LTV ELECTROSYSTEMS, INC.
GREENVILLE DIVISION
P. O. BOX 1056 GREENVILLE, TEXAS 75401

47

MUDDY HILL

FINAL REPORT

08432.01.06

ORD # 1578-68

DATE 23 February 1968

APPROVED BY C. V. Slagle
C. V. Slagle

S/N EH58
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E8-56605(R4)-11

INTRODUCTION

This report is submitted in accordance with the requirements of paragraph 8.1 (16) of LTV Electrosystems Report No. 6400.00.26 dated 21 December 1967. Test results and summaries were omitted since they are contained in LTV Electrosystems, Report G8432.16.02 which is being released concurrently.

Approved for Release: 2020/12/28 C05752559

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1.0 PROBLEMS ENCOUNTERED

1.1 FLIR INSTALLATION

1.1.1 BUFFET

In the early stages of the structural flight test program a buffet was encountered. The buffet was defined as mild to moderate in magnitude. A series of flight test investigations identified the problem to a pocket at the lower intersection of the FLIR shroud and the modified APS-20 radome. A fairing plate was then installed to close this pocket and smooth the air flow through the transition. A very low magnitude buffet remained after the change was accomplished. No attempt was made to completely eliminate this very low magnitude buffet since the buffet was not objectionable and the cost of any corrective action to overcome the minor buffet attributable to the large cutout in the APS-20 radome would have been prohibitive under this program.

1.1.2 FLIR SHROUD

In the early stages of the program mechanical interference jamming of the FLIR during slew operations was experienced. Investigations revealed that air loads entering the opening provided for the scanner were ballooning the shroud structure causing major structural interference. The shroud was then strengthened and pressure relieving holes added to the shroud to dump any ram air pressure build up. No structural interference or dragging problems were encountered after the incorporation of these changes.

1.1.3 SERVO DRIVE

Following the solution to the above problem it was determined that the servo drive mechanism did not have sufficient power to slew the FLIR scanner during flight operations. A redesign was accomplished by the GFE supplier and the unit returned to test. The redesign did not completely eliminate the servo drive problems. Binding of the slew mechanism occurred at air speeds in excess of 185 knots after the incorporation of the change. Further changes were not pursued because of the time factor in the program and the probability that operational speeds above 180 knots would not be useable with the FLIR operation because of the limited range of the unit.

1.2 NAVIGATION SYSTEM

1.2.1 LORAN SYSTEM

Numerous maintenance problems were encountered with this system. These were attributable to the mechanical design of the basic ARN78 Loran receiver which was modified for this program. After three major program delays because of Loran system failures, a supplier's field service representative reworked the mechanical connections within the receiver and attained satisfactory Loran operation.

During the flight test program numerous unexplained Loran jumps and malfunctions occurred in operations over Western Florida. It was ascertained tha the Loran system would jump when an L band signal was received.

1.2.1 (continued)

A number of minor jumps were attributable to operation of IFF gear on other aircraft in the vicinity of the Muddy Hill airplane. In Western Florida the problems were attributable to a large L band radar in the early warning system stationed at Eufaula, Alabama. No solution to these particular problems has been found. The contractor, however, is still actively pursuing a satisfactory correction action.

1.2.2 INERTIAL PLATFORM

An abnormally high number of problems were experienced with the LN-15 Inertial Platform. Original problems generated from system design deficiencies caused by internal management problems at the supplier. Upon correction of the management problems and the elimination of design deficiencies the system had attained excessive run times in various test operations and began to experience normal component wearout.

The inertial platform was returned to the supplier in Mid-November 1966 for repair and modification. The unit remained at the supplier until Mid-December 1966, at which time it was returned to the contractor. Navigation system integration testing was attempted in a laboratory environment. By early February 1967 it became apparent that there were basic design deficiencies involved and the unit was returned to the supplier for further modification.

In late February the Verdan Computer Program was rewritten to allow a degraded operation of the weapon delivery system using velocity inputs from the Doppler system in the event

1.2.2 (continued)

the inertial platform was not available for the program or a specific mission.

The platform was returned to the contractor in early March and integration testing resumed. The system did not provide the desired repeatability at any time, however, enough data was collected to ascertain that the expected navigational accuracies were obtainable.

1.3 PROGRAM PHILOSOPHY

The philosophy of conducting a test and evaluation and training program concurrently in order to compress a schedule generates several severe problems.

1.3.1 AIRCRAFT MAINTENANCE

Basic aircraft maintenance remained a problem throughout the program. The operational crew provided to accomplish the required maintenance was oriented toward corrective maintenance tather than preventive maintenance. Consequently, an abnormally high number of tests were aborted, or retest was required, because of basic aircraft system failures.

1.3.1.1 ENGINE FIRES

Three tests were aborted because of engine fires either during take-off or shortly after take-off. A fourth test should have been aborted because of engine fire, but the crew was unaware of the difficulty because the fire warning circuits were deactivated. In this instance, the fire was blown out during the take-off roll.

1.3.1.2 AIRCRAFT ELECTRICAL POWER

Several Verdan failures were experienced during the program through the failure to maintain electical power generation within the limits of MIL-STD-704. Both power levels and frequencies varied excessively between engines and outside the acceptable limits.

1.3.1.3 AIRCRAFT COMPASS SYSTEM

Although the basic aircraft compass system was capable of providing the accuracies required to perform the desired functions in the integrated navigation system, navigation system errors, attributable to compass inaccuracies, were present throughout the life of the program and during aircraft deployment.

1.3.2 SYSTEM TEST G.F.E. EQUIPMENT

The contractor was unable to control the testing of the G.F.E. sensors as desired because of the overlapping of training operations.

The operational crew operated the equipments on all flights when the contractor did not specify designated test parameters. This practice results in the unavailability of the units for tests as planned by the contractor due to failures, or unknown uncoordinated adjustments to the equipment. The operational crew also interfaced directly with the suppliers with no coordination with the contractor.

1.3.2 (continued)

The practice of loading the maximum number of people permissible aboard each flight created a great deal of confusion. On several occasions, equipments affecting the results of planned tests were operated without the knowledge of the contractor's test director. These actions prevented orderly investigation of problems in a timely manner.

2.0 RECOMMENDATIONS

2.1 BOW COMPARTMENT

The CRT type displays in the bow compartment are of questionable value, and in some situations are a definite detriment, to the success of the mission; therefore, the contractor recommends that these displays be removed and a stabilized star scope be added.

2.2 RADAR ANTENNA

The size of the anntenna for the SPR-1 radar was established in order to mount the radar in a chin position under the bow observers seat. Later investigations revealed that this location impinged of the viewing cone of the FLIR and the radar was moved to a cheek pod. The Contractor recommends that the antenna size be increased in order to provide better radar mapping capability, and that moving target indicator be incorporated in the radar.

2.3 COCKPIT AREA

The contractor recommends that all scope type sensor displays be removed from the cockpit area with the exception of the radar display. If the pilot is operating in the terrain following, or the terrain avoidance, mode of operation his attention must be focused completely on that aspect of the operation, and there is not sufficient time to adequately view and attempt to interpret information from other sensor displays.

2.3 (continued)

It is also recommended that steering error signal, or steering information, to the pilot be displayed on the ARU-11A Heading Error Needle. This input can be time shared with the ASN-25 output. The computer program can also be rewritten to give an automatic return to target signal displayed on the same ARU-11A.

2.4 FLIR

Flight test and limited operational use has revealed the requirement for azimuth control of the FLIR. An azimuth slew of 60 degrees right and left of the center line of the aircraft will greatly enhance the operational capabilities of this system.

2.5 ARMAMENT

It is recommended that either a turret containing quad-mini guns be added to the belly of the aircraft, or provisions made to utilize gun packets mounted on the wing external armament racks. Although the original mission of the aircraft did not involve a killer role, it becomes apparent that in some instances fire power is required to keep opposition off balance in order to survive.

3.0 STRUCTURAL ANALYSIS

The following pages of this report contain an analysis of the major structural modifications to the aircraft. Included in this section are structural design criteria; analysis of angle of attack probe installation; pod and pylon installation; the A scanner, or FLIR installation; the aft fuselage modification; the C antenna, or Doppler antenna installation; and the N scanners, or D5 installation.

STRUCTURAL DESIGN CRITERIA

All structural modifications and equipment installations were designed to the load factors presented under this section. The criteria is the same as used in the original design by the manufacturer.

1. LIMIT FLIGHT LOAD FACTORS [1]

A. Maximum take-off gross weight -- 80,000 lbs.

Design Envelope: Down: +2.34 G's
Up : 0 G's

B. Design Gross Weight -- 70,900 lbs.

Design Envelope: Down: +2.67 G's
Up : -.67 G's

C. Minimum Flying Weight -- 53,300 lbs.

Design Envelope: Down: +3.00 G's
Up : -1.00 G's

2. LIMIT GROUND LOAD FACTORS [1]

A. Taxi: N_z = +1.5G's

B. Landing: N_z = +3.0 G's

C. Hoisting: N_z = +3.14 G's

[1] Ref. Lockheed Report 8676, P2V-7 Structural Summary and Operating Restrictions, Dated 1 December, 1953.

3. INSTALLATION DESIGN CRITERIA [1]

A. Unoccupied areas-equipment situated in such a manner as to not endanger the safety of the crew or prevent egress were designed to the following ultimate load factors acting individually.

N_z = 5.0 G's

N_z = +5.0 G's + N_x = ±1.0 G's

N_z = +5.0 G's + N_y = ±1.0 G's

N_x = 3.0 G's FWD.

B. Occupied areas-equipment situated in such a manner as to endanger the safety of the crew or prevent egress were designed to the following ultimate load factors acting individually.

N_x = 20.0 G's FWD.

N_z = +10.0 G's

[1] Ref. Lockheed Report 8671, P2V-7 Fuselage Structural Analysis, Dated 23 April, 1953.

4. EXTERNAL STORE CRITERIA

All external protuberances were designed to a rational combination of flight inertia loads and aerodynamic loads. The critical conditions are as follows.

CONDITION 1-PLAA

V	=	350 Knots
ALT.	=	Sea Level
N_z	=	+4.0 G's
	=	3.7°
	=	0

CONDITION 2-YAW MANEUVER

V	=	350 Knots
ALT.	=	Sea Level
N_z	=	+1.0 G
	=	0
	=	50

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CHECKED BY		REPORT NO. G8432.01.06
DATE 8-22-66	ANGLE OF ATTACK PROBE INSTL.	MODEL NO. SP-2H

REF. DWG. 8432-01600

AN ANGLE OF ATTACK PROBE WAS INSTALLED ON THE TOP CENTERLINE OF THE AIRCRAFT. THE PROBE IS SUPPORTED AT FS 21, FS 42.66 AND FS 69 AND PROTRUDES OUT OF THE AIRCRAFT 117.9" FWD OF FS 21. THE PROBE IS CONSTRUCTED OF ROUND HOLLOW TUBING WHICH IS STEPPED FROM A LARGE DIAMETER AT THE AFT SECTION TO A SMALL DIAMETER AT THE FWD TIP. THE PROBE, IS NOT ANALYZED IN THIS REPORT AS IT WAS ANALYZED ON A PREV. PROGRAM, THE PROBE IS SUPPORTED BY FITTINGS ON THE FRAMES AT FS 21 AND FS 42.66 AND ON THE BULKHEAD AT FS 69. THE TWO FRAMES WERE REINFORCED BUT THE MAGNITUDE OF LOADS DID NOT WARRANT REINFORCEMENT OF THE BULKHEAD. THE PROBE INSTALLATION WAS DESIGNED FOR AIRLOADS COMBINED WITH INERTIA LOADS AND INCLUDE AN AMPLIFICATION FACTOR ON THE INERTIA LOADS WHICH VARIED LINEARLY FROM 3.0 AT THE PROBE TIP TO 1.0 TO THE FRAME AT FS 21. THIS IS IN ACCORDANCE WITH THE DESIGN CRITERIA USED ON THE PREVIOUS PROGRAM. THE INERTIA FACTOR APPLICABLE IS 4.[illegible]

NO PORTION OF THIS INSTALLATION WAS STRUCTURALLY CRITICAL, HOWEVER, ANALYSIS IS SHOWN FOR THE HEAVIEST LOADED FITTINGS WHICH ARE LOCATED AT FS 21.

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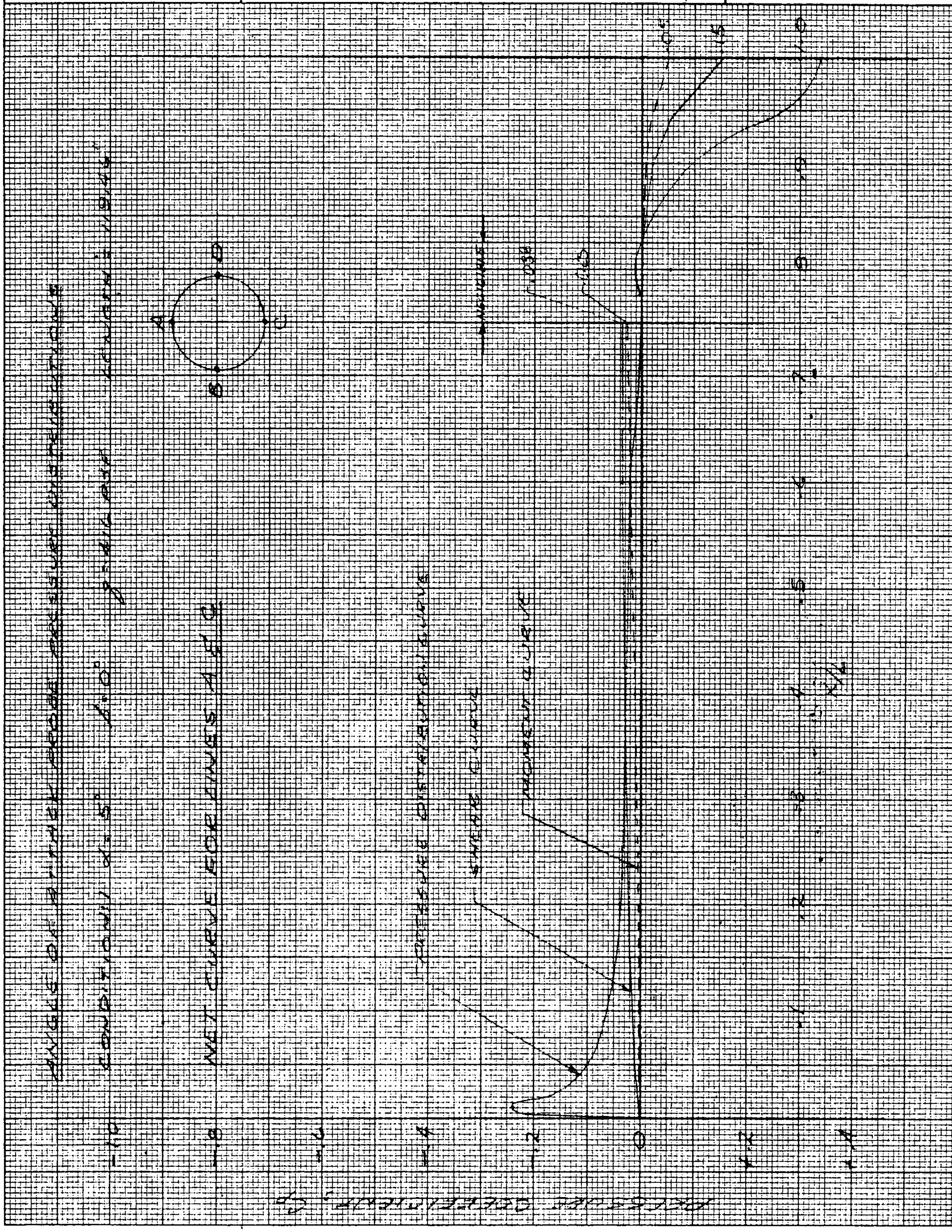
Date:		Model No. SP2H



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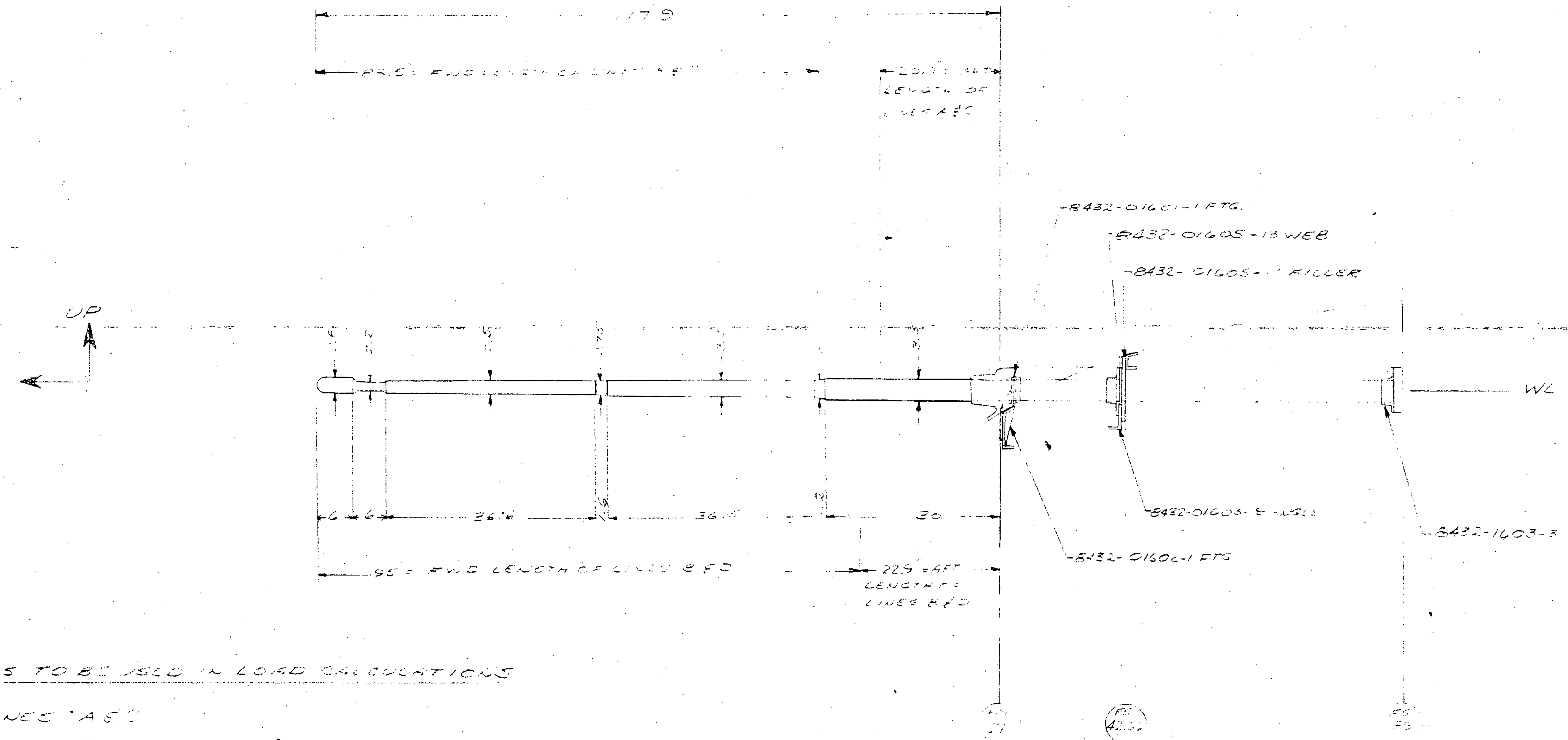
DATE 8-11-66	ANGLE OF ATTACK PROBE INSTL.	MODEL NO. SP-2



S TO BE USED IN LOAD CALCULATIONS

NEC'AED

FWD AREA = 237.7 IN.²

AFT AREA = 79.1 IN.²

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LOADS AND CENTERS OF PRESSURE CALCULATIONS

I. AIRLOADS

1. LINES A & C

A. FWD PORTION

AVE. PRESSURE COEFFICIENT, $C_p = .038$

AREA = 237.7 IN.^2

$q = 416$ PSF OR 2.9 PSI

ULT. LOAD FACTOR = 1.5

$P = 1.5 (2.9)(.038)(237.7)$

$= 39.2^{\#}$

CENTER OF PRESSURE = $\frac{.025}{.038} = .658$

$.658 (88.5) = 58.4''$ FWD FROM $\frac{x}{L} = .75$

THE LOAD OF $39.2^{\#}$ ACTS AT A DISTANCE OF:

$117.9 - (88.5 - 58.4)$

$= 87.8$ FROM FS 21.

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LOADS AND CENTERS OF PRESSURE CALCULATIONS (CONT)

1. LINES A & C (CONT)

B. AFT PORTION

$C_p = .15$

$A = 73.1 \text{ IN}^2$

$q = 2.9 \text{ PSI}$

ULT. LOAD FACTOR = 1.5

$P = 1.5 (2.9)(.15)(73.1)$

$= 72.7^{\#}$

CENTER OF PRESSURE $= \frac{.05}{.15} (20.9)$

$= 7''$ FROM FS 21

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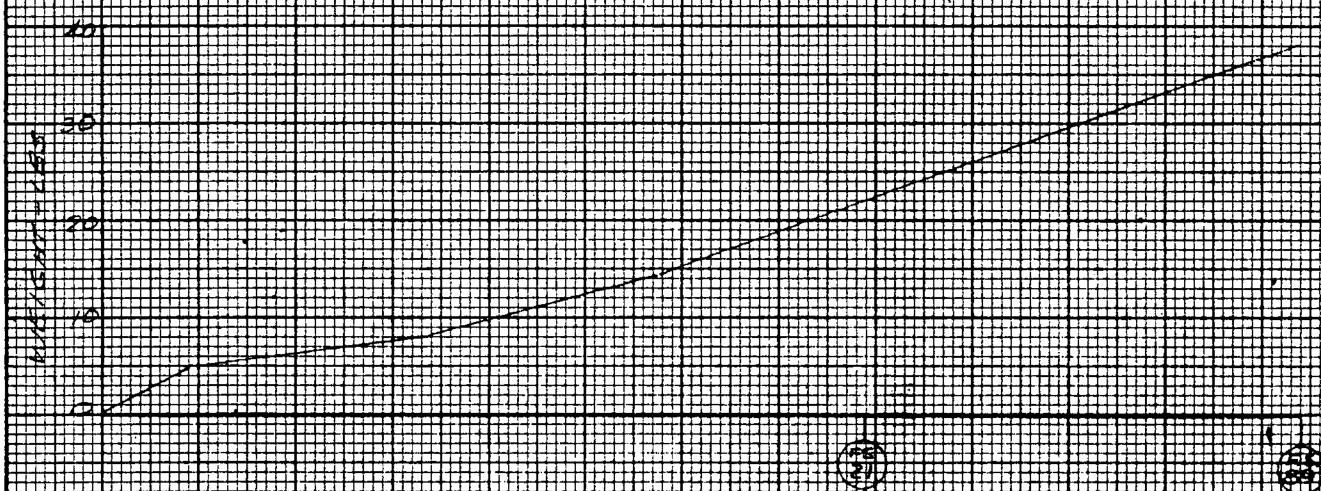
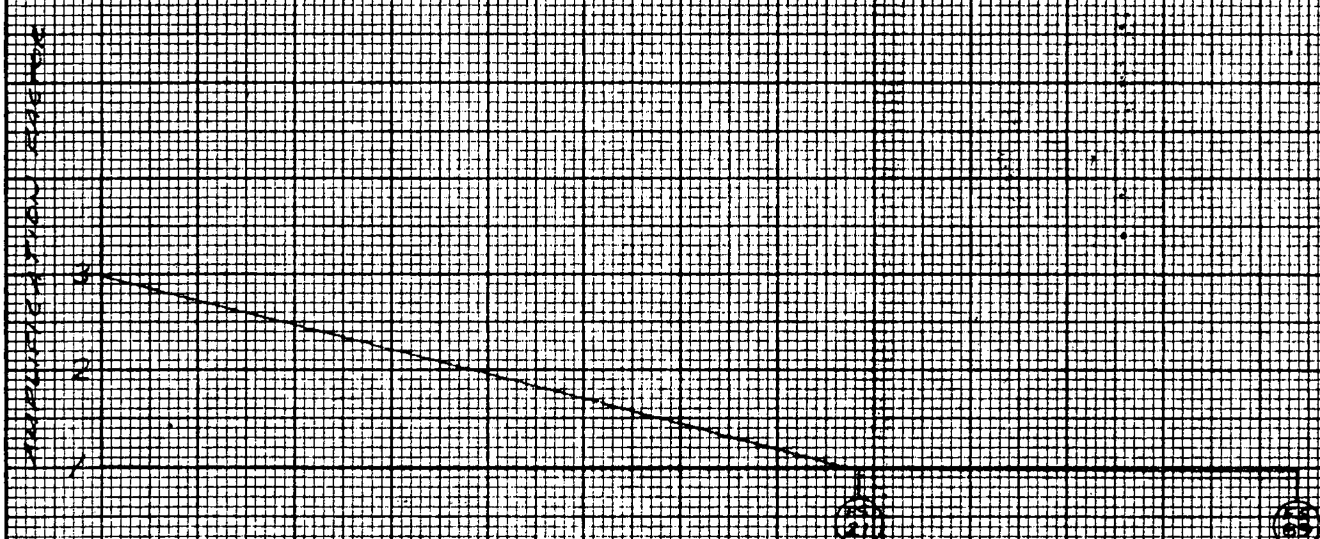
III INERTIA LOADS



STATIC WEIGHT CURVE



AMPLIFICATION FACTOR CURVE

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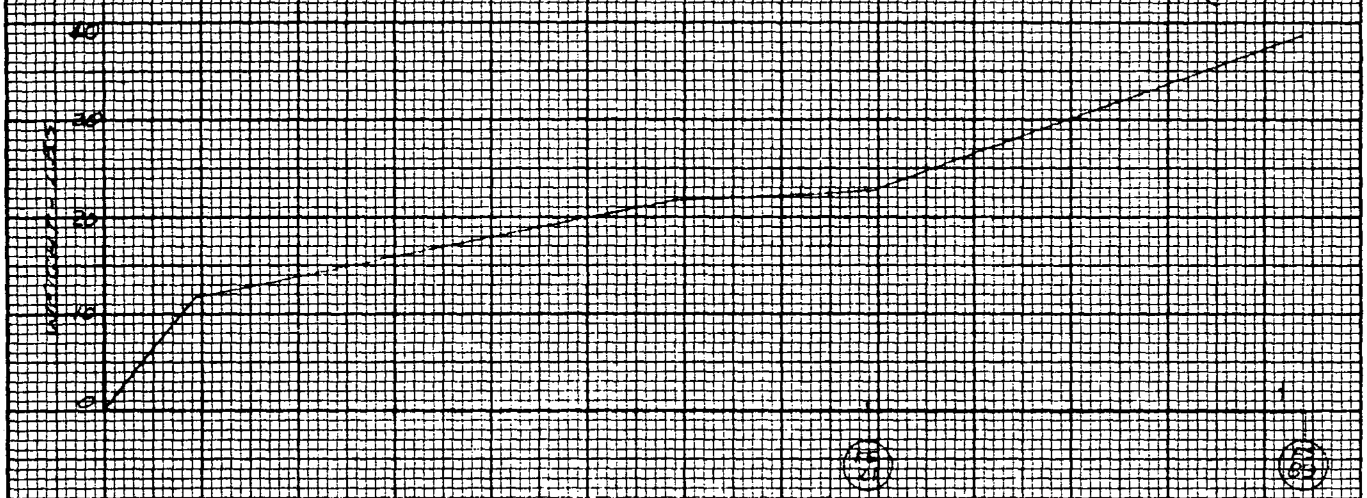
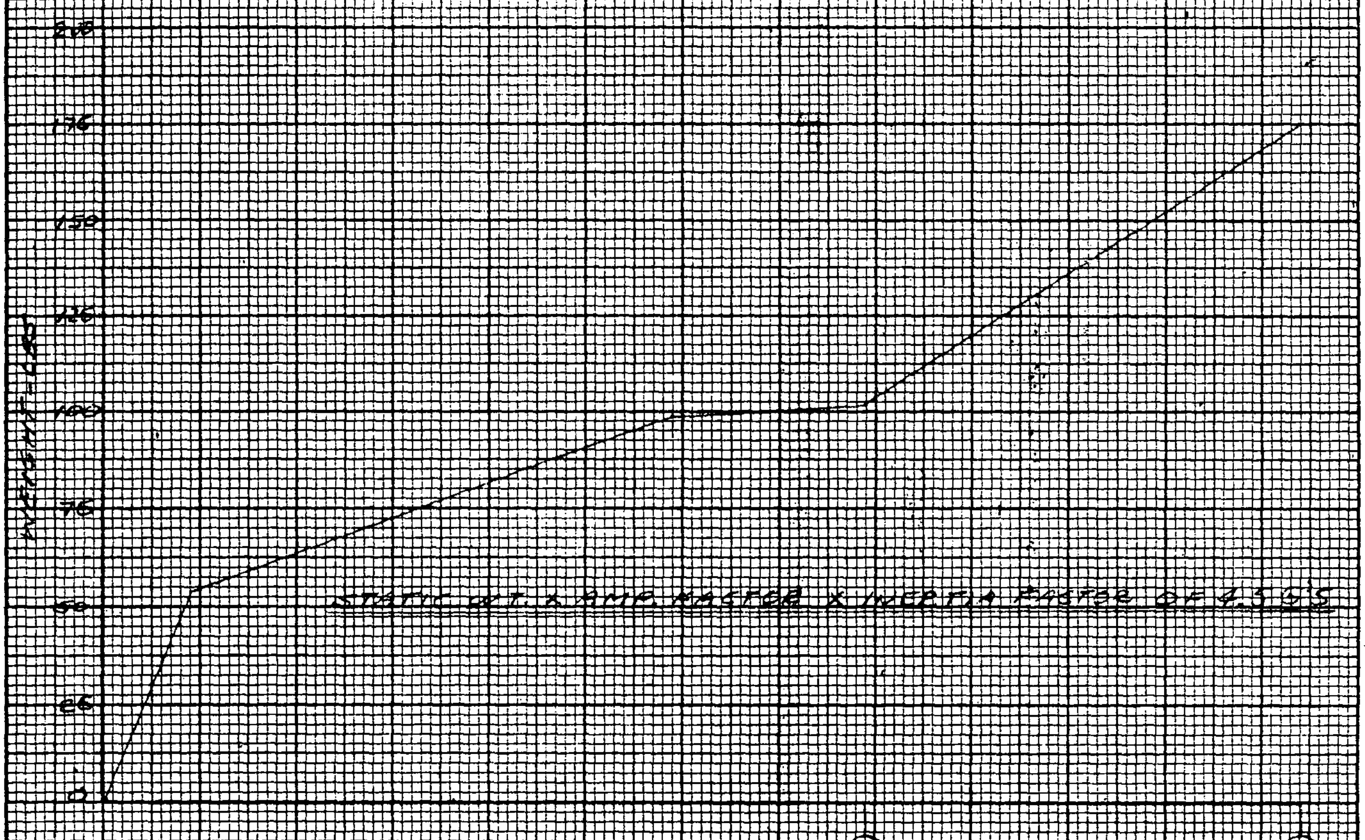
II. INERTIA LOADS (CONT)



STATIC WEIGHT X AMPLIFICATION FACTOR CURVE



DESIGN LOAD CURVE

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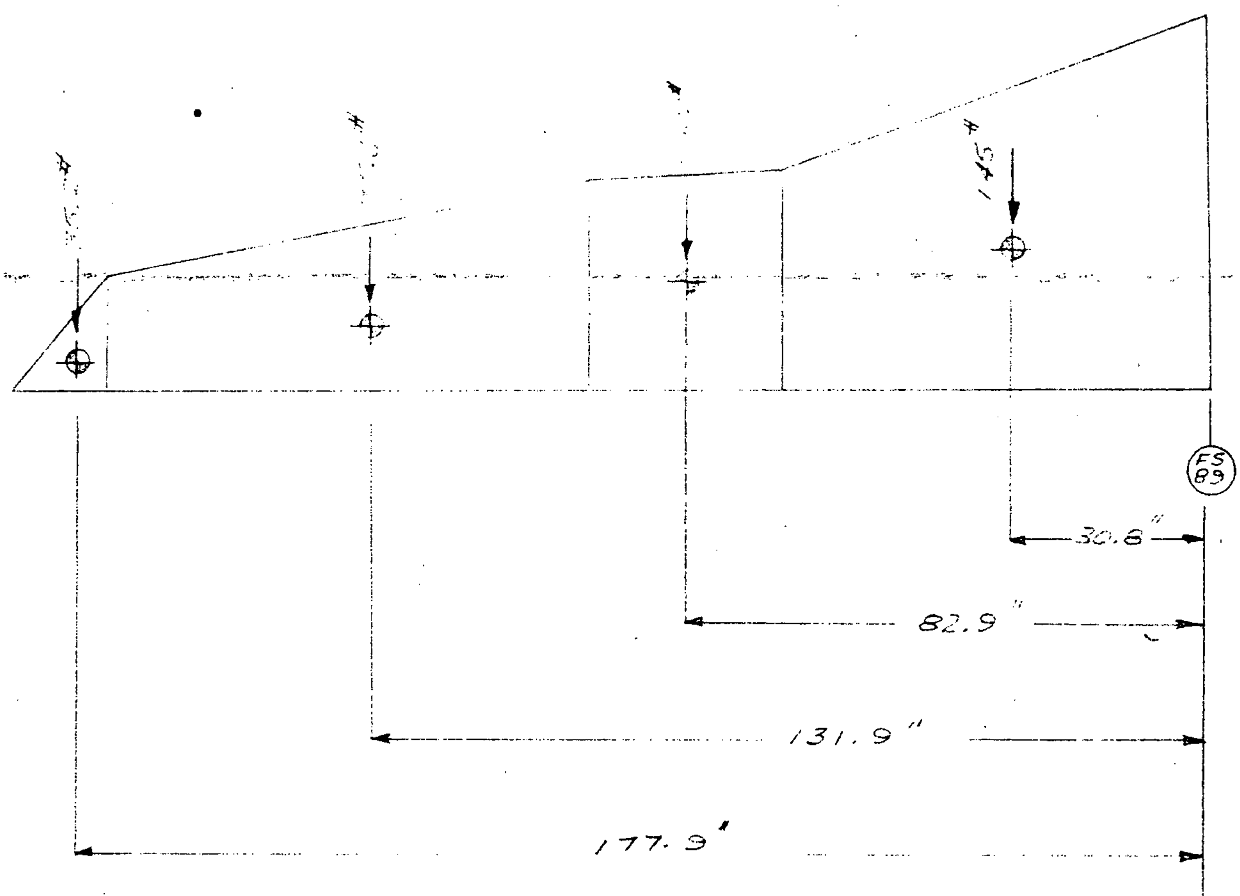
LOADS AND CENTERS OF PRESSURE CALCULATIONS

II. INERTIA LOADS (CONT)

THE DESIGN [illegible] CURVE SHOWN ON P. , IS BROKEN INTO SECTIONS AND THE TOTAL LOAD PER SECTION IS APPLIED AT THE SECTION CENTROID FOR MOMENT CALCULATIONS



$\Sigma M_{F.S.89} = 35.2\,(177.9) + [illegible]\,(131.9) + 100\,(82.9) + 30.8\,(145)$

$= 28{,}970$ IN-LBS

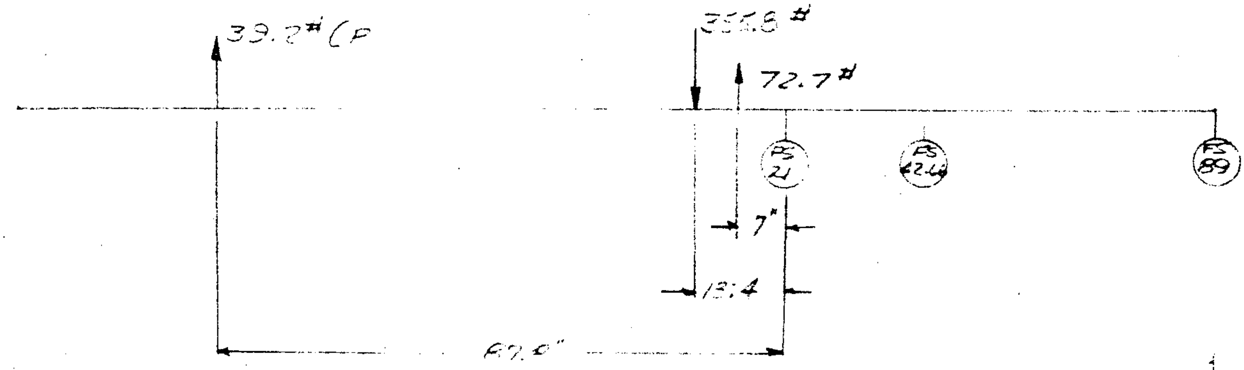
TOTAL LOAD, $P = 355.8^{\#}$

CENTER OF PRESSURE $= \dfrac{26{,}970}{355.8} = 81.4''$ FWD OF FS 89

LOAD DISTRIBUTION

THE AIRLOADS AND INERTIA LOADS ARE DISTRIBUTED INTO THE AIRCRAFT FRAMES AT FS 21, FS 42.66 & FS 89.

A. VERTICAL LOAD DISTRIBUTION



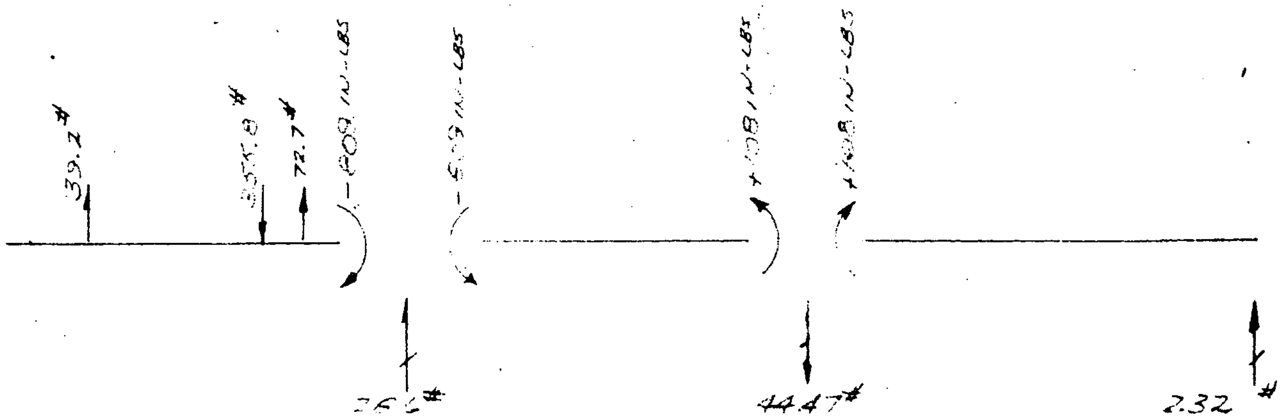
THE HARDY CROSS SOLUTION IS USED TO DETERMINE THE FRAME REACTIONS

$M_{FS21} = +39.2(87.8) - 355.8(13.4) + 72.7(7)$

$= -809$ IN-LBS

		K = 2.14		K = 1.0	
D.F.	0	1	.68	.32	1
FEM	-809	0	0	0	0
RELEASE JOINT FS21	0	-809 →	+405		
ADJ. FEM	-809	-809	+405	0	0
1ST DIST.			-275	+130	0
CARRY OVER			—	0	-65
2ND DIST.			0	0	+65
CARRY OVER			—	-32	0
3RD DIST.			-22	+10	0
CARRY OVER			—	0	-5
4TH DIST.			0	0	+5
Σ	-809	-809	+108	+108	0

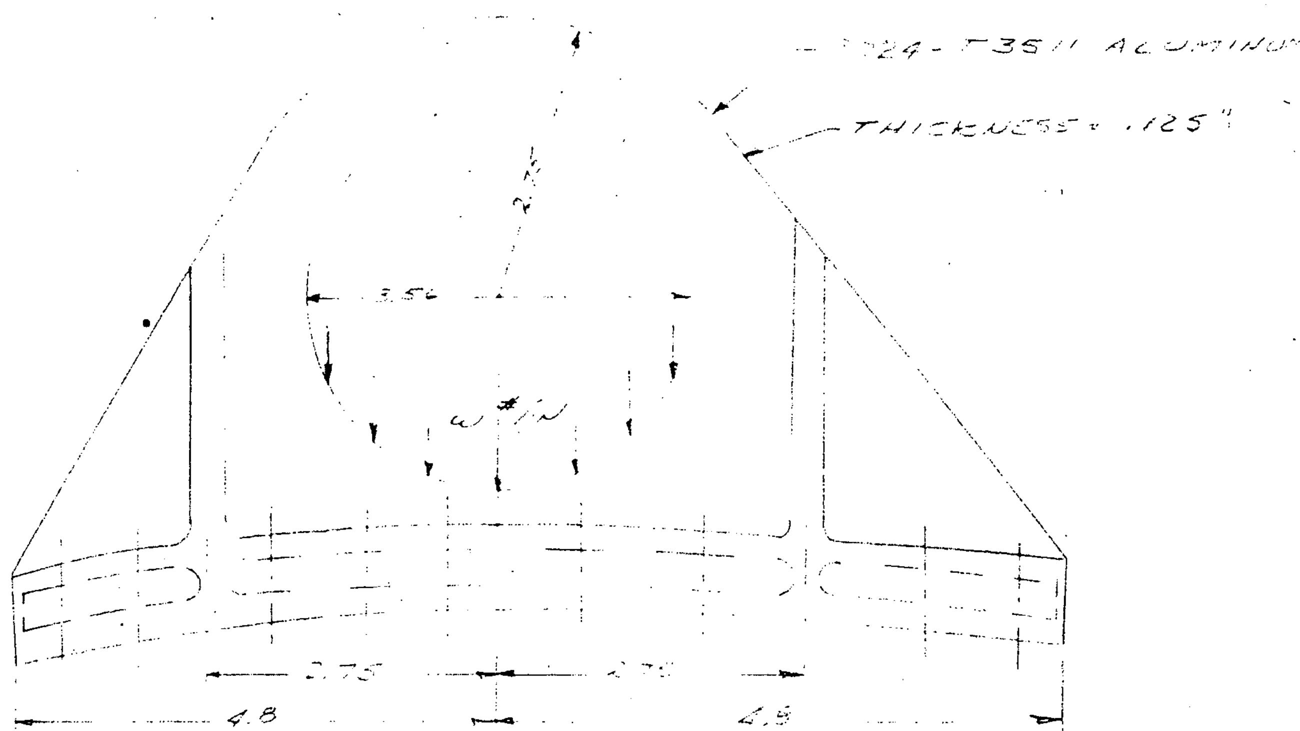
LOAD DISTRIBUTION (CONT)



B. HORIZONTAL LOAD DISTRIBUTION

THE SIDE LOADS WERE NOT CRITICAL AND WILL NOT BE SHOWN.

ANALYSIS OF THE F632-01661-1 FTG



VIEW LOOKING AFT AT FITTING

ANALYSIS OF THE 8432-01601-1 FTG (CONT)

THE FTG IS ANALYZED FOR CONTACT STRESSES WHERE THE PROBE BEARS AGAINST THE LOWER CUTOUT SURFACE

P = 286#

w = 286/[illegible] = 81.8 #/in

CHECK ULT STRESS LEVEL ASSUMING A MAX. STRESS FACTOR OF 2.

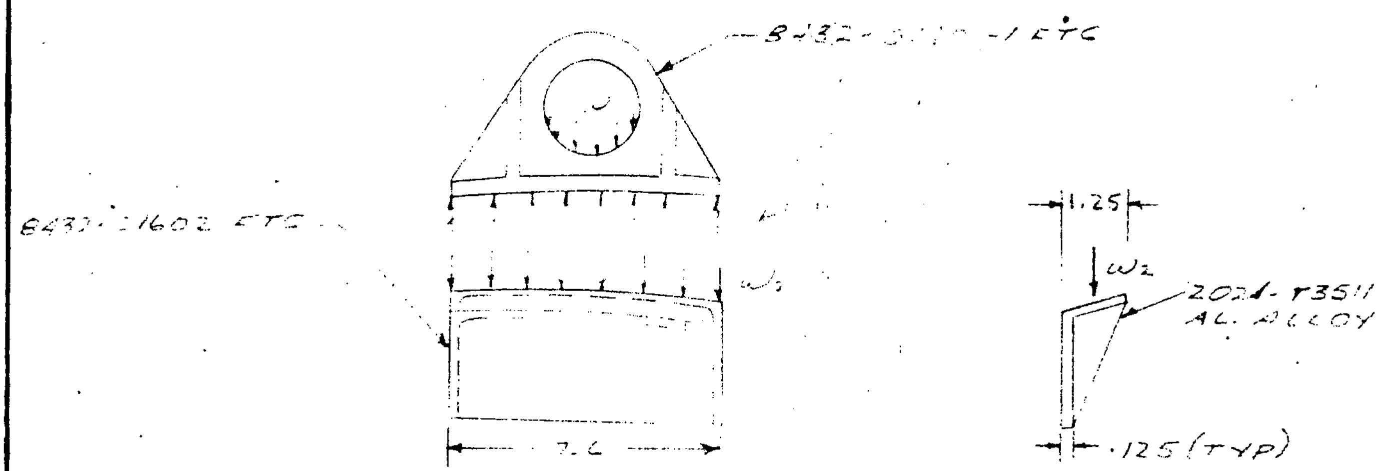
$f_{br_{ULT}}$ = 2P/Dt = 2(286)/[illegible] = 1280 psi

F_{bu} = 105,000 psi

BEARING M.S. = 105,000/1280 - 1 = LARGE

ANALYSIS OF THE 8432-01602 FITTING

THE 8432-01602 FITTING IS SHOWN AND THIS FITTING IS ANALYZED FOR THE 722# DOWN LOAD SHOWN ABOVE



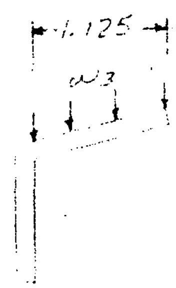
VIEW LOOKING AFT AT FTGS

ANALYSIS OF THE A432-01602 FITTING (CONT)

TOTAL LOAD ON FTG = 286#

$w_2 = 286/7.6 = 37.6$ #/IN.

WORKING WITH A 1" STRIP, THE FLANGE OF THE FITTING IS CHECKED FOR BENDING THE 37.6# LOAD IS DISTRIBUTED ALONG THE FLANGE LENGTH



SECTION THRU ℄ OF FTG

$w_3 = \frac{37.6}{1.125} = 33.4$ #/IN

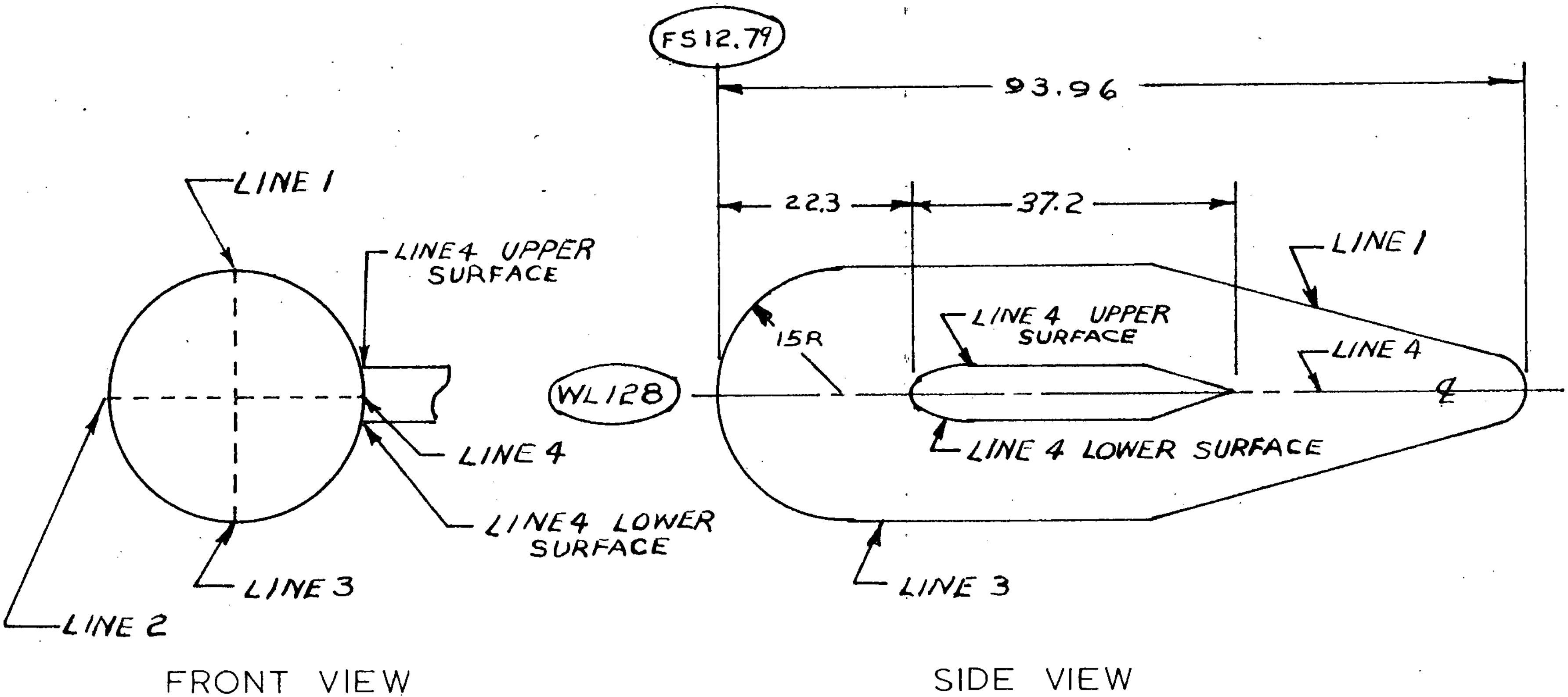
$M_{MAX} = \frac{wl^2}{2} = \frac{33.4(1.125)^2}{2} = 21.1$ IN-LBS

$f_b = \frac{6M}{bt^2} = \frac{6(21.1)}{1(.125)^2} = 8120$ PSI

$F_{tu} = 57000$ PSI

BENDING M.S. $\frac{57000}{8120} - 1 =$ LARGE

THE WEB OF THE FITTING IS STABLE AS IT IS FASTENED TO THE EXISTING AIRCRAFT FRAME AT FS 21. REF. PAGE



POD AND PYLON GEOMETRY

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DATE

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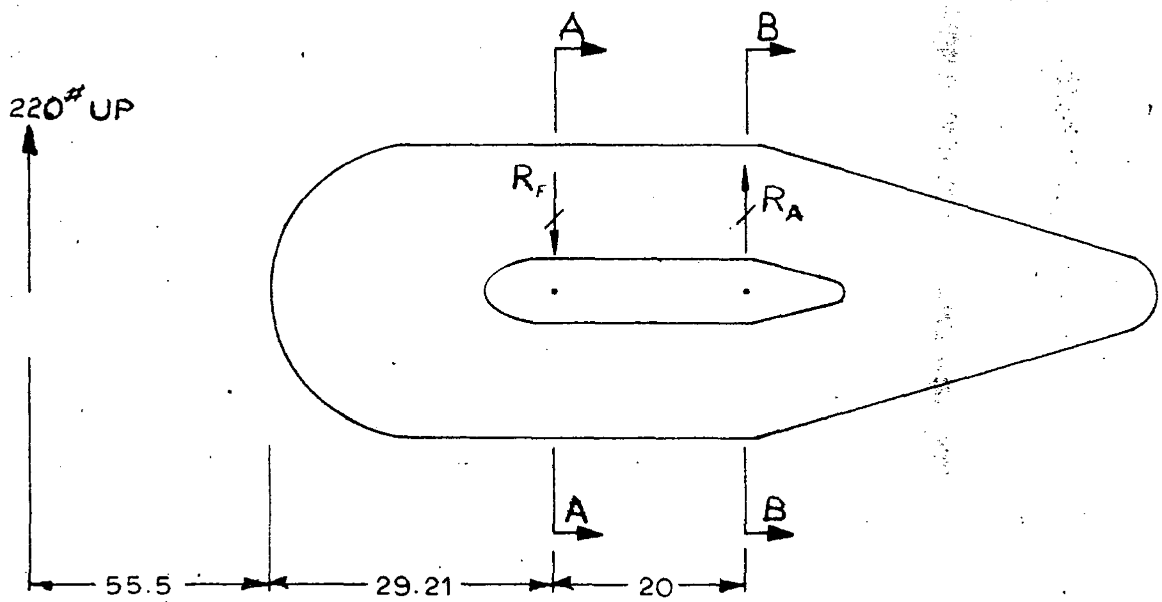
ESTIMATED POD AIR LOADS

Pod Moment = 12,200 in-lbs
Pod Load = 220#

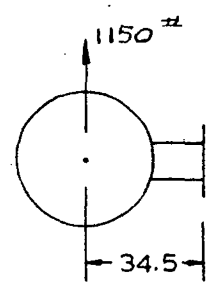
$$C.P. = \frac{12,200}{220} = 55.5''$$



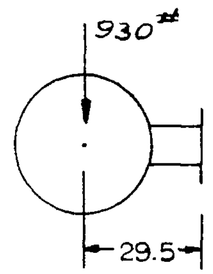
$$M_{RA} = 220(104.71) - 20R_F = 0$$

$$R_F = 1150\#$$

$$R_A = 1150 - 220 = 930\#$$

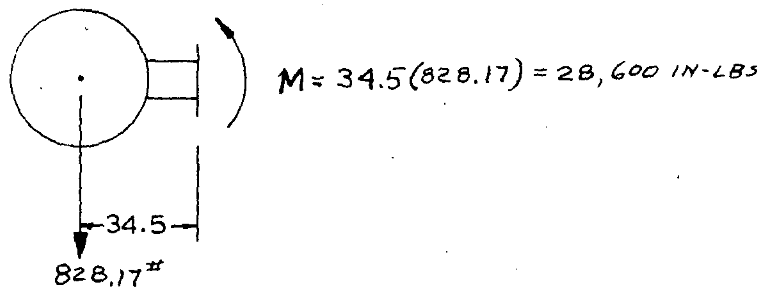


Sec. A-A

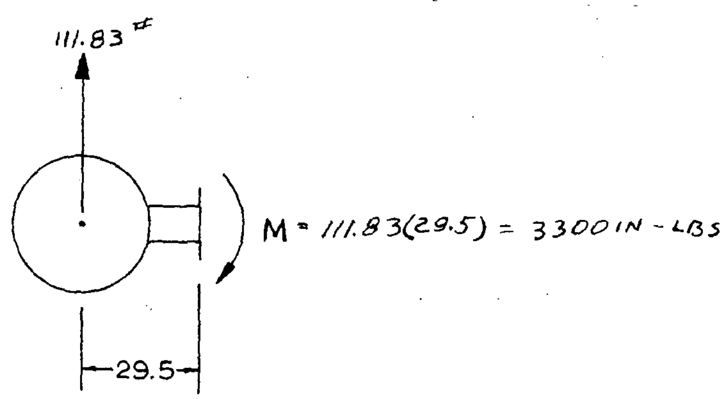


Sec. B-B

POD INERTIAL LOADS (4.5 G's Down)



Sec. A-A



Sec. B-B

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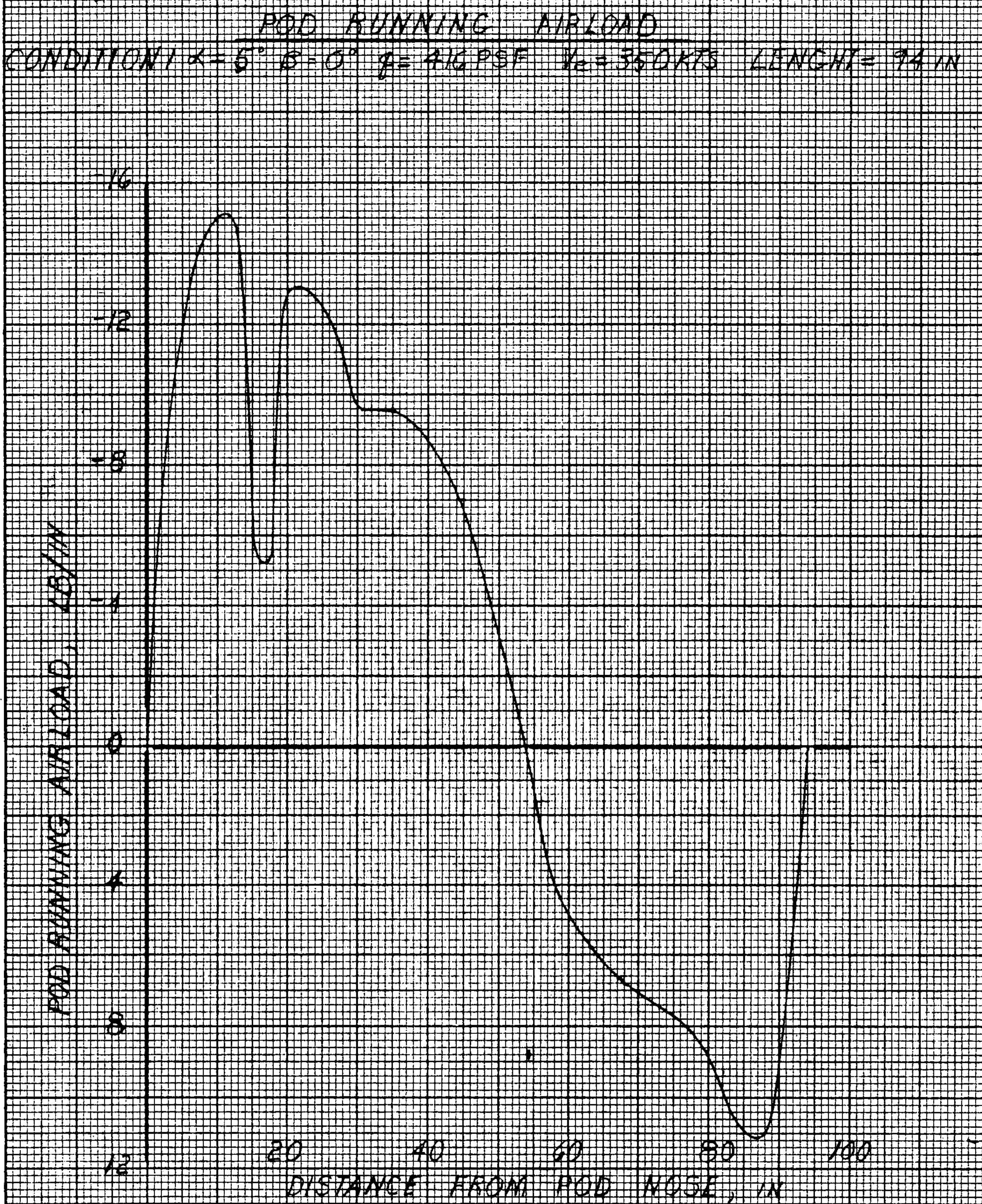
Checked by: JJK		Report No. G8432.01.06
Date:		Model No. SP2H



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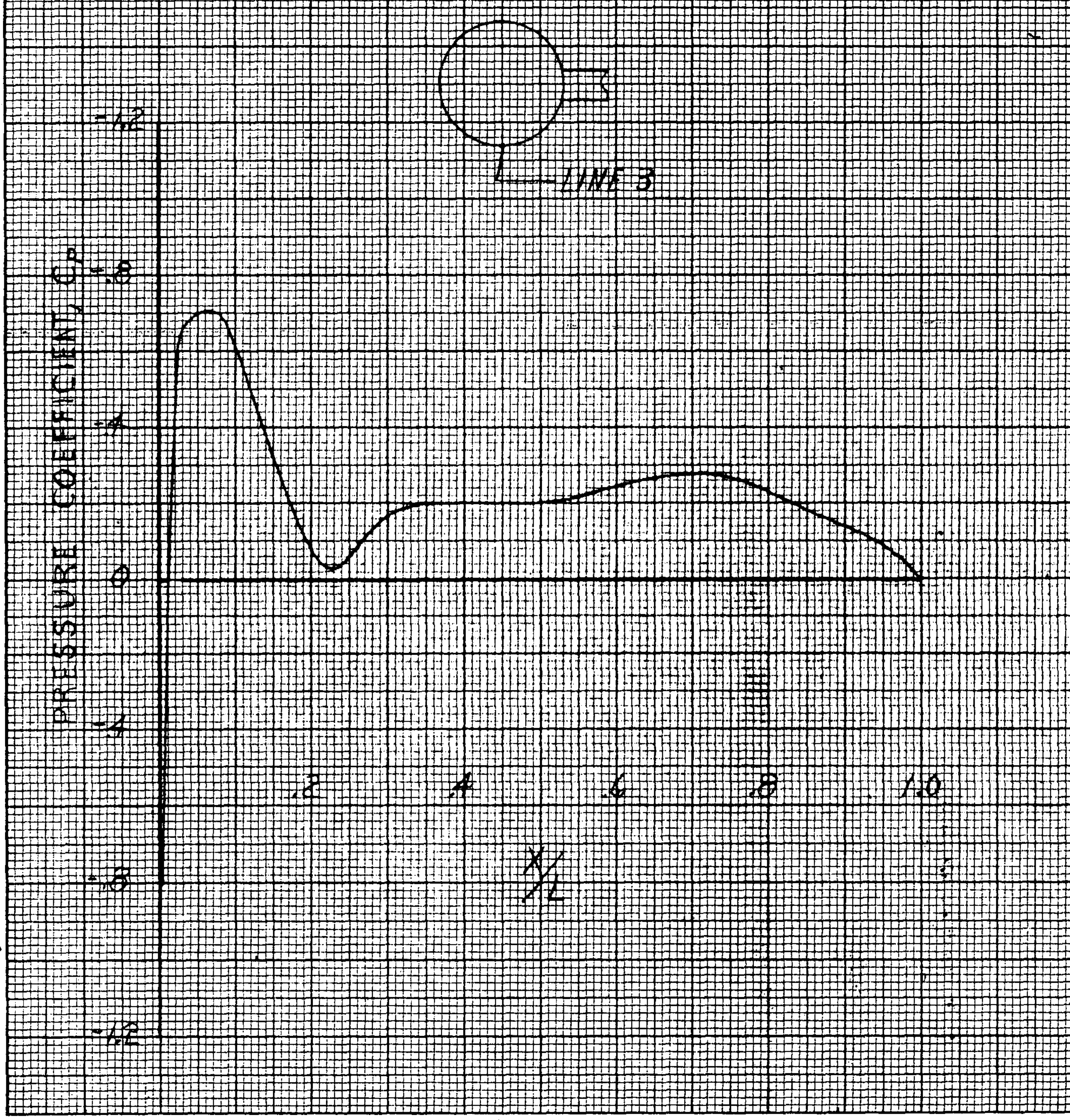
Prepared by: J WEHENER Checked by: JJK	LTV ELECTROSYSTEMS, INC.	Page No. 3.3.5 Report No. G8432.01.06
Date:	FIGURE 10	Model No. SP2H

H AND M SYSTEM POD PRESSURE COEFFICIENTS

CONDITION 1 α = 5° β = 0° q = 416 PSF Ve = 350 KTS L = 94 IN

LINE 3



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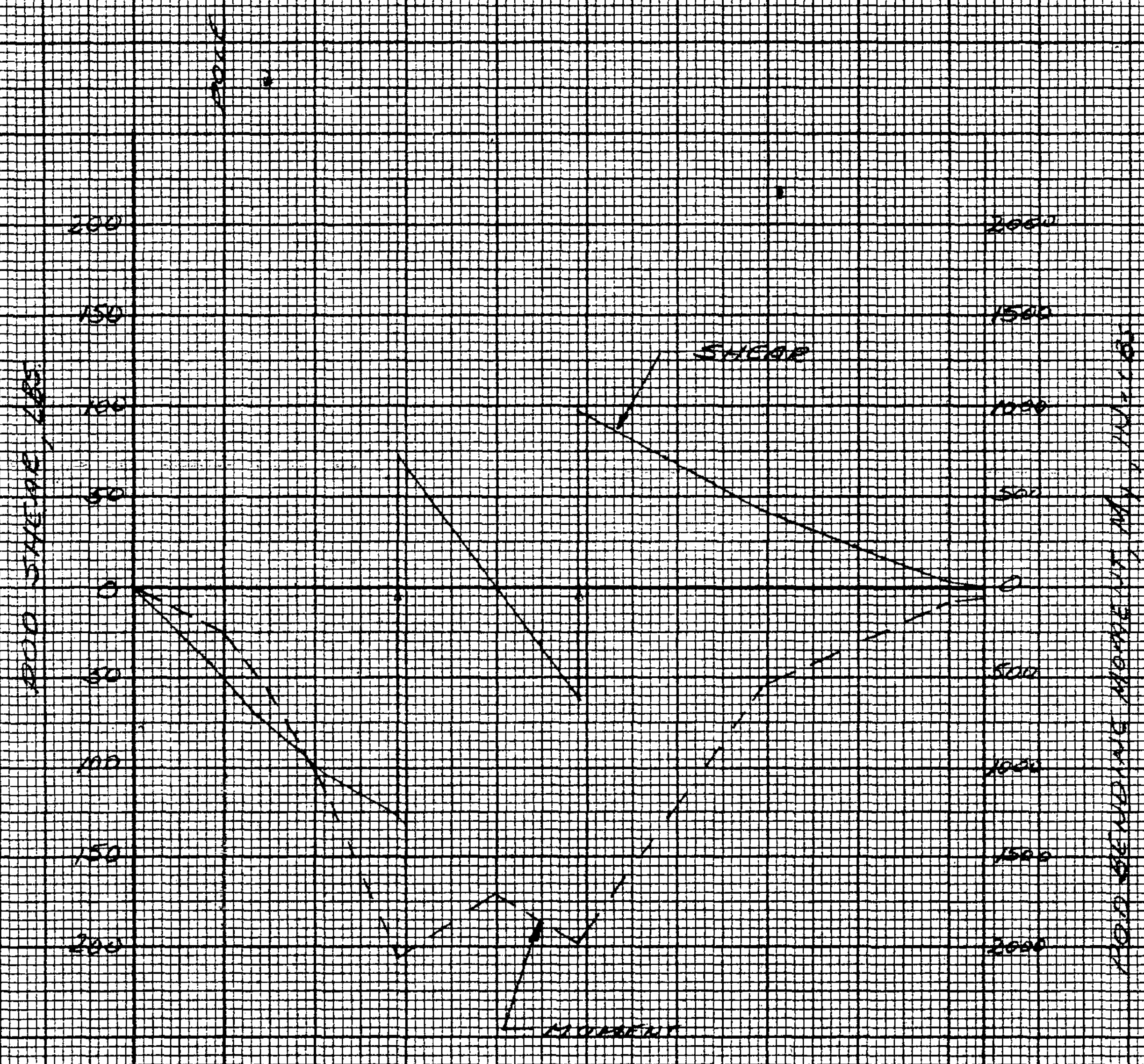
Date: 4-15-66	FWD POD	Model No. SP2H

SHEAR & BENDING MOMENT CURVES DUE TO INERTIA LOADS

N_Z = 4.5 G'S



MOMENT % ERROR = $\frac{60}{2600}$ X100 = 2.3%

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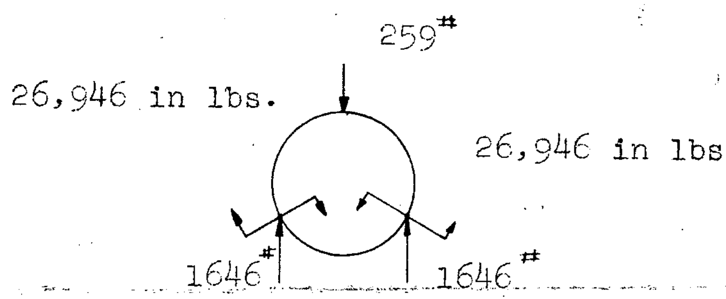
SUMMARY OF LOADS

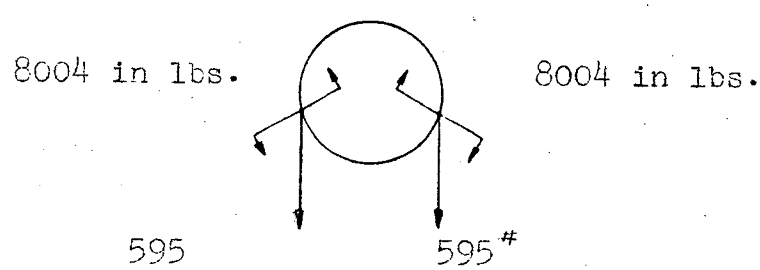
The loads shown below are the effects of the pods and pylons and do not reflect existing frame loads and moments.

PRELIMINARY ANALYSIS LOADS AND MOMENTS ON FRAMES DUE TO POD AND PYLON AIRLOADS AND PROBE LOADS

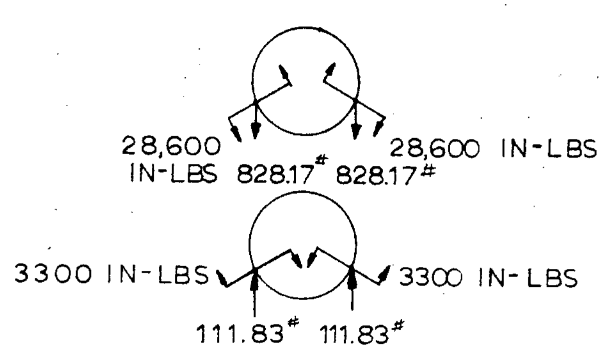
FS 42



FS 64



PRELIMINARY ANALYSIS LOADS AND MOMENTS ON FRAMES DUE TO POD INERTIALLOADS



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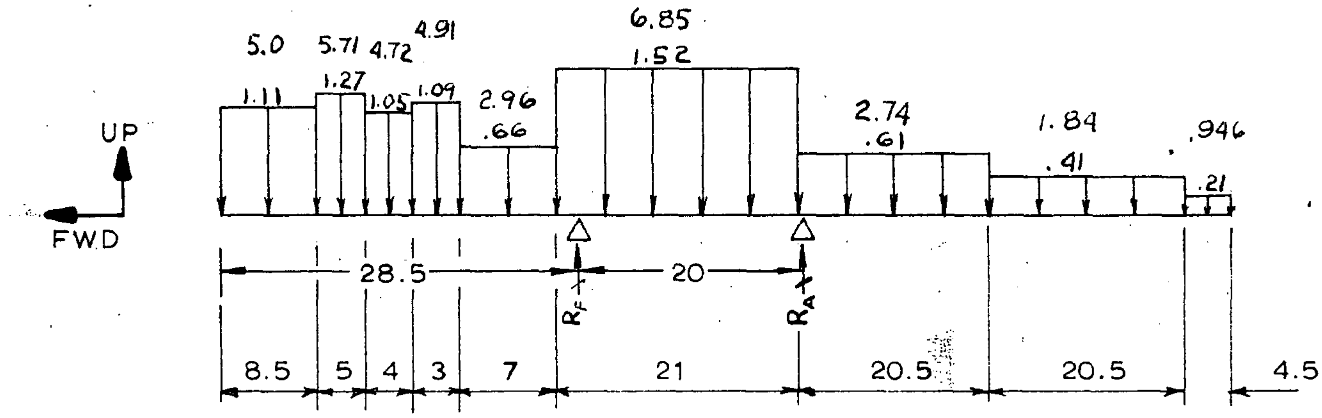
CONDITION 1 $\alpha = 5$ $\beta = 0$ q = 416 PSF V_c = 350 KTS
q = 2.89PSI
Δx = 4.7 in Δxq = 13.583 LB/IN

1	2	3	4	5	6	7	8	9	10
X/L	D	C_{P_U} Line 1	C_{P_L} Line 3	ΔC_P $C_{PU}-C_{PL}$ (3) - (4)	LOAD LB/IN Δxq X (5)	LOAD LB (6) x (2)	ARM X	MOMENT IN-LB Σ (7)x(8)	LOAD PER INCH LB/IN q x (2) x (5)
0-5	17.0	-.83	-.65	-.18	-2.581	-41.4	2.6		-8.80
5-10	26.2	-.90	-.71	-.19	-2.581	-65.76	7.5		-13.99
10-15	29.	-.64	-.46	-.18	-2.445	-70.91	11.8		-15.09
15-20	30.1	-.26	-.20	-.06	- .815	-24.53	16.45		- 5.22
20-25	↑	-.18	-.03	-.15	-2.037	-61.31	21.20		-13.04
25-30		-.27	-.13	-.14	-1.902	-57.25	25.95		-12.18
30-35		-.31	-.20	-.11	-1.494	-44.97	30.70		- 9.57
35-40		-.31	-.20	-.11	-1.494	-44.97	35.45		- 9.57
40-45	↓	-.30	-.20	-.10	-1.358	-40.88	40.20		- 8.70
45-50	30.1	-.28	-.20	-.08	-1.087	-32.72	44.95		- 7.00
50-55	29.6	-.25	-.21	-.04	- .543	-16.07	49.70		- 3.42
55-60	27.25	-.23	-.23	0	0	0	54.45		0
60-65	24.75	-.20	-.26	+.06	+.815	20.17	59.20		4.29
65-70	22.25	-.18	-.27	+.09	+1.222	27.19	63.95		5.78
70-75	19.75	-.15	-.27	+.12	+1.630	32.19	68.70		6.85
75-80	17.25	-.10	-.25	+.15	2.037	35.14	73.45		7.48
80-85	14.75	-.01	-.20	+.19	2.581	38.07	78.20		8.10
85-90	12.25	+.12	-.16	+.28	3.803	46.59	82.95		9.91
90-95	9.90	+.28	-.11	+.39	5.297	52.44	87.70		11.16
95-100	7.95	+.25	-.05	+.30	4.075	30.36	89.70		64.59
100-									

F = -218.62 LB M = 410,370

$$C_p = \frac{M}{F} = -47.40$$

WT. DISTRIBUTION ALONG POD WITHOUT CAMERA



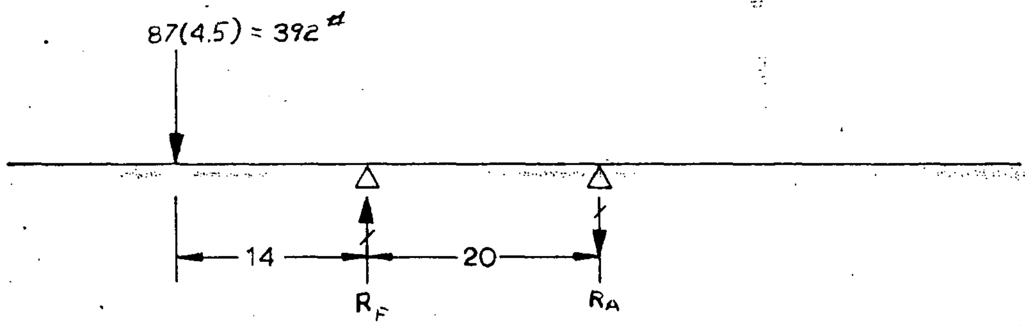
UPPER LOADINGS SHOWN ARE FOR 4.56 G's DOWN.
LOWER NUMBERS ARE FOR 1 G.

R_A = 162.17

4.5 G Down Cond.

R_F = 205.35

REACTIONS DUE TO CAMERA

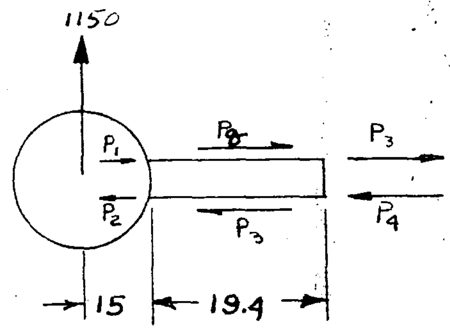


$$R_F = \frac{392(34)}{20} = 666^{\#}$$

$$R_A = \frac{392(14)}{20} = 274^{\#}$$

KICK LOADS

A) Fwd Frame

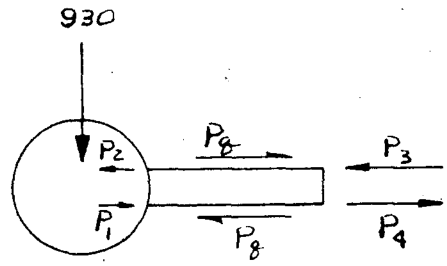


$$P_1 = P_2 = \frac{1150(15)}{6} = 2880^{\#}$$

$$P_8 = 19.4\,(105.2^{*} - 86.7) = 358^{\#}$$

$$P_3 = P_4 = 2880 + 358 = 3238^{\#}$$

B) Aft Frame



$$P_1 = P_2 = \frac{930(15)}{6} = 2320^{\#}$$

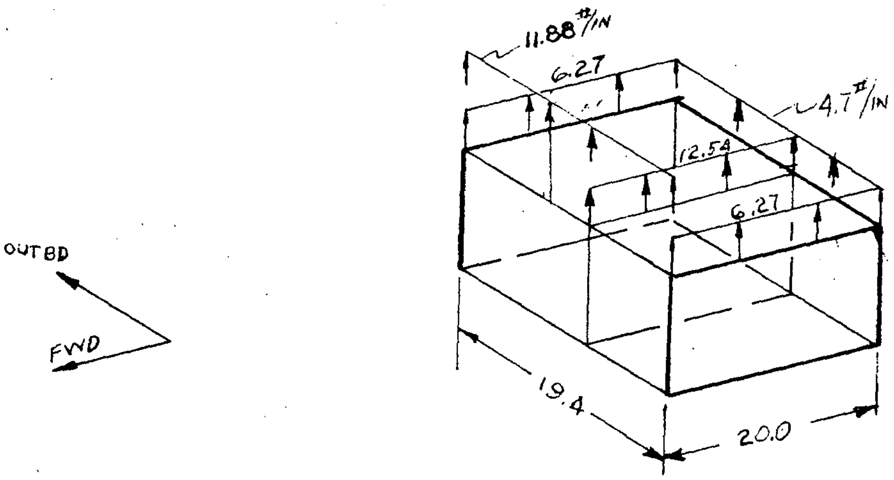
$$P_8 = 19.4(86.7 - ^{*}67.4) = 374^{\#}$$

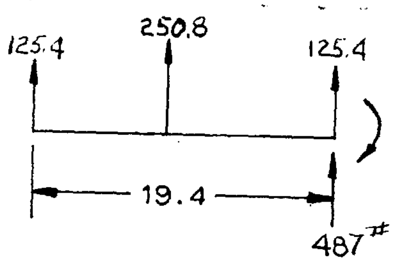
$$P_3 = P_4 = 2320 - 374 = 1946''$$

* See Pylon analysis.

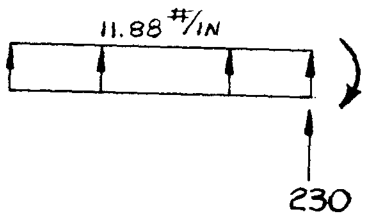
ES-56602-11

FRAME LOADS DUE TO PYLON

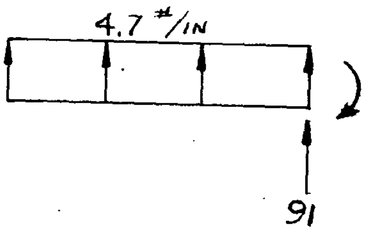




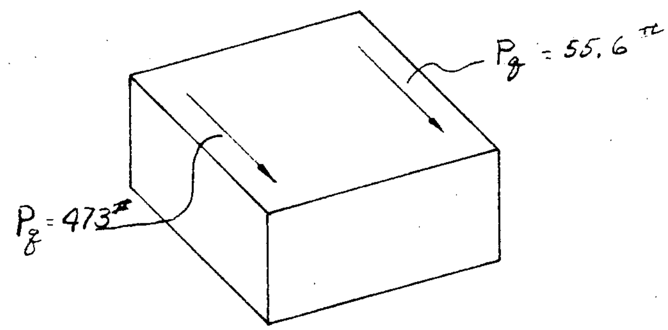
M = 125.4 (19.4) + 250.8 (9.7) = 4880



$M = \frac{230(19.4)}{2} = 2230$

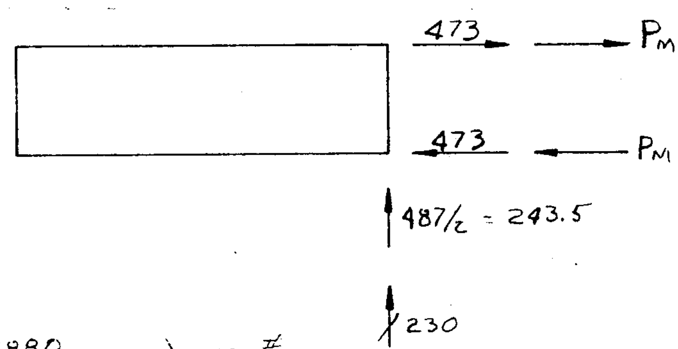


$M = \frac{91(19.4)}{2} = 882,$

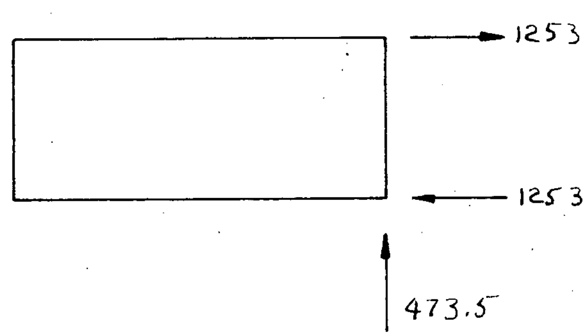


Total Loads and Moments (Pylon)

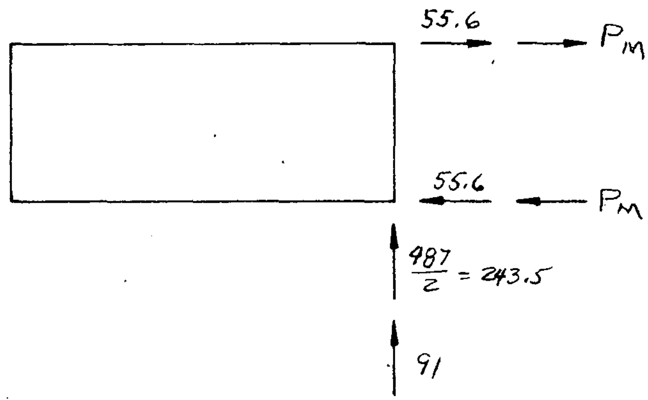
A). Front Spar



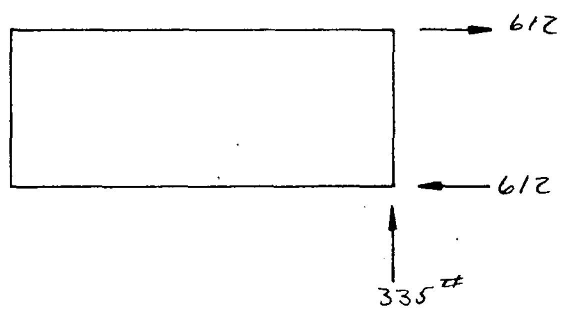
$P_M = \frac{1}{6}\left(\frac{4880}{2} + 2230\right) = 780^{\#}$



B). Aft Spar.

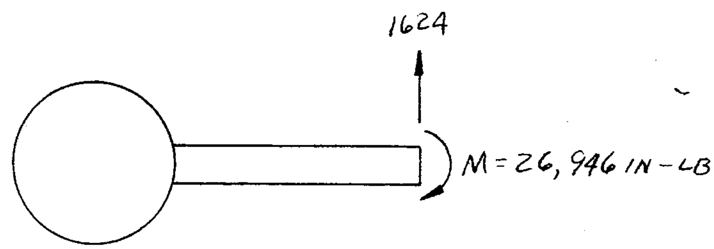


$$P_M = \frac{1}{6}\left(\frac{4880}{2} + 882\right) = 556$$

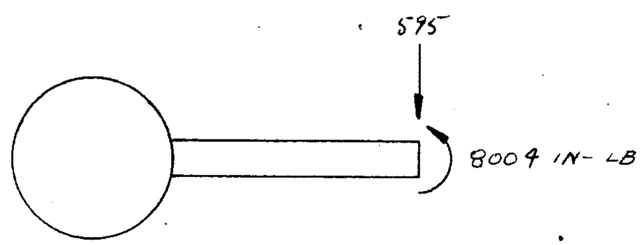


FRAME AIR LOADS AND MOMENTS - POD AND PYLON

FWD FRAME



AFT FRAME



INERTIA LOADS

Relieving - Do Not Incl.

TOTAL MOMENTS

0	+3130	
20	+1445	
40	-1035	
60	-2358	
80	0	
100	+3620	
110	+5778 -21168	} 26946
120	-13110	
140	-945	
160	+5969	
180	+7450	
200	+5969	
220	-945	
240	-13110	
250	+5778 -21168	} 26,946
260	+3620	
280	0	
300	-2358	
320	-1035	
340	+1445	
360	+3130	

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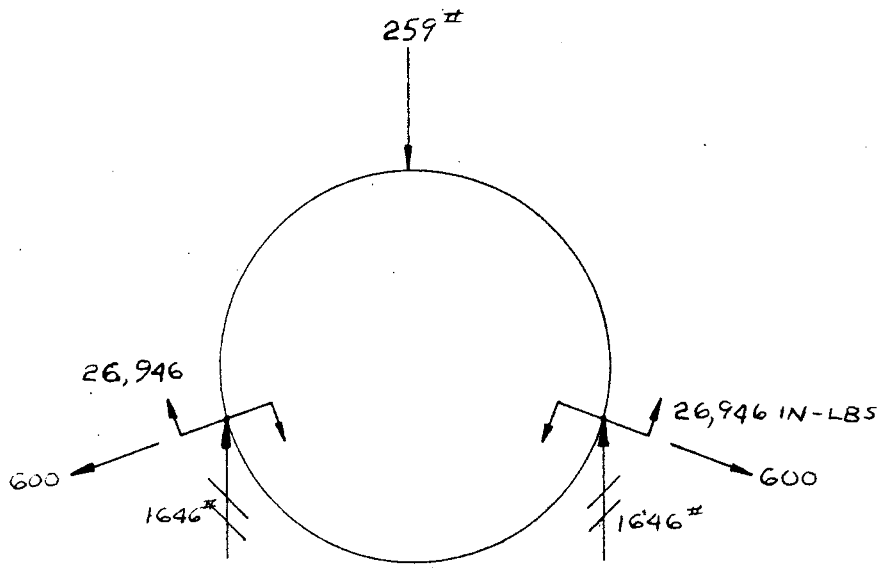
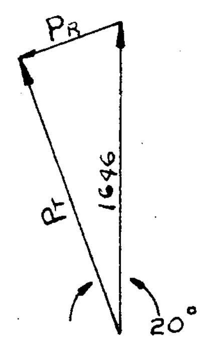
0	+2300	+1155	+1155	+2220	+2220	-2960	-2960
20	+ 850	0	+1512	+3160	+ 633	-2960	-1750
40	- 300	-1365	+1890	+2220	-1460	-2020	0
60	- 850	-1575	+1365	+ 760	-4750	- 808	+3500
80	- 850	-1575	- 430	- 760	-4050	+ 808	+6860
100	- 725	-1365	-3360	-2220	-2030	+2020	+11,300
110	- 550	- 775	-5020	-2750	0	+2400	+13,473 -13,473
120	- 280	0	-3360	-3160	+2030	+2960	-11,300
140	+ 400	+1155	- 430	-2220	+4050	+2960	-6860
160	+ 725	+1512	+1365	- 633	+4750	+1750	-3500
180	+ 750	+1890	+1890	+1460	+1460	0	0
200	+ 725	+1365	+1512	+4750	- 633	-3500	+1750
220	+ 400	-430	+1155	+4050	-2220	-6860	+2960
240	- 280	-3360	0	+2030	-3160	-11,300	+2960
250	- 550	-5020	- 775	0	-2750	-13,473 +13,473	+2400
260	- 725	-3360	-1365	-2030	-2220	+11,300	+2020
280	- 850	- 430	-1575	-4050	- 760	+6860	+ 808
300	- 850	+1365	-1575	-4750	+ 760	+3500	-808
320	- 300	+1890	-1365	-1460	+2220	0	-2020
340	+ 850	+1512	0	+ 633	+3160	-1750	-2960
360	+2300	+1155	+1155	+2220	+2220	-2960	-2960

FRAME DESIGN



Components of 1646# Load



$\sin 20° = .342 = \frac{P_R}{1752}$

$P_R = 600$

$\cos 20° = .939 = \frac{1646}{P_T}$

$P_T = 1752$

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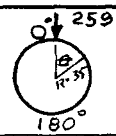

					CmRP	CnP	CvP
θ	C_M	C_V	C_N	RP	M	N	V
0	+.239	-.50	-.24	9600	+2300	-62.1	-129.5
10	+.16	-.45	-.31		+1535	-80.2	-116.5
30	+.02	-.33	-.41		+ 197	-106	- 85.4
50	-.065	-.18	-.43		- 625	-111.2	- 46.6
70	-.09	-.03	-.37		- 865	- 95.8	- 7.76
90	-.072	+.075	-.26		- 692	- 67.3	+ 19.4
110	-.055	+.14	-.13		- 528	- 33.6	+ 36.2
130	+.00	+.15	+.04		+ 0	+ 10.3	+ 38.8
150	+.065	+.11	+.16		+ 624	+ 41.3	+ 28.5
170	+.075	+.04	+.24		+ 720	+ 62.1	+ 10.35
190	+.075	-.04	+.24		+ 720	+ 62.1	- 10.35
210	+.065	-.11	+.16		+ 624	+ 41.3	- 28.5
230	0	-.15	+.04		0	+ 10.3	- 38.8
250	-.055	-.14	-.13		- 528	- 33.6	- 36.2
270	-.072	-.075	-.26		- 692	- 67.3	- 19.4
290	-.09	+.03	-.37		- 865	- 95.8	- 7.76
310	-.065	+.18	-.43		- 625	-111.2	+ 46.6
330	+.02	+.33	-.41		+ 197	-106	+ 85.4
350	+.16	+.45	-.31		+1535	-80.2	+116.5
360	+.239	+.50	-.24		+2300	-62.1	+129.5

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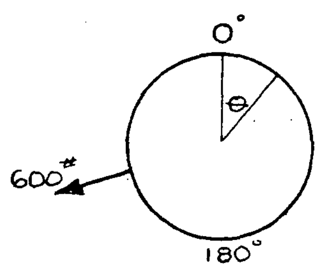
θ	C_M	C_V	C_N	RP	CmRP M	CnP N	CvP V
110	+.055	-.14	+.13	21000	+1155	+78	-84
130	0	-.15	-.04	↓	0	-24	-90
150	-.065	-.11	-.16		-1365	-96	-66
170	-.075	-.04	-.24		-1575	-144	-24
190	-.075	+.04	-.24		-1575	-144	+24
210	-.065	+.11	-.16		-1365	-96	+66
230	0	+.15	-.04		0	-24	+90
250	+.055	+.14	+.13		+1155	+78	+84
270	+.072	+.075	+.26		+1512	+156	+45
290	+.09	-.03	+.37		+1890	+222	-18
310	+.065	-.18	+.43		+1365	+258	-108
330	-.02	-.33	+.41		-430	+246	-198
350	-.16	-.45	+.31		-3360	+186	-270
360	-.239	-.50	+.24		-5020	+144	-300
0	-.239	+.50	+.24		-5020	+144	+300
10	-.16	+.45	+.31		-3360	+186	+270
30	-.02	+.33	+.41		-430	+246	+198
50	+.065	+.18	+.43		+1365	+258	+108
70	+.09	+.03	+.37		+1890	+222	+18
90	+.072	-.075	+.26	↓	+1512	+156	-45



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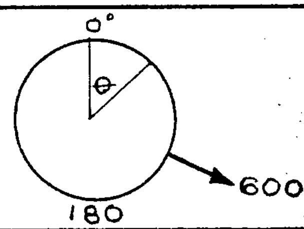
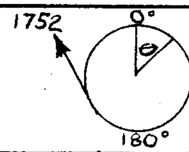
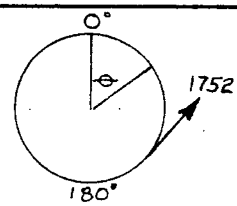


θ	C_M	CV	C_N	RP	M	N	V
250	+.055	+.14	+.13	21,000	+1155	+78	+84
270	+.072	+.075	+.26	↓	+1512	+156	+45
290	+.09	-.03	+.37		+1890	+222	-18
310	+.065	-.18	+.43		+1365	+258	-108
330	-.02	-.33	+.41		- 430	+246	-198
350	-.16	-.45	+.31		-3360	+186	-270
360	-.239	-.50	+.24		-5020	+144	-300
0	-.239	+.50	+.24		-5020	+144	+300
10	-.16	+.45	+.31		-3360	+186	+270
30	-.02	+.33	+.41		-430	+246	+198
50	+.065	+.18	+.43		+1365	+258	+108
70	+.09	+.03	+.37		+1890	+222	+18
90	+.072	-.075	+.26		+1512	+156	-45
110	+.055	-.14	+.13		+1155	+78	-84
130	0	-.15	-.04		0	-24	-90
150	-.065	-.11	-.16		-1365	-96	-66
170	-.075	-.04	-.24		-1575	-144	-24
190	-.075	+.04	-.24		-1575	-144	+24
210	-.065	+.11	-.16		-1365	-96	+66
230	0	+.15	-.04	↓	0	-24	+90



RP=63,300

θ	C_M	C_V	C_N	$\frac{C_M RP}{M}$	$\frac{C_N P}{N}$	V
110	+.035	+.05	+.14	+2220	+246	+82.5
130	+.05	0	+.15	+3160	+263	0
150	+.035	-.06	+.11	+2220	+193	-105
170	+.012	-.10	+.04	+760	+70.2	-175.2
190	-.012	-.09	+.04	-760	-70.2	-158
210	-.035	-.06	-.11	-2220	-193	-105
230	-.05	0	-.15	-3160	-263	0
250	-.035	+.05	+.14	-2220	-246	+82.5
270	-.01	+.09	-.08	+633	-140	+158
290	+.023	+.09	+.03	+1460	+52.5	+158
310	+.075	+.06	+.17	+4750	+292	+105
330	+.064	-.03	+.32	+4050	+560	-52.5
250	+.032	-.13	+.45	+2030	+789	-228
360	0	-.26	+.50	0	+825	-456
0	0	-.26	-.50	0	-825	-456
10	-.032	-.13	-.45	-2030	-789	-228
30	-.064	-.03	-.32	-4050	-560	-52.5
50	+.075	+.06	+.17	+4750	+292	+105
70	+.023	+.10	+.03	+1460	+52.5	+175.2
90	-.01	+.09	-.08	-633	-140	+158



θ	Cm	Cv	Cn	M	N	V
250	+.035	-.05	+.14	+2220	+246	-82.5
270	+.01	-.09	+.08	+633	+140	-158
290	-.023	-.09	-.03	-1460	-52.5	-158
310	-.075	-.06	-.17	-4750	-292	-105
330	-.064	+.03	-.32	-4050	-560	-52.5
350	-.032	+.13	-.45	-2030	-789	+228
360	0	+.26	-.50	0	-825	+456
0	0	+.26	+.50	0	+825	+456
10	+.032	+.13	+.45	+2030	+789	+228
30	+.064	+.03	+.32	+4050	+560	+52.5
50	+.075	-.06	-.17	+4750	-292	-105
70	+.023	-.10	-.03	-1460	-52.5	-175.2
90	+.01	-.09	+.08	+633	+140	-158
110	-.035	-.05	-.14	-2220	-246	-82.5
130	-.05	0	-.15	-3160	-263	0
150	-.035	+.06	-.11	-2220	-193	+105
170	-.012	+.10	-.04	-760	-70.2	+175.2
190	+.012	+.09	+.04	+760	+70.2	+158
210	+.035	+.06	+.11	+2220	+193	+105
230	+.03	0	+.15	+3160	+263	0

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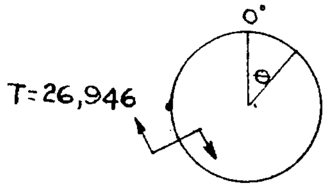

$\frac{T}{R} = \frac{26946}{35} = 770$

θ	Cn	Cv	C_N	CmT M	Cn($\frac{T}{R}$) N	Cv($\frac{T}{R}$) V	
110	-.11	-.05	-.3	-2960	-231	-38.4	
130	-.11	+.050	-.24	-2960	-184.5	+38.4	
150	-.075	+.14	-.16	-2020	-123	+107.5	
170	-.03	+.155	-.06	-808	-46.2	+119.1	
190	+.03	+.155	+.06	+808	+46.2	+119.1	
210	+.075	+.14	+.16	+2020	+123	+107.5	
230	+.11	+.05	+.24	+2960	+184.5	+38.4	
250	+.11	-.05	+.3	+2960	+231	-38.4	
270	-.065	-.155	+.32	+1750	+246	-119.1	
290	0	-.27	+.3	0	+231	-208	
310	-.13	-.36	+.24	-3500	+184.5	-277	
330	-.255	-.43	+.16	+6860	+123	-331	
350	-.42	-.47	+.06	-11,300	+46.2	-362	
360	-.50	-.47	0	-13,473	0	-362	
0	+.50	-.47	0	+13,473	0	-362	
10	+.42	-.47	-.06	+11,300	-.46.2	-362	
30	+.255	-.43	-.16	+6860	-123	-331	
50	+.13	-.36	-.24	+3500	-184.5	-277	
70	0	-.27	-.3	0	-231	-208	
90	-.065	-.155	-.32	-1750	-246	-119.1	

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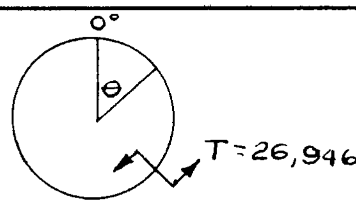

θ	Cm	Cv	Cn	M	N	V
250	-.11	+.05	-.3	-2960	-231	+38.4
270	-.065	+.155	-.32	-1750	-246	+119.1
290	0	+.27	-.3	0	-231	+208
310	+.13	+.36	-.24	+3500	-184.5	+277
330	+.255	+.43	-.16	+6860	-123	+331
350	+.42	+.47	-.06	+11,300	-46.2	+362
360	+.50	+.47	0	+13,473	0	+362
0	-.50	+.47	0	-13,473	0	+362
10	-.42	+.47	+.06	-11,300	+46.2	+362
30	-.255	+.43	+.16	-6860	+123	+331
50	-.13	+.36	+.24	-3500	+184.5	+227
70	0	+.27	+.3	0	+231	+208
90	+.065	+.155	+.32	+1750	+246	+119.1
110	+.11	+.05	+.3	+2960	+231	+38.4
130	+.11	-.05	+.24	+2960	+184.5	-38.4
150	+.075	-.14	+.16	+2020	+123	-107.5
170	+.03	-.155	+.06	+808	+46.2	-119.1
190	-.03	-.55	-.06	-808	-46.2	-119.1
210	-.075	-.14	-.16	-2020	-123	-107.5
230	-.11	-.05	-.24	-2960	-184.5	-38.4

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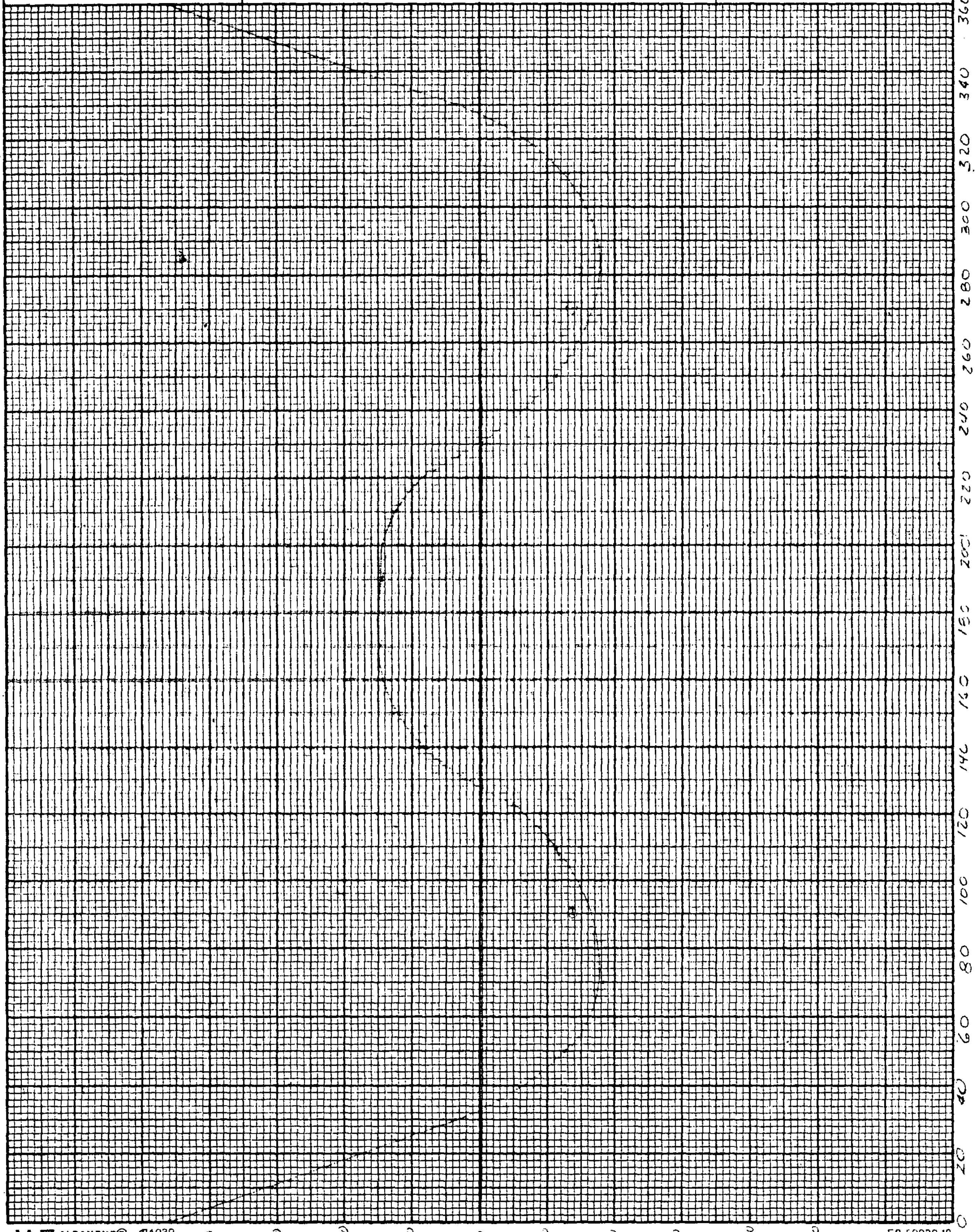

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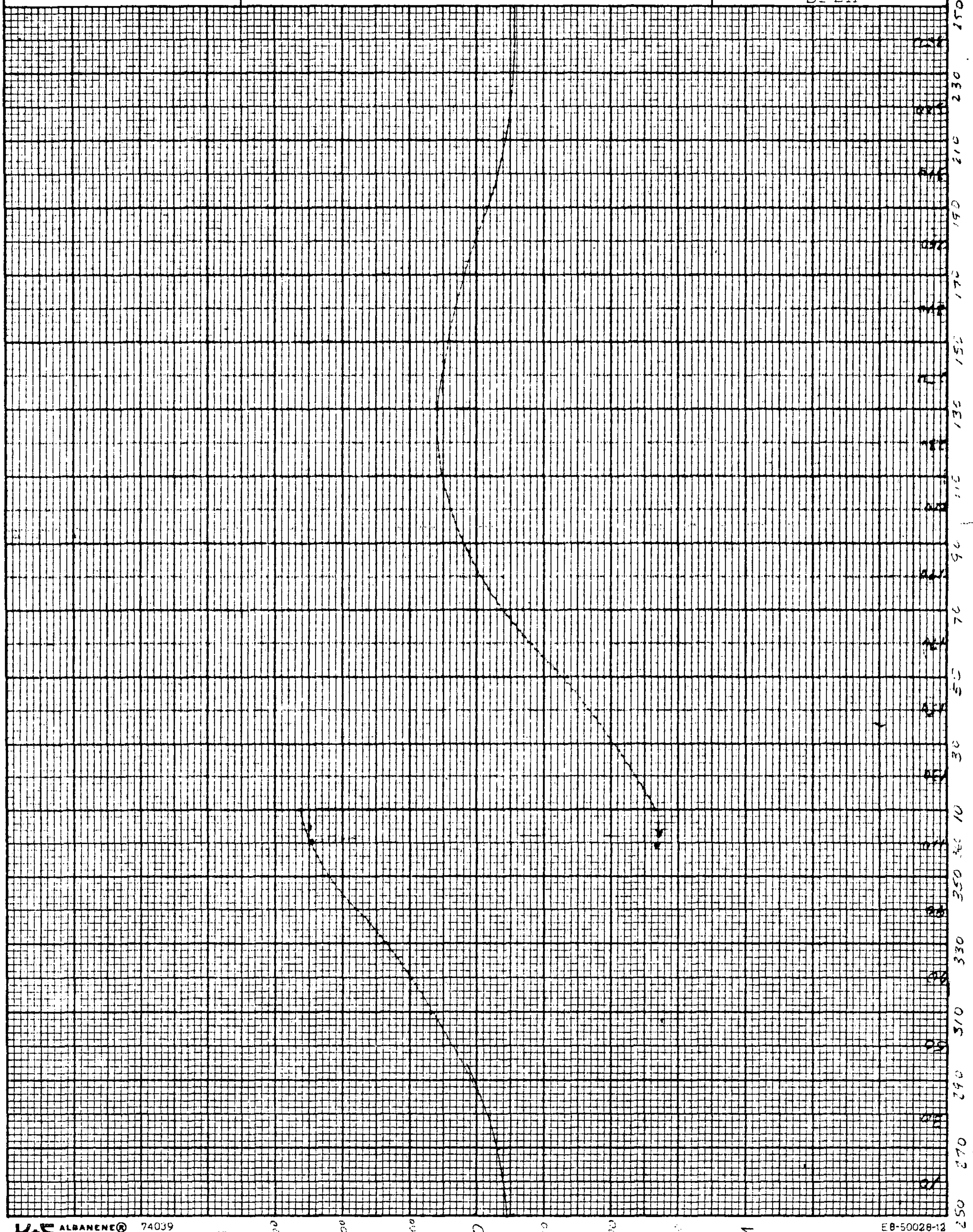

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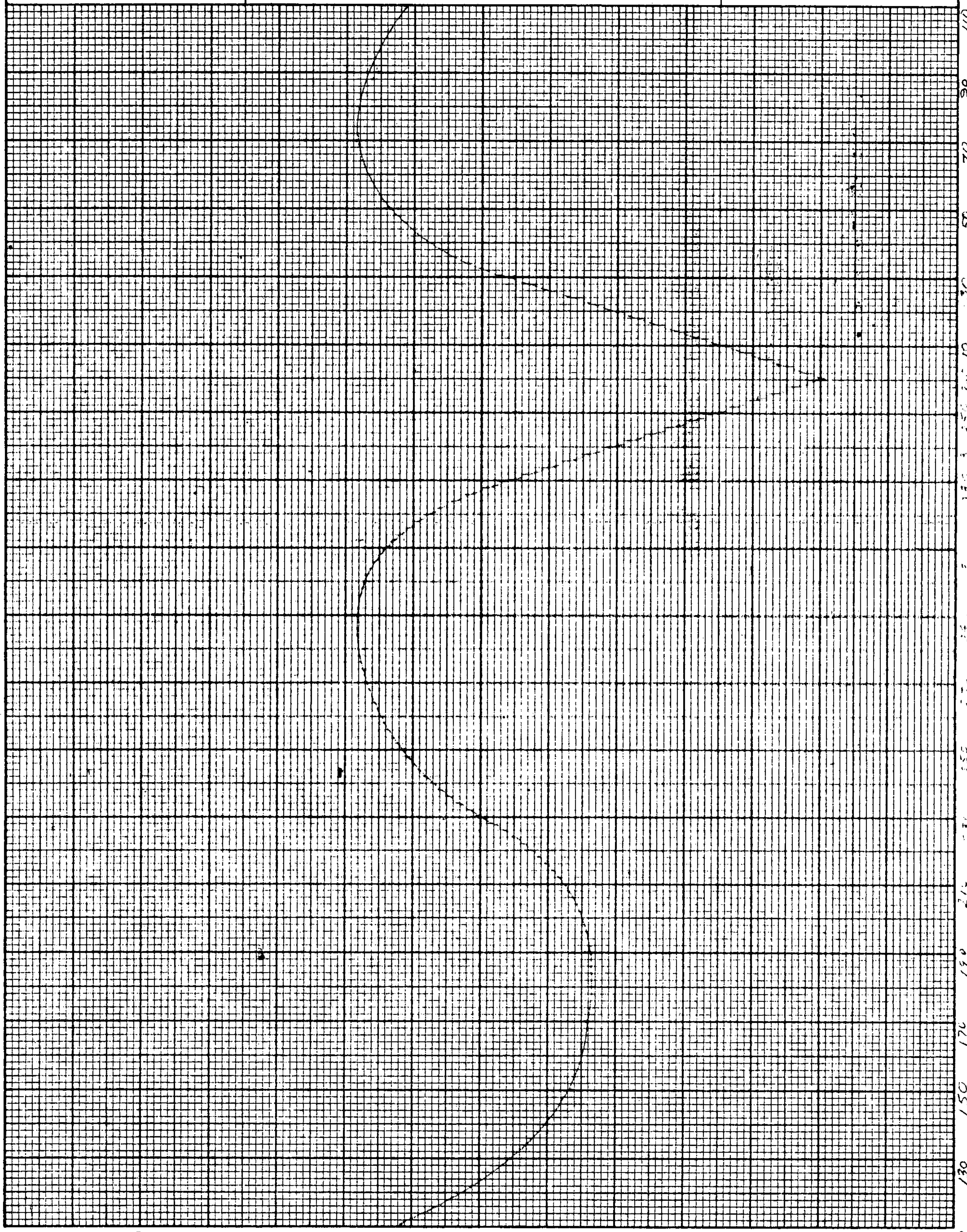

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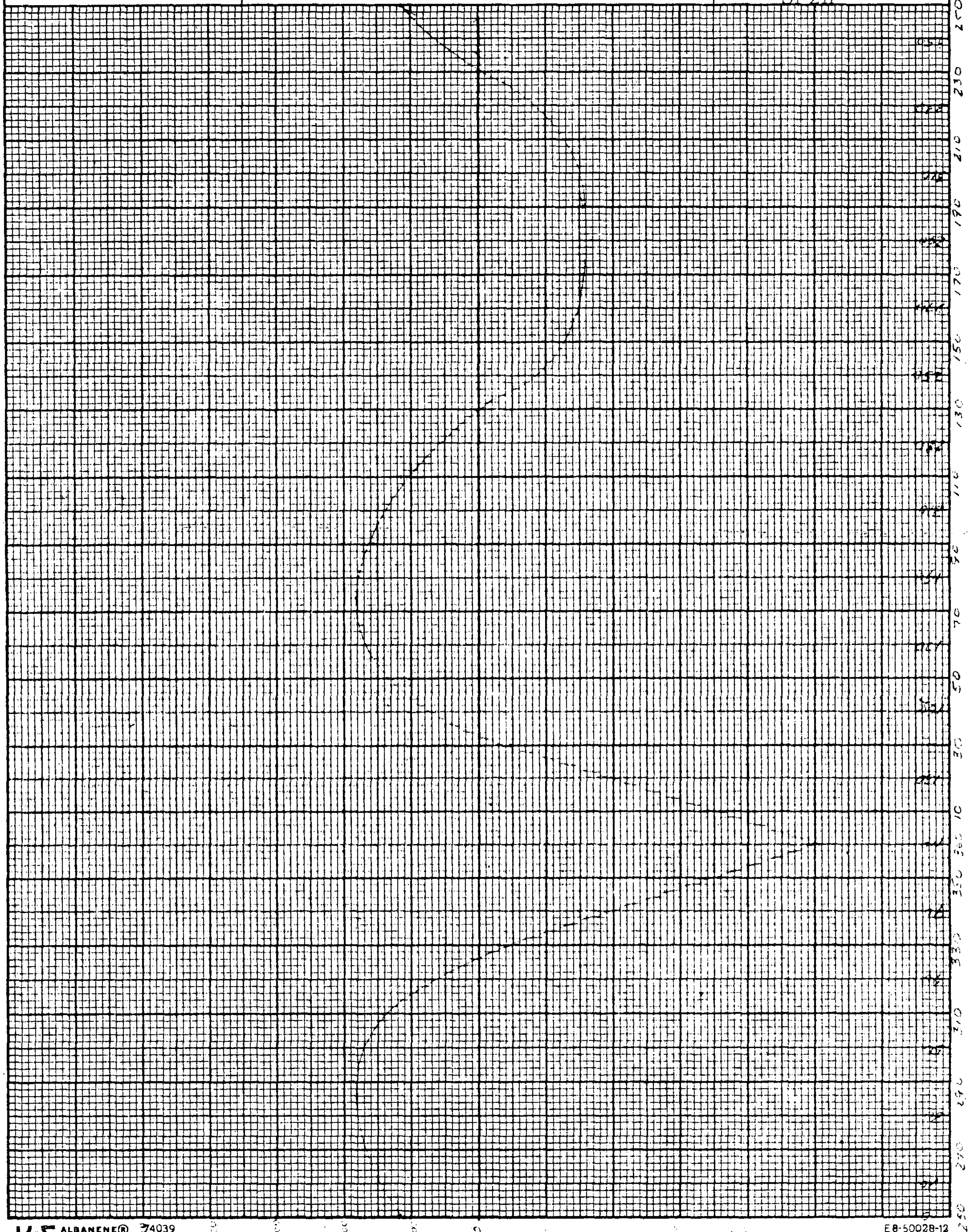

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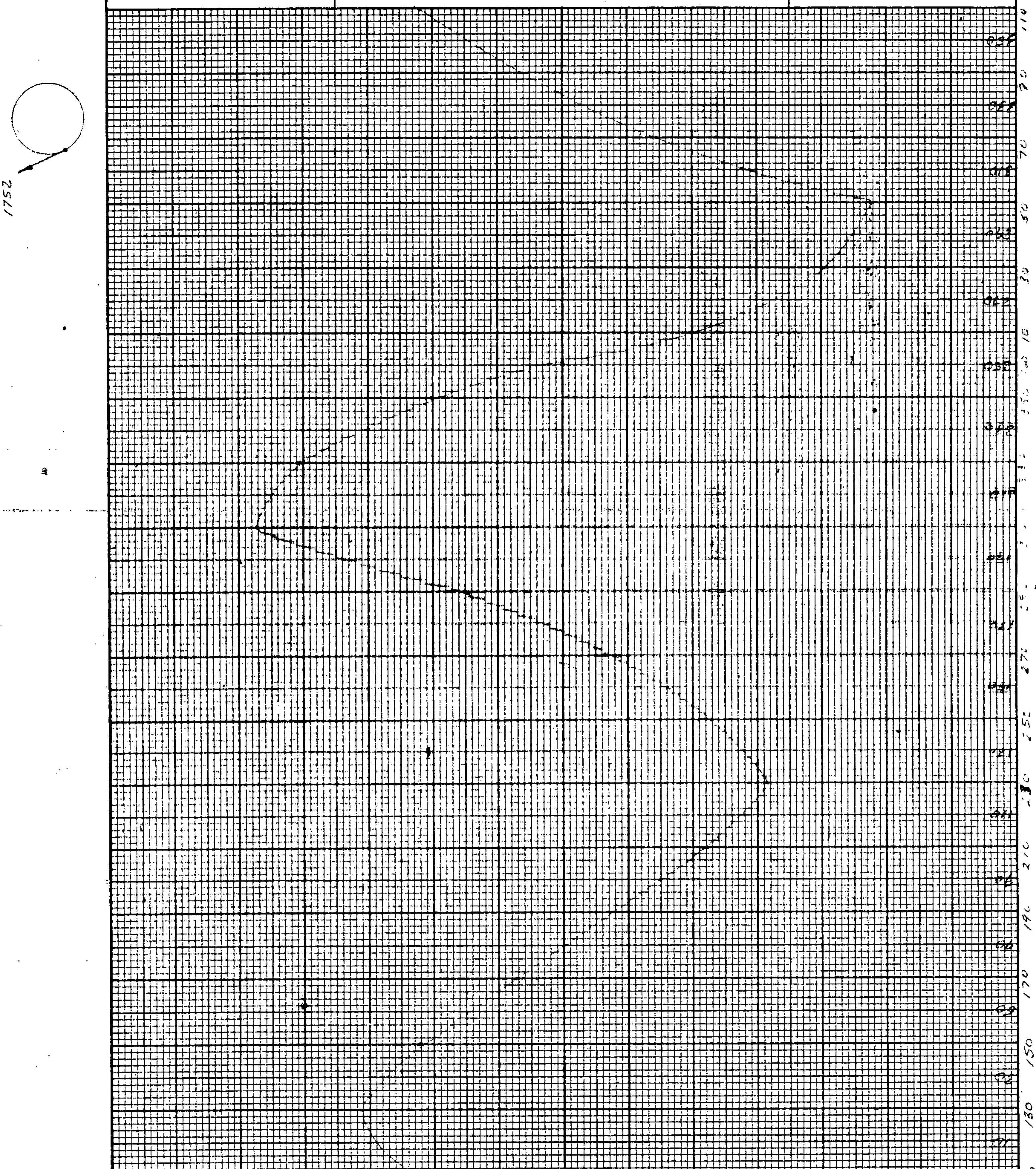

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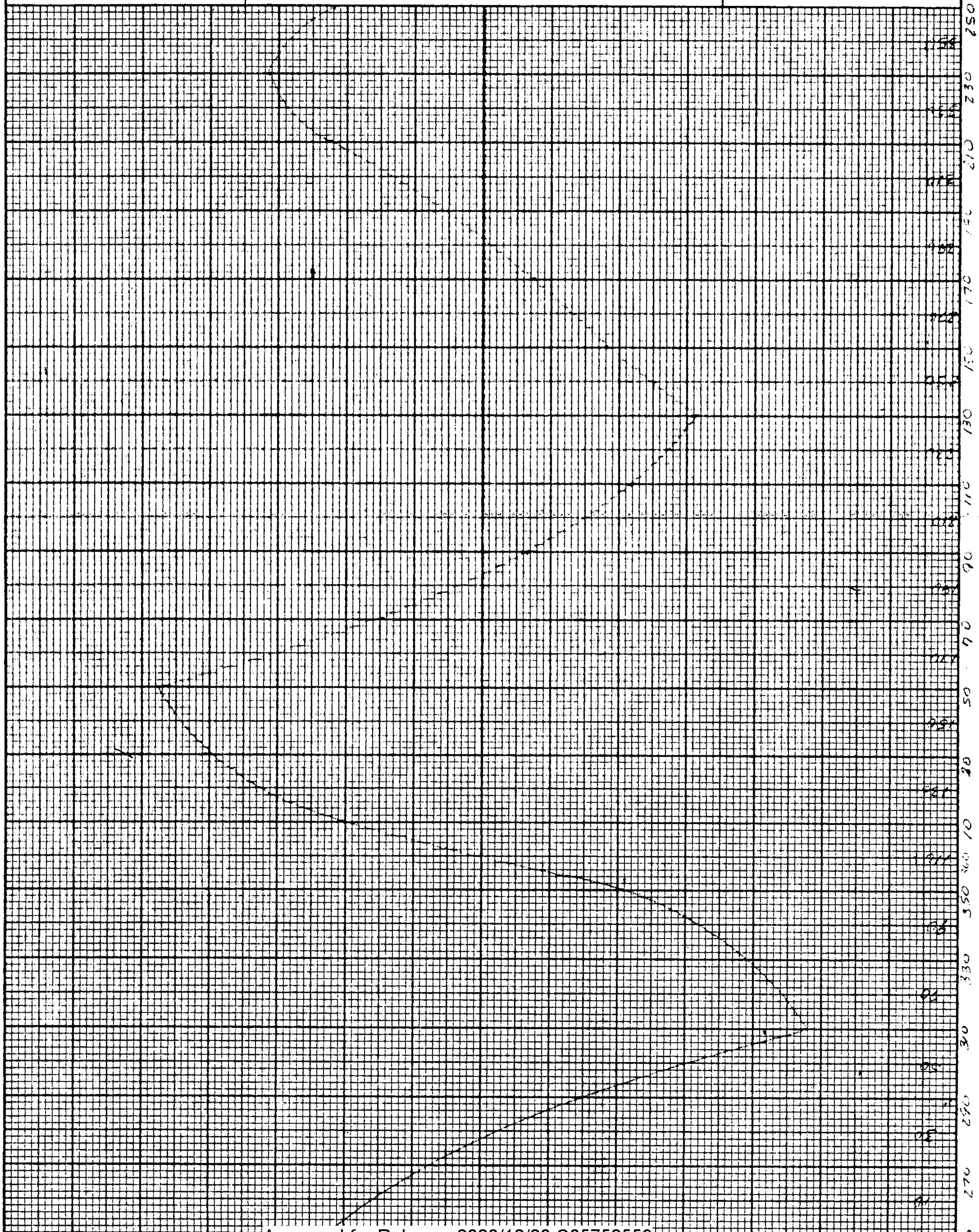

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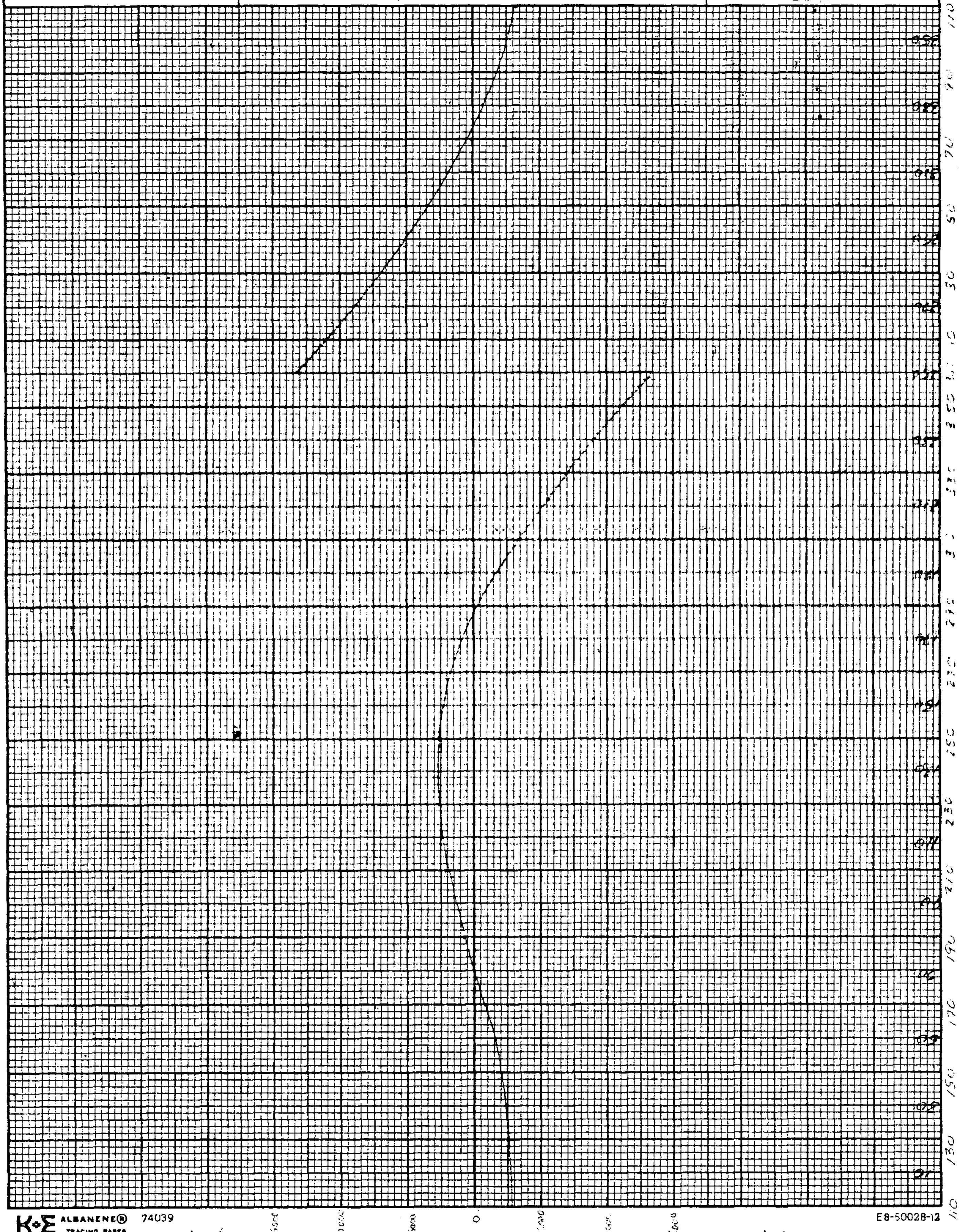

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(POD DS INSTALLED)
POD & PYLON MOMENTS ON FRAME

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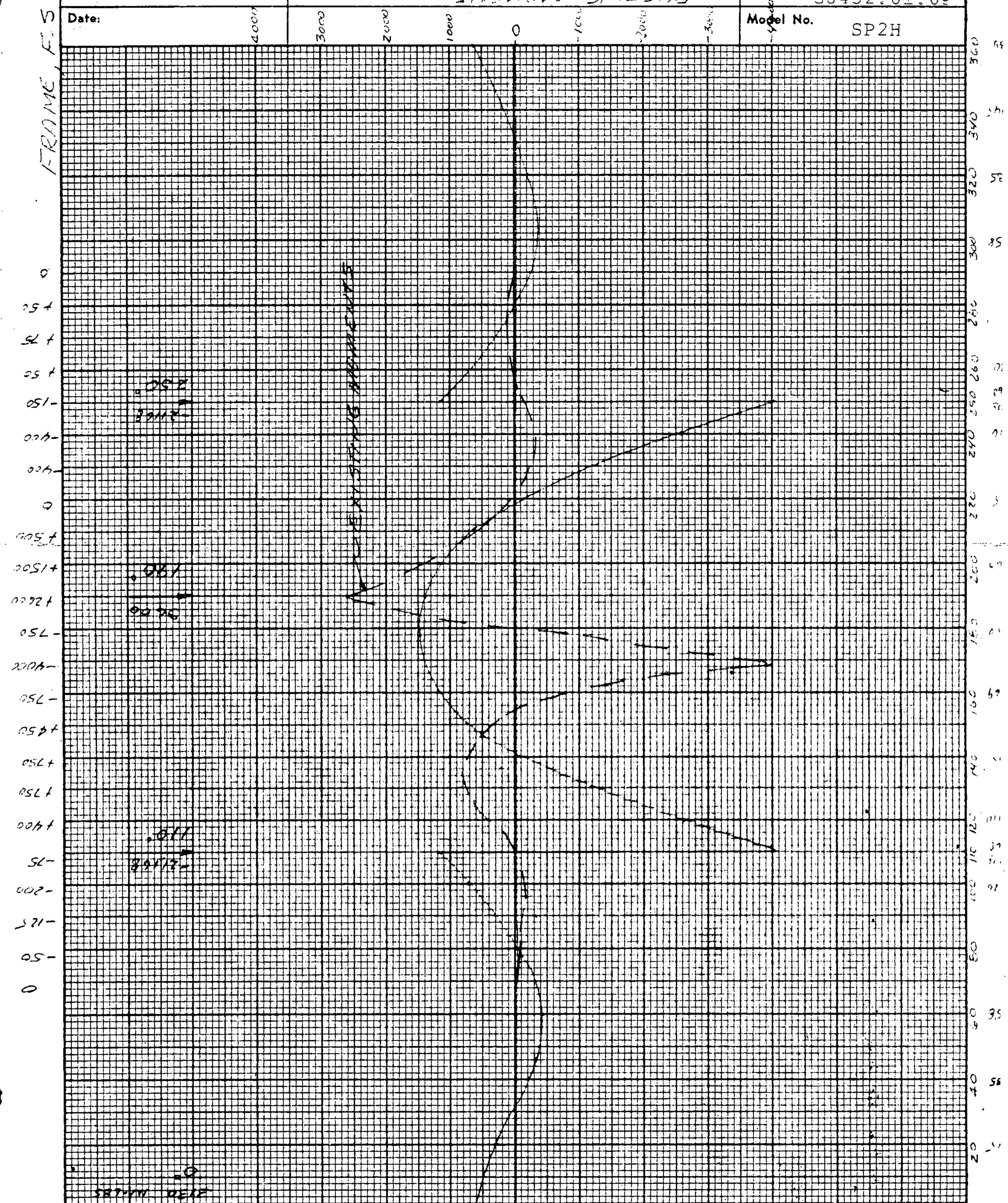
FRAME F.S. 42



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Shear and Ten. at 0°, 110°, 190°, 250°

TENSION, N

0°	-62.1	+78	+78	+246	+246	-231	-231	+124
110°	-33.6	-60	+144	-228	-825	+154	0	-849
190°	+62.1	+240	+189	+172	+43.8	+208	+239	+1154
250°	-33.6	+164.	-60	+807	-228	+23.1	+154	+826

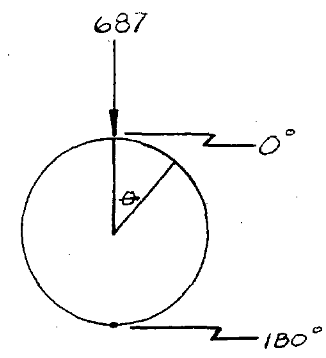
SHEAR, V

0°	-130	-84	+84	+83	-83	-38.4	+38.4	-130
110°	+36	+78	-300	-53	+342	+73	+362	+538
190°	-10	-63	-13.5	+132	-167	-242	+164	-200
250°	-36	-285	-78	-342	+53	-362	-73	-1122

PROBE LOADS AND MOMENTS

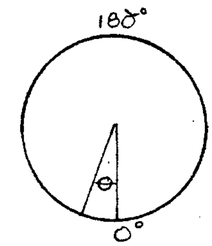
F.S. 21 Frame Analysis

θ°	M	N	V
0	+6100	-165	-343
10	+4070	-212	-134
30	+522	-280	-226
50	-1660	-295	-123
70	-2300	-260	-20.6
90	-1835	-178	+51.4
110	-1400	-89.4	+96
130	0	+27.3	+103
150	+1655	+109.5	+70.5
170	+1910	+165	+27.4
190	+1910	+165	-27.4
210	+1655	+109.5	-70.5
230	0	+27.3	-103
250	-1400	-89.4	-96
270	-1835	-178	-51.4
290	-2300	-260	+20.6
310	-1660	-295	+123
330	+522	-280	+226
350	+4070	-212	+134
360	+6100	-165	+343



$\frac{687}{259} = 2.65$

F.S. 21 Frame Analysis - Existing Loads & Moments

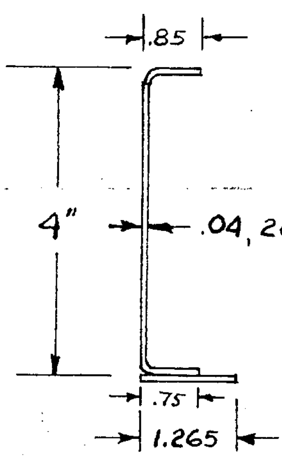


Max. Bending at $\theta = 9°$

$M = 2540$ in - lbs

Axial Load = $-375^{\#}$ (comp.) at $\theta = 9°$

FRAME SECTION (LOWER)

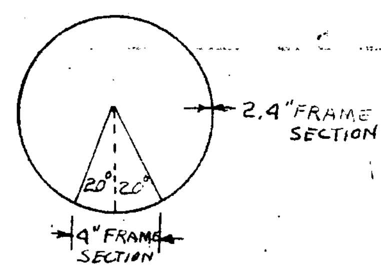


(Ref. ER 8935)
Crippling Allow of Section = 20,221 PSI

$A = .2811 \text{ In.}^2$

$= 2.03"$

$I = .81056 \text{ In.}^4$



Determine max. allow. moment assuming no axial load.

Axial Load

$$M = \frac{fI}{c} = \frac{20,221\ (.81056)}{2.03} = 8090 \text{ in - lbs}$$

At this point only

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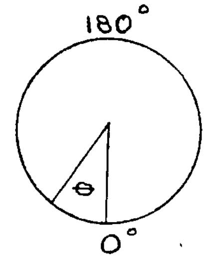

Existing Moments

θ		θ	
0	+230	190	0
10	+2540	200	0
20	+925	210	0
30	0	220	0
40	-400	230	0
50	-440	240	-25
60	-375	250	-75
70	-100	260	-75
80	+25	270	0
90	+90	280	+100
100	+100	290	+225
110	+90	300	+300
120	+25	310	+225
130	0	320	+50
140	0	330	-350
150	0	340	-1000
160	0	350	-1900
170	0	360	+200
180	0		

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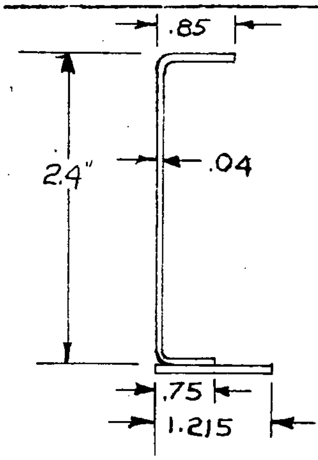
2.4" Frame Section



F_C = 20,221 PSI

$\bar{Y}$ = 1.0015"

I = .17431 in.^{4}

A = .1931 in.^{2}

Determine max. allow moment assuming no axial load.

$$M = \frac{fI}{c} = \frac{20,221\ (.17431)}{1.0015} = 3520 \text{ in - lbs.}$$

A) Stress at 4" Section.

M_{max} = 2540 2000 = 2540 in - lbs.

Axial load = 375 + 165 = 540 #

$$f = \frac{4540\ (2.03)}{.81056} + \frac{540}{.2811}$$

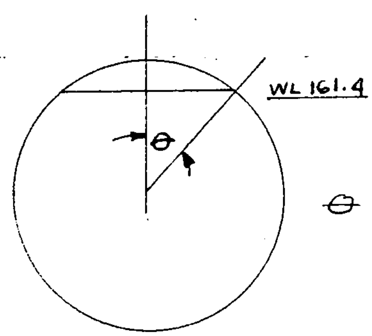
$$= 11,350 + 1920$$

13,270 PSI

F_c = 20,221

m.s. = +.53

B)



θ = 38°

Stress on frame that isn't reinforced.

M = 2200 + 75 = 2275 in - lbs (θ = 70°)
P = 260 + 530 = 790#

$$f = \frac{2275(1.0015)}{.17431} + \frac{790}{.1931} = 17,090 \text{ PSI}$$

F_c = 20,221

m.s. = +.18

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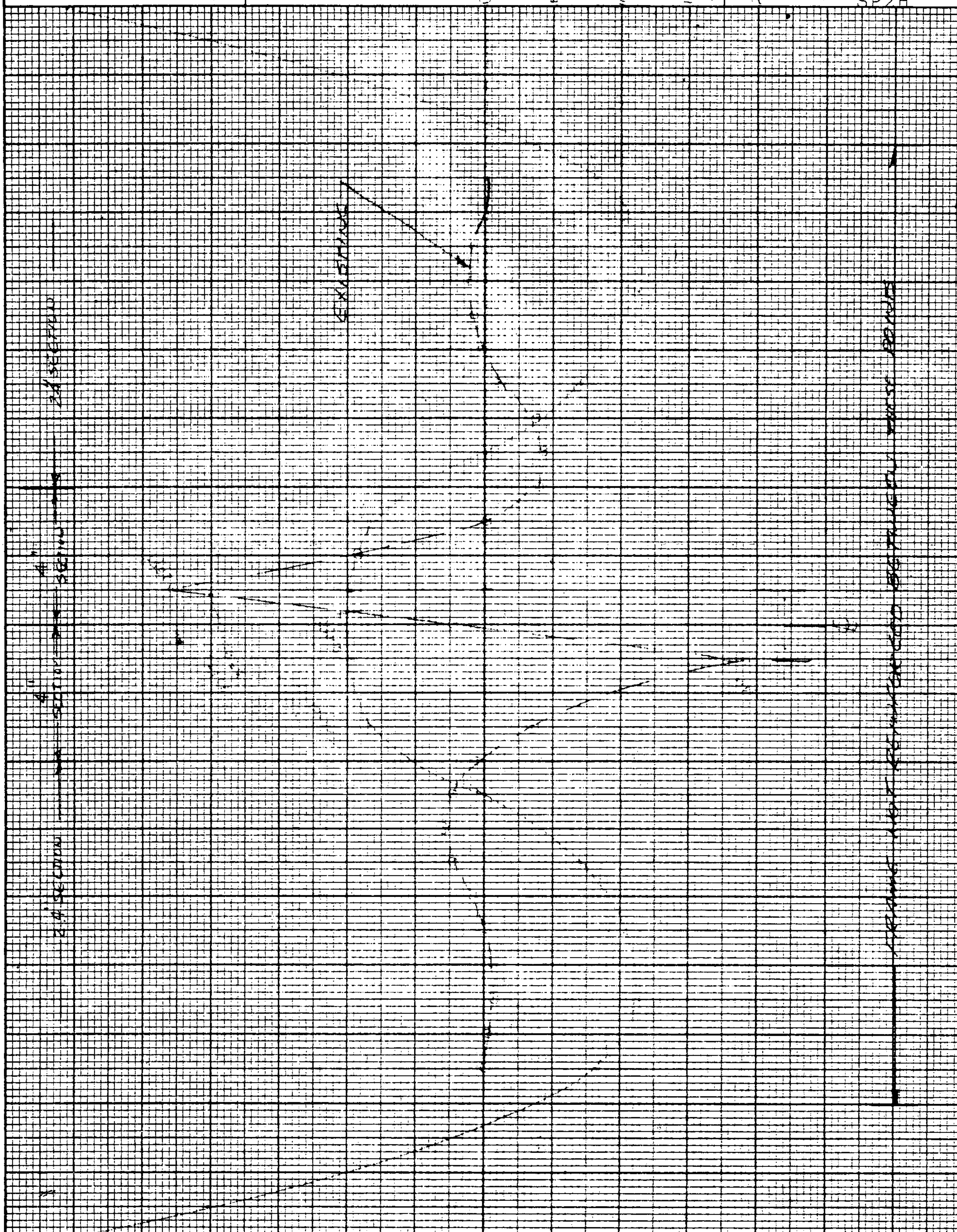

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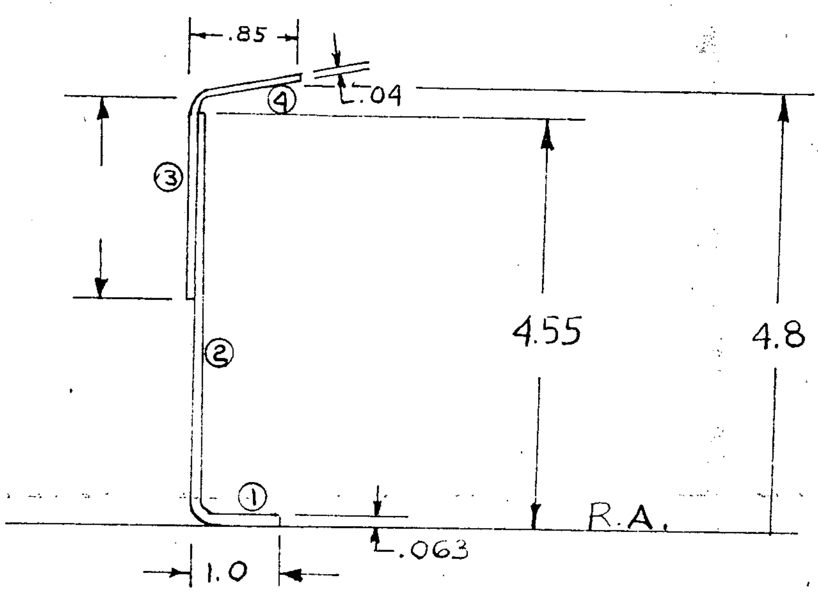
C). Stress at reinforced section

M = 6100 in - lbs

P = 165#

Do not incl. ftg. in eff. bending section



No.					
1	.0590	.0315	.0019	.001	
2	.2867	2.275	.6550	1.4900	.493
3	.0700	3.8	.2660	1.0108	.0178
4	.0324	4.8	.1536	.7373	
	.4481		1.0765	3.2382	.5108

$\bar{Y} = \frac{1.0765}{.4481} = 2.4"$, C = 2.4"

$I = 3.2382 + .5108 - .4481\,(2.4)^2$

$= 1.169"$

C). Stress at reinforced section (cont.)

$$f_b = \frac{6100\ (2.4)}{1.169} + \frac{165}{.4481}$$

$$= 12{,}550 + 368$$

$$= 12{,}918 \text{ PSI}$$

$$\frac{b}{t} = \frac{1.00}{.063} = 15.9$$

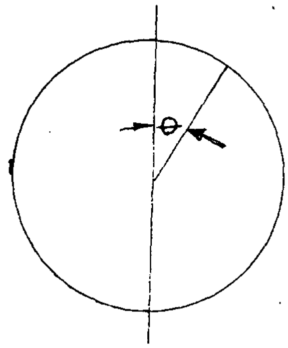
$$F_c = 20{,}000 \text{ PSI}$$

$$\frac{b}{t} = \frac{.85}{.063} = 13.5$$

$$F_c = 23{,}500 \text{ PSI}$$

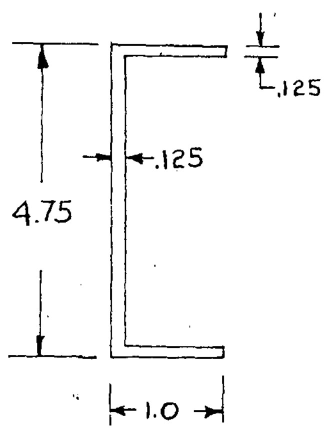
$$\text{Crippling M.S.} = \frac{20{,}000}{12918} - 1 = \underline{\underline{+.55}}$$

Frame at FS 42



θ	M	Tension	Shear
0°	3130	124	130
110°	21,168	849	538
190°	9600	1154	200
250°	21,168	826	1122

Does not Include Existing Axial Load



$$I = \frac{1(4.75)^3}{12} - \frac{.875(4.5)^3}{12}$$
$$= 8.95 - 6.65$$
$$= 2.3 \text{ in.}^4$$
$$A = .815 \text{ in}^2$$

$$f_b = \frac{21,168(2.375)}{2.3} = 21,800 \text{ PSI}$$
$$f_t = \frac{849}{.815} = -1040 \text{PSI}$$
$$f_s = 538/.815 = 660 \text{PSI}$$ Small enough to neglect
$$f_{b\ total} = 20,760 \text{PSI}$$
$$b/t = \frac{.875}{.125} = 7$$

Crippling $F_c = 37,600\text{PSI}$ $\quad$ $M.S. = \frac{37,600}{20,760} - 1 = \underline{\underline{+.81}}$

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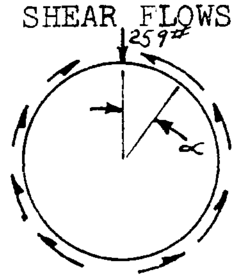
1.



α	SIN α	2P	πR	2P Sin α	$q = \frac{2P \sin\alpha}{\pi R}$
0	0	518	110	0	0
10	.174	↓	↓	90	.819
20	.342			177	1.61
30	.50			259	2.36
40	.643			333	3.02
50	.766			397	3.61
60	.866			449	4.08
70	.939			486	4.42
80	.985			510	4.63
90	.999			517	4.71
100	.985			510	4.63
110	.939			486	4.42
120	.866			449	4.08
130	.766			397	3.61
140	.643			333	3.02
150	.5			259	2.36
160	.342			177	1.61
170	.174			90	.819
180	0	↓	↓	0	0

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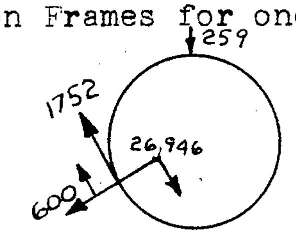
Loads and Moments on Frames for one POD Installed.



θ					Σ
0	+2300	+1155	+2220	-2960	+2715
20	+ 850	0	+3160	-2960	+1050
40	- 300	-1365	+2220	+2020	+1465
60	- 850	-1575	+ 760	- 808	-2473
80	- 850	-1575	- 760	+ 808	-2290
100	- 725	-1365	-2220	+2020	-2290
110	- 550	- 775	-2750	+2400	-1675
120	- 280	0	-3160	+2960	- 480
140	+ 400	+1155	-2220	+2960	+1555
160	+ 725	+1512	- 633	+1750	+3354
180	+ 750	+1890	+1460	0	+4100
200	+ 725	+1365	+4750	-3500	+3340
220	+ 400	- 430	+4050	-6860	-2840
240	- 280	-3360	+2030	-11,300	-12,910
250	- 550	-5020	0	-13,473 -13,473	-19,043 +7903
260	- 725	-3360	-2030	+11,300	+5185
280	- 850	- 430	-4050	+6860	+1530
300	- 850	+1365	-4750	+3500	- 735
320	- 300	+1890	-1460	0	+ 130
340	+ 850	+1512	+ 633	-1750	+1245
360	+2300	+1155	+2220	-2960	+2715

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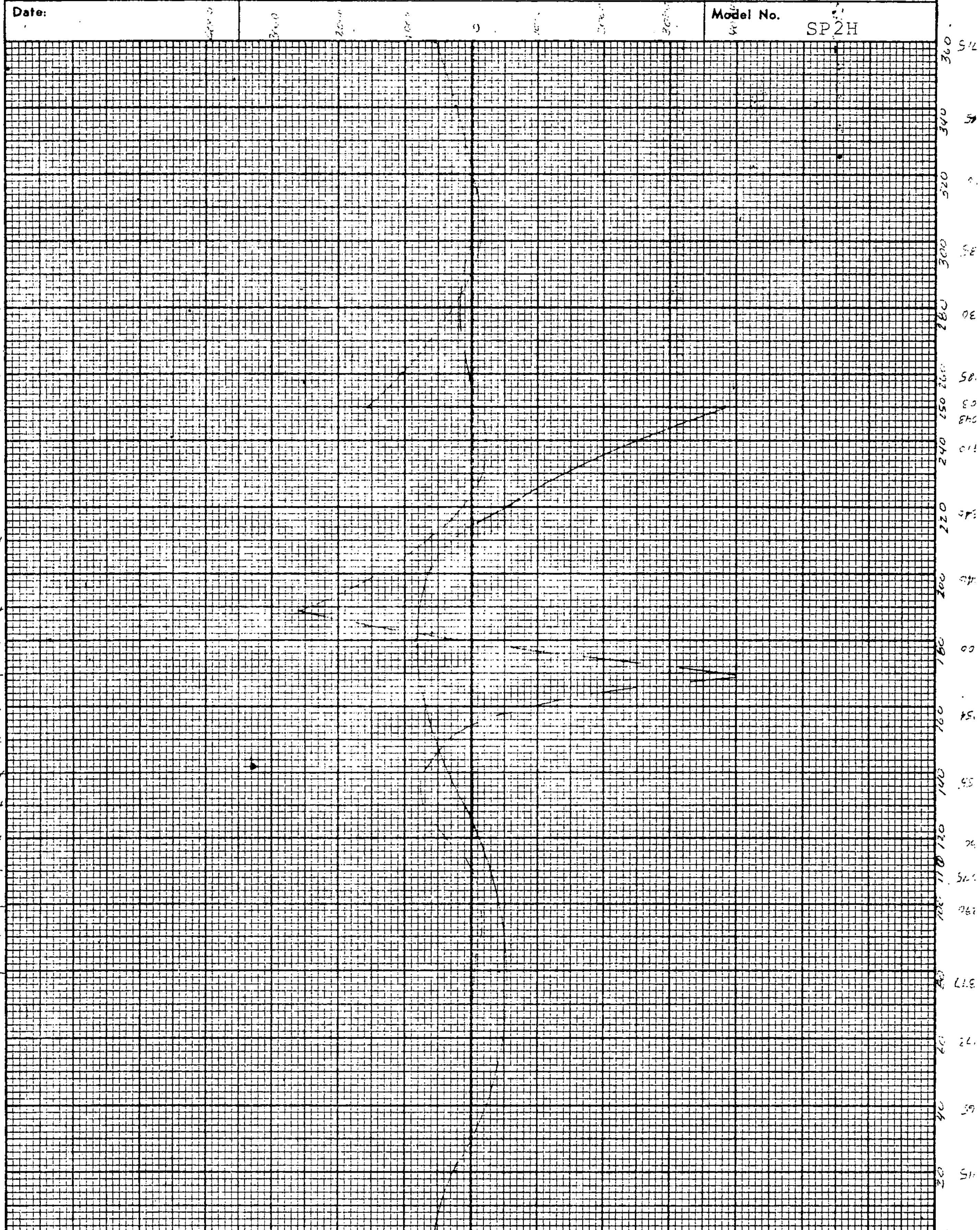
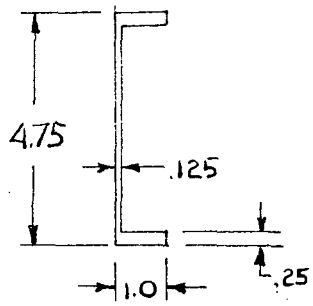


Max. Section - Both Pods Installed

$M = 21,168$ in - lbs

$P_T = 849^{\#}$

$P_S = 538^{\#}$



$$I = \frac{1(4.75)^3}{12} - \frac{-875(4.25)^3}{12}$$

$$= 3.36 \text{ in.}^4$$

$$A = .814 \text{ in.}^2$$

$$f_b = \frac{21,168(2.375)}{3.36} = 15,360\text{PSI}$$

$$f_T = 849/.814 = 1042\text{PSI}$$

$$f_S = 538/.814 = 661 \text{ PSI (Neglect)}$$

$$f_{total} = 15,360 - 1042$$

$$= 14,318 \text{ PSI}$$

$$\frac{b}{t} = \frac{.875}{25} = 3.5$$

$$F_c = 43,250\text{PSI}$$

$$\text{Crippling M.S.} = \frac{43,250}{14,318} = \underline{\underline{+ 2.01}}$$

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One Pod Installed

$M = 19243$

$P_T = 958$

$P_S = 963$

$$f_b = \frac{19,243(2.375)}{3.36} = 13,560 \text{ PSI}$$

$f_T = 958/.814 = 1178$ PSI

$F_{tot} = 12,382$

$F_c = 43,250$

$$\text{Crippling M.S.} = \frac{43250}{12382} - 1 = +2.5$$

No.	A	Y	AY	AY^2	I_0
①	.030	.02	.0006	.0000	
②	.078	.145	.0113	.0016	
③	.043	.625	.0268	.0167	.031
④	.0184	.25	.0046	.0016	
⑤	.1680	4.6	.7740	3.5600	.246
⑥	.0352	6.26	.2200	1.375	.0227
⑦	.0336	6.68	.2240	1.495	
	.4062		1.2613	6.4499	.2997

$\bar{Y} = \frac{1.2613}{.4062} = 3.1$

$I = 6.4499 + .2997 - .4062(3.1)^2$

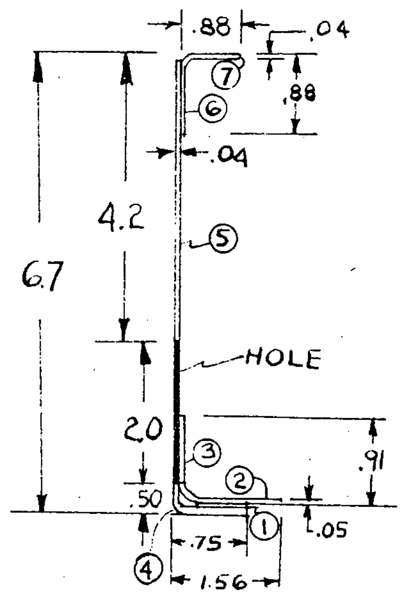
$= 2.85$

$M = 7450$

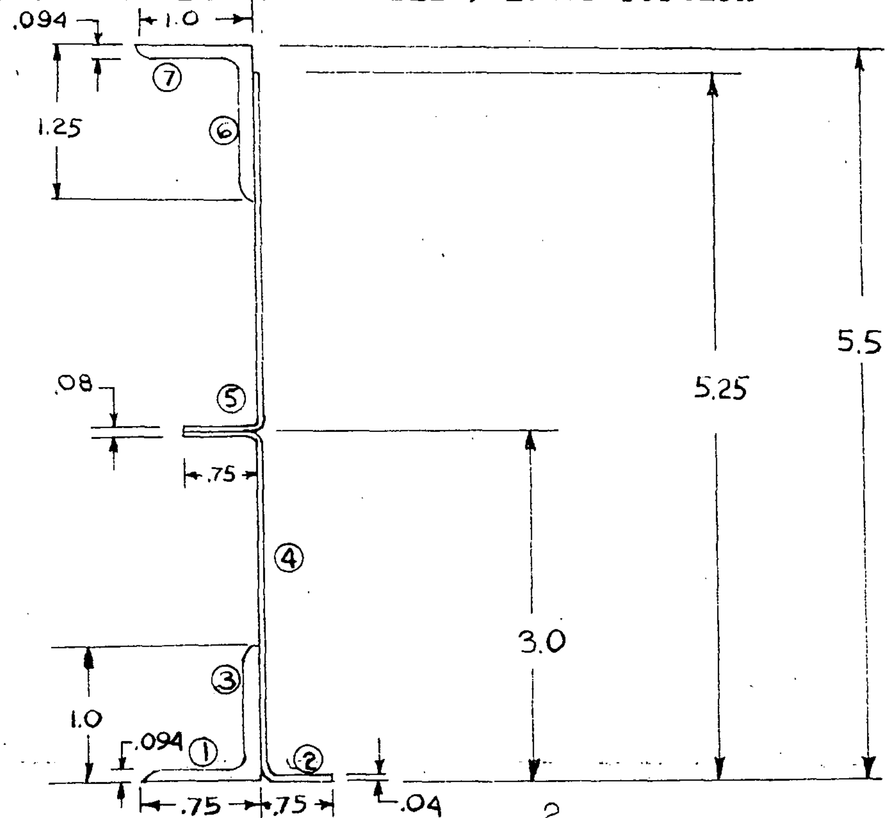
$fb = \frac{7450\ (3.1)}{2.85} = 8100$ PSI

$b/t = .88/.04 = 22$

$F_c = 17{,}000$ PSI



Frame, FS42, Moment of Inertia at BL10, Lower Portion



No.	A	Y	AY	AY^2	I_0
①	.0705	.047	.0033	.0002	
②	.0300	.02	.0006	.0000	
③	.0850	.50	.0425	.0213	.00078
④	.2100	2.63	.5520	1.4600	.5520
⑤	.0600	3.0	.1800	.5400	
⑥	.1176	4.625	.5540	2.5600	.0153
⑦	.0850	5.453	.4620	2.5200	
	.6581		1.7944	7.1015	.5751

$$\bar{Y} = \frac{1.7944}{.6581} = 2.72''$$

$$I = 7.1015 + .5751 - .6581\,(2.72)^2$$

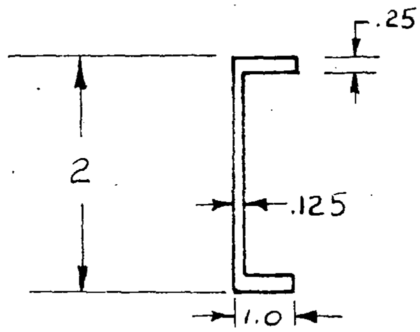
$$= 2.82 \text{ in.}^4$$

$$\frac{b}{t} = \frac{.1.0}{.094} = 10.6$$

F_c = 28,500PSI

E-56602-11

At 130°, M= 5850, Section as below



$$I = \frac{1(2)^3}{12} - \frac{.875(1.5)^3}{12}$$

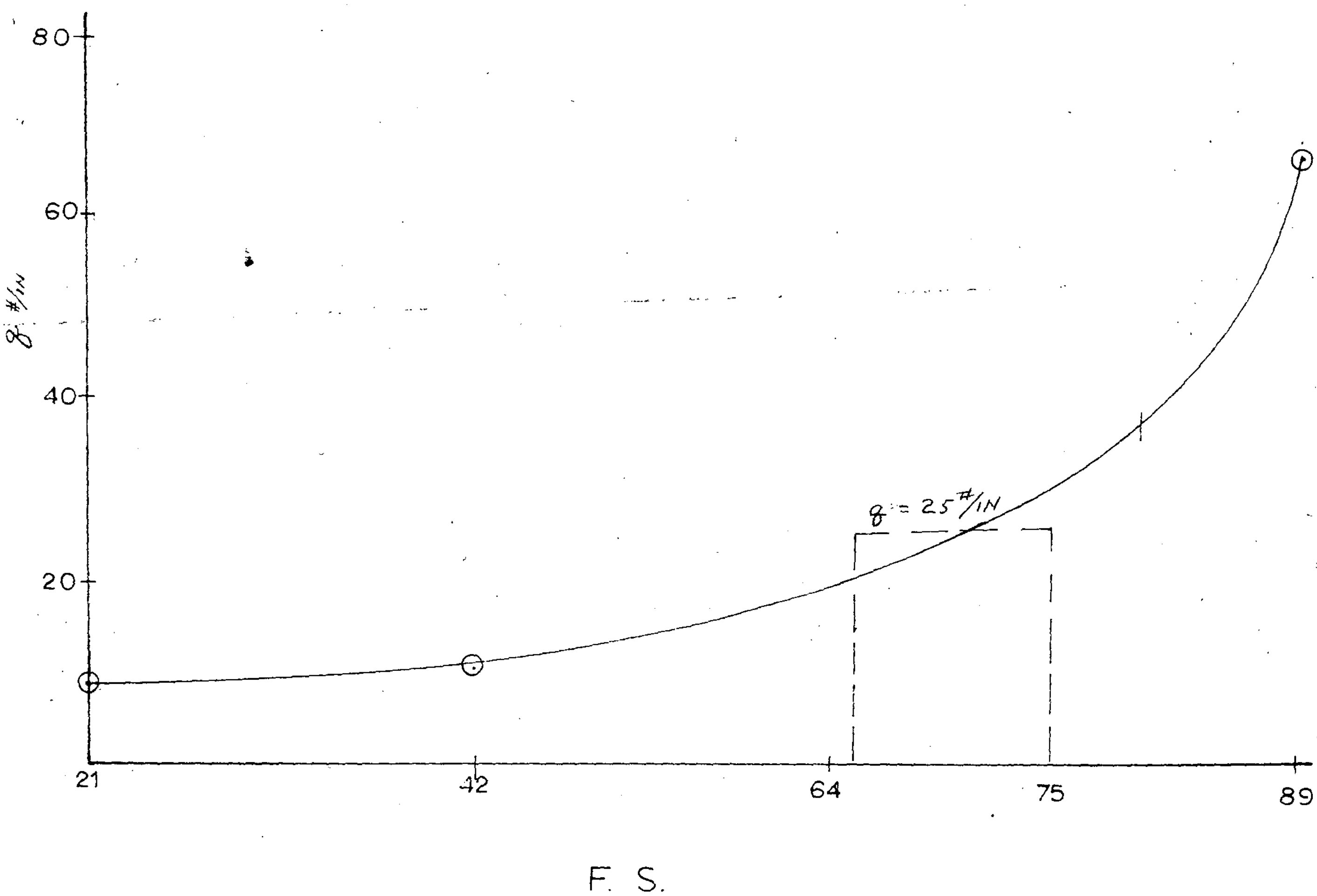
$$= .666 + .246$$

$$= .42 \text{ in.}^4$$

$$f_b = \frac{5850\ (1.0)}{.42} = 13,900 \text{ PSI}$$

3" Dia. Hole Cutout between WL 131.43 and WL 124 and between STA 64 and 75.

STA	q
89	66.57 #/in
21	8.4 #/in.
42.7	10 #/in.



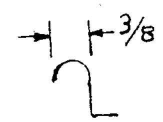
Hole Cutout

Panel Size : 7.5" x 11

Area of Stringers at WL131 and 124

= .0632 IN^2

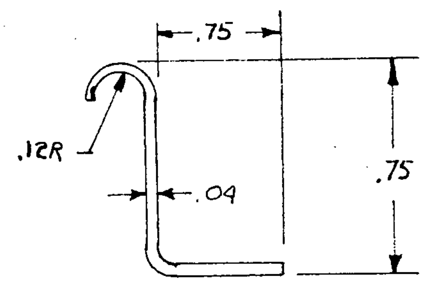
Skin is .032", 2024 - T4



Skin Area = 7.5 (.032) = .24

$$\frac{\text{Stiff. Area}}{\text{Web Area}} = \frac{.0032}{.24} = .263$$

LOW < 3



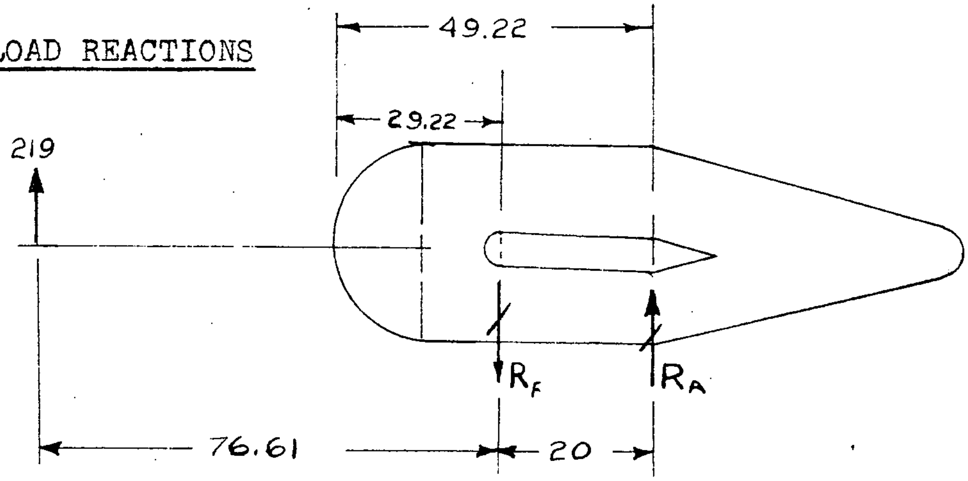
K = .83

q = 600 (.83) = 496 #/in.

BENDING OF POD

The pod max. moment is determined and is analyzed for cover-all flexure and for local buckling.

AIRLOAD REACTIONS



$$R_F = \frac{218.62(96.61)}{20} = 1058^{\#}$$

$$R_A = 1055-218.62 = 839$$

BENDING OF POD DUE TO AIRLOADS

M_{Max} = 7860 in - lbs

$I_{yy} = 3.14\ r^3 t$

$= 3.14\ (15.05)^3 (.05)$

$= 536\ \text{In.}^4$

Alloy - 2024-T3 AL.

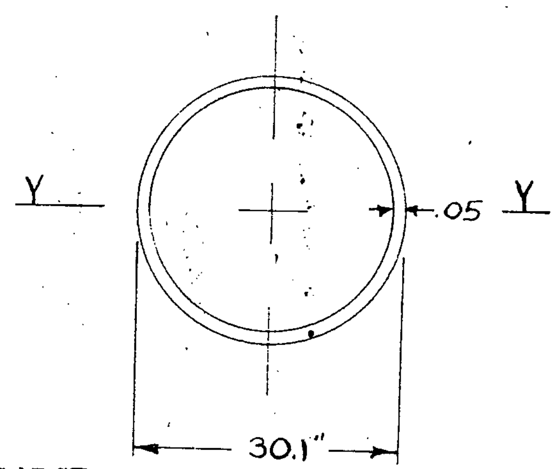
C = 15.05

I/C = 536/15.05 = 35.6

Over-all Flexure

$$fb = \frac{M}{I/c} = \frac{7860}{35.6} = 221\ \text{PSI}$$

F_{tu} = 60,000PSI



Bending MS = LARGE

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BENDING OF POD DUE TO AIRLOADS (Cont)

BUCKLING

$r/t = 15.05/.05 = 301$

$\frac{L}{t} = \frac{10}{.05} = 200$

$(\frac{b}{t})_c = 34$

$\frac{F_{CR}}{E_c} = .00088$

$F_{CR} = .00088(.0.5 \times 10^6)$

$= 9230 PSI$ (Critical Buckling Stress)

Determine moment that will give this stress.

$f = M/I/_C$

$M = f(I/_C)$

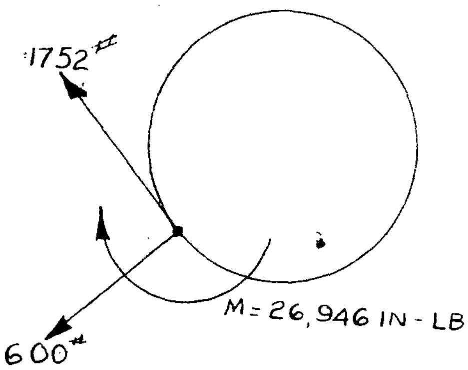
$= 9230\ (35.6)$

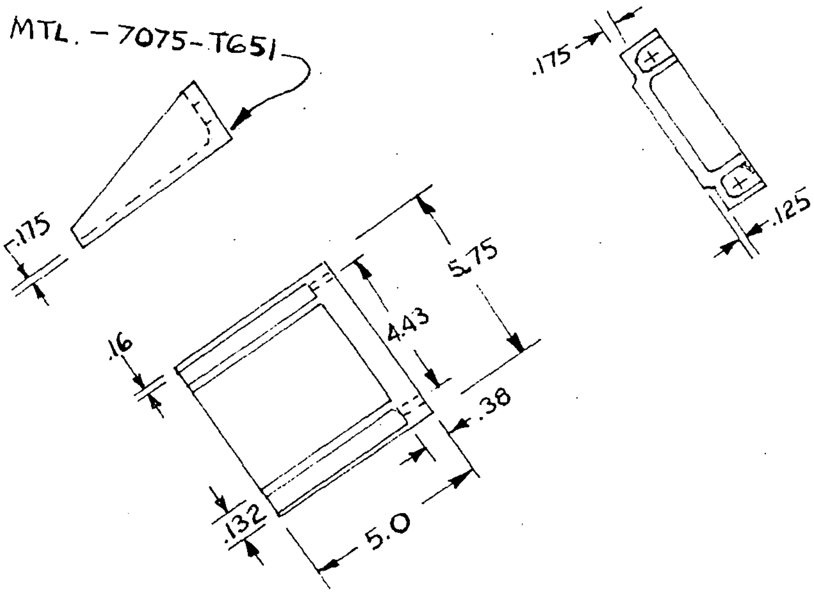
$= 324,000$ in - lbs

The actual moment is only 7860 in - lbs, therefore the pod is stable against buckling.

ANALYSIS OF PYLON FITTINGS

The pylon fittings are designed for the loads shown below.



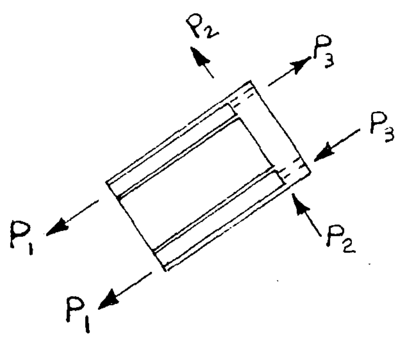


LOADS

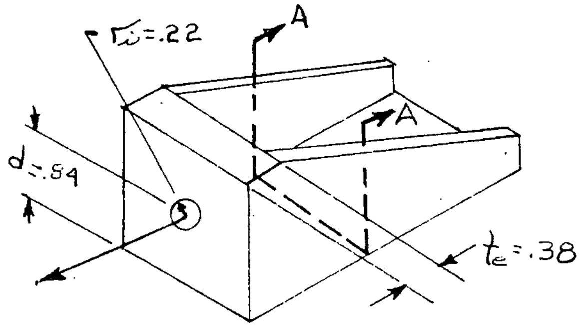
$P_1 = 600/2 = 300\#$

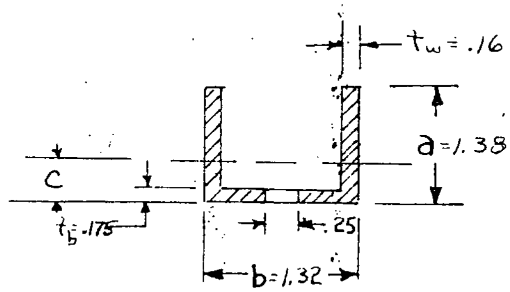
$P_2 = 1752/2 = 876\#$

$P_3 = 26,946/4.43 = 6080\#$



Half of the Ftg. will be analyzed as a tension type Ftg.





Sec. A-A

A. Wall Analysis

1. Tension in Wall

$$Ag = 2at_w + bt_b$$

$$= 2(1.38)(.16) + 1.32(.175)$$

$$= .465 \text{ In.}^2$$

$$f_{tw} = P_u/A_g = 5780/.465 = 12{,}400 \text{PSI}$$

F_{tu} = 77,000 PSI   Wall tension M.S. = $\frac{77000}{12400} - 1$ = LARGE

2. Bending in Wall

Compute C for Sec. A-A

$$C = \frac{\frac{t_b^2}{2}(b - \frac{t_w}{2}) + at_w(a + t_b)}{2at_w + bt_b} = \frac{\frac{(.175)^2}{2}(1.32 - \frac{.16}{2}) + 1.38(.16)(1.38 + .175)}{2(1.38)(.16) + 1.32(.175)}$$

$$= .768 \text{ in.}^2$$

$$M_u = P_u(d - c) = 5780(.84 - .768) = 416 \text{ In - lbs.}$$

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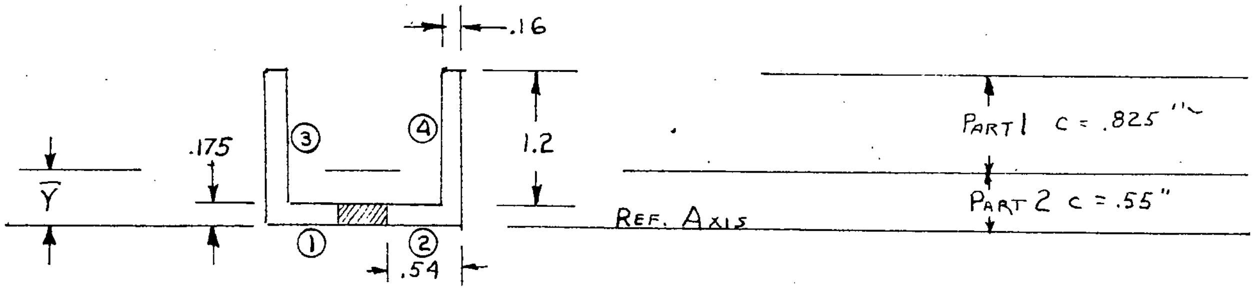
A. Wall Analysis

2. Bending In Wall (cont)



No.	A	Y	AY	AY^2
①	.0945	.0875	.0084	
②	.0945	.0875	.0084	
③	.1920	.775	.1490	
④	.1920	.775	.1490	
	.5730		.3148	

$\bar{Y}$ = .3148/.5730 = .55 In. C = .825"

For each part, compute Qm, I, and I/C, then K = Qm/Ic

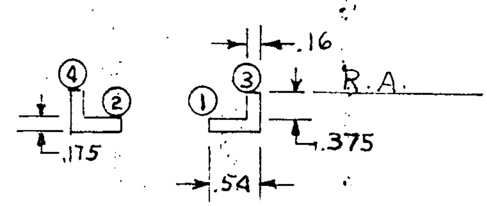
Part 1

$$I = 2\,\frac{(.16(.825)^3)}{3} = .0598 \text{ In.}^4$$

$$I/C = \frac{.0598}{.825} = .0725 \text{ in.}^3$$

$$Qm = 2(.132)(.413) = .109 \text{ in.}^3$$

$$K = \frac{.109}{.0725} = 1.5$$



Part 2

No.	A	Y	AY	AY^2	I_0
①	.0945	.4625	.0438	.0202	
③	.0600	.1875	.0113	.0021	
	.1545				

2. Bending In Wall (cont)

Part 2

$$I_{tot} = 2(.02311) = .04622 \text{ In.}^4$$

$$\frac{I}{C} = \frac{.04622}{.55} = .084$$

$$Qm = .0551(2) = .1102$$

$$K = \frac{.1102}{.084} = 1.31$$

$$F_{tu} = 77,000 \text{ PSI} \qquad \frac{Mc}{I} = 110,000 \text{ PSI}$$

$$K = 1.5$$

$$C_s = \frac{.55}{.825}(.06) = .04$$

$$F = 77,000 \text{ PSI}$$

$$\frac{Mc}{I} = 98,000 \text{PSI}$$

$$M_u = 110,000\ (.0725) + 98000\ (.084)$$

$$= 16,227 \text{ in - lbs.}$$

$$M_u = 416 \text{ in - lbs (P.2)}$$

$$\text{Wall bending M.S} = \frac{16,227}{416} - 1 = \underline{\underline{\text{LARGE}}}$$

B. END PAD ANALYSIS

$$\frac{i}{a} = \frac{.22}{1.38} = .159$$

$$\frac{b}{a} = \frac{1.32}{1.38} = .955$$

$$K_3 = .765$$

$$f_{bue} = \frac{Pu(2d-tb)K_3}{te^2a} = \frac{5780(2X\ .84 - .175)\ (.765)}{(.38)^2\ (1.38)}$$

B. End Pad Analysis (Cont)

$$= 33{,}500 PSI$$

K = 1.5

$$\frac{Mc}{I} = 115{,}000 PSI \qquad \text{Bending M.S.} = \frac{11500}{33{,}500} - 1 = \underline{\underline{+2.44}}$$

PREPARED BY	LTV ELECTROSYSTEMS, INC.	PAGE NO. 3.3.61
CHECKED BY		REPORT NO. G8432.01.06
DATE		MODEL NO. SP2H

PYLON FTG. BOLTS

The Pylon FTG. bolts are MS20007 (7/16" Dia.) 160 KSI.

ALLOWABLE LOADS

Shear - 17,780#

Tension - 19,500#

ACTUAL LOADS

Shear - 876#

Tension - 6380#

BOLTS ARE NOT CRITICAL

E -56602-11

"A" SCANNER INSTL.
(REF. DWG. 8432-02500)

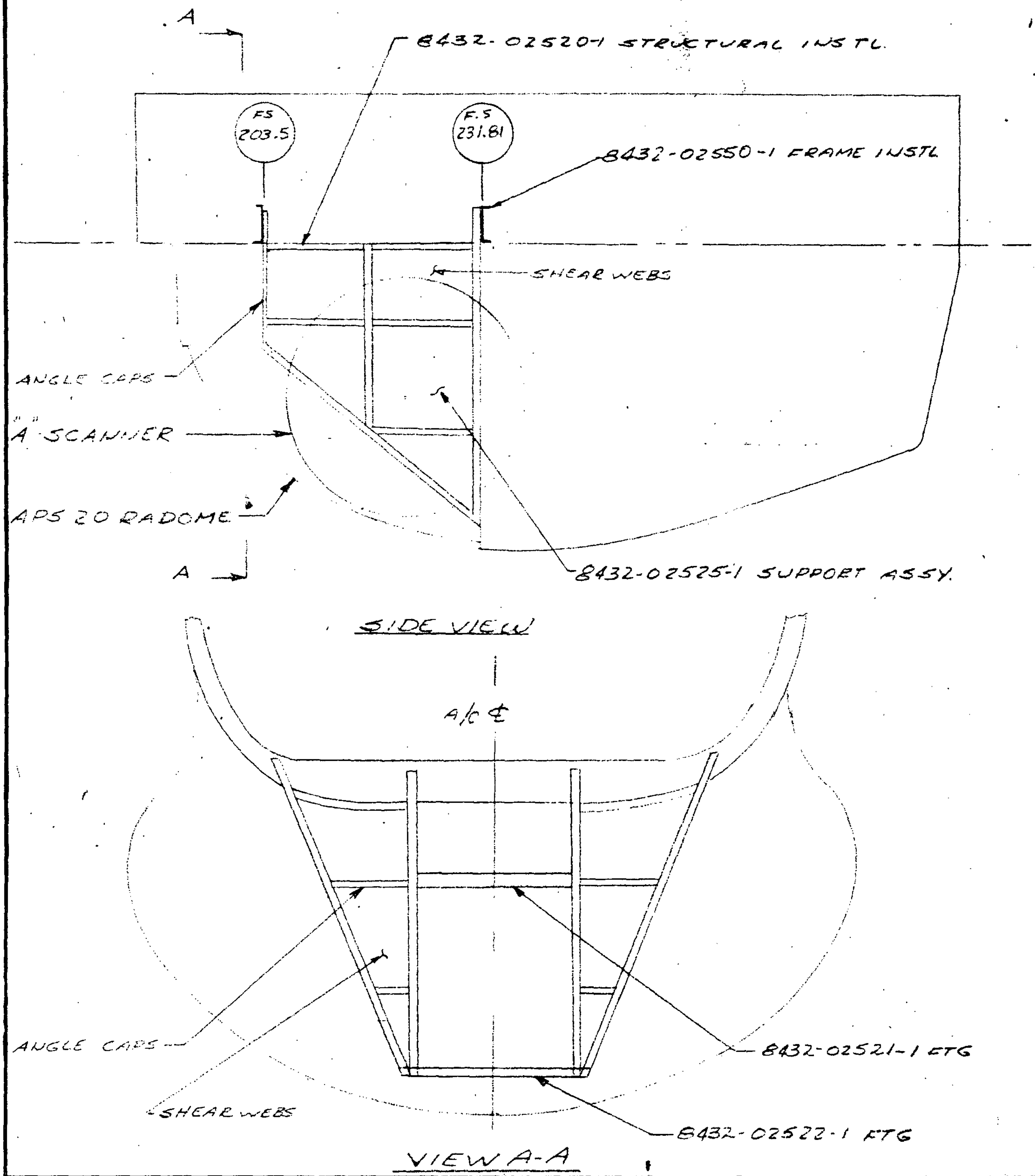
THIS SECTION WILL BE DIVIDED INTO TWO PARTS.

PART I WILL COVER THE SCANNER INSTL

PART II WILL COVER THE APS-20B RADOME MODIFICATION.

PREPARED BY R. BAIS	LTV ELECTROSYSTEMS, INC P. O. BOX 1056 - GREENVILLE, TEXAS 75402	PAGE NO. 3.4.2
CHECKED BY		REPORT NO. G8432.01.06
DATE 8-25-66	"A" SCANNER SUPPORT STRUCTURE	MODEL NO. SP-2H

GENERAL CONFIGURATION OF SCANNER SUPPORT STRUCTURE



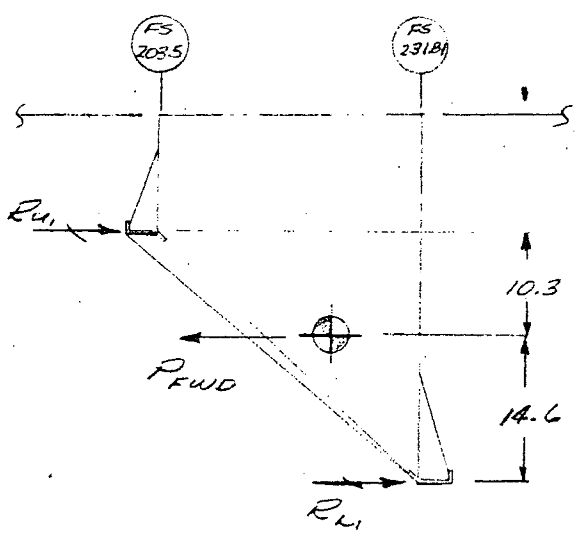
INERTIA LOADS

THE FWD LOADING FACTOR IS 3.0 G'S

THE DOWN LOADING FACTOR IS 4.5 G'S

A) FWD INERTIA LOADS

THE FWD INERTIA LOADS ARE REACTED BY THE 8432-1-02521 & 02522 FITTINGS



THE "A" SCANNER WEIGHS 150#

$P_{FWD} = 150(3) = 450^{\#}$

$R_U = 264^{\#}$

$R_L = 186^{\#}$

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AIRLOADS (CONT)

A). DRAG LOADS

$C_D = .308$

FWD. PROJECTED AREA FOR DRAG CALCULATIONS:

$A = 23.44\,(27.48) = 645\ IN.^2$

$q_{ULT} = 4.34\ PSI$

$P_{DRAG} = 4.34\,(645)(.308)$

$= 860^{\#}$ THIS LOAD ACTS 6" BELOW THE SCANNER C.G.

B) DOWN LOADS

DOWNWARD PROJECTED AREA $= 23.44\,(40.5) = 953\ IN.^2$

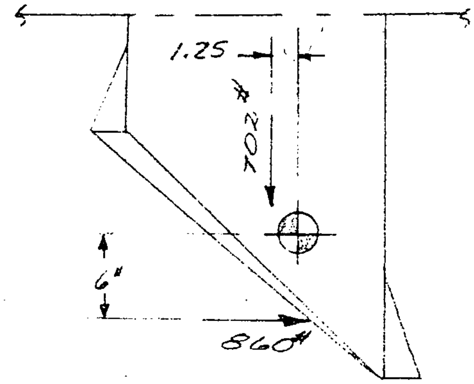
$C_D = .17$

$q_{ULT} = 4.34\ PSI$

$P_{DOWN} = 4.34\,(953)(.17)$

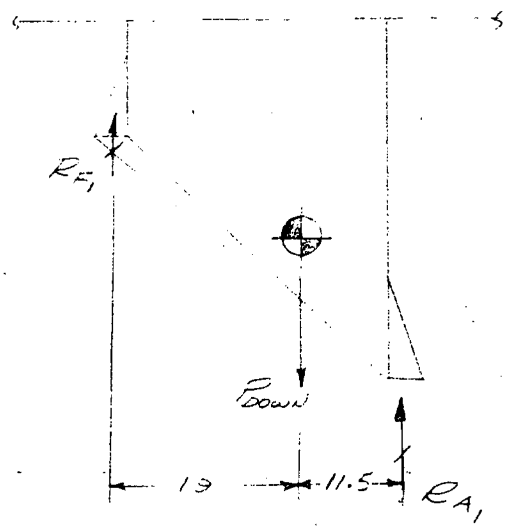
$= 702^{\#}$ AND ACTS 1.25" FWD OF THE SCANNER C.G.

SUMMARY OF AIRLOADS



INERTIA LOADS (CONT)

B. DOWN LOADS



$P_{DOWN} = 4.5(150) = 675^{\#}$

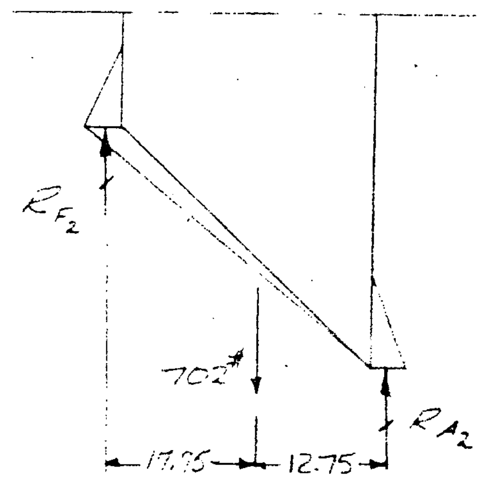
$R_{F_1} = 255^{\#}$

$R_{A_1} = 420^{\#}$

AIRLOADS

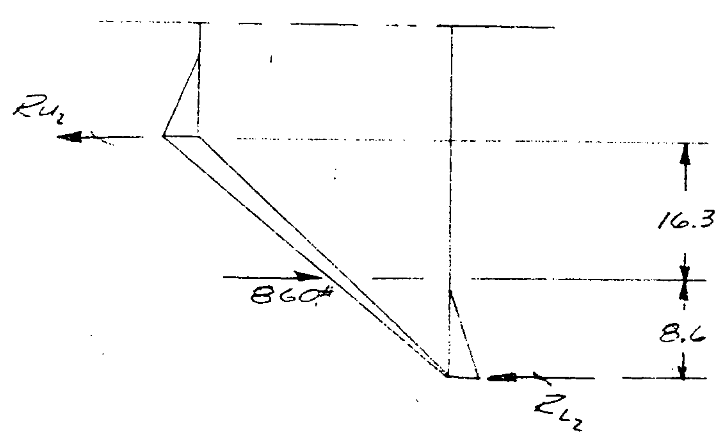
DUE TO THE FWD RECTANGULAR CUTOUT IN THE APS 20 RADOME, THE SCANNER SUPPORT STRUCTURE IS SUBJECTED TO AIRLOADS WHICH COMBINE WITH THE DOWN LOADING CONDITION. THESE AIRLOADS ARE TRANSFERRED THROUGH THE VENDOR FURNISHED SCANNER TO THE 8432-02521 & 02522 FITTINGS WHERE THEY ARE REACTED.

LOADS ON FITTINGS DUE TO DOWN AIRLOAD



R_{A_2} = 408# ; R_{F_2} = 294#

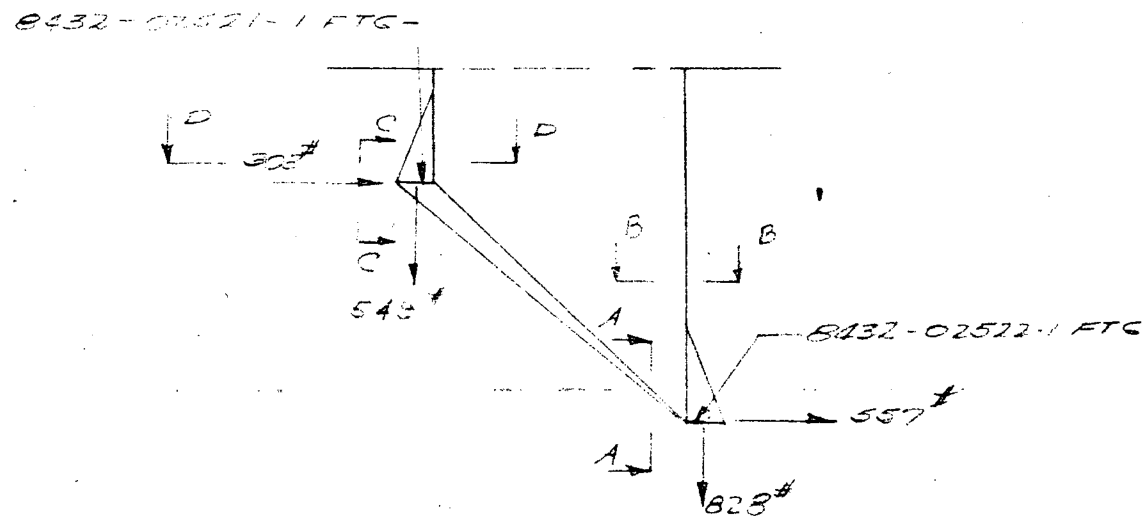
LOADS ON FITTINGS DUE TO AFT LOAD



R_{U_2}: 303# ; R_{L_2}: 557#

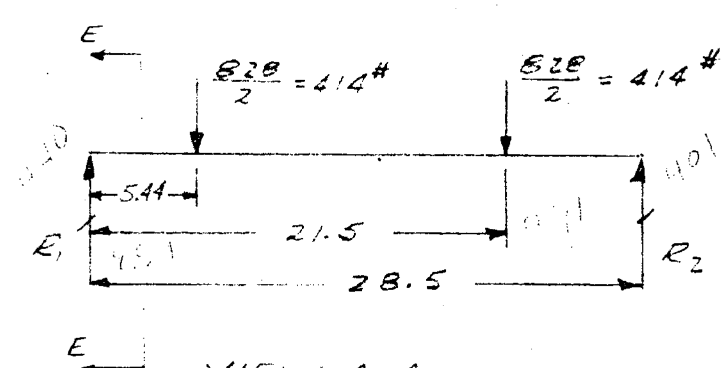
DESIGN LOADS FOR SCANNER SUPPORT STRUCTURE

THE SCANNER DESIGN LOADS ARE THE DOWN INERTIA LOADS & THE AIRLOADS COMBINED.



LOAD DISTRIBUTION AT 8432-02522-1 FTG

A) VERTICAL LOADS



VIEW A-A

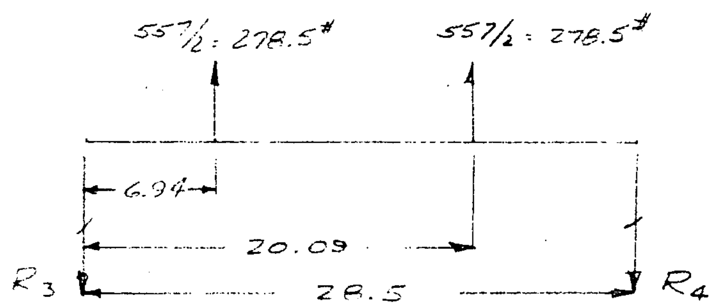
$R_1 = 436^{\#}$

$R_2 = 392^{\#}$

$M_{max} = 3780$

LOAD DISTRIBUTION AT 8432-02522-1 FTG (CONT)

B. HORIZONTAL LOADS



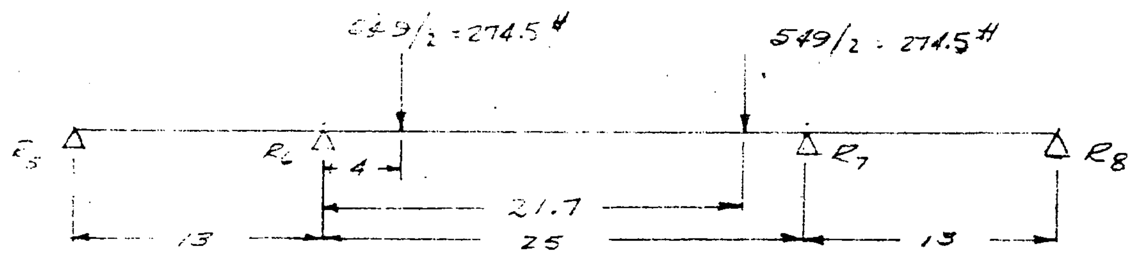
VIEW B-B (ROTATED 90° CCW) REF. P.

R_3 = 293#

R_4 = 264# M_{MAX} = 2630 in#

LOAD DISTRIBUTION AT 8432-02521-1 FTG.

C. VERTICAL LOADS



VIEW C-C (PAGE)

FIXED-END MOMENT CALCULATIONS FOR MIDDLE SPAN

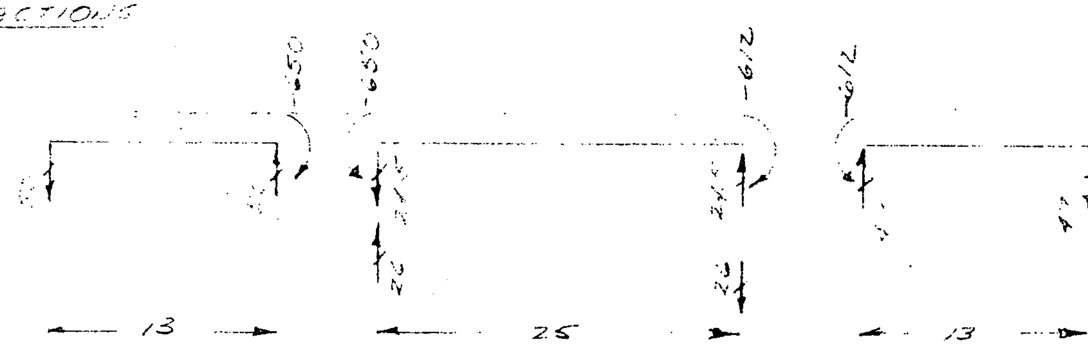
$$FEM_{R_6} = \frac{-274.5(4)(21)^2}{(25)^2} - \frac{274.5(21.7)(3.3)^2}{(25)^2} = -880 \text{ IN-LBS}$$

$$FEM_{R_7} = \frac{-274.5(21)(4)^2}{(25)^2} - \frac{274.5(3.3)(21.7)^2}{(25)^2} = -832 \text{ IN-LBS}$$

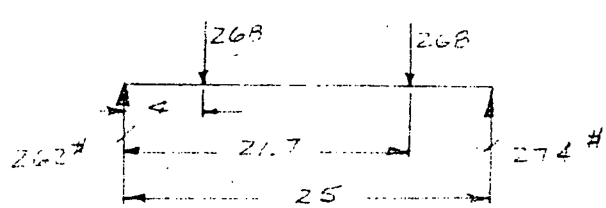
LOAD DISTRIBUTION AT 8432-02521-1 FTG (CONT)

K = I/L	K = 1.92		K = 1		K = 1.92	
D. F.	1	.66	.34	.34	.66	1
FEM	0	0	-880	-832	0	0
1ST DISTRIBUTION	0	-580	-300	+282	-550	0
CARRY OVER	[illegible]	0	-14	-150	0	+275
2ND DISTRIBUTION	-290	[illegible]	[illegible]	+51	-99	-275
CARRY OVER	+4[illegible]	[illegible]	-25	-24	[illegible]	+50
3RD DISTRIBUTION	-46	[illegible]	[illegible]	[illegible]	[illegible]	-50
CARRY OVER	+56	+23	[illegible]	[illegible]	[illegible]	+54
4TH DISTRIBUTION	-56	-23	+17	+35	[illegible]	-54
Σ	[illegible]	-550	-550	-612	-612	0

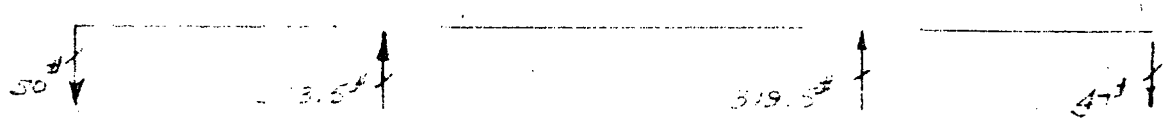
MOMENT REACTIONS



SIMPLE BEAM REACTIONS

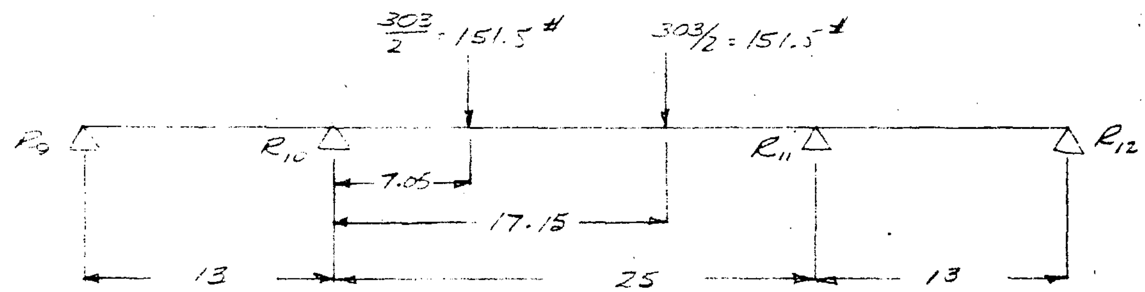


NET REACTIONS



LOAD DISTRIBUTION AT 8432-02521-1 FTG (CONT)

D. HORIZONTAL LOADS



VIEW D-D (P.   ) ROTATED 90° CCW

FIXED-END MOMENT CALCULATIONS FOR MIDDLE SPAN

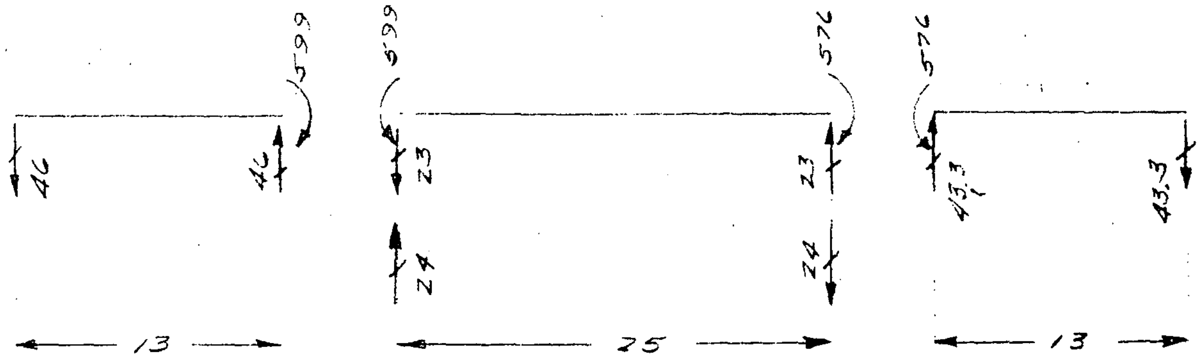
$$FEM_{R10} = \frac{-151.5(7.05)(17.95)^2}{(25)^2} - \frac{151.5(17.15)(7.85)^2}{(25)^2} = -808 \text{ IN-LBS}$$

$$FEM_{R11} = \frac{-151.5(17.95)(7.05)^2}{(25)^2} - \frac{151.5(7.85)(17.15)^2}{(25)^2} = -786 \text{ IN-LBS.}$$

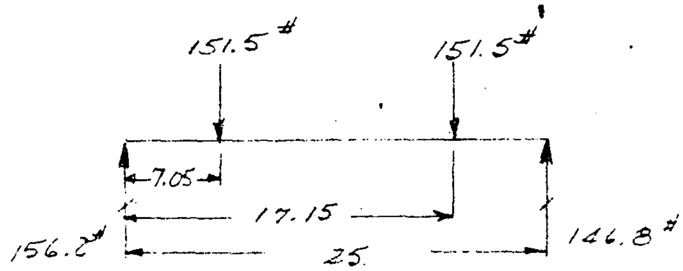
K = I/L	K = 1.92		K = 1.0		K = 1.92	
D. F.	1	.66	.34	.34	.66	1
FEM	0	0	-808	-786	0	0
1ST DISTRIBUTION	0	-531	+277	+266	-520	0
CARRY OVER	+266	0	-133	-138	0	+260
2ND DIST.	-266	-88	+45	+47	-91	-260
CARRY OVER	+44	+133	-24	-23	+130	+46
3RD DIST.	-44	-103	+54	+52	-101	-46
CARRY OVER	+52	+22	-26	-27	+23	+50
4TH DIST.	-52	-32	+16	+33	-17	-50
Σ	0	-599	-599	-576	-576	0

LOAD DISTRIBUTION AT 8432-02521-1 FTG (CONT)

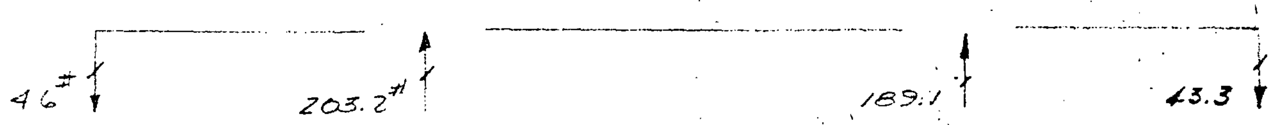
MOMENT REACTIONS



SIMPLE BEAM REACTIONS

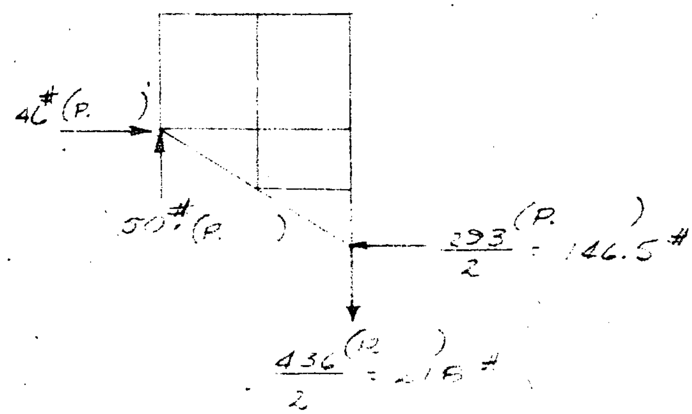


NET REACTIONS

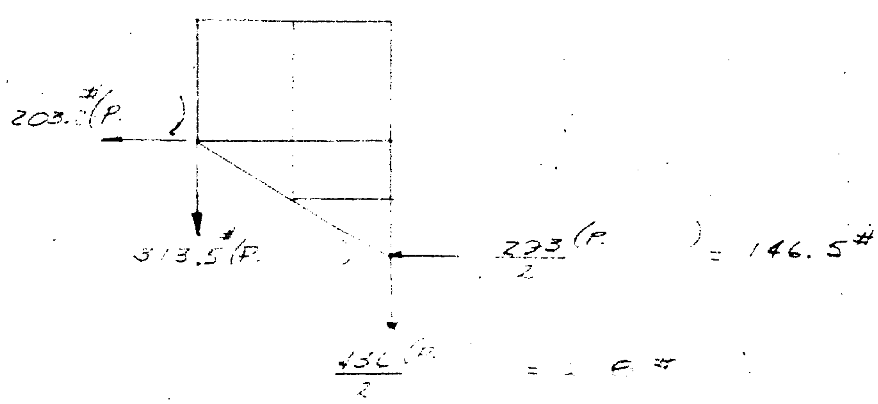


SUMMARY OF LOADS

A. RIGHT OUTBD SIDE

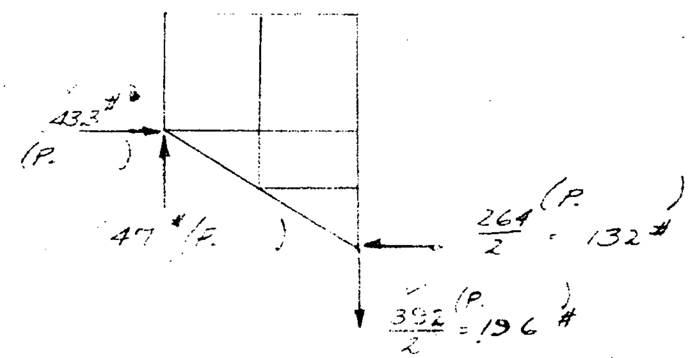


B. RIGHT INBD SIDE

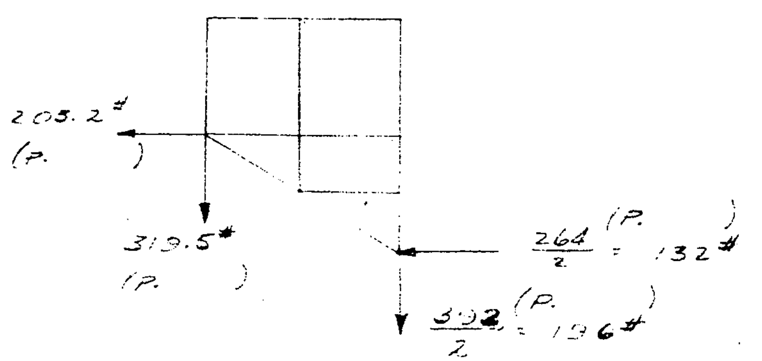


SUMMARY OF LOADS (CONT)

C. LEFT OUTBD SIDE

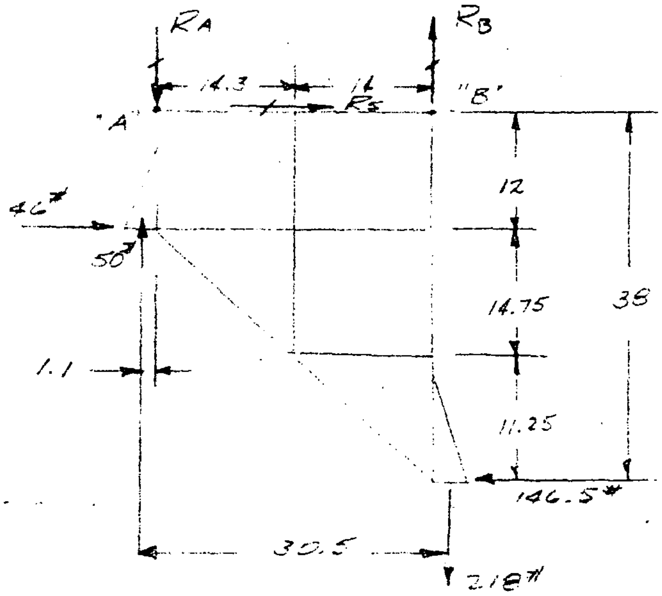


D. LEFT INBD SIDE



STRUCTURE TIE-IN LOADS

A. RIGHT OUTBD SIDE (REF. P. , FOR LOADS)



$\Sigma M_A = -46(12) + 50(1.1) + 218(29.4) + 146.5(38) - 28.3 R_B = 0$

$R_B = 405^{\#} \downarrow$

$\Sigma F_V = +50 - 218 + 405 - R_A = 0$

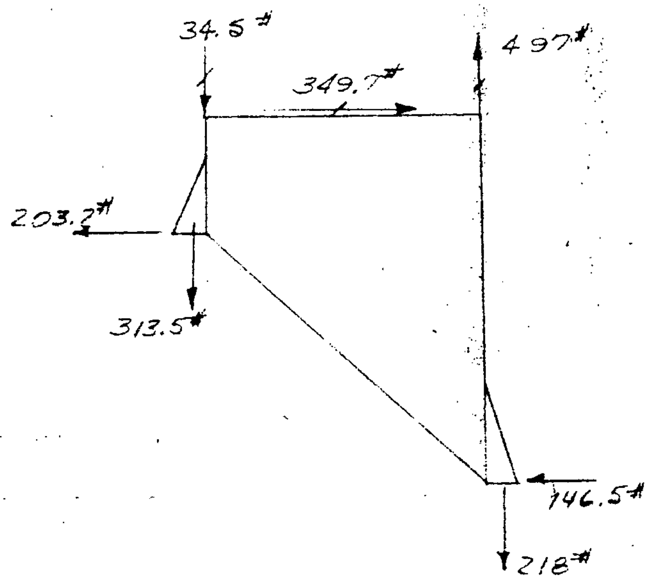
$R_A = 237^{\#} \downarrow$

$\Sigma F_H = -46 + 146.5 - R_S = 0$

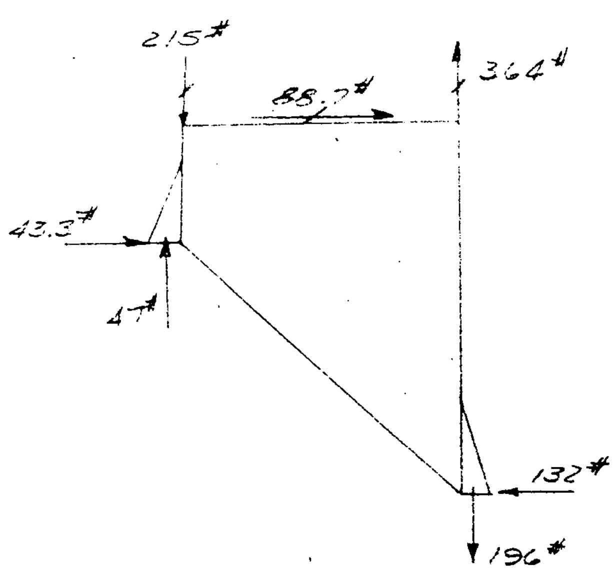
$R_S = 100.5^{\#} \rightarrow$

STRUCTURE TIE-IN LOADS (CONT)

B. RIGHT INBD SIDE (REF. P. FOR LOADS & P. FOR DIMENSIONS)

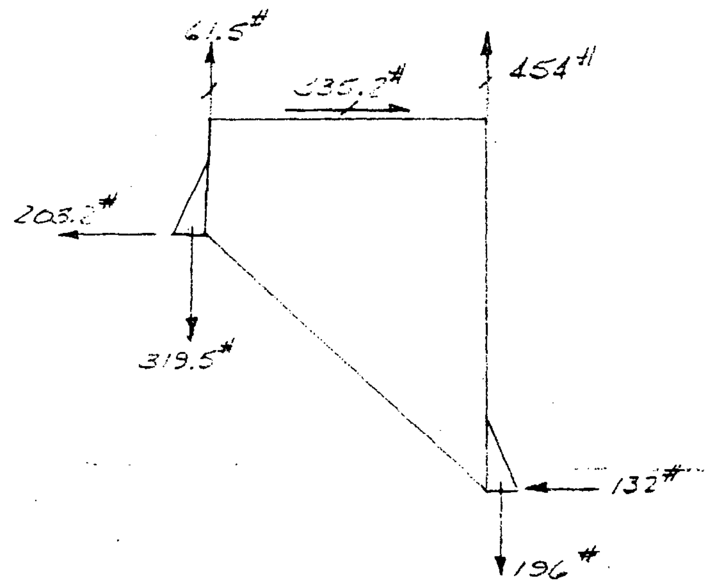


C. LEFT OUTBD SIDE (REF. P FOR LOADS & P FOR DIMENSIONS)



STRUCTURE TIE-IN LOADS (CONT)

D LEFT INBD SIDE (REF P. FOR LOADS & P. FOR DIMENSIONS)



ANALYSIS OF THE 8432-02522-1 FITTING

THIS FITTING HAD THE HIGHEST BENDING MOMENTS.

THE FOLLOWING MOMENTS WERE DERIEVED.

$M_{MAX-VERTICAL}$ = 2744 IN-LBS
$M_{MAX-HORIZONTAL}$ = 2220 IN-LBS
} AT LOAD APPLIED ON LEFT END OF FITTING

THESE WERE THE HIGHEST FITTING MOMENTS, HOWEVER, THE CRITICAL POINT OF THE FITTING WAS 2.3" FROM THE RIGHT END WERE THE SECTION REDUCED CONSIDERABLE IN SIZE. THE MOMENTS AT THIS SECTION WERE:

M_{VERT} = 1005 IN-LBS

$M_{HOR.}$ = 674 IN-LBS

ANALYSIS OF THE 8432-02522-1 FITTING (CONT)

IN ADDITION TO THE BENDING MOMENTS, TORSION IS IMPOSED ON THE FITTING DUE TO THE OFFSET OF THE LOAD PADS

SECTION PROPERTIES

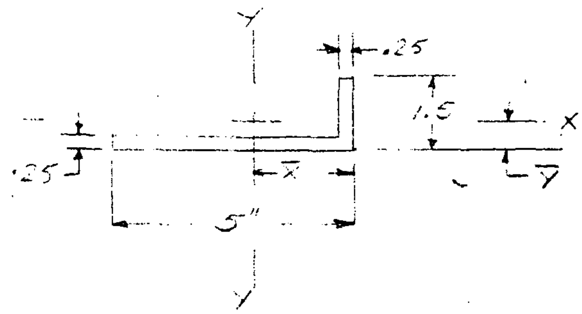
$\bar{Y} = .334$

$I_{xx} = .3312 \text{ IN}^4$

$\bar{X} = 2.02$

$I_{yy} = 4.055 \text{ IN}^4$

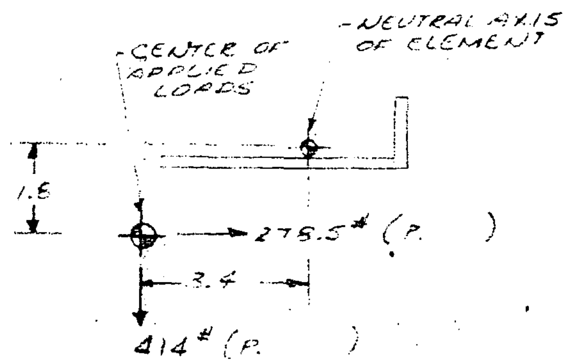
$A = 1.5625 \text{ IN}^2$



TORSION ON FITTING

$T = 278.5(1.6) + 414(3.14)$

$= 1802 \text{ IN-LBS}$



STRESS DUE TO TORSION

$$f_s = \frac{3T}{\Sigma b t^2}$$

$$= \frac{3(1802)}{(5+1.25)(.25)^2}$$

$= 13,880 \text{ PSI}$

$F_{su} = 37,000 \text{ PSI}$

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CHECKED BY		REPORT NO. G8432.01.06
DATE 9-14-66	"A" SCANNER SUPPORT STRUCTURE	MODEL NO. SP-2H

ANALYSIS OF THE 8432-02522-1 FITTING (CONT)

STRESS DUE TO VERTICAL BENDING

$$f_c = \frac{1005(P.\quad)(1.5-.334)}{.3312} = 3540 \text{ PSI}$$

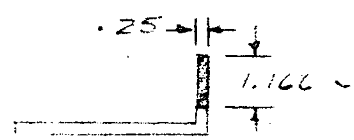
$$f_t = \frac{1005(.334)}{.3312} = 1015 \text{ PSI}$$

STRESS DUE TO HORZONTAL BENDING

$$f_c = \frac{647(2.02)}{4.055}(P.\quad) = 322 \text{ PSI}$$

$$f_t = \frac{647(5-2.02)}{4.055} = 476 \text{ PSI}$$

THE FLANGE SHOWN SHADED BELOW IS CHECKED FOR COMBINED BUCKLING AND TORSION.



f_s = 13,880 PSI (P.   )

F_s = 37,000 PSI (P.   )

$$R_s = \frac{13,880}{37,000} = .375$$

$f_{BENDING}$ = 3540 + 322 = 3862 PSI

K = .4

b/t = 1.166/.25 = 4.66

F_{CR} = 2/3 (37,000) = 24,800 PSI

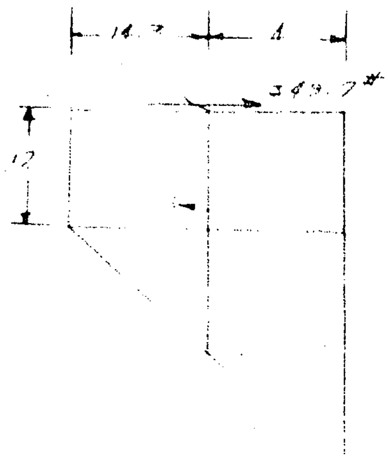
$$R_b = \frac{3862}{24,800} = .156$$

$$\text{COMBINED M.S.} = \frac{1}{.375+.156} - 1 = \underline{+.88}$$

8-56803R1-11

ANALYSIS OF THE R432-02525-5 PANEL

THIS PANEL IS THE RIGHT INBD PANEL AND HAS THE HIGHEST SHEAR FLOW. IT IS CHECKED FOR SHEAR BUCKLING.



-R432-02525-5 PANEL
[illegible] THICK
2024-T3 AL ALLOY

$f_{max} = 34 \ldots$ [illegible] #/in

$\frac{a}{b} = \frac{14.3}{12} = 1.192$

$K = 7.75$

$b/t = 12/.032 = 375$

$F_{CR} = KE\left(\frac{t}{b}\right)^2$

$= 7.75 \times 10.$ [illegible] $\left(\frac{.032}{12}\right)^2$

$= 731$ PSI

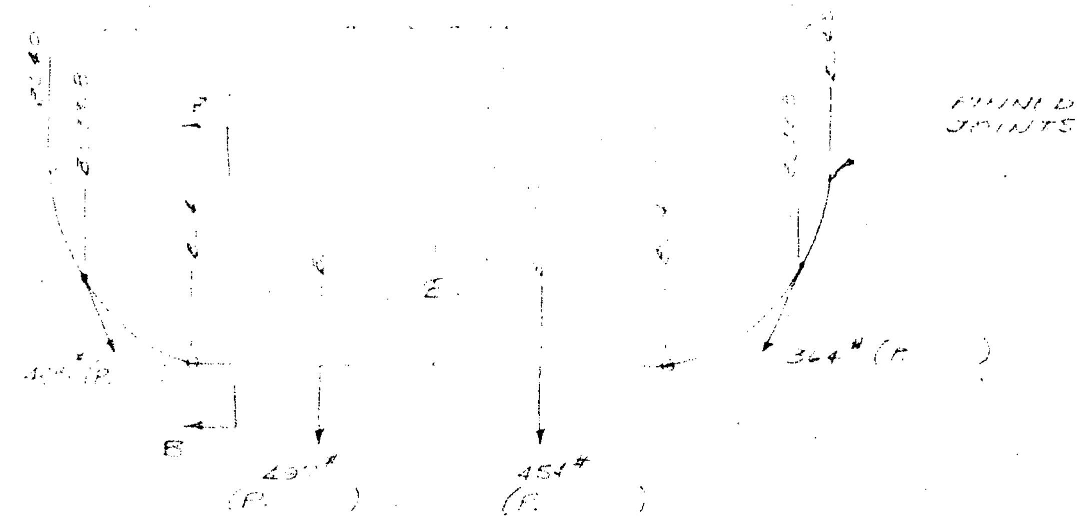
$f_{CR} = 731(.032)$

$= 23.4$ #/in

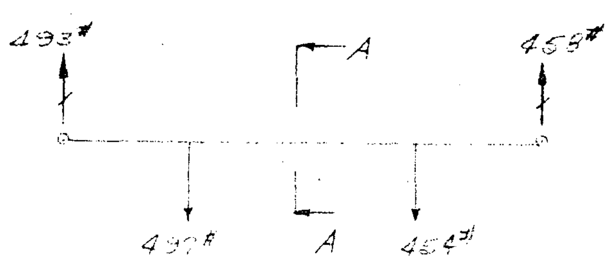
BUCKLING M.S. $= \frac{23.4}{12.3} - 1 = +.91$

ANALYSIS OF THE 8432-02550-1 FRAME

IN ORDER TO REACT VERTICAL LOADS AT THE AFT END OF THE SCANNER, A PARTIAL FRAME WAS INSTALLED AT FS 231.86. THIS FRAME SECTION WAS PATTERNED AFTER THE EXISTING FRAME AT FS 118 EXCEPT THAT IT WAS MADE IN THREE SECTIONS. THE LOADS APPLIED AT LBL 11.50 & RBL 11.50 ARE [illegible] TO EXISTING INTERCOSTALS AT LBL 14 & RBL 14. THE LOADS APPLIED AT BL [illegible] ARE TRANSFERRED INTO THE AIRCRAFT SKIN IN SHEAR [illegible] IN THE FRAME. THE [illegible] BETWEEN RBL 14 & LBL 14 IS CHECKED FOR BENDING.

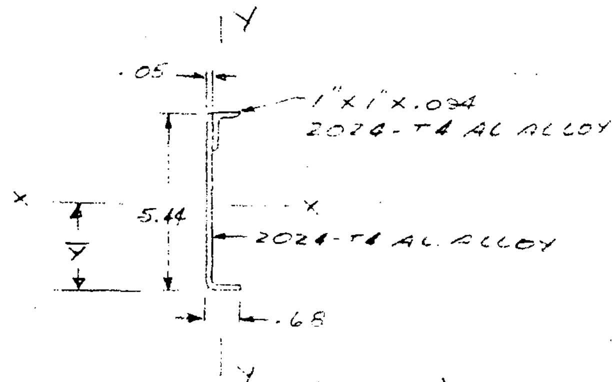


VIEW LOOKING AFT



M_{MAX} = 1190 IN-LBS

ANALYSIS OF THE 8432-02550 FRAME (CONT)



SEC. A-A (P.)

$\bar{Y} = 3.74''$; $C = 1.7$ IN.

$I = 1.128$ IN.^{4}

$M = 1190$ IN-LBS

$$f_{b_c} = \frac{1190(1.7)}{1.128} = 1800 \text{ PSI}$$

THE 1" ANGLE FLANGE IS CHECKED FOR COMPRESSION

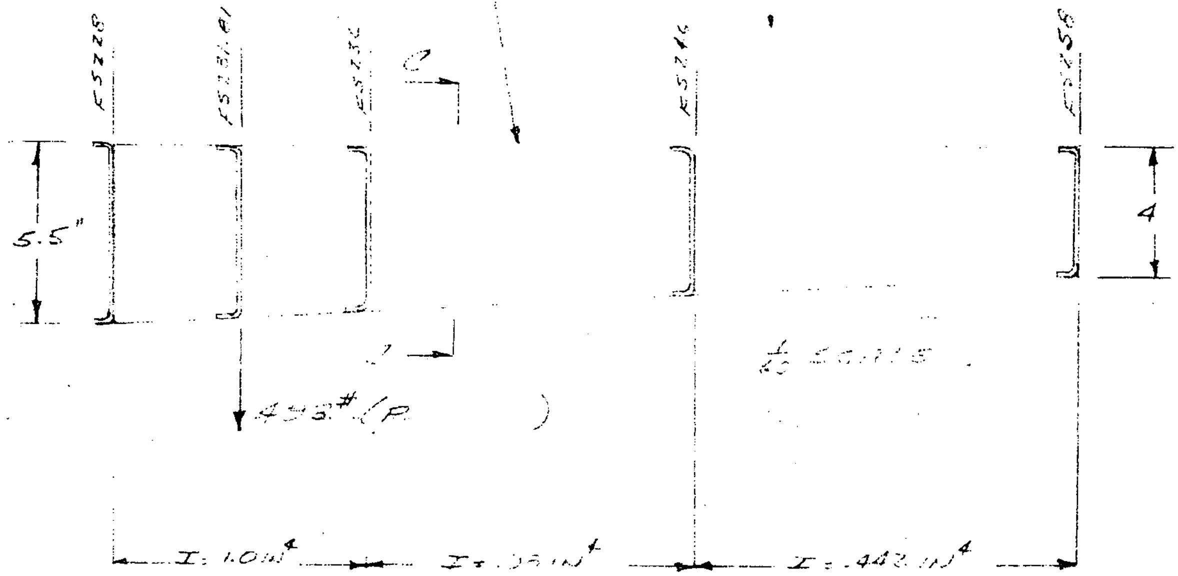
$b/t = 1/.094 = 10.65$

$F_c = 32,000$ PSI

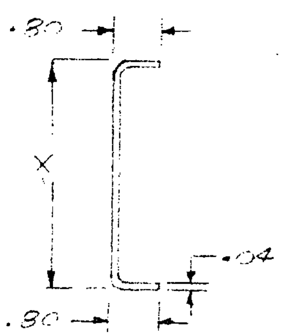
CRIPPLING M.S. $= \frac{32000}{1800} - 1 =$ LARGE

ANALYSIS OF EXISTING INTERCOSTALS

AS STATED ON P. , THE VERTICAL REACTIONS AT BL 14 ARE CARRIED BY EXISTING INTERCOSTALS. THE INTERCOSTAL AT RBL 16 IS CHECKED AS IT IS THE HEAVIEST LOADED



SEC. B-B (P.)



SEC. C-C

FIXED-END MOMENT CALCULATIONS

ALL FRAMES ARE CONTINUOUS EXCEPT THE FRAME AT FS 231.81 WHICH IS TIED TO THE EXISTING INTERCOSTAL

$FEM_{FS 236} = FEM_{FS 226} = \frac{-49.2(4)(4)^2}{(8)^2} = -498$ IN-LBS.

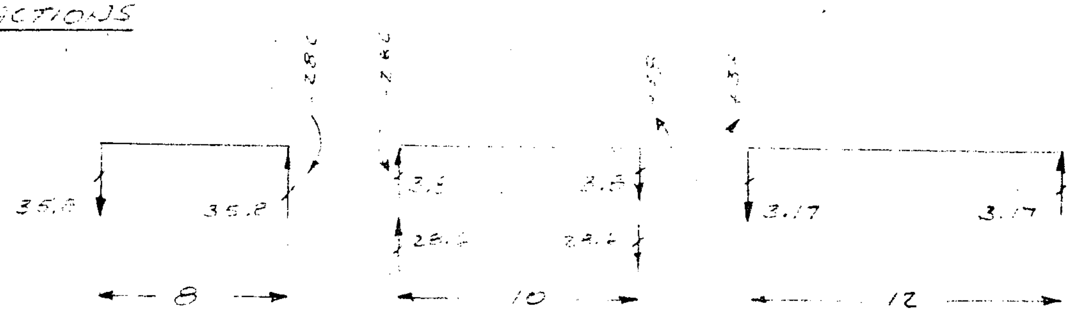
ANALYSIS OF EXISTING INTERCOSTALS (CONT)

THE HARDY CROSS SOLUTION IS USED

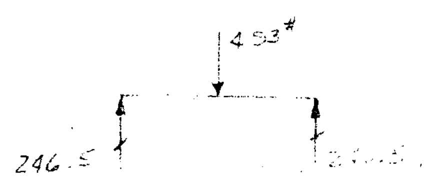
K = I/L K = .125 K = .10 K = .0368

DISTRIBUTION FACTOR	1	.63	.37	.73	.27	1
FEM	-493	-493	0	0	0	0
1ST DISTRIBUTION	+493	+310	-183	0	0	0
CARRY OVER	-155	-247	0	+92	0	0
2ND DISTRIBUTION	+155	+156	-91	-67	+25	0
CARRY OVER	-78	-78	+33	+45	0	-13
3RD DISTRIBUTION	+78	+70	-41	-33	+12	+13
CARRY OVER	-35	-39	+17	+21	-7	-6
4TH DISTRIBUTION	+35	+35	-21	-20	+8	+6
Σ	0	-286	-286	+38	+38	0

MOMENT REACTIONS



SIMPLE BEAM REACTIONS



TOTAL REACTIONS

ANALYSIS OF EXISTING INTERCOSTAL (CONT)

FROM THE LOADS AND REACTIONS SHOWN ON P. THE MAX. MOMENT WAS FOUND TO BE 842.8 IN-LBS AT THE LOCATION OF THE APPLIED LOAD.

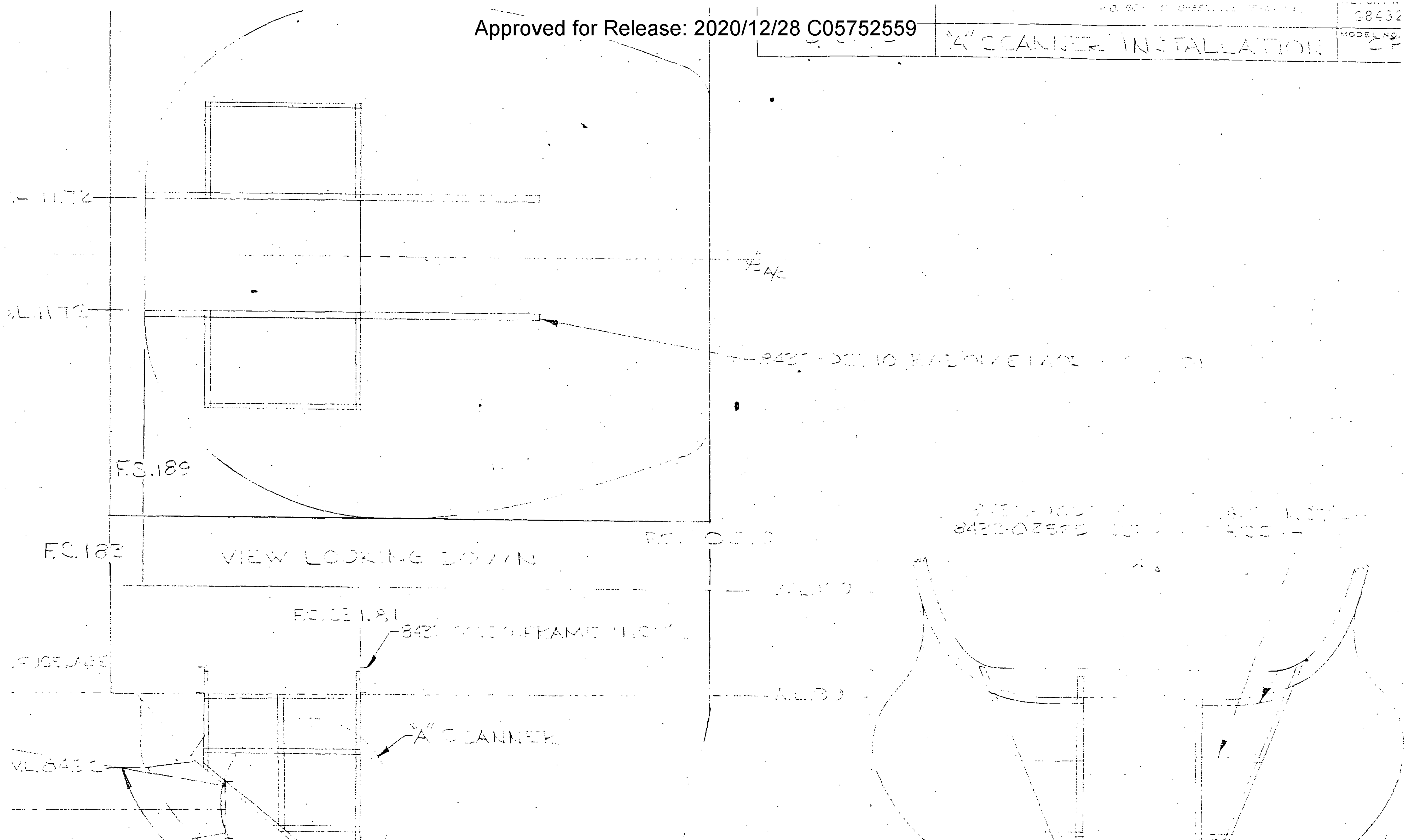
$$f_b = \frac{842.8\left(\frac{5.0}{2}\right)}{1.0} = 2110 \text{ PSI}$$

CRIPPLING OF THE .80 FLANGE WILL BE CHECKED REF. P. , SEC. C-C

$$\frac{b}{t} = \frac{.80}{.04} = 20$$

$$F_c = 15,000 \text{ PSI}$$

$$\text{CRIPPLING M.S.} = \frac{15,000}{2110} - 1 = \underline{\text{LARGE}}$$


"A" SCANNER INSTALLATION
38432
MODEL NO.
F.S.189
F.S.183
VIEW LOOKING DOWN
"A" SCANNER

PART II

APS-20B RADOME MODIFICATION

(REF DWG 8432-02510)

The existing APS-20B Radome is modified due to the installation of the "A" scanner. This scanner cannot look through a radome; therefore, a cutout has been made in the FWD section of the radome so that the scanner can track through an angle of approximately 90 degrees. The sketch on page shows the location of the cutout in respect to the existing radome. The size of the cutout is 53.14 inches by 23.44 inches. The basic construction of the APS-20B radome in the are of the cutout is 1/4 inch fiberglass honeycomb core with 3 ply fiberglass facings on the lower half of the cutout with 1/2 inch fiberglass honeycomb core with 2 ply fiberglass facing on the upper half of the cutout. The radome is made in two halves and joined together by 39 NAS 222 screws along the fore and AFT centerline. Attachment of the radome to the fuselage is made as follows:

1. By 23 NAS 222 screws at the F.S. 183 bulkhead.
2. By 13 NAS 222 screws at the F.S. 300 bulkhead.
3. By 10 hinge fittings on each side at W.L. 120.

Design loads used to analyze the radome modification are generated by airloads from the following two conditions:

1. Condition 1 - Positive low angle of attack
2. Condition 2 - Yaw Maneuver

Pressure coefficient curves for the original and modified APS-20 Radome are presented for Condition 1 on pages and . The curves on page show the pressure coefficients for Condition 2 of the modified radome. The original pressure distributions shown on page were taken from Ref. . The relative distribution of the original radome loads to the fuselage attach points was determined during static tests of the radome at Zenith Plastics Company in Gardena, California. Reference , pages 9.018 and 9.019 give some indication of the magnitude of load reacted at the different fuselage attach points. Due to the lack of stress analysis and static test data on the APS-20 Radome, the following assumptions concerning load paths in the radome will be used throughout the analysis.

Assumption 1. All down loads along the bottom of the radome will be beamed out to the FWD and AFT ends of the Radome.

Assumption 2. 70% of all outward acting load on each half of the radome will be carried across the bottom center-line as a hoop tension type load.

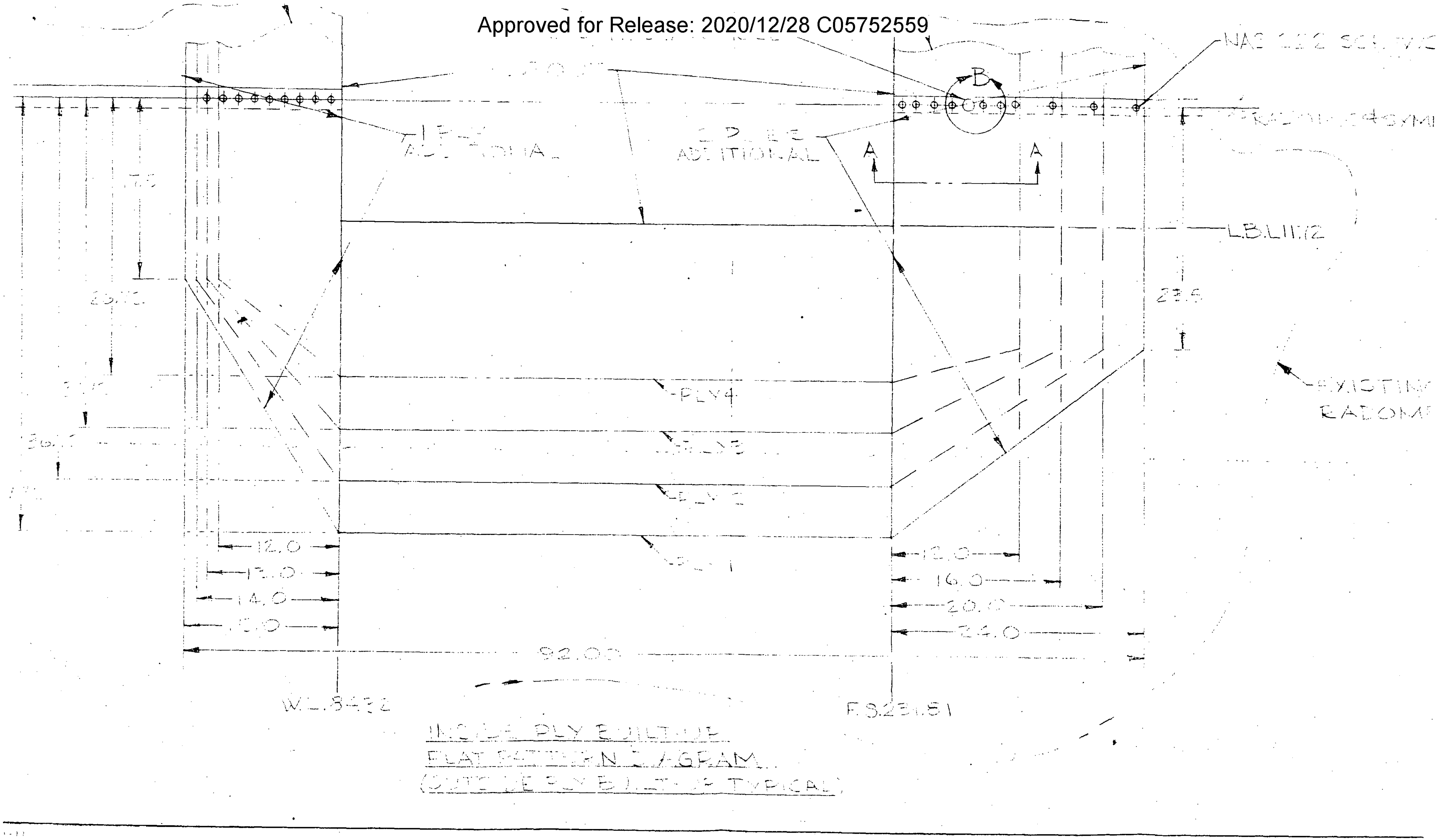
Assumption 3. Fore and AFT loads will continue to be sheared into the radomes side attach points as before.

The reinforcement of the radome around the cutout is as follows:

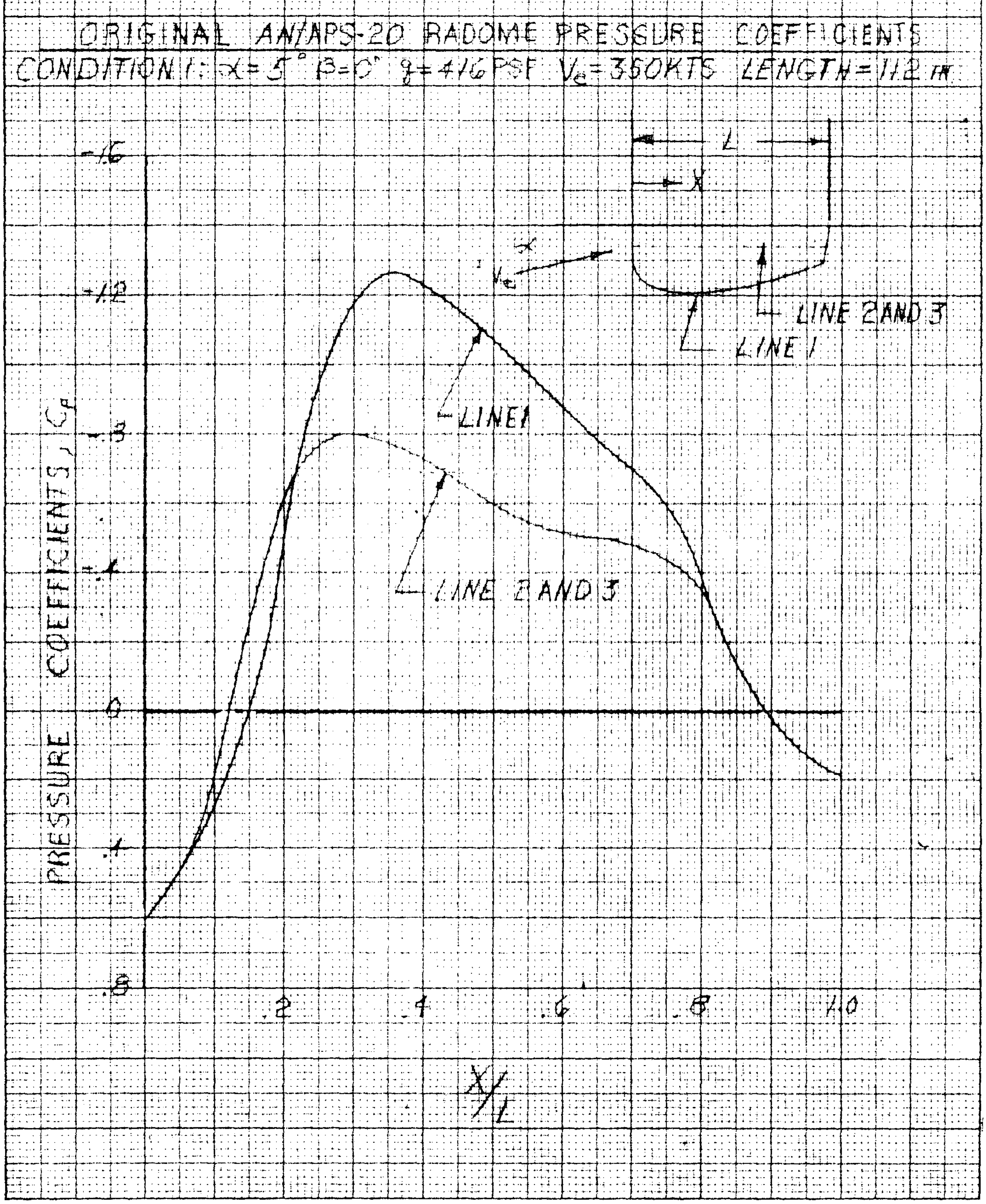
1. To transfer the outward acting loads on each half of the radome around the curout area, additional plies of fiberglass are added to both the inside and outside skins of the radome. The sketch on page shows the flat pattern layout of these added plies and their geometry. Loads are transferred into the added plies and around the cutout through a shear lag process.
2. Built-up aluminum beams are installed on each side of the radome cutout as shown in the sketch on page . Bending loads normally carried by the removed radome structure will be beamed fore and AFT by the new beams. These beams, as shown in the sketch, extend above and behind the cutout so that an abrupt change in the bending cross section does not occur. Another function of the added beams is to provide a sealing plane

between the radome modification and the "A" scanner cavity.

The following analysis is then presented to substantiate structurally the modified APS-20B radome.


B
A
A
PLY4
PLY 3
PLY 2
PLY 1
L.B.L.11.2
EXISTING
RADOME
12.0
13.0
14.0
92.00
12.0
16.0
20.0
34.0
W.L.84.32
F.S.231.81
23.5

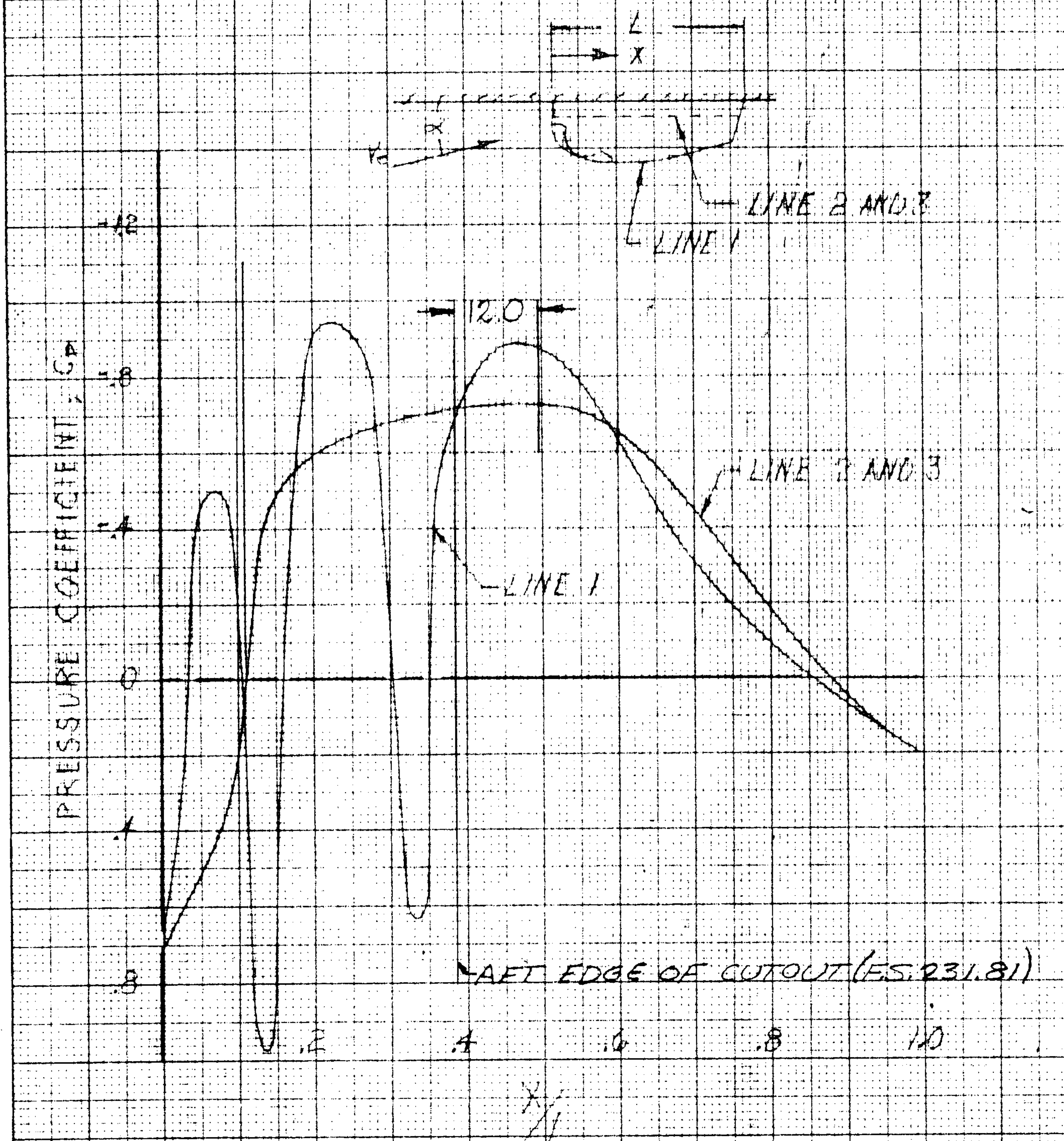
Prepared by: J. WEHENER	LTV ELECTROSYSTEMS, INC.	Page No. 3.4.30
Checked by IJK		Report No. G8432.01.06
Date: 7-5-66	"A" SCANNER INSTALLATION	Model No. JF-2H



Prepared by: WIHENER	LTV ELECTROSYSTEMS, INC.	Page No. 3.4.31
Checked by:		Report No. G8432.01.06
Date: 7-5-66	"A" SCANNER INSTALLATION	Model No. SP-2H

MOD. AN/APS-20 RADOME PRESSURE COEFFICIENTS

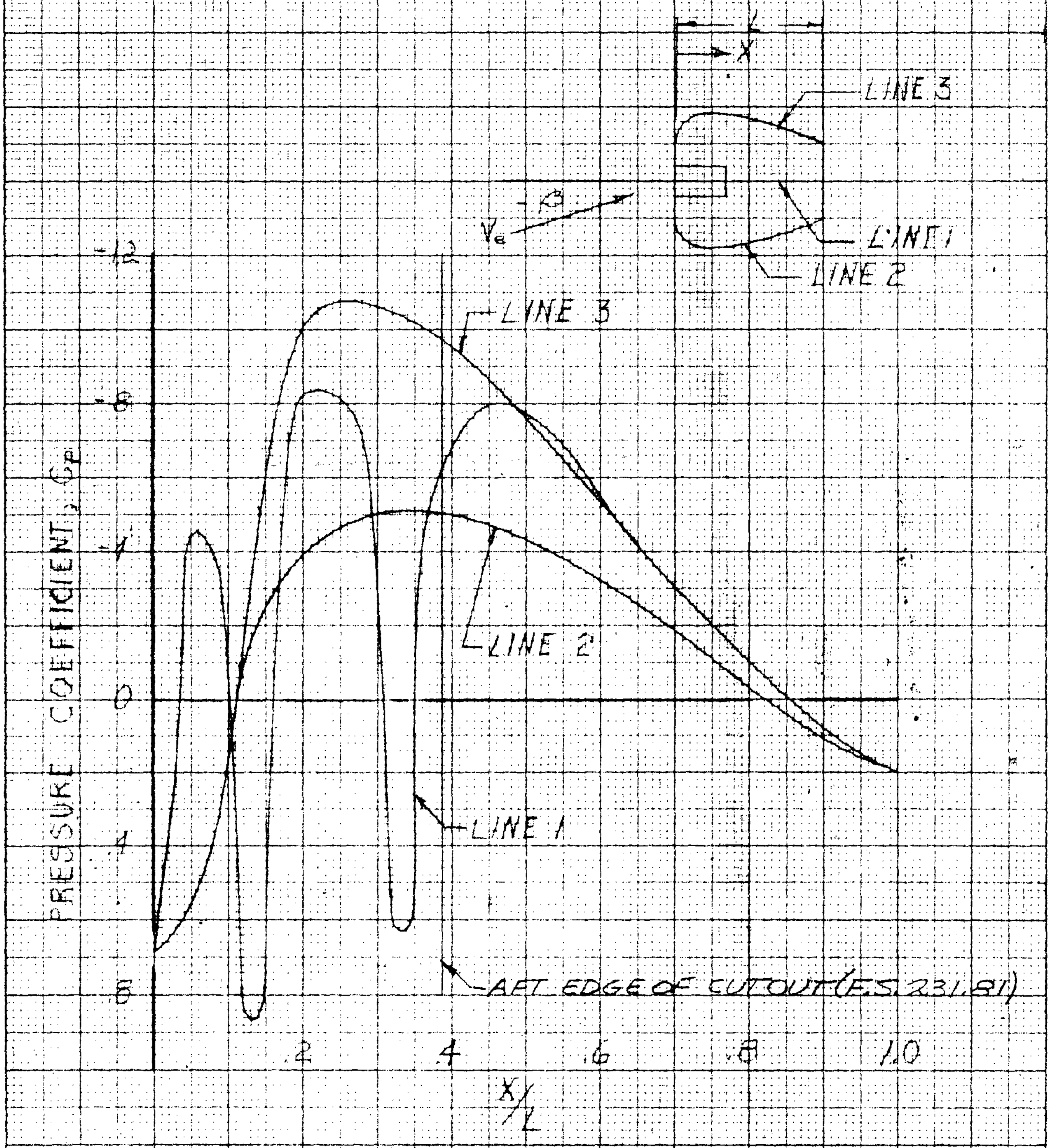
CONDITION I: $\alpha = 5°$ $\beta = 0°$ $q = 416$ PSF $V_e = 350$ KTS LENGTH = 112 IN



Prepared by: J. WEHENER	LTV ELECTROSYSTEMS, INC.	Page No. 3.4.32
Checked by:		Report No. G8432.01.06
Date: 7-5-66	"A" SCANNER INSTALLATION	Model No. SP-2H

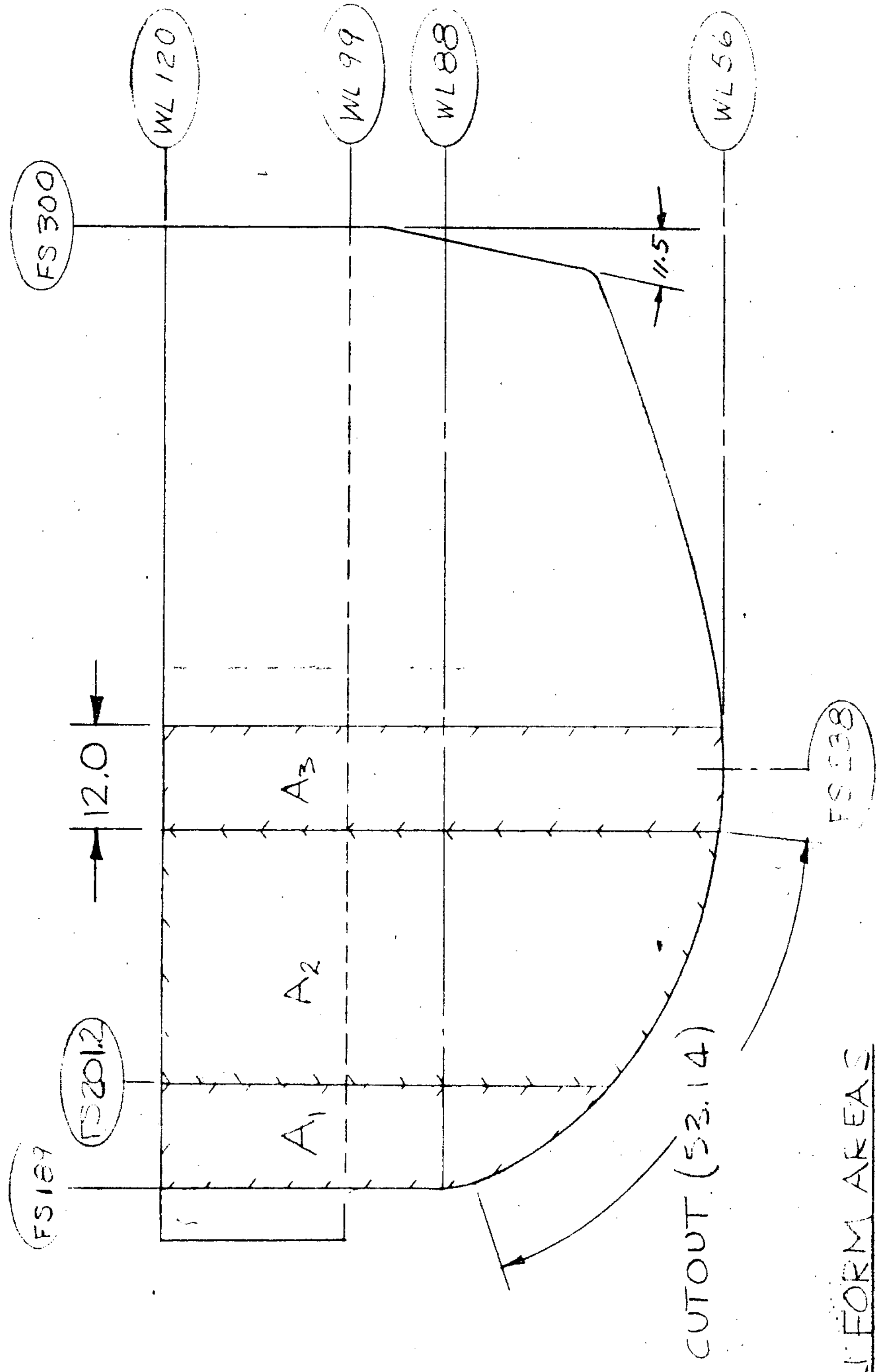
MOD AN/APS-20 RADOME PRESSURE COEFFICIENTS

CONDITION 2 $\alpha = 0°$ $\beta = -5.7°$ $q = 416$ PSF $V_e = 350$ KTS $L = 112$ IN



PREPARED BY STUTH	LTV ELECTROSYSTEMS, INC P.O. BOX 1056 · GREENVILLE, TEXAS 75402	PAGE NO. 3.4.33
CHECKED BY		REPORT NO. G8432.01.06
DATE 7-5-66	"A" SCANNER INSTALLATION	MODEL NO. SP-2H

APS-20B RADOME MODIFICATION (COND.)



PLAN FORM AREAS

$A_1 = 551\ IN^2$

$A_2 = 1792\ IN^2$

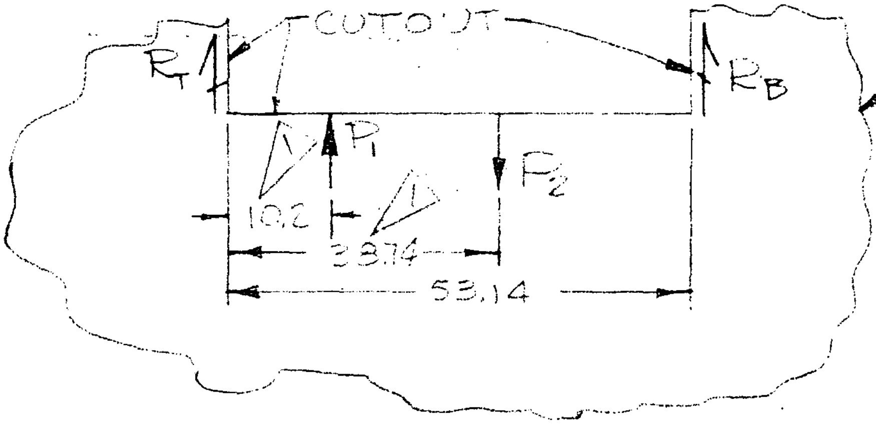
$A_3 = 770\ IN^2$

8-56603R1-11

APS-20B RADOME MODIFICATION (CONT.)

LOAD PATH ANALYSIS FOR OUTW'D. ACTING LOADS

AS STATED IN THE INTRODUCTION, 70% OF ALL OUTWARD ACTING LOADS ON EACH HALF OF THE RADOME WILL BE TRANSFERRED ACROSS THE BOTTOM CENTERLINE SPLICE JOINT AS A HOOP TENSION TYPE LOAD. THE LOADS TO BE TRANSFERRED AROUND THE CUTOUT ARE DERIVED USING THE PRESSURE COEFFICIENTS ON PAGE FOR LINE 2 AND THE FLAT PLANE PROJECTED AREAS SHOWN ON PAGE THESE LOADS AND THEIR LOCATIONS ARE SHOWN BELOW.



FLAT PATTERN LOAD DIAGRAM

$P_1 = C_p A_1 q\, 1.5$ WHERE: 1.5 = ULT. FACTOR

$= .48(551)2.89(1.5)$ q = DYNAMIC PRESSURE $= 416/144 = 2.89$ psi

$= 1148$ # A_1 = PROJECTED AREA FOR FWD PORTION OF LOAD. SEE P.

C_p = AVG. PRESSURE COEF. OVER A_1 OBTAINED BY GRAPHICAL INTERGRATION OF LINE 2.

◁1 LOCATION OF LOADS DETERMINED BY GRAPHICAL INTERGRATION OF THE INTERGRATED PRESSURE CURVE.

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CHECKED BY		REPORT NO. G8432.01.06
DATE 7-7-66	"A" SCANNER INSTALLATION	MODEL NO. SY-2H

APS-20B RADOME MODIFICATION (CONT.)

LOAD PATH ANALYSIS FOR OUTW'D ACTING LOADS (CONT.)

$P_2 = C_p A_2 \frac{q}{\delta} 1.5$ WHERE: A_2 = PROJECTED AREA FOR AFT PORTION OF LOAD. SEE P.

$= -.60(179)2.89(1.5)$ — C_p = AVG. PRESSURE COEF. OVER A_2 OBTAINED BY GRAPHICAL INTERGRATION OF LINE 2.

$= -4,660^{\#}$

$$\Sigma M_{R_T} = 10.7(1148) - 38.74(4660) + 53.14(R_B) = 0$$

$$R_B = \frac{-10.7(1148) + 38.74(4660)}{53.14}$$

$$= 3,180^{\#}$$

$$R_T = 4660 - 3,180 - 1148 = 332^{\#}$$

TENSION ANALYSIS OF ADDED PLIES

SECTION A-A ON P. [illegible] IS THE CRITICAL TENSION AREA. THE FIRST 12 INCHES AFT OF THE CUTOUT WILL BE USED FOR DETERMINING THE TENSION AREA OF THE HONEYCOMB FACINGS. AS SHOWN ON THE SKETCH ON PAGE , 6 ADDITIONAL PLIES HAVE BEEN ADDED TO BOTH FACINGS OF THE RADOME IN THIS AREA. THESE ADDITIONAL PLIES ARE 181 BI-DIRECTIONAL FABRIC.

$A_t = L \times t$ WHERE: L = 12 INCH CROSS SECTION, t = .12 INCH - THICKNESS OF 6 ADDITIONAL PLIES ADDED TO BOTH SIDES.

$= 12 \times .12$

$= 1.44\ IN^2$

$f_t = \frac{.70P}{A_t}$

$= \frac{.70(3180)}{1.44}$

$= 1,546$ PSI

NOTE: PER ASSUMPTION 2 ON PAGE , ONLY 70% OF THE SIDE ACTING LOADS ARE TRANSFERRED ACROSS THE BOTTOM OF THE RADOME.

ESC-50199-11

Approved for Release: 2020/12/28 C05752559

APS-20E RADOME MODIFICATION (CONT.)

LOAD PATH ANALYSIS FOR OUTW'D ACTING LOADS (CONT.)

TENSION ANALYSIS OF ADDED PLIES (CONT.)

$F_{tu} = 16,300$ PSI [1]

TENSION M.S. $= \frac{16300}{1375} - 1 =$ LARGE

IT SHOULD BE NOTED THAT ONLY THE ADDED PLIES WERE USED IN REACTING THE LOADS TRANSFERRED AROUND THE CUTOUT.

LUG ANALYSIS OF RADOME SPLICE BOLTS

SINCE THE RADOME HAS A LAP SPLICE AT THE RADOME CENTERLINE, ALL LOADS TRANSFERRED AROUND THE CUTOUT ARE REACTED BY THE SPLICE BOLTS IN THE 12 INCH TENSION AREA.

THE LOAD NORMALLY CARRIED BY THE 12 INCH TENSION AREA IS

$P_0 = (C_p A_3\, q\, 1.5).5$ WHERE: $A_3 = 770\ IN^2$ (REF. P.)

$= [(-.72)770(2.89)1.5].7$

$= -1,674^{\#}$

C_p = AVG. PRESSURE COEF. OVER A_3 OBTAINED BY GRAPHICAL INTERGRATION OF LINE 2.

.7 = SEE NOTE ON BOTTOM OF P.

THE LOAD TRANSFERRED AROUND THE AFT SIDE OF THE CUTOUT IS

$R_B = 3180$ [2] $(.7)$ [3]

$= -2230^{\#}$

[3] SEE NOTE ON BOTTOM OF P.

[2] REF. P.

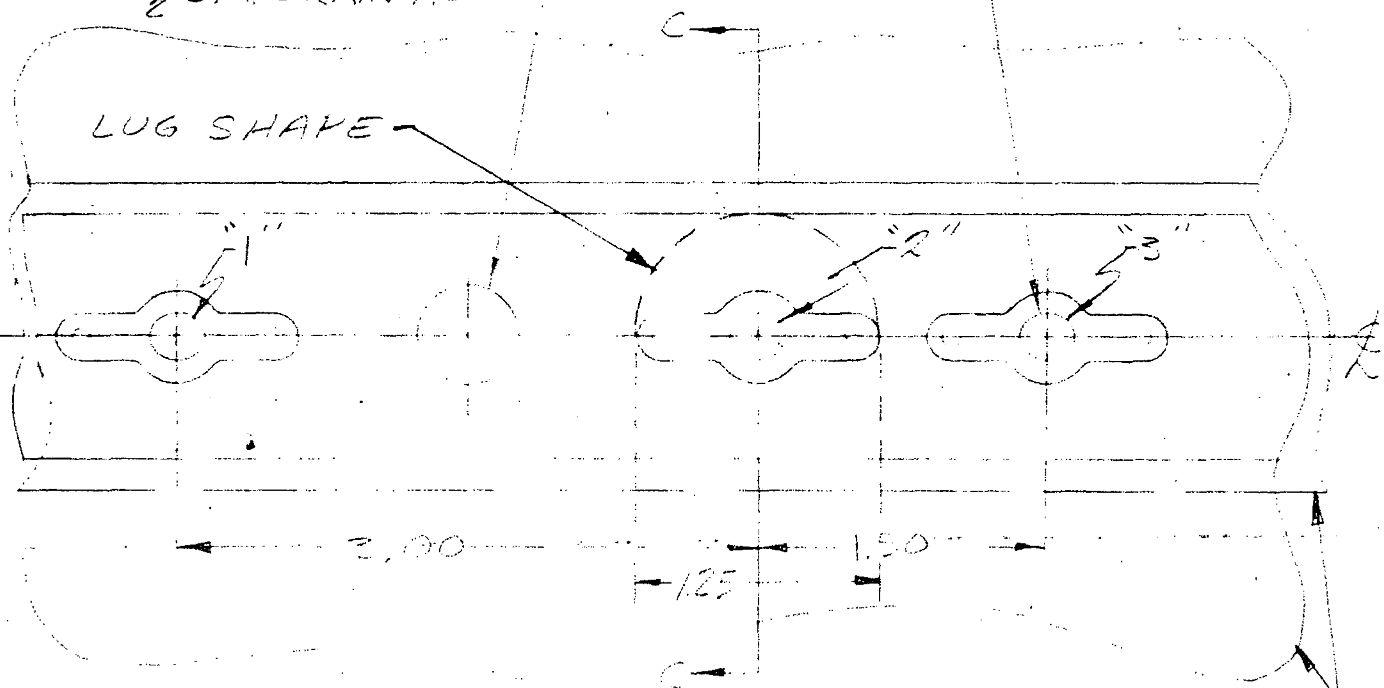
[1] REF. , MEMO 107, PAGE 9 - THIS VALUE IS FOR A PARALLEL LAMINATE AT 45° TO THE WARP DIRECTION.

E8C-50199-11

APS-20B RADOME MODIFICATION (CONT.)

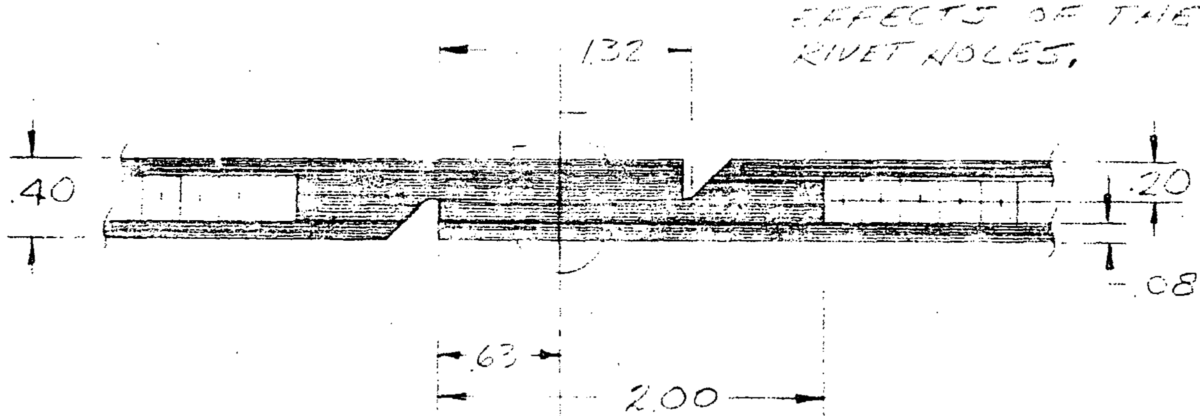
LOAD PATH ANALYSIS FOR OUTWD. ACTING LOADS (CONT.)

LUG ANALYSIS (CONT.)



DETAIL B

NOTE: WHEN FINDING ALLOWABLE LOAD FOR ABOVE LUG USE A STRESS CONCENTRATION FACTOR OF .5 TO INCLUDE EFFECTS OF THE NUTPLATE RIVET HOLES.



SEC C-C

APS-20B RADOME MODIFICATION (CONT.)

LOAD PATH ANALYSIS FOR OUTWARD ACTING LOADS (CONT.)

LUG ANALYSIS (CONT.)

REF. , MEMO 107, PARA II-B IS USED FOR METHOD OF DETERMINING ALLOWABLE LOAD OF RADOME LUG.

$\frac{a}{D} = \frac{.63}{.25} = 2.52$ WHERE: a = EDGE DISTANCE
D = FASTENER DIAMETER
W = LUG WIDTH
t = LUG THICKNESS

$\frac{W}{D} = \frac{1.25}{.25} = 5.0$

$\frac{D}{t} = \frac{.25}{.20} = 1.25$

BY USING THE ABOVE VALUES INTO FIG. 16 OF REF. , MEMO 107, WE GET

$F_{bru} = 38{,}500$ psi

$A_{BEARING} = tD = .20(.25) = .05$ IN²

THE ALLOWABLE BEARING LOAD IS THEN

$P_{ALLOW} = F_{bru} \times A_{bru} = .05(38{,}500) = 1{,}925$ #/SCREW

SCREW #"2" SHOWN IN DETAIL "B" & IS THE CRITICALLY LOADED FASTENER IN THE RADOME SPLICE JOINT. THE LOAD APPLIED TO THIS FASTENER IS THE LOAD APPLIED TO THE RADOME OVER A LENGTH OF HALF WAY TO EACH ADJACENT FASTENER.

$P_{ACT"2"} = \frac{(1674 + 2230)\left(\frac{3.0 + 1.5}{2}\right)}{12} = 723$ # (notes 1, 3, 2)

BEARING $M.S. = \frac{1925(.5)}{723} - 1 = +.33$ (note 4)

3 SEE P. FOR DISTANCE BETWEEN FASTENERS
2 LOADS APPLIED OVER 12 IN. TENSION AREA
1 SEE P. FOR LOADS

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DATE		REPORT NO.
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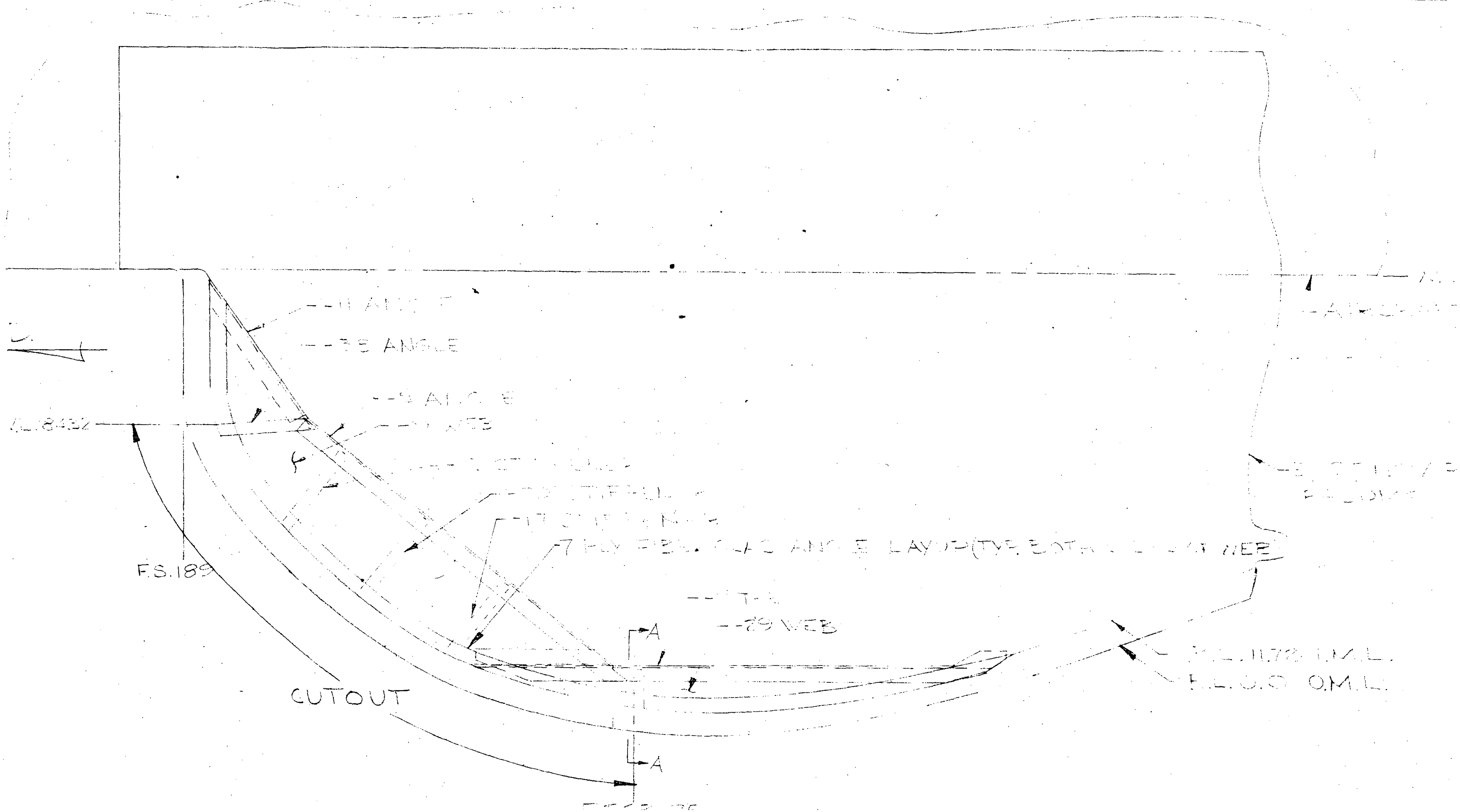
		MODEL NO.



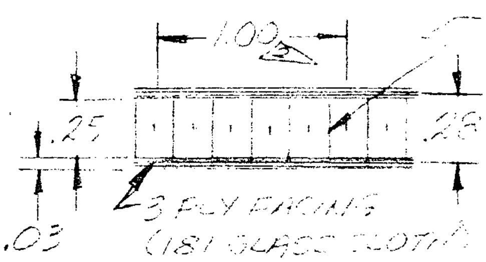
AFT SIDE RADOME INSTALLATION (CONT.)

BENDING ANALYSIS OF FORE AND AFT BEAMS

[illegible] LOADS APPLIED TO THE AIRPLANE NORMALLY [illegible] THE FORE AND AFT ATTACHMENTS OF THE RADOME THROUGH BENDING. THE NEW BEAMS ADDED [illegible] EACH SIDE OF THE CUTOUT ARE INSTALLED TO MAKE IT POSSIBLE FOR THIS LOAD PATH [illegible], BENDING LOADS [illegible] AREA ARE NOW [illegible] IN THE [illegible] AND MODIFIED [illegible] THAT [illegible] RADOME [illegible] RADOME, THE ADDED BEAMS WILL [illegible] MAXIMUM MOMENT, SHEAR [illegible] BY THE REMOVED SECTION [illegible], IS EQUIVALENT [illegible].

THE [illegible] OF THE RADOME IS 1/2 INCH FIBERGLASS [illegible] WITH 3 PLY FIBERGLASS FACING [illegible] OF THE CUTOUT AND 1/2 INCH [illegible] HONEYCOMB [illegible] 2 PLY FIBERGLASS [illegible] HALF OF THE CUTOUT.

ALLOWABLE [illegible] FOR THE RADOME IN THE AREA OF THE 1/2 INCH [illegible].



CROSS SECTION

ALLOWABLE MOMENT

$P_c = \frac{M}{r}$ WHERE: P_c = CAP LOAD

M = BENDING MOMENT

r = DIST. BETWEEN CAP [illegible]

$F_c = \frac{P_c}{A}$

A = CAP AREA = 1(.03) = .03 IN

F_c = FACING ALLOWABLE = 29,000 PSI ③

ALLOW MOM = $F_c A r$ = [(29000)(.03)].28 = 244 IN#/IN OF WIDTH

② UNIT WIDTH

③ [illegible] TO WIRE [illegible]

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MI-30B RADOME MODIFICATION (CONT.)

BENDING ANALYSIS OF FORE AND AFT BEAMS (CONT.)

ALLOWABLE SHEAR

$F_s = \frac{2V}{t + t_1}$ — WHERE V = CHORDWISE SHEAR LOAD PER INCH OF WIDTH

t = OVERALL PANEL THICKNESS

t_1 = CORE THICKNESS

F_s = ALLOWABLE SHEAR STRENGTH OF CORE = 325 PSI

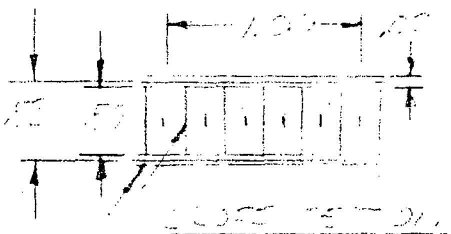
$V_{ALL} = \frac{325(.25+.31)}{2}$

= 91 #/IN [illegible]

ALLOWABLE TENSION

[illegible] AROUND THE [illegible]

ALLOWABLE LOADS FOR THE RADOME IN THE AREA OF [illegible] LOAD.



CORE DETAIL

[illegible] CORE [illegible] GLASS CLOTH

ALLOWABLE MOMENT

$M_{ALL} = F_c A h$ = [29,000(1 X .02) .50]

290 IN # [illegible]

ALLOWABLE SHEAR

$V_{ALL} = \frac{F_s(t+t_1)}{2} = \frac{325(.04+.50)}{2}$

= 88 #/IN [illegible]

ALLOWABLE TENSION

[illegible]

[illegible]

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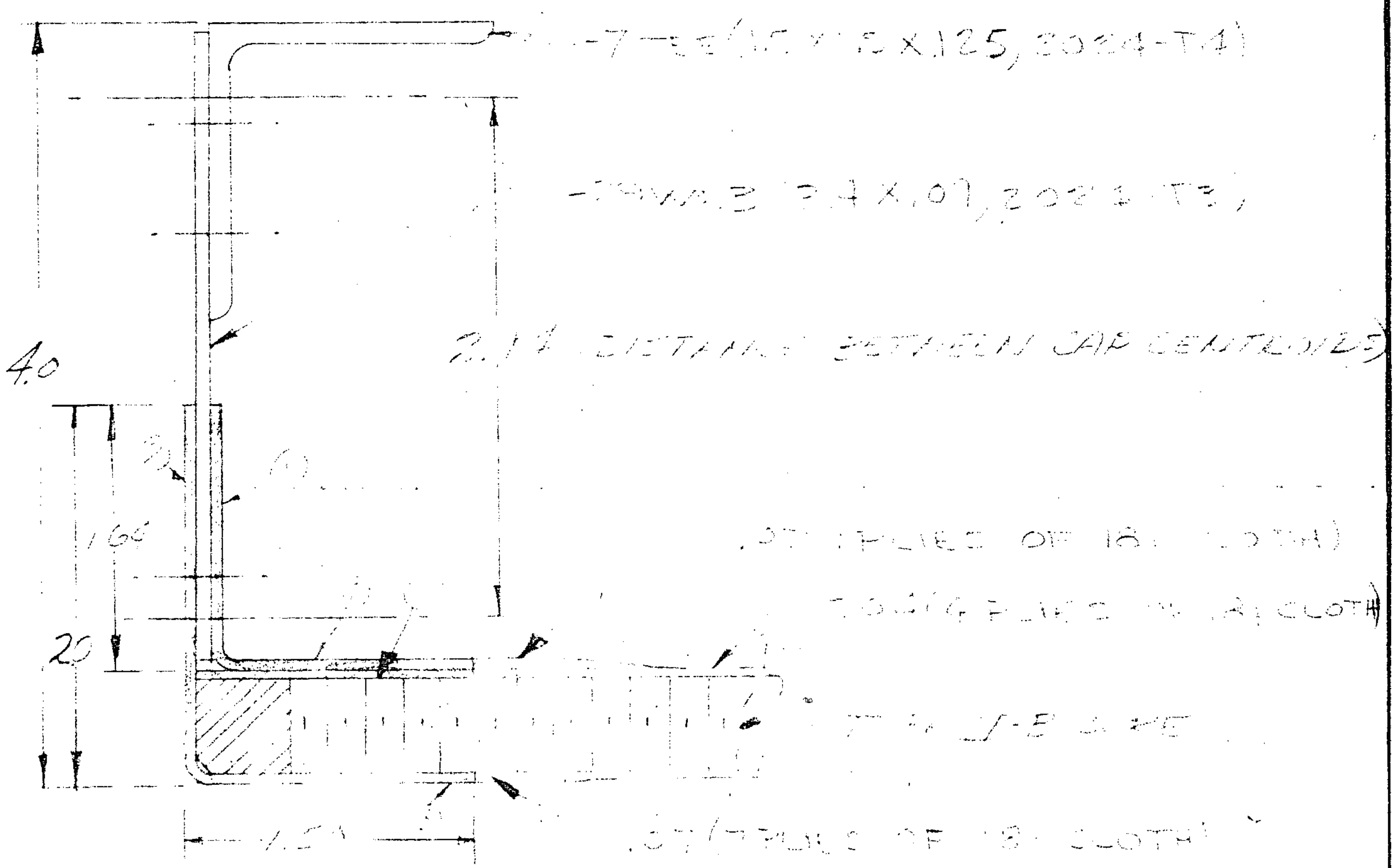
APS-108 RADOME MODIFICATION (CONT.)

BENDING ANALYSIS OF FORE AND AFT BEAMS (CONT.)

SECTION A-A (REF. [illegible])



SEC A-A

[illegible]

$A_{TOT} = A_1 + A_2 + A_3 + A_4 + A_5$

$= 1.64(.07) + [illegible] + 1.50(.07 + 1.4 .04)$

$= .50\ IN^2$

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APS-20B RADOME MODIFICATION (CONT)

BENDING ANALYSIS OF FORE AND AFT BEAMS (CONT)

CHECK SEC. A (CONT)

THE [illegible] TENSION LOAD IN THE LOWER CAP [illegible]

$F_{[illegible]} = \frac{[illegible]\ N_{[illegible]}}{[illegible]} = \frac{[illegible](40)}{[illegible]}$

[illegible]

$f_t = \frac{P}{A} = [illegible] = [illegible]$ PSI

$F_{tu} = 6[illegible]$

[illegible] [illegible] [illegible]

THE [illegible] [illegible] LOAD IN THE LOWER [illegible]

[illegible] $(11) = 1068^{\#}$

$f = \frac{P}{A} = [illegible] = [illegible]10$ PSI

$F_{[illegible]} = [illegible]$

[illegible] [illegible]

[illegible] $N = \dots [illegible](.119)^2 + (.253)^2]^{\frac{1}{2}} - 1 = +2.59$

THE [illegible] [illegible] [illegible] CONSERVATIVE [illegible] [illegible] STRESS WERE [illegible] [illegible] [illegible] [illegible] ULT VALUE OF [illegible] [illegible] FOR ALLOWABLES.

▷ REF. [illegible] [illegible] MAXIMUM ULT SHEAR STRESS AT 0° [illegible] DIRECTION.

▷ [illegible] ULT [illegible] [illegible] -45° TO [illegible] DIRECTION [illegible] [illegible]

▷ 1/2 [illegible] OF CUTOUT

LTV ELECTROSYSTEMS, INC.

1. [illegible] R 7246, [illegible]

2. [illegible] 8477, [illegible]

3. [illegible]

4. [illegible]

5. [illegible]

6. [illegible]

LTV ELECTROSYSTEMS, INC.

[illegible]

[illegible]

[illegible]

[illegible]

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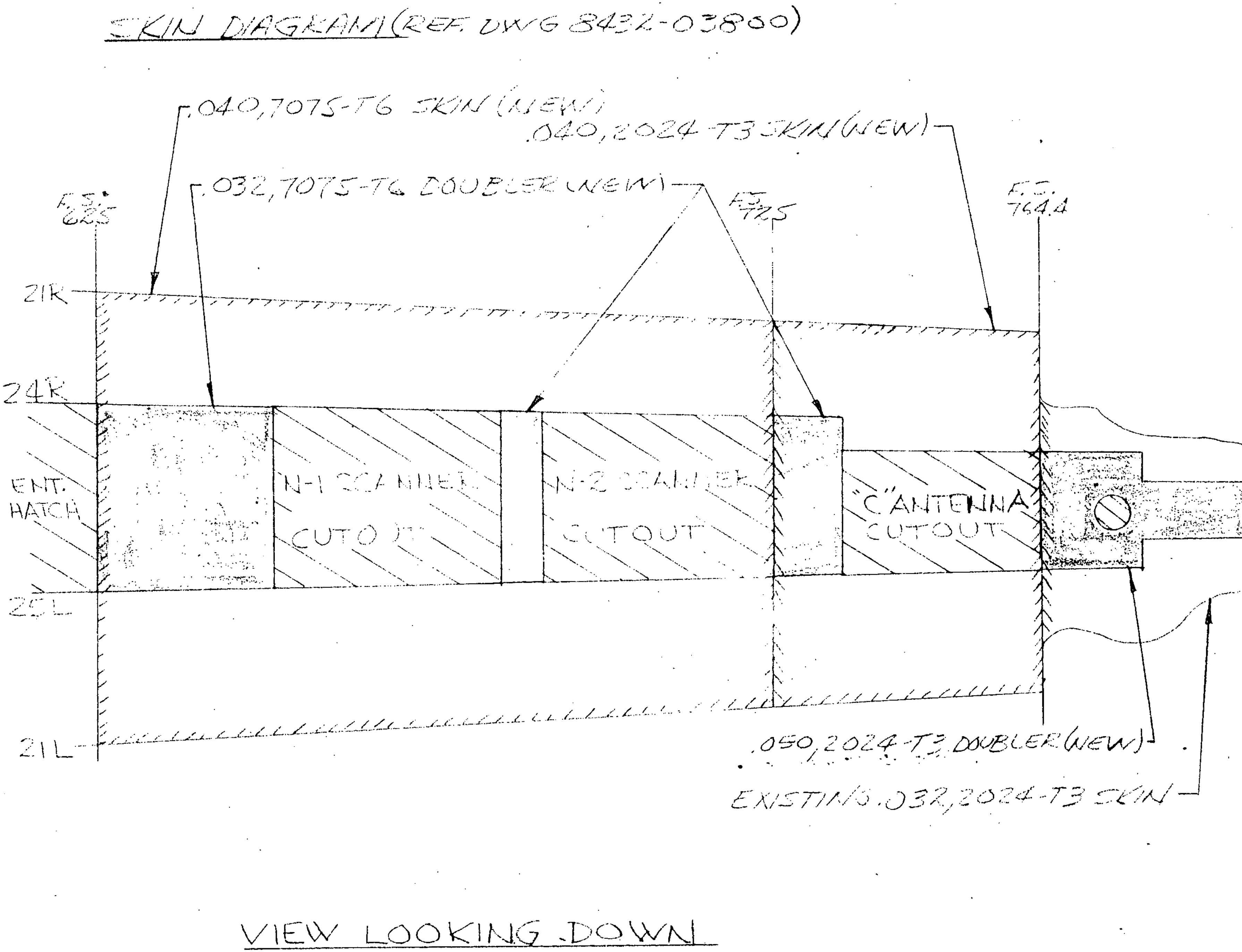


PREPARED BY

CHECKED BY

DATE 7-12-66

LTV ELECTROSYSTEMS, INC
P.O. BOX 1056 GREENVILLE, TEXAS 75402

AFT FUSELAGE MODIFICATION

PAGE NO.

REPORT NO. 23432.01

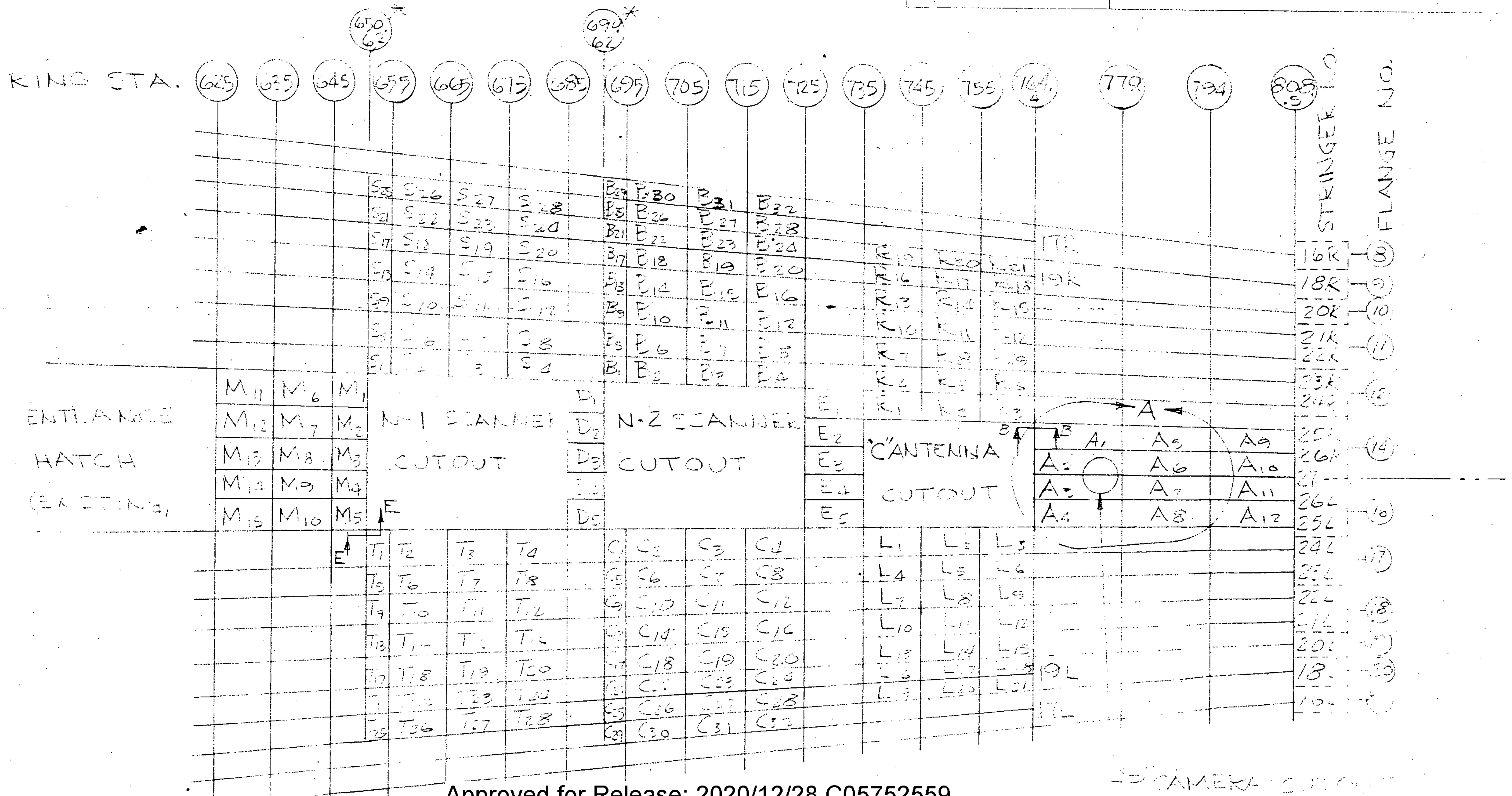
MODEL NO.

LOAD ANALYSIS - AFT FUSELAGE
(REF. DWG. 8432-03100)

PREPARED BY
CHECKED BY
DATE 7-17-66

LTV ELECTROSYSTEMS

AFT FUSELAGE MODIFICA



Approved for Release: 2020/12/28 C05752559

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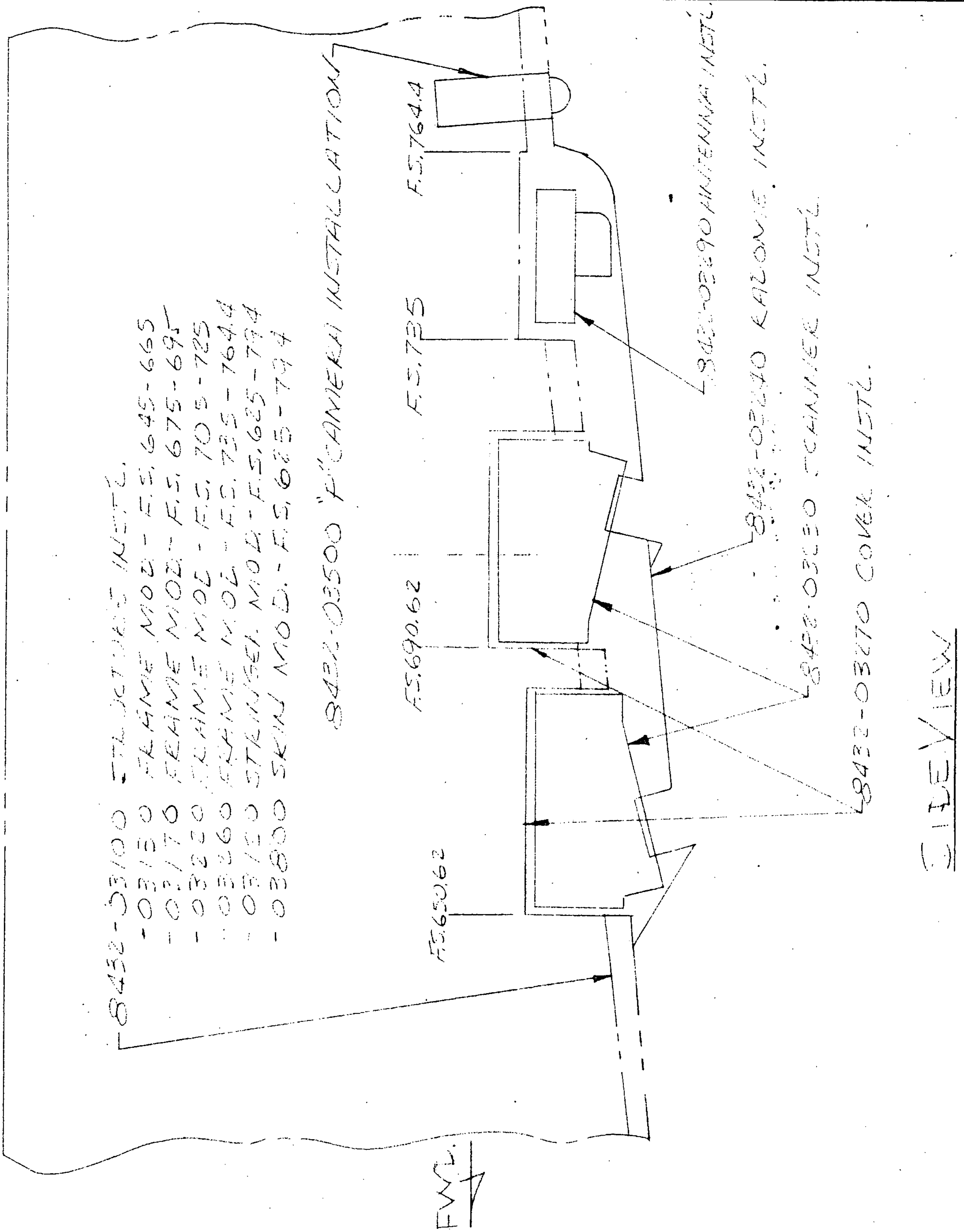
CHECKED BY		REPORT NO. 33432.01.06
DATE 7-12-66	AFT FUSELAGE MODIFICATION	MODEL NO. JP-24

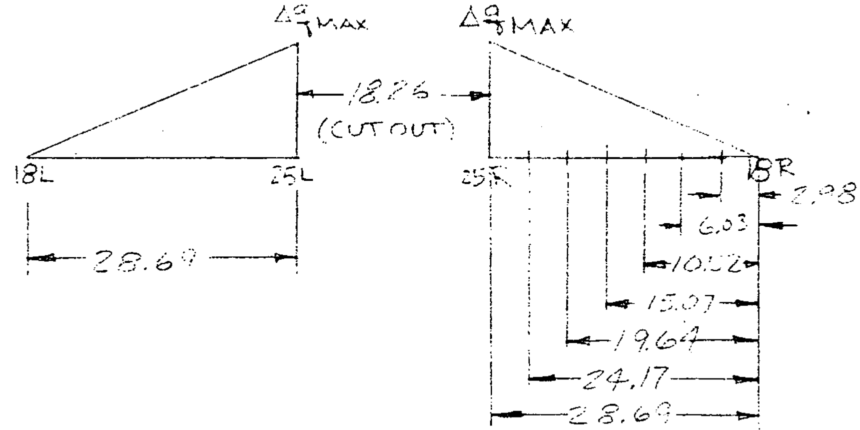


E8C-50199-11

LOAD ANALYSIS (CONT.)

TRANSVERSE SHEAR REDISTRIBUTION

"C" ANTENNA CUTOUT



AVG. q ACROSS CUTOUT = $q_0 = \frac{1}{2}(q_{12} + q_{14})$

$\Delta q_{MAX} = q_0 \left(\frac{18.26}{28.69}\right) = .636\, q_0$

VALUES OF q_{12} + q_{14} ARE FOR F.S.750 (REF. , P.3.26)

COND (7-1) 46GsL

$q_0 = \frac{(-223 - 232)}{2} = -228$ #/IN

$\Delta q_{MAX} = .636(-228) = -145$ #/IN

COND (7-1) 46GsR

$q_0 = \frac{234 + 217}{2} = 225$ #/IN

$\Delta q_{MAX} = .636(225) = 143$ #/IN

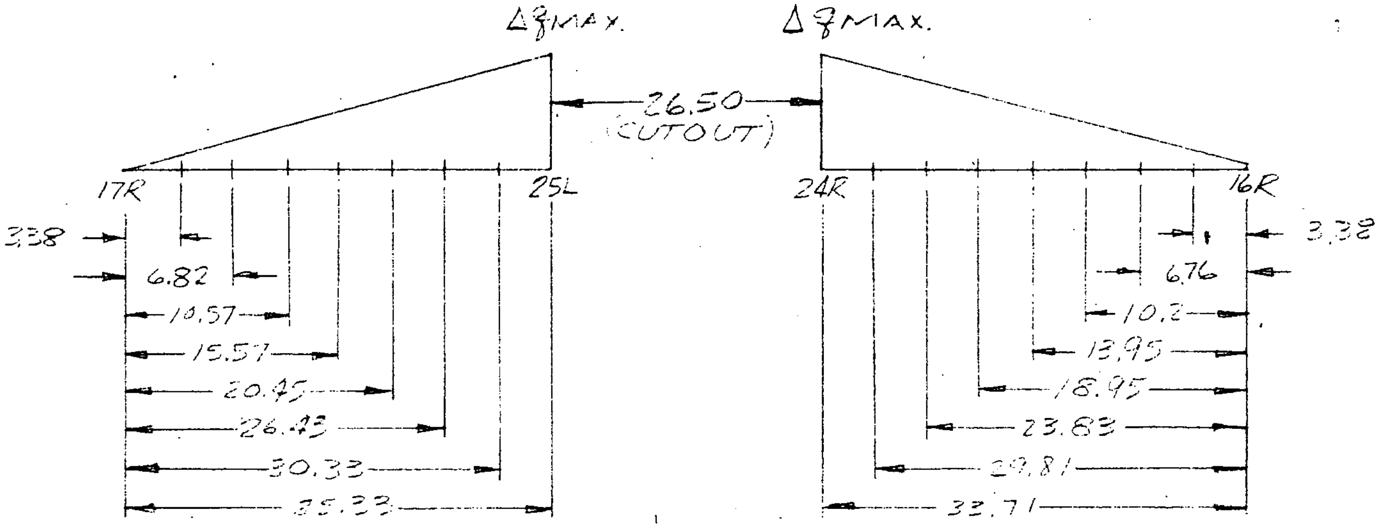
THE SHEAR FLOWS TABULATED BELOW ARE AVG. VALUES BETWEEN STRINGERS. FOR PANEL DESIGNATION REFER TO P.

PANEL	COND (7-1)46GsL Δq_t	COND (7-1)46GsR Δq_t	PANEL	COND (7-1)46GsL Δq_t	COND (7-1)46GsR Δq_t
$R_1 - R_3$	-133	131	$L_1 - L_3$	-133	131
$R_4 - R_6$	-111	109	$L_4 - L_6$	-111	109
$R_7 - R_9$	-88	87	$L_7 - L_9$	-88	87
$R_{10} - R_{12}$	-65	64	$L_{10} - L_{12}$	-65	64
$R_{13} - R_{15}$	-42	41	$L_{13} - L_{15}$	-43	41
$R_{16} - R_{18}$	-23	22	$L_{16} - L_{18}$	-23	22
$R_{19} - R_{21}$	-7.5	7	$L_{19} - L_{21}$	-7.5	7

LOAD ANALYSIS (CONT.)

TRANSVERSE SHEAR REDISTRIBUTION (CONT.)

H-2 SCANNER CUTOUT



AVG q ACROSS CUTOUT $= q_0 = \frac{1}{2}(q_{12} + q_{14})$

VALUES OF q_{12} & q_{14} ARE FOR F.S. 710 (REF. P. 3.26)

$\Delta q_{MAX} = q_0 \left(\frac{2 \times 26.50}{35.33 + 33.71} \right) = .768\, q_0$

COND (7-1) 46 GsL

$q_0 = \frac{-173 - 180}{2} = -176$ #/IN

$\Delta q_{MAX} = .768(-176) = -135$ #/IN

COND (7-1) 46 GsR

$q_0 = \frac{182 + 165}{2} = 173$ #/IN

$\Delta q_{MAX} = .768(173) = 133$ #/IN

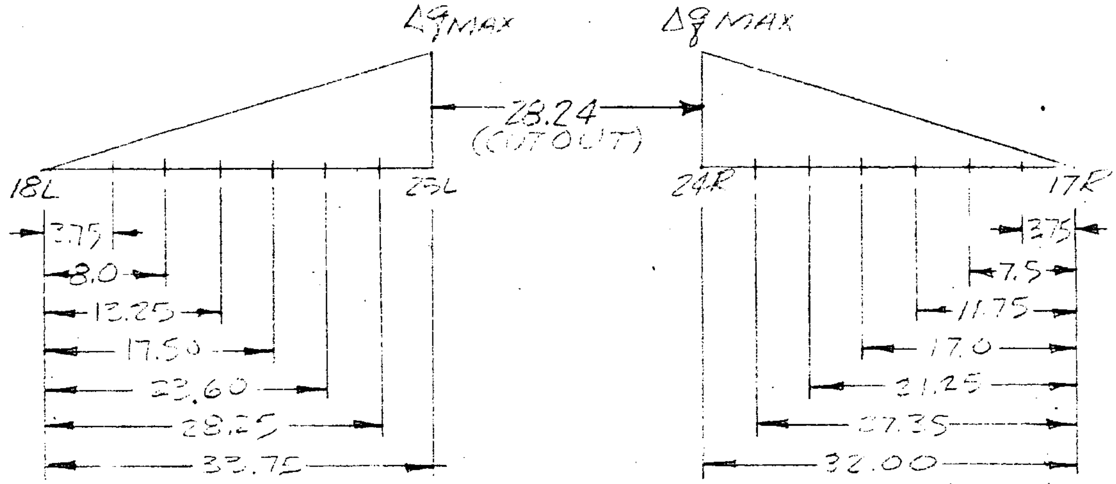
THE SHEAR FLOWS TABULATED BELOW ARE AVG. VALUES BETWEEN STRS., FOR PANEL DESIGNATION REFER TO P.

PANEL	COND. (7-1) 46GsL Δq_t	COND. (7-1) 46GsR Δq_t	PANEL	COND. (7-1) 46GsL Δq_t	COND. (7-1) 46GsR Δq_t
$B_1 - B_4$	-127	125	$C_1 - C_4$	-130	123
$B_5 - B_8$	-107	106	$C_5 - C_8$	-113	107
$B_9 - B_{12}$	-86	85	$C_9 - C_{12}$	-90	88
$B_{13} - B_{16}$	-66	65	$C_{13} - C_{16}$	-70	68
$B_{17} - B_{20}$	-48	48	$C_{17} - C_{20}$	-50	49
$B_{21} - B_{24}$	-34	33	$C_{21} - C_{24}$	-33	33
$B_{25} - B_{28}$	-20	20	$C_{25} - C_{28}$	-20	19
$B_{29} - B_{32}$	-7	7	$C_{29} - C_{32}$	-6	7

LOAD ANALYSIS (CONT.)

TRANSVERSE SHEAR REDISTRIBUTION (CONT.)

N-1 SCANNER CUTOUT



AVG. q ACROSS CUTOUT = $q_0 = \frac{1}{2}(q_{12} + q_{14})$

VALUES OF q_{12} & q_{14} ARE FOR F.S. 690 (REF. , P.3.26)

$$\Delta q_{MAX} = q_0\left(\frac{2(28.24)}{33.75+32.0}\right) = .859\,q_0$$

COND (7-1) 46GsL

$$q_0 = \frac{-176-191}{2} = -184 \text{ \#/IN}$$

$$\Delta q_{MAX} = .859(-184) = -158 \text{ \#/IN}$$

COND. (7-1) 46GsR

$$q_0 = \frac{212+195}{2} = 203 \text{ \#/IN}$$

$$\Delta q_{MAX} = .859(203) = 174 \text{ \#/IN}$$

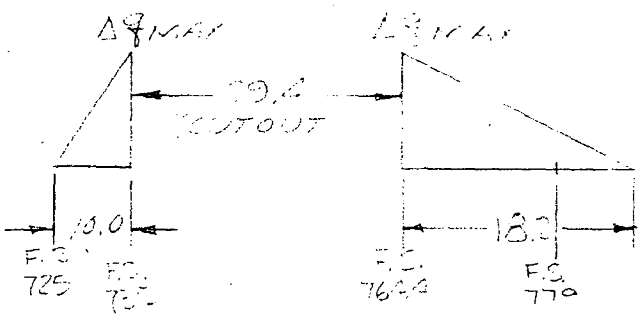
THE SHEAR FLOWS TABULATED BELOW ARE AVG. VALUES BETWEEN STRS. FOR PANEL DESIGNATION REFER TO P.

PANEL	COND (7-1) 46GsL	COND (7-1) 46GsR	PANEL	COND. (7-1) 46GsL	COND. (7-1) 46GsR
	Δq_t	Δq_t		Δq_t	Δq_t
$S_1 - S_4$	-146	161	$T_1 - T_4$	-145	160
$S_5 - S_8$	-120	132	$T_5 - T_8$	-121	133
$S_9 - S_{12}$	-94	104	$T_9 - T_{12}$	-96	106
$S_{13} - S_{16}$	-71	78	$T_{13} - T_{16}$	-72	79
$S_{17} - S_{20}$	-47	52	$T_{17} - T_{20}$	-50	55
$S_{21} - S_{24}$	-28	30	$T_{21} - T_{24}$	-27	30
$S_{25} - S_{28}$	-9	10	$T_{25} - T_{28}$	-8	10

LOAD ANALYSIS, CONT.

LONGITUDINAL SHEAR REDISTRIBUTION

"C" ANTENNA CUTOUT



REF. P. FOR VALUES OF AVERAGE $\bar{q}$ ACROSS THE CUTOUT ($\bar{q}$).

COND (7-1) 46 G=L

$$\Delta q_{MAX} = -228\left(\frac{2 \times 29.4}{10+18.2}\right) = -476 \ \#/IN$$

COND (7-1) 46 G=R

$$\Delta q_{MAX} = 225\left(\frac{2 \times 29.4}{10+18.2}\right) = 470 \ \#/IN$$

THE SHEAR FLOWS TABULATED BELOW ARE AVG. VALUES BETWEEN FRAMES. REF. P. FOR PANEL DESIGNATION.

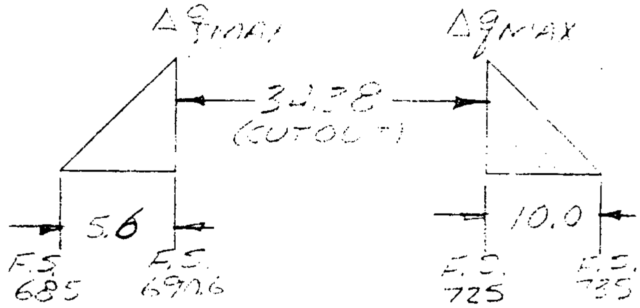
PANEL	COND. (7-1) 46 G=L	COND. (7-1) 46 G=R
	Δq_L	Δq_L
$A_1 - A_4$	−285	281
$A_5 - A_8$	−47*	46*
$E_2 - E_5$	−238	235

* AVG. OVER 3.6 IN LENGTH AFT OF F.S. 779

LOAD ANALYSIS (CONT.)

LONGITUDINAL SHEAR REDISTRIBUTION (CONT.)

N-2 SCANNER CUTOUT



REF [illegible] FOR VALUES OF AVERAGE q ACROSS THE CUTOUT (q_o).

COND-D-(7-1)46 GSL

$$\Delta q_{MAX} = -176\left(\frac{2(34.38)}{5.6+10}\right) = -776 \ \#/IN$$

COND (7-1) 46 GSR

$$\Delta q_{MAX} = 73\left(\frac{2(34.38)}{5.6+10}\right) = 763 \ \#/IN$$

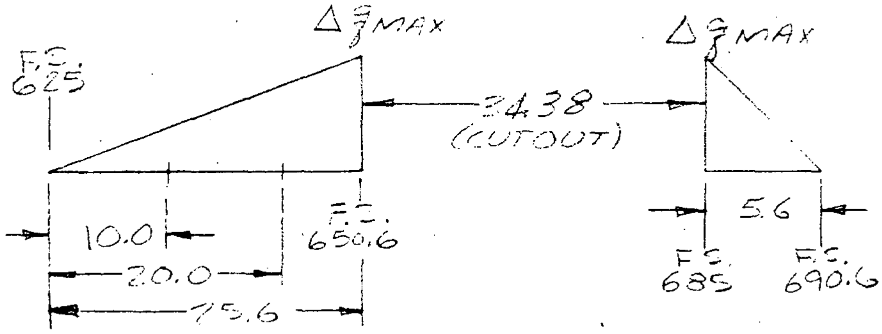
THE SHEAR FLOWS TABULATED BELOW ARE AVG. VALUES BETWEEN FRAMES. REF. [illegible] FOR PANEL DESIGNATION.

PANEL	COND. (7-1)46 GSL	COND. (7-1)46 GSR
	Δq_L	Δq_L
$E_1 - E_5$	−388	+381
$D_1 - D_5$	−388	+381

LOAD ANALYSIS (CONT.)

LONGITUDINAL SHEAR REDISTRIBUTION (CONT.)

N-1 SCANNER CUTOUT



REF. P [illegible] FOR VALUES OF AVERAGE q ACROSS THE CUTOUT (q_o).

COND. (7-1) 46G=L

$$\Delta q_{MAX} = -184\left(\frac{2(34.38)}{25.6+5.6}\right) = -306$$

COND. (7-1) 46G=L

$$\Delta q_{MAX} = 203\left(\frac{2(34.38)}{25.6+5.6}\right) = 447$$

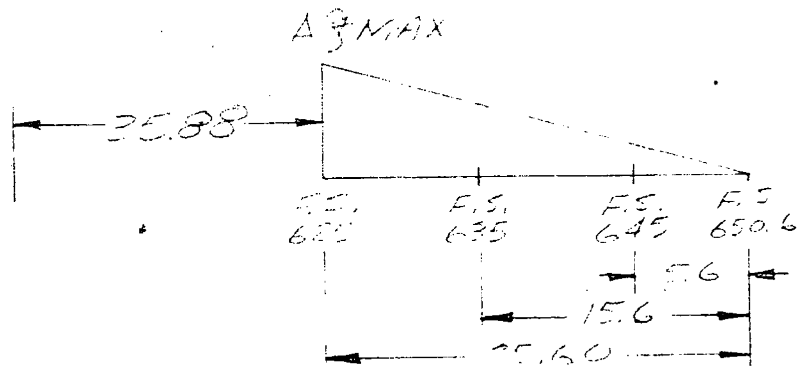
THE SHEAR FLOWS TABULATED BELOW ARE AVG. VALUES BETWEEN FRAMES. REF. P [illegible] FOR PANEL DESIGNATION.

PANEL	COND. (7-1) 46G=L	COND (7-1) 46G=R
	Δq_L	Δq_L
$D_1 - D_5$	-203	223
$M_1 - M_5$	-361	398
$M_6 - M_{10}$	-239	261
$M_{11} - M_{15}$	-79	87

LOAD ANALYSIS (CONT.)

LONGITUDINAL SHEAR REDISTRIBUTION (CONT.)

ENTRANCE HATCH



REF. P ___ FOR VALUES OF AVERAGE q ACROSS CUTOUT, (q_a).

COND (7-1) 46G:L

$$\Delta q_{MAX} = -184\left(\frac{35.88}{25.60}\right) = -258\ \#/IN$$

COND (7-1) 46G:R

$$\Delta q_{MAX} = 203\left(\frac{35.88}{25.60}\right) = 284\ \#/IN$$

THE SHEAR FLOWS TABULATED BELOW ARE AVG. VALUES BETWEEN FRAMES. REF. P ___ FOR PANEL DESIGNATION.

PANEL	COND. (7-1)46G:L Δq_L	COND. (7-1)46G:R Δq_R
$M_1 - M_5$	-28	31
$M_6 - M_{10}$	-104	117
$M_{11} - M_{15}$	-205	223

LOAD ANALYSIS (CONT.)

SHEAR FLOW DUE TO STRINGER LOAD DECAY

BASIC STRINGER LOADS

STR. NO.	COND (7-1) 46 GsL				
	F.S. 695	F.S. 764.4	F.S. 625	F.S. 650.6	F.S. 725
25R	-1507	-1323	-1685	-1620	-3757
26R	-1869	-1512	-2230	-2095	—
27	-1280	-1183	-1375	-1340	—
26L	-1382	-1164	-1600	-1520	—

REF P. 3.24 FOR LOADS AT F.S. 695 AND F.S. 764.4. LOADS AT F.S. 625, 650.6, AND 725 ARE INTERPOLATED USING LOADS AT F.S. 695 & 764.4 AS A GUIDE.

STR. NO.	COND (7-1) 46 GsR				
	F.S. 695	F.S. 764.4	F.S. 625	F.S. 650.6	F.S. 725
25R	-1726	-1281	-2175	-2015	-3975
26R	-2141	-1464	-2785	-2540	—
27	-1224	-1185	-1275	-1260	—
26L	-1104	-1203	-995	-1030	—

REF P.3.24 FOR LOADS AT F.S. 695 AND F.S. 764.4. LOADS AT F.S. 625, 650.6, AND 725 ARE INTERPOLATED USING LOADS AT F.S. 695 & 764.4 AS A GUIDE.

STRINGER LOAD DECAY

"C" ANTENNA CUTOUT

STR NO.	AFT SIDE			AFT SIDE		
	$P_{764.4}$	L	P/L	$P_{764.4}$	L	P/L
	COND (7-1) 46 GsL			COND (7-1) 46 GsR		
26R	-1512	14.6	-103	-1464	14.6	-100
27	-1183	29.6	∓40*	-1185	29.6	∓40*
26L	-1164	14.6	+80	-1203	14.6	+82

* THESE VALUES ARE TOTAL/STRINGER. IT IS ASSUMED THAT THE TOTAL IS DISTRIBUTED 1/2 TO EACH SIDE OF THE STRINGER.

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LOAD ANALYSIS (CONT.)

SHEAR FLOW DUE TO STRINGER LOAD DECAY (CONT.)

N-2 SCANNER CUTOUT (AFT SIDE)

STR. NO.	L	COND (7-1) 46 Gs L		COND (7-1) 46 Gs R	
		P_{725}	P/L	P_{725}	P/L
25R	10	-3751	-357	-3975	-397

N-1 SCANNER CUTOUT (FWD SIDE)

STR. NO.	COND (7-1) 46 Gs L			COND (7-1) 46 Gs R		
	$P_{650.6}$	L	P/L	$P_{650.6}$	L	P/L
25R	-1630	15.6	+104	-2015	15.6	+129
26R	-2095	25.6	+82	-2540	25.6	+99
27	-1340	25.6	-52	-1260	25.6	-49
26L	-1520	15.6	-98	-1030	15.6	-66

ENTRANCE HATCH CUTOUT (AFT SIDE)

STR. NO.	COND (7-1) 46 Gs L			COND (7-1) 46 Gs R		
	P_{625}	L	P/L	P_{625}	L	P/L
25R	-1685	15.6	-108	-2175	15.6	-139
26R	-2220	25.6	-87	-2785	25.6	-109
27	-1375	25.6	+54	-1275	25.6	+50
26L	-1600	15.6	+103	-995	15.6	+64

LOAD ANALYSIS (CONT)

TOTAL SHEAR FLOWS

THE SHEAR FLOWS SUMMARIZED ON THE FOLLOWING PAGES ARE FOR THE SHEAR REDISTRIBUTIONS SHOWN THUS FOR IN THE LOAD ANALYSIS.

NOMENCLATURE FOR THE ITEMS USED AND WHERE THE VALUES ARE FOUND IS AS FOLLOWS.

q_o = BASIC IBM SHEAR FLOW (REF. , P.3.26) q_o AS GIVEN IN REF. , P.3.26 IS FOR "FLANGE PANELS". FOR VALUES BETWEEN INDIVIDUAL STRINGERS INTERPOLATE FROM VALUES FOR THE FLANGES.

Δq_T = INCREMENT DUE TO TRANSVERSE REDISTRIBUTION. (REF. PP. THRU)

Δq_L = INCREMENT DUE TO LONGITUDINAL REDISTRIBUTION. (REF. PP. THRU)

Δq_D = INCREMENT DUE TO STRINGER LOAD DECAY (REF. PP THRU)

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LOAD ANALYSIS [illegible]

TOTAL SHEAR FLOWS (CONT.)

PANEL NO.	ZONE 17-L 26 SH L			ZONE 17-26 SH R		
	q_0	Δq_T	q_{TOTAL}	q_0	Δq_T	q_{TOTAL}
K1	-210	-133	-343	234	131	365
K2	-225	-133	-358	248	131	379
K3	-239	-133	-372	262	131	393
K4	-211	-111	-322	249	109	358
K5	-226	-111	-337	263	109	372
K6	-240	-111	-351	277	109	386
K7	-211	-88	-299	267	87	354
K8	-226	-88	-314	282	87	369
K9	-240	-88	-328	295	87	382
K10	-212	-65	-277	286	64	350
K [illegible]	-227	-65	-292	300	64	364
K [illegible]	[illegible]	-65	-306	314	64	378
K [illegible]	-214	-42	-256	294	41	335
K [illegible]	-229	-42	-271	308	41	349
K [illegible]	-243	-42	-285	322	41	363
K [illegible]	-216	-23	-239	303	22	325
K [illegible]	-231	-23	-254	317	22	339
K [illegible]	-245	-23	-268	331	22	353
K [illegible]	-216	-8	-224	324	7	331
K [illegible]	-231	-8	-239	338	7	345
K [illegible]	-245	-8	-253	352	7	359

L [illegible]

[illegible] FLOWS [illegible]

[illegible]	[illegible] 7-1263			COND. 7-1263R		
[illegible]	q_0	Δq_T	q_{T-A}	q_0	Δq_T	q_{TOTAL}
L 1	-225	-133	-358	206	131	337
L [illegible]	-240	-133	-373	220	131	351
L [illegible]	-254	-133	-387	234	131	365
L [illegible]	-236	-111	-347	210	109	319
L [illegible]	-251	-111	-362	224	109	333
L [illegible]	-265	-111	-376	238	109	347
L [illegible]	-241	-88	-335	215	87	302
L 8	-262	-88	-350	229	87	316
L [illegible]	-276	-88	-364	243	87	330
L [illegible]	-266	-65	-331	217	64	281
L [illegible]	-281	-65	-346	231	64	295
L [illegible]	-296	-65	-361	245	64	309
L [illegible]	-285	-42	-327	219	41	260
L [illegible]	-300	-42	-342	233	41	274
L [illegible]	-314	-42	-356	247	41	288
L [illegible]	-310 *	-23	-333	229 *	[illegible]	251
L [illegible]	-325 *	-23	-348	243 *	22	265
L [illegible]	-339 *	-23	-362	257 *	22	279
L [illegible]	-[illegible] *	-8	-343	239 *	7	246
L [illegible]	-350 *	-8	-358	253 *	7	260
L [illegible]	-364 *	-8	-372	267 *	7	274

* THESE SHEAR FLOWS ARE ESTIMATED

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LOAD ANALYSIS [illegible]

SKIN SHEAR FLOWS (CONT)

PANEL NO.	COND [illegible] 146 [illegible] q_o	Δq_T	q_{TOTAL}	COND [illegible] 4635R q_o	Δq_T	q_{TOTAL}
B1	-168	-127	-295	226	125	351
B2	-162	-127	-289	200	125	325
B3	-174	-127	-301	211	125	336
B4	-186	-127	-313	224	125	369
B5	-168	-107	-275	239	106	345
B6	-162	-107	-269	218	106	324
B7	-174	-107	-281	229	106	335
B8	-186	-107	-293	242	106	348
B9	-168	-86	-254	252	85	337
B10	-163	-86	-249	237	85	322
B[illegible]	-175	-86	-261	248	85	333
B[illegible]	-187	-86	-273	261	85	346
B[illegible]	-168	-66	-234	264	65	329
B[illegible]	-165	-66	-231	245	65	310
B15	-177	-66	-243	256	65	321
B[illegible]	-189	-66	-255	269	65	334
B[illegible]	-169	-48	-217	276	48	324
B[illegible]	-167	-48	-215	254	48	302
B[illegible]	-179	-48	-227	265	48	313
B[illegible]	-191	-48	-239	278	48	326
B[illegible]	-171	-34	-205	294	33	327
B22	-167	-34	-201	275	33	308
B23	-179	-34	-213	286	33	319
B24	-191	-34	-225	299	33	332
B25	-173	-20	-193	312	20	332
B26	-168	-20	-188	296	20	316
B27	-180	-20	-200	307	20	327
B28	-192	-20	-212	320	20	340
B29	-178*	-7	-185	337*	7	344
B30	-173*	-7	-180	321*	7	328
B31	-185*	-7	-192	332*	7	339
B32	-197*	-7	-204	345*	7	352

* THESE SHEAR FLOWS ARE ESTIMATED

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DATE ? ? 66	AFT FUSELAGE MODIFICATION	MODEL NO. SP-2H

LOAD ANALYSIS (CONT)

SKIN SHEAR FLOWS (CONT)

PANEL NO.	CONST (7-1465-L) q_0	Δq_T	q_{TOTAL}	CONST (7-1465R) q_0	Δq_T	q_{TOTAL}
C1	-205	-130	-335	170	123	293
C2	-176	-130	-306	157	123	280
C3	-188	-130	-318	168	123	291
C4	-200	-130	-330	181	123	304
C5	-218	-113	-331	169	107	276
C6	-187	-113	-300	161	107	268
C7	-199	-113	-312	172	107	279
C8	-211	-113	-324	185	107	292
C9	-232	-90	-322	168	88	256
C10	-198	-90	-288	166	88	254
C11	-210	-90	-300	177	88	265
C12	-222	-90	-312	190	88	278
C13	-243	-70	-313	170	68	238
C14	-217	-70	-287	168	68	236
C15	-229	-70	-299	179	68	247
C16	-241	-70	-311	192	68	260
C17	-255	-50	-305	171	49	220
C18	-236	-50	-286	170	49	219
C19	-248	-50	-298	181	49	230
C20	-260	-50	-310	194	49	243
C21	-280*	-33	-313	180*	33	213
C22	-261*	-33	-294	179*	33	212
C23	-273*	-33	-306	190*	33	223
C24	-285*	-33	-318	203*	33	236
C25	-305*	-20	-325	189*	19	208
C26	-286*	-20	-306	188*	19	207
C27	-298*	-20	-318	198*	19	216
C28	-310*	-20	-330	212*	19	231
C29	-330*	-6	-336	204*	7	211
C30	-311*	-6	-317	203*	7	210
C31	-323*	-6	-329	213*	7	220
C32	-335*	-6	-341	227*	7	234

* THESE SHEAR FLOWS ARE ESTIMATED.

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LOAD ANALYSIS (CONT)

TOTAL SHEAR FLOWS (CONT)

PANEL NO.	COND (7-1) 46 G5L			COND (7-1) 46 G5R		
	q_o	Δq_T	q_{TOTAL}	q_o	Δq_T	q_{TOTAL}
S1	-170	-146	-316	236	161	397
S2	-170	-146	-316	236	161	397
S3	-170	-146	-316	236	161	397
S4	-170	-146	-316	236	161	397
S5	-170	-120	-290	247	132	379
S6	-170	-120	-290	247	132	379
S7	-170	-120	-290	247	132	379
S8	-170	-120	-290	247	132	379
S9	-170	-94	-266	258	104	362
S10	-170	-94	-266	258	104	362
S11	-170	-94	-266	258	104	362
S12	-170	-94	-266	258	104	362
S13	-169	-71	-240	272	78	350
S14	-169	-71	-240	272	78	350
S15	-169	-71	-240	272	78	350
S16	-169	-71	-240	272	78	350
S17	-169	-47	-216	286	52	338
S18	-169	-47	-216	286	52	338
S19	-169	-47	-216	286	52	338
S20	-169	-47	-216	286	52	338
S21	-171	-28	-199	302	30	332
S22	-171	-28	-199	302	30	332
S23	-171	-28	-199	302	30	332
S24	-171	-28	-199	302	30	332
S25	-174	-9	-183	319	10	329
S26	-174	-9	-183	319	10	329
S27	-174	-9	-183	319	10	329
S28	-174	-9	-183	319	10	329

LOAD ANALYSIS (CONT)

TOTAL SHEAR FLOWS (CONT)

PANEL NO.	COND (7-D) 46 S=L q_0	Δq_T	q_{TOTAL}	COND (7-D) 46 S=R q_0	Δq_T	q_{TOTAL}
T 1	-217	-145	-362	175	160	335
T 2	-217	-145	-362	175	160	335
T 3	-217	-145	-362	175	160	335
T 4	-217	-145	-362	175	160	335
T 5	-231	-121	-352	171	133	304
T 6	-231	-121	-352	171	133	304
T 7	-231	-121	-352	171	133	304
T 8	-231	-121	-352	171	133	304
T 9	-246	-96	-342	168	106	274
T 10	-246	-96	-342	168	106	274
T 11	-246	-96	-342	168	106	274
T 12	-246	-96	-342	168	106	274
T 13	-254	-72	-326	169	79	248
T 14	-254	-72	-326	169	79	248
T 15	-254	-72	-326	169	79	248
T 16	-254	-72	-326	169	79	248
T 17	-263	-50	-313	171	55	226
T 18	-263	-50	-313	171	55	226
T 19	-263	-50	-313	171	55	226
T 20	-263	-50	-313	171	55	226
T 21	-288 *	-27	-315	180 *	30	210
T 22	-288 *	-27	-315	180 *	30	210
T 23	-288 *	-27	-315	180 *	30	210
T 24	-288 *	-27	-315	180 *	30	210
T 25	-313 *	-8	-321	189 *	10	199
T 26	-313 *	-8	-321	189 *	10	199
T 27	-313 *	-8	-321	189 *	10	199
T 28	-313 *	-8	-321	189 *	10	199

*THESE SHEAR FLOWS ARE ESTIMATED.

LOAD ANALYSIS (CONT.)

TOTAL SHEAR FLOWS (CONT.)

	COND (7-1) 46 G5 L				COND (7-1) 46 G5 R						
PANEL NO.	q_0	Δq_L	Δq_D	q_{TOTAL}	q_0	Δq_L	Δq_L	q_{TOTAL}			
A_1	-187	-285	-123	-595	281	281	-120	442			
A_2	-208	-285	-20	-513	259	281	-20	520			
A_3	-230	-285	+20	-495	237	281	+20	538			
A_4	-247	-285	+100	-432	220	281	+102	603			
A_5	-199	-47	-20	-266	293	46	-20	319			
A_6	-220	-47	-20	-287	271	46	-20	297			
A_7	-242	-47	+20	-269	249	46	+20	315			
A_8	-259	-47	+20	-286	232	46	+20	298			
A_9	-213	0	0	-213	307	0	0	307			
A_{10}	-234	0	0	-234	285	0	0	285			
A_{11}	-256	0	0	-256	263	0	0	263			
A_{12}	-273	0	0	-273	246	0	0	246			
E_1	-197	-383	-357	-942	222	+381	-397	206			
E_2	-197	-626	0	-823	207	616	0	823			
E_3	-200	-626	0	-826	198	616	0	814			
E_4	-204	-626	0	-830	190	616	0	806			
E_5	-208	-626	0	-834	191	616	0	807			

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7-14-66 AFT. FUSELAGE MOD. SP-2H

LOAD ANALYSIS (CONT.)

TOTAL SHEAR FLOWS (CONT.)

	COND (7-1) 46 G5 L				COND (7-1) 46 G5 R			
PANEL NO.	q_0	Δq_L	Δq_D	q_{TOTAL}	q_0	Δq_L	Δq_D	q_{TOTAL}
M_1	-173	-389	99	-463	224	429	119	772
M_2	-176	-389	-5	-570	212	429	-10	631
M_3	-183	-389	0	-572	203	429	0	632
M_4	-191	-389	+2	-578	195	429	+1	625
M_5	-204	-389	-96	-689	185	429	-65	549
M_6	-173	-343	-9	-525	224	378	-20	582
M_7	-176	-343	-5	-524	212	378	-10	580
M_8	-183	-343	0	-526	203	378	0	581
M_9	-191	-343	+2	-532	195	378	+1	574
M_{10}	-204	-343	+7	-540	185	378	-1	562
M_{11}	-173	-284	-113	-570	224	310	-149	385
M_{12}	-176	-284	-5	-465	212	310	-10	512
M_{13}	-183	-284	0	-467	203	310	0	513
M_{14}	-191	-284	+2	-473	195	310	+1	506
M_{15}	-204	-284	+105	-383	185	310	+65	560

LOAD ANALYSIS (CONT.)

TOTAL SHEAR FLOWS (CONT.)

	COND (7-1) .46 Gs L				COND (7-, .46 Gs R			
PANEL NO.	q_o	Δq_L	Δq_D	q_{TOTAL}	q_o	Δq_L	Δq_L	q_{TOTAL}
D_1	-173	-591	0	-764	224	604	0	828
D_2	-176	-591	0	-767	212	604	0	816
D_3	-183	-591	0	-774	203	604	0	807
D_4	-191	-591	0	-782	195	604	0	799
D_5	-204	-591	0	-795	185	604	0	789

LOAD ANALYSIS (CONT.)

FINAL LOADS IN BOUNDARY STRINGERS

STRINGER 24 R

FUS. STA.	COND (7-1)46GSL	COND. (7-1)46GSR
764.4	-1302	-1156
750	-*4377	*-520
730	-*8642	* 360
725	-9705	577
720	-8140	-1268
708	-4470	-5465
700	-2122	-8098
690.6	- 765	-11338
685	-10076	164
680	-8496	-1821
668	-4704	-6585
660	-3176	-9761
650.6	+ 858	-13572
647.8	- 250⊗	-12000⊗
640	-3950⊗	-7200⊗
630	-8500⊗	-1250⊗
625	-10750⊗	-1800⊗

$P_{764.4}$ = BASIC IBM LOAD (REF. , P3.24)

P_{708} = BASIC IBM LOAD (REF. , P3.24)
$= P_{STR24R} + P_{STR25R} + P_{STR26R}$

$P_{720} = P_{708} + 7\frac{q}{8}B_3 + 5\frac{q}{8}B_4$

$P_{725} = P_{708} + 7\frac{q}{8}B_3 + 10\frac{q}{8}B_4$

$P_{700} = P_{708} - 3\frac{q}{8}B_3 - 5\frac{q}{8}B_2$

$P_{690.6} = P_{708} - 3\frac{q}{8}B_3 - 10\frac{q}{8}B_2 - 4.6\frac{q}{8}B_1$

P_{668} = BASIC IBM LOAD (REF. , P3.24)
$= P_{STR24R} + P_{STR25R} + P_{STR26R}$

$P_{680} = P_{668} + 7\frac{q}{8}S_3 + 5\frac{q}{8}S_4$

$P_{685} = P_{668} + 7\frac{q}{8}S_3 + 10\frac{q}{8}S_4$

$P_{660} = P_{668} - 3\frac{q}{8}S_3 - 5\frac{q}{8}S_2$

$P_{650.6} = P_{668} - 3\frac{q}{8}S_3 - 10\frac{q}{8}S_2 - 4.6\frac{q}{8}S_1$

* LOADS AT THESE STATIONS ARE INTERPOLATED BETWEEN F.S. 725 & 764.4

⊗ LOADS AT THESE STATION ARE ESTIMATED.

LOAD ANALYSIS (CONT.)

FINAL LOADS IN BOUNDARY STRINGER'S (CONT.)

STRINGER 25R

FUS. STA.	COND. (7-1)466L	COND. (7-1)466SR
794	-855	-805
786.5	*-2880	* -90
771.7	*-6860	*+330
764.4	-8836	+1012
759.7	-7088	+174
750	-3550	-3568
740	+45	-7388
735	+760	-7113
730	*+890	*-4556
725	0	0

*LOADS AT THESE STATIONS ARE INTERPOLATED BETWEEN F.S. 764.4 + 794 AND F.S. 725 + 735.

$P_{771.7}$ = BASIC IBM LOAD (REF. P.3.25) (INTERPOLATED BETEEN F.S. 764.4 AND F.S. 808.5)

P_{750} = BASIC IBM LOAD (REF. P.3.25)
$= P_{STR25R} + P_{STR26R} + \frac{1}{2} P_{STR27}$

$P_{759.7} = P_{750} + 5 q k_2 + 4.7 q k_3$

$P_{764.4} = P_{750} + 5 q k_2 + 9.4 q k_3$

$P_{740} = P_{750} - 5 q k_2 - 5 q R_1$

$P_{735} = P_{750} - 5 q k_2 - 10 q R_1$

LOAD ANALYSIS (CONT)

FINAL LOADS IN BOUNDARY STRINGERS (CONT.)

STRINGER 25L

FUS. STA.	COND (7-1) 46GsL	COND (7-1) 46GsR
794	-760	-810
786.5	*+290	*-2650
771.7	*+2360	*-6320
764.4	+3378	-8135
759.7	457	-6420
750	-3025	-2960
740	-6680	+480
735	-8470	+2165
730	*-3450	*-3250
725	+1586	-8537
720	-64	-7017
708	-3940	-3460
700	-6424	-7187
690.6	-9428	+1502
685	+1906	-7065
680	+96	-7290
668	-4250	-3370
660	-7146	-690
650.6	-10549	+2459
647.8	-9600⊗	+1300⊗
640	-6700⊗	-2400⊗
630	-3000⊗	-6900⊗
625	-1200⊗	-9200⊗

*LOADS AT THESE STATIONS ARE INTERPOLATED BETWEEN F.S. 764.4 & 794 AND F.S. 725 & 735

⊗ LOADS AT THESE STATIONS ARE ESTIMATED.

P_{794} = BASIC IBM LOAD (REF. , P.3.24) (INTERPOLATE BETWEEN F.S. 764.4 AND F.S. 808.5)

P_{750} = BASIC IBM LOAD (REF. , P.3.24) $= P_{STR25L} + P_{STR26L} + \frac{1}{2} P_{STR27}$

$P_{759.7} = P_{750} - 5q_{L_2} - 4.7q_{L_3}$

$P_{764.4} = P_{750} - 5q_{L_2} - 9.4q_{L_3}$

$P_{740} = P_{750} + 5q_{L_2} + 5q_{L_1}$

P_{708} = BASIC IBM LOAD (REF. , P.3.24) $= P_{STR25L} + P_{STR26L} + P_{STR27}$

$P_{720} = P_{708} - 7q_{C_3} - 5q_{C_4}$

$P_{725} = P_{708} - 7q_{C_3} - 10q_{C_4}$

$P_{700} = P_{708} + 3q_{C_3} + 5q_{C_2}$

P_{668} = BASIC IBM LOAD (REF. , P.3.24) $= P_{STR25L} + P_{STR26L} + P_{STR27}$

$P_{680} = P_{668} - 7q_{T_3} - 5q_{T_4}$

$P_{685} = P_{668} - 7q_{T_3} - 10q_{T_4}$

$P_{660} = P_{668} + 3q_{T_3} + 5q_{T_2}$

$P_{650.6} = P_{668} + 3q_{T_3} + 10q_{T_2} + 4.4q_{T_1}$

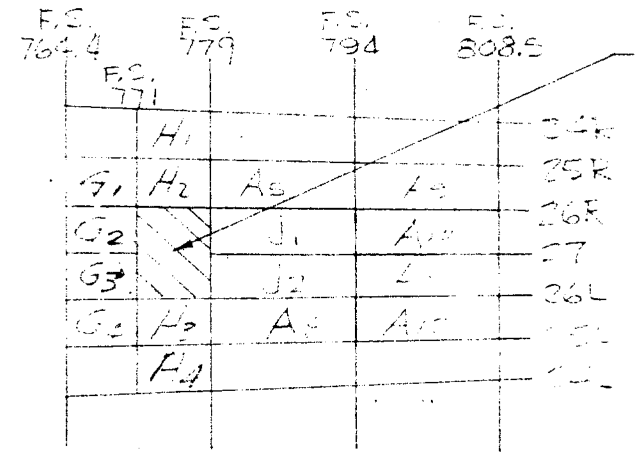
$P_{690.6} = P_{708} + 3q_{C_3} + 10q_{C_2} + 4.4q_{C_1}$

$P_{735} = P_{750} + 5q_{L_2} + 10q_{L_3}$

LOAD ANALYSIS (CONT.)

"F" CAMERA CUTOUT EFFECTS

THE "F" CAMERA CUTOUT EFFECTS THE STRINGER LOADS AND SHEAR FLOWS AS SHOWN BELOW.



q_o FOR CUTOUT IS TAKEN AS AVERAGE OF VALUES A_5 & A_8. (INCLUDE Σ Δq_T FROM "C" ANTENNA CUTOUT.)

"DETAIL "A"
REF. P.

SHEAR FLOW REDISTRIBUTION

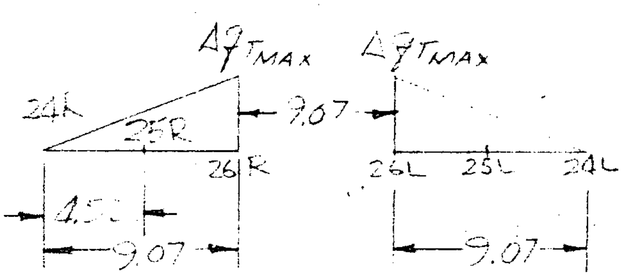
COND (7-1) 46 G₅L → **COND (7-1) 46 G_5L**

$$q_o = \frac{-513 - 495}{2} = -504 \ \#/IN$$

COND (7-1) 46 G_5R

$$q_o = \frac{520 + 538}{2} = 529 \ \#/IN$$

TRANSVERSE REDISTRIBUTION



$$\Delta q_T = \frac{9.07}{9.07}(-504) = -504 \ \#/IN$$ (7-1) 46 G_5L

$$\Delta q_T = \frac{9.07}{9.07}(529) = 529 \ \#/IN$$ (7-1) 46 G_5R

THE SHEAR FLOWS TABULATED BELOW ARE AVG. VALUES BETWEEN STRINGERS.

PANEL	COND. (7-1) 46 G_5L	COND. (7-1) 46 G_5R
	Δq_T	Δq_T
H_2 & H_3	-378	396
H_1 & H_4	-126	132

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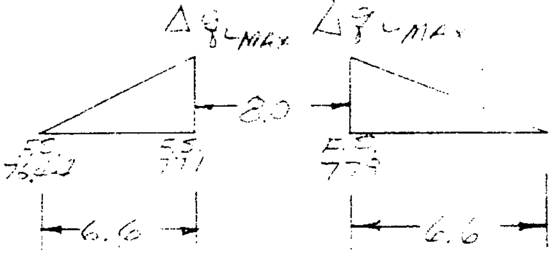
LOAD ANALYSIS (CONT.)

"P" CAMERA CUTOUT EFFECTS (CONT.)

LONGITUDINAL DISTRIBUTION



$\Delta q_{L_{MAX}} = \frac{8}{6.6}(-504) = -610$ #/IN
(7-1) 46 Gs L

$\Delta q_{L_{MAX}} = \frac{8}{6.6}(529) = 640$ #/IN
(7-1) 46 Gs R

THE SHEAR FLOWS TABULATED BELOW ARE AVG. VALUES BETWEEN STRINGERS.

PANEL	COND. (7-1) 46 Gs L	COND. (7-1) 46 Gs R
	Δq_L	Δq_L
G_2 & G_3	-305	320
J_1 & J_2	-305 *	320 *

* AVG. OVER 6.5" LENGTH AFT OF F.S. 779.

STRINGER LOAD DECAY

THE BASIC STRINGER LOAD IN S-27 AT F.S. 779 IS

P_{779} = -986# (SAME FOR BOTH CONDITIONS)

STR. NO.	AFT SIDE OF CUTOUT		
	P_{779}	L	P/L
	APPLIES TO BOTH CONDITIONS		
27	-986	15	766 *

* THIS VALUE IS TOTAL/STRINGER. IT IS ASSUMED THAT THE TOTAL IS DISTRIBUTED 1/2 TO EACH SIDE OF THE STRINGER.

E8C-50199-11

LOAD ANALYSIS (CONT.)
TOTAL SHEAR FLOWS (CONT.)

	COND (7-1) 46 Gs L				COND (7-1) 46 Gs R			
PANEL NO.	q_0	Δq_L	Δq_D	q_{TOTAL}	q_0	Δq_L	Δq_D	q_{TOTAL}
G_1	SAME AS A_1 SHOWN ON PAGE							
G_2	-513	-305	0	-818	520	320	0	840
G_3	-495	-305	0	-800	538	320	0	858
G_4	SAME AS A_4 SHOWN ON PAGE							
	q_0 IS EQUAL TO q_{TOTAL} ON PAGE							
J_1	-287	-305	-33	-625	297	320	-33	584
J_2	-269	-305	+33	-541	315	320	+33	668
A_5	SAME AS VALUES SHOWN ON PAGE							
A_8	✓	✓	✓		✓	✓	✓	✓
A_9	✓	✓	✓		✓	✓	✓	✓
A_{10}	✓	✓	✓		✓	✓	✓	✓
A_{11}	✓	✓	✓		✓	✓	✓	✓
A_{12}	✓	✓	✓		✓	✓	✓	✓

STUTH

7-14-66

LTV ELECTROSYSTEMS, INC.

AFT. FUSELAGE MOD.

SP-2H

08432.01.06

3.5.31

LOAD ANALYSIS (CONT.)

TOTAL SHEAR FLOWS (CONT.)

PANEL NO.	COND (7-1) 46.5 SL			COND (7-1) 46.5 SR		
	q_0	Δq_T	q_{TOTAL}	q_0	Δq_T	q_{TOTAL}
H_1	-172⊗	-126	-298	303 ⊗	132	435
H_2	-266*	-378	-644	319 *	396	715
H_3	-286*	-378	-664	298 *	396	694
H_4	-268⊗	-126	-394	207 ⊗	132	339
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						

* q_0 VALUE IS EQUAL TO q_{TOTAL} VALUE ON PAGE

⊗ q_0 VALUE IS BASIC (BM) SHEAR, REF. P.3.26 VALUES SHOWN ARE INTERPOLATED AT F.S. 775.

LOAD ANALYSIS (CONT.)

FINAL LOADS IN BOUNDARY STRINGERS (CONT)

STRINGER 26R

FUS. STA.	COND. (7-1)46GsL	COND. (7-1)46GsR
764.4	0	0
767.7	+375*	-2315*
771	+751	-4630
775	-1835	-1770
779	-4401	+1090
786.5	-2660*	+112*
794	-920	-865

* LOADS AT THESE STATIONS ARE INTERPOLATED BETWEEN ADJACENT STATIONS.

P_{794} = BASIC IBM LOAD (REF. , P.3.24) (INTERPOLATE BETWEEN F.S. 764.4 AND F.S. 808.5)

P_{775} = BASIC IBM LOAD (REF. , P.3.24) $= P_{STR26R} + \frac{1}{2} P_{STR27}$

$P_{771} = P_{775} - 4(\frac{q}{8} H_2)$

$P_{779} = P_{779} + 4(\frac{q}{8} H_2)$.

STRINGER 26L

FUS STA	COND (7-1)46GsL	COND. (7-1)46GsR
764.4	0	0
767.7	-2098*	+598*
771	-4196	+1196
775	-1540	-1580
779	+1116	-4356
786.5	+178*	-2583*
794	-760	-810

P_{794} = BASIC IBM LOAD (REF. , P.3.24) (INTERPOLATE BETWEEN F.S. 764.4 AND F.S. 808.5)

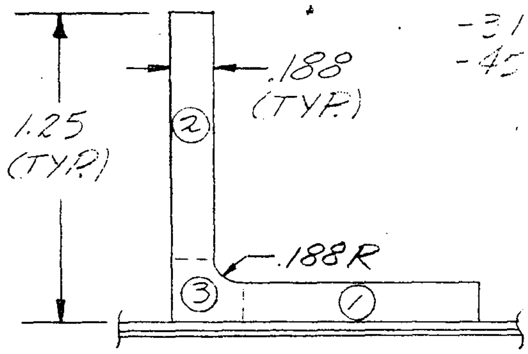
P_{775} = BASIC IBM LOAD (REF. , P.3.24) $= P_{STR26L} + \frac{1}{2} P_{STR27}$

$P_{771} = P_{775} + 4(\frac{q}{8} H_3)$

$P_{779} = P_{779} - 4(\frac{q}{8} H_3)$

* LOADS AT THESE STATIONS ARE INTERPOLATED BETWEEN ADJACENT STATIONS.

ALLOWABLE STRINGER LOADS-AFT FUSELAGE



-29 STR (25L FROM F.S. 650-764.4)
-31 STR (24R FROM F.S. 640-764.4)
-45 STR (35R FROM F.S. 725-764.4)

FROM CURVE ON F

$\frac{b_e}{t_e} = 14.3$ @ $F_{cc} = 67{,}300$ #/IN²

$b_{e.040} = 14.3(.04 \times 1.0) = .572$ IN

$b_{e.032} = 14.3(.032 \times 1.0) = .457$ IN

$A_{E_{SKIN+DBLR}} = .572(.04) + .457(.032) = .0375$ IN²

$A_{E_{SKIN\ ONLY}} = .572(.04) = .0229$ IN²

.040, 7075-T6 SKIN
*.032, 7075-T6 DBLR.

*DOUBLER ONLY BETWEEN CUTOUTS.

CRIPPLING PREDICTION

MATERIAL 7075-T6 SECTION 843..-03120-.., -31, -45 STRS.

① NO.	② b	③ R	$\frac{R}{t_{MIN}}$	④ t	⑤ $\frac{b}{t}$ (2/4)	⑥ K* × Fcc REF S.M.45,P25	⑦ A	⑧ Pcc ⑥⑦
①	.874			.188	4.65	64,800	.1642	10640
②	.874			.188	4.65	64,800	.1642	10640
③		.188	1.0			74,800	.1130	8450
					Σ =	67,300	.4414	29,730
			SKIN + DOUBLER			61,300	.0375	2,620
						Σ =	.4789	32,350
			SKIN ONLY			67,300	.0229	1,540
						Σ =	.4643	31,270
Σ								

* K = 90% WHEN USING "B" VALUES.

PREPARED BY		PAGE NO
STUTH	LTV [illegible]	3.5.35
CHECKED BY		REPORT NO
		13432.01.06
DATE		MODEL NO
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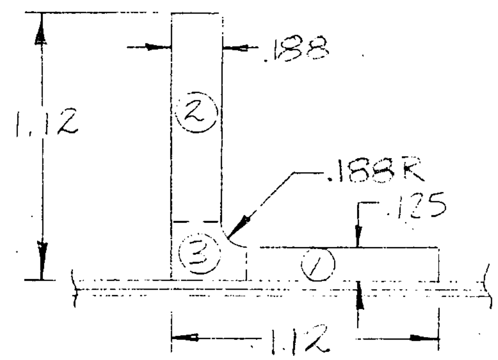
ALLOWABLE STRINGER LOADS-AFT FUSELAGE

-1 STR. (25L @ 767.7)
-2 STR. (25R & 26R @ 767.7)



.032, 2024-T3 SKIN
.050, 2024-T3 DBLR.

FROM CURVE ON [illegible].

$\frac{b_e}{t_e} = 14.6$ @ 66,300 #/IN²

$b_{e.032} = 14.6(.032 \times 1.0) = .467$ IN

$b_{e.050} = 14.6(.050 \times 1.0) = .730$ IN

$A_{e_{SKIN+DBLR}} = .467(.032) + .73(.05) = .0514$ IN²

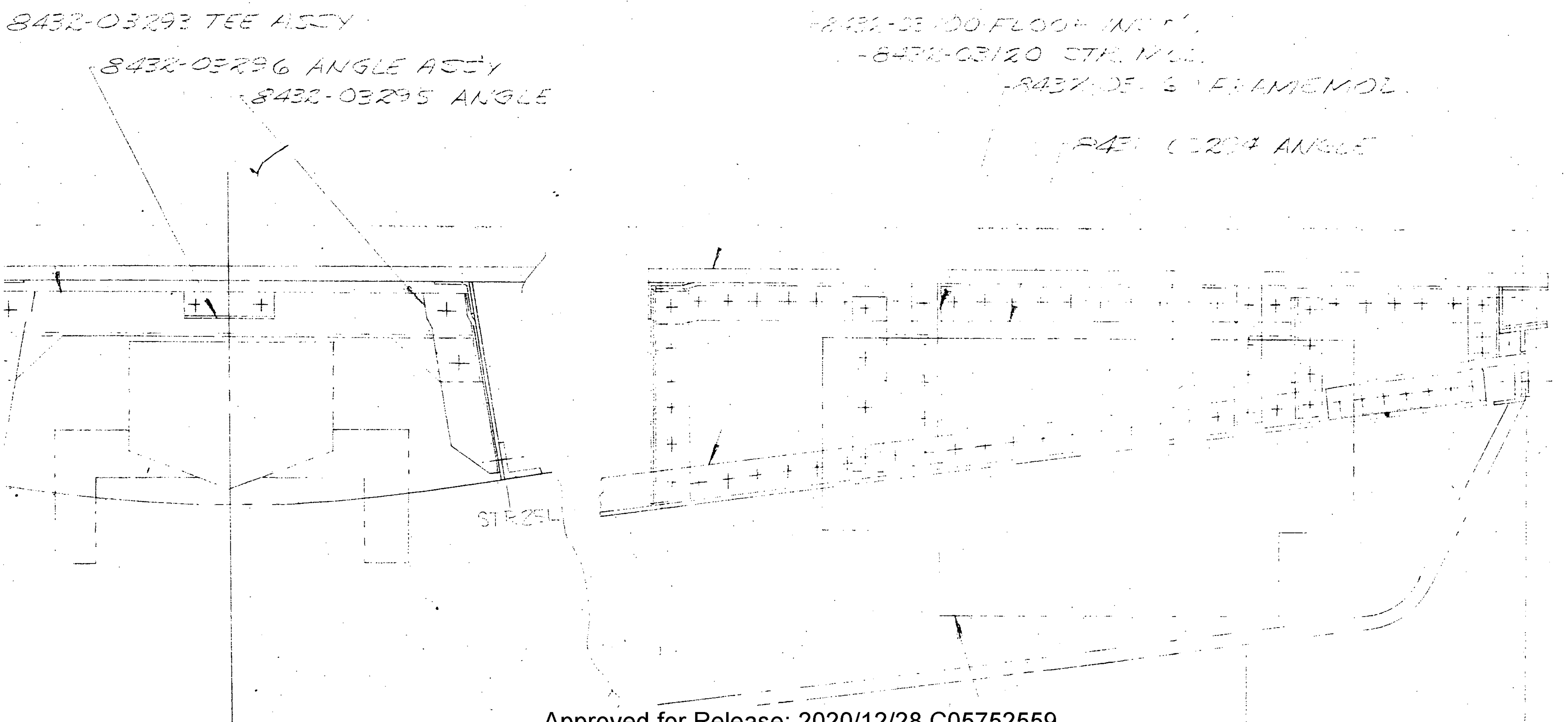
CRIPPLING PREDICTION

MATERIAL 7075-T6 | SECTION [illegible] STRG.

①	②	③		④	⑤	⑥	⑦	⑧
NO.	b	R	R/tMIN	t	b/t ②/④	K* × Fcc REF S.M.45,125	A	Pcc ⑥⑦
①	.744			.125	5.95	58,600	.0930	5,450
②	.807			.188	4.29	66,100	.1518	10,020
③		.188	1.5			74,700	.0900	6,720
					Σ =	66,300	.3348	22,190
			SKIN+DBLR			66,300	.0514	3,405
Σ							.3862	25,595

* K = 90% WHEN USING "B" VALUES.

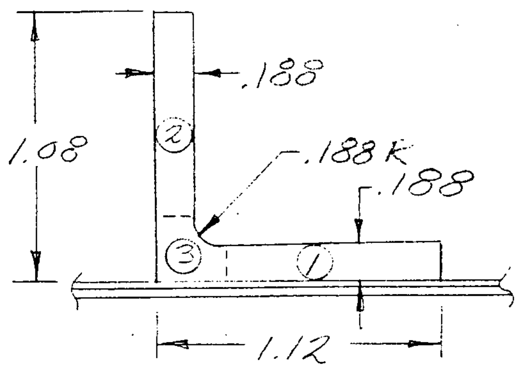
PREPARED BY	LTV ELECTROSYSTEMS, INC	PAGE NO.
STUTH	P. O. BOX 1056 - GREENVILLE, TEXAS 75402	3.6.2
CHECKED BY		REPORT NO. G8432.01.06
DATE 7-26-66	"C" ANTENNA INSTALLATION	MODEL NO.



Approved for Release: 2020/12/28 C05752559

PREPARED BY STUTH	LTV	PAGE NO 3.5.36
CHECKED BY		REPORT NO. 98432.01.06
DATE 7-18-66	AFT FUSELAGE MODIFICATION	MODEL NO SP-2H

ALLOWABLE STRINGER LOADS-AFT FUSELAGE



.032, 2024-T3 SKIN
.050, 2024-T3 DBLR

-1 STR (25L @ F.S. 775)
-2 STR (25R & 26R @ F.S. 775)

FROM CURVE ON P.

$\frac{b_e}{t_e} = 13.8$ @ 69,900 #/IN²

$b_{e,032} = 13.8(.032 \times 1.0) = .442$ IN.

$b_{e,050} = 13.8(.050 \times 1.0) = .690$ IN

$A_{E_{SKIN \& DBLR}} = .442(.032) + .69(.05) = .0486$ IN²

CRIPPLING PREDICTION

MATERIAL 7075-T6 | SECTION 8432-03125-1 & -2 STRS.

① NO.	② b	③ R	R/t MIN	④ t	⑤ b/t ②/④	⑥ K* × Fcc REF S.M.45,P.25	⑦ A	⑧ Pcc ⑥⑦
①	.744			.188	3.96	67,200	.1400	9,400
②	.704			.188	3.74	68,500	.1324	9,080
③		.188	1.0			74,700	.1130	8,440
					Σ=	69,900	.3854	26,920
			SKIN & DBLR			69,900	.0486	3,390
Σ							.4340	30,310

* K = 90 %

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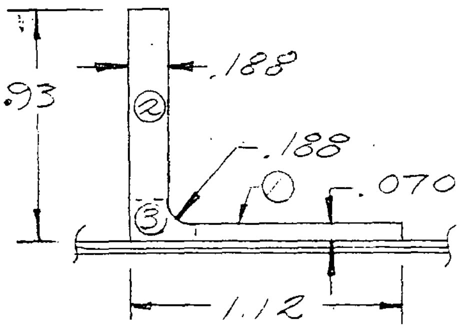
DATE 7-18-66	AFT FUSELAGE MODIFICATION	MODEL NO. SP-2H

ALLOWABLE STRINGER LOADS-AFT FUSELAGE

-1 STR (25L @ F.S. 786.5)
-2 STR (25R & 26R @ F.S. 786.5)



.032, 2024-T3 SKIN
.050, 2024-T3 DBLR

FROM CURVE ON F_c

$\frac{b_e}{t_e} = 16.1$ @ 59,600 #/IN²

$b_{e,032} = 16.1(.032 \times 1) = .515$ IN

$b_{e,050} = 16.1(.050 \times 1) = .805$ IN

$A_{E\,SKIN\,\&\,DBLR} = .515(.032) + .805(.05) = .0568$ IN

CRIPPLING PREDICTION

MATERIAL: 7075-T6 | SECTION: 8.15-03125-1 & -2 STR.

①	②	③		④	⑤	⑥	⑦	⑧
NO.	b	R	$\frac{R}{t_{MIN}}$	t	$\frac{b}{t}$	$K^* \times F_{cc}$	A	P_{cc}
					②/④	REF S.M.45, P.25		⑥⑦
①	.744			.070	10.62	20,100	.0521	1,048
②	.672			.188	3.57	68,900	.1264	8,720
③		.188	2.69			72,100	.0693	5,000
					Σ =	59,600	.2478	14,768
			SKIN & DBLR		=	59,600	.0568	3,390
Σ							.3046	18,158

* K = 90% WHEN USING "[illegible]"

PREPARED BY: STUTH	LTV ELECTROSYSTEMS INC	PAGE NO: 3.5.38
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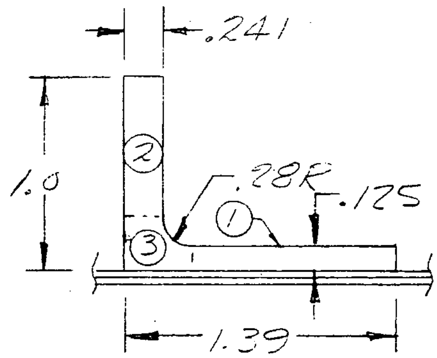
ALLOWABLE STRINGER LOADS-AFT FUSELAGE

STR. 25L @ F.S. 647.8



FROM CURVE ON P.

$\frac{be}{te} = 18.2$ @ 52,900 #/IN²

$be_{.032} = 18.2(.032 \times 1) = .582$ IN

$be_{.04} = 18.2(.04 \times 1) = .728$ IN

$A_{E_{SKIN \& DBLR}} = .582(.032) + .728(.04) = .0477 \text{ IN}^2$

.032, 7075-T6 DBLR
.040, 7075-T6 SKIN

CRIPPLING PREDICTION

MATERIAL: 7075-T6 | SECTION: LAC DWG. 446378 (L.S. 1780)

① NO.	② b	③ R	③ $\frac{R}{t_{MIN}}$	④ t	⑤ $\frac{b}{t}$ ②/④	⑥ $K^* \times F_{cc}$ REF S.M.45	⑦ A	⑧ P_{cc} ⑥⑦
①	.869			.125	6.95	49,500	.1087	5,380
②	.595			.241	2.47	71,500	.1434	10,260
③		.28	2.24			72,600	.1495	10,880
					Σ=	52,900	.5016	26,520
				SKIN & DBLR.		52,900	.0477	2,525
Σ							.5493	29,045

* K = 90% [illegible]

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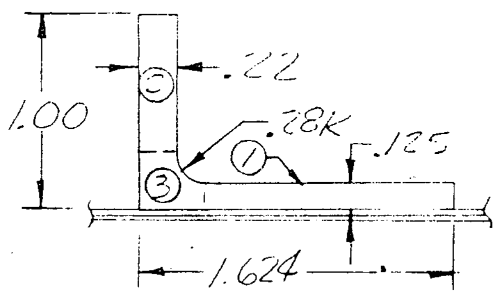
ALLOWABLE STRINGER LOADS-AFT FUSELAGE



STK. 24R @ F.S. 630

FROM CURVE ON P.

$\frac{b_e}{t_e} = 16.9$ @ 56,750 #/IN²

$b_{e.032} = 16.9(.032 \times 1) = .541$ IN

$b_{e.040} = 16.9(.04 \times 1) = .675$ IN

$A_{SKIN \& DBLR} = .541(.032) + .675(.04) = .0443$ IN²

.040, 2024-T3 SKIN
.032, 2024-T3 DBLR

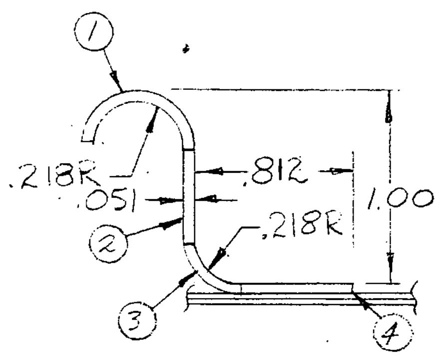
CRIPPLING PREDICTION

MATERIAL 7075-T6 | SECTION: LAC DWG 446542 (L.S. 1780)

①	②	③		④	⑤	⑥	⑦	⑧
NO.	b	R	$\frac{R}{t_{MIN}}$	t	$\frac{b}{t}$	$K^* \times F_{cc}$	A	P_{cc}
					② ÷ ④	REF S.M.45, P.25		⑥⑦
①	1.124			.125	9.0	26,500	.1408	3,730
②	.595			.22	2.7	71,200	.1312	9,340
③		.28	2.24			72,600	.1495	10,880
					Σ =	56,750	.4215	23,950
		SKIN & DBLR =				56,750	.0443	2,510
Σ							.4658	26,460

* K = 90% WHEN USING "B" VALUES

ALLOWABLE STRINGER LOADS-AFT FUSELAGE



.050, 2024-T3 DBLR
.032, 2024-T3 SKIN

STR 27 @ F.S. 786.5

FROM CURVE ON P.

$\frac{b_e}{t_e} = 22.7$ @ 42,800 #/IN²

$b_{e.032} = 22.7(.032 \times 1) = .72$ IN

$b_{e.050} = 22.7(.05 \times 1) = 1.13$ IN

$A_{E\,SKIN \,\&\, DBLR} = .72(.032) + 1.13(.05) =$ IN²

CRIPPLING PREDICTION

MATERIAL 7075-T6 | SECTION: LAC. DWG. (LS 157-15)

①	②	③		④	⑤	⑥	⑦	⑧
NO.	b	R	R/t_MIN	t	b/t	K* × Fcc	A	Pcc
					②/④	REF S.M.45		⑥⑦
①		.243	4.77			36900	.0391	1444
②	.513			.051	10.07	63000	.0261	1645
③		.253	4.77			66200	.0196	1300
④	.594			.051	11.66	17500	.0303	541
					Σ=	42800	.1151	4930
			SKIN & DBLR =			42800	.0797	3420
Σ							.1948	8350

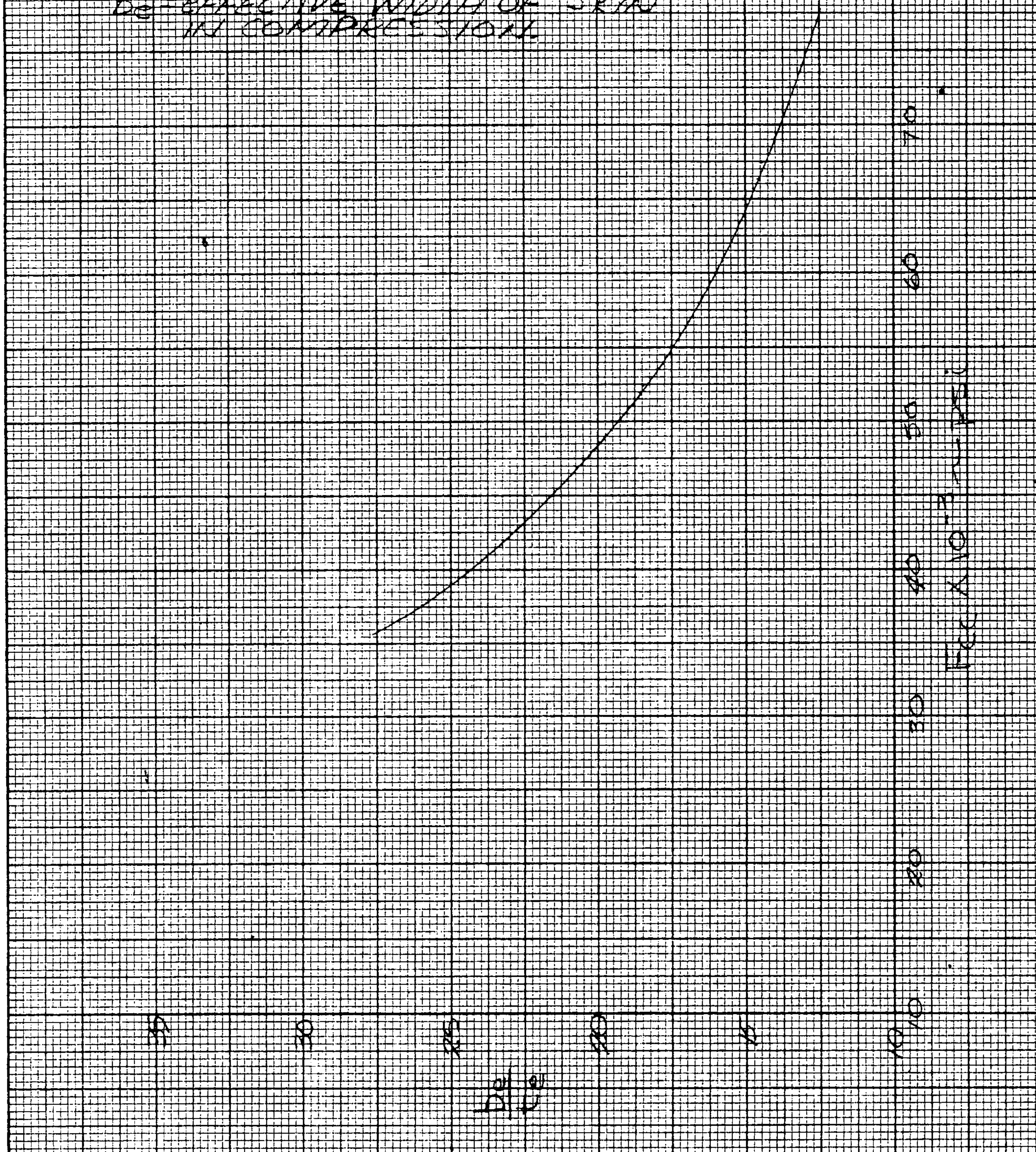
* K = 90%

Prepared by: STUTH	LTV ELECTROSYSTEMS, INC.	Page No. 3.5.41
Checked by:		Report No. 38432.01.06
Date: 7-19-66	AFT FUSELAGE MODIFICATION	Model No. SP-2H

ALLOWABLE STRINGER LOADS-AFT FUSELAGE

THIS CURVE IS PLOTTED FROM DATA TAKEN FROM REF. , P7.

be-EFFECTIVE WIDTH OF SKIN IN COMPRESSION



E8-50028-12

COMBINED COMPRESSION-SHEAR ANALYSIS OF STRINGER-SKIN COMBINATIONS

1	FUSELAGE STATION		630	647.8	775	767.7	775	786.5	786.5	
2	CRITICAL STRINGER		24R	24R	25R	26R	26R	26R	27	
3	CRITICAL CONDITION		(7-1)46G$_5$L	(7-1)46G$_5$R	(7-1)46G$_5$L	(7-1)46G$_5$R	(7-1)46G$_5$R	(7-1)46G$_5$L	(7-1)46G$_5$R	
4	AREA CRITICAL STR.	P.	.4215	.4414	.3854	.3348	.3854	.2478	.1151	
5	AREA CRITICAL STR.+SKIN		.4658	.4789	.4340	.3862	.4340	.3046	.1948	
6	STRINGER LOAD	P.	-8500	-12,000	-5,970	-2315	-1770	-2660	890	
7	ULT. STRINGER ALLOW.	P.	26,460	32,350	30,310	25,595	30,310	18,158	8350	
8	q_{MAX}	P.	-570	772	-644	840	715	-625	668	
9	STRINGER SPACING		4.95	4.75	4.55	4.75	4.55	4.35	4.35	
10	WEB THICKNESS	SKIN DBLR	.040 .032	.040 .032	.032 .050	.032 .050	.032 .050	.032 .050	.032 .050	
11	$A_{STR}/A_{WEB(STR)}$	(4)/(9)(10)	1.18	1.29	1.03	.90	1.03	.695	.322	
12	RING AREA		.288	.288	.215	.215	.215	.132	.132	
13	RING SPACING	P.	10	5.6	8	6.6	8	15	15	
14	$A_{RING}/A_{WEB(RING)}$	(12)/(9)(13)	.40	.714	.328	.397	.328	.1074	.1074	
15	K_{MIN}	P.	.832	.90	.782	.831	.782	.525	.525	
16	$q_{ALLOW} = K_{MIN}(q \text{ FOR } K=1)$	REF. P.	1164	1262	1298	1380	1298	871	871	
17	R_C	(6)/(7)	.321	.371	.197	.091	.059	.146	.107	
18	R_S	(8)/(16)	.49	.612	.496	.608	.551	.718	.767	
19	PANEL M.S. USING $R_S^2+R_C^2=1$	REF. S.M. 70 FIG. 3	+.71	+.40	+.86	+.64	+.80	+.36	+.29	
20										

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CHECKED BY:		REPORT NUMBER: C8432.01.06
DATE: 7-20-66	AFT FUSELAGE MODIFICATION	MODEL: SP-2H

COMBINED COMPRESSION-SHEAR ANALYSIS OF STRINGER-SKIN COMBINATIONS

1	FUSELAGE STATION		647.8	730	652.8					
2	CRITICAL STRINGER		25L	25L	24R					
3	CRITICAL CONDITION		(7-1)46GsL	(7-1)46GsL	(7-1)46GsR					
4	AREA CRITICAL STR.	P.	.5016	.4414	.4414					
5	AREA CRITICAL STR.+SKIN		.5493	.4789	.4643					
6	STRINGER LOAD	P.	-9600	-3450	12,700					
7	ULT. STRINGER ALLOW.	P.	29,052	32,350	31,270					
8	q_{MAX}	P.	-689	-834	397					
9	STRINGER SPACING		5.50	4.62	4.72					
10	WEB THICKNESS	SKIN DBLR.	.040 .032	.040 .032	.040 —					
11	$A_{STR}/A_{WEB(STR)}$	(4)/(9)(10)	1.26	1.33	2.34					
12	RING AREA		.2054	.2054	.2054					
13	RING SPACING	P.	5.6	10	4.4					
14	$A_{RING}/A_{WEB(RING)}$	(12)/(9)(13)	.508	.251	1.17					
15	K_{MIN}	P.	.882	.714	1.0					
16	$q_{ALLOW.}K_{MIN}$ (q FOR K=1)	REF. P.	1236	1000	790					
17	R_C	(6)/(7)	.33	.107	.406					
18	R_S	(8)/(16)	.558	.834	.503					
19	PANEL M.S.	REF. S.M. 70 FIG.	+.54	+.19	+.54					
20										

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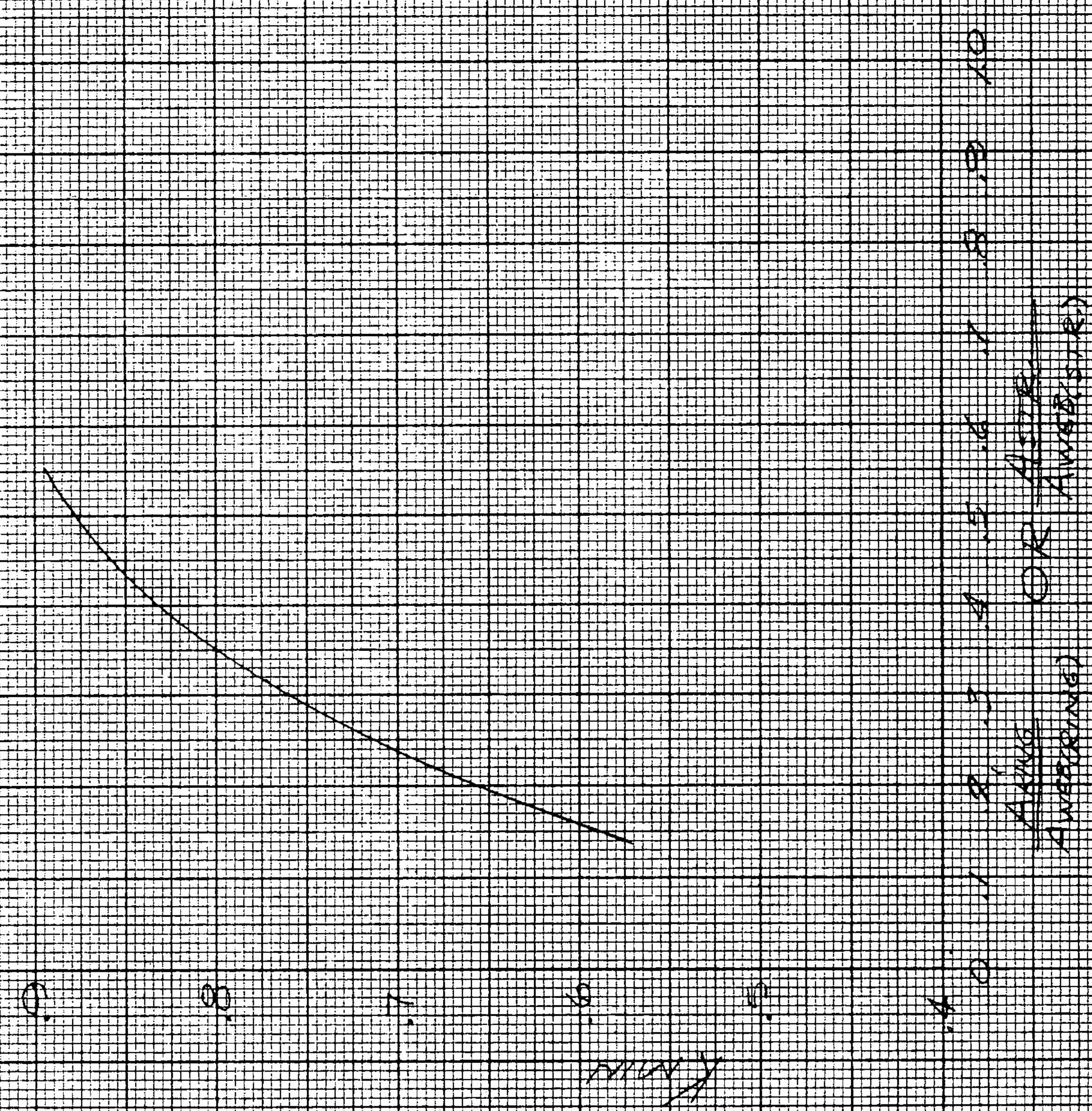
Date: 7-20-66	AFT FUSELAGE MODIFICATION	Model No. SP2H

COMBINED COMPRESSION-SHEAR ANALYSIS OF STRINGER-SKIN COMBINATIONS (CONT)

K-TENSION FIELD WEB CORRECTION FACTOR



FRC-50199-11

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DATE 7-66

LTV ELECTROSYSTEMS, INC
P. O. BOX 1056 GREENVILLE, TEXAS 75402

AFT FUSELAGE MODIFICATION

LONGITUDINAL SKIN ATTACHMENT MARGINS

PAGE NO. 3.5.45

REPORT NO. 38432.01.06

MODEL NO. SP-2H

1	FUSELAGE STATION		652.8	730	730	759.7
2	CRITICAL STR. NO.		24R	25R	24R	25R
3	JOINT DESCRIPTION, TYPE, SIZE AND SPACING OF RIVETS	DWG. 8432-03800	.04 LAP ON STR. AD-5 RIVET @.77 SPACING	.04+.032 LAP ON STR. AD-6 @ .73 SPACING	.04+.032 LAP ON STR. AD-6 @ .73 SPACING	.04 LAP ON STR. AD-5 @ .71 SPACING
4	CRITICAL CONDITION		(1-1)46GsR	(1-1)46GsR	(1-1)46GsL	(7-1)46GsL
5	STR. AXIAL LOAD		12700	-4556	-8642	-7088
6	q_{MAX}		397	942	942	-372
7	WEB THICKNESS		.04	.04+.032	.04+.032	.04
8	STR + SKIN TEN. AREA (GROSS)		.5534	.6354	.6304	.5124
9	STR + SKIN EFF COMP. AREA		—	—	—	—
10	STRINGER SPACING.		5.6	5.38	5.25	3.60
11	SHEAR STRESS (f_s)	(6) ÷ (7)	9930	13080	13080	9320
12	GROSS AREA AXIAL STRESS	(5) ÷ (8)	23000	7180	13720	13720
13	GROSS AREA COMP. STRESS (f_c) / SHEAR STRESS (f_s)	(12) / (11)	2.32	.549	1.049	1.47
14	BUCKLING STRESS RATIO (k_s)	P.	.297	.697	.533	.525
15	CRITICAL SHEAR STRESS (F_{SCR}) TEN. & COMP. EFFECTS INCLUDED	P.	743	3081	2452	3150
16	$F_{SCR} \div f_s$	(15) ÷ (11)	.075	.236	.187	.338
17	DIAGONAL TENS. FACTOR (K)	P.	.845	.670	.715	.60
18	$q_{DT} = K q_{MAX}$	(17)(6)	335	631	674	223
19	TEN. q_b = (7)(5) ÷ (8); COMP. q_b = (7)(5) ÷ (9)		—	—	—	—
20	$q_N = q_b + q_{DT}$	(18) + (19)	335	631	674	223
21	$q_R = \sqrt{q^2 + q_N^2}$	$((6)^2 + (20)^2)^{\frac{1}{2}}$	519	1134	1159	434
22	MIN. SHEAR OR BRG. ALLOW. PER RIVET	REF. P.	574	862	862	574
23	MIN. SHEAR OR BRG. ALLOW. PER INCH		746	1181	1181	746
24	ATTACHMENT M.S.	(23) ÷ (21) −1	+.44	+.04	+.02	+.72

LTV ELECTROSYSTEMS, INC
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PREPARED BY STOTH
CHECKED BY
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MODEL NO. 5P-2H

AFT FUSELAGE MODIFICATION

LONGITUDINAL SKIN ATTACHMENT MARGINS

1	FUSELAGE STATION		786.5	767.7	786.5	730
2	CRITICAL STR. NO.		26R	27	27	25L
3	JOINT DESCRIPTION, TYPE, SIZE AND SPACING OF RIVETS	DWG 8432 -03800	.032+.05 LAP ON STR. AD-6 @ 1.0 SPACING	.032+.05 LAP ON STR. 3/16 HI-SHEAR @1.08 SPACING	.032+.05 LAP ON STR. AD-6 @ 1.0 SPACING	.04+.032 LAP ON STR. AD-6 @ .72 SPACING
4	CRITICAL CONDITION		(7-1)46GsL	(7-1)46GsK	(7-1)46GsR	(7-1)46GsL
5	[illegible] AXIAL LOAD		-2660	0	-493	-3450
6	q_{MAX}		-625	858	668	-834
7	WEB THICKNESS		.032+.05	.032+.05	.032+.05	.04+.032
8	STR + SKIN TEN. AREA (GROSS)		.4633	.3306	.3306	.6304
9	STR + SKIN EFF. COMP. AREA		—	—	—	—
10	STRINGER SPACING		5.25	5.25	5.25	5.25
11	SHEAR STRESS (f_s)	(6) ÷ (7)	7630	10,480	8140	11,600
12	GROSS AREA AXIAL STRESS	(5) ÷ (8)	5750	0	1,492	5,480
13	GROSS AREA COMP. STRESS (f_c) / SHEAR STRESS (f_s)	(12) / (11)	.753	0	.183	.472
14	BUCKLING STRESS RATIO (K_s)	P.	.615	1.0	.885	.733
15	CRITICAL SHEAR STRESS (F_{scr}) TEN. & COMP. EFFECTS INCLUDED	P.	3,900	6,400	5,660	3,370
16	$F_{scr} \div f_s$	(15) ÷ (11)	.511	.61	.696	.28
17	DIAGONAL TENS. FACTOR (K)	P.	.50	.446	.395	.64
18	$q_{DT} = K q_{MAX}$	(17)(6)	-312	383	264	533
19	TEN. q_b = (7)(5) ÷ (8); COMP q_b = (7)(5) ÷ (9)		—	—	—	—
20	$q_N = q_b + q_{DT}$	(18) + (19)	-312	383	264	533
21	$q_R = \sqrt{q^2 + q_N^2}$	$((6)^2 + (20)^2)^{\frac{1}{2}}$	699	940	718	990
22	MIN. SHEAR OR BRG. ALLOW. PER RIVET	REF. P.	862	1252	837	862
23	MIN. SHEAR OR BRG. ALLOW. PER INCH		862	1160	837	1198
24	ATTACHMENT M.S.	(23) ÷ (21) -1	+.23	+.23	+.16	+.21

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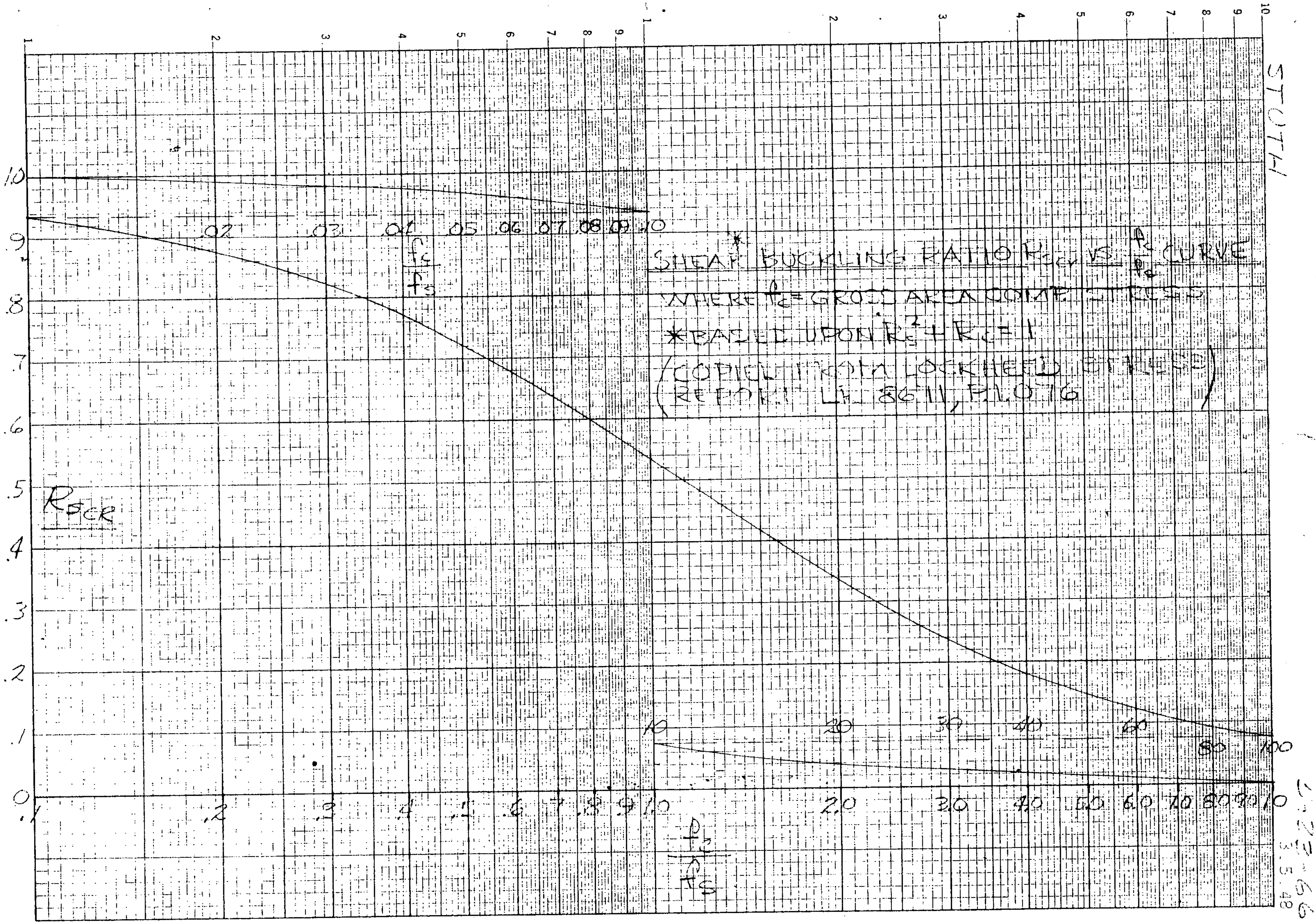
DATE 7- -66	AFT FUSELAGE MODIFICATION	MODEL NO. SP-2H

TRANSVERSE SKIN ATTACHMENT MARGINS

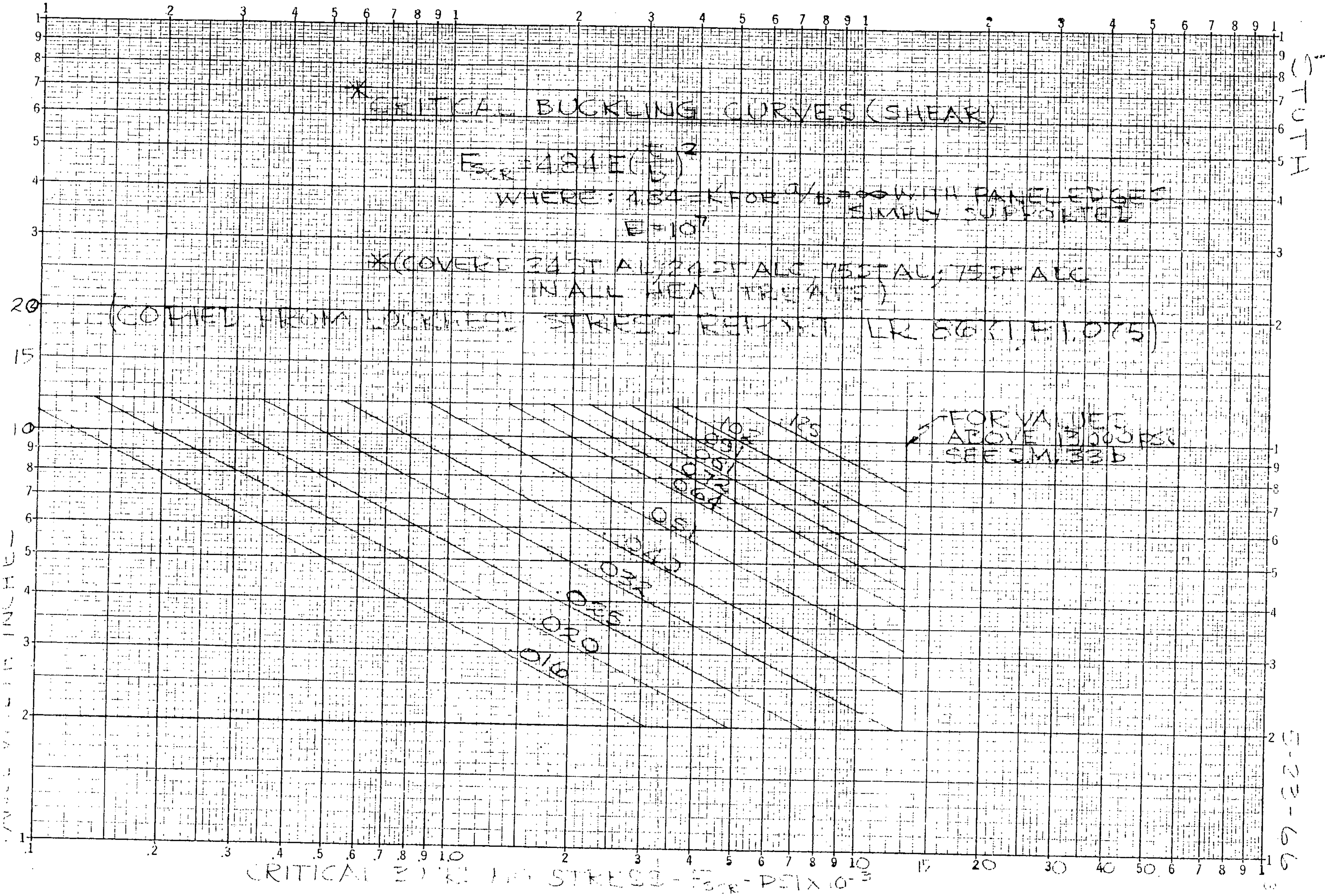
1	FUSELAGE STATION		650.6	[illegible]	690.6	771
2	CRITICAL STR. NO.		24K	24K	24R	26R
3	JOINT DESCRIPTION, TYPE, SIZE AND SPACING OF RIVETS	DWG. 8432 -03800	.04+.032 LAP ON FRAME 3/16 HI-SHEAR @.94 SPACING	.04+.032 LAP ON FRAME 3/16 HI SHEAR @1.16 SPACING	.04+.032 LAP ON FLAME AD-6 @ .80 SPACING	.032+.05 LAP ON FRAME 3/16 HI-SHEAR @1.14 SPACING
4	CRITICAL CONDITION		(1-1)46GsK	(1-1)46GsK	(1-1)46GsR	(1-1)46GsR
5	STR. AXIAL LOAD		-13,572	-10100	-11338	-4650
6	q_{MAX}		772	772	323	840
7	WEB THICKNESS		.04+.032	.04+.032	.04+.032	.032+.050
8	STR. + SKIN TEN. AREA (GROSS)		.6392	.6392	.6214	.601
9	STR. + SKIN EFF. COMP. AREA		.4789	.4789	.4789	.4340
10	STRINGER SPACING		5.25	5.25	5.0	5.25
11	SHEAR STRESS (f_s)	[illegible]	10720	10720	11500	10250
12	GROSS AREA AXIAL STRESS	(5) ÷ (8)	[illegible]	15800	18270	7730
13	GROSS AREA COMP. STRESS (f_c) / SHEAR STRESS (f_s)	(12) / (11)	1.98	1.47	1.59	.755
14	BUCKLING STRESS RATIO (K_s)	P.	.337	.423	.40	.615
15	CRITICAL SHEAR STRESS (F_{SCR}) TEN. + COMP. EFFECTS INCLUDED	P.	1,550	1,946	2,040	3,930
16	$F_{SCR} \div f_s$	(15) ÷ (11)	.144	.181	.177	.383
17	DIAGONAL TENS. FACTOR (K)	P.	.755	.72	.725	.57
18	$q_{DT} = K q_{MAX}$	(17)(6)	583	561	600	479
19	TEN. q_b = (7)(5) ÷ (8); COMP. q_b = (7)(5) ÷ (9)		—	-1518	—	—
20	$q_N = q_b + q_{DT}$	(18) + (19)	583	-957	600	479
21	$q_R = \sqrt{q^2 + q_N^2}$	$((6)^2 + (20)^2)^{\frac{1}{2}}$	968	1230	1044	968
22	MIN. SHEAR OR BRG. ALLOW. PER RIVET	REF. P.	1770	1770	862	1998
23	MIN. SHEAR OR BRG. ALLOW. PER INCH	[illegible]	1882	1526	1078	1754
24	ATTACHMENT M.S.	(23) ÷ (21) -1	+.94	+.24	+.03	+.81

EBC-50199-11

K+E SEMI-LOGARITHMIC 2 CYCLES X 70 DIVISIONS KEUFFEL & ESSER CO.



K+E LOGARITHMIC 2 X 3 CYCLES KEUFFEL & ESSER CO. MADE IN U.S.A.



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Date: 5-23-66		Model No. P2V-7

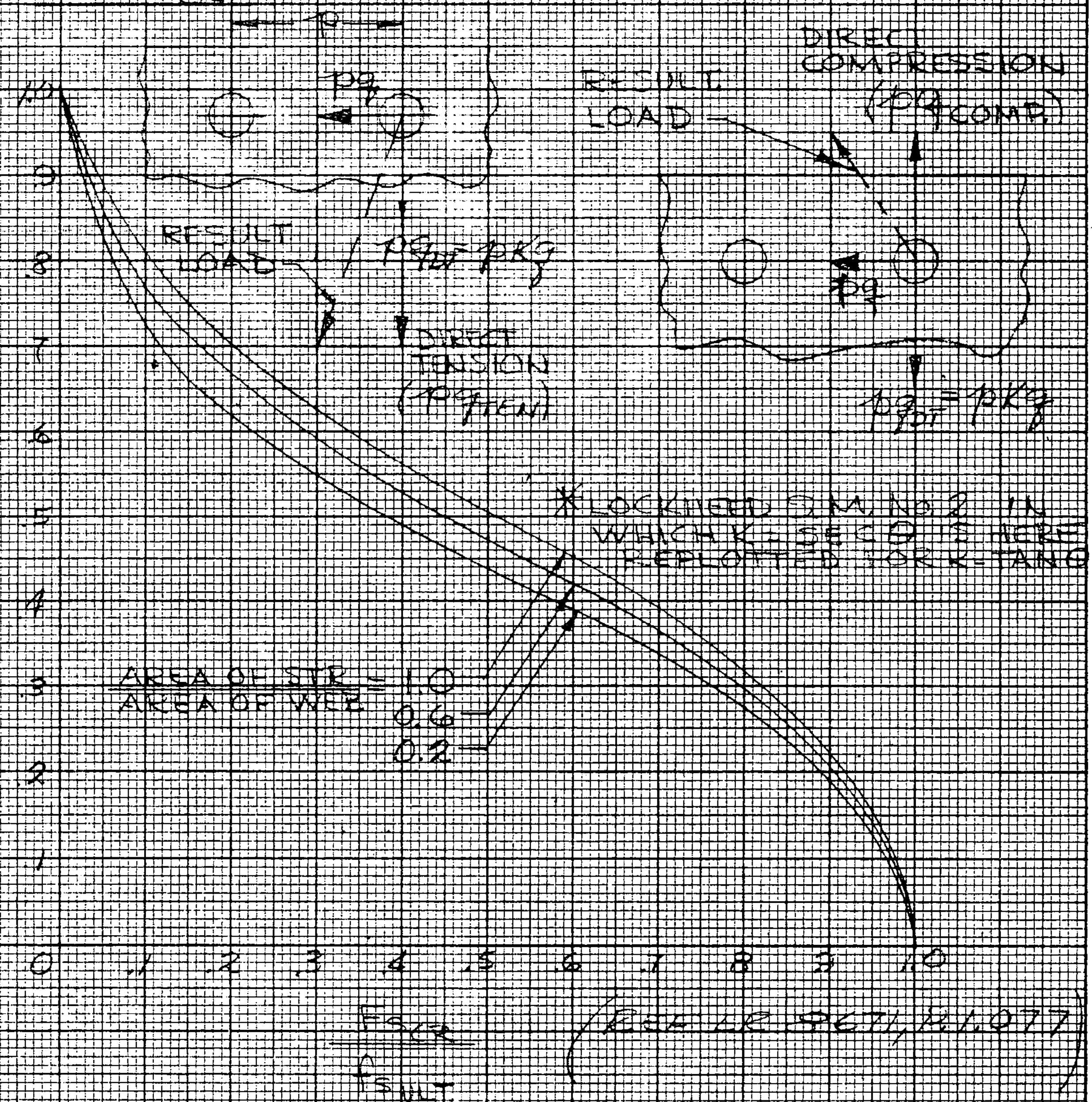
* TENSION FIELD FACTOR K VS $\frac{F_{SCR}}{f_{S_{ULT}}}$ CURVES

(WHERE DIAGONAL TENSION SHEAR FLOW $q_{DT} = Kq$)

TO INCLUDE THE EFFECT OF DIRECT TENSION LET $F_{SCR} = F_{SCR}$ (FROM S.M.33b) + .20 $f_{t_{ULT}}$ (REF. PG. 0.20)

TO INCLUDE THE EFFECT OF DIRECT COMP. LET $F_{SCR} = F_{SCR}$ (FROM S.M.33b OR PG. 0.24) X R_{SCR} (FROM P.G. 27) (REF. PG. 0.21)

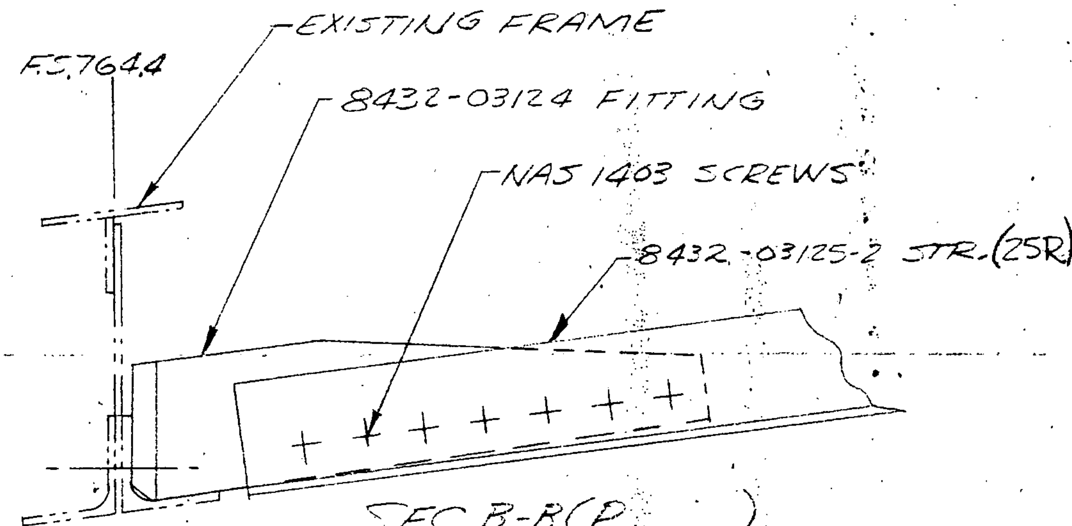
SPLICE RIVET RESULTANT LOADS INCLUDING DIRECT TENSION AND COMPRESSION EFFECT ON F_{SCR}



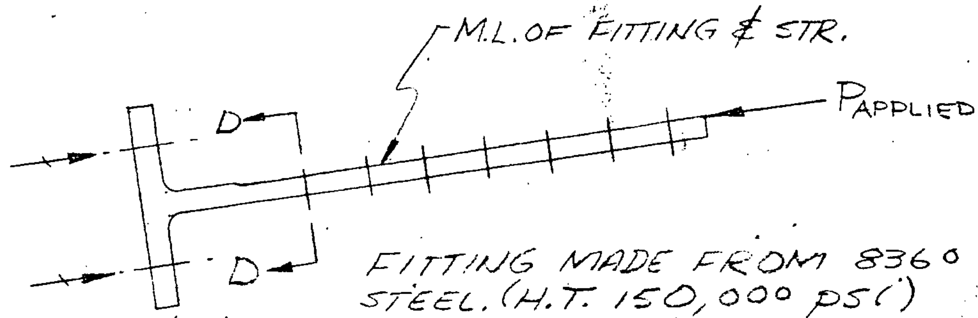
ANALYSIS OF STRINGER SPLICES

F.S. 764.4 SPLICES

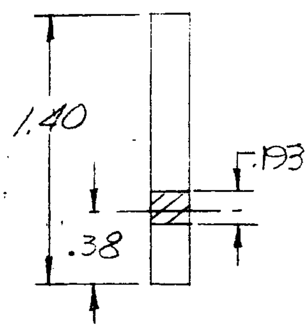
THE STRINGERS ARE SPLICED AT FUSELAGE STATION 764.4 SINCE THIS IS A PRODUCTION JOINT. TEE TYPE FITTING ARE INSTALLED ON EACH SIDE OF THE BULKHEAD TO TRANSFER STRINGER AXIAL LOADS. THESE FITTINGS ARE SIMILAR TO THOSE NORMALLY USED BY LOCKHEED.



SEC B-B (P.)



FITTING MADE FROM 8360 STEEL. (H.T. 150,000 psi)
F_{tu} = 150,000 psi
F_{cy} = 145,000 psi



THE METHOD USED IN DETERMINING THE ALLOWABLE COMPRESSION LOAD OF THE FITTING IS FOUND IN REF. PAGES 2.09 AND 2.10.

SEC D-D

ANALYSIS OF STRINGER SPLICES (CONT.)

F.S. 764.4 SPLICES (CONT.)

ALLOW. DIRECT LOAD = 145,000 (1.40 x .22) = 44,600#

ALLOW. MOMENT = (222,000) $\frac{1.4 (.22)^2}{6}$ = 2,500 IN#

WHERE: 222,000 = $\frac{MC}{I}$ (REF. MEMO 53 FOR K = 1.5)

ECCENTRICITY = $\frac{.22}{2}$ = .11 IN

ALLOW. P_C = $\frac{44600}{1 + \frac{44600 (.11)}{2500}}$ = 15,050 #

APPLIED P_C = 8836 x 1.15 = 10,160 #
(1) (2)

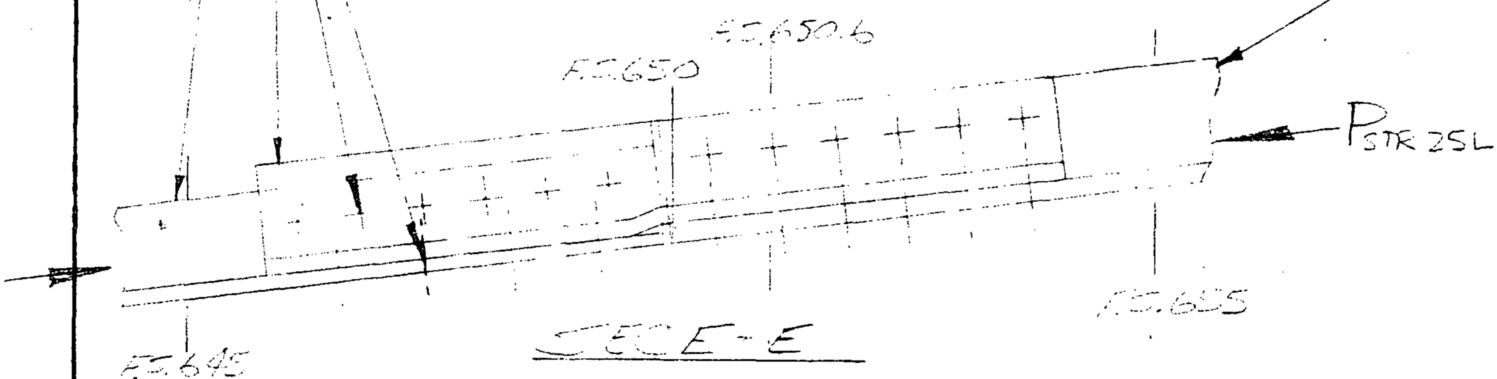
COLUMN M.S. = $\frac{15050}{10160}$ − 1 = +.48

FASTENERS NOT CRITICAL

(1) [illegible] CHK.
(2) [illegible] FITTING FACTOR LTV POLICY

STRINGER 25L SPLICE

- LAC 2N 446378 STRINGER [illegible] (FOR CLOSE SECTION)
- 8432-0310-1 SPLICE (.190 THICK, 7075-T6)
- NAS [illegible]-6 HI-SHEAR RIVETS (12 PLACES)
- 8432-0300-2 STRINGER (.188 THICK, 7075-T6)
- NAS [illegible]-6 HI-SHEAR RIVETS (10 PLACES)



SEC E-E

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ANALYSIS OF STRINGER SPLICES (CONT.)

STRINGER 22L SPLICE (CONT.)

$P_{STRING} = -10,549^{\#}$ (REF.)

CHECK OF FASTENERS FOR LOAD TRANSFER BETWEEN FS. 645 AND FS. 650.

$P_{ALLOW} = 6(1820) + 4(2620)$

= 21,400#

SHEAR M.S. = $\frac{21400}{10549} - 1 = \underline{+1.03}$

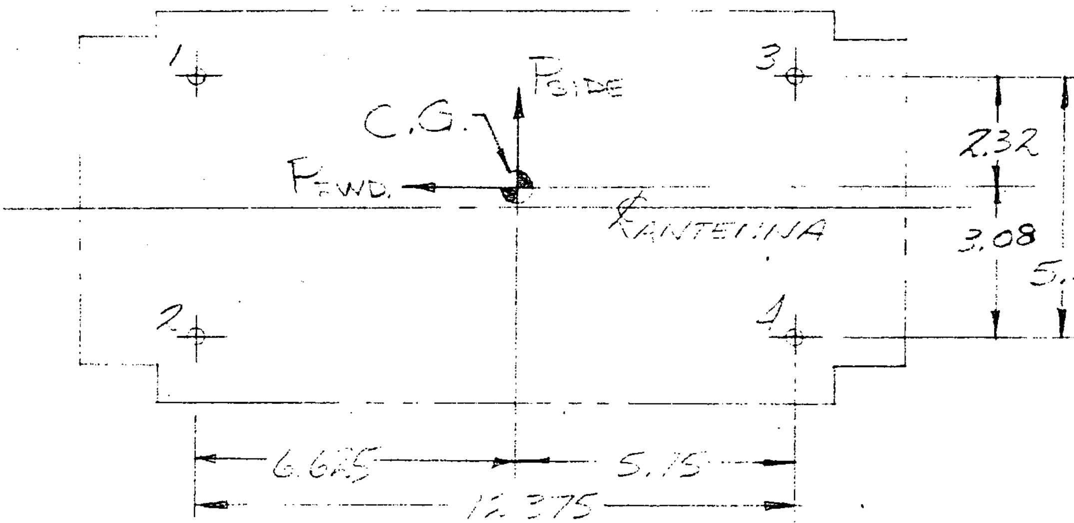
3 REF. , P. 1.5.4 (BEND 116 NOT CRITICAL)
2 REF. A, 4 NAS 525-6 HI-SHEARS
1 REF. A, 6 NAS 525-5 HI-SHEARS

LTV ELECTROSYSTEMS, INC.

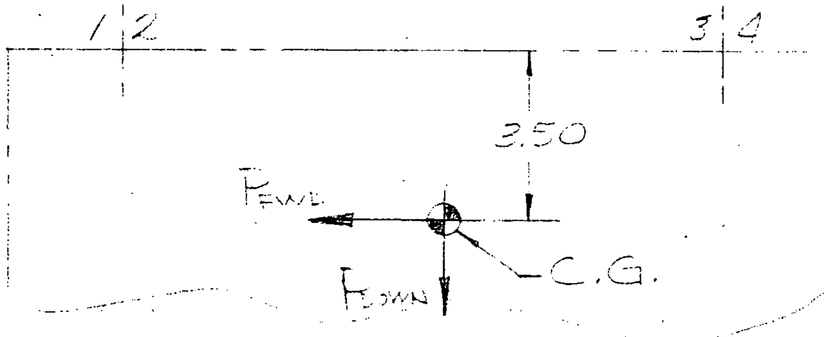
Approved for Release: 2020/12/28 C05752559

ANTENNA LOADS

WEIGHT OF ANTENNA IS 24 POUNDS



PLAN VIEW



SIDE VIEW

$P_{FWD} = 3.0$ G's $(24^{\#}) = 72^{\#}$ — LOAD COND. 1

$P_{DOWN} = 5.0$ G's $(24) = 120^{\#}$ — LOAD COND. 2

$P_{DOWN} = 120^{\#} \pm P_{SIDE} = 24^{\#}$ — LOAD COND. 3

$P_{DOWN} = 120^{\#} \pm P_{FWD} = 24^{\#}$ — LOAD COND. 4

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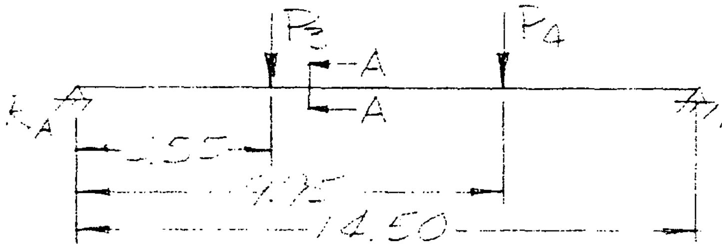
DATE 7-26-66	ANTENNA INSTALLATION	MODEL NO. JP-2H

BENDING ANALYSIS OF THE 8432-03293-1 TEE ASSY

LOAD CONDITION NO. 4 PRODUCES THE MOST CRITICAL LOADS ON THE TEE ASSY.



$F_{DOWN} = 120^{\#}$ ▷1

$F_{FWD} = 24^{\#}$ ▷1

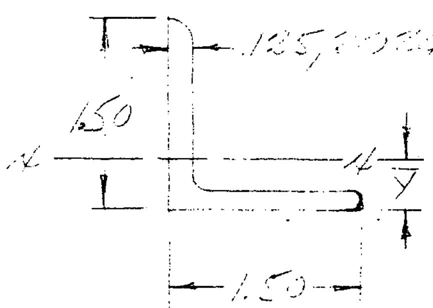
$$P_3 = 120\left(\frac{6.625}{12.375}\right)\left(\frac{3.08}{5.4}\right) + 24\left(\frac{3.5}{12.375}\right)\left(\frac{3.08}{5.4}\right) = 40.6^{\#}$$ ▷1

$$P_4 = 120\left(\frac{6.625}{12.375}\right)\left(\frac{2.32}{5.4}\right) + 24\left(\frac{3.5}{12.375}\right)\left(\frac{2.32}{5.4}\right) = 30.5^{\#}$$ ▷1

$$R_B = \frac{40.6(4.55) + 30.5(9.75)}{14.5} = 33.5^{\#}$$

$$R_A = 37.6^{\#}$$

$$M_{max} = 4.55(37.6) = 171\ IN^{\#}$$



SEC A-A

$I_{N} = .0741\ IN^4$

$\bar{Y} = .409\ IN;\ C = 1.091\ IN$

$$f_b = \frac{1.091(171)}{.0741} = 2{,}520\ psi$$

$F_c = 35{,}500\ psi$ ▷2

$$\text{BUCKLING } M.S. = \frac{35500}{2520} - 1 = \underline{LARGE}$$

NO FURTHER ANALYSIS WILL BE SHOWN FOR THE 2 ANTENNA INSTL. PRELIMINARY ANALYSIS INDICATES THAT LARGE MARGINS OF SAFETY EXIST ON ALL COMPONENTS AND FASTENERS.

▷2 REF. ... WHEN K = .4 AND b/t = 1.091/.125 = 8.75

▷1 REFER TO ... FOR LOADS & DIMENSIONS.

E8C-50199-11

[illegible] INSTALLATION

[illegible]

The two [illegible] scanners are installed [illegible] of the [illegible] page [illegible]. The scanners are shock [illegible] to achieve [illegible] attached to the [illegible] scanners.

Design [illegible] for [illegible].

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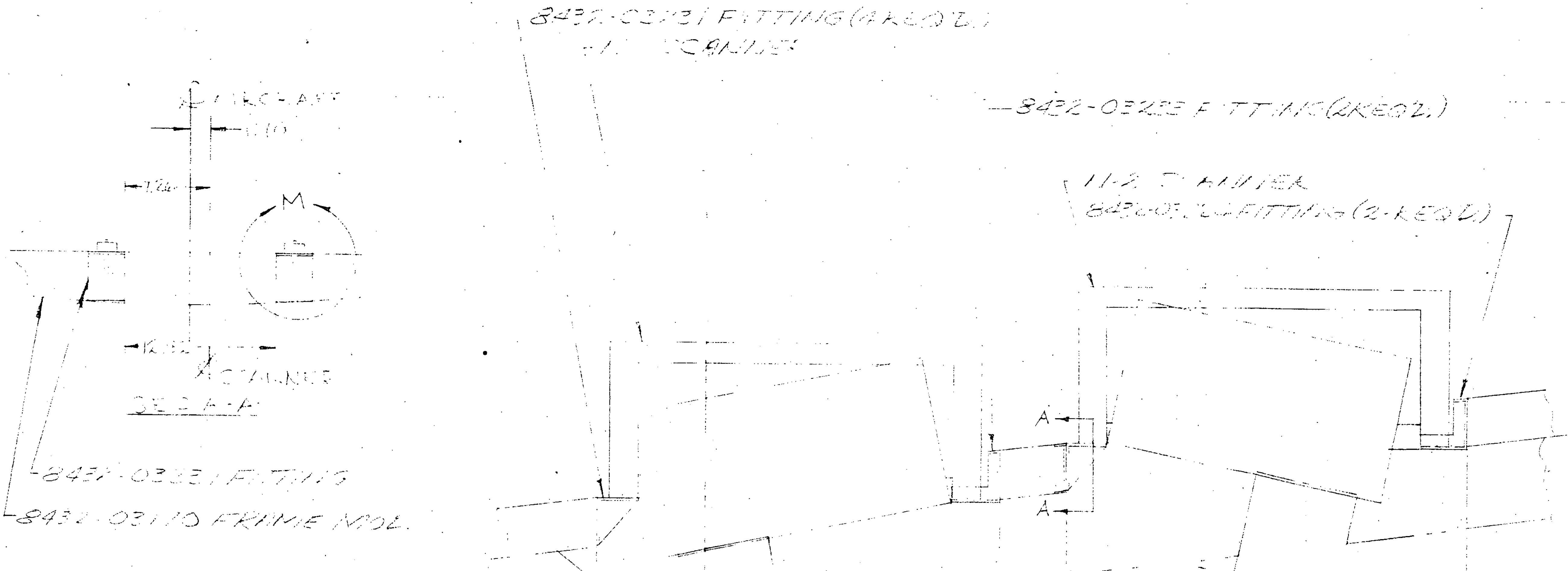
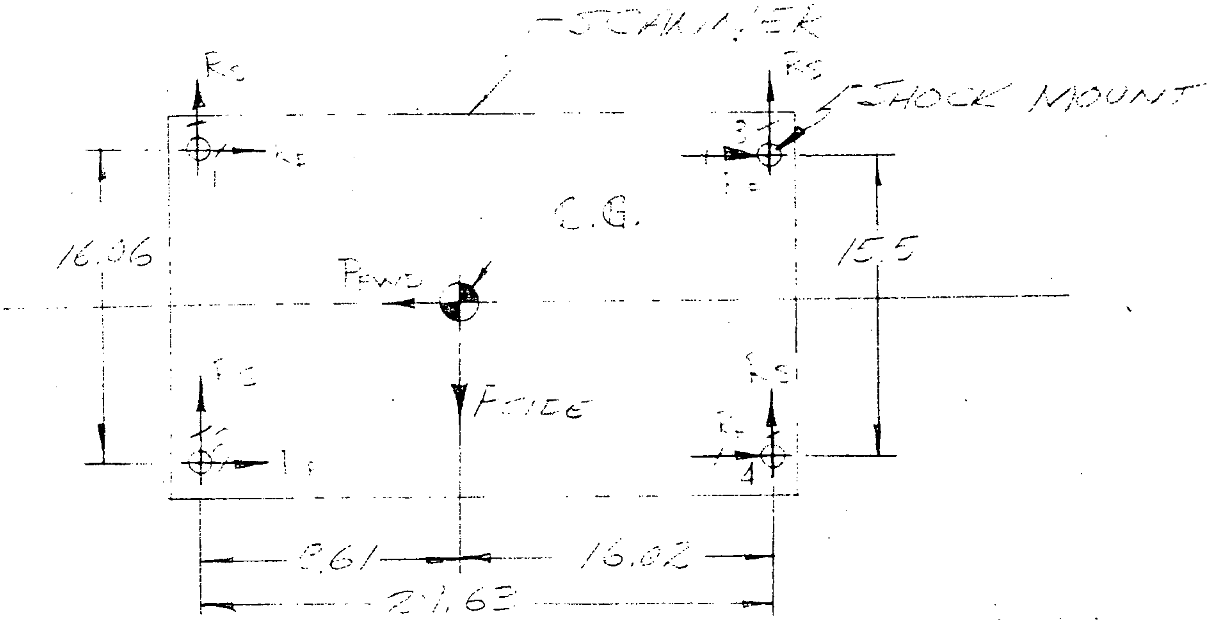
...NNERS INSTL. (CONT.)
...WG. 8432-03230)

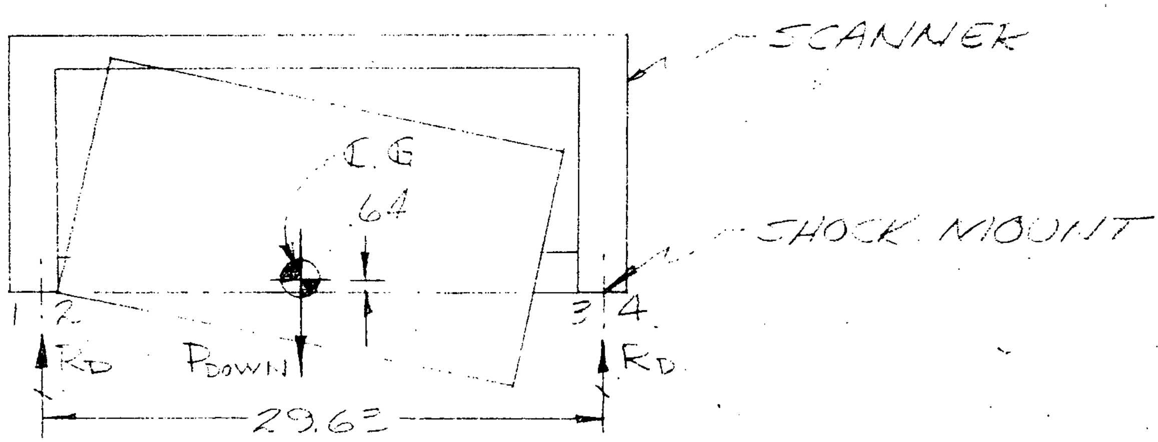


SCANNER LOADS

WEIGHT OF SCANNER IS 175 POUNDS



PLAN VIEW OF SCANNER



SIDE VIEW OF SCANNER

KICK LOADS DEVELOPED AS A RESULT OF FWD AND SIDE LOADS WILL BE IGNORED. THESE KICK LOADS WILL BE NEGLIGIBLE DUE TO THE SMALL OFFSET OF THE VERTICAL C.G. LOCATION.

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SCANNER LOADS (CONT)

$P_{FWD} = 3.0 g's (195) = 585^{\#}$ — LOAD COND. 1

$P_{DOWN} = 5.0 g's (195) = 975^{\#}$ LOAD COND. 2

$P_{DOWN} = 975^{\#} \pm P_{SIDE} = 195^{\#}$ — LOAD COND. 3

$P_{DOWN} = 975^{\#} \pm P_{FWD} = 195^{\#}$ — LOAD COND. 4

LOAD COND. 1

$R_{F1}, R_{F2}, R_{F3}, R_{F4} = \frac{585}{4} = 146^{\#}$

LOAD COND. 2

$R_{D3}, R_{D4} = \frac{975}{2}\left(\frac{13.6}{29.63}\right) = 224^{\#}$

$R_{D1}, R_{D2} = \frac{975}{2} - 224 = 264^{\#}$

LOAD COND. 3

$R_{D1}, R_{D2} = 264^{\#}$; $R_{D3}, R_{D4} = 224^{\#}$

$R_{S1}, R_{S2} = \frac{195}{2}\left(\frac{16.02}{29.63}\right) = 54^{\#}$

$R_{S3}, R_{S4} = \frac{195}{2} - 54 = 44^{\#}$

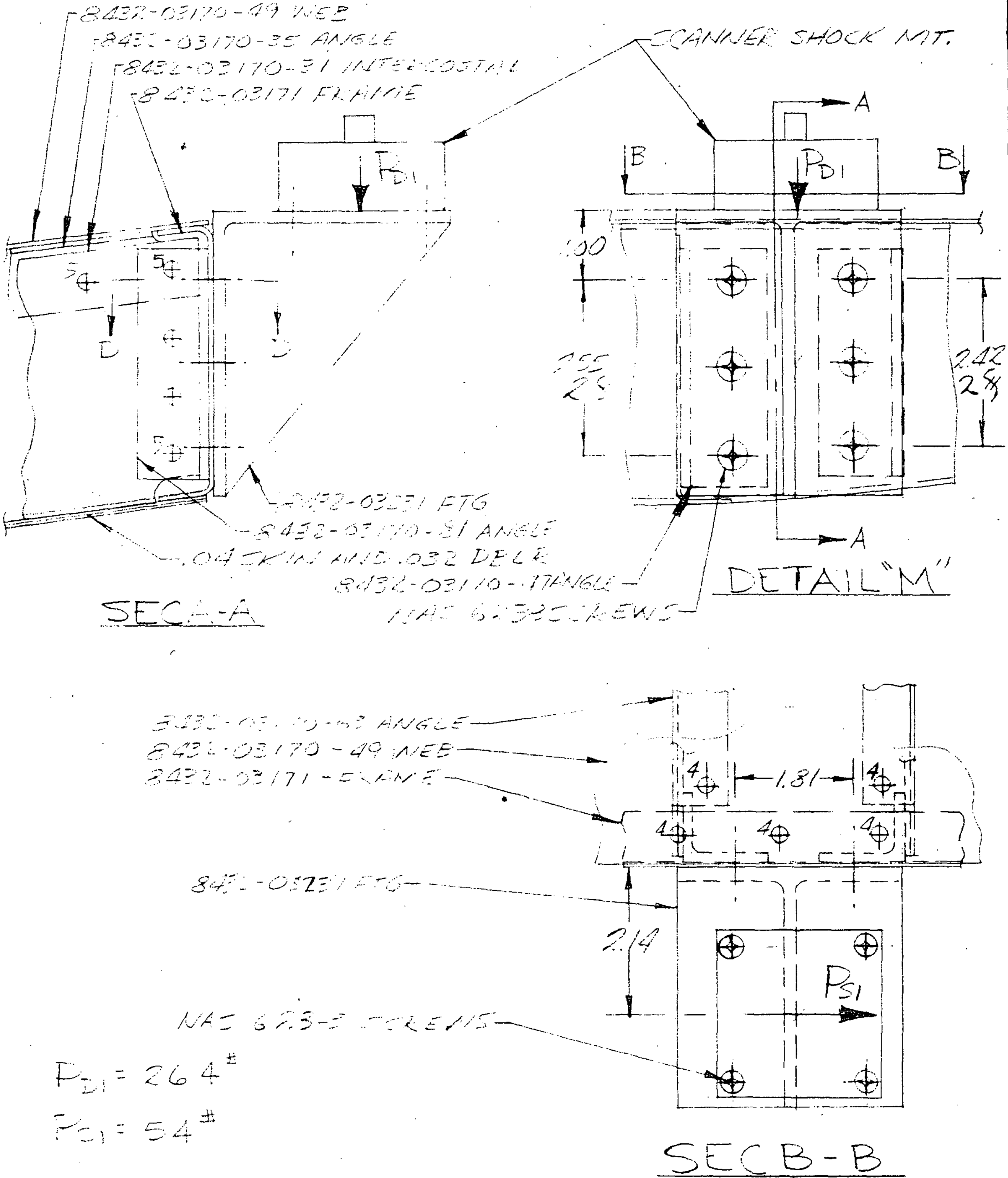
LOAD COND. 4

$R_{D1}, R_{D2} = 264^{\#}$ $R_{D3}, R_{D4} = 224^{\#}$

$R_{F1}, R_{F2}, R_{F3}, R_{F4} = \frac{195}{4} = 49^{\#}$

EBC-50199-11

ANALYSIS OF THE 8432-03231 FITTING



$P_{D1} = 264^{\#}$

$P_{S1} = 54^{\#}$

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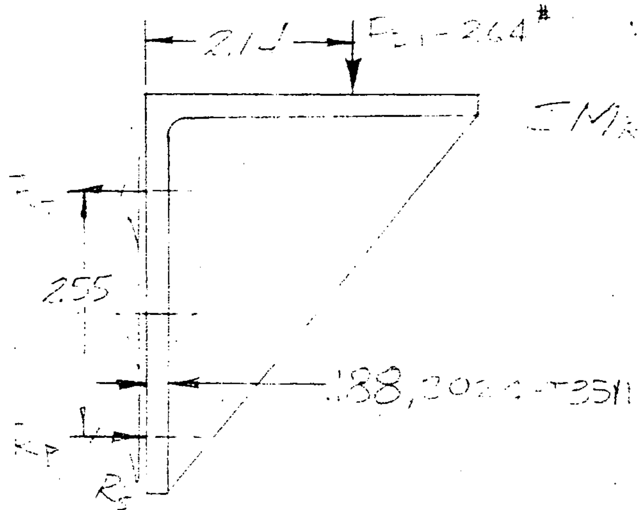
ANALYSIS OF THE 3432-03231 FITTING (CONT.)

CHECK OF THE [illegible] ATTACHMENT SCREWS

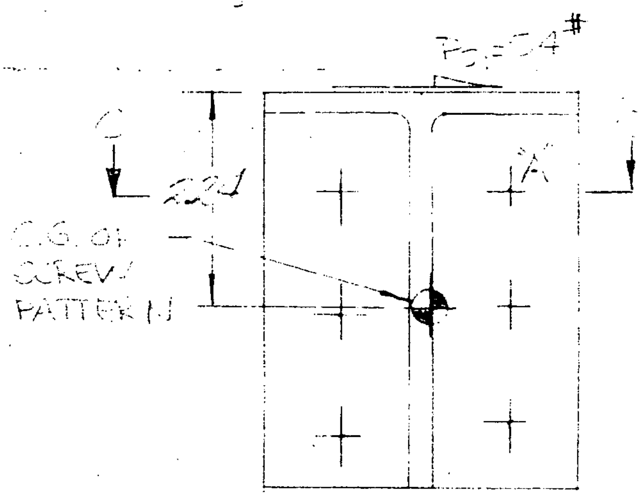


$\Sigma M_{R_T} = 2.14(264) + 2.55(R_B)2 = 0$

$R_B =$ [illegible] #/SCREW (COMP.)

$R_T =$ 111 #/SCREW (TEN.)

$R_S = \frac{264}{6} = 44$ #/SCREW (SHEAR)



$P_{SCREW} = \frac{M\,r}{\Sigma r^2}$

WHERE: $M = 54(2.24) = 121$ IN#
r = DISTANCE TO CRITICAL SCREW
Σr^2 = Σ OF DISTANCE SQ. FROM C.G. TO ALL SCREWS = 10.9 IN^2

$P_{\text{SCREW "A"}} = \frac{121(1.5)}{10.9} = 17$ #(SHEAR)

$P_S = \frac{54}{6} = 9$ #/SCREW (SHEAR)

$F_{T\,TOTAL} = 111$ #

$F_{S\,TOTAL} = \sqrt{9^2 + 44^2} \rightarrow 17 = 57$ #

FASTENING NOT CRITICAL

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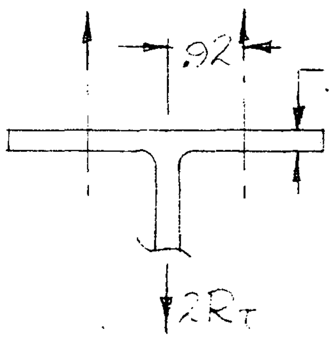
ANALYSIS OF THE 8432-03831 FITTING (CONT.)

CHECK OF FITTING FOR FLANGE BENDING



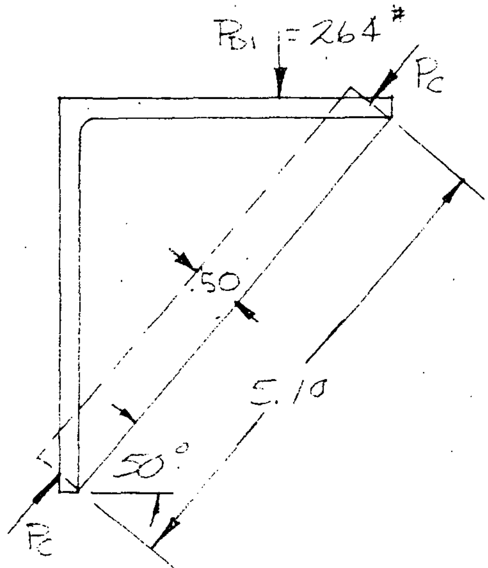
SEC C-C
F

$P_{ALLOW} = 3(960) = 2880^{\#}$ ▷1

$2R_T = 2(111) = 222^{\#}$ ▷2

FLANGE BENDING $M.S. = \frac{2880}{222} - 1 = $ LARGE

CHECK OF FITTING GUSSET FOR BUCKLING



REF. PP. 4.3 AND 4.7 FOR METHOD OF ANALYSIS

$P_C = \frac{264}{\cos 40°} = 345^{\#}$

$f_C = \frac{345}{(.188).5} = 3,670$ psi

$a/b = 5.1/.50 = 10.2$

$K = .40$

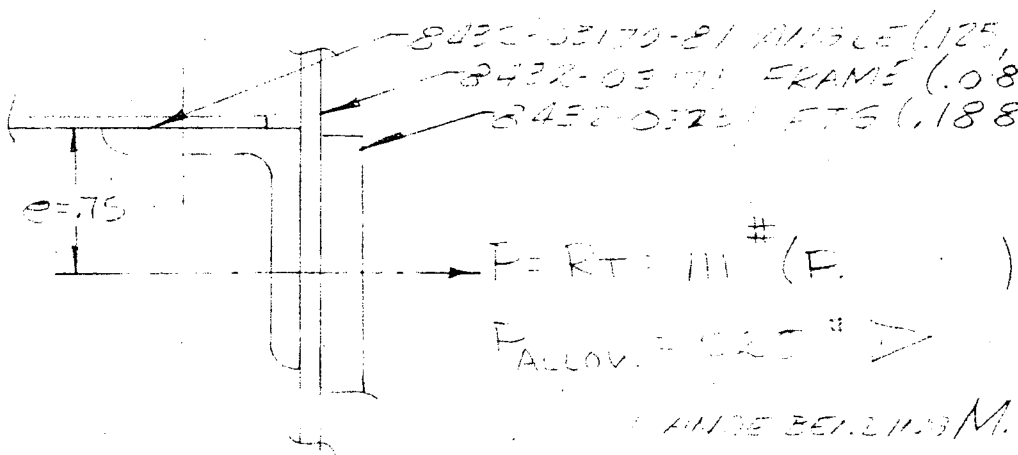
$b/t = .5/.188 = 2.66$

$F_C = 51,000$ psi

BUCKLING M.S. = LARGE

▷1 REF. 1.
▷2 REF. MEMO. 89, P. 6

ANALYSIS OF THE 8432-03170-81 CLIP ANGLE



ANGLE BENDING $M.S. = \frac{520}{111} - 1 = \underline{LARGE}$

NO FUTHER ANALYSIS WILL BE SHOWN ON THE "N" SCANNERS INSTALLATION AS IT IS OBVIOUS THAT LARGE MARGINS OF SAFETY EXIST FOR ALL COMPONENTS.