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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AND SPACE ADMINISTRATION

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E	Stress Analysis - Lockalloy Ventral	E-1 thru E-35

APPENDIX A

BIBLIOGRAPHY OF EXISTING

LOCKALLOY DATA

TEMPERATURE AND STRAIN RATE DEPENDENCE OF THE MECHANICAL PROPERTIES OF A BERYLLIUM - 38WT. % ALUMINUM ALLOY

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Air Force Materials Laboratory
Wright-Patterson Air Force Base, Ohio

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CONSTANT AMPLITUDE FATIGUE TESTING OF LOCKALLOY SHEET

Interdepartmental Communication
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Lockheed Missiles and Space Company
From: J.M. Van Orden
Lockheed-California Company

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To: F.A. Crossley/D.D. Crooks
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From: J.M. Van Orden/W.J. Craig
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Stanford University and Stanford Research Institute

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Lockheed Missiles and Space Company

(Contract F33615-67-C-1290)
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(Contract F33615-67-C-1246)
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NAS CR-64343

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R.W. Fenn, Jr., R.A. Glass, R.A. Needham, M.A. Steinberg
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LOCKALLOY

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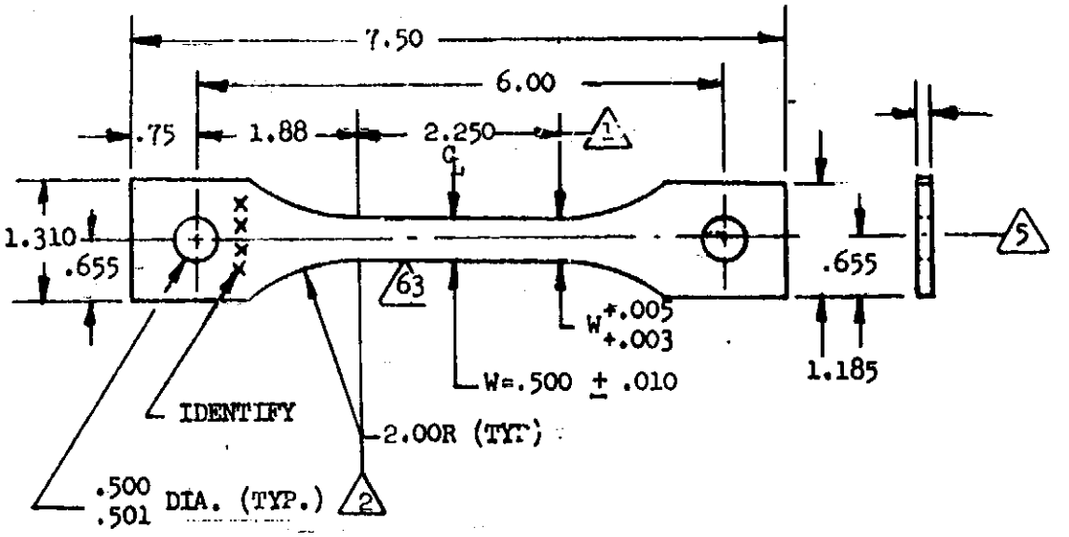
Lockheed Missiles and Space Company

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

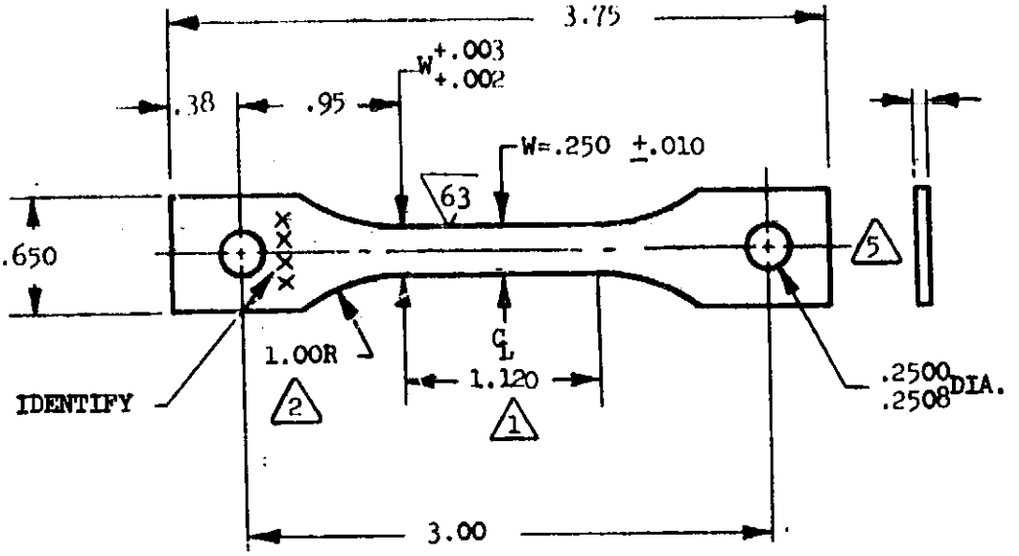
(5) SYMMETRICAL TOLERANCE ±.001

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

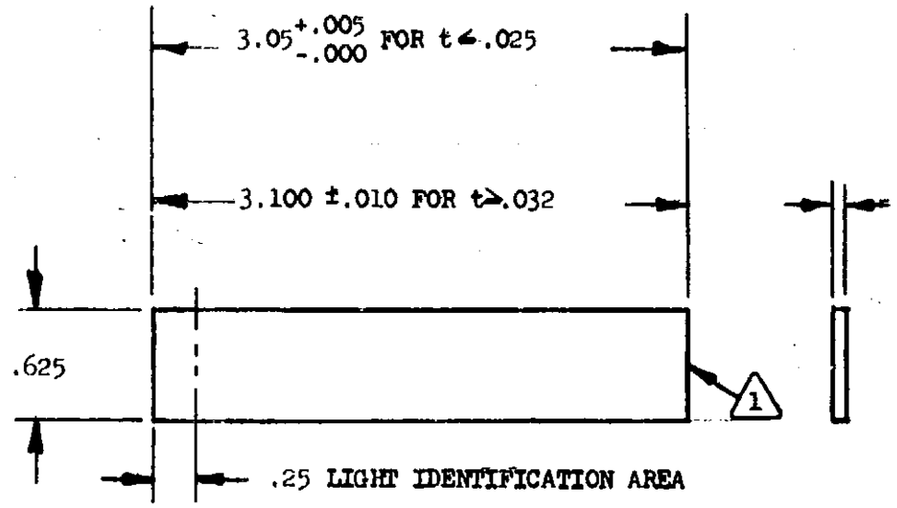
5. SYMMETRICAL TOLERANCE ±.001

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

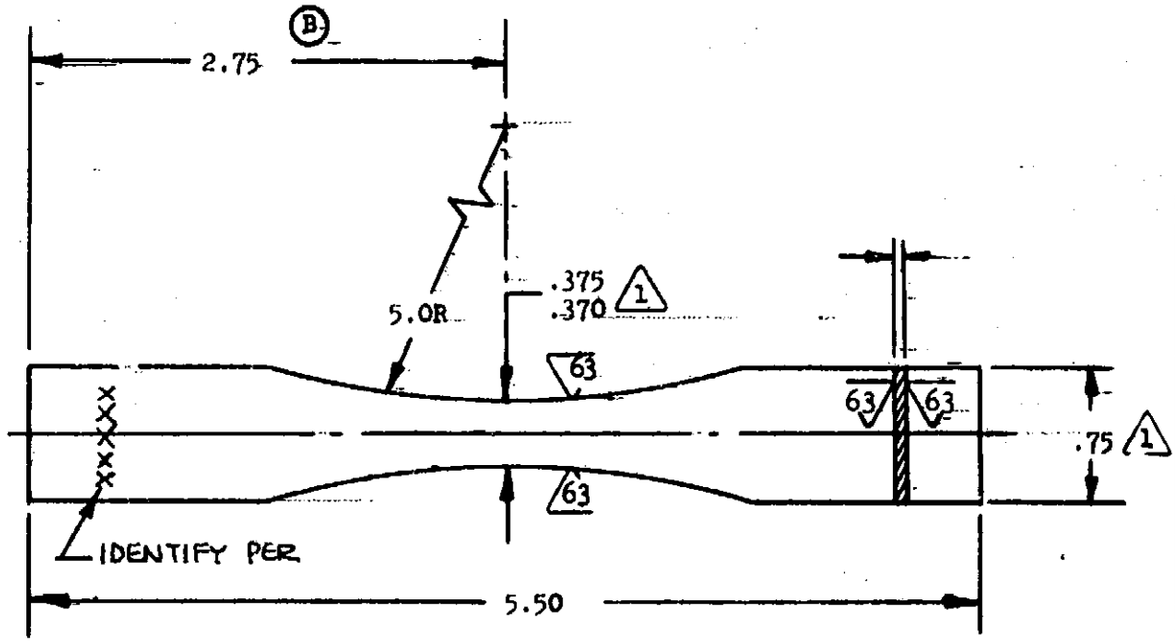
2 LEAVE ALL EDGES SHARP

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

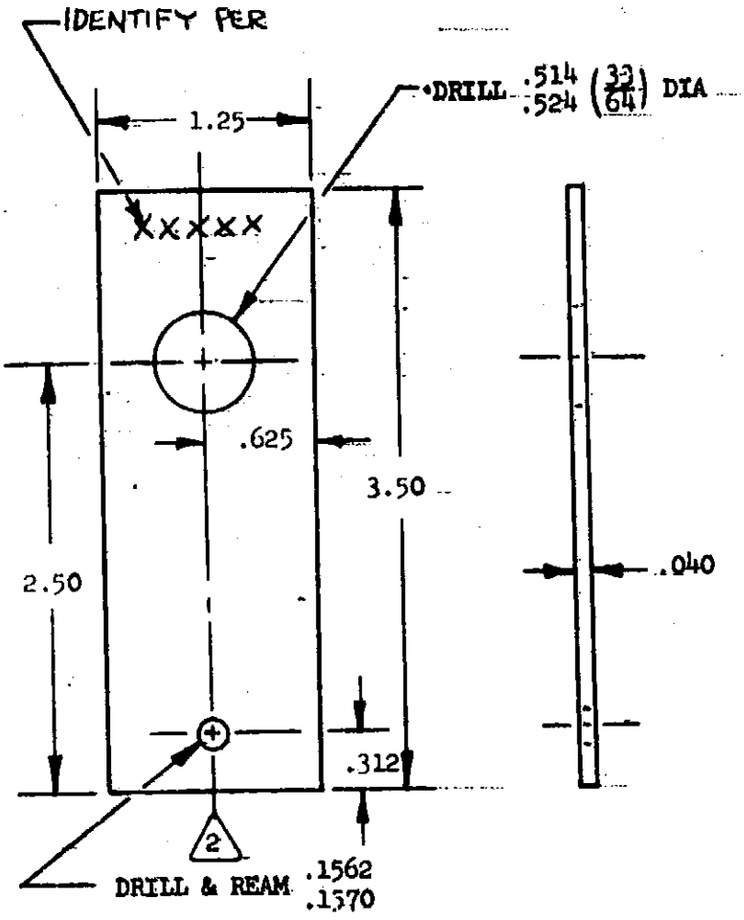
3. ENDS MAY BE SHEARED, ALL OTHER SURFACES TO BE 63

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

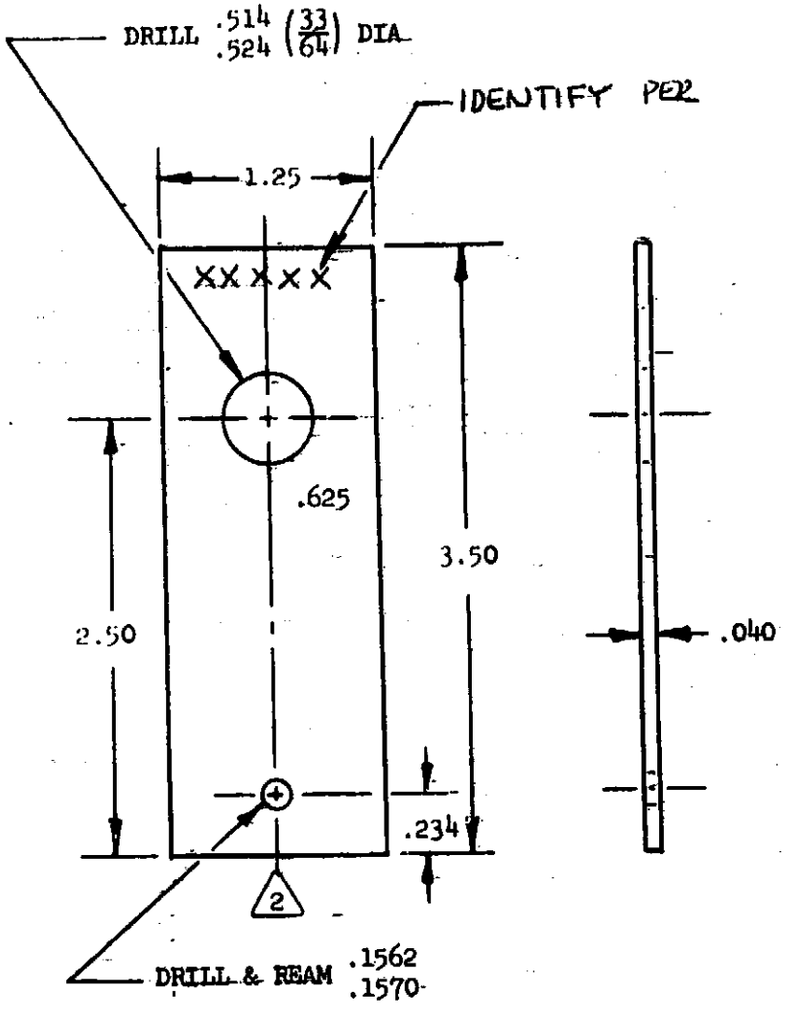
(2) TO BE SYMMETRICAL ABOUT CENTERLINE WITHIN ±.003 INCHES (A)

4-9-64

S35

1404

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



BEARING COUPON - ED = 1.5

NOTES:

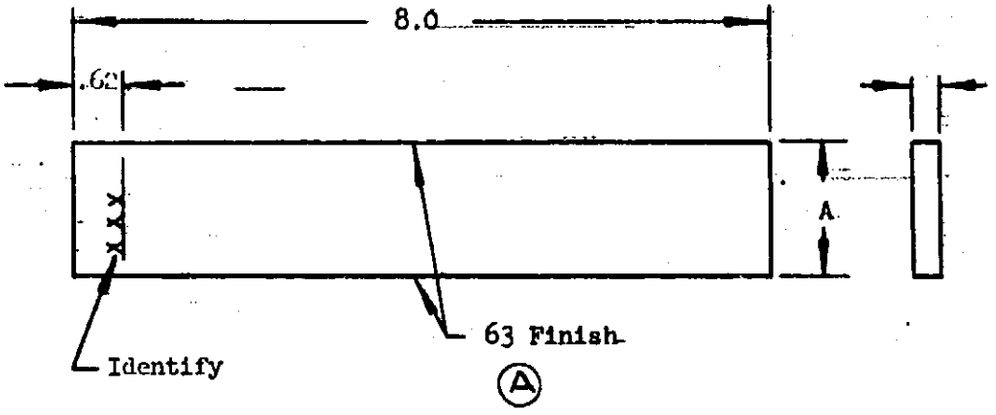
1. SURFACE FINISH TO BE √63
2. TO BE SYMMETRICAL ABOUT CENTERLINE WITHIN ±.003 INCHES (A)

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

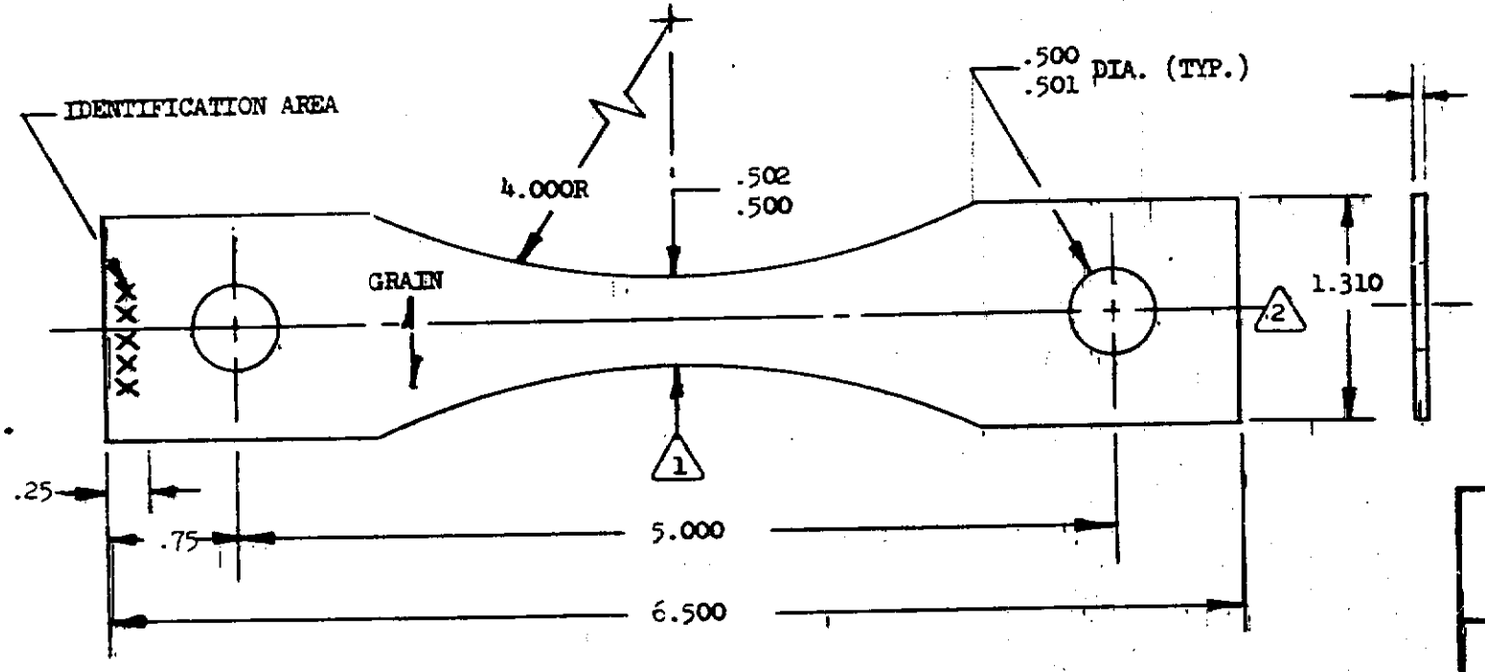
3-26-73

S46 A

1404

6-13-69

STRESS CORROSION COUPON



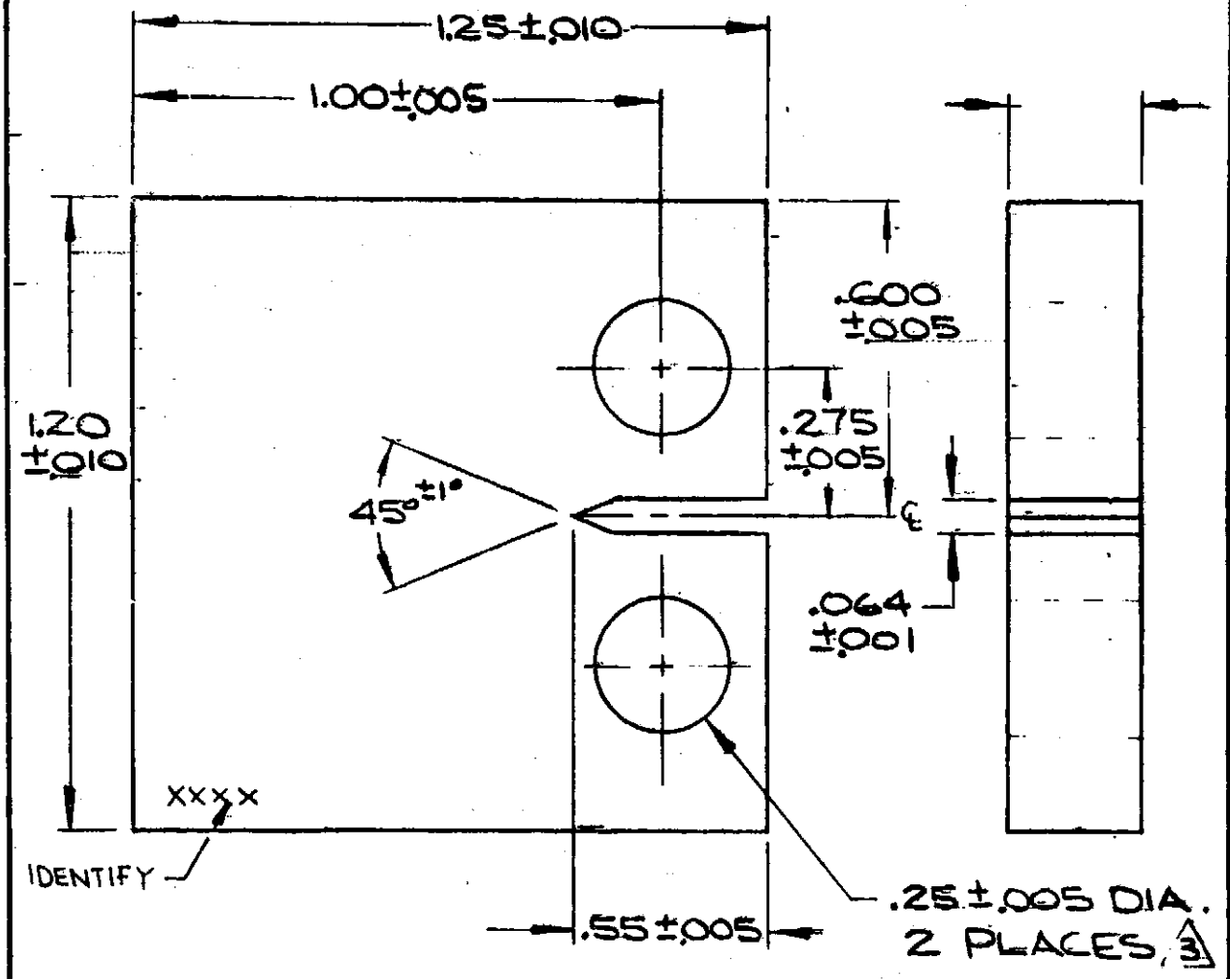
NOTE: ⚠1 LEAVE EDGES SHARP ON THESE SURFACES - NO BURRS. HOLD 63 FINISH.

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

REV.	DATE	CHANGE

S47

REV.	DATE	CHANGE

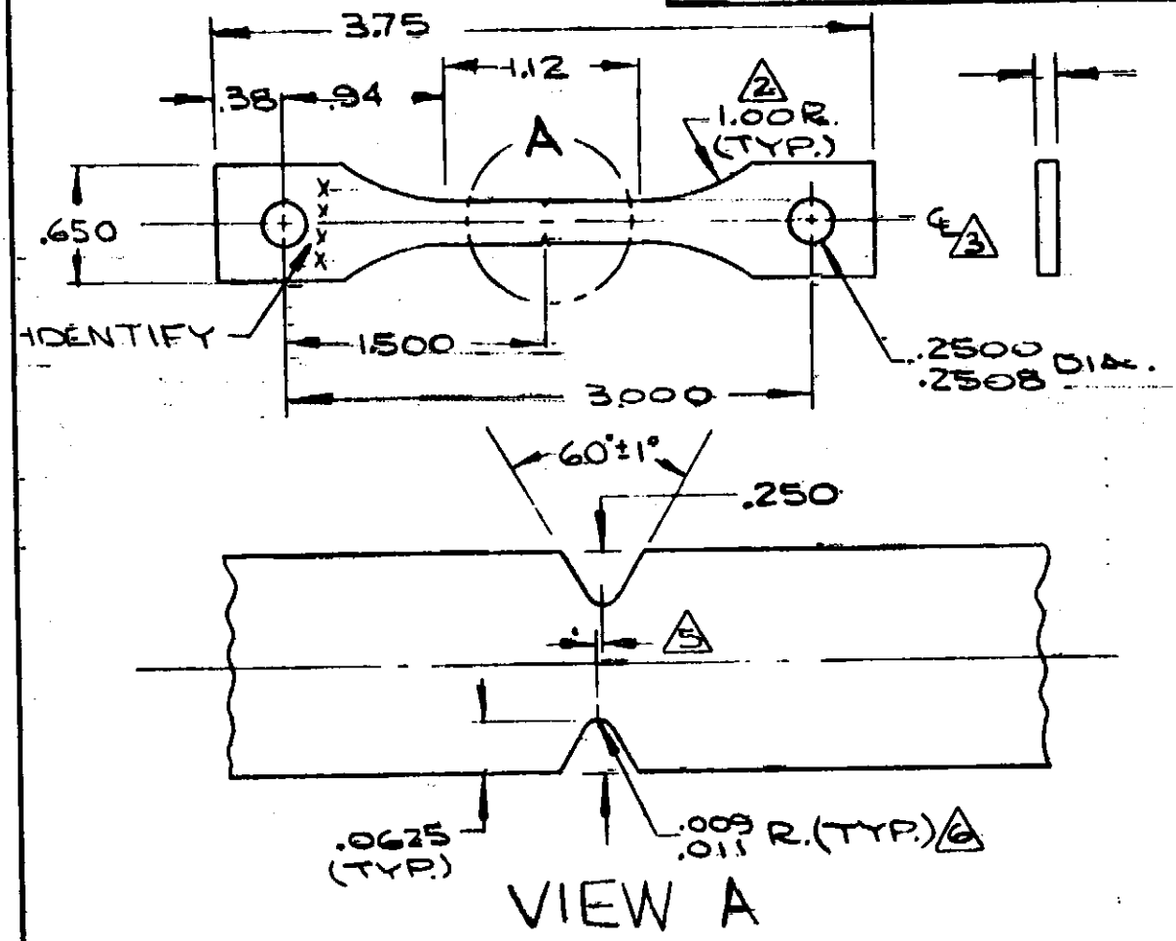


FRACTURE TOUGHNESS COUPON (K_{Ic})

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 $K_T = 3.0$

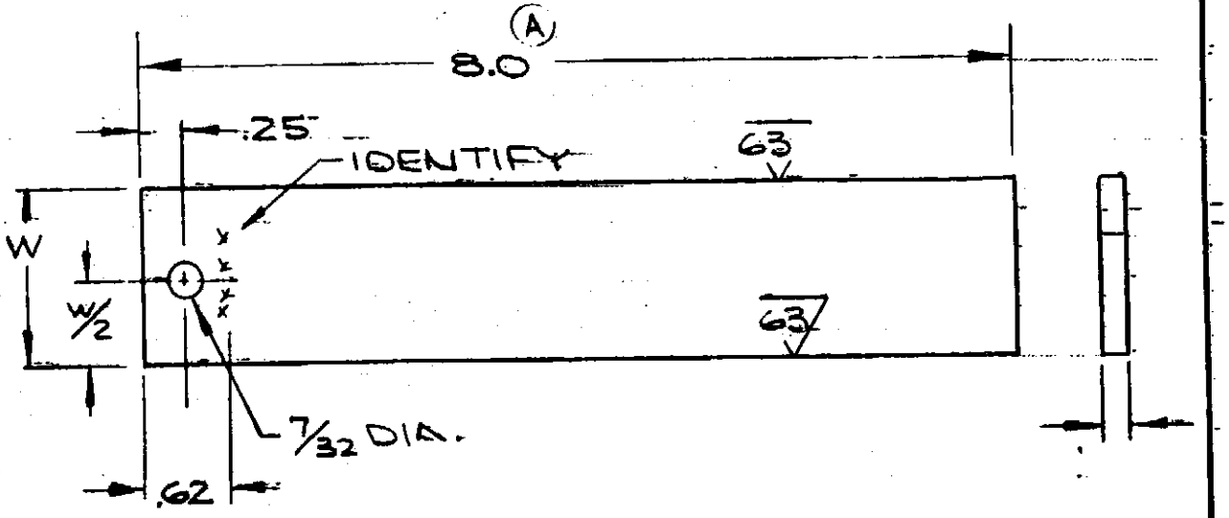
NOTE:

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

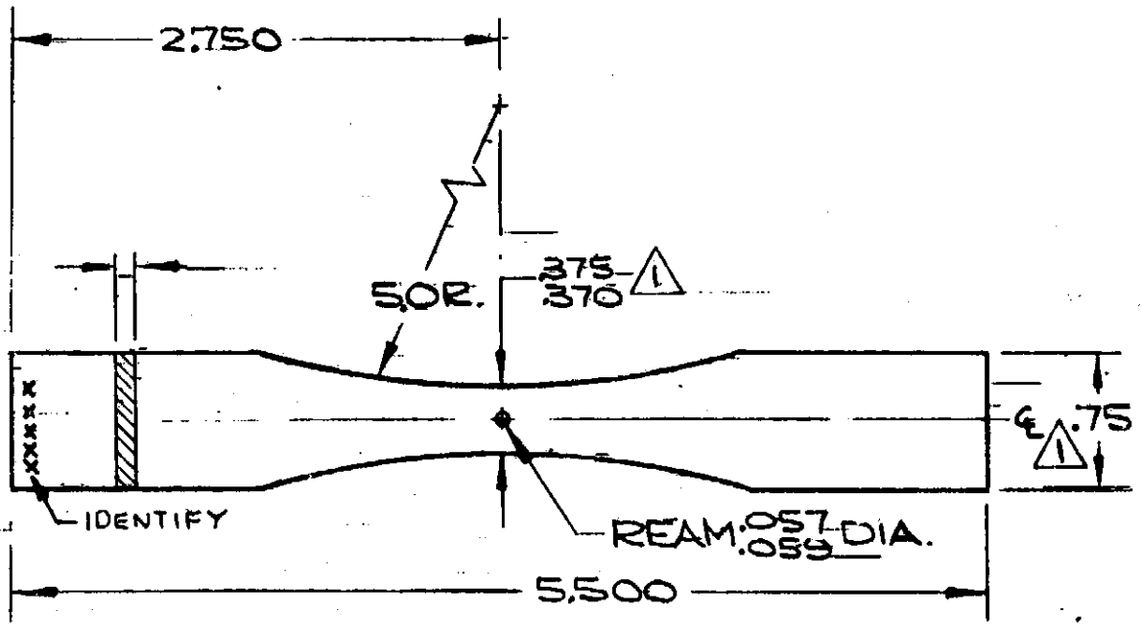
UN-NOTCHED BEND COUPON

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

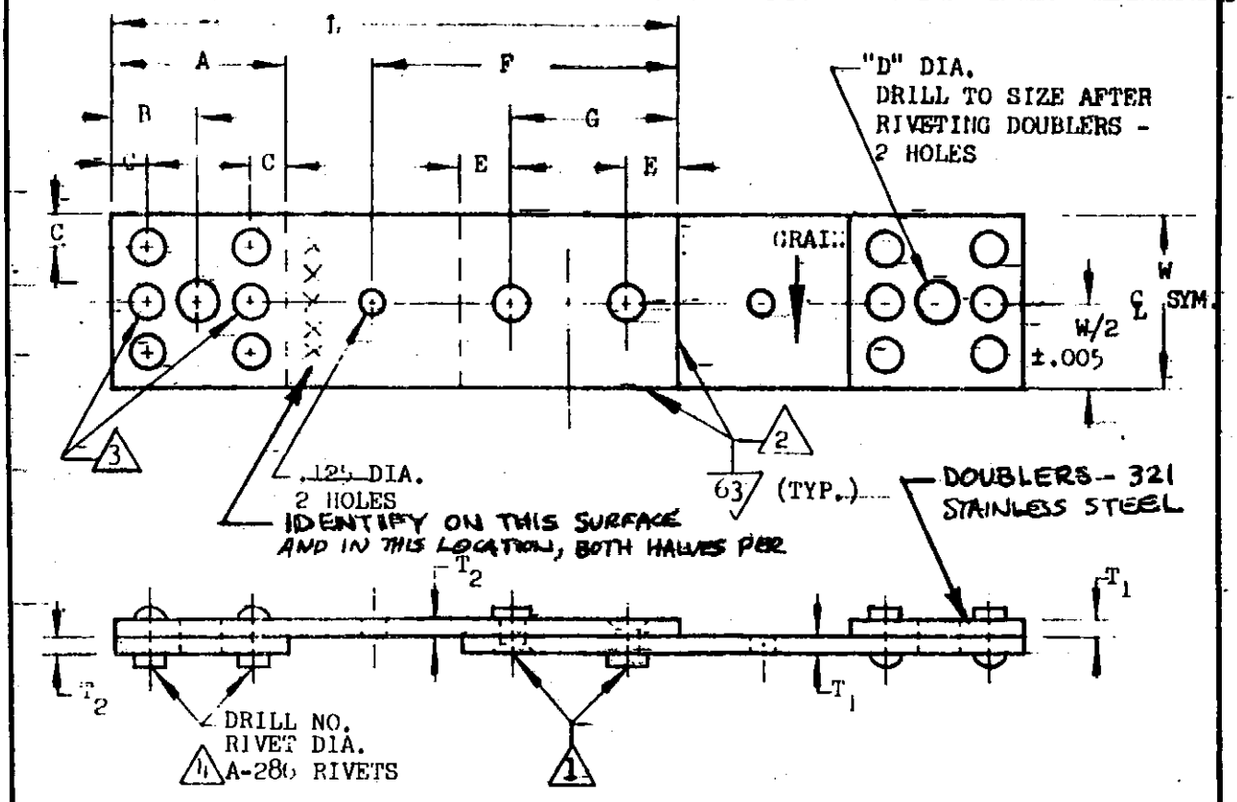
S-51

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.

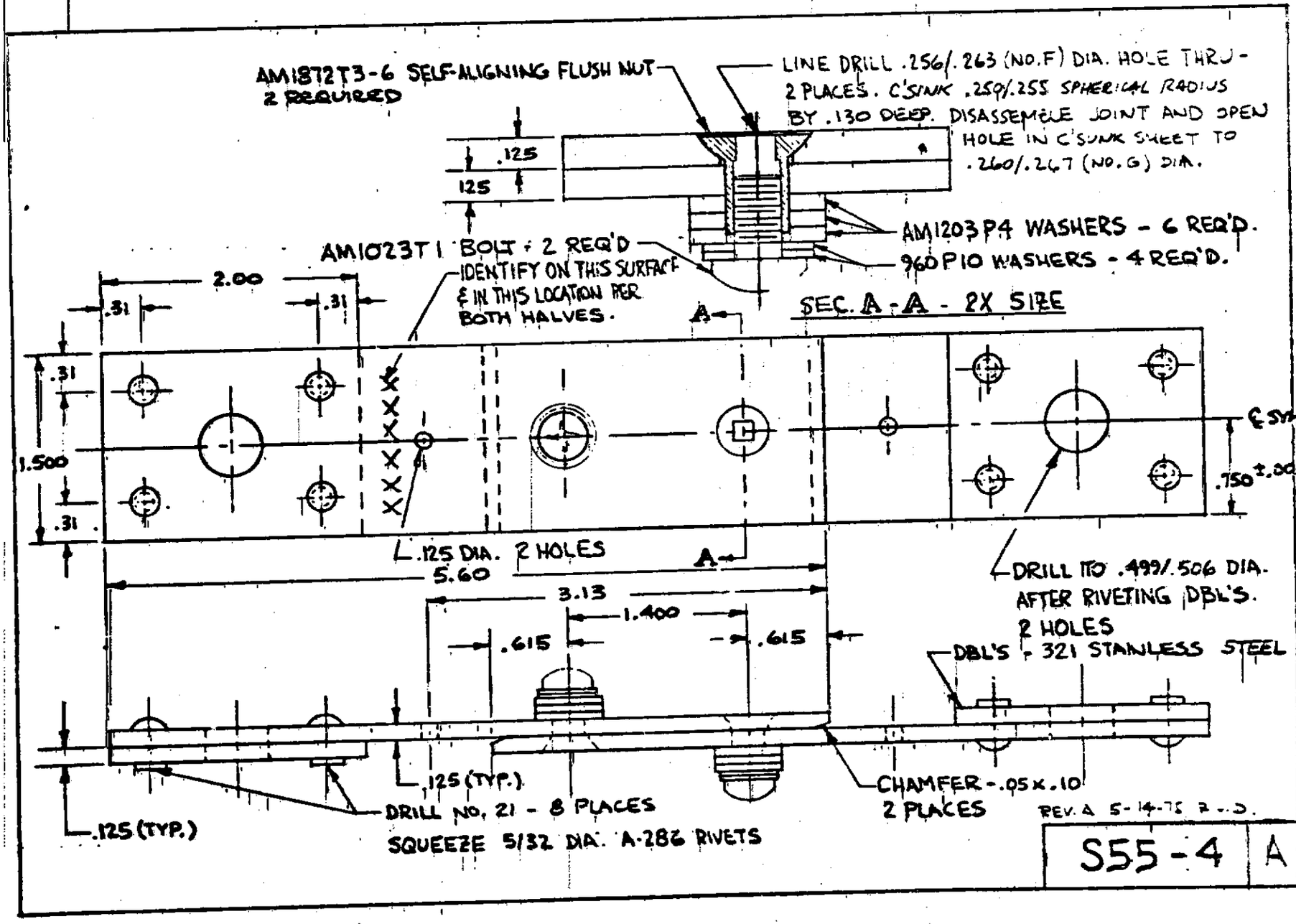


DASH NO.	FAST. SIZE	W	A	B	L	C	F	E	G	"D" DIA.	RIVET DIA.	DRILL NO.
-1	3/32	.75	1.50	.75	3.375	.19	1.375	.188	.564	.251 .258	3/32	41
-2	1/8	1.00	1.50	.75	3.50	.25	1.50	.250	.750	.376 .383	1/8	30
-3	5/32	1.25	2.00	1.00	4.125	.31	1.625	.312	.936	.499 .506	5/32	21
-4	3/16	1.50	2.00	1.00	4.50	.31	1.75	.375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

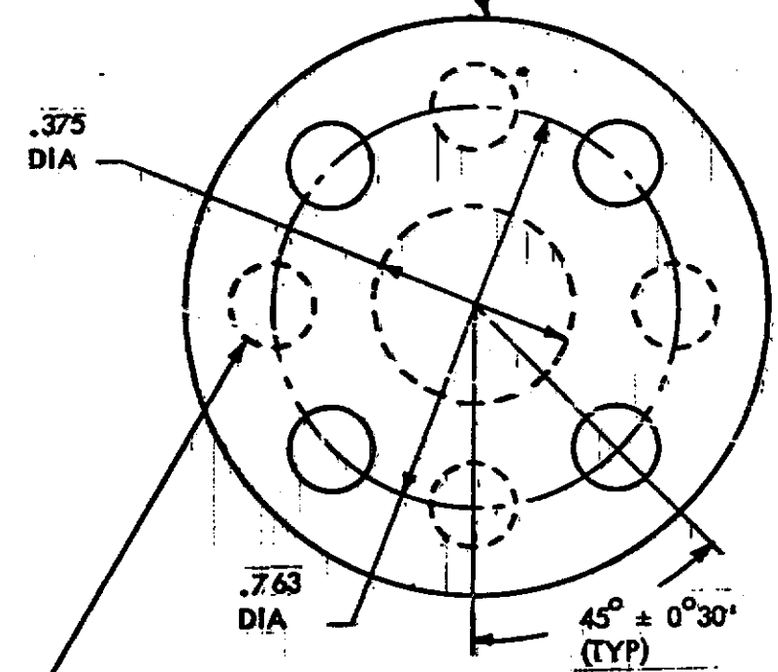
S54 | A

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



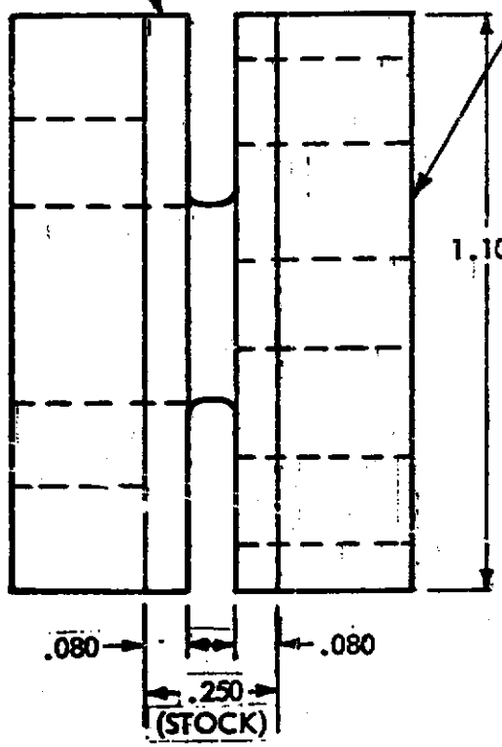
.165
.171 (NO 19) DIA-HOLE-8 PLACES (-1 & -4)

.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

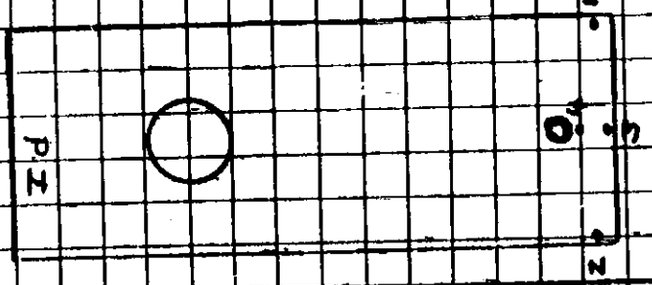
DATE 12 22 75

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		11×10^6	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	1.4×10^7	12-10		✓
3UF-10T	.1418	.374	.0542	15	600	1.2×10^7	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.	1×10^7	1-5-76		
3NF-11T	.1411	.374	.0549	10	600	1.1×10^7	12-1-75		✓
3NF-11L	.1450	.375	.0543	10	600	1.0×10^7	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.	1×10^7	11-24-75		✓
3NF-2L	.1462	.374	.0547	17.5	R.T.	1.1×10^7	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.	1×10^7	12-12-75		✓
3UF-8T	.1452	.374	.0543	25	R.T.	1800	12-18-75	✓	
3UF-9T	.1450	.373	.0541	25	R.T.	1×10^7	12-15-75		✓
3UF-9L	.1473	.373	.0549	27.5	R.T.	1.5×10^7	12-23-75		✓
3NF-7T	.1466	.375	.0550	20	R.T.	1×10^7	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.

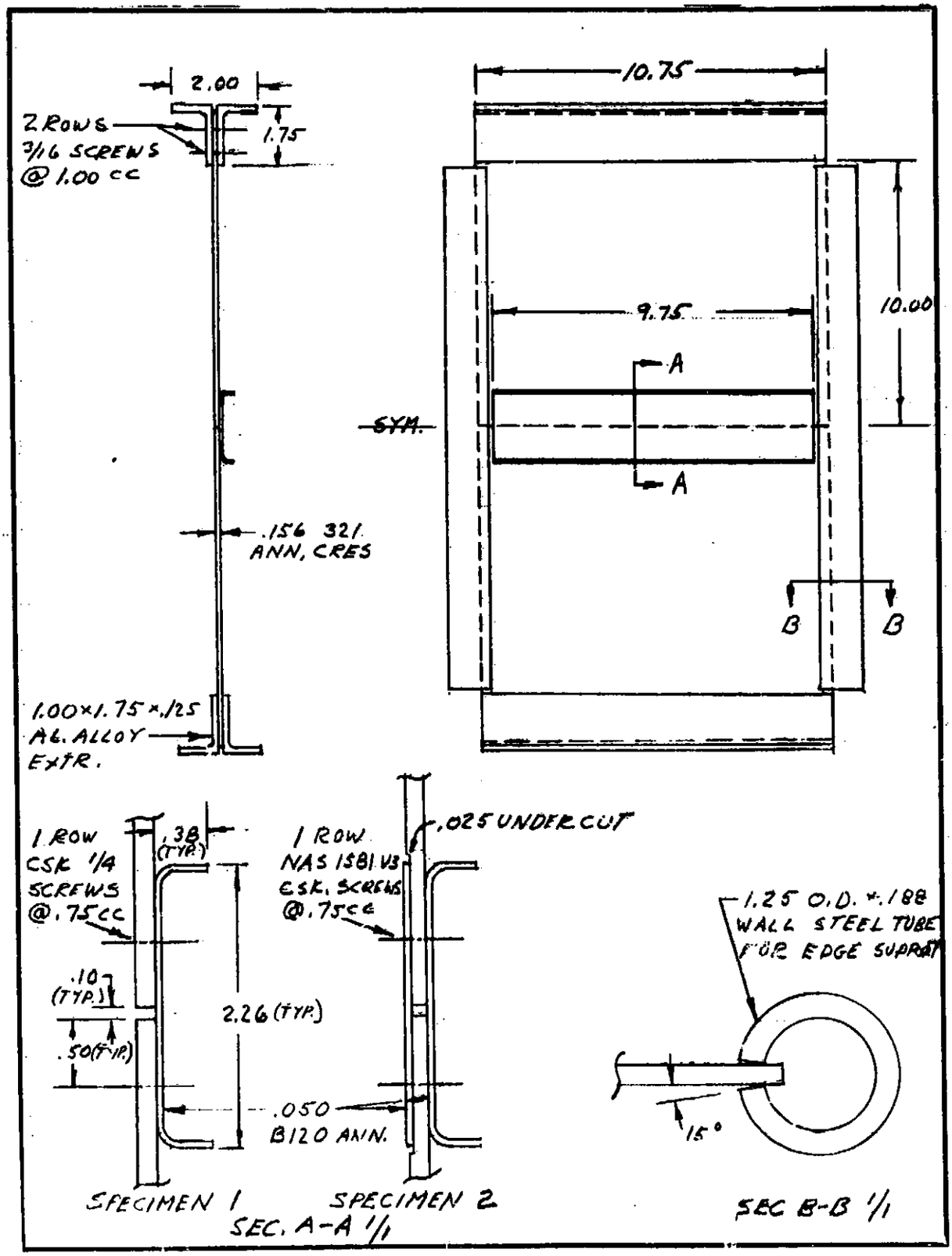
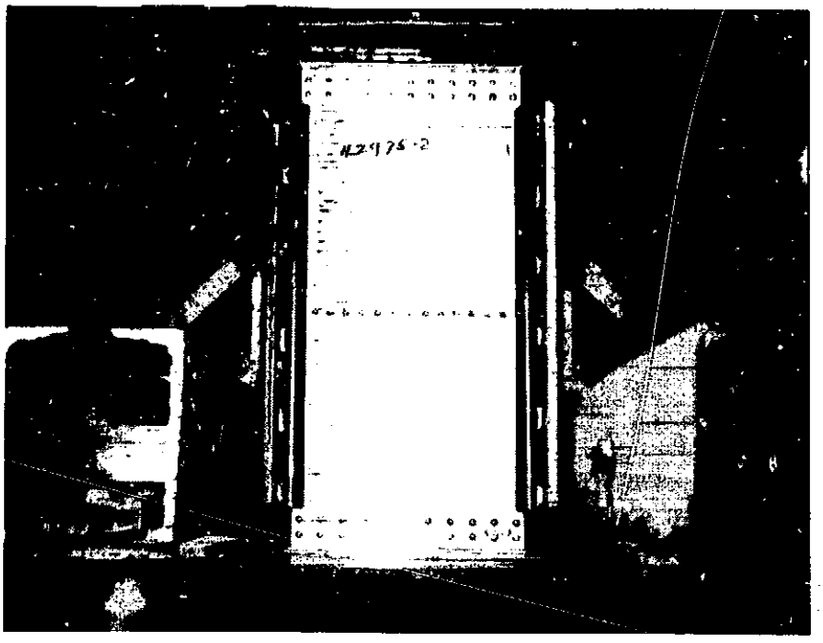
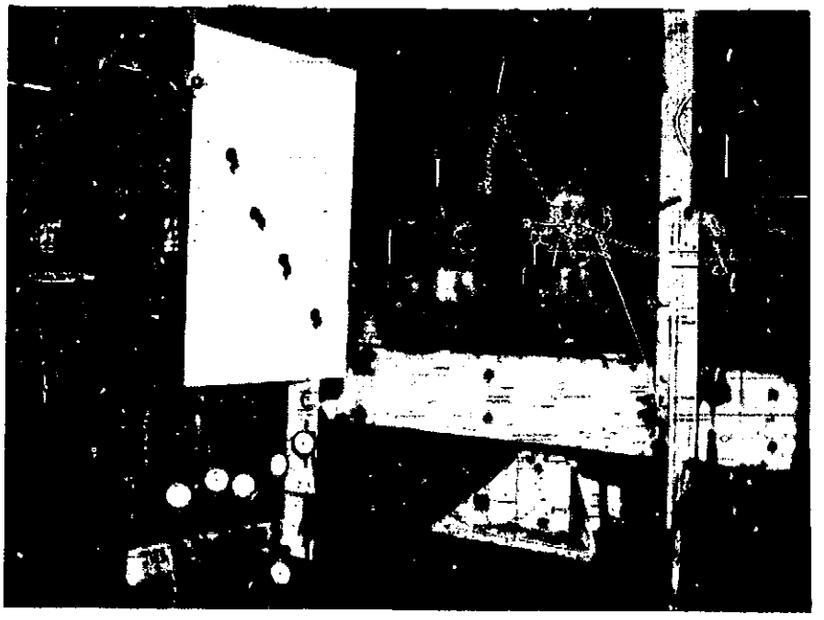


FIG. D-1 COMPRESSION TEST SPECIMENS

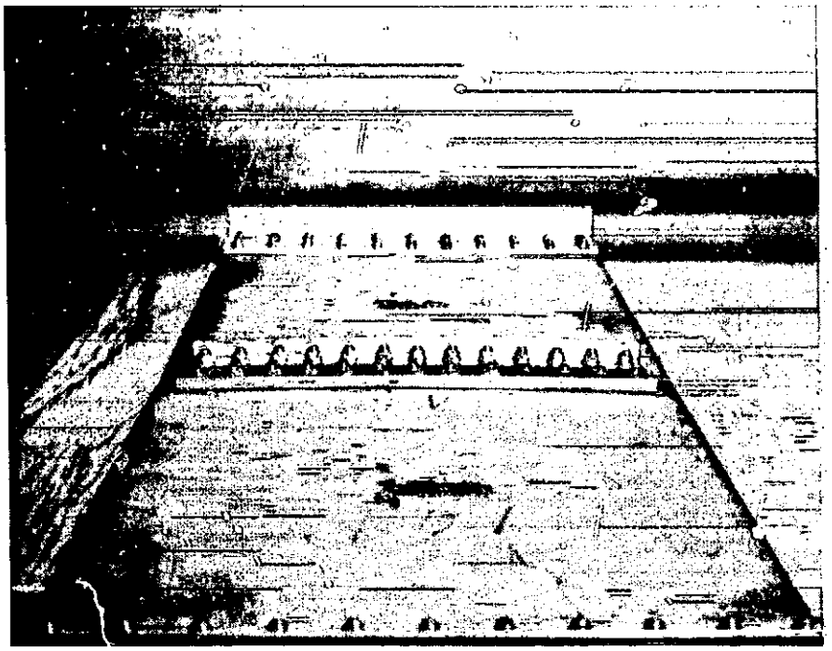


75-5166-4



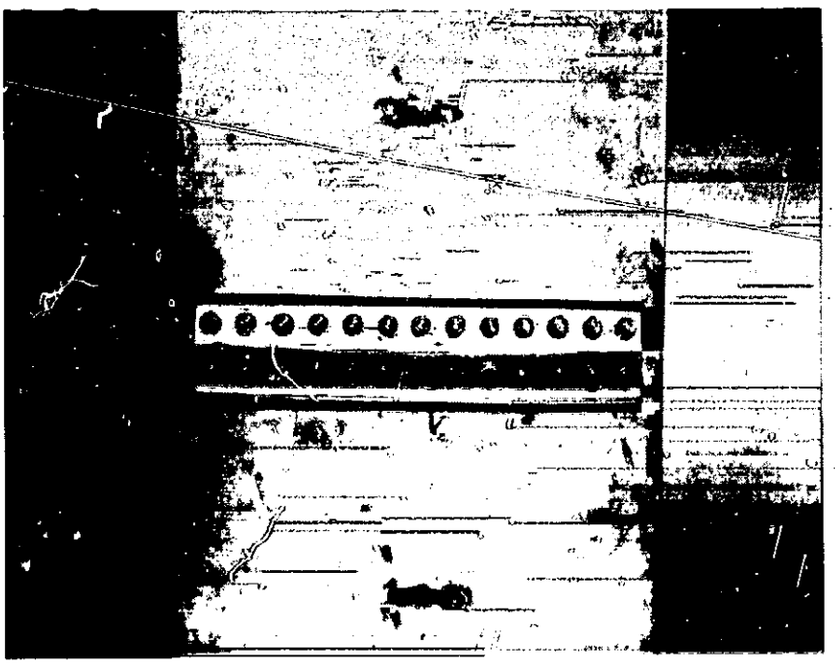
75-5166-2

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



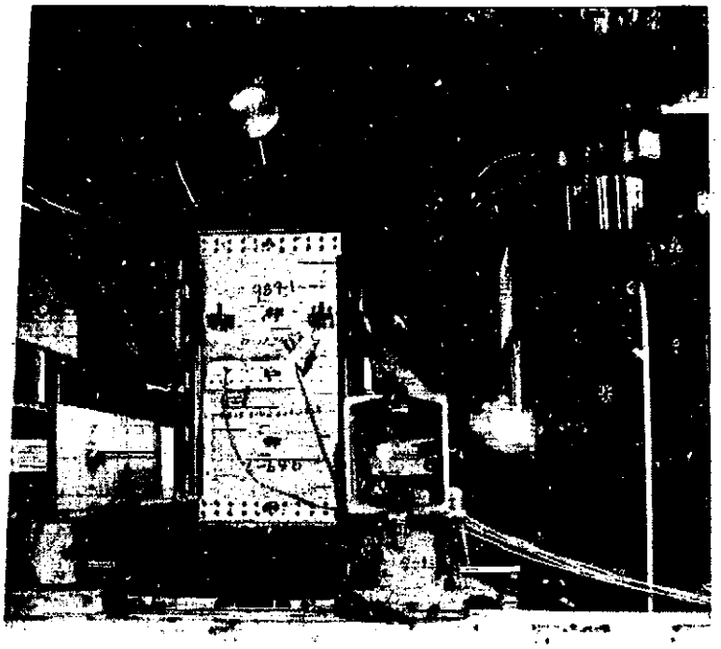
75-5169-4

FIG. D-3 BOWING FAILURE OF SPECIMEN NUMBER ONE



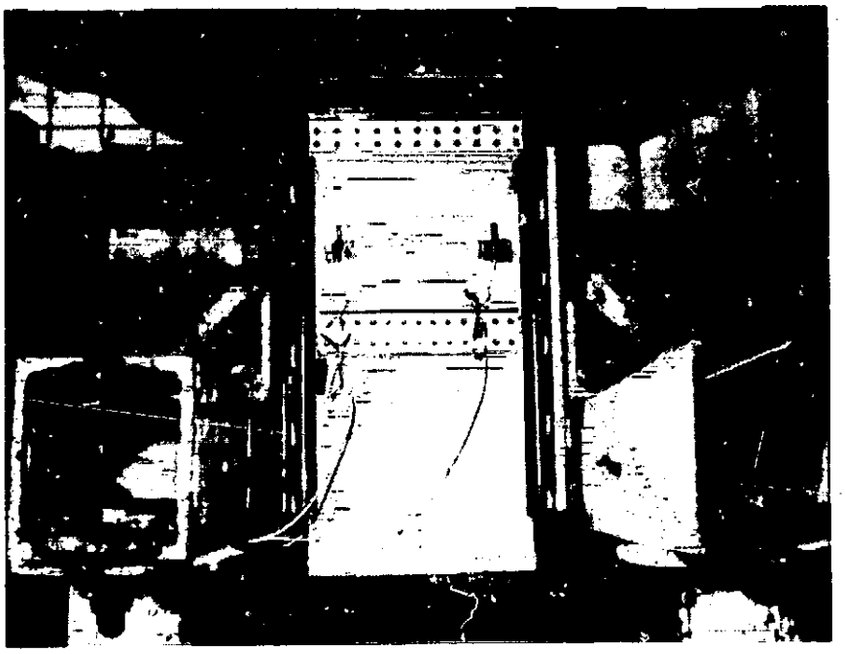
75-5169-1

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



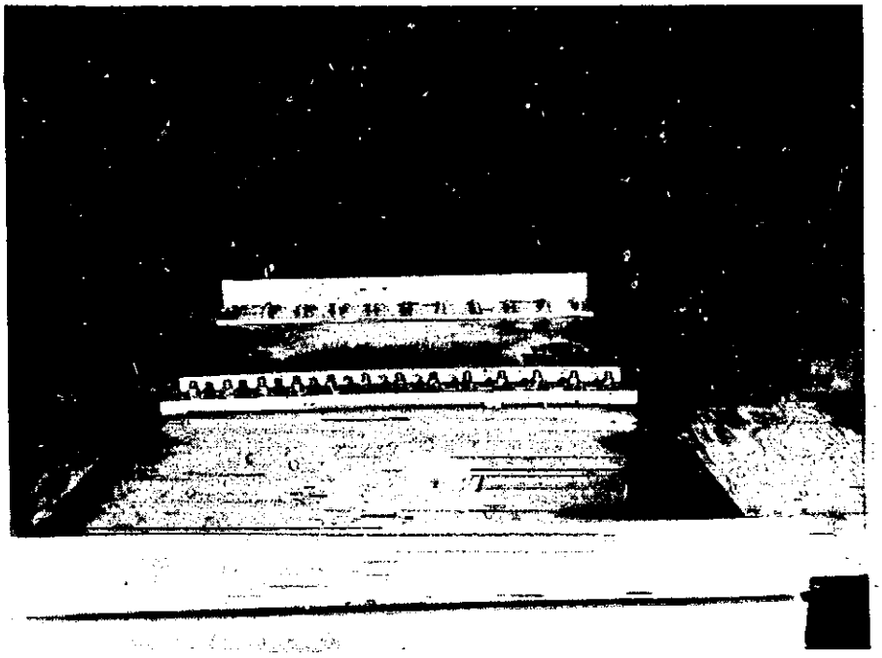
75-5188-2

FIG. D-5 TEST SETUP FOR SPECIMEN NUMBER TWO



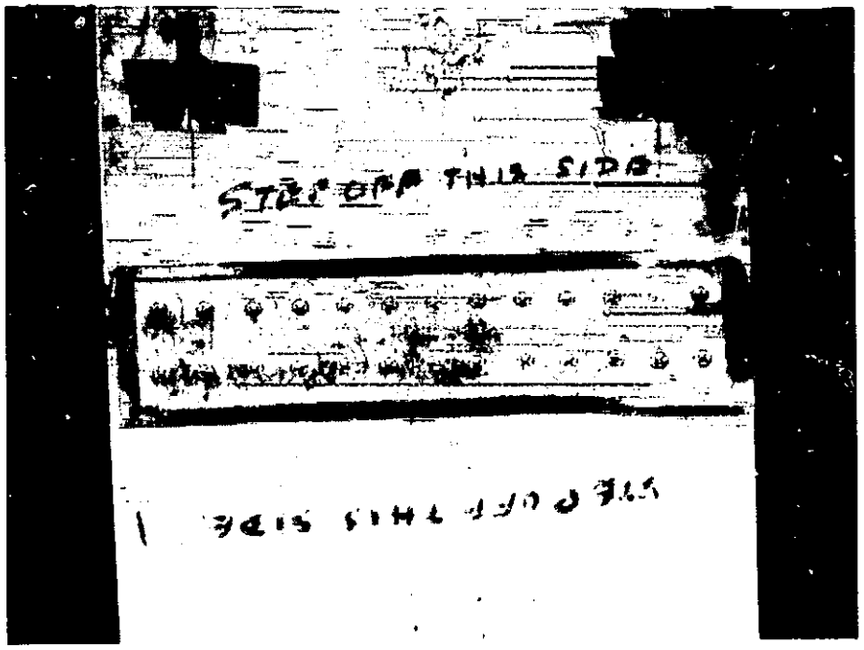
75-5188-5

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

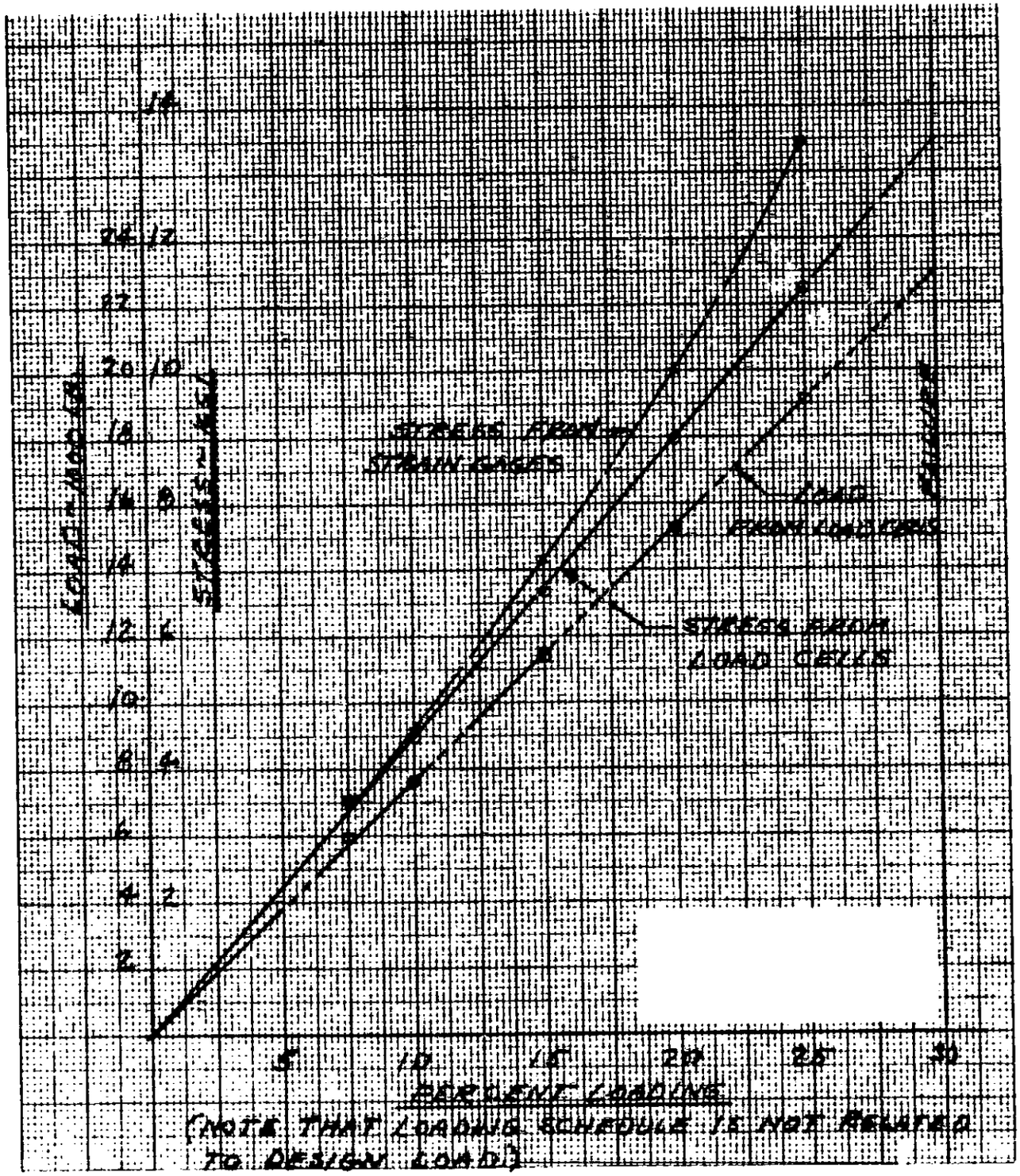


FIG. D-9 LOAD AND STRESS CURVES FROM TEST OF SPECIMEN NUMBER 2.

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

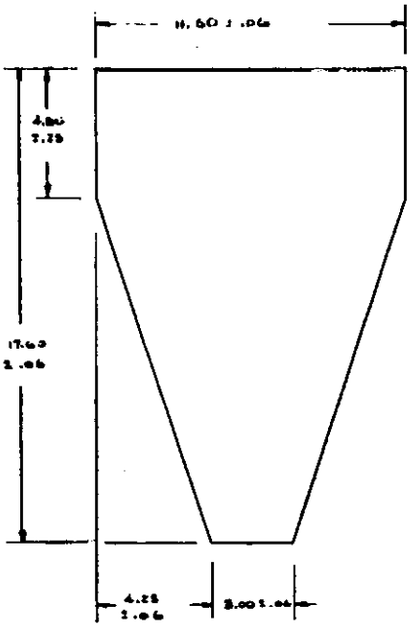
Loads were applied to the specimen in 5% increments until the 15% level was reached. After these readings were taken the load was reduced to zero and readings again taken. Then the load was returned to 15%, readings taken, and then advanced to 20%. In this way the load was progressively increased with 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 28×10^6 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.

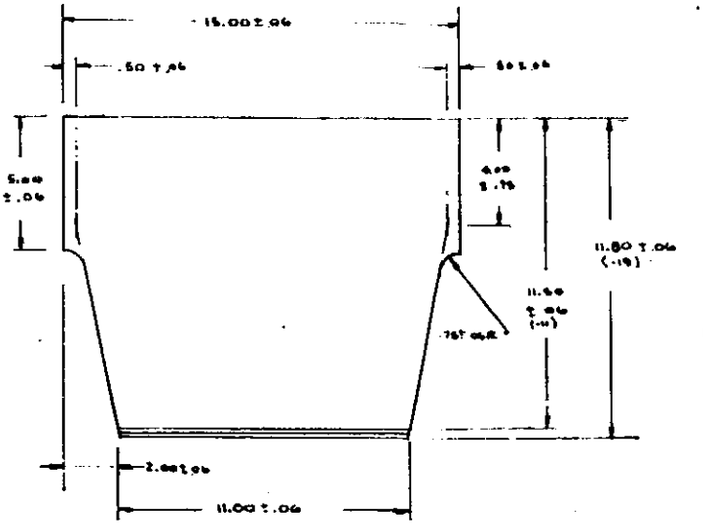
Test Results (Continued)

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.

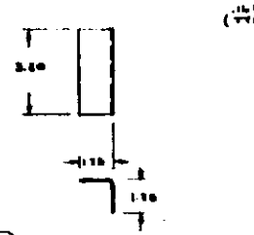


(15) LOWER PLATE 1 REQ.
.156 321 STAINLESS STEEL
AS RECEIVED
SEE ENG. FOR MAT'L
AS SHEARED EDGES OK

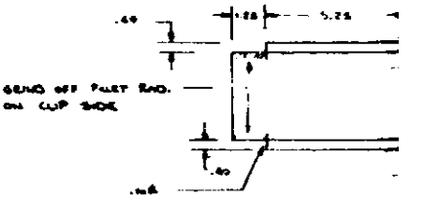


(11) PLATE 1 REQ
.156 321 STAINLESS
STEEL AS RECEIVED
SEE ENG. FOR MAT'L
AS SHEARED EDGES OK

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

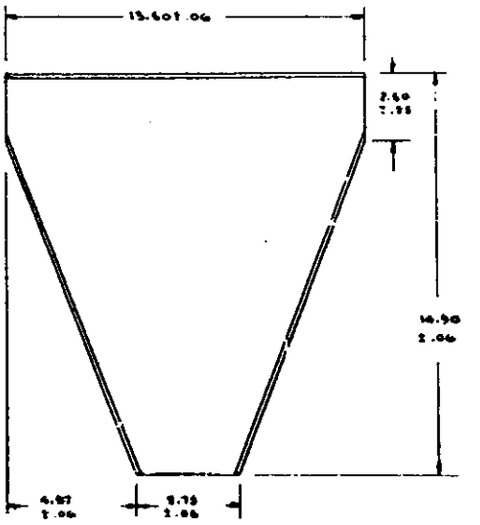


(6) CUP 25 REQ.
.050 DIA AN
B.E. .16

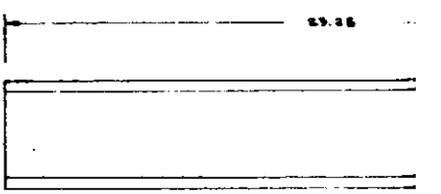


GRIND OFF FILET RAD.
ON CUP SIDE

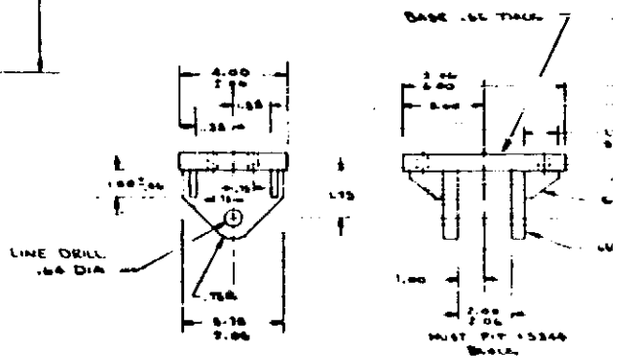
(7) I BEAM 2 REQ
4 x 5.8 STRUCT STEEL
M SHAPE
OR 4 x 13.0 M SHAPE



(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

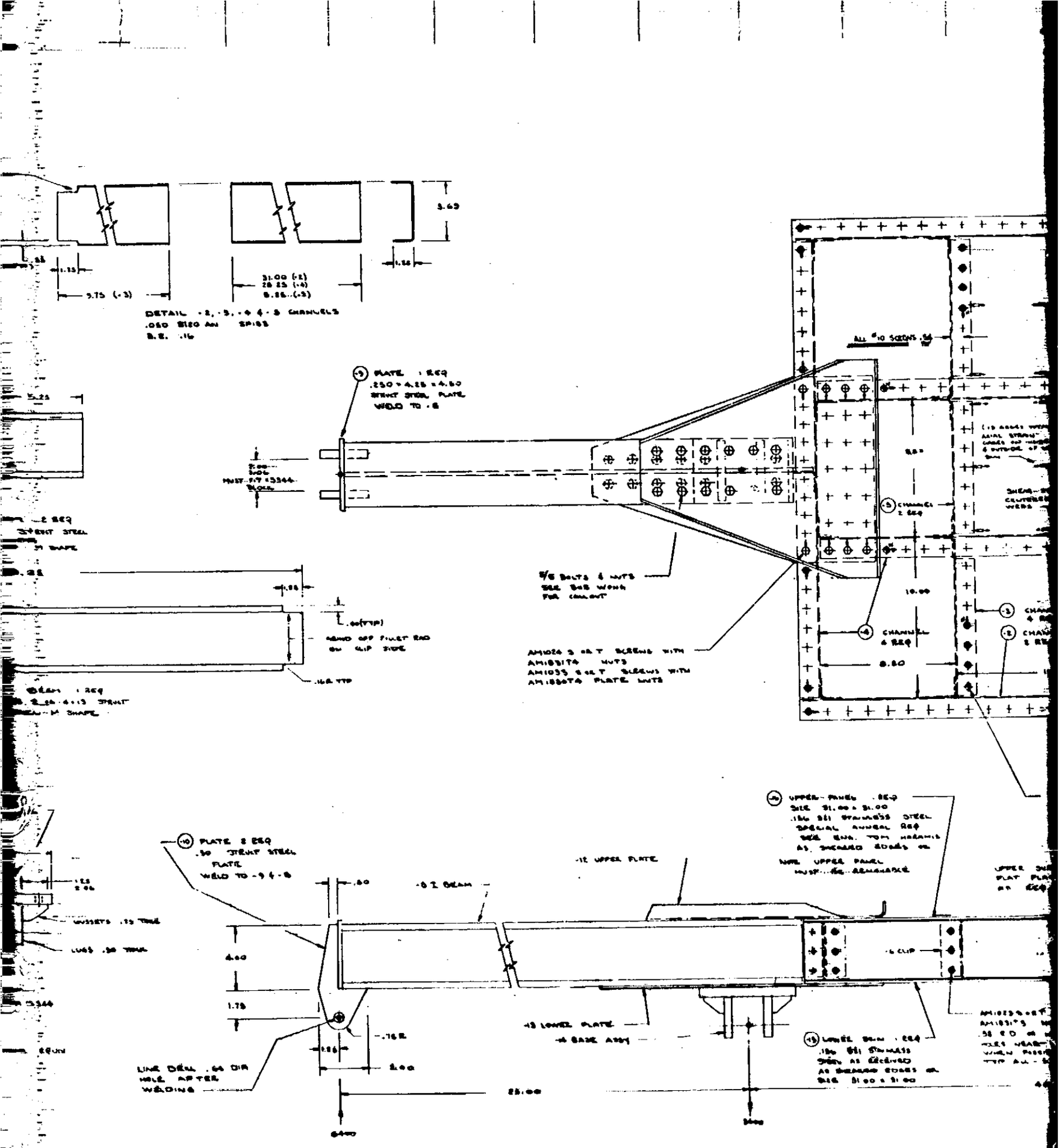


(8) I BEAM
4 x 13.0 M 4 x
STEEL M SH



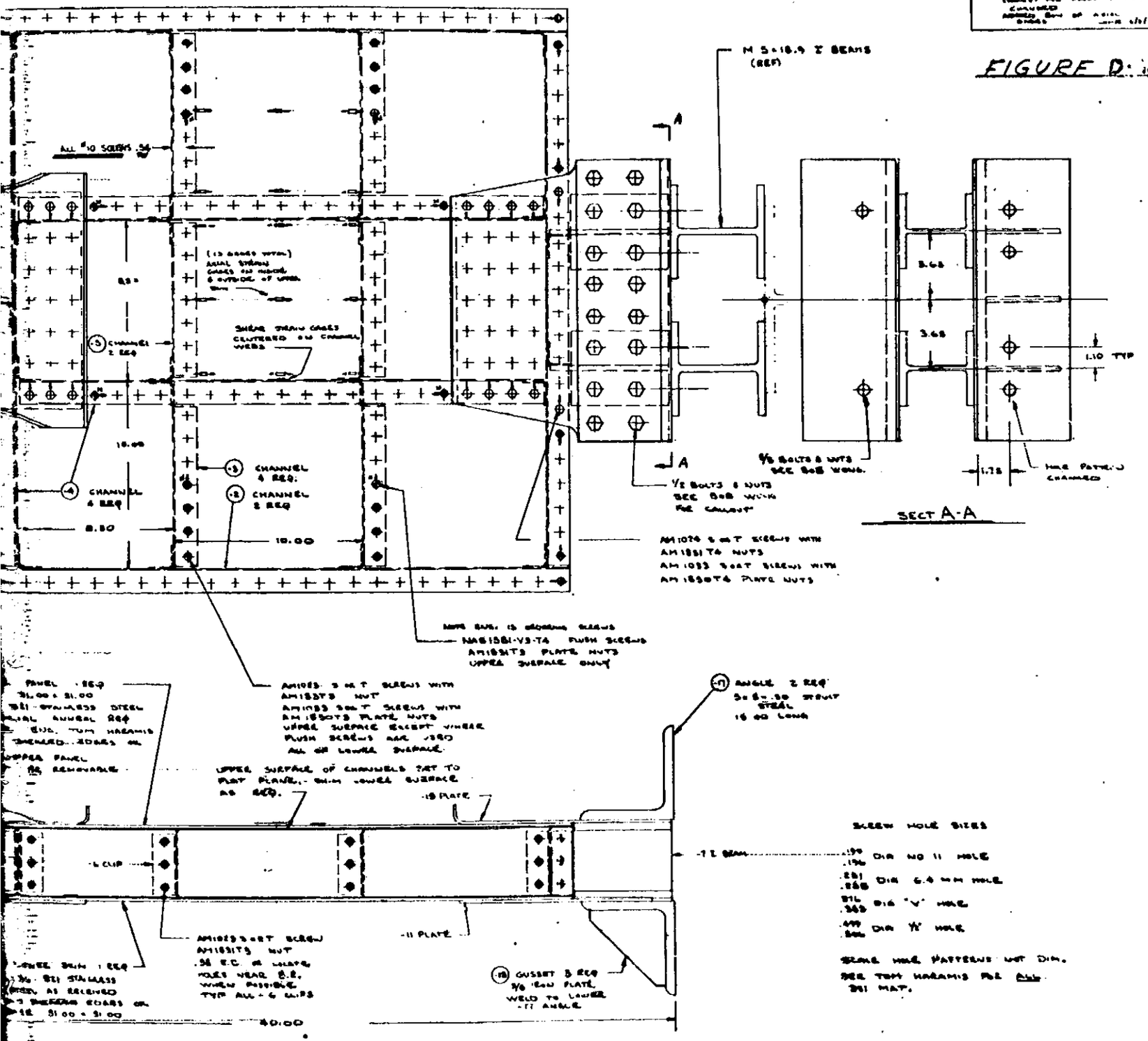
(14) BASE ASSY 1 REQ
ALL PARTS AISI 1018 STEEL M 50 AT
WELD ASSY.

ABOUT FRAME 1

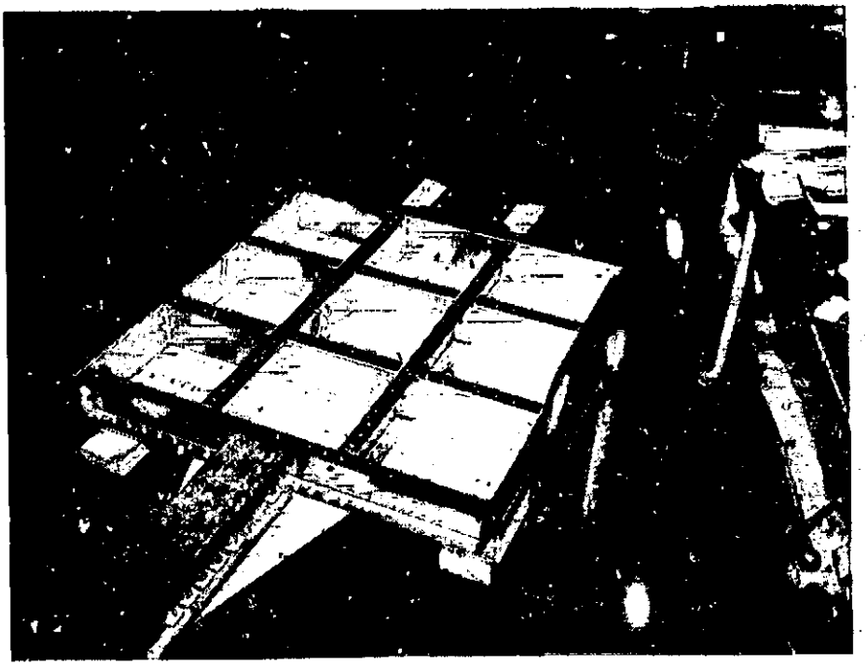


LAYOUT FRAME 2

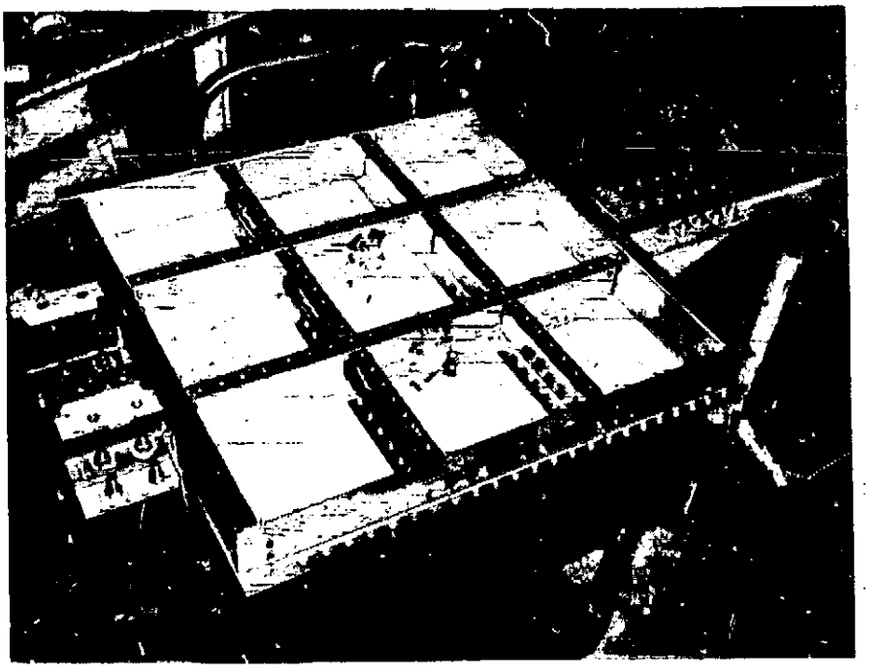
FIGURE D-10



COCKPIT FRAME

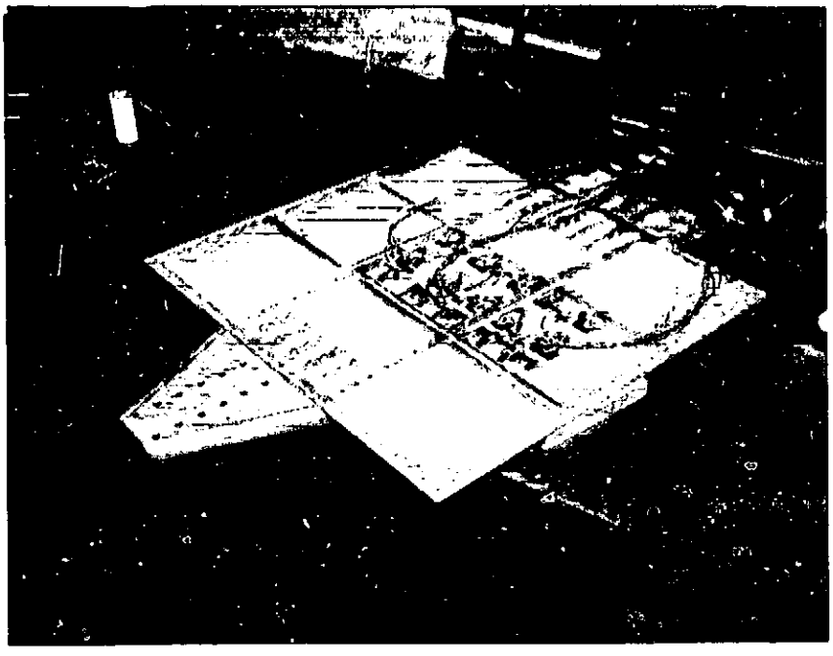


75-5206-3

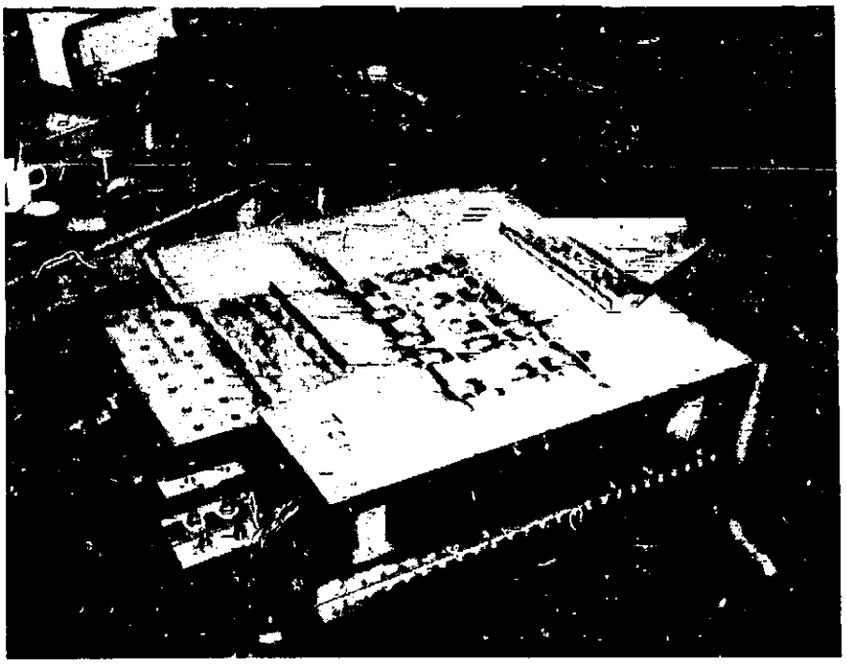


75-5206-4

FIG. D-11 SUBSTRUCTURE OF BENDING BOX SPECIMEN



75-5206-1



75-5206-2

FIG. D-12 BOX COMPRESSION SURFACE
STRAIN GAGE INSTRUMENTATION

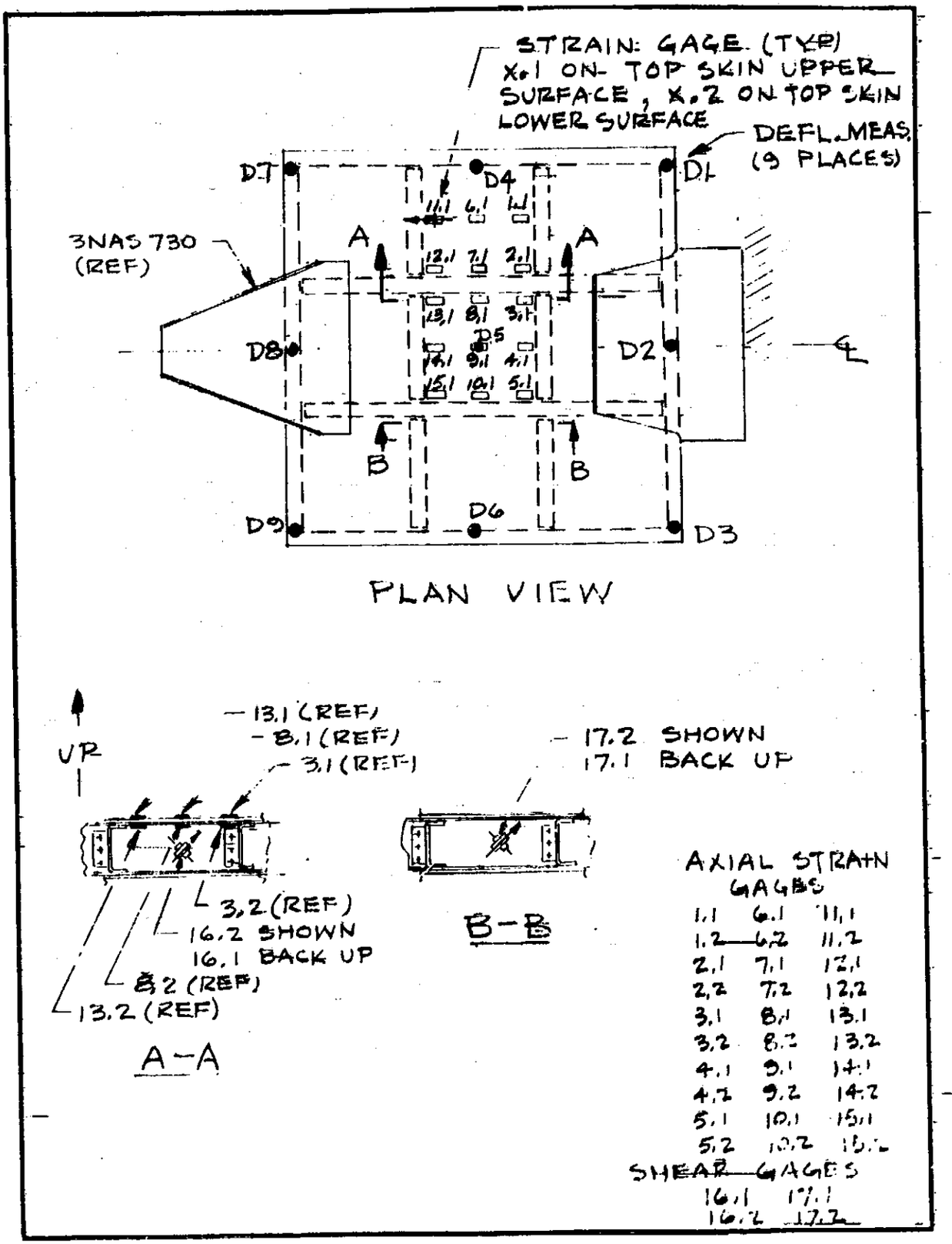
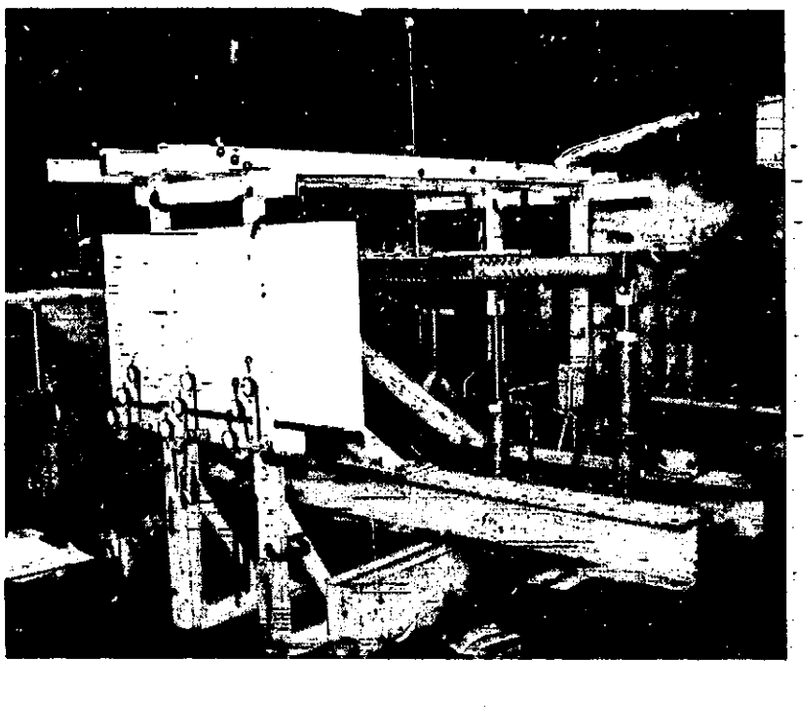
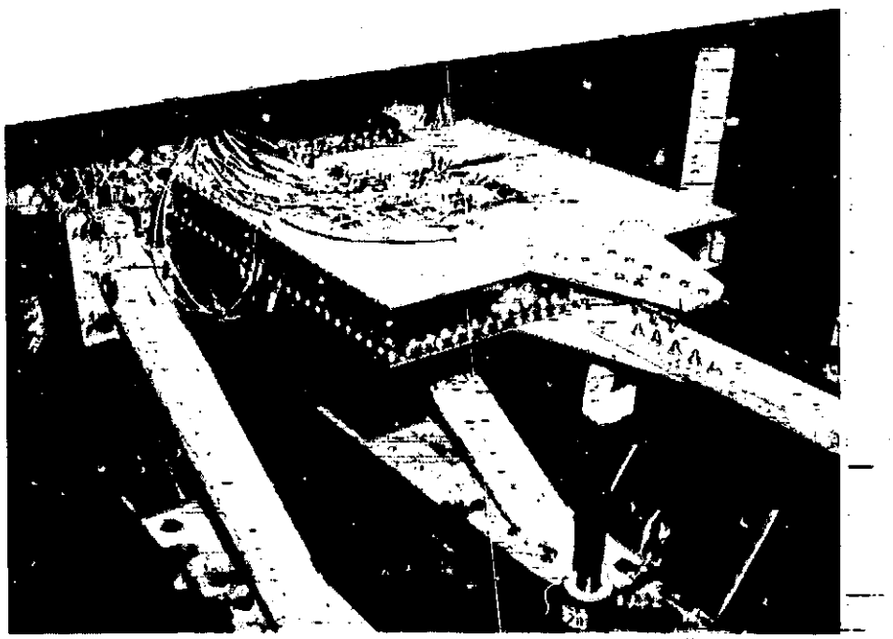


FIG. D-13 INSTRUMENTATION - COMPRESSION TEST BOX, VENTRAL

C-2



75-5209-2



75-5209-4

FIG. D-14 TEST SETUP FOR BOX BENDING TEST

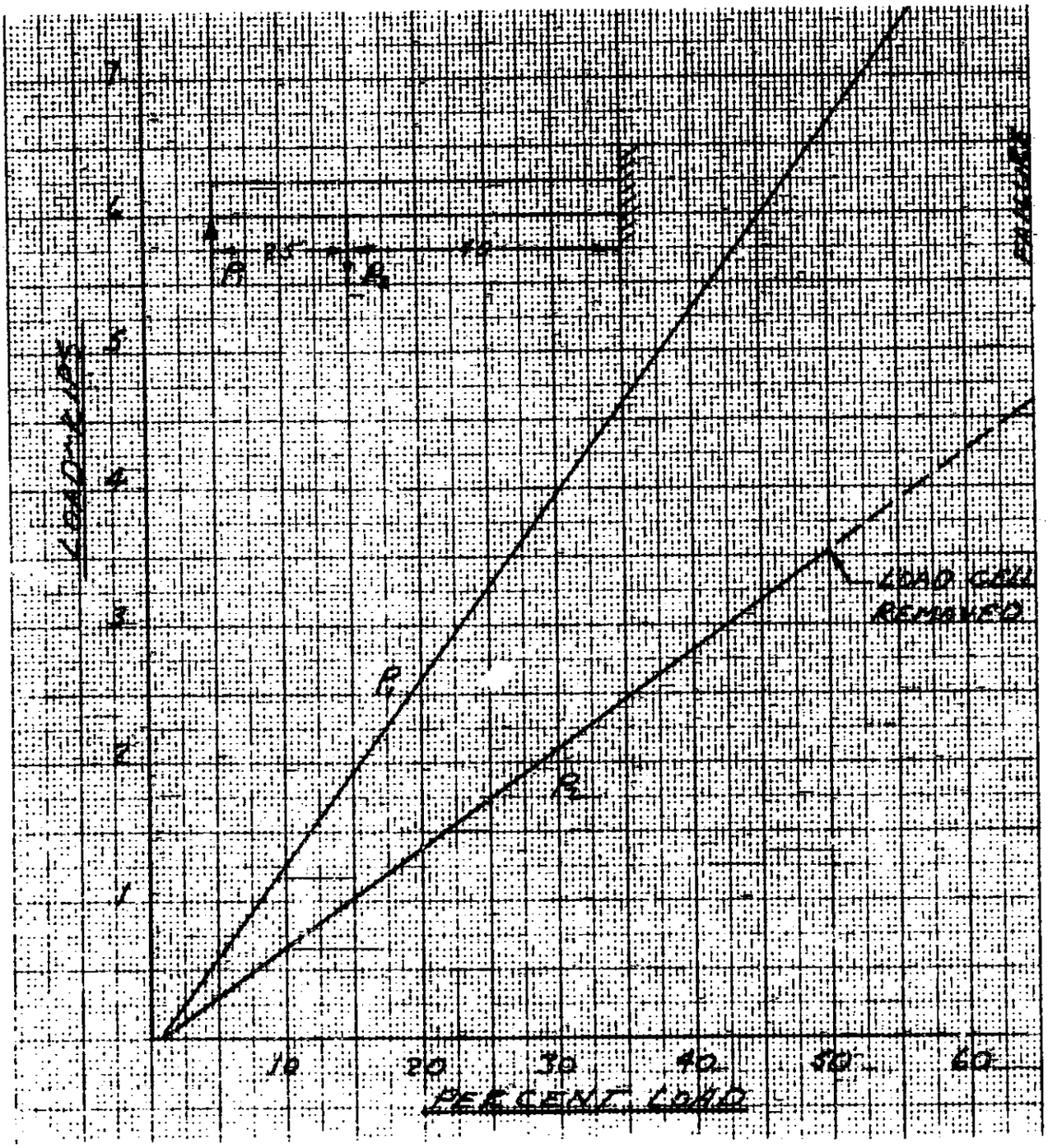


FIG. D-15 MEASURED LOADS APPLIED TO TEST SPECIMEN. P_1 MEASURED WITH PRESSURE GAGE - P_2 WITH LOAD CELL

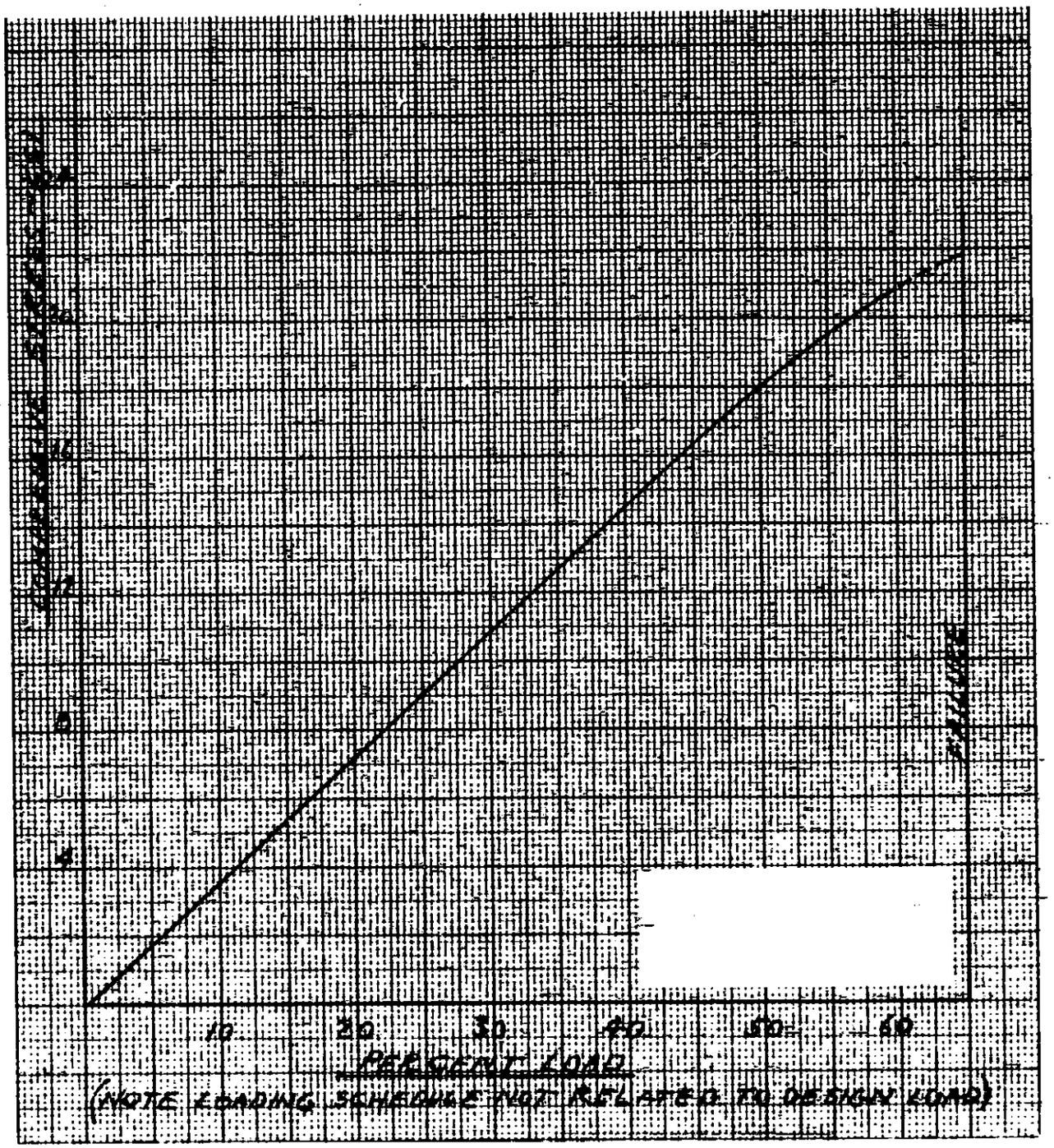


FIG. D-16 MEASURED STRESS FROM THE AVERAGE OF THE READINGS FROM SIX STRAIN GAGES IN THE CENTER OF THE CENTER PANEL. GAGES 8.1, 8.2, 9.1, 9.2, 10.1, AND 10.2.

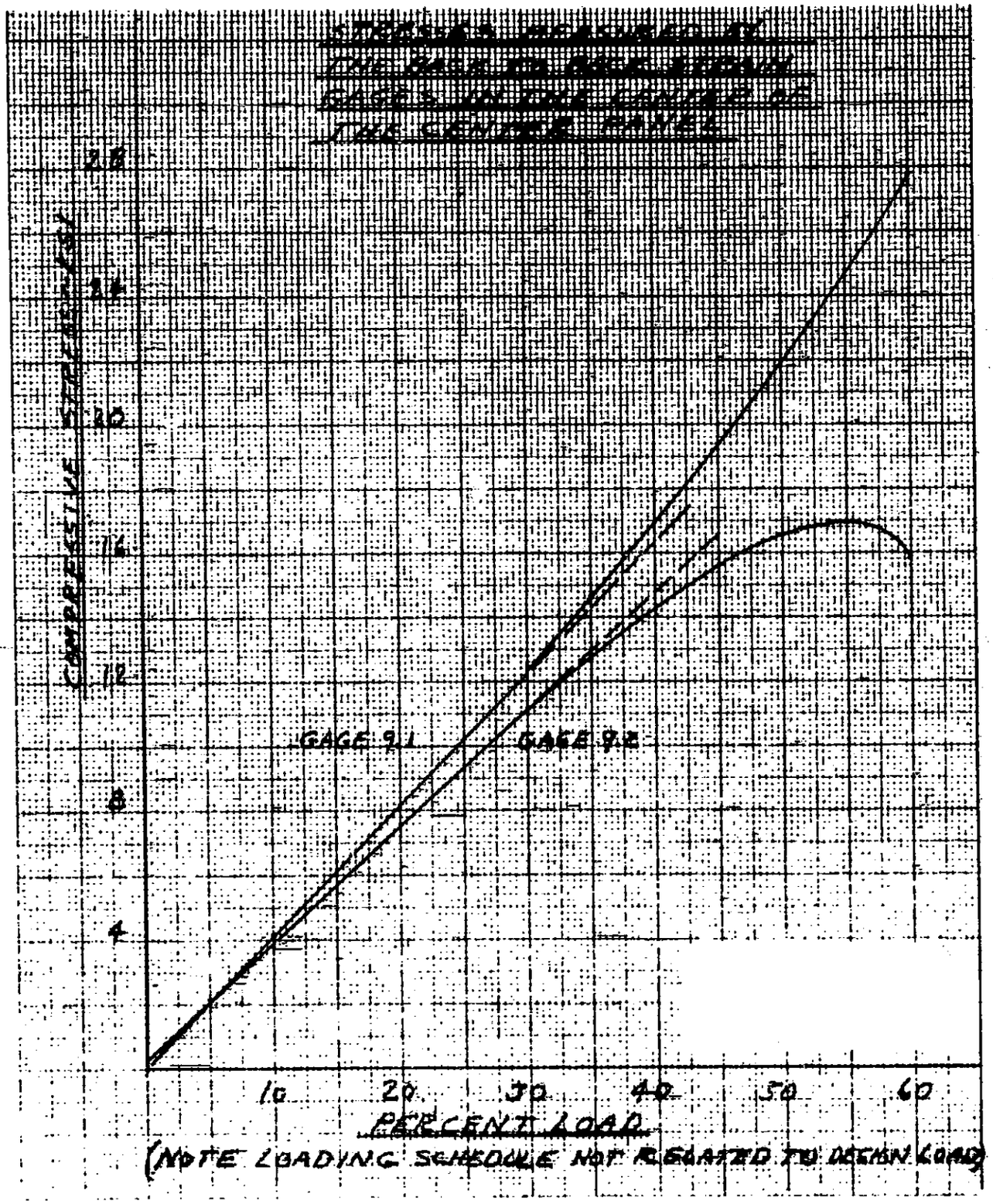


FIG. D-17 BOX BENDING TEST

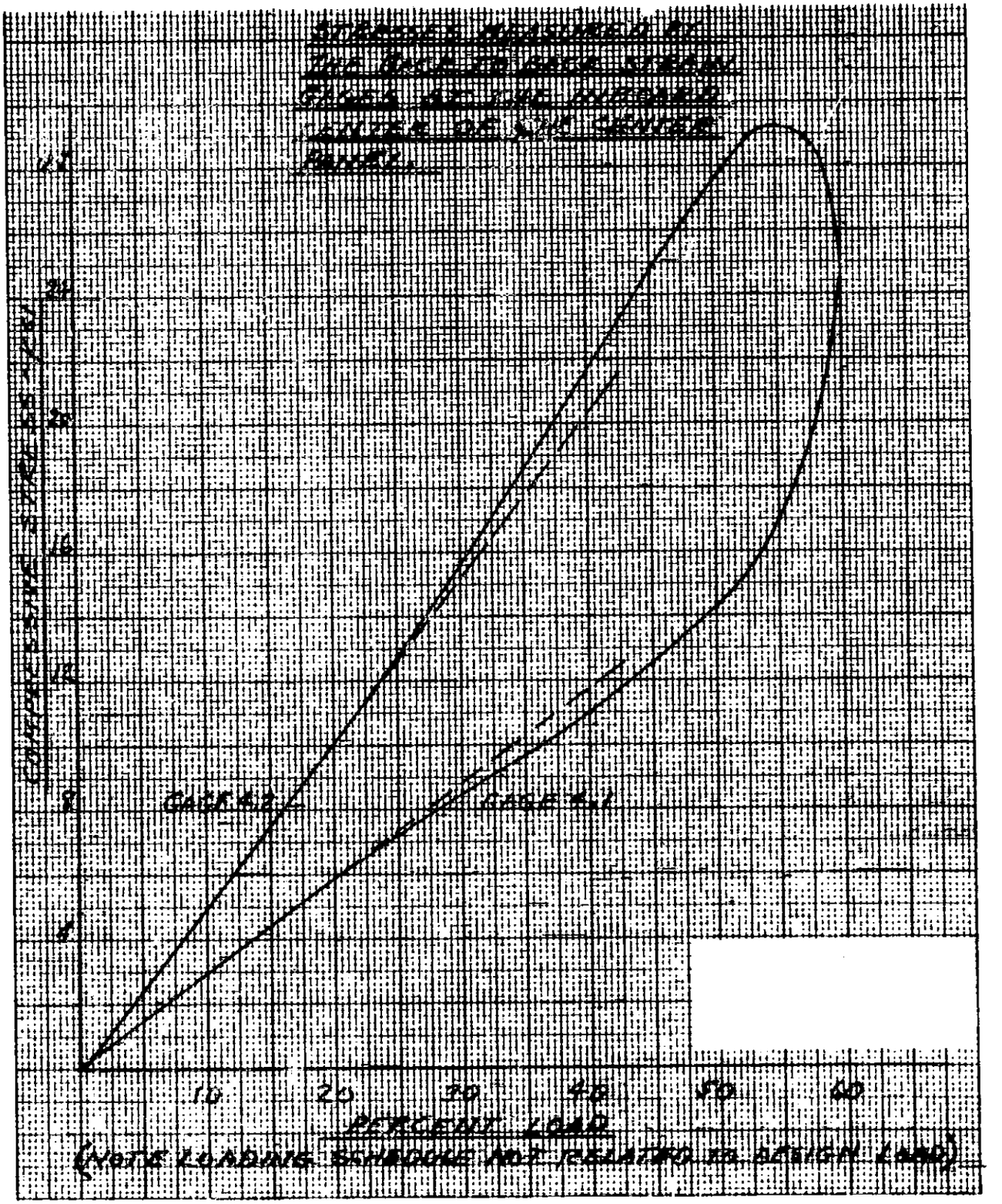


FIG. D-18 BOX BENDING TEST

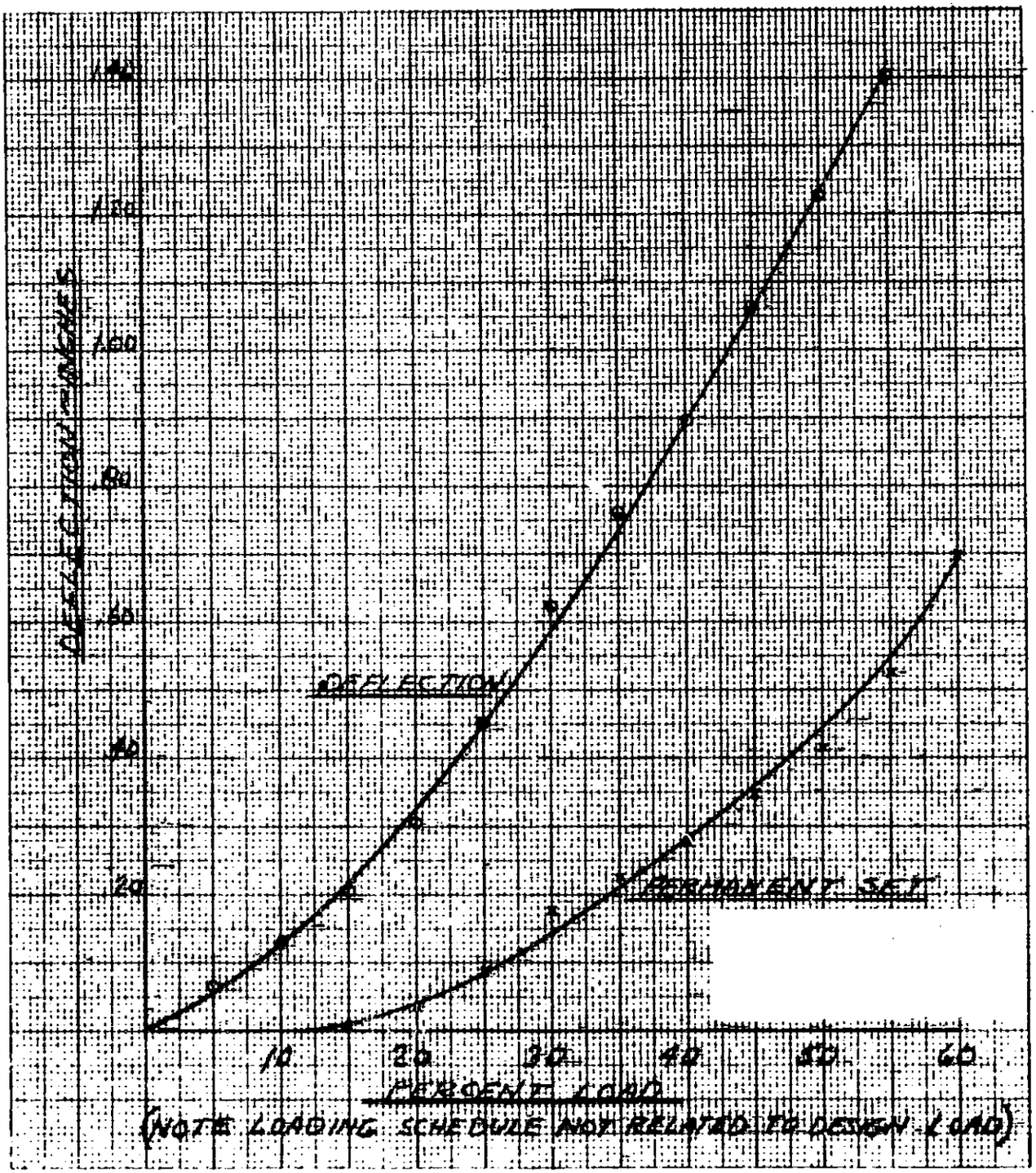
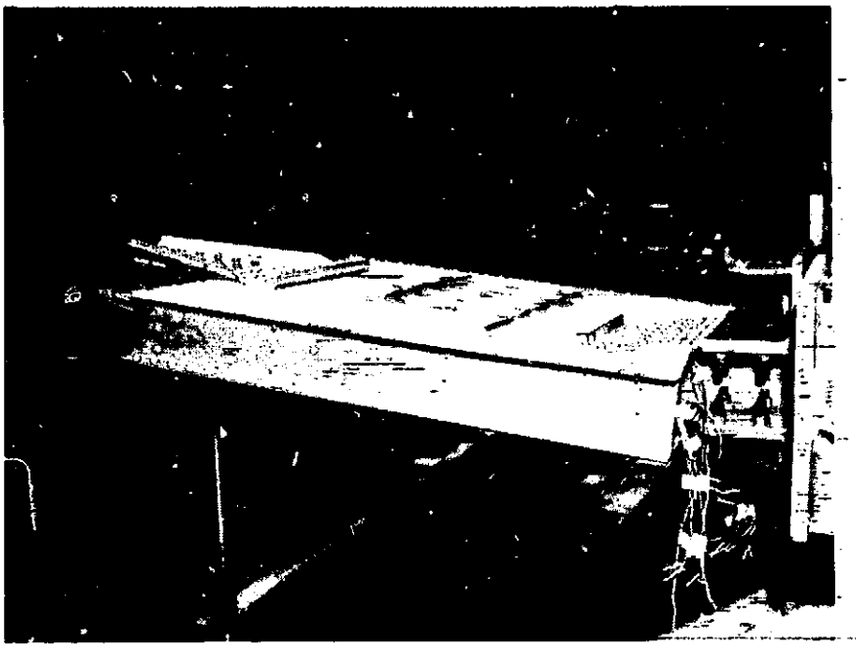
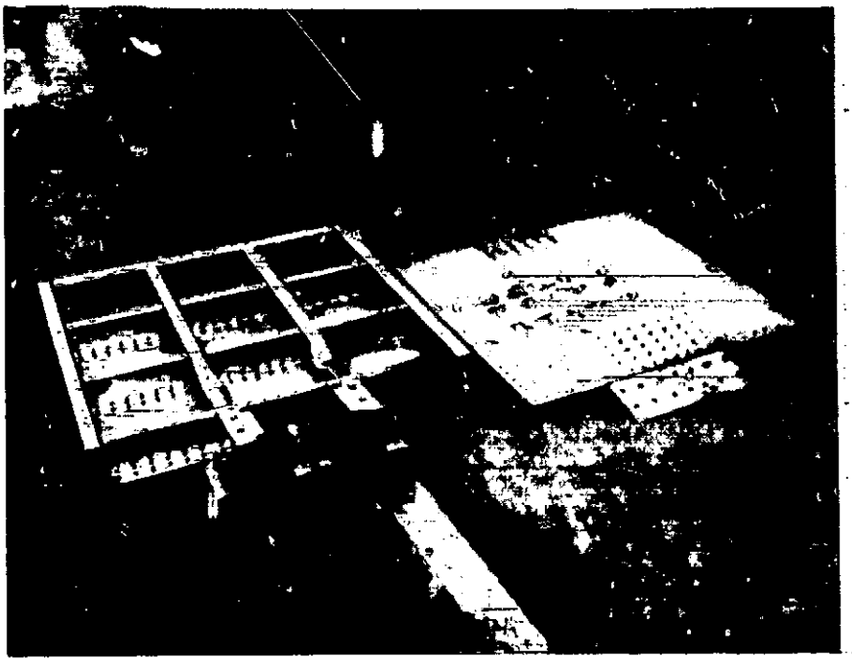


FIG. D-19 DEFLECTION AND PERMANENT SET OF THE OUTBOARD EDGE OF THE BOX SPECIMEN. CURVES ARE AVERAGE OF THE READINGS OF GAGES 7, 8, AND 9.



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.

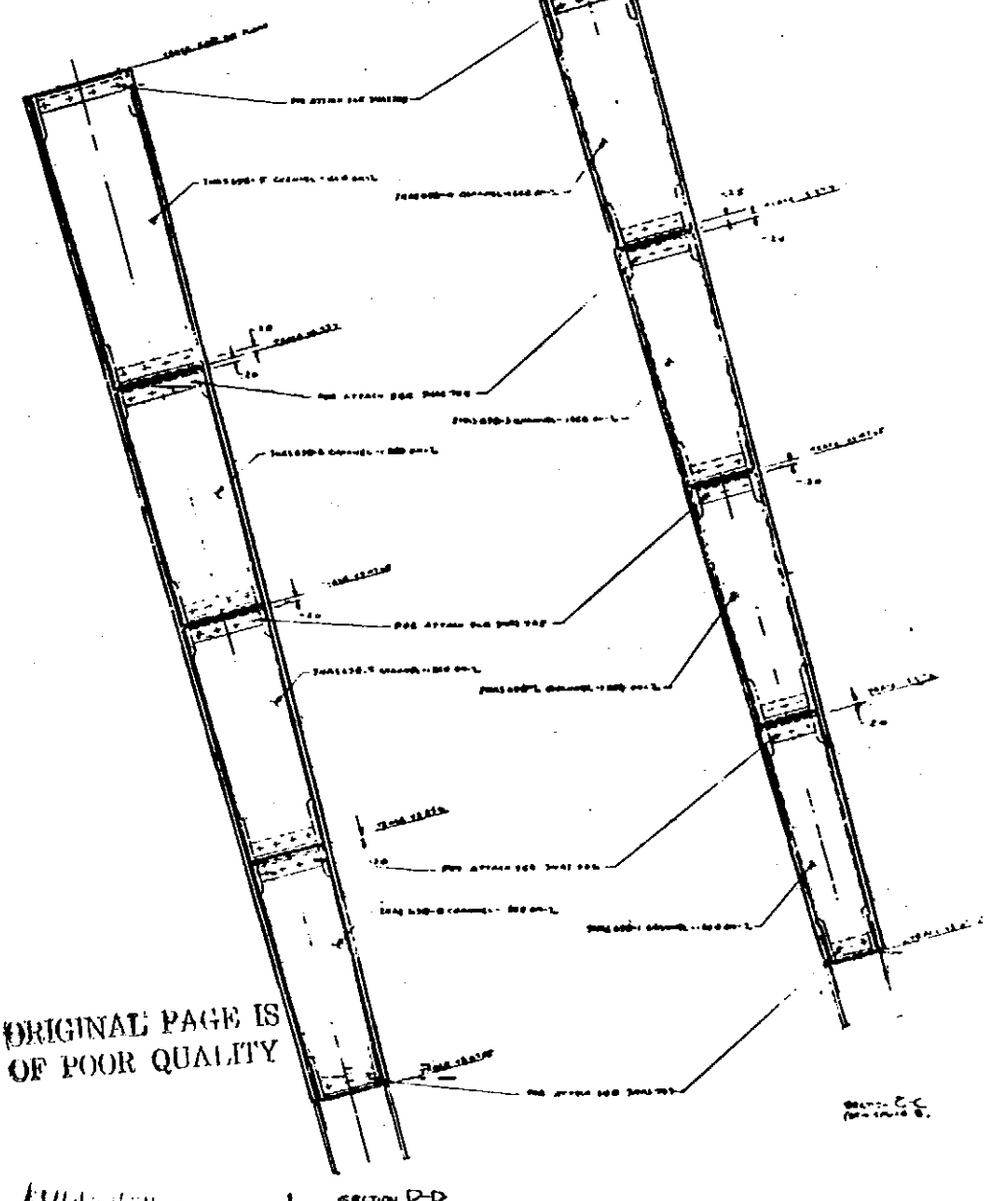
INTRODUCTION

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.

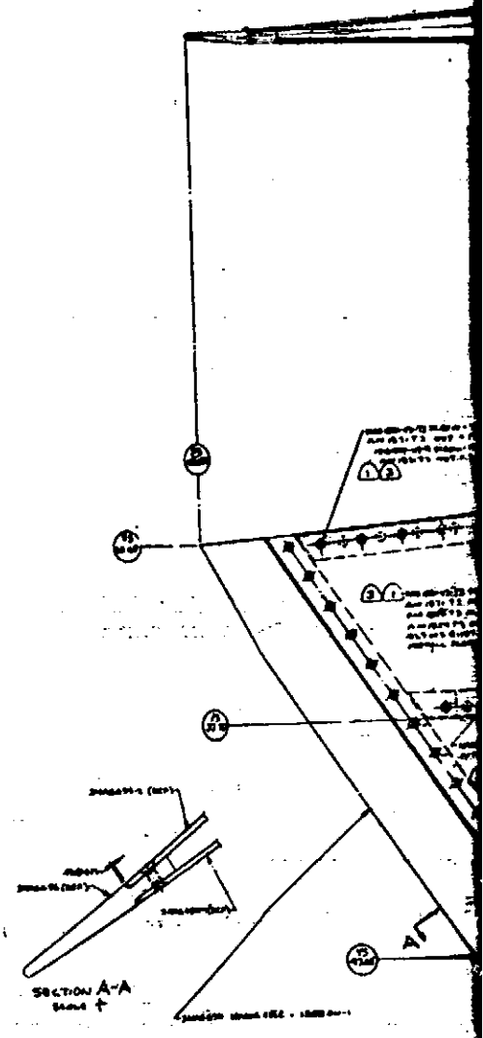
Additional structural verification is supplied by the ventral fin proof test in which the ventral is loaded to limit load for three critical conditions.

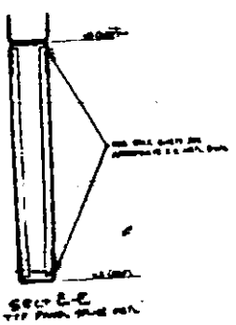
DESCRIPTION

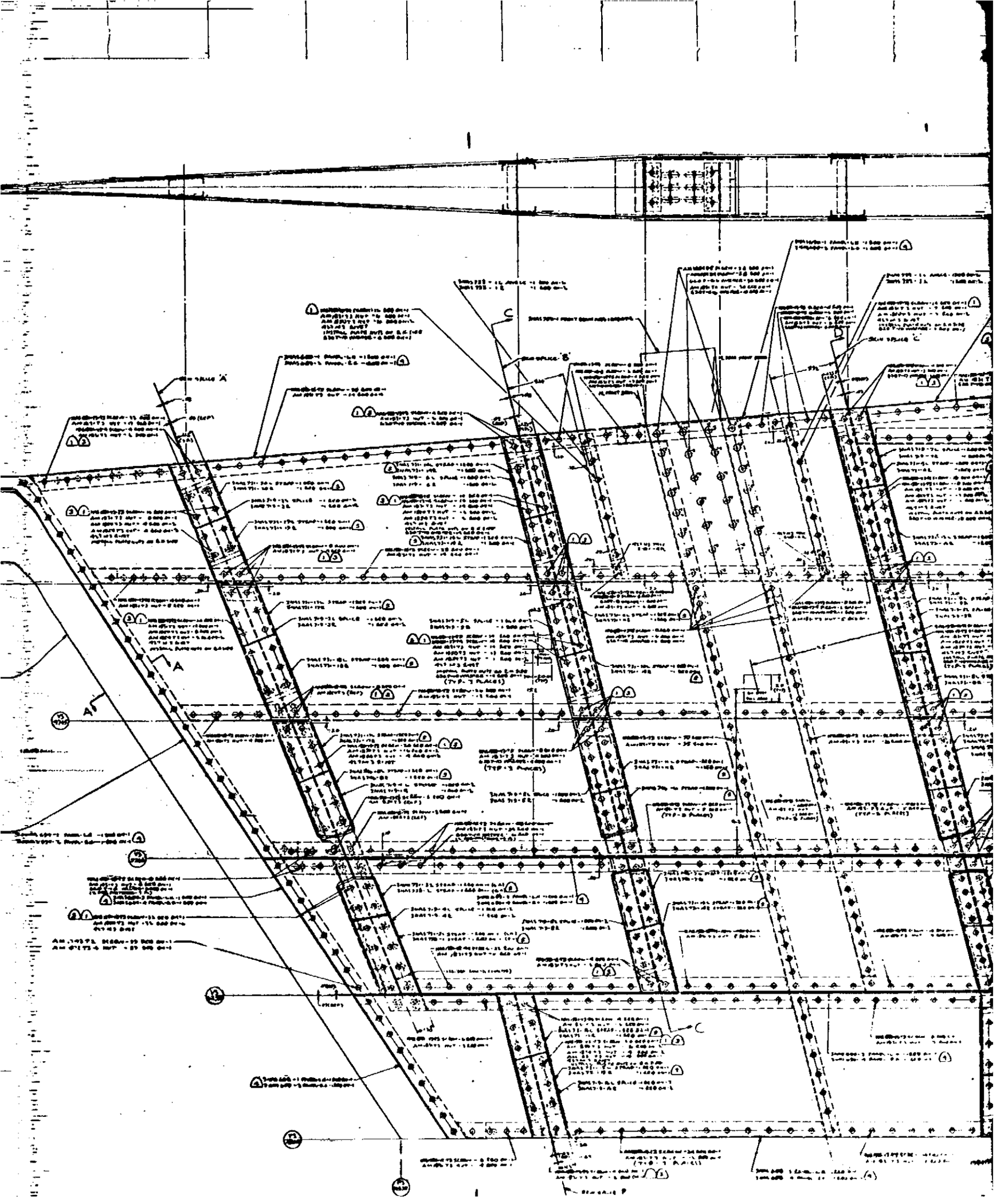
The Lockalloy ventral fin assembly is shown on Figure 1 and basic fin geometry is shown on Figures 2 and 3. The fin structure essentially consists of .050 B-120 annealed titanium channel type ribs and beams with .150 and .125 thick Lockalloy skins. Skin panels are available in limited sizes so appropriate 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.

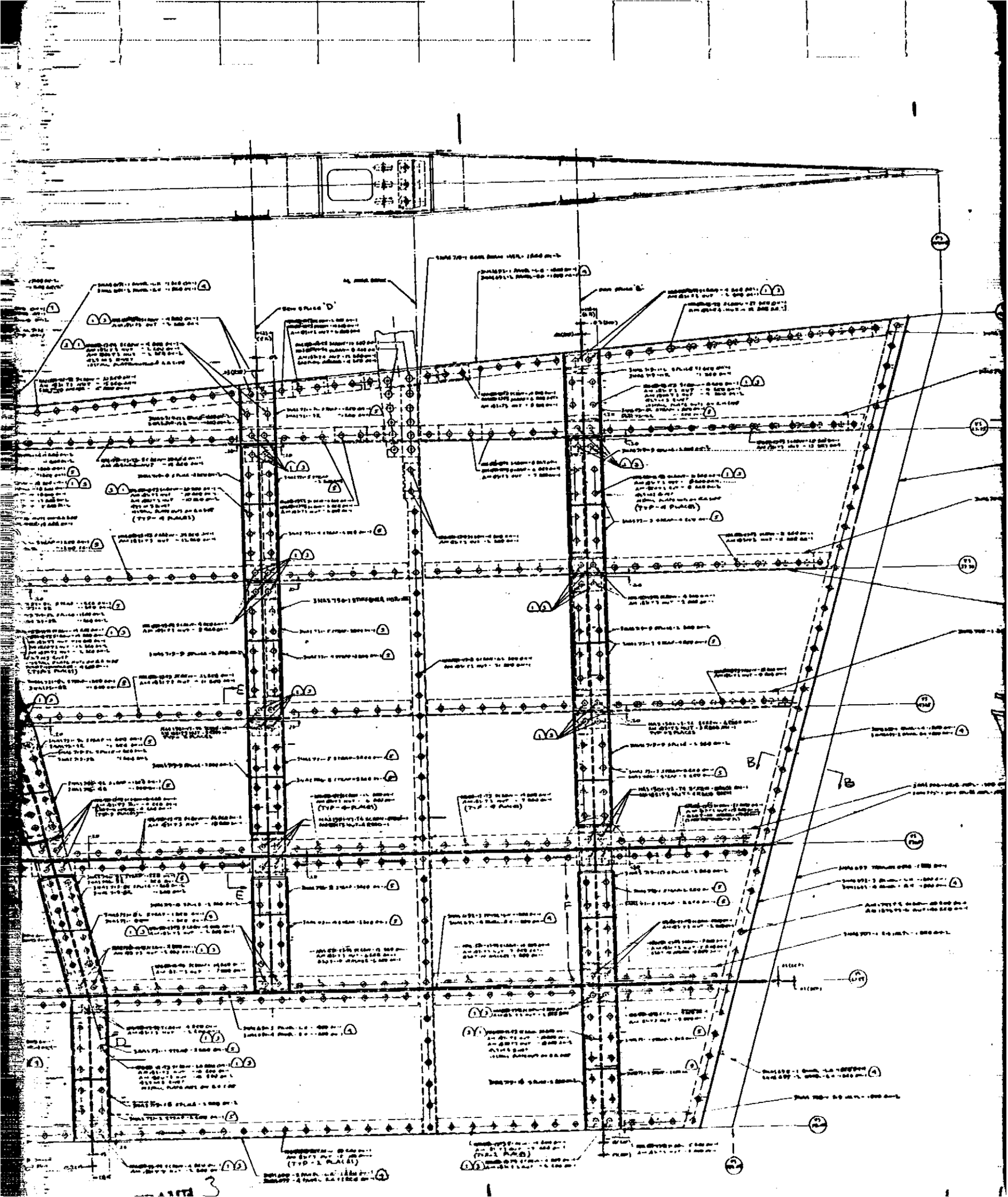


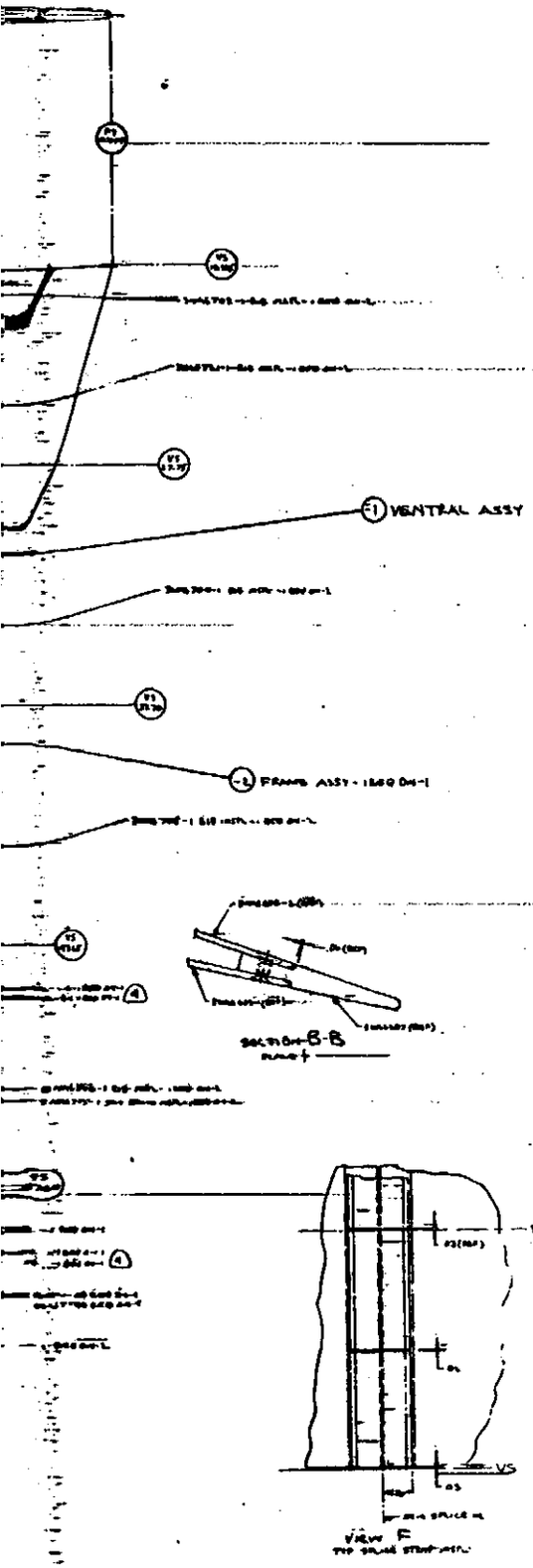
SECTION D-D

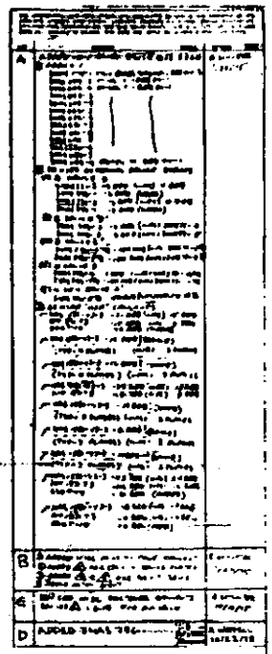








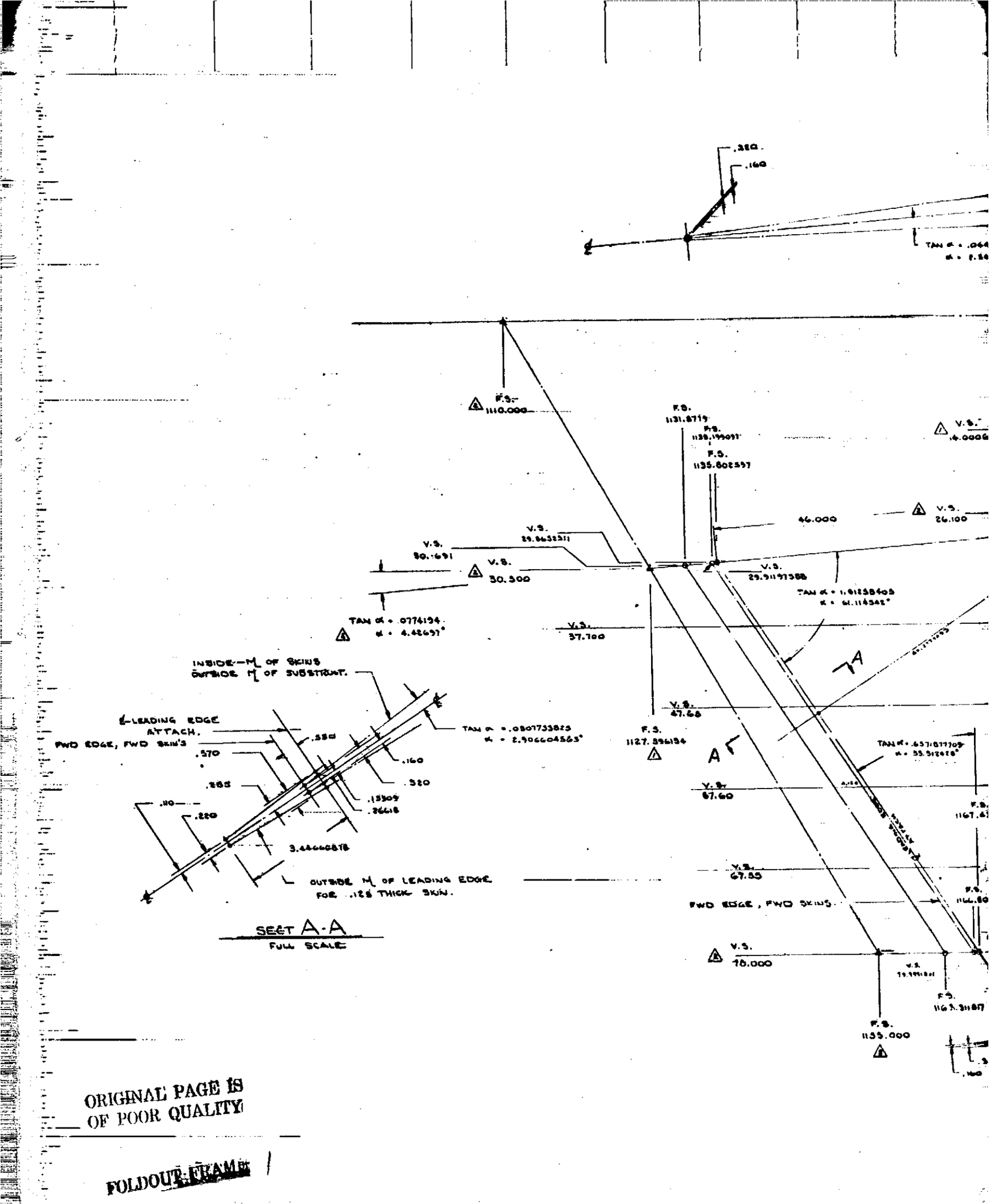




FOLDOUT FRAME

FIGURE 1

VENTRAL ASSY
Be-38AL
3NAS 68
D



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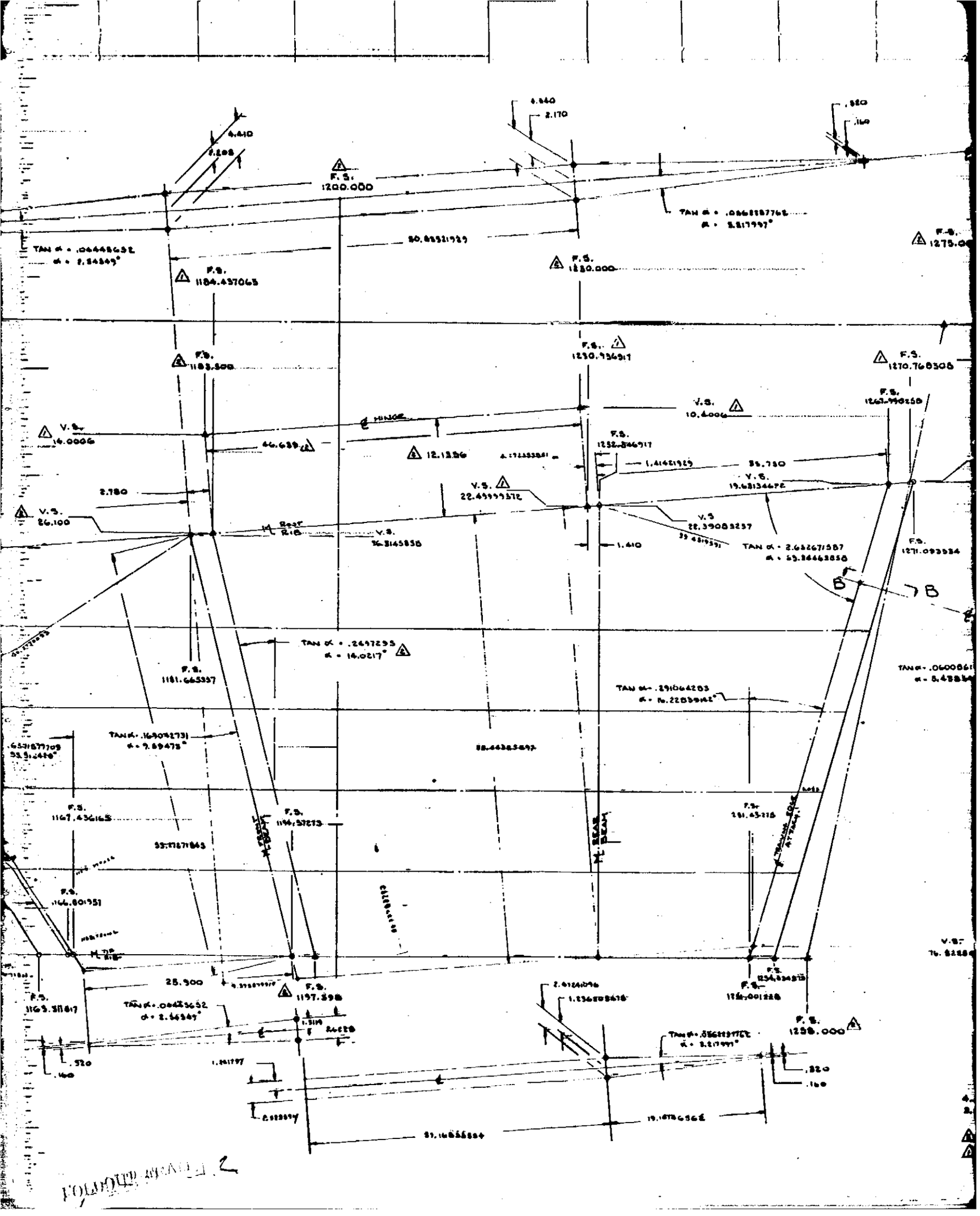
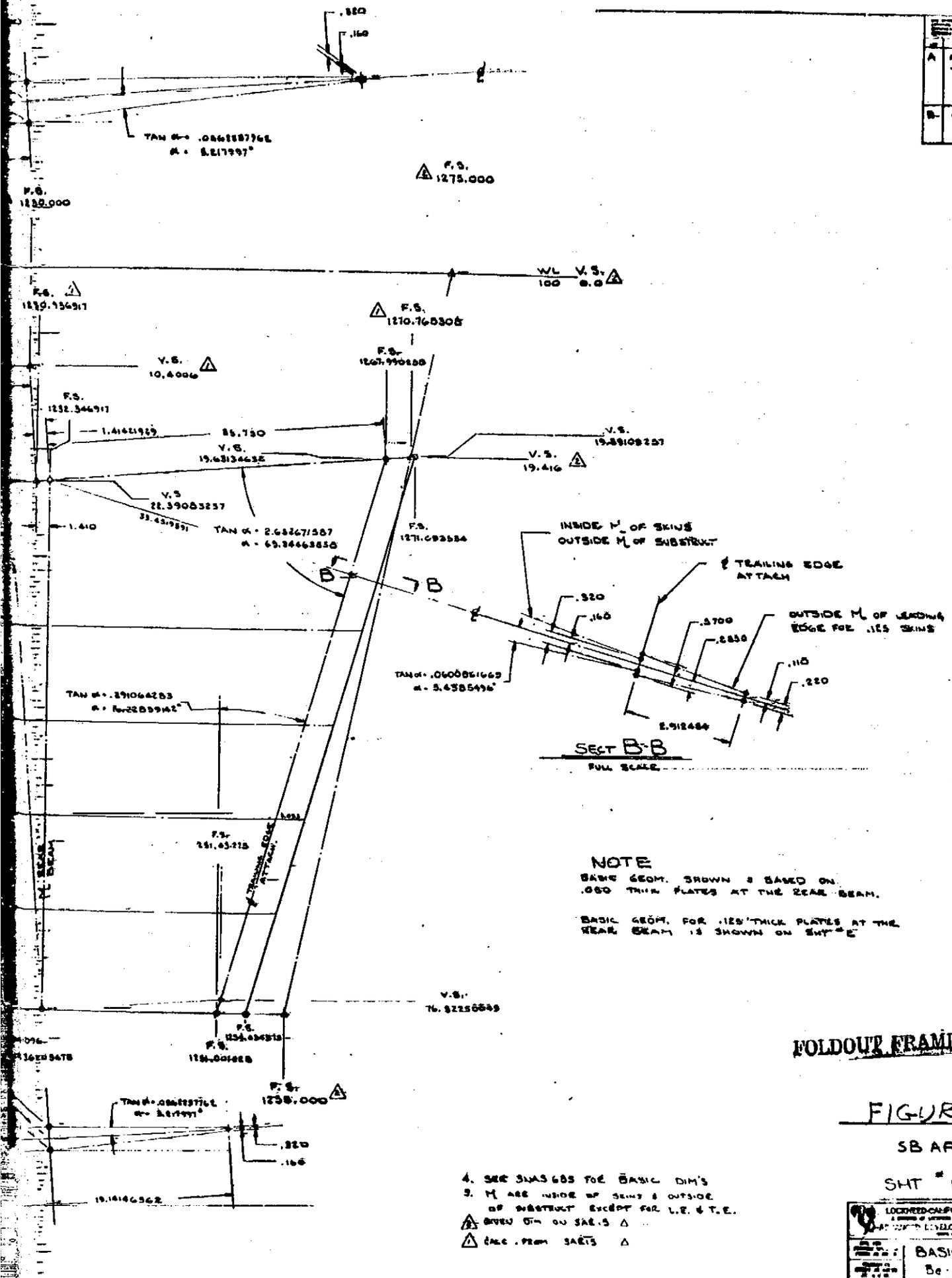
OF POOR QUALITY

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

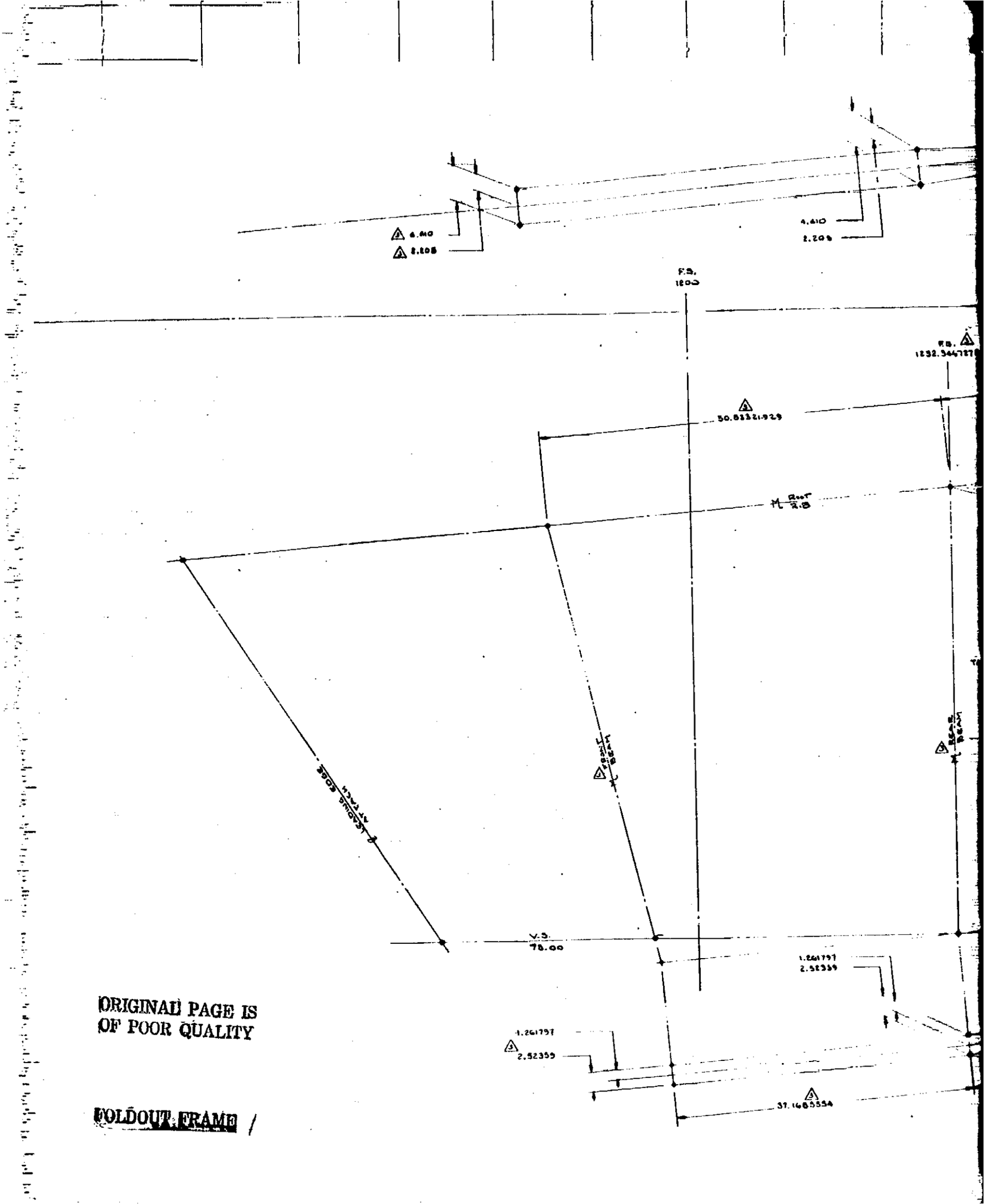
SHT # 1 OF 2

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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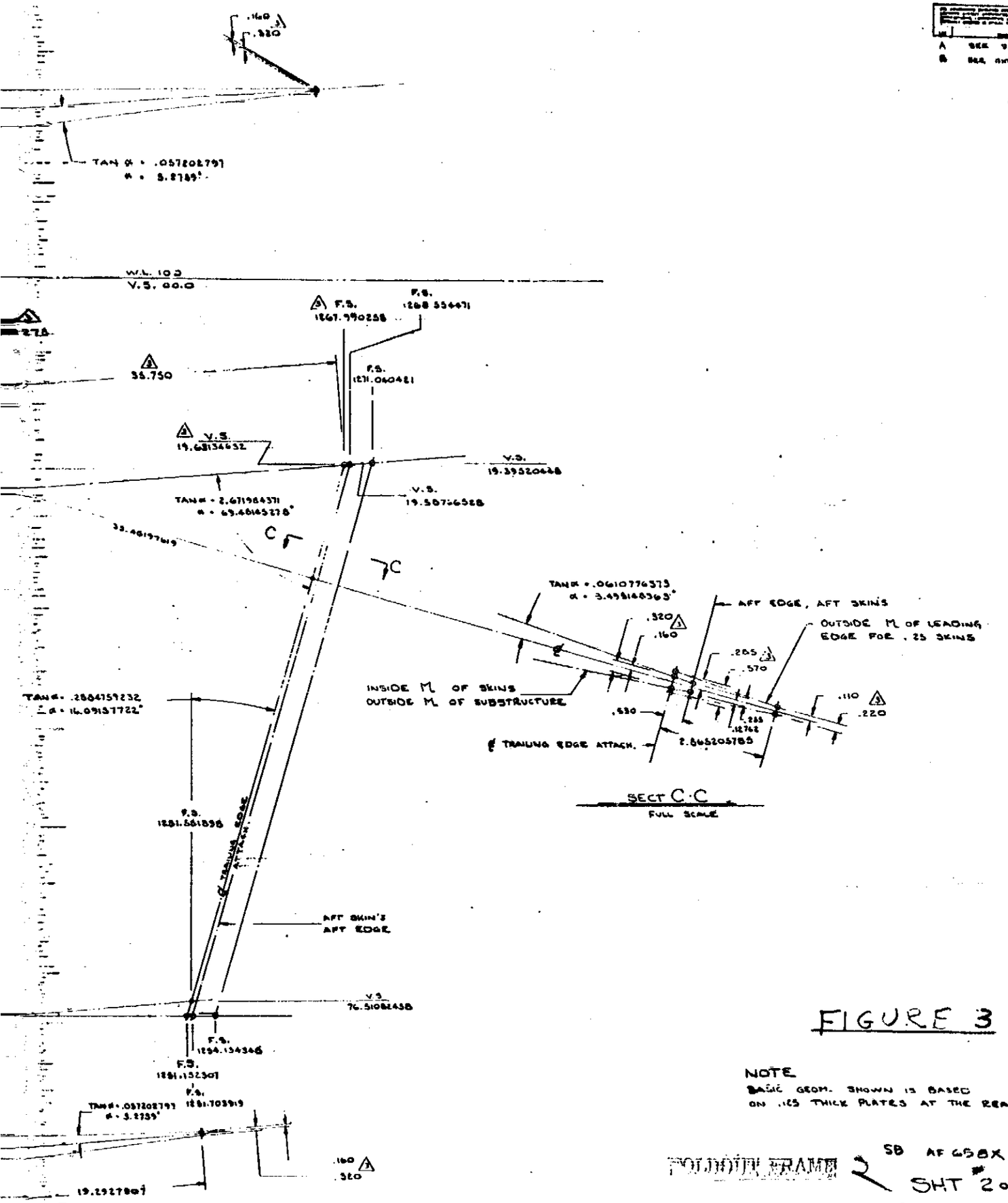


FIGURE 3

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.

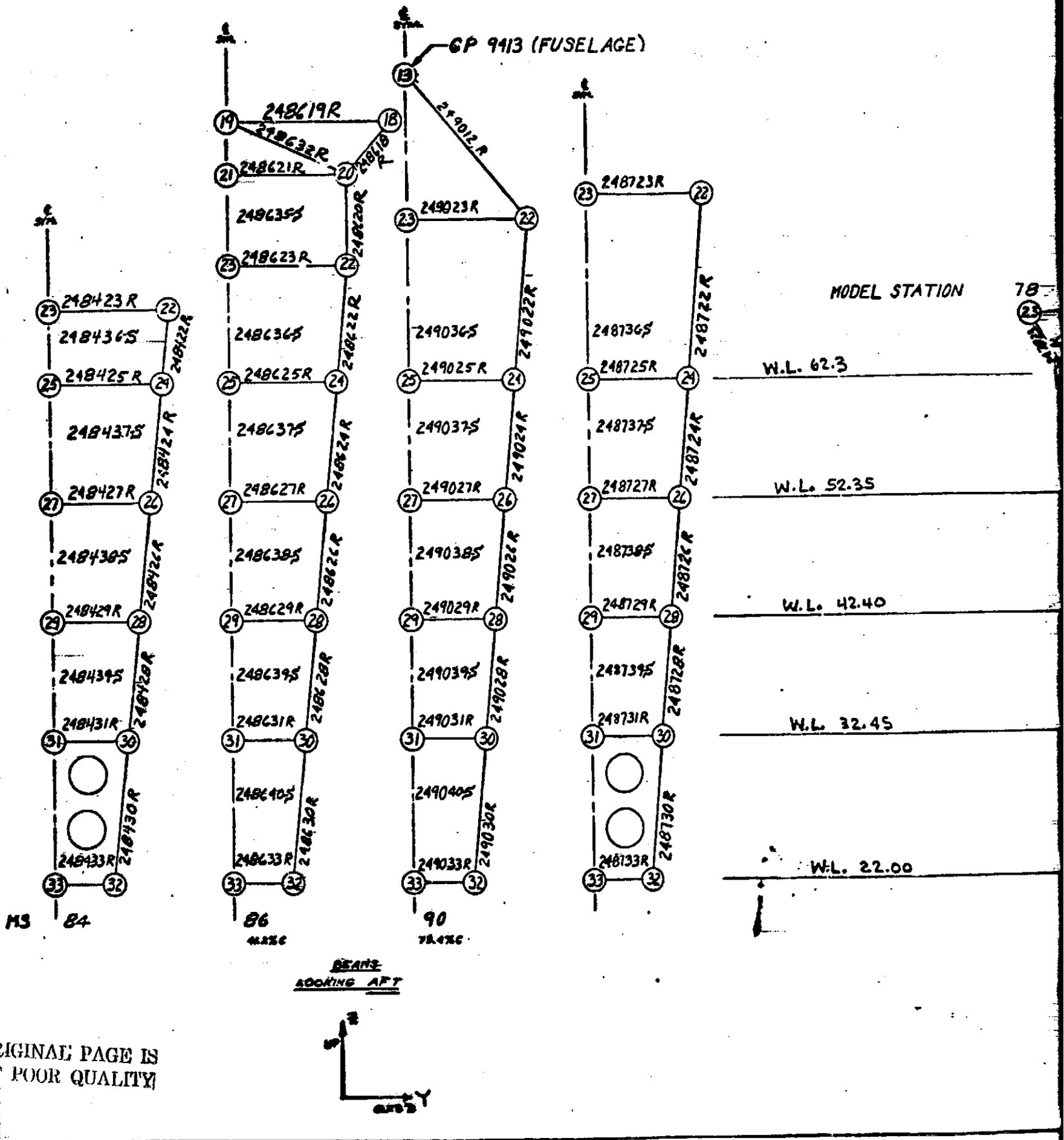
All section properties, gridpoint locations and internal loads are contained in unsubmitted data. Representative internal loads data is plotted on Figures 7 through 13. The total applied loads are listed in the table below. Gridpoint loads or panel pressures used to represent these applied loads are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

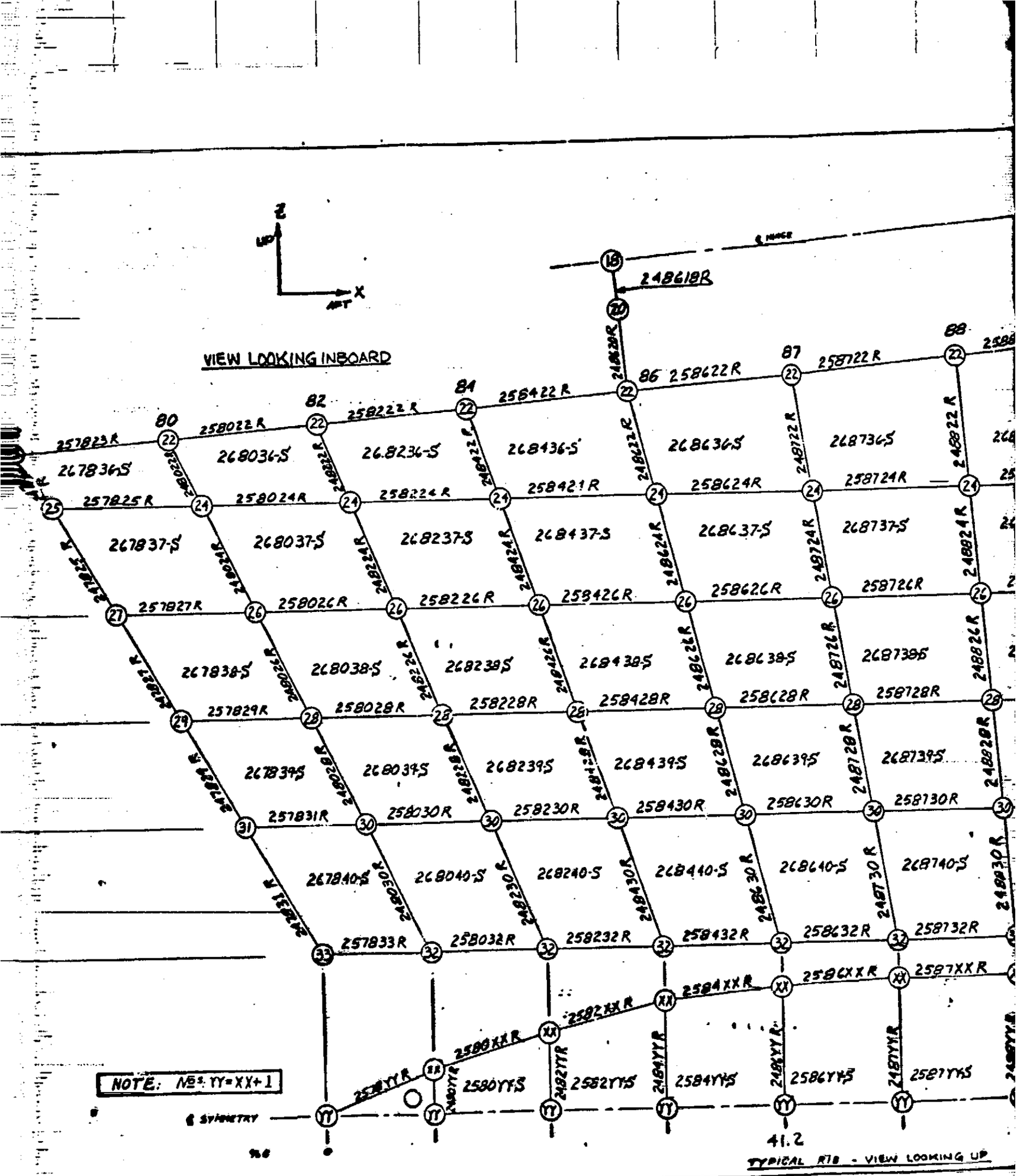
TOTAL VENTRAL APPLIED LOAD (ULTIMATE)				
CASE NO.	CONDITION	P_Y LB.	C.P.	TEMP.
1	CRUISE	6,685	47.2%	550°F
2	FWD. C.P.	6,822	15.0%	R.T.
3	AFT C.P.	6,207	71.1%	R.T.
4	ARB. FWD C.P.	4,695	5.0%	R.T.

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

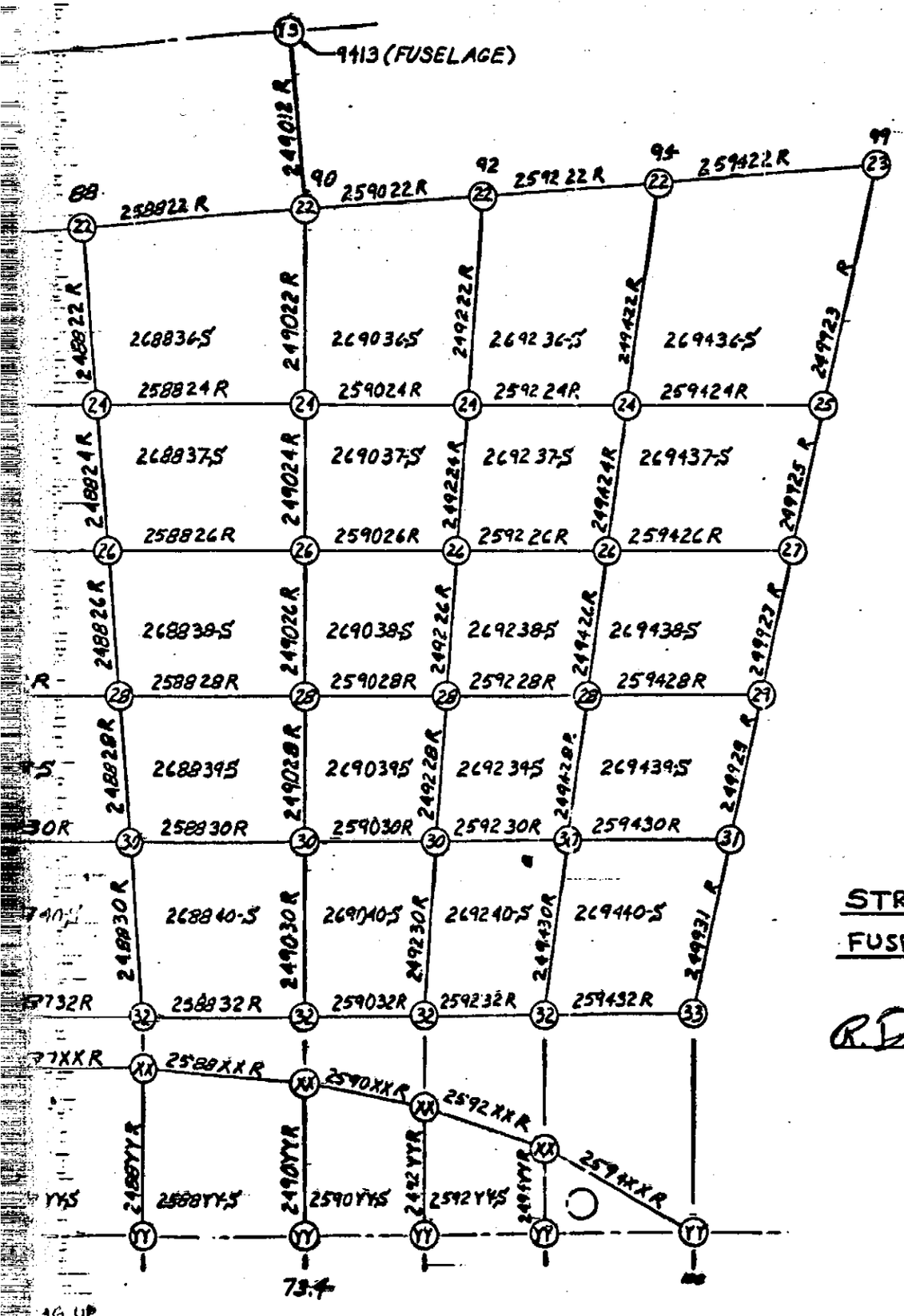


FIGURE 4

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.

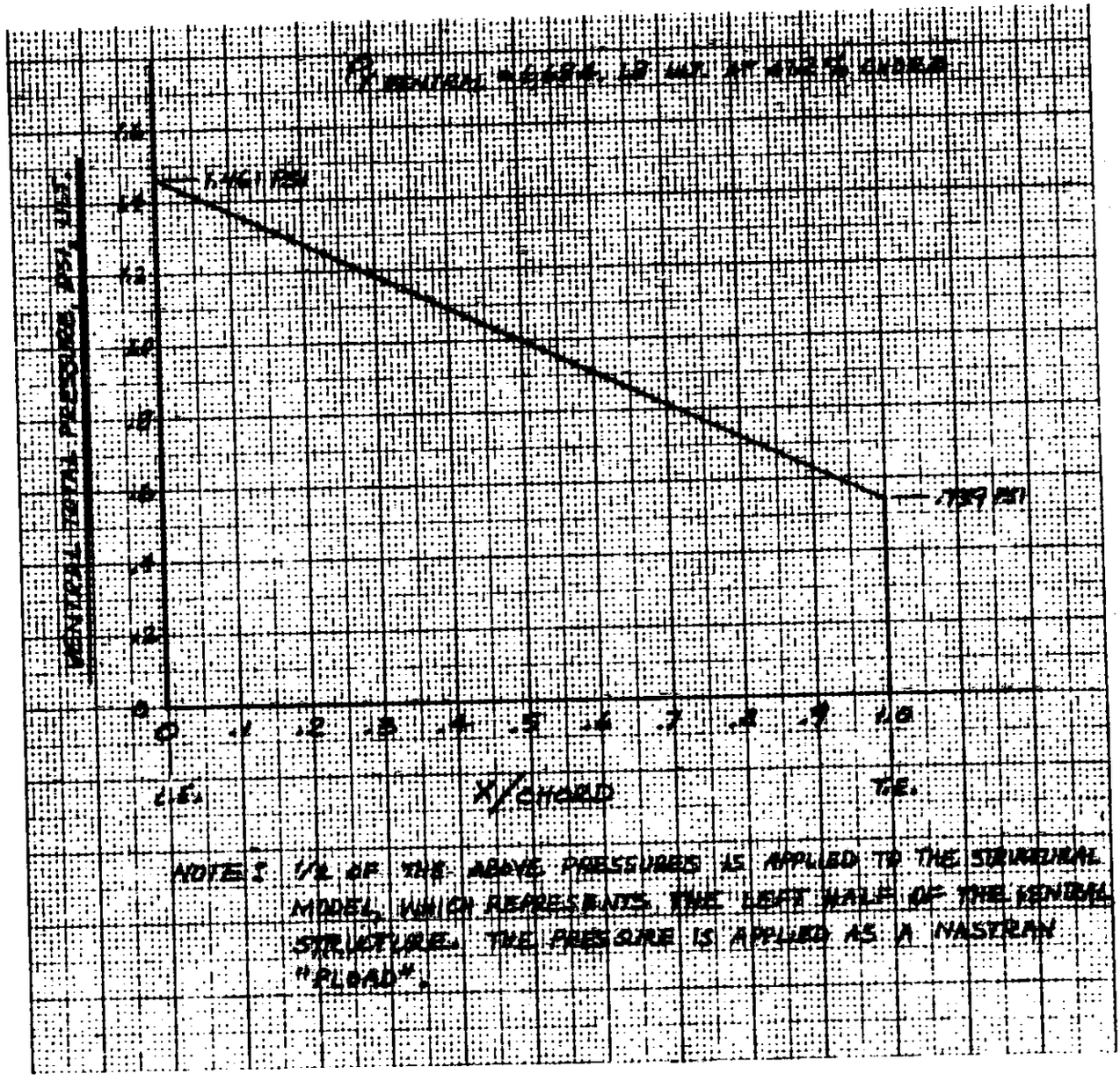


FIGURE 5 STRUCTURAL MODEL PRESSURE DISTRIBUTION
CASE 1 CRUISE MACH - ENGINE FAILURE

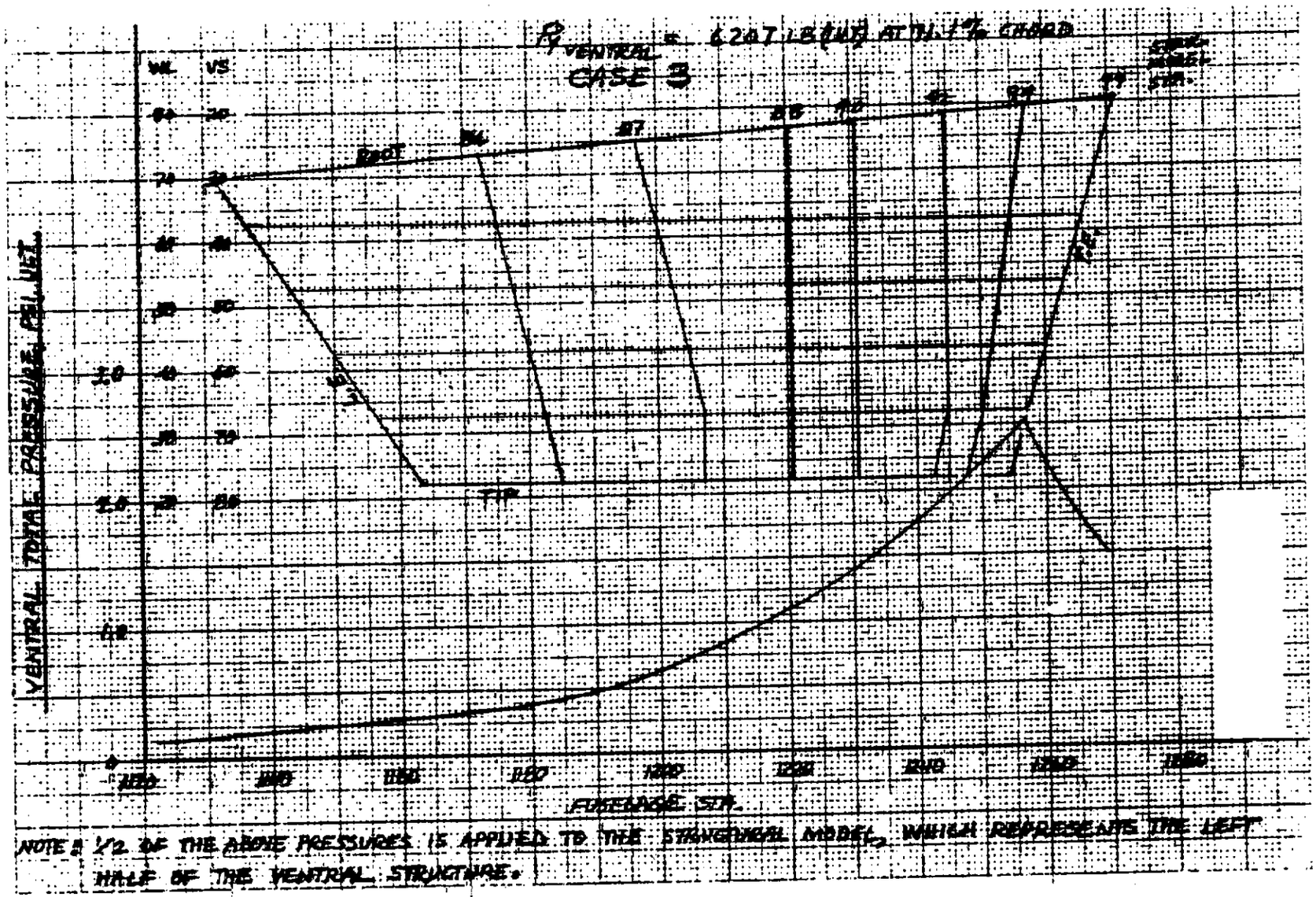


FIGURE 6 STRUCTURAL MODEL PRESSURE DISTRIBUTION
14° (TOTAL) AILERON DEFLECTION AT M = .95

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.

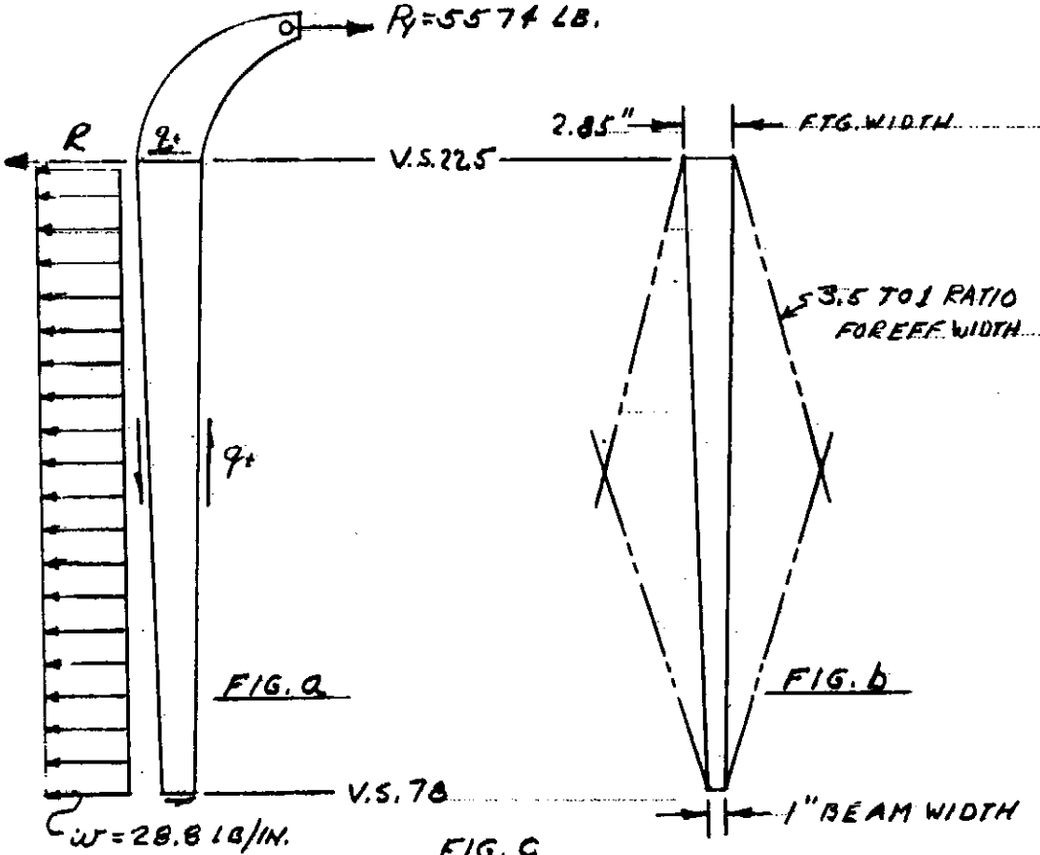
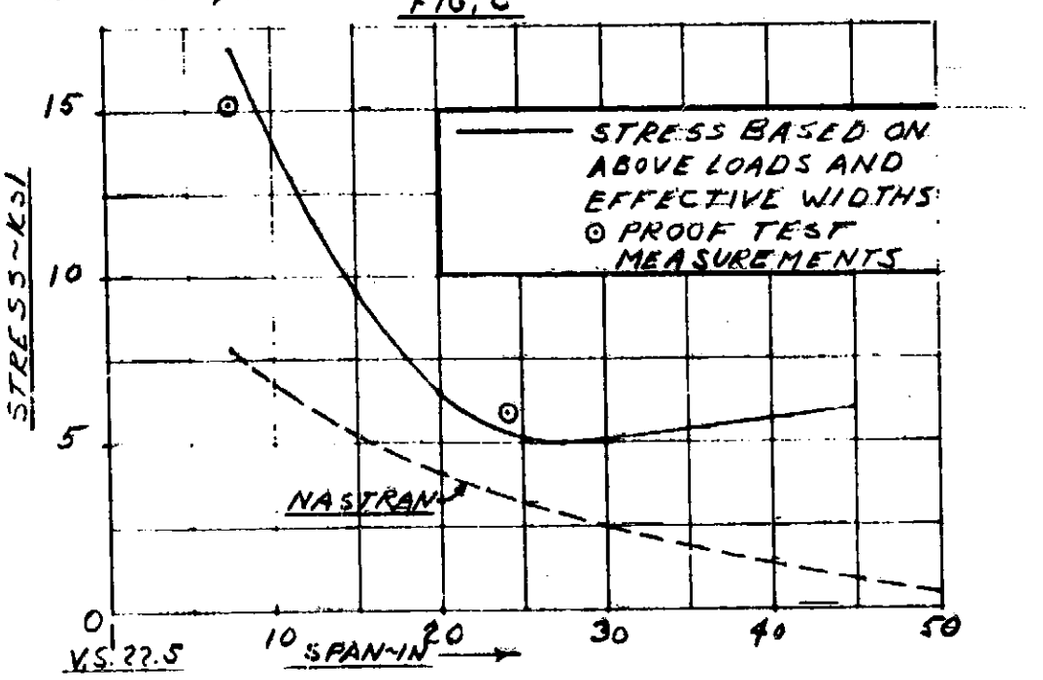


FIG. C



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

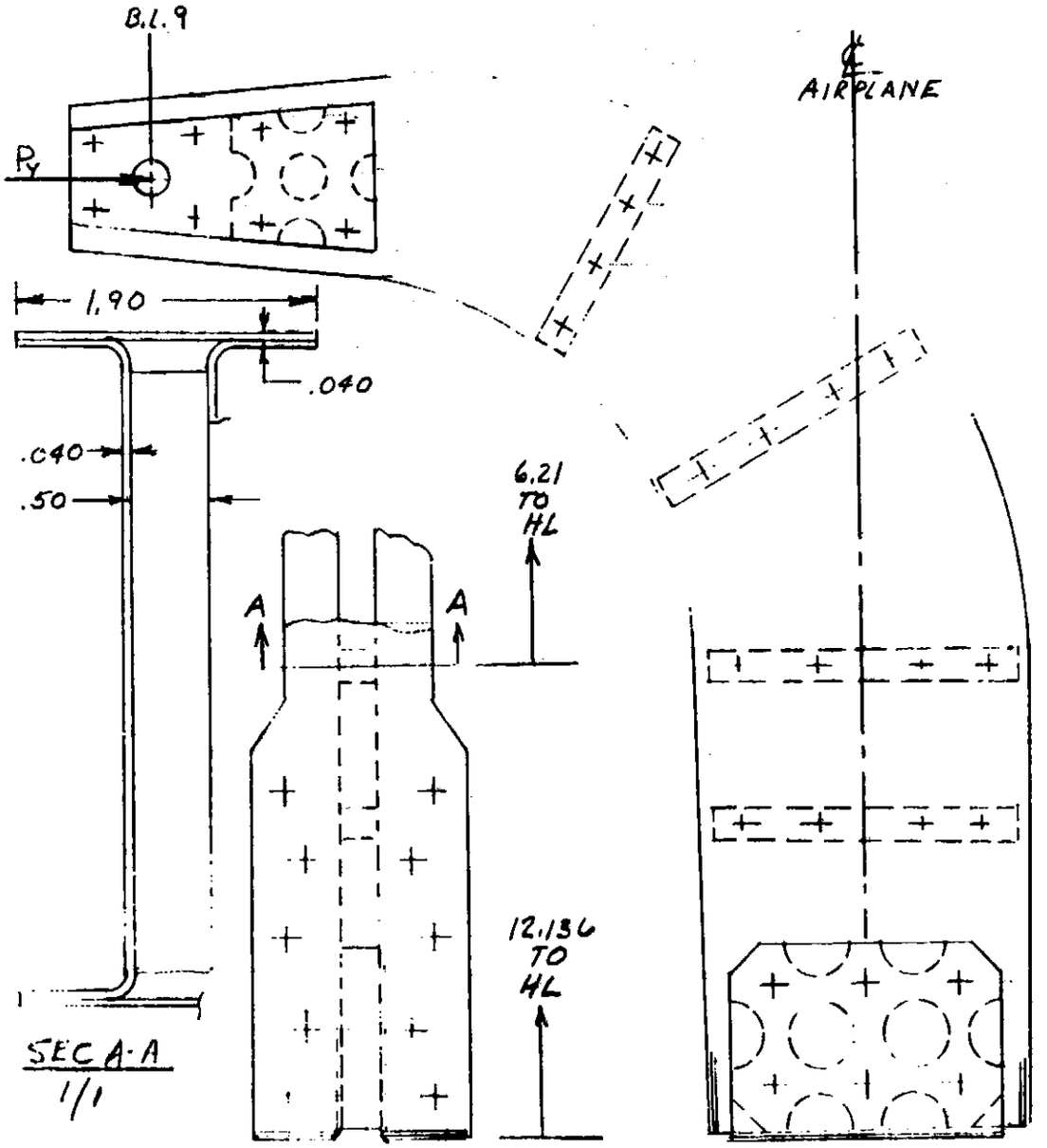
$$M.S. = \frac{28000}{7800+8800} - 1 = .69 \quad (.472 \text{ CP COND.})$$

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.

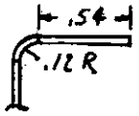
BENDING ON SEC. A-A

$M = 5574 \times 6.21 = 34615$ 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.

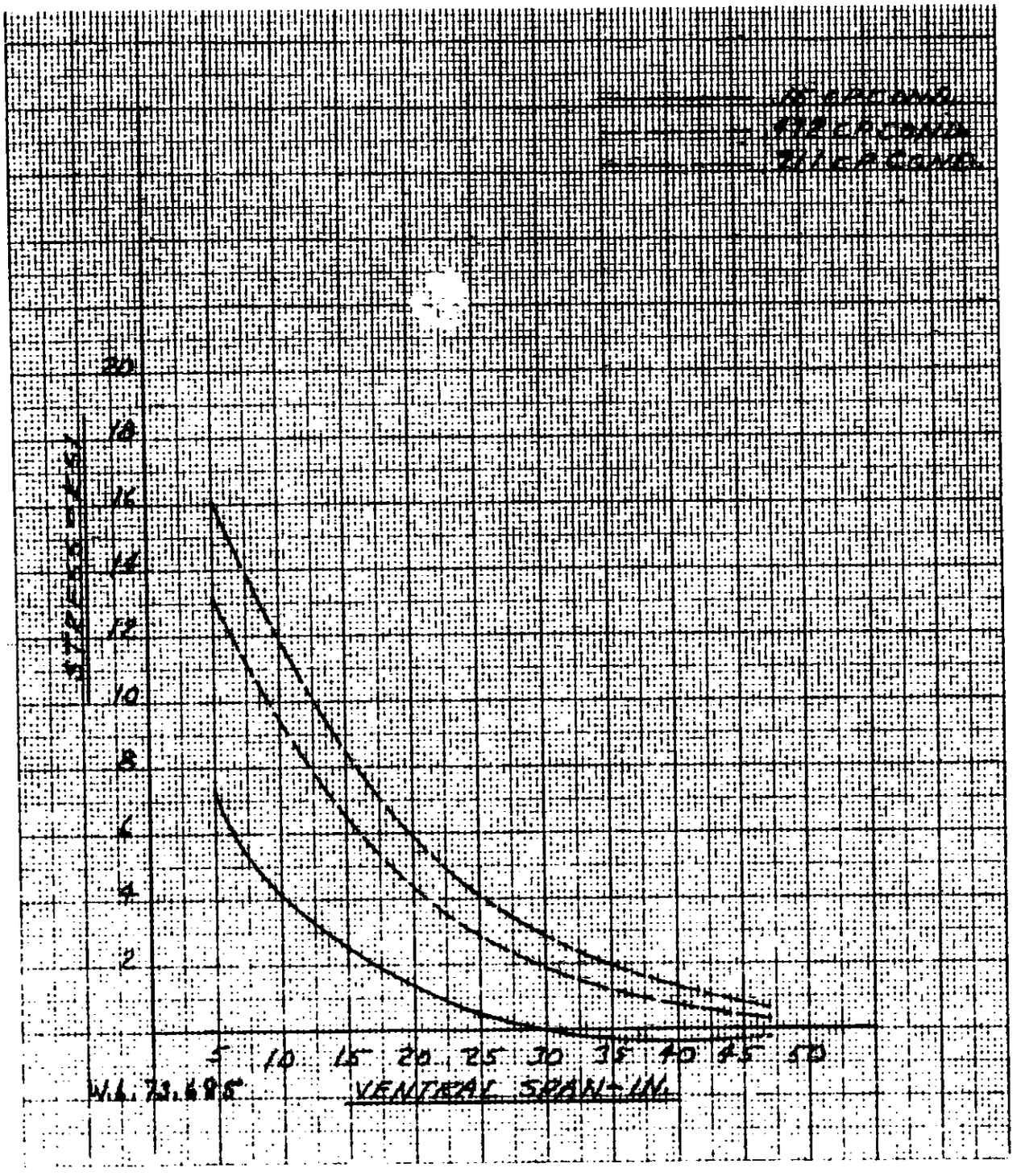


FIGURE 7 FRONT BEAM CAP STRESSES

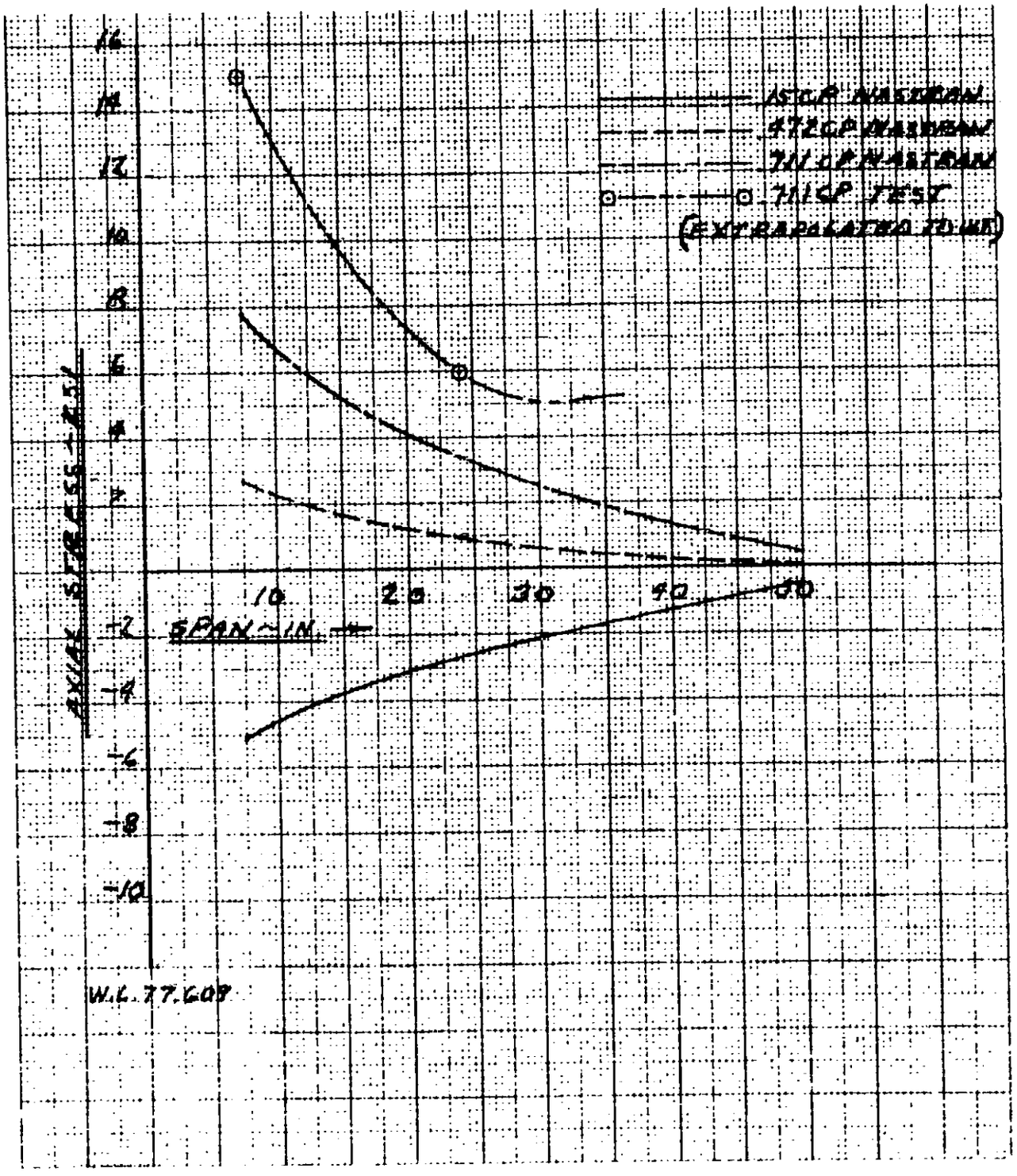


FIGURE 8 REAR BEAM CAP STRESSES (ULTIMATE)

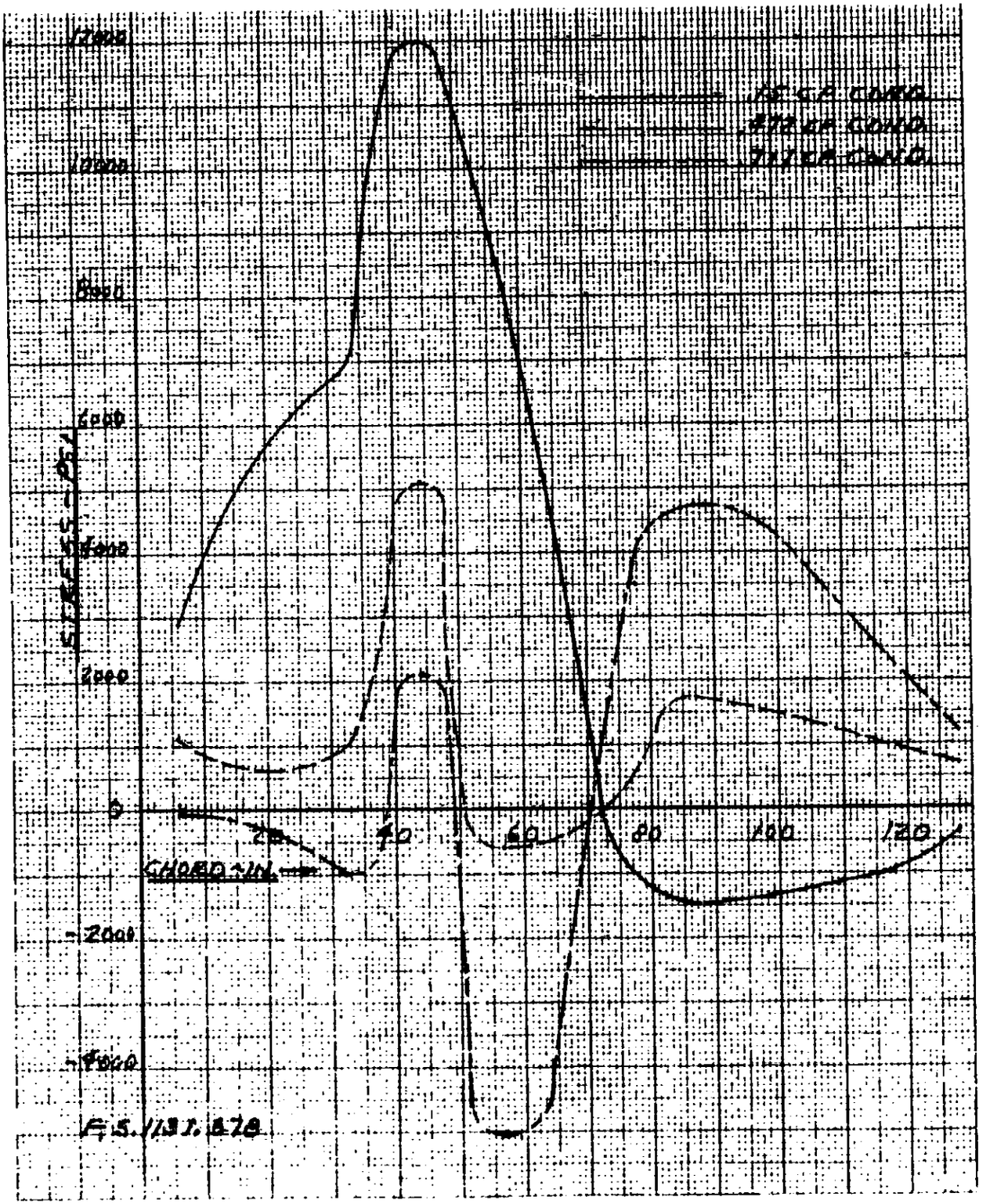


FIGURE 9 ROOT RIB CAP STRESSES

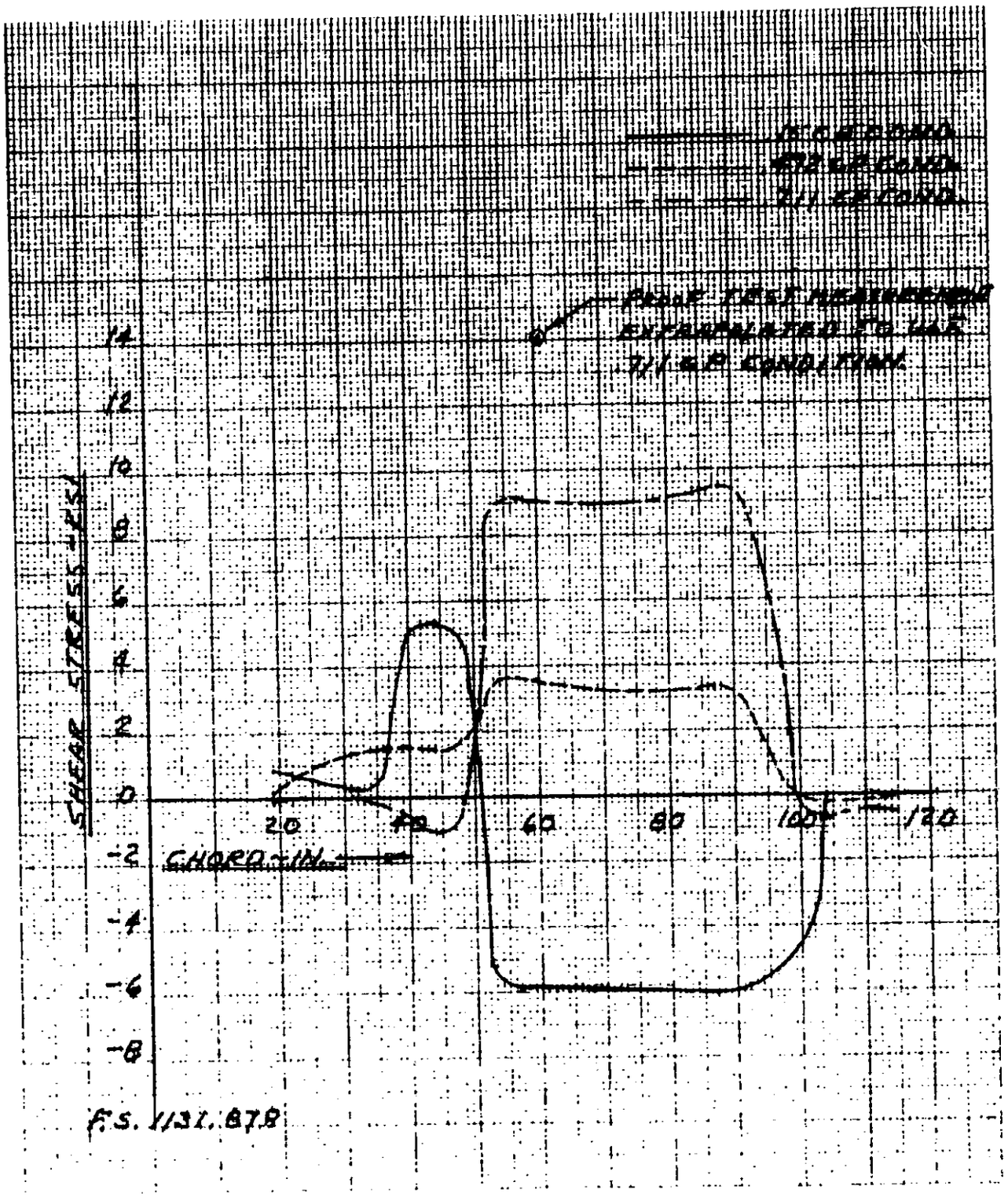


FIGURE 19 RIB WEB SHEAR STRESSES-ROOT RIB

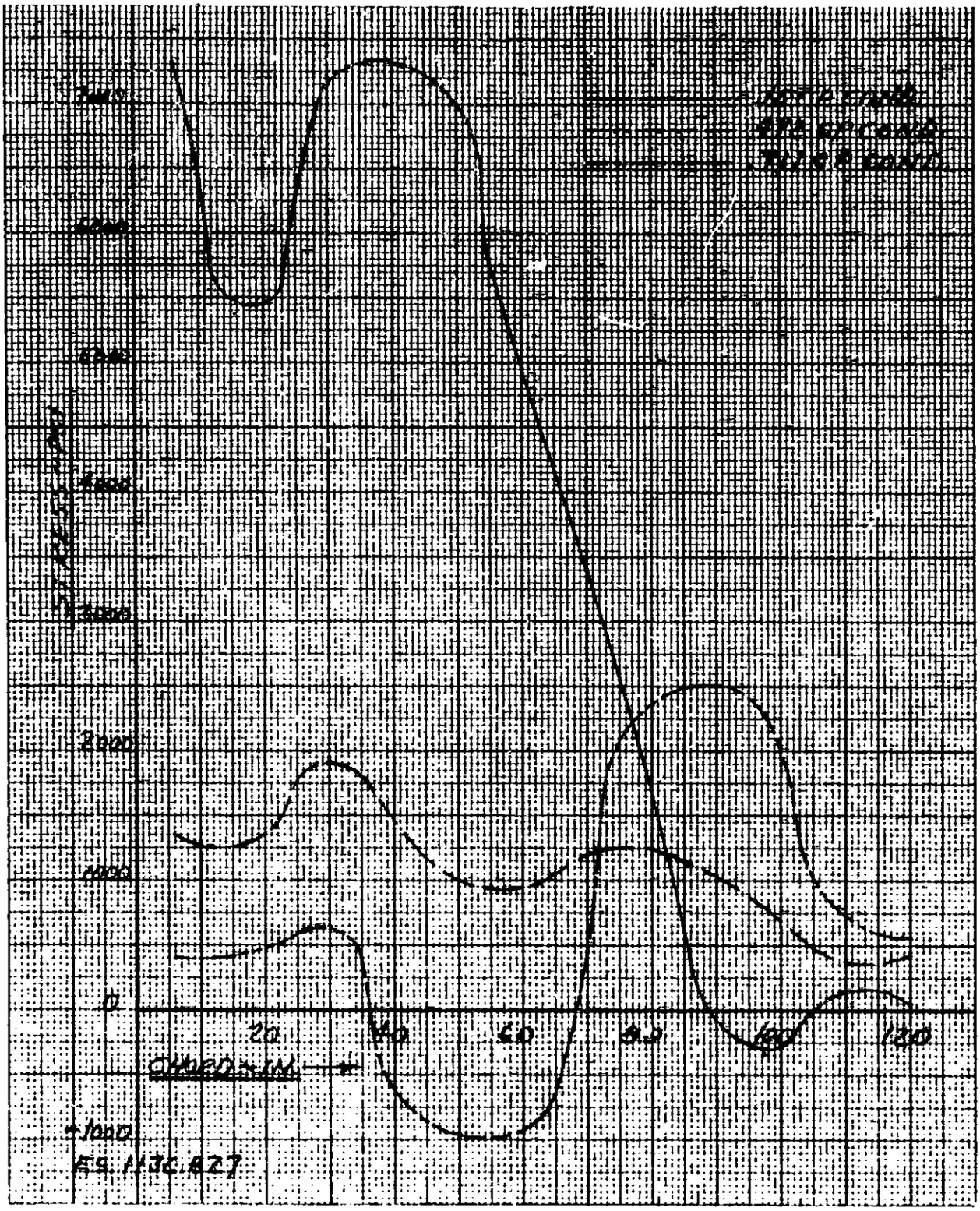


FIGURE 11 V.S. 37.7 RIB CAP STRESSES

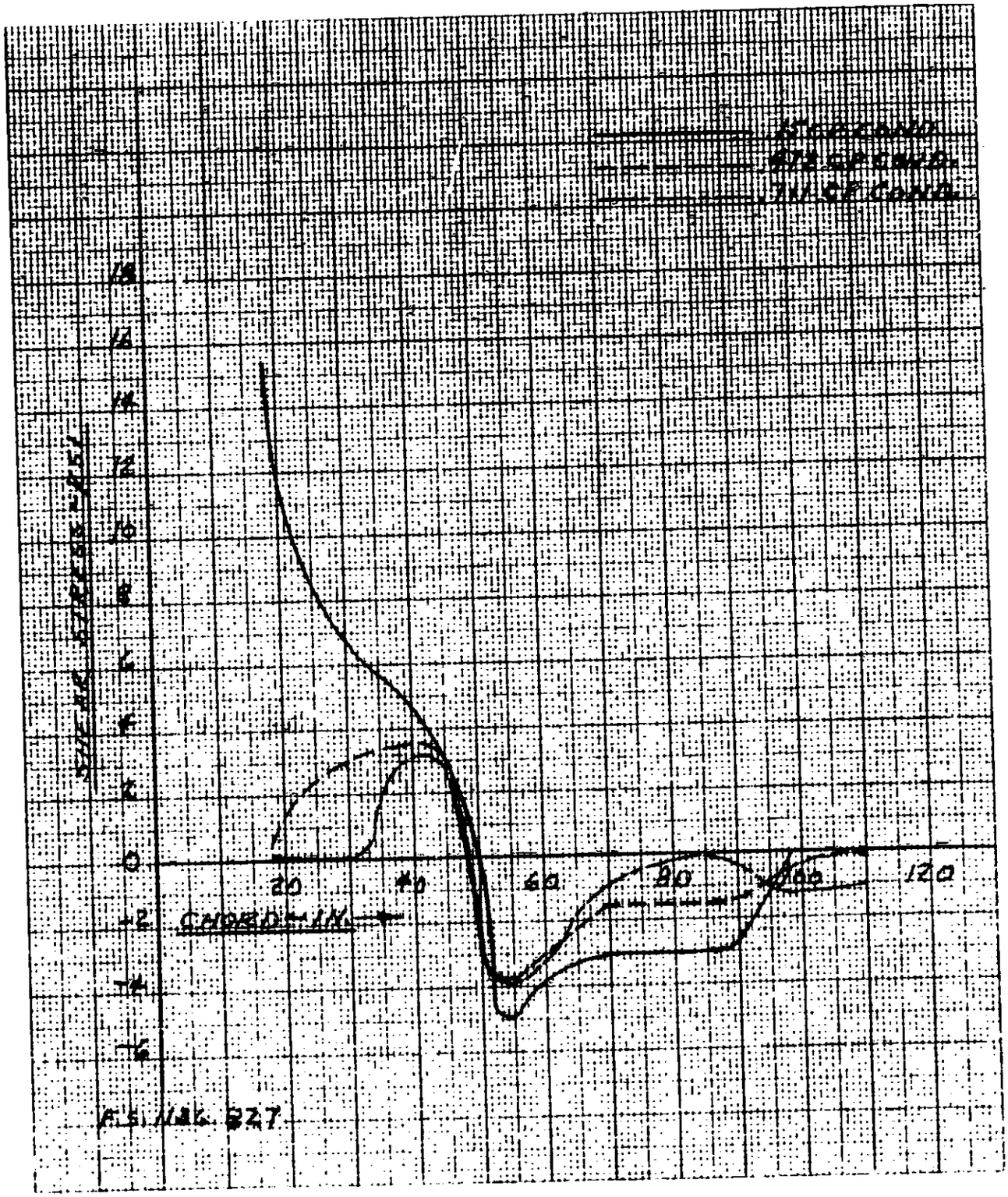


FIGURE 12 V.S. 37.7 RIB WEB SHEAR STRESSES

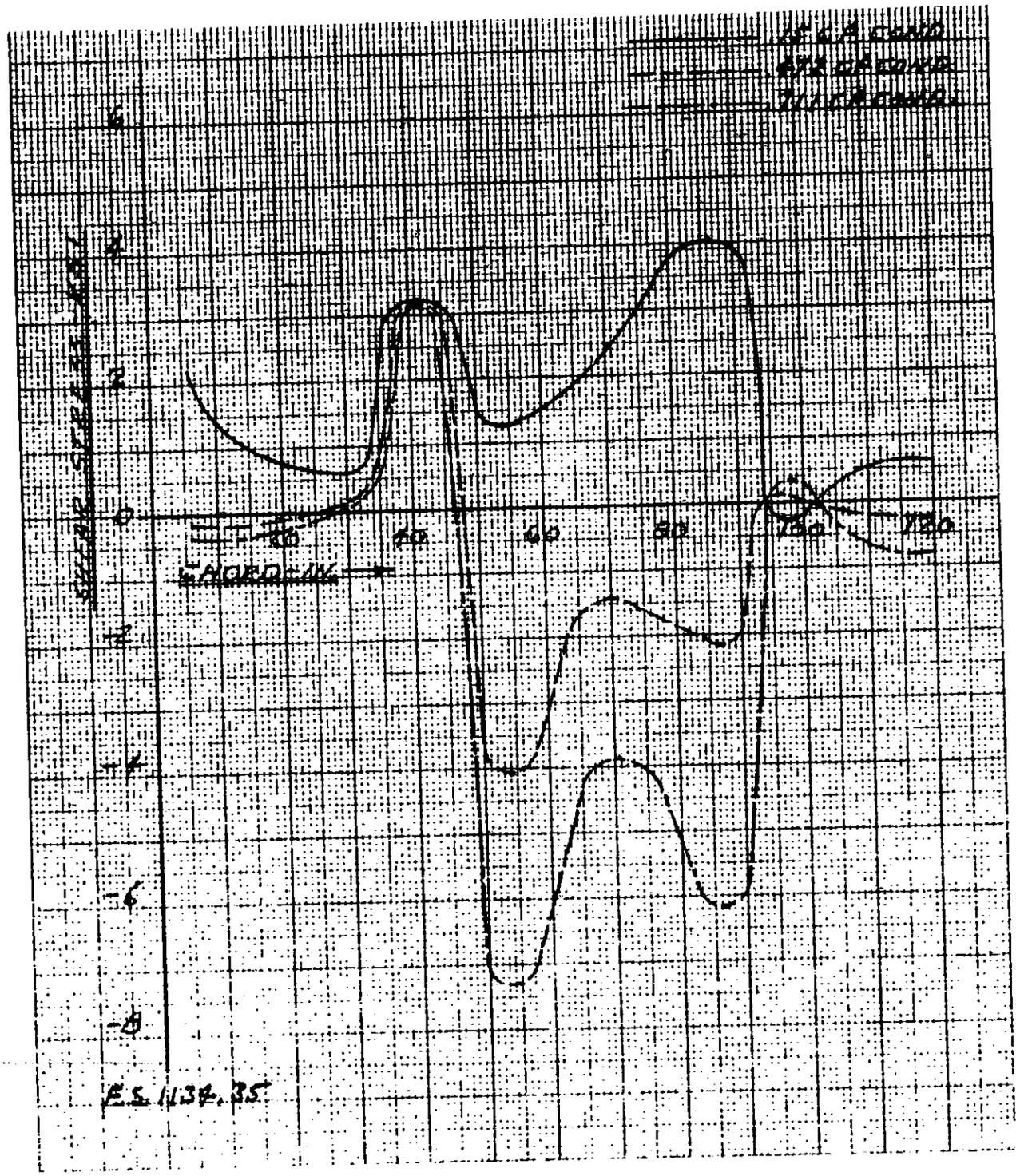


FIGURE 13 SHEAR STRESSES IN SURFACE PANELS BETWEEN ROOT RIB AND V.S. 37.7 RIB

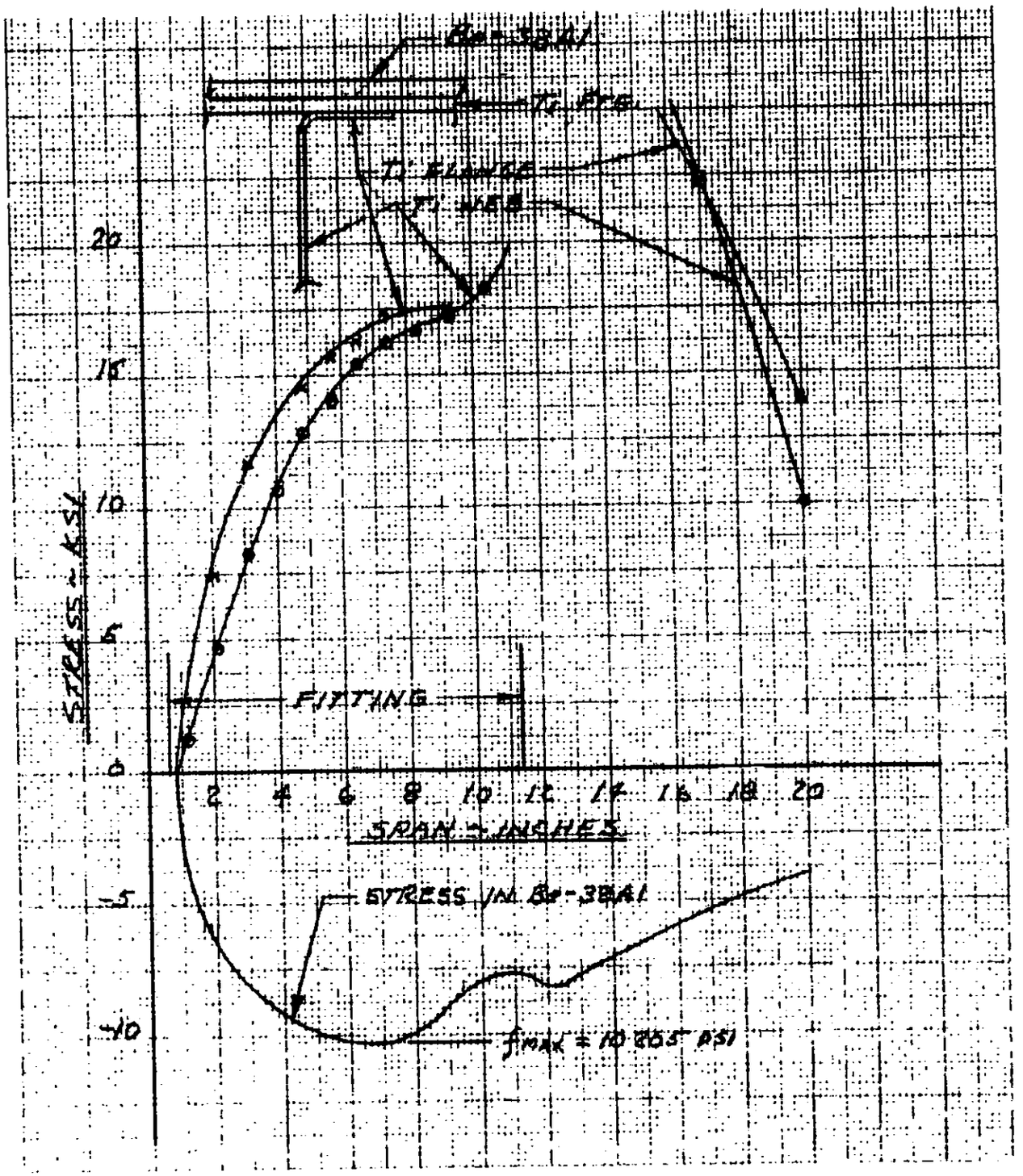


FIGURE 14 THERMAL STRESSES IN REGION OF VENTRAL ROOT - FRONT BEAM FITTING. TEMP. = 550°F