | .003 | .042 | .041 | .044 | .092 | .094 | .074 |
| 25 | .054 | .052 | .048 | .246 | .239 | .251 | .452 | .476 | .466 |
| 30 | .066 | .067 | .062 | .328 | .320 | .335 | .606 | .640 | .624 |
| 0 | 0 | .005 | .004 | .090 | .082 | .088 | .174 | .182 | .174 |
| 30 | .068 | .069 | .063 | .339 | .329 | .342 | .622 | .656 | .638 |
| 35 | .081 | .083 | .075 | .401 | .390 | .405 | .742 | .782 | .758 |
| 0 | .003 | .008 | .004 | .115 | .105 | .110 | .222 | .236 | .210 |
| 35 | .087 | .087 | .076 | .414 | .400 | .414 | .760 | .802 | .762 |
| 40 | .101 | .102 | .089 | .481 | .466 | .483 | .850 | .934 | .898 |
| 0 | .004 | .010 | .005 | .144 | .130 | .139 | .276 | .294 | .270 |
| 40 | .104 | .104 | .091 | .497 | .478 | .495 | .910 | .960 | .922 |
| 45 | .119 | .121 | .106 | .565 | .544 | .561 | 1.038 | 1.098 | 1.052 |
| 0 | .008 | .013 | .007 | .177 | .161 | .173 | .342 | .366 | .338 |
| 45 | .123 | .123 | .109 | .581 | .558 | .576 | 1.060 | 1.122 | 1.074 |
| 50 | .139 | .141 | .126 | .621 | .611 | .652 | 1.204 | 1.260 | 1.216 |
| 0 | .004 | .016 | .006 | .210 | .192 | .199 | .404 | .436 | .402 |
| 50 | .144 | .144 | .130 | — | .611 | — | 1.232 | 1.302 | 1.298 |
| 55 | .158 | .161 | .143 | — | — | — | — | — | 1.406 |
| 0 | .016 | .022 | .012 | .268 | .240 | .261 | .504 | .554 | .514 |
| 55 | .163 | .168 | .142 | — | — | — | — | — | 1.448 |
| 60 | .178 | .187 | .161 | — | — | — | — | — | — |
| 0 | .019 | .030 | .015 | .354 | .322 | .342 | .680 | .730 | .686 |
| 60 | .186 | .194 | .166 | — | — | — | — | — | — |

# APPENDIX E

## STRESS ANALYSIS - LOCKALLOY VENTRAL FIN

# MARGINS OF SAFETY

| COMPONENT | PG. | MODE | MATERIAL | CONDITION | MARGIN |
|---|---|---|---|---|---|
| ROOT RIB | 15 | WEB SHEAR | B120Ti | .15 CP | .41 |
| VERTRAL STATION 37.7 RIB | 15 | WEB SHEAR | B120Ti | .15 CP | 2.59 |
| SURFACE - FWD. BEAM | 17 | COMPRESSION | Be-38Al | .15 CP | .24 |
| SURFACE - REAR BEAM | 20 | COMPRESSION | Be-38Al | .711 CP | .43 |
| SURFACE SPLICE | 21 | COMPRESSION | Be-38Al | .15 CP | .20 |
| SURFACE - FWD. BEAM FTG. | 22 | THERMAL STRESS | Be-38Al | .472 CP | .69 |
| FRONT ACTUATOR FTG. | 23 | STIFFENER BNDG. | B120Ti | .711 CP | 1.33 |
| AFT HINGE FTG. | 25 | BENDING | B120Ti | .711 CP | .07 |
| AFT HINGE FTG. | 25 | ATTACHMENTS | 6Al-4V Ti | .711 CP | .12 |

## REFERENCES

Appendix D - Component Tests for Lockalloy Ventral Fin.

Lockheed Stress Memo Manual.

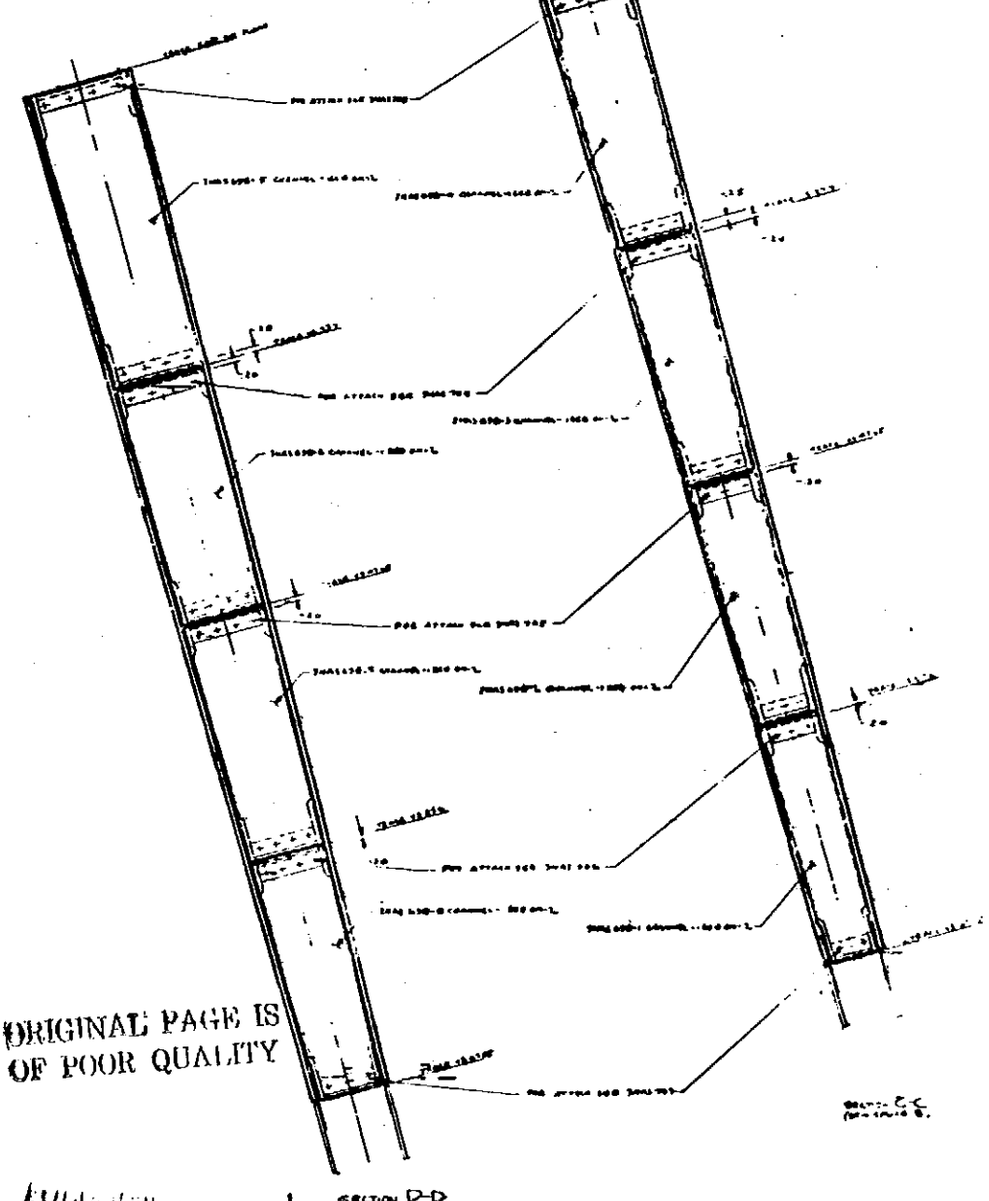
## INTRODUCTION

The following report contains external loadings, critical internal loads, and stress calculations to verify the structural integrity of the Lockalloy ventral fin. Internal loads and stresses are calculated by setting up a structural model of the ventral and employing the NASTRAN program.

Additional structural verification is supplied by the ventral fin proof test in which the ventral is loaded to limit load for three critical conditions.

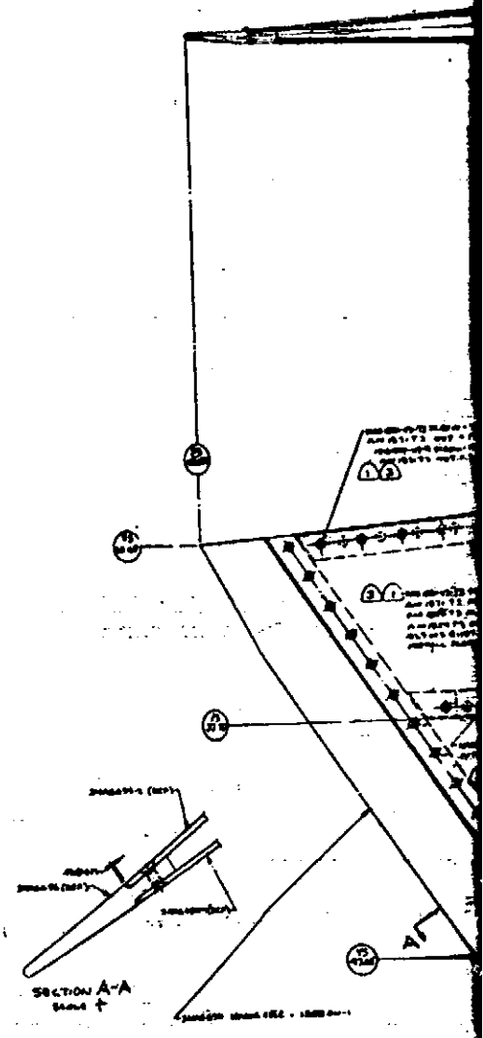
DESCRIPTION

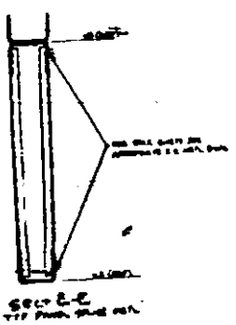
The Lockalloy ventral fin assembly is shown on Figure 1 and basic fin geometry is shown on Figures 2 and 3. The fin structure essentially consists of .050 B-120 annealed titanium channel type ribs and beams with .150 and .125 thick Lockalloy skins. Skin panels are available in limited sizes so appropriate splices are provided. All of the panels on the right side of the ventral are removable providing ready access to the inside. There are two principal beams at 41.2% and 72.6% chord lines. These beams attach, at the root rib, to the two hinge fittings. The ventral is rotated about these hinge fittings to retract it for takeoff and landing. The forward fitting reacts all of the ventral spanwise bending moment and provides the actuation mechanism. The rear hinge fitting reacts side load only.

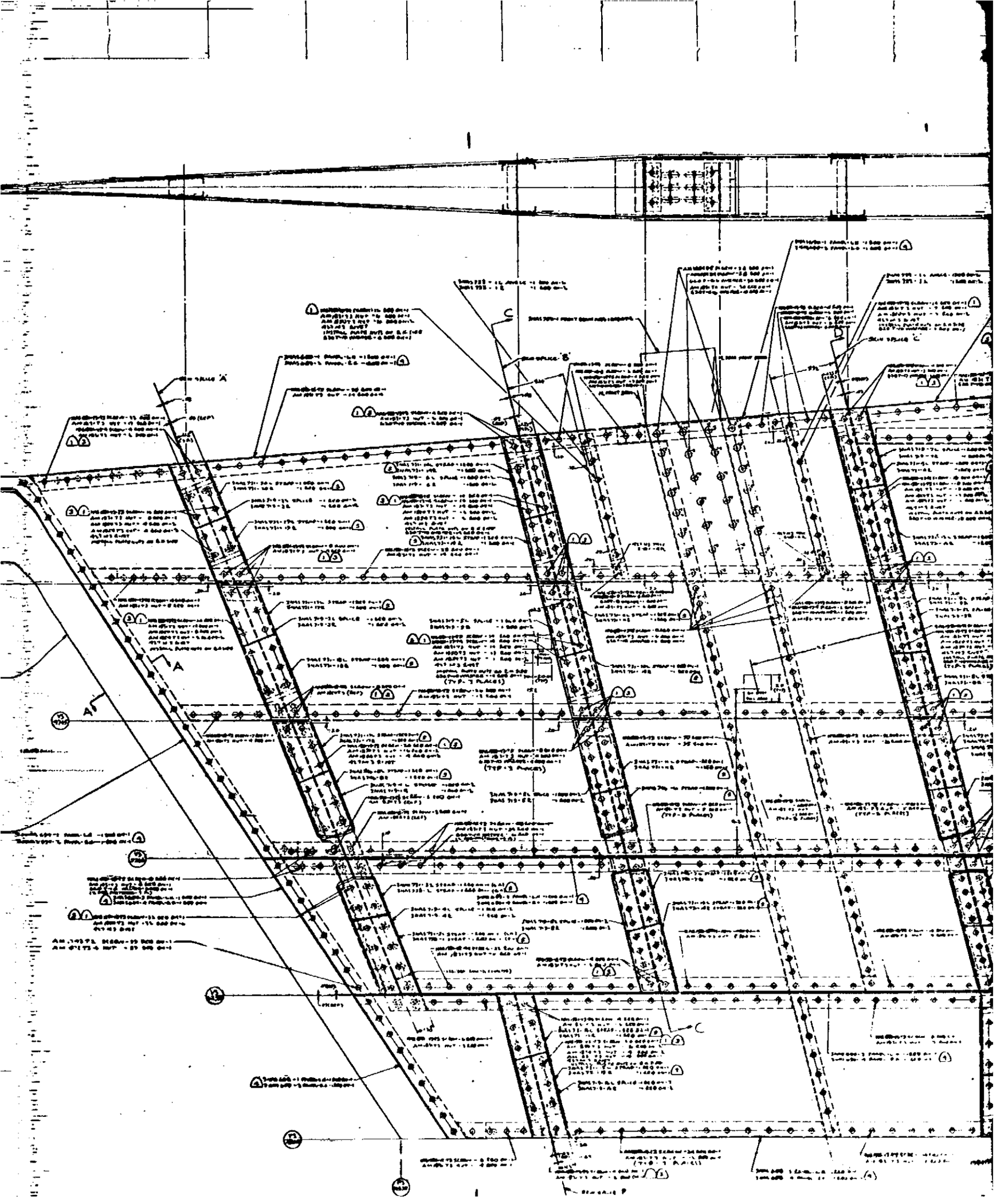


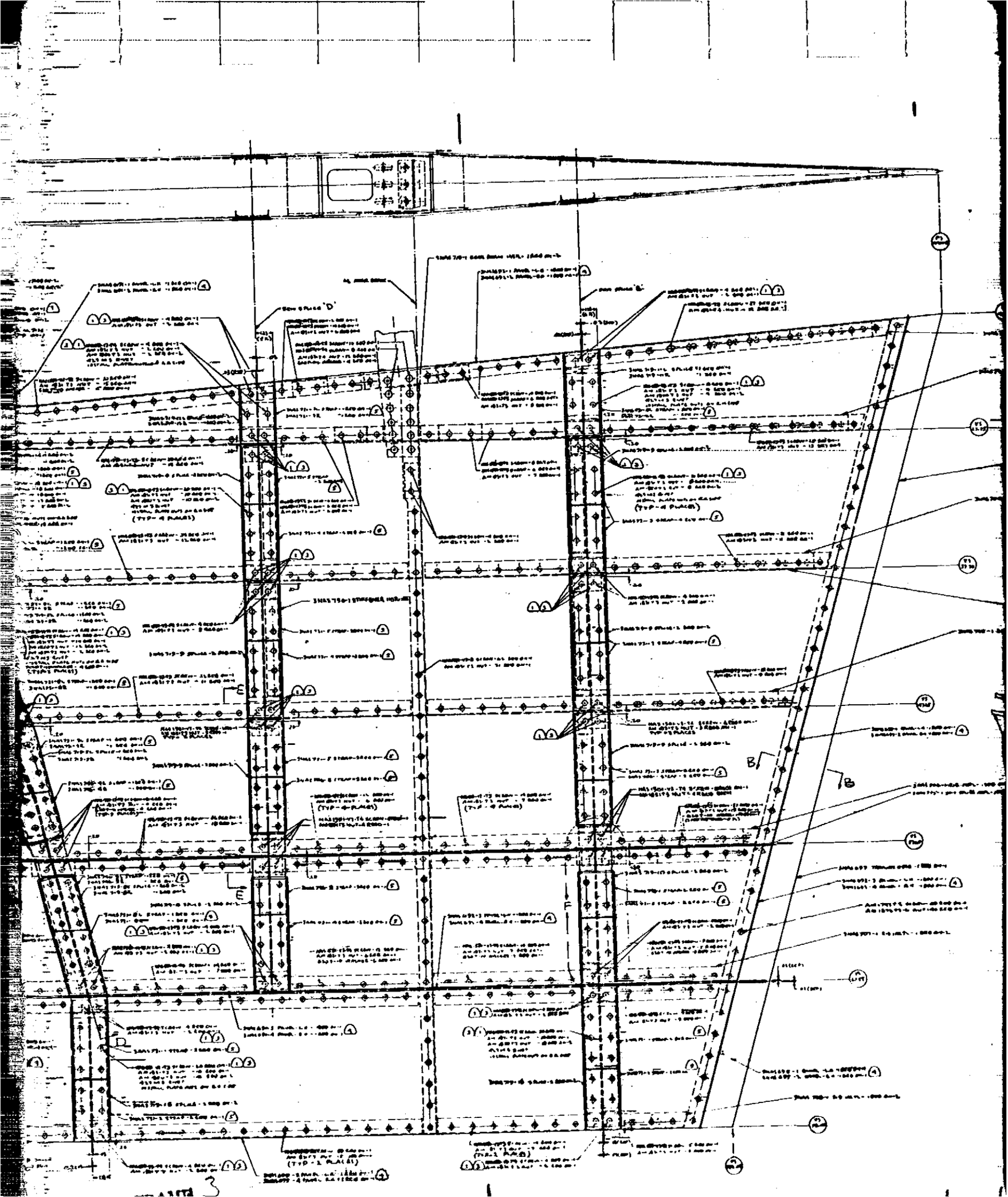


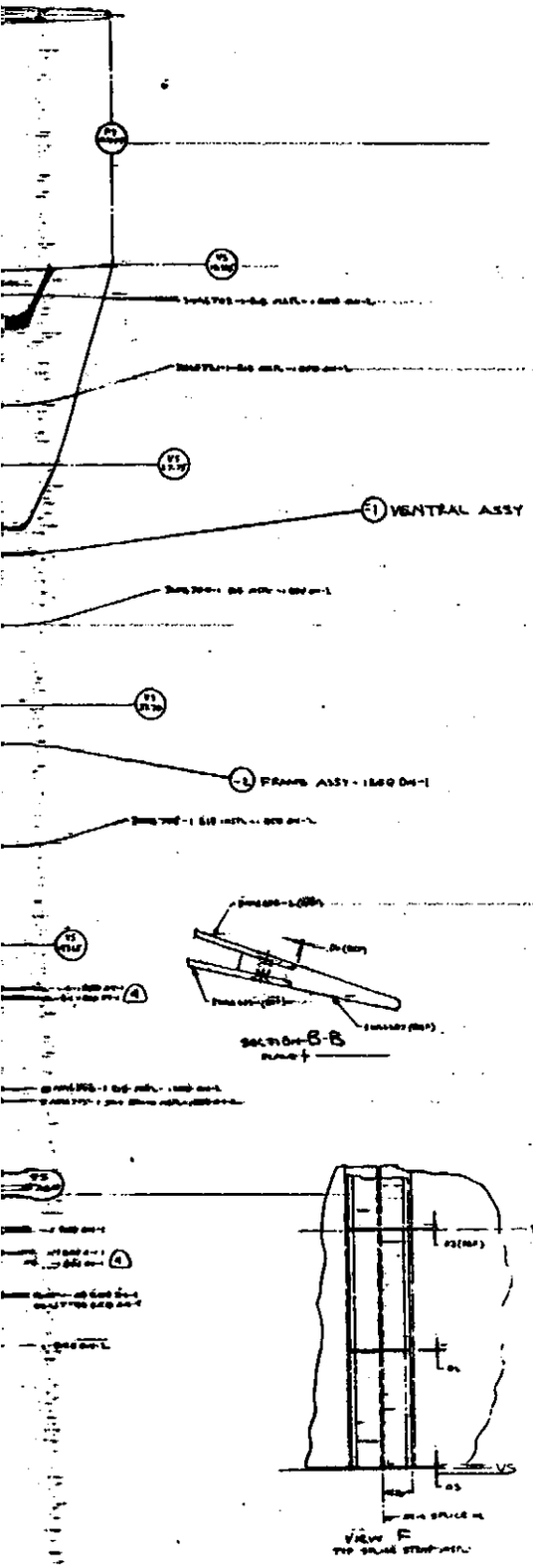
SECTION D-D

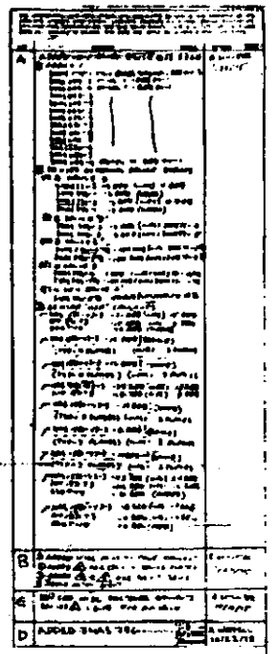








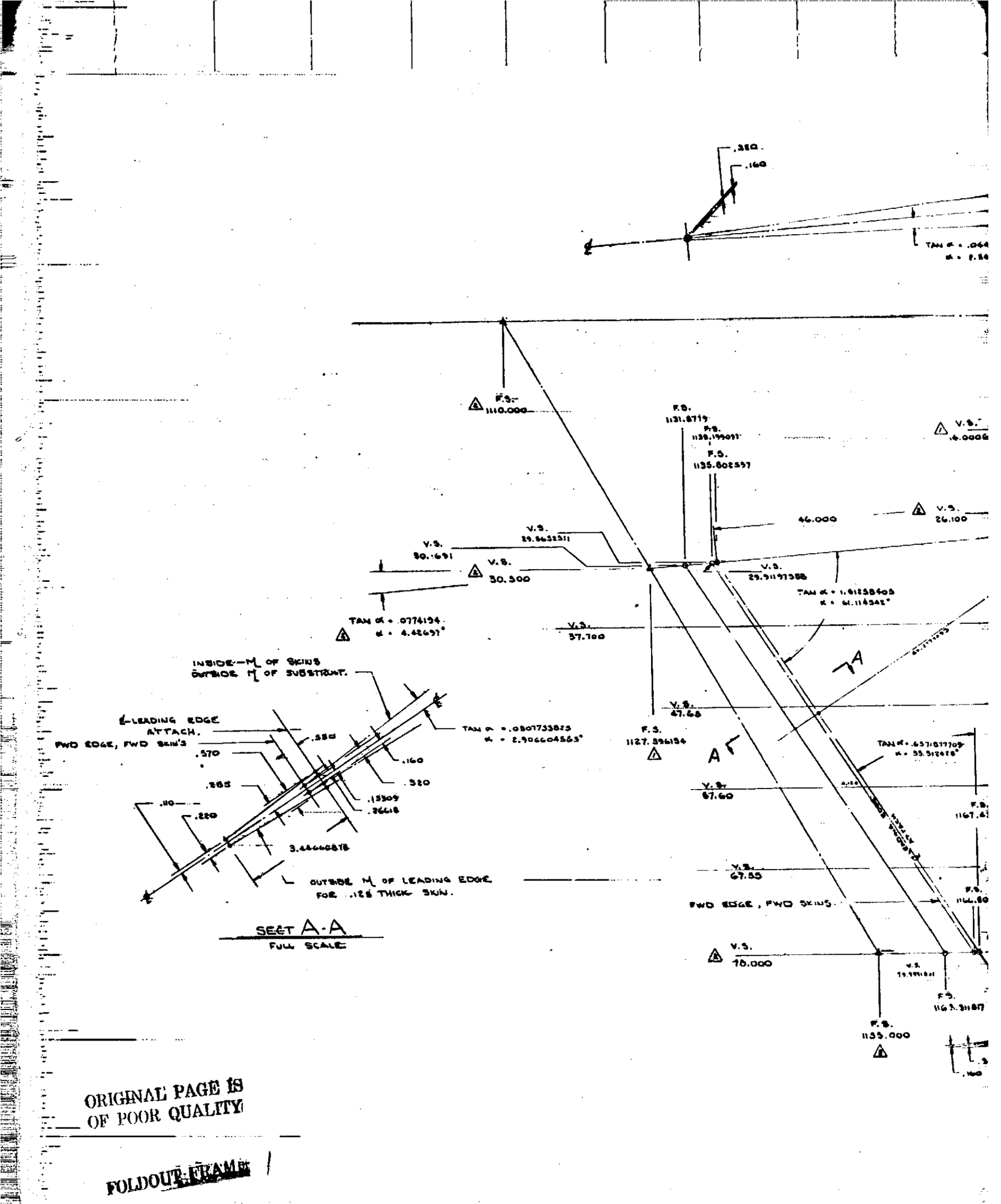



FOLDOUT FRAME

FIGURE 1



VENTRAL ASSY
Be-38AL
3NAS 68
D

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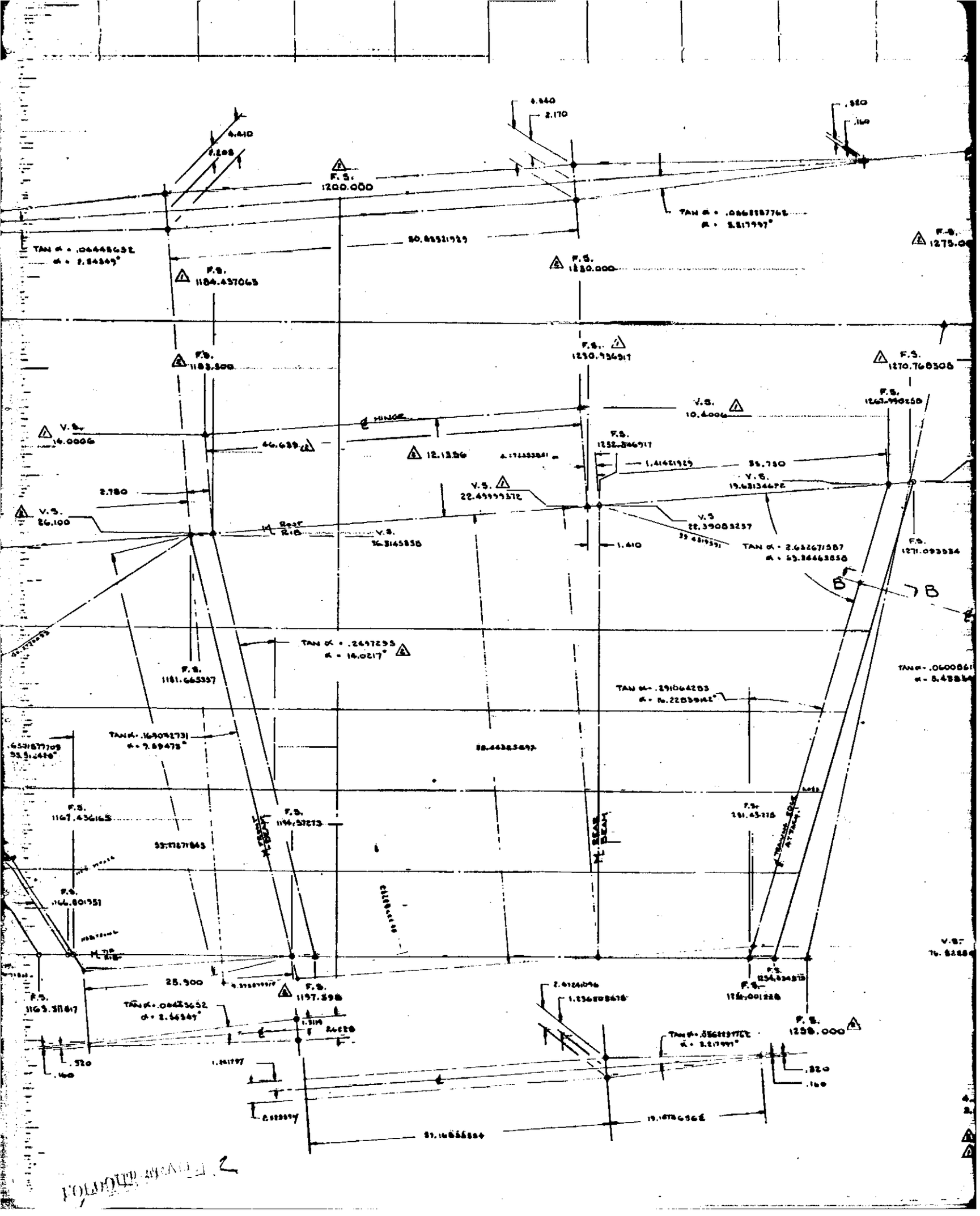
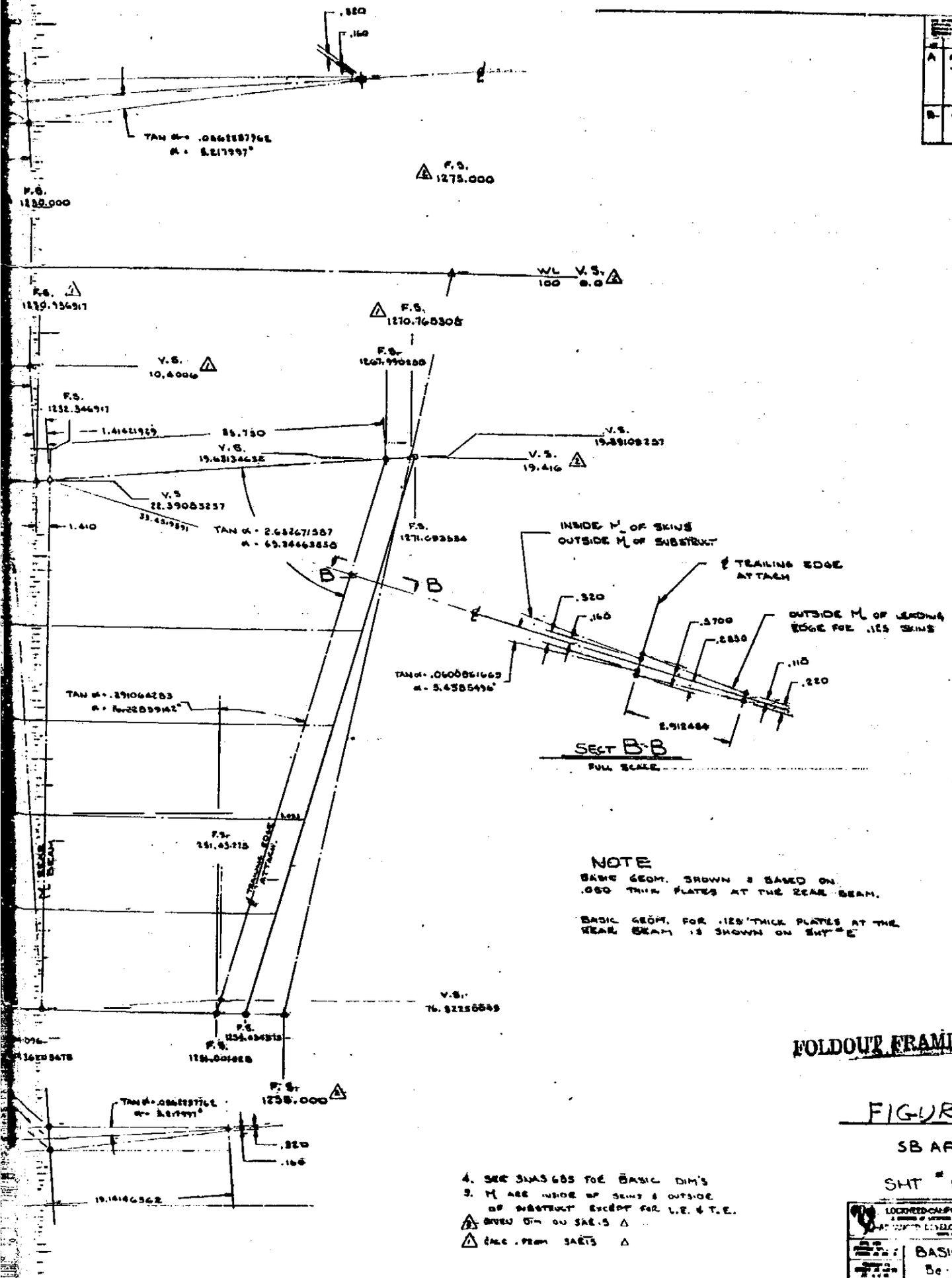
FOLDOUT FRAME 1


F.S. 1200.000
F.S. 1184.437065
F.S. 1183.500
F.S. 1230.934911
F.S. 1270.768508
F.S. 1261.990258
F.S. 1252.846911
F.S. 1275.00
F.S. 1271.093934
F.S. 1181.665337
F.S. 1147.436165
F.S. 1144.537213
F.S. 1166.801951
F.S. 1165.311817
F.S. 1197.398
F.S. 1254.334813
F.S. 1258.000
F.S. 1251.45-218
V.S. 14.0006
V.S. 26.100
V.S. 10.4006
V.S. 22.459995212
V.S. 22.390832237
V.S. 19.631346472
V.S. 16.3145858
TAN ∝ = .06448638
∝ = 3.84849°
TAN ∝ = .0868287765
∝ = 5.217997°
TAN ∝ = .2497295
∝ = 14.0217°
TAN ∝ = .291064283
∝ = 16.22859162°
TAN ∝ = 2.65267/587
∝ = 69.36463858
TAN ∝ = .1690942731
∝ = 9.69478°
TAN ∝ = .0643636.52
∝ = 3.68369°
TAN ∝ = .0868287765
∝ = 5.217997°
46.639
12.1356
1.410
28.900
35.780
2.780
.520
.160
.320
.160
M. Rear
Rib
M. Rear
Beam
M. Rear
Edge
M. Rib
HINGE

| | |
|---|---|
| A | ADDED SHT # 2 FOR .115 THICK PLATES @ REAR BEAM |
| B- | CORRECTED ERRORS ADDED SHT 2 AFT EDGE OF SKINS |

PAGE E-7




NOTE

BASIC GEOM. SHOWN IS BASED ON .060 THICK PLATES AT THE REAR BEAM.

BASIC GEOM. FOR .125" THICK PLATES AT THE REAR BEAM IS SHOWN ON SHT # E

FOLDOUT FRAME

FIGURE 2

SB AF 658X

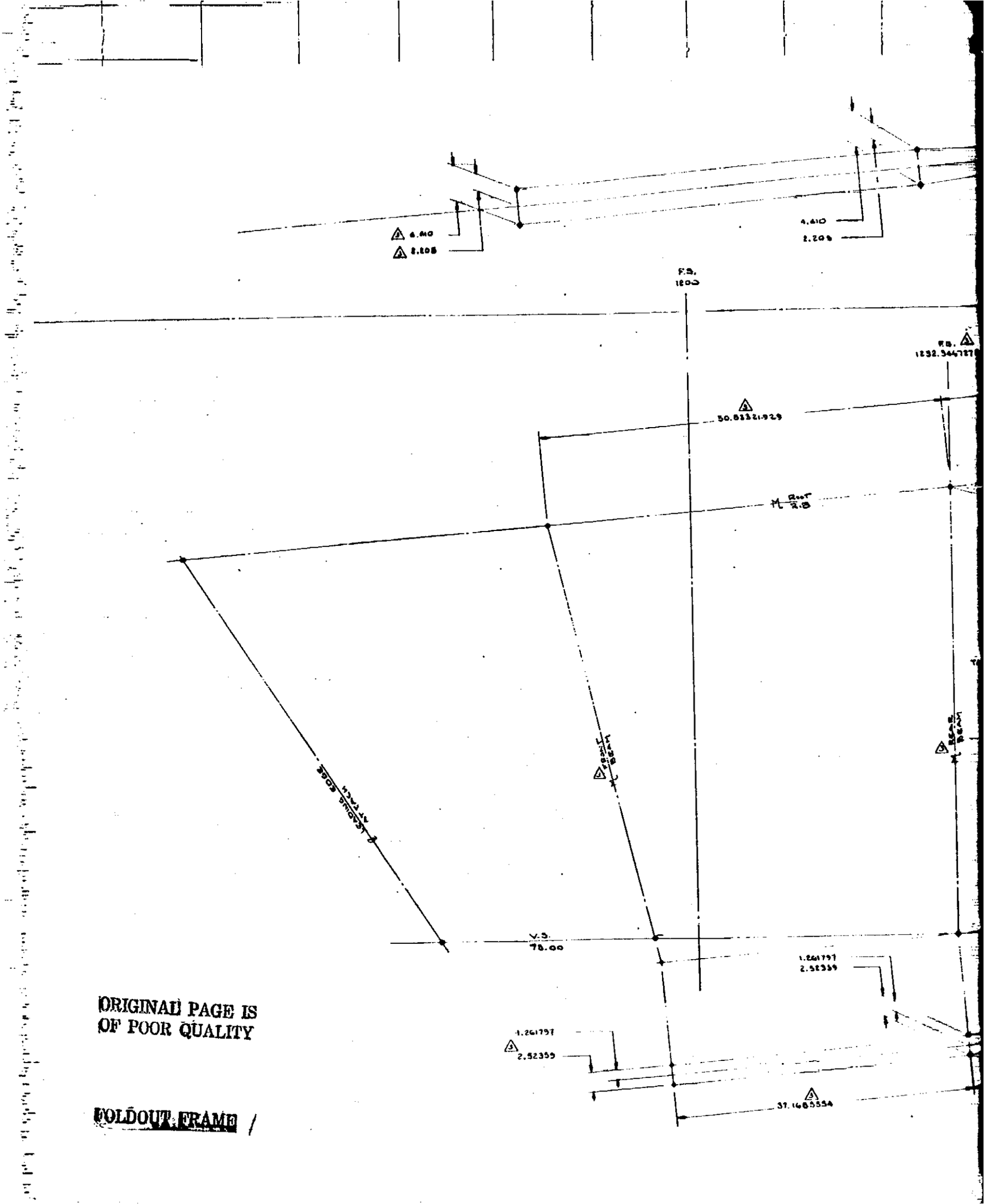
SHT # 1 OF 2

4. SEE 3NAS 685 FOR BASIC DIM'S
5. M ARE INSIDE OF SKINS & OUTSIDE OF SUBSTRUCT EXCEPT FOR L.E. & T.E.

△ GIVEN DIM ON SAE.S △

△ CALC. FROM SHEETS △

| | |
|---|---|
| LOCKHEED-CALIFORNIA COMPANY | |
| BASIC GEOM. | 3NAS673 |
| Be-38AL | |
| VENTRAL FIN | B |

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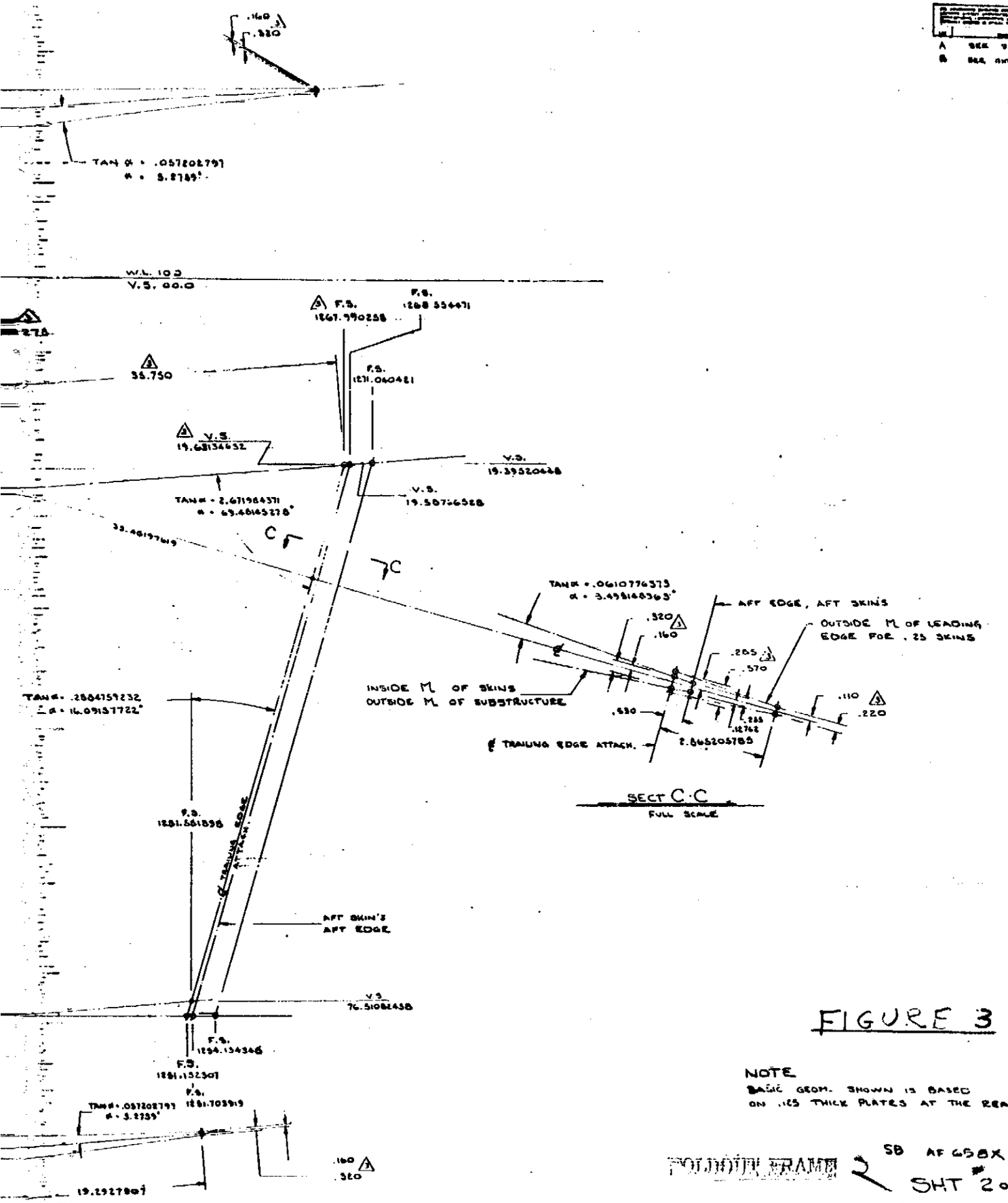



FIGURE 3

NOTE
BASIC GEOM. SHOWN IS BASED ON .125 THICK PLATES AT THE REAR BEAM

FOLDOUT FRAME 2

SB AF 658X
SHT 2 OF 2

△ POINTS & DIM'S COMMON TO SHT 1

NOTE

| | | |
|---|---|---|
| A | SEE SHT 1 | James 9/7/78 |
| B | SEE SHT 1 | James 6/14/79 |

LOCKHEED-CALIFORNIA COMPANY
ADVANCED DEVELOPMENT PROJECTS

BASIC GEOM.
B. 38AL
VENTRAL FIN

SHAS 673 B

# STRUCTURAL MODEL

## DESCRIPTION

The structural model used to calculate internal loads is shown on Figure 4. The NASTRAN program is used. The structural model is for one half of the ventral, from the ventral centerline (Buttline 0) to the left-hand contour, with anti-symmetric constraints at the centerline. Since the model represents only one-half the structure (in this case the left half), one half the total ventral load is applied to the structural model.

The Lockalloy surfaces are modeled as shear panels. Surfaces are also considered 100% effective axially, therefore the total surface area is included with the titanium beam and rib flanges as beam and rib cap areas in the model.

The titanium beams and ribs are modeled as shear panels with axial elements as caps, with effective skin as noted above. Posts at rib-to-beam intersections are modeled as axial elements.

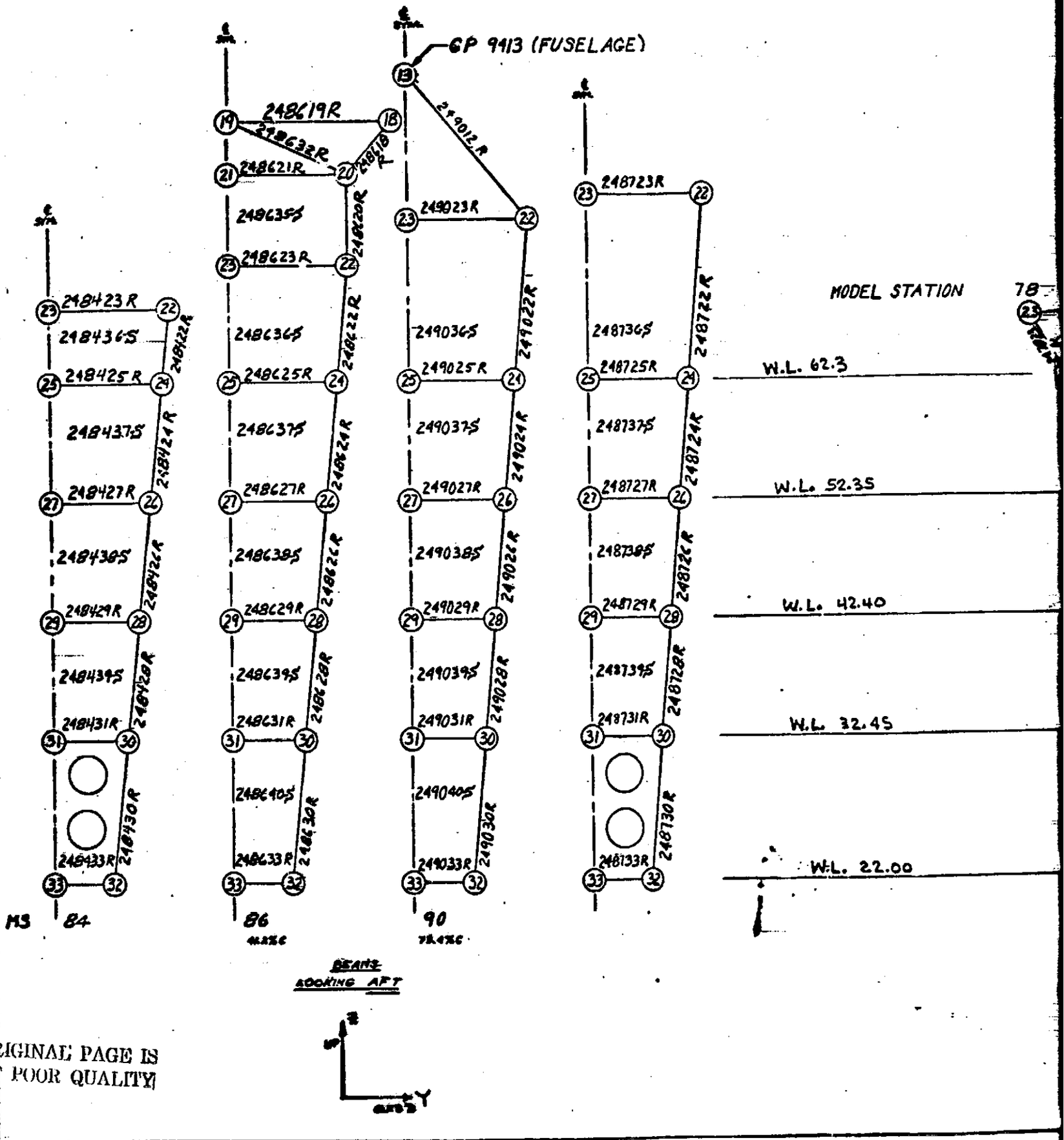
All section properties, gridpoint locations and internal loads are contained in unsubmitted data. Representative internal loads data is plotted on Figures 7 through 13. The total applied loads are listed in the table below. Gridpoint loads or panel pressures used to represent these applied loads are given on Pages 11-13.

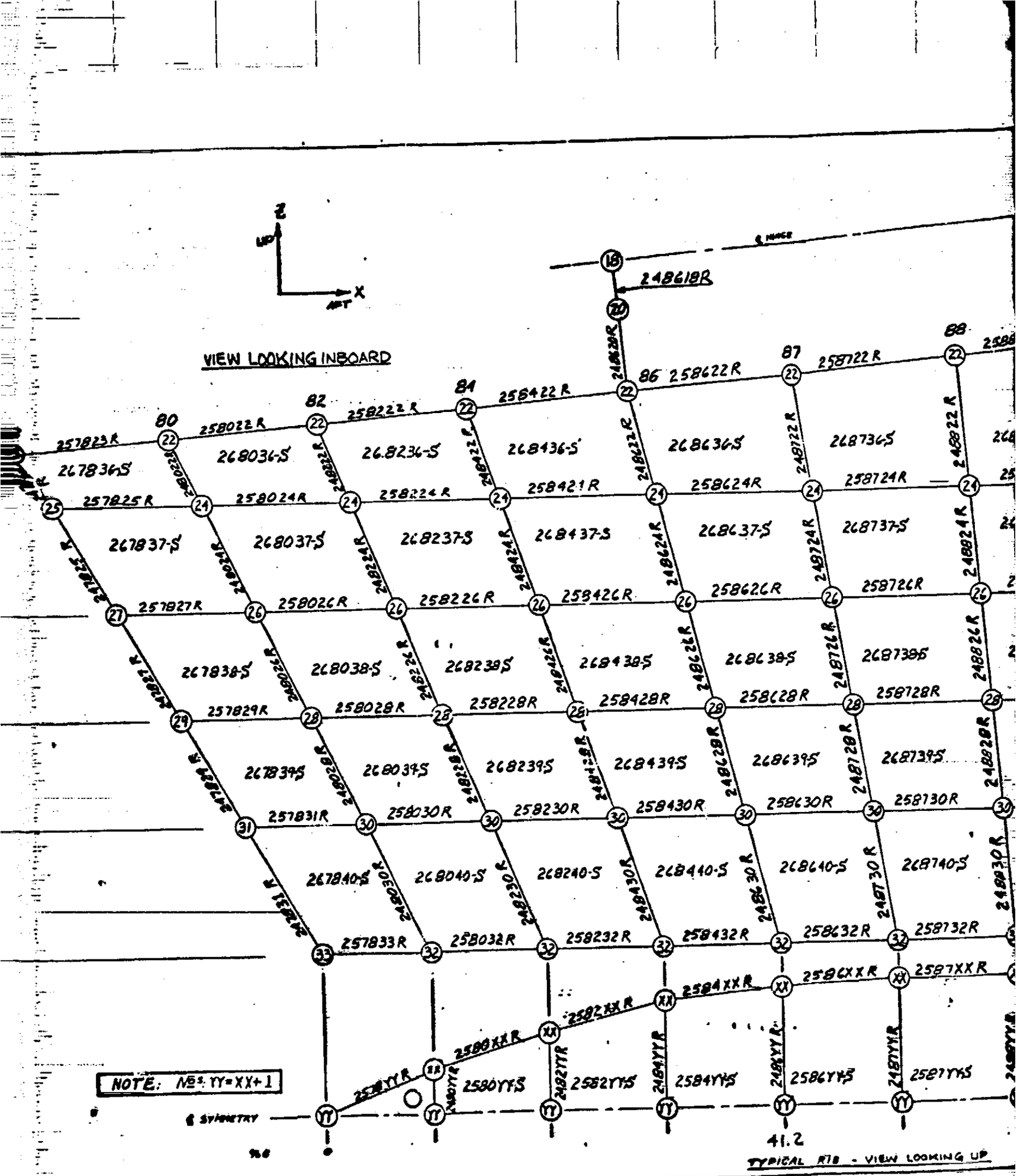
| TOTAL VENTRAL APPLIED LOAD (ULTIMATE) | | | | |
|---|---|---|---|---|
| CASE NO. | CONDITION | $P_Y$ LB. | C.P. | TEMP. |
| 1 | CRUISE | 6,685 | 47.2% | 550°F |
| 2 | FWD. C.P. | 6,822 | 15.0% | R.T. |
| 3 | AFT C.P. | 6,207 | 71.1% | R.T. |
| 4 | ARB. FWD C.P. | 4,695 | 5.0% | R.T. |

## STRUCTURAL MODEL

This essentially represents the following basic loads:

| CASE NO. | $P_y$ (ULT.) | C.P. |
|---|---|---|
| 1 | 6,600 | 47.2% |
| 2 | 6,822 | 15.0% |
| 3 | 6,192 | 72.0% |
| 4 | 4,695 | 5.0% |




Z
UP
X
AFT
VIEW LOOKING INBOARD
80
82
84
86
87
88
257823R
258022R
258222R
258422R
258622R
258722R
257825R
258024R
258224R
258421R
258624R
258724R
257827R
258026R
258226R
258426R
258626R
258726R
257829R
258028R
258228R
258428R
258628R
258728R
257831R
258030R
258230R
258430R
258630R
258730R
257833R
258032R
258232R
258432R
258632R
258732R
248618R
NOTE: Nos. YY=XX+1
℄ SYMMETRY
41.2
TYPICAL RIB - VIEW LOOKING UP

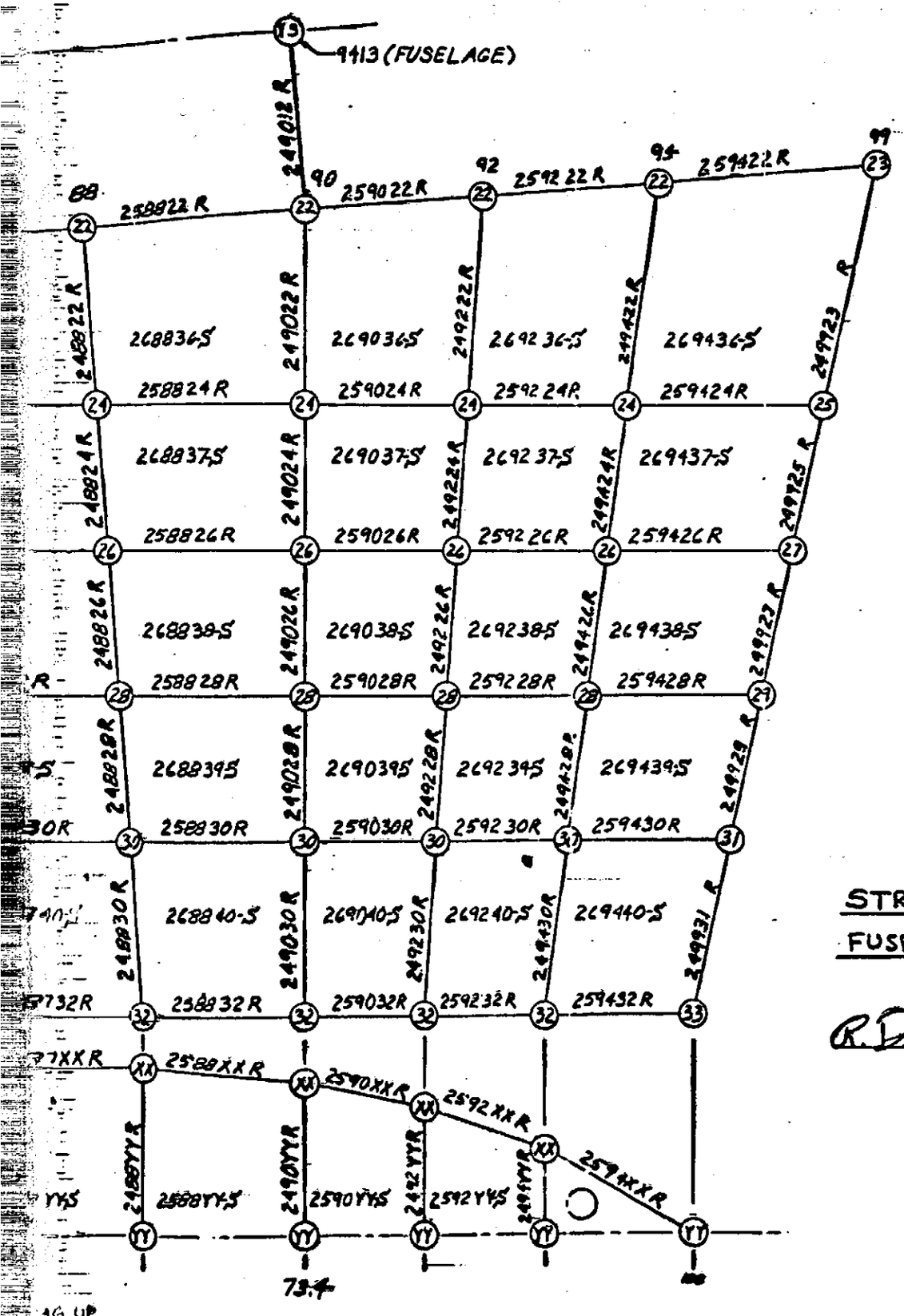



FIGURE 4

STRUCTURAL MODEL
FUSELAGE VENTRAL

R. Deming 11 July 1975

STRUCTURAL MODEL

## GRIDPOINT LOADS [A] (ULT.)

| CASE | | | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|---|
| CONDITION | | | ENG. FAIL. CRUISE | LAT. GUST @ M .95 | AIL. DEFL. @ M .95 | ARB. SIDE LOAD |
| TOTAL VENTRAL SIDE LOAD (ULT) | | | 6684 | 6822 | 6207 | 4695 |
| @ PER CENT CHORD | | | 44.5 | 15 | 71.1 | 5 |
| GRIDPOINT | FUS. STA. | WATERLINE | | | | |
| 7825 | 1139.417 | 62.30 | APPLIED AS SURFACE PRESSURE. SEE PAGE 12 | 590.7 | APPLIED AS SURFACE PRESSURE. SEE PAGE 13 | 332.4 |
| 27 | 1145.956 | 52.35 | | 178.2 | | 356.6 |
| 29 | 1152.495 | 42.40 | | 197.0 | | 334.0 |
| 31 | 1159.034 | 32.45 | | 194.6 | | 314.7 |
| 33 | 1165.902 | 22.00 | | 166.6 | | 153.0 |
| 80 24 | 1151.267 | 62.3 | | 428.5 | | 162.6 |
| 26 | 1156.455 | 52.35 | | 274.5 | | 154.9 |
| 28 | 1161.643 | 42.40 | | 223.0 | | 126.4 |
| 80 | 1166.830 | 32.45 | | 145.4 | | 105.3 |
| 32 | 1172.279 | 22.00 | | 13.0 | | 49.5 |
| 8224 | 1163.118 | 62.3 | | 125.1 | | |
| 26 | 1166.954 | 52.35 | | 103.2 | | 2.7 |
| 28 | 1170.790 | 42.4 | | 106.7 | | 7.7 |
| 30 | 1174.627 | 32.45 | | 83.5 | | 12.9 |
| 32 | 1178.656 | 22.0 | | 16.5 | | 8.0 |
| 84 26 | 1177.453 | 52.35 | | -.5 | | |
| 86 24 | 1187.308 | 62.3 | | 146.2 | | 148.1 @ G.P. 7823, F.S. 1134.299, W.L. 70.018 |
| 26 | 1189.793 | 52.35 | | 62.6 | | |
| 28 | 1192.278 | 42.4 | | 57.2 | | |
| 30 | 1194.693 | 32.45 | | 45.8 | | |
| 32 | 1197.373 | 22.0 | | 22.8 | | |
| 8724 | 1199.705 | 62.3 | | 32.0 | | 78.4 @ G.P. -8022, F.S. 1146.968 W.L. 70.999 |
| 26 | 1202.190 | 52.35 | | 23.4 | | |
| 28 | 1204.675 | 42.40 | | 23.1 | | |
| 30 | 1207.160 | 32.45 | | 16.4 | | |
| 32 | 1207.160 | 22.0 | | 5.3 | | |
| 88 24 | 1220.571 | 62.3 | | 3.2 | | |
| 26 | 1220.571 | 52.35 | | 3.8 | | |
| 28 | 1220.571 | 42.4 | | 3.1 | | |
| 30 | 1220.571 | 32.45 | | 2.8 | | |
| 32 | 1220.571 | 22.00 | | 1.4 | | |
| 90 24 | 1230.937 | 62.3 | | 51.3 | | |
| 26 | 1230.937 | 52.35 | | 22.2 | | |
| 28 | 1230.937 | 42.4 | | 20.9 | | |
| 30 | 1230.937 | 32.45 | | 15.2 | | |
| 32 | 1230.937 | 22.00 | | 6.6 | | |

A -- THESE LOADS ARE ½ THE TOTAL LOAD APPLIED TO THE VENTRAL. SINCE THE MODEL REPRESENTS ½ THE STRUCTURE, THE INTERNAL LOADS ARE 100% OF ULTIMATE.

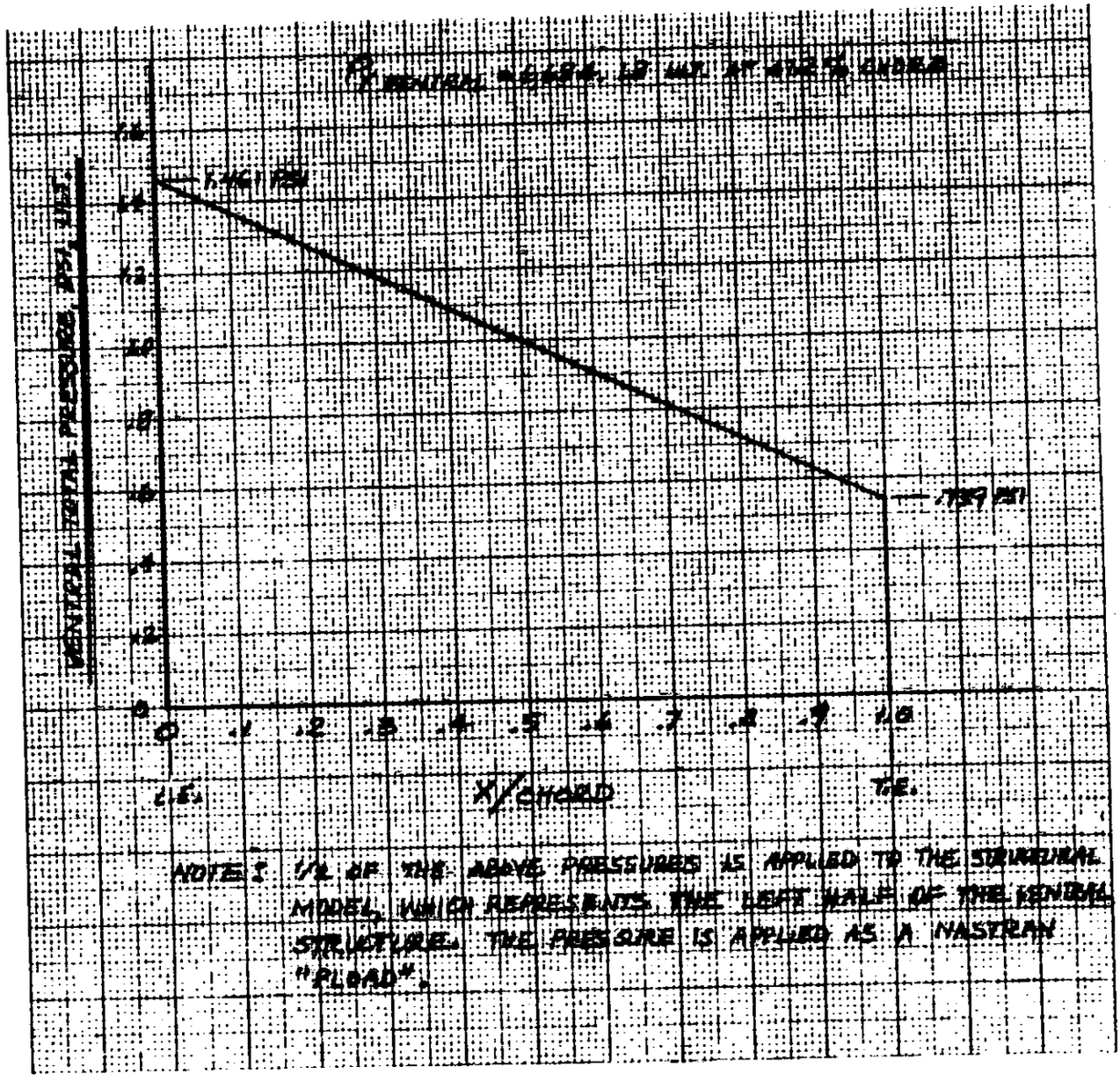





FIGURE 5 STRUCTURAL MODEL PRESSURE DISTRIBUTION
CASE 1 CRUISE MACH - ENGINE FAILURE

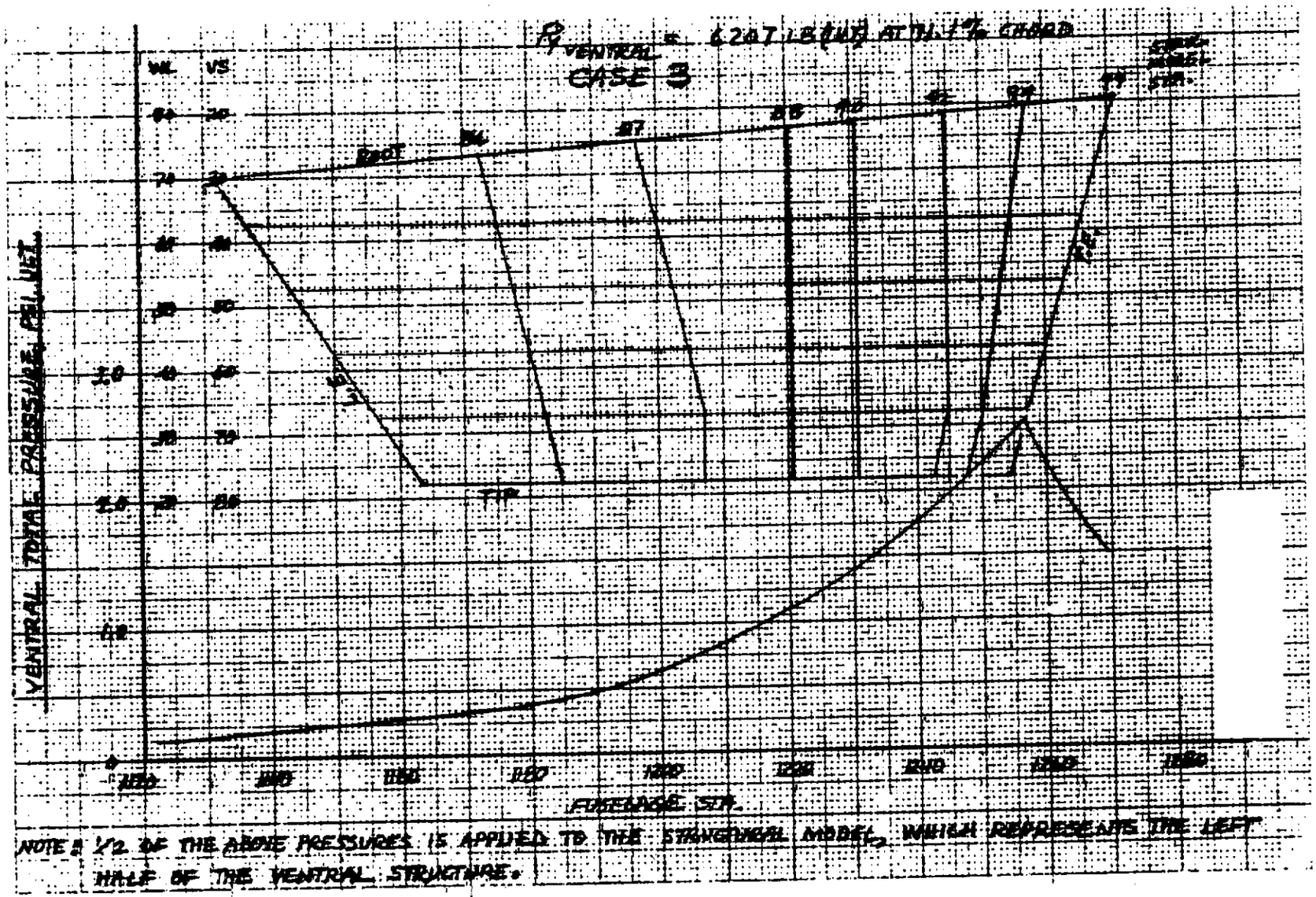



FIGURE 6 STRUCTURAL MODEL PRESSURE DISTRIBUTION
14° (TOTAL) AILERON DEFLECTION AT M = .95

## STRESS ANALYSIS

The ventral carries most of the internal loads in the surface skins which are of heavy gauge Lockalloy material. The relatively light titanium substructure, in the main, provides stabilization and support for the surfaces as well as splicing the surface panels which are relatively small. The surface panels are designed to be nonbuckled at ultimate load; since the skins are so heavy relative to the support structure, buckling stress is considered to be failure stress.

RIBS

ROOT RIB

FROM THE NASTRAN STRESS PLOT OF FIG. 10 THE MAXIMUM SHEAR STRESS IS 9400 psi'. HOWEVER THE PROOF TEST SHOWED A HIGHER MEASURED ROOT RIB WEB SHEAR STRESS

$f_s$ (MEASURED) = 9420 psi (LIM.)

THE RIB WEB IS .063 AND 4.30" DEEP

FOR THIS CONFIGURATION $\sqrt{K}$ = 2.60 (SM 33d FIG. 6)

$$(b/t)e = \frac{4.3}{.063 \times 2.6} = 26.3$$

$F_{scr}$ = 20000 psi'

$$M.S. = 20000/9420 \times 1.5 - 1 = \underline{.41}$$

V.S. 37.7 RIB.

CRITICAL WEB SHEAR IS AT 55 IN. AFT OF THE L.E. AND IS 4900 psi (REF. FIG. 12)

AT THIS POINT WEB IS .050 AND 3.80" DEEP

FOR THIS CONFIGURATION $\sqrt{K}$ = 2.70 (SM33d FIG. 6)

$$(b/t)e = \frac{3.8}{.05 \times 2.7} = 28.1$$

$F_{scr}$ = 17600 psi'

$$M.S. = 17600/4900 - 1 = \underline{HIGH}$$

## LOCKALLOY SURFACE

THE LOCKALLOY SURFACE IS CRITICAL IN BIAXIAL COMPRESSION ADJACENT TO THE FRONT BEAM ROOT FITTING.

ALLOWABLE STRESS FOR PANEL STABILITY IS TAKEN FROM SP-4396 "COMPONENT TESTS FOR LOCKALLOY VENTRAL". THIS REPORT DESCRIBES A COMPRESSION STABILITY TEST OF A BOX WITH PANELS APPROXIMATING THOSE OF THE VENTRAL. ALLOWABLE STRESS FROM THIS TEST IS 21800 PSI (ULT.)

SM 70 Q STATES THAT FOR SQUARE PANELS UNDER BIAXIAL COMPRESSION THE INTERACTION RATIOS ADD DIRECTLY, IE THE TWO STRESSES ADD DIRECTLY FOR MARGIN CALCULATION.

THE FOLLOWING MARGIN OF SAFETY IS QUITE CONSERVATIVE BECAUSE THE PANELS ADJACENT TO THE FRONT BEAM FITTING EACH HAVE A SPANWISE STIFFENER WHICH RAISES THE PANEL BUCKLING STRESS CONSIDERABLY.

CHORDWISE STRESS -
AVERAGE BETWEEN ROOT RIB AND V.S. 37.7 RIB IS USED (FWD C.P. COND.)

$$f_c = \frac{-12000 - 7200}{2} = -9600 \text{ psi} \quad \text{(REF. FIGS. 9 \& 11)}$$

SPANWISE STRESS -

$$f_c = -7300 \text{ psi} \quad \text{(REF. FIG. 7)}$$

$$R_c = \frac{-9600 - 7300}{-21800} = .775$$

LOCKALLOY SURFACE

SHEAR STRESS -

$f_s$ = 3100 psi (REF. FIG. 13.)

b = 9.3, t = .15 (REF. DWG. 3NAS-687)

$\sqrt{K}$ = 3.20 (SM.33e FIG. 10)

$(b/t)_e = \frac{9.3}{3.20 \times .15} = 19.4$

$F_{scr}$ = 18000 psi

$R_s = \frac{3100}{18000} = .172$

INTERACTION FOR COMPRESSION AND SHEAR IN PANELS:

$R_c + R_s^2 = 1$ (SMM-SM 70a Pg. 6)

M.S. = .24

LOCKALLOY SURFACE

REAR BEAM

THE REAR BEAM CAP (LOCKALLOY SURFACE PANELS) STRESSES MEASURED DURING THE PROOF TEST WERE TWICE AS HIGH AS PREDICTED BY NASTRAN FOR THE .711 C.P. CONDITION. INVESTIGATION OF THIS DISPARITY INDICATED THAT THE NASTRAN GRID WAS TOO COARSE IN THIS REGION AND ACCORDINGLY, AN INDEPENDENT ANALYSIS WAS MADE OF THE REAR BEAM. FOR THIS ANALYSIS THE REAR FITTING REACTION AS WELL AS APPLIED EXTERNAL LOADS AND REACTIVE SHEAR FLOWS WERE CONSIDERED AS SHOWN IN FIGURE a. (THE PROOF TEST REAR FITTING REACTION AGREED CLOSELY WITH THAT CALCULATED IN NASTRAN.) EFFECTIVE WIDTHS OF THE SURFACE PANEL ACTING AS THE REAR BEAM CAP WERE CONSIDERED AS SHOWN ON FIGURE b. THE RESULTING STRESS DISTRIBUTION IS IN MUCH BETTER AGREEMENT WITH THE EXPERIMENTAL DATA AS SHOWN ON FIGURE C. A STRESS CURVE OF THE FORM OF FIGURE C IS FAIRED THROUGH THE TEST DATA POINTS AND IS INCLUDED ON FIGURE B. THIS CURVE IS USED FOR THE STRESS ANALYSIS. NOTE THAT THE MEASURED STRESSES WERE TENSION - THEY ARE ASSUMED BY SYMMETRY TO BE EQUAL AND OPPOSITE ON THE OTHER SURFACE.

LOCKALLOY SURFACE

REAR BEAM CAP STRESS ~ .71/C.D. COND.

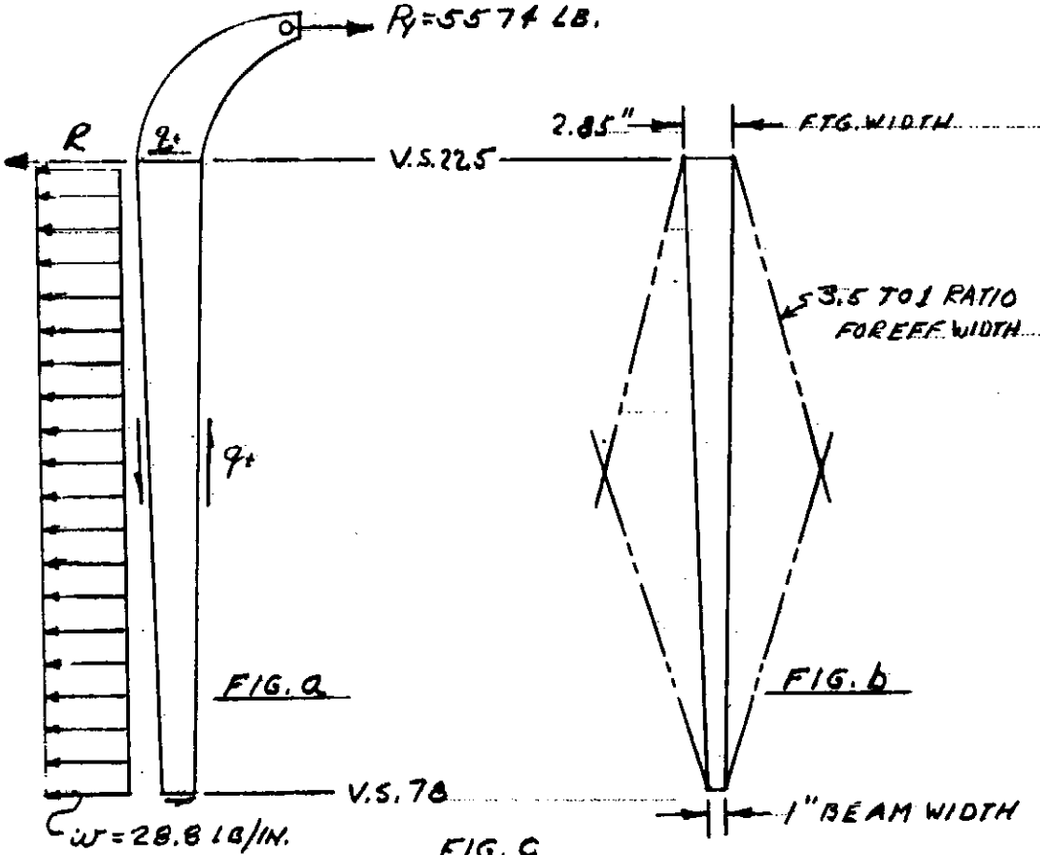
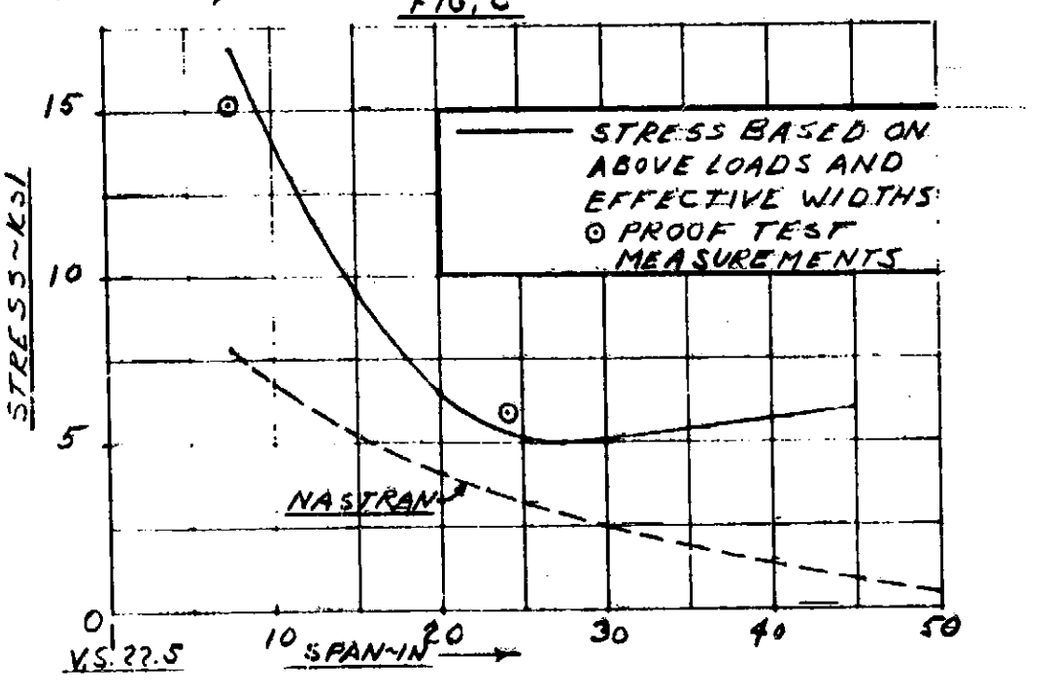



FIG. C



LOCKALLOY SURFACE

REAR BEAM (CONT'D.)

THE PANEL BELOW THE FIRST RIB AND AFT OF THE REAR BEAM IS 10" DEEP BY 12" WIDE AND .125 THICK. (REF. DWG. 3NAS 6-87) THE PEAK STRESS AS MEASURED FROM TEST IS USED FOR ANALYSIS HOWEVER THE RATIO OF PEAK STRESS TO PANEL EDGE STRESS IS DETERMINED FROM THE NASTRAN RESULTS.

FROM NASTRAN

REAR BEAM PEAK STRESS = 7810 PSI
PANEL FORWARD STRESS = 927 PSI
PANEL AFT STRESS = 737 PSI
FWD. & AFT PANEL AVG. = 832 PSI

FOR THE FOLLOWING - REF. SMM SM 33e FIG. 8

$$\alpha = \frac{f_u}{f_u - f_l} = \frac{7810}{7810 - 832} = 1.12$$

$\sqrt{K} = 2.60$ (REF. FIG. 8 SM 33e)

$$(b/t)_e = \frac{12}{.125 \times 2.60} = 37$$

$F_{cr} = 18700$ PSI

AT THE CENTER OF THE PANEL ~10" BELOW N.L. 77.609

$f_c = 13100$ PSI (REF. FIG. 8)

M.S. = 18700/13100 − 1 = .43

LOCKALLOY SURFACE

A SPANWISE PANEL SPLICE IS CHECKED. CRITICAL SPLICE AREA IS ADJACENT TO ROOT RIB AT A DISTANCE OF 40 INCHES FROM THE LEADING EDGE..

THE SPLICE ALLOWABLE LOAD IS TAKEN FROM A COMPRESSION TEST OF A SPLICE SPECIMEN AND REPORTED IN APPENDIX D "COMPONENT TESTS FOR LOCKALLOY VENTRAL." IN THIS TEST THE JOINT FAILURE LOAD WAS 23000 LB. FOR A 10.75 INCH WIDE PANEL

$W_{ALL.} = 23000/10.75 = 2140$ LB/IN.

RIB CAP STRESS = 11,500 psi (REF. FIG. 9)

PANEL SHEAR STRESS = 3200 psi

$11500 \times .15 + 3200 \times .15 = 1790$ LB/IN

M.S. = 2140/1790 − 1 = .20

## THERMAL STRESSES

THE CONSIDERABLE DIFFERENCE IN THE COEFFICIENTS OF EXPANSION OF LOCKALLOY AND TITANIUM WILL INDUCE THERMAL STRESSES AT ELEVATED TEMPERATURES. THESE STRESSES WILL BE GENERALLY LOW IN THE LOCKALLOY PANELS BECAUSE THEY ARE SO MUCH THICKER THAN THE TITANIUM SUBSTRUCTURE. THE HIGHER STRESSES INDUCED IN THE TITANIUM ARE NO PROBLEM BECAUSE OF ITS GREATER STRENGTH. ONE LOCATION WHERE THE TITANIUM SUBSTRUCTURE IS HEAVIER HOWEVER, IS IN THE AREA OF THE FRONT BEAM SPLICE PLATE FITTING. ACCORDINGLY, A MODEL OF THIS AREA WAS SET UP AND A NASTRAN THERMAL ANALYSIS WAS RUN FOR THE SUPERSONIC CONDITION. THE RESULTS OF THIS ANALYSIS ARE PLOTTED ON FIGURE . THE THERMAL STRESSES ARE ADDED TO THE BENDING STRESSES TO CALCULATE A MARGIN OF SAFETY. THE CRITICAL LOCATION IS AT THE END OF THE FITTING WHICH IS 11.3 INCHES BELOW THE ROOT RIB. ABOVE THIS POINT LOAD IS TRANSFERRED OUT OF THE LOCKALLOY PANEL INTO THE FITTING.

THERMAL STRESS = 7800 psi (REF FIG. 14)
BENDING STRESS = 8800 psi (REF. FIG. 7)
@ 600 °F $F_{TU}$ = 28000 psi

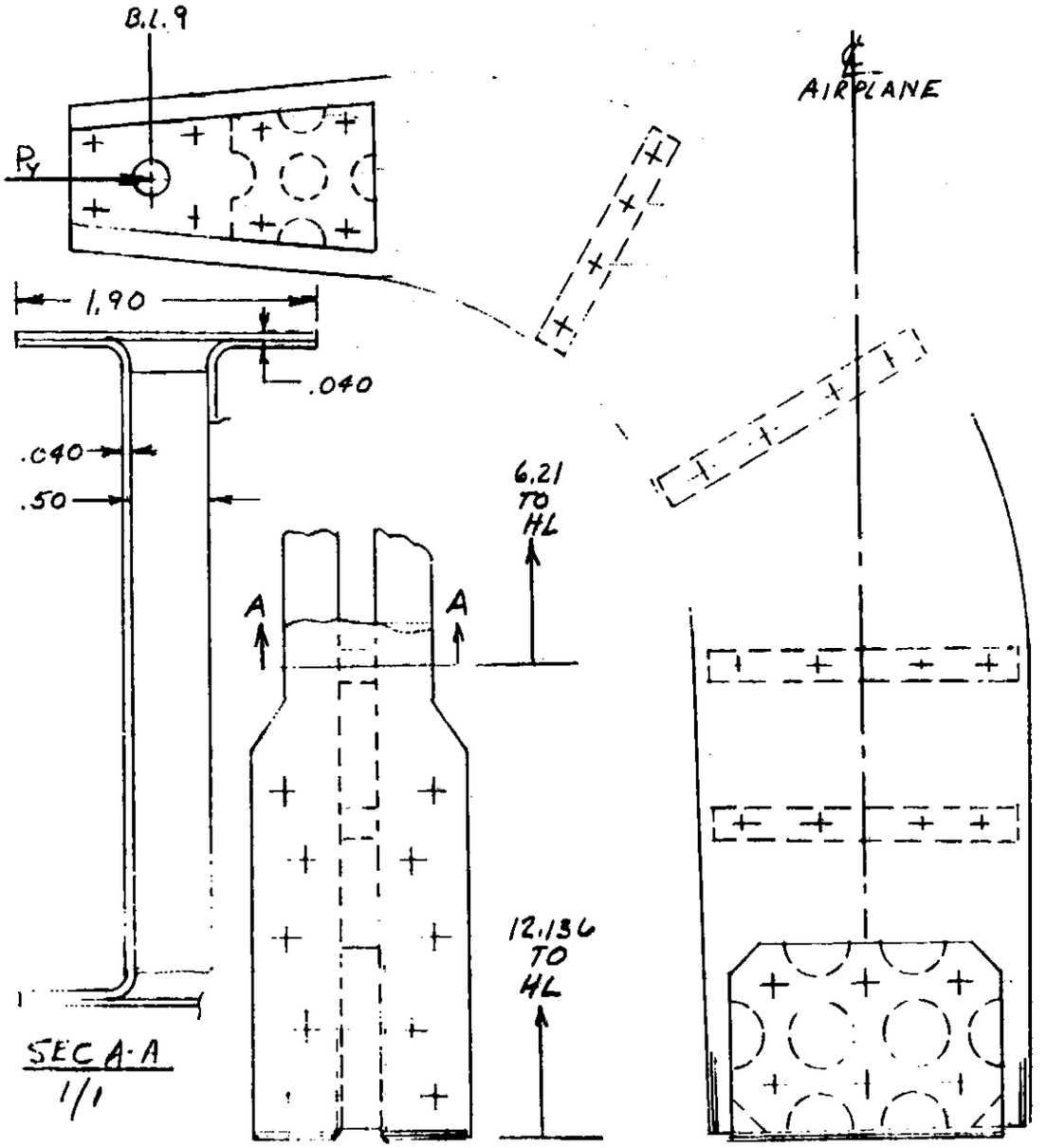
$$M.S. = \frac{28000}{7800+8800} - 1 = .69 \quad (.472 \text{ CP COND.})$$

FRONT BEAM ACTUATOR FITTING

THE VENTRAL ACTUATOR FITTING IS UNCHANGED FROM THE ORIGINAL.

THE LOWEST MARGIN IN THE ORIGINAL ANALYSIS IS 67%. THE SIDE LOAD USED IN THIS ANALYSIS IS 14400 LB. AND THE MAXIMUM SIDE LOAD ON THE FITTING FOR THIS VENTRAL IS 10290 LB. (NASTRAN). THEREFORE THE ORIGINAL ANALYSIS DEMONSTRATES A MORE THAN ADEQUATE STRENGTH LEVEL OF THE ACTUATOR FITTING FOR THE PRESENT VENTRAL.

## REAR HINGE FITTING



## REAR HINGE FITTING

THE MAXIMUM LOAD ON THE REAR HINGE FITTING IS 5574 LB.(ULT.) THIS IS FROM THE NASTRAN PROGRAM – AFT C.P. COND.

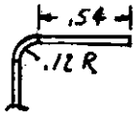
### BENDING ON SEC. A-A

$M = 5574 \times 6.21 = 34615$ IN.-LB.

$I = 1.36$ IN.$^4$

DEPTH AT THIS SECTION IS 4.28"

$f_b = \frac{34615 \times 2.12}{1.36} = 53959$ psi (REF SM 126a)




| b | t | A | b/t | $F_c$ | $F_c \cdot A$ |
|---|---|---|---|---|---|
| .54 | .04 | .022 | 13.5 | 17200 | 378 |
| .14 | .04 | .009 | 3.5 | 51500 | 464 |
| | | .031 | | | 842 |

MCF = 2.123 (SM 126a TABLE I)

$F_{cc} = \frac{842 \times 2.123}{.031} = 57663$ psi

$M.S. = 57663/53959 - 1 =$ .07

### ATTACHMENT TO REAR BEAM

LOAD AT ROOT OF FITTING

$P = \frac{5574 \times 12.136}{4.25} = 15917$ LB.

ATTACHMENT CONSISTS OF 10 3/16 SCREWS CSK. IN .060 B120 ANN.

$P_{ALL} = 10 \times 1775 = 17750$ LB.

$MS = 17750/15917 - 1 =$ .12

## STRESS PATTERNS

The following pages contain plots of ventral element stresses.

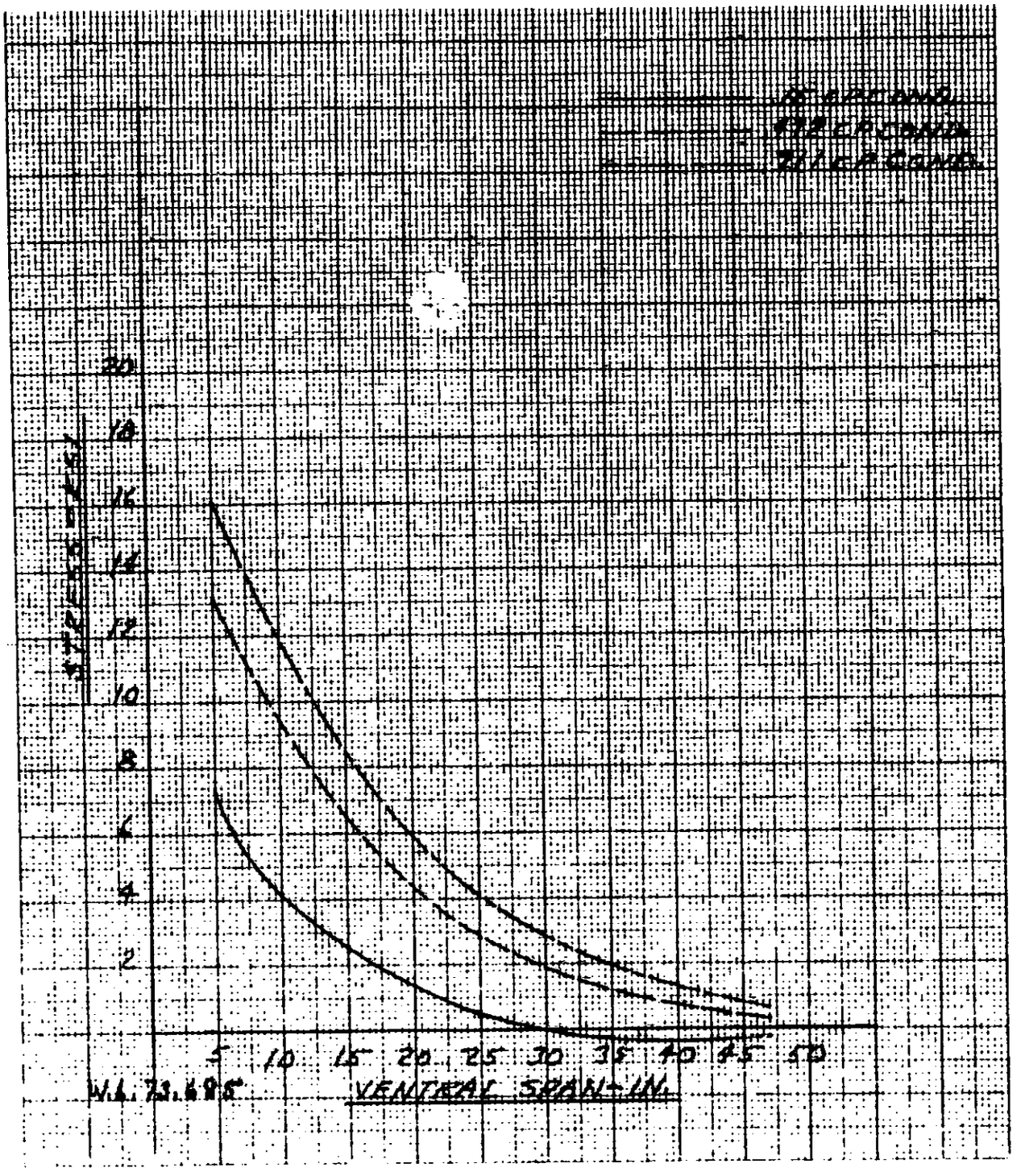



FIGURE 7 FRONT BEAM CAP STRESSES

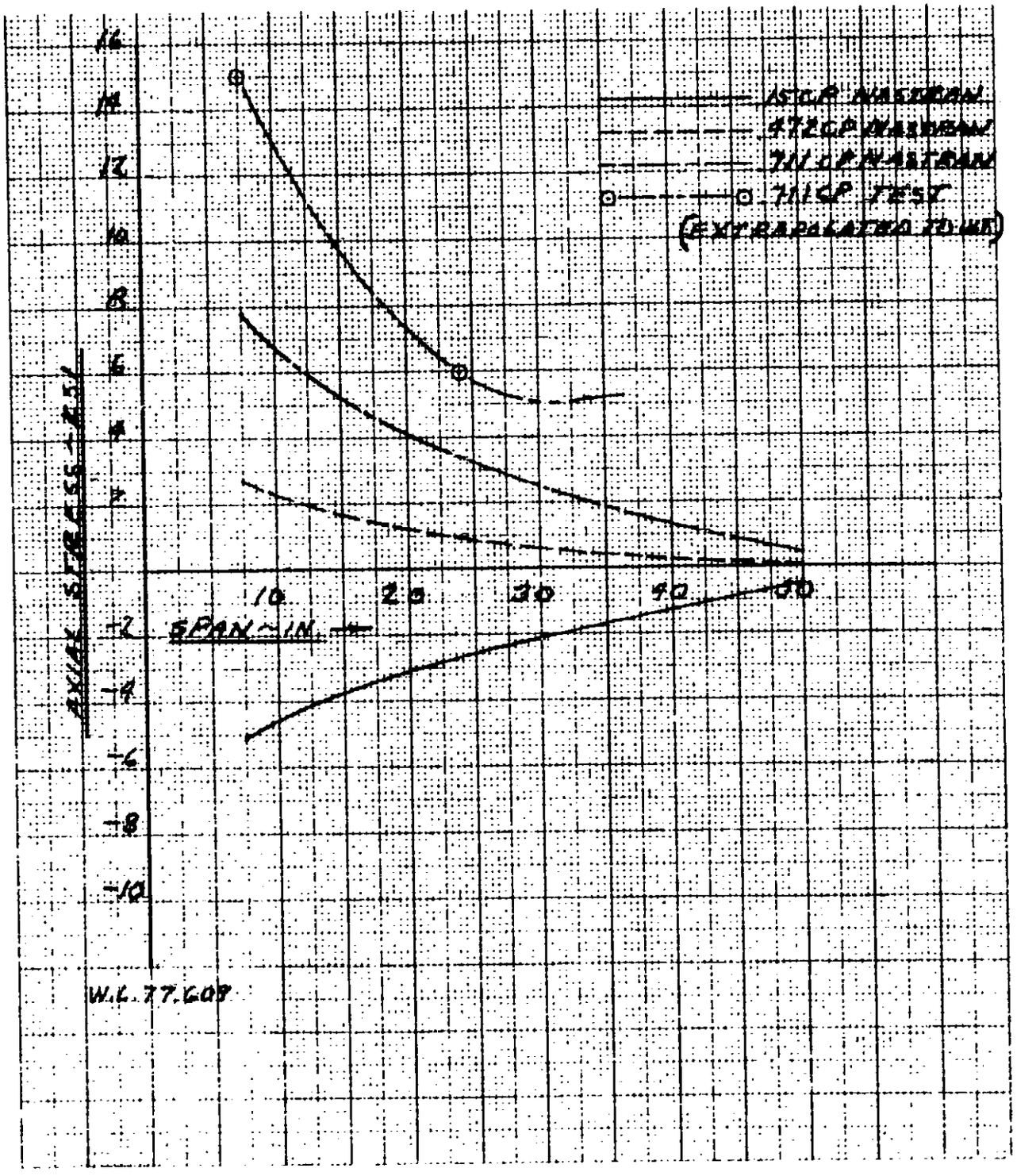



FIGURE 8 REAR BEAM CAP STRESSES (ULTIMATE)

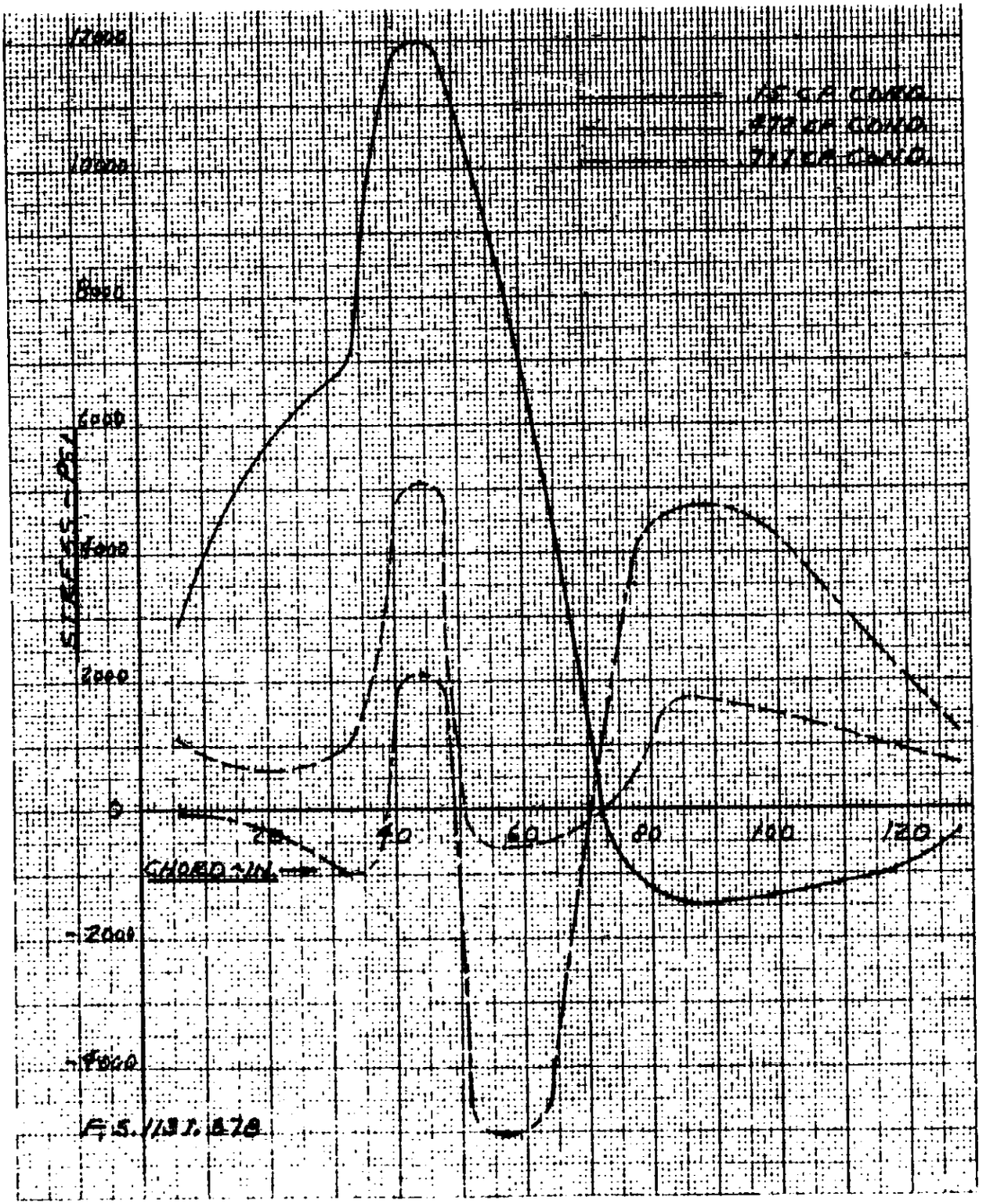



FIGURE 9 ROOT RIB CAP STRESSES

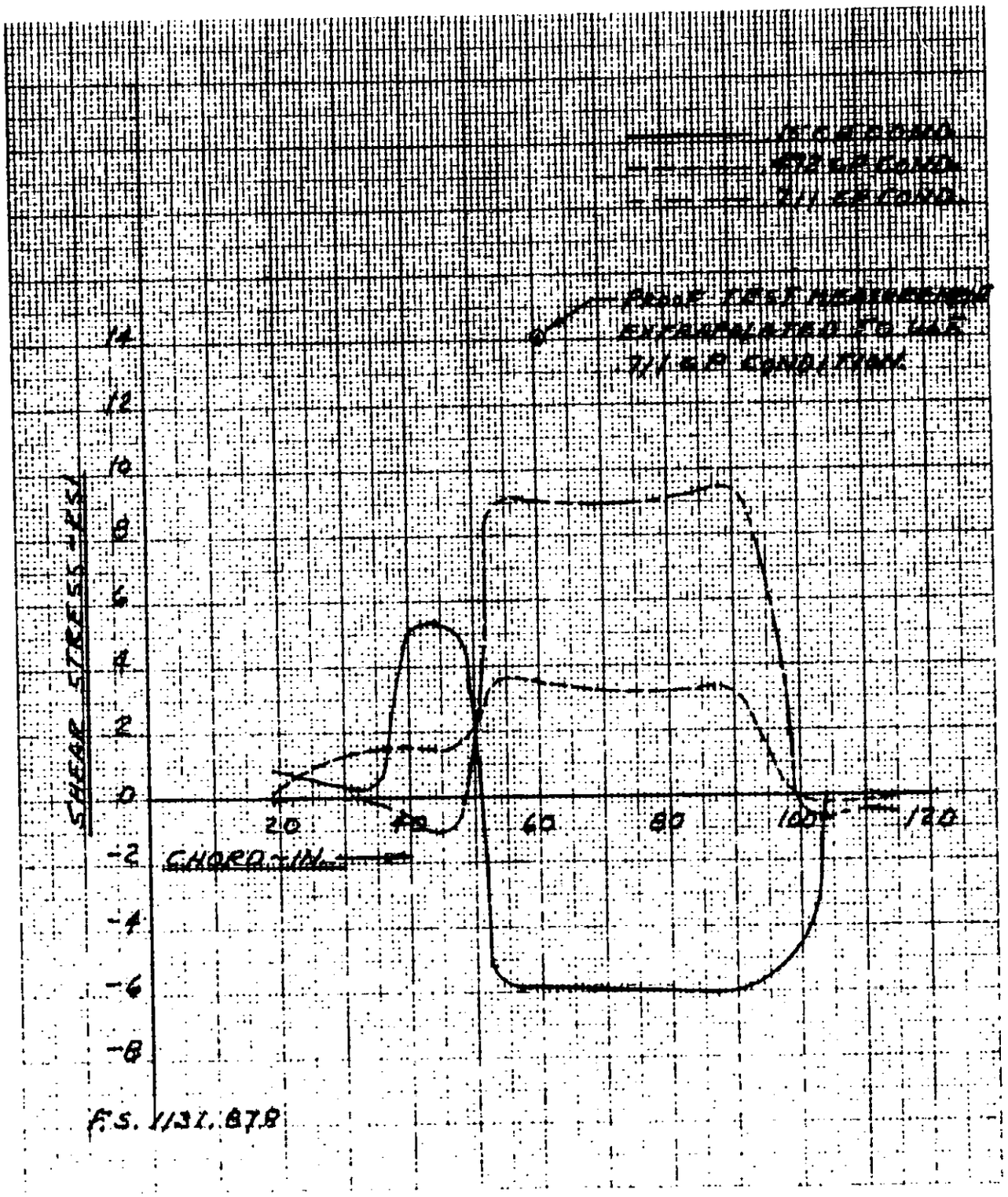





FIGURE 19 RIB WEB SHEAR STRESSES-ROOT RIB

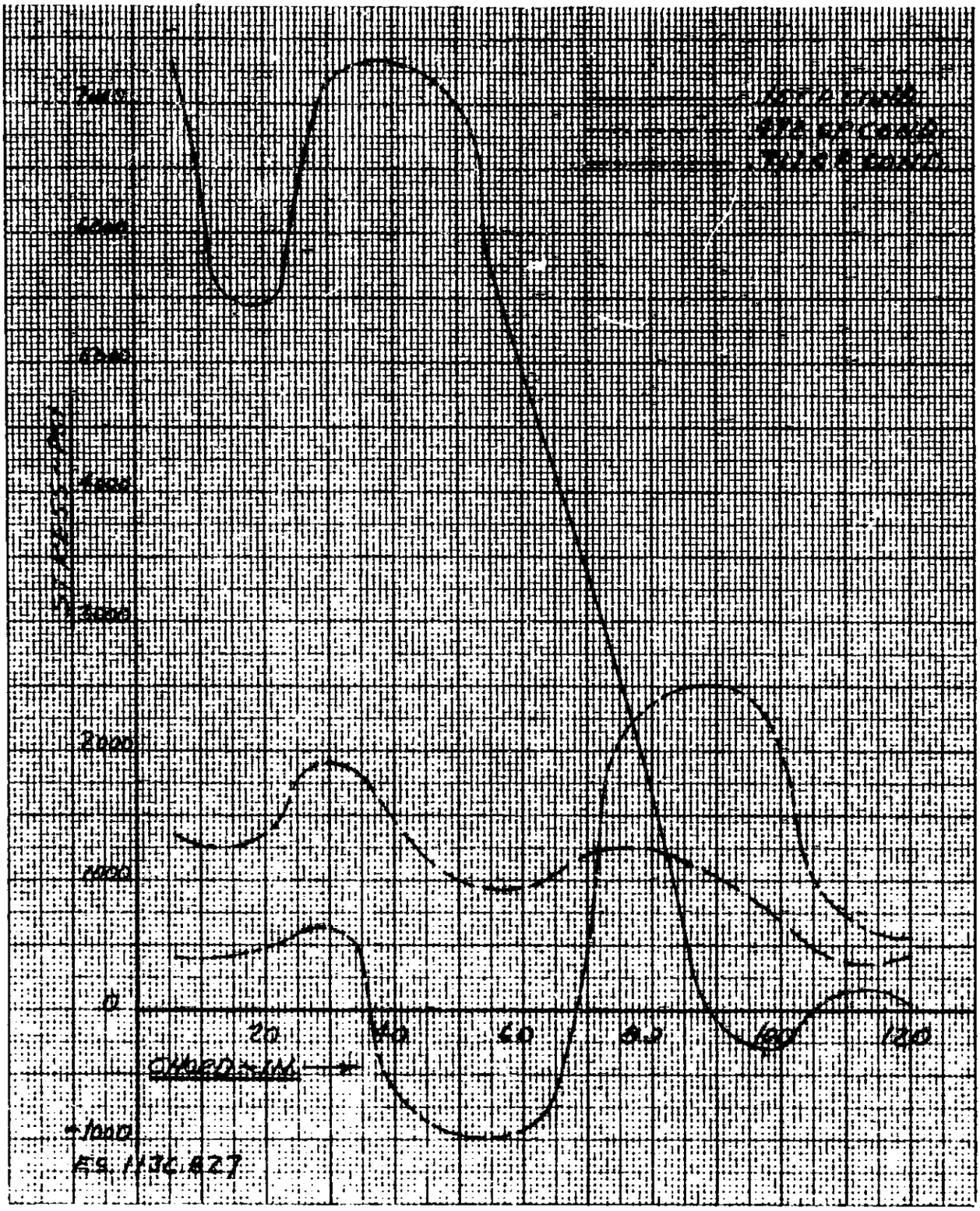



FIGURE 11 V.S. 37.7 RIB CAP STRESSES

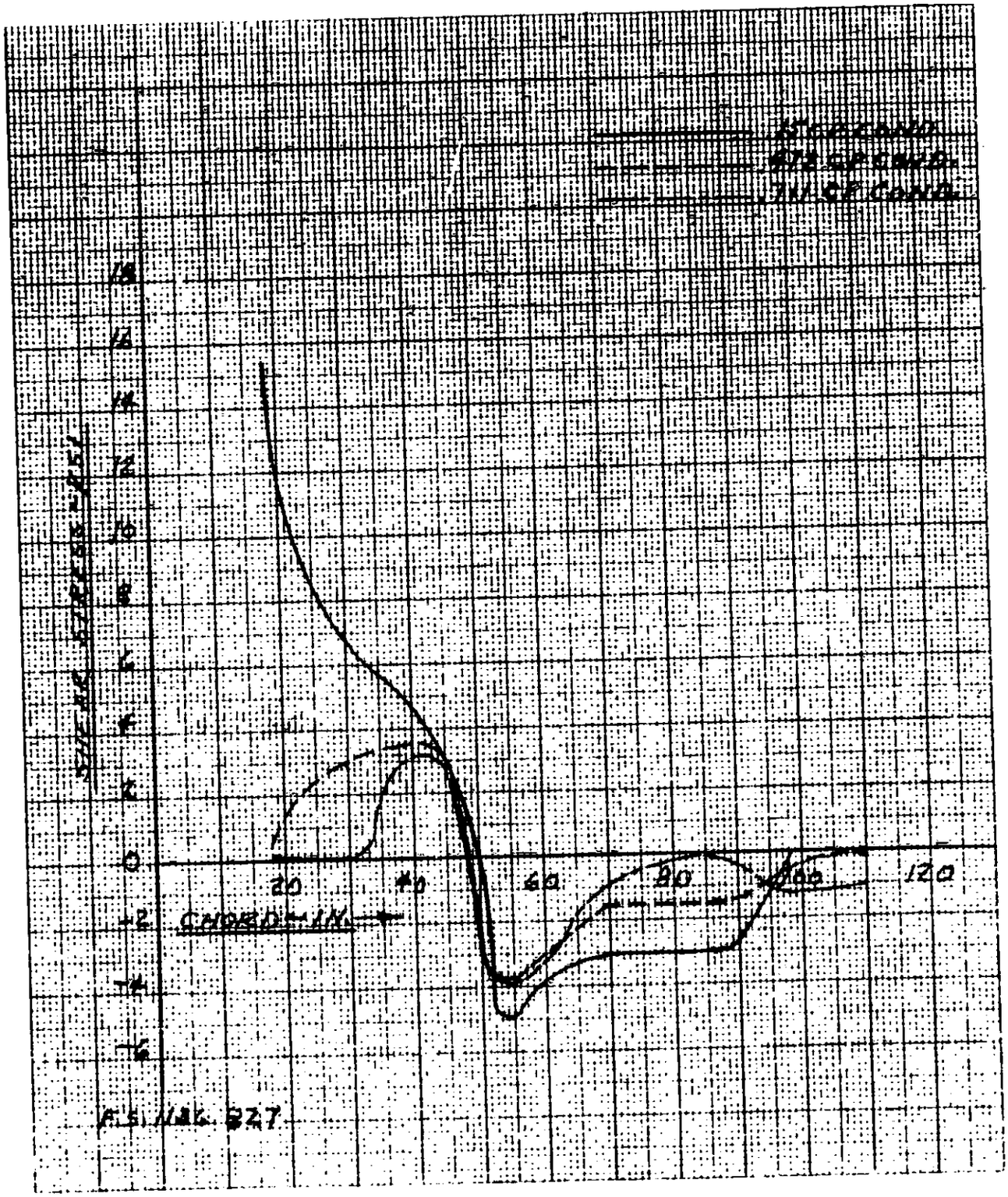



FIGURE 12 V.S. 37.7 RIB WEB SHEAR STRESSES

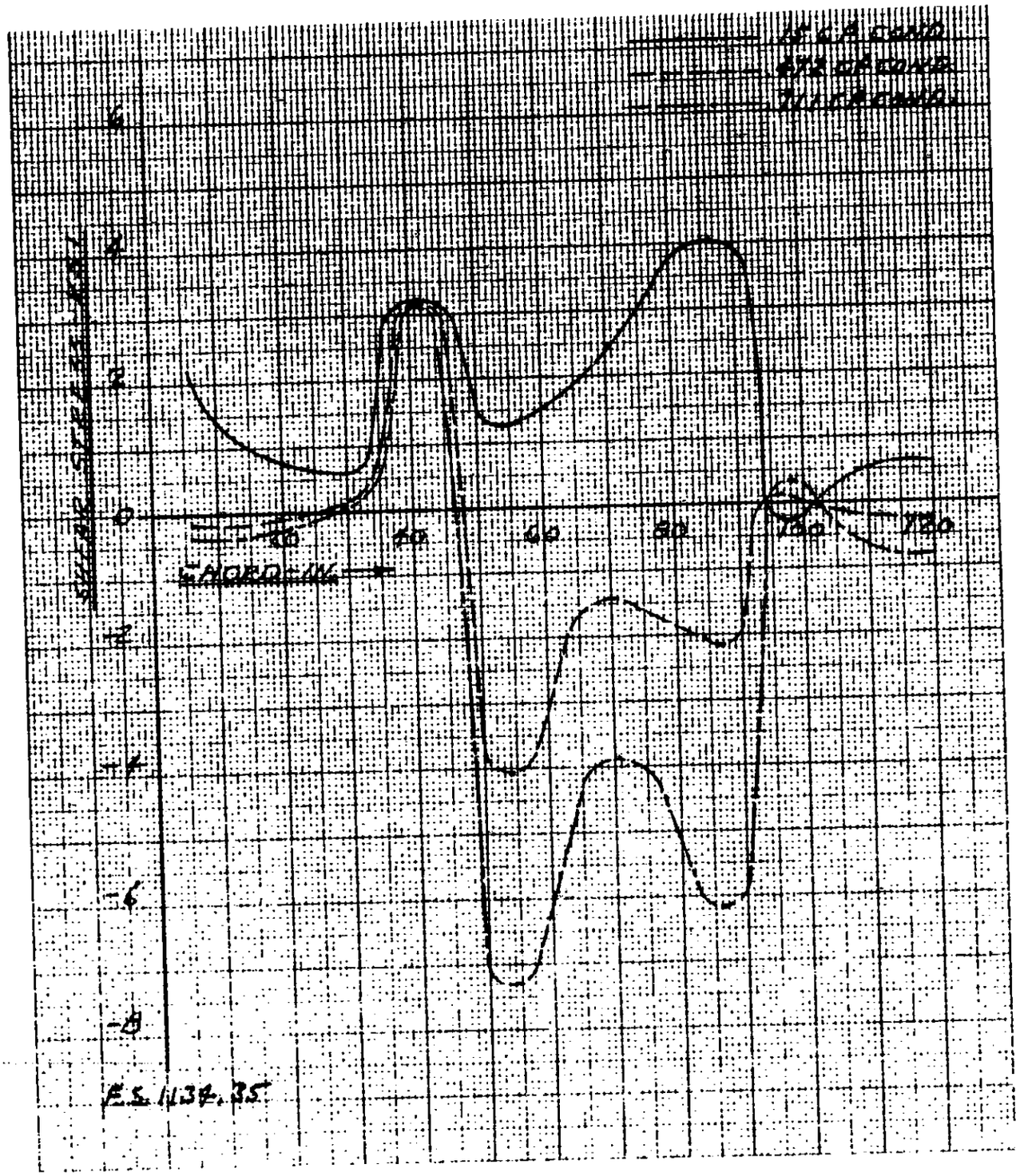



FIGURE 13 SHEAR STRESSES IN SURFACE PANELS BETWEEN ROOT RIB AND V.S. 37.7 RIB

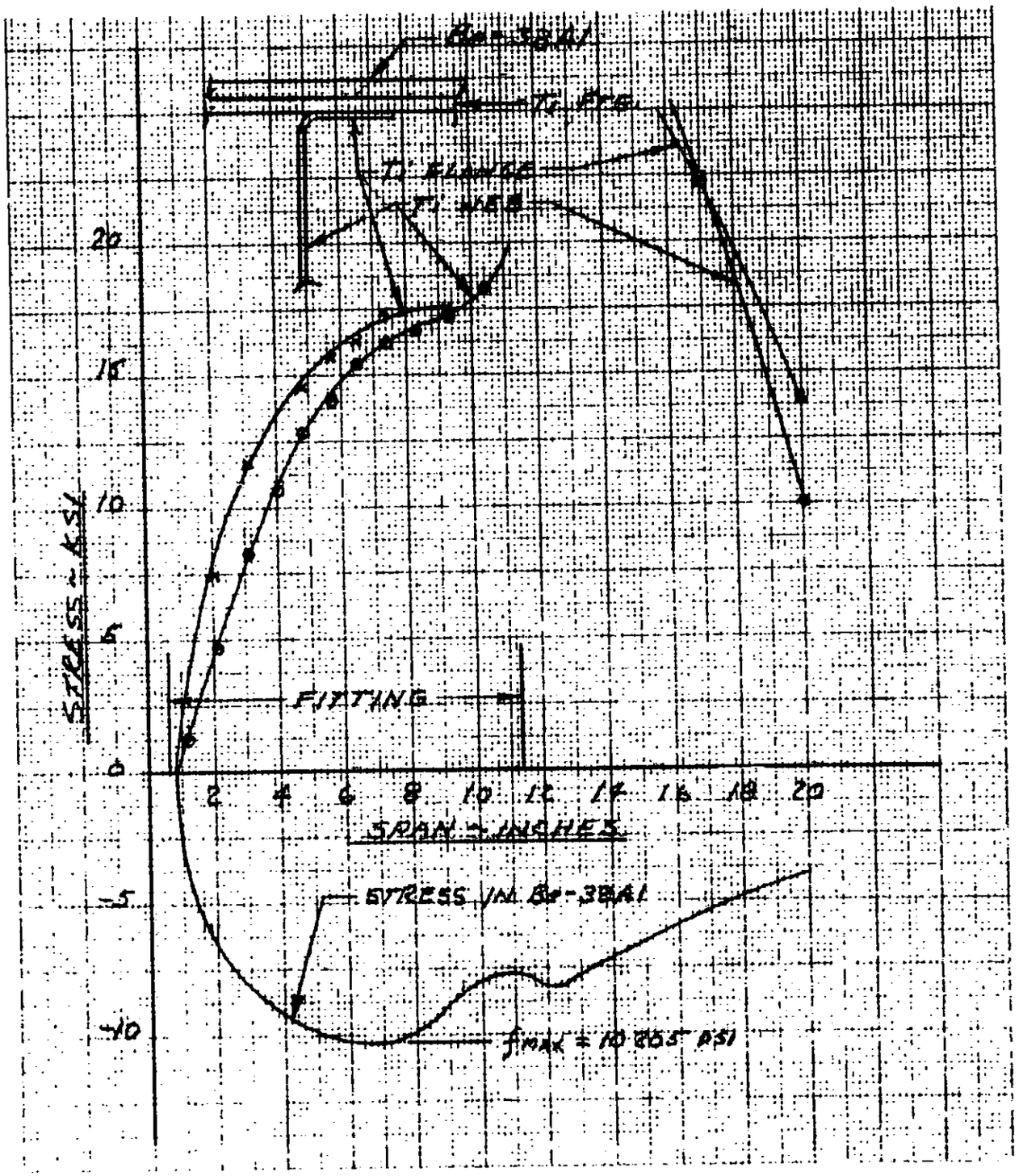



FIGURE 14 THERMAL STRESSES IN REGION OF VENTRAL ROOT - FRONT BEAM FITTING. TEMP. = 550°F