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(NASA-CR-170870) LOW CONCENTRATION RATIO SOLAR ARRAY FOR LOW EARTH ORBIT MULTI-100kW APPLICATION. VOLUME 2: DRAWINGS Final Report (Rockwell International Corp.) 175 p HC A08/MF A01 CSCL 22B G3/18

N83-36098

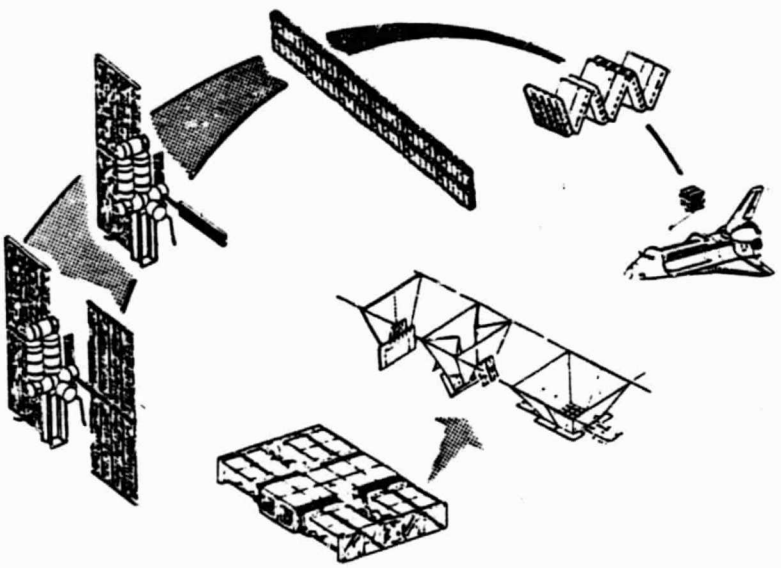
Unclas 44084

SSD 83-0075-2

LOW CONCENTRATION RATIO SOLAR ARRAY FOR LOW EARTH ORBIT MULTI-100 kW APPLICATION

VOLUME 2—DRAWINGS

FINAL REPORT
JULY 1983



Prepared for:

National Aeronautics and Space Administration
George C. Marshall Space Flight Center
Marshall Space Flight Center, AL 35812

Contract NAS8-34214

Shuttle Integration & Satellite Systems Division

Rockwell International

SSD83-0075-2

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VOLUME 2 - DRAWINGS

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CONTRACT NAS8-34214

Rockwell International
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TECHNICAL REPORT INDEX/ABSTRACT

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							UNCLASSIFIED	

TITLE OF DOCUMENT

Low Concentration Ratio Solar Array for Low Earth Orbit Multi-100 kW Application, Final Report, Vol. 2 - Drawings

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AUTHOR(S)

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DESCRIPTIVE TERMS

Concentrators, Solar Arrays, Concentrator Arrays, Concentrating Silicon Solar Cells, Concentrating Gallium Arsenide Cells, Low Earth Orbit Multi-100 kW Solar Array Design

ABSTRACT

This report describes a preliminary design effort directed toward a low-concentration-ratio photovoltaic array system based on 1984 technology and capable of delivering multi-hundred kilowatts (300 kW to 1000 kW range) in low earth orbit. The array system consists of two or more array modules each capable of delivering between 113 kW to 175 kW using silicon solar cells or gallium arsenide solar cells, respectively.

The array module deployed area is 1320 square meters and consists of 4356 pyramidal concentrator elements. The module, when stowed in the Space Shuttle's payload bay, has a stowage volume of a cube with 3.24 meters on a side. The concentrator elements are sized for a geometric concentration ratio (GCR) of six with an aperture area of 0.5 meters x 0.5 meters.

Volume 1 discusses the structural analysis and design trades leading to the baseline design. It describes the configuration, as well as optical, thermal and electrical performance analyses that support the design and overall performance estimates for the array. Experimental results are also presented for a concentrator element using both silicon and gallium arsenide solar panels. They confirm the preliminary design analysis and performance estimates. Recommendations are provided for future development effort for low earth orbit application. Volume 2 provides drawings for the preliminary design configuration and for the test hardware that was fabricated for design evaluation and test.

II

FOREWORD

This report describes the effort performed for the preliminary design of low-cost concentrator multi-hundred kilowatt solar arrays. The Volume 1 report summarizes activities performed between June 18, 1981 and July 1983, as required by Contract NAS8-34214 Statement of Work. Volume 2 contains drawings prepared describing the preliminary design configuration, test hardware and manufacturing flow concept. The report was prepared by the Shuttle Integration and Satellite Systems Division of Rockwell International Corporation for the NASA George C. Marshall Space Flight Center (MSFC), Huntsville, Alabama. The NASA technical Contractor Officer Representative for the activity is Mr. W. L. Crabtree. The contents of this document are not necessarily endorsed by the NASA-MSFC.

Mr. S. J. Nalbandian is the project supervisor. Dr. E. P. French is the assistant project supervisor. Principal contributors to the project were:

J. B. Adkins	Mechanism Design
H. C. Ayers	Reflector Design
Z. Backovsky	Testing and Thermal Analysis
R. A. Bellgardt	Electrical Test Equipment
M. S. Biss	Overall Preliminary Design
J. L. Edwards	Structural Analysis
J. D. Eliot	Mechanical Test Equipment
Dr. E. P. French	Optical and Thermal Analysis
G. C. Frey	Materials
R. V. Frost	Reflector Panel Fabrication
H. S. Greenberg	Initial Structural Design and Analysis
K. M. Hicks	Manufacturing Planning
Dr. L. Hsu	Solar Cell Technology
R. L. Long	Materials
M. W. Mills	Electrical Testing and Analysis
Dr. T. S. Nishimoto	Structural Analysis
F. A. Perry	Structural Analysis
A. M. Pope	Development Plans
D. A. Reed	Initial Preliminary Design
A. A. Sileski	Test Planning
L. Vega	Test Hardware

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ILLUSTRATIONS

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1.0 PRELIMINARY DESIGN DRAWINGS

1.1 DISCUSSION

The solar array preliminary design developed under this program is described in a set of 30 level-one drawings. These drawings and their relationships are depicted in the drawing tree shown in Figure 1. Together with their associated callouts and specifications, the drawings provide a physical description of two variants of a 1320 m^2 solar array module (deployed area), one fitted with silicon solar cells and the other with gallium arsenide solar cells. The requirements, trades and analytical studies leading to the design are fully described in Volume 1 of this report.

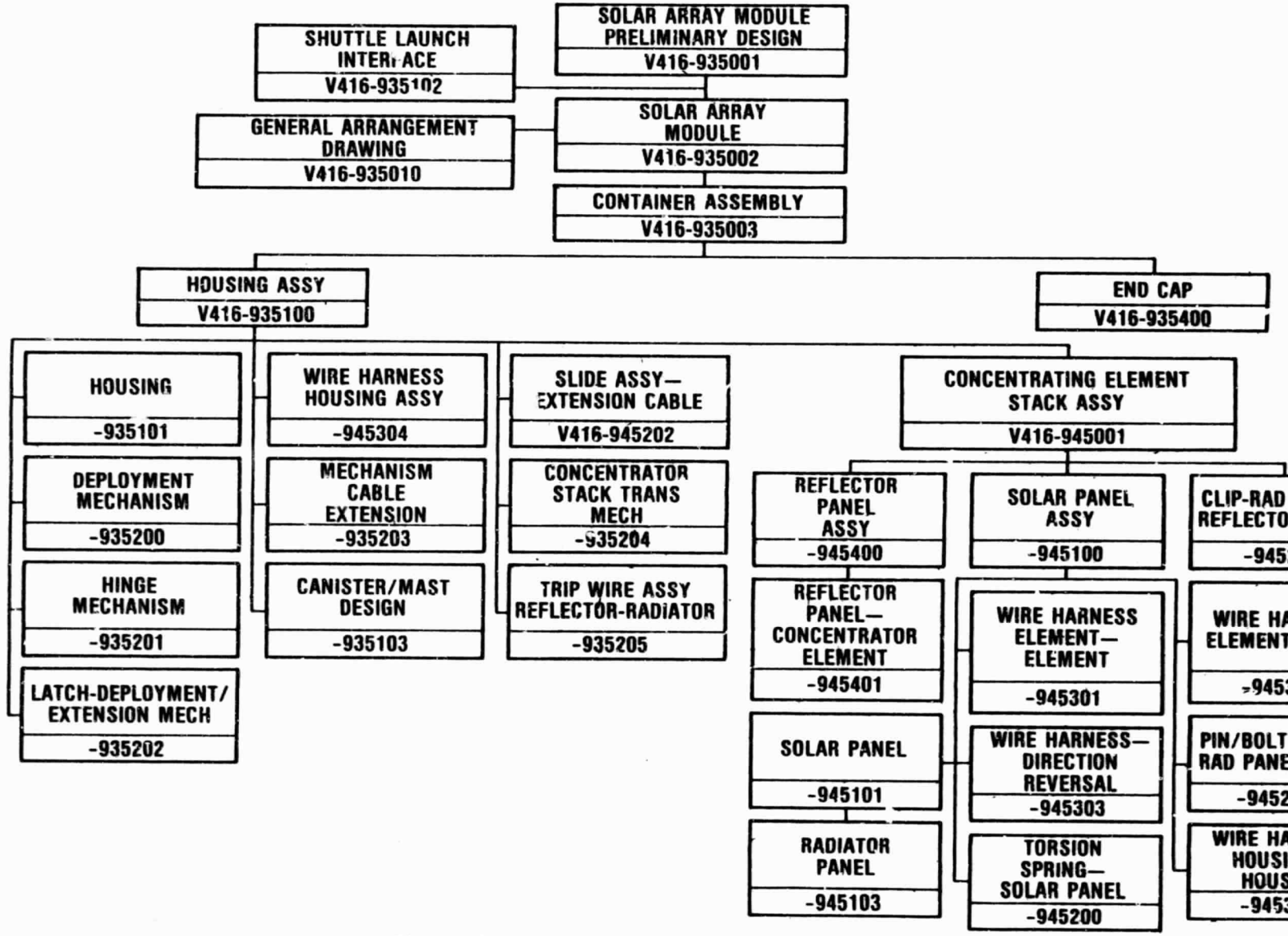

Figure 1. Preliminary Design Drawing Tree (Updated)

1.2 DESIGN DRAWINGS

1. V416-935001
2. V416-935002, sheets 1 of 2 and 2 of 2
3. V416-935003
4. V416-935010
5. V416-935100, sheets 1 of 2 and 2 of 2
6. V416-935101, sheets 1 of 3, 2 of 3, and 3 of 3
7. V416-935102
8. V416-935103
9. V416-935200
10. V416-935201
11. V416-935202
12. V416-935203
13. V416-935204
14. V416-935205
15. V416-935400
16. V416-945001
17. V416-945100
18. V416-945101
19. V416-945103
20. V416-945200
21. V416-945202
22. V416-945203
23. V416-945204A
24. V416-945301
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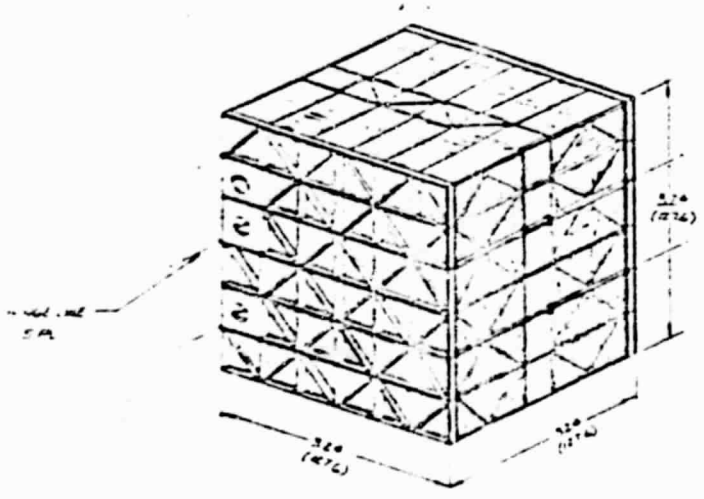

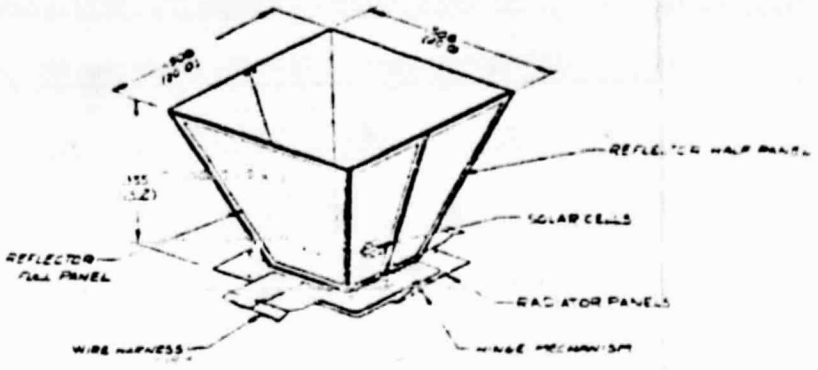

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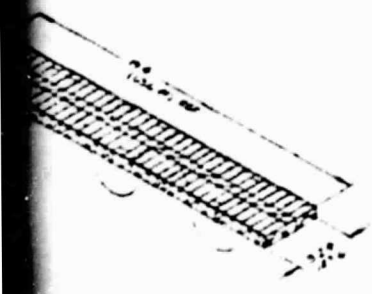

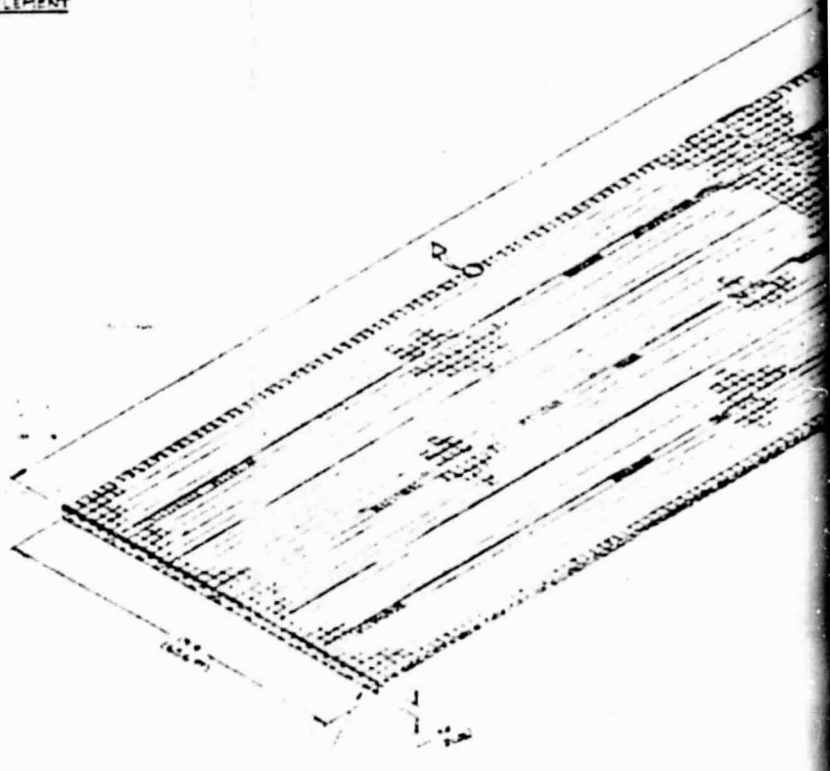

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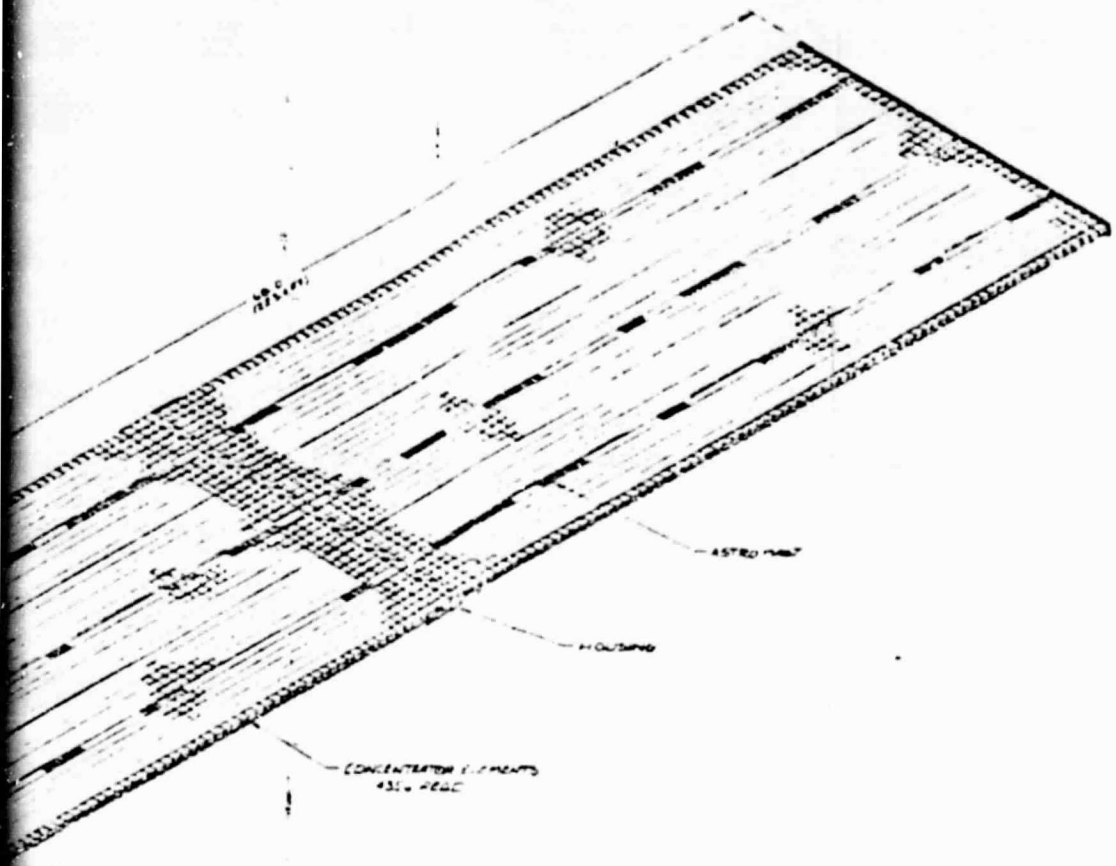

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LOW CONCENTRATION RATIO
SOLAR ARRAY MODULE
PRELIMINARY DESIGN

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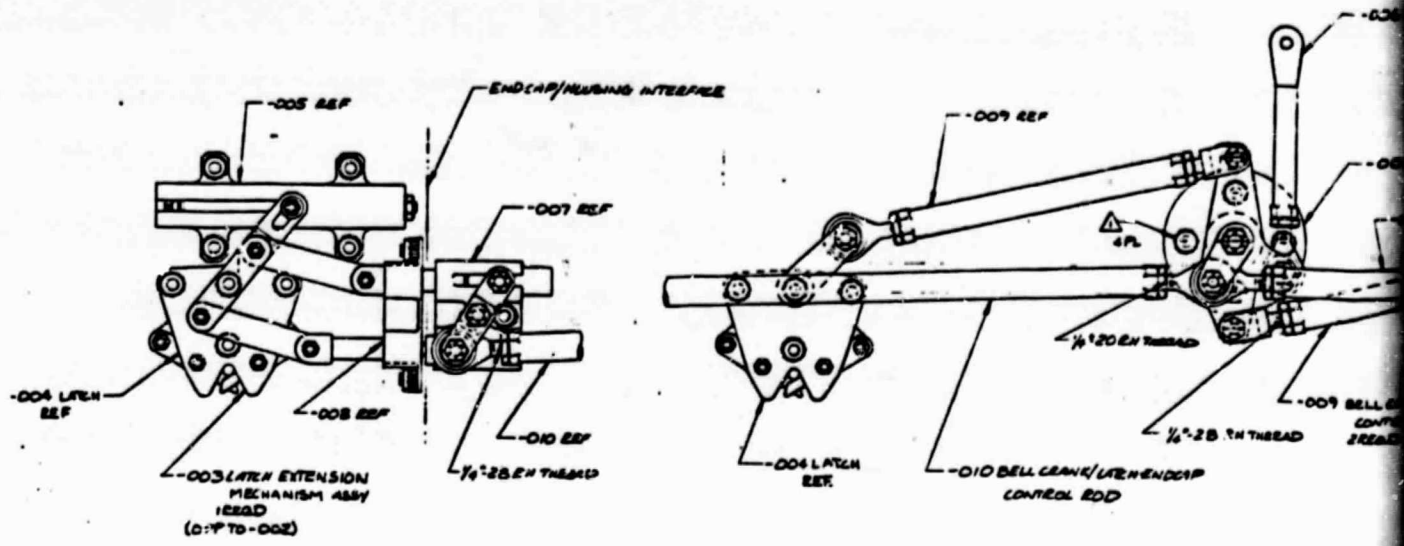

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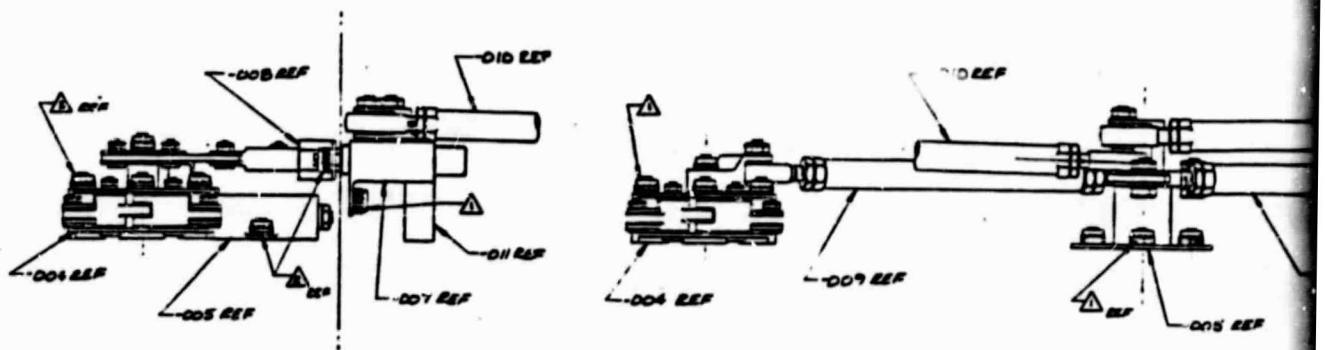

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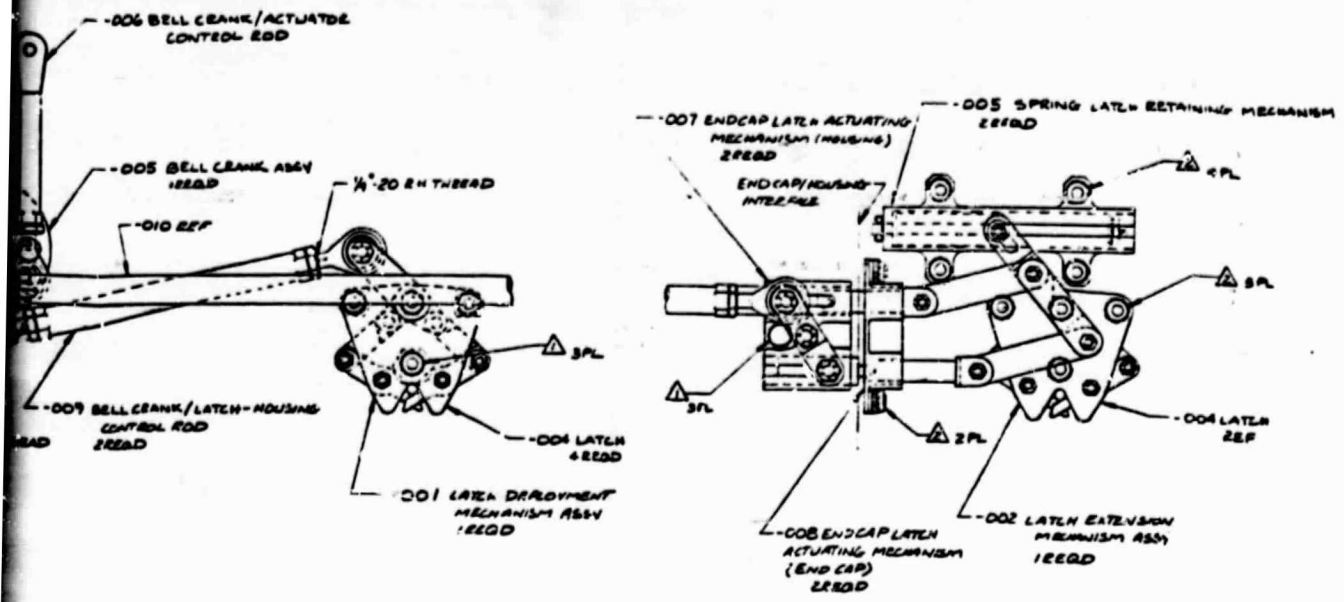

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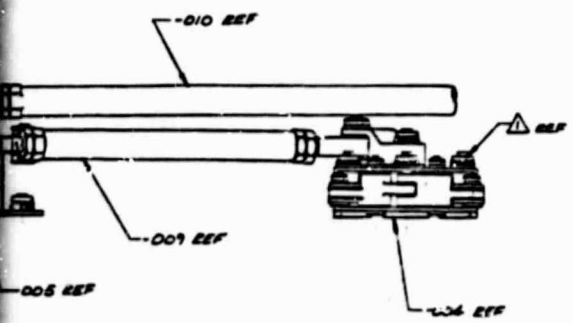

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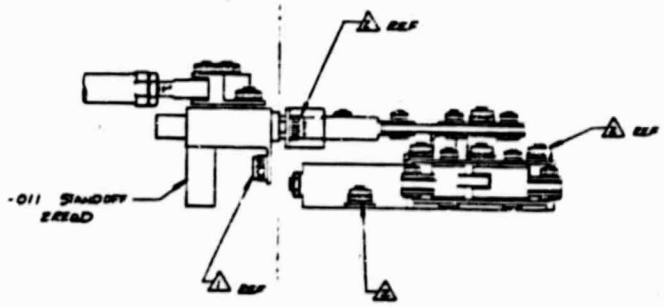

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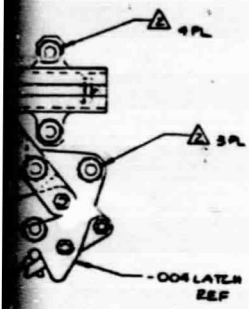

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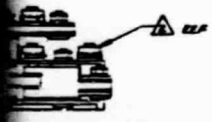

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							-009	CONTROL ROD	ALUMINUM		
							-008	LATCH ACTUATOR	ALUMINUM		
							-007	LATCH ACTUATOR	ALUMINUM		
							-006	CONTROL ROD	ALUMINUM		
							-005	BELLCRANK ASSY	ALUMINUM		
							-004	LATCH ASSY	AL/CRES		
				-003				END CAP LATCH ASSY			
				-002				END CAP HSG ASSY			
					-001		V416-935202	HOUSING LATCH ASSY			

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-003	1	V416-935100	-003A		
-002	1	V416-935100	-002A		
-001	1	V416-935100	-001A		

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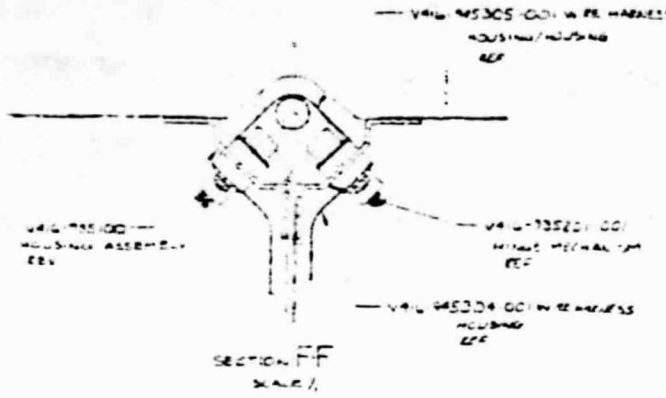

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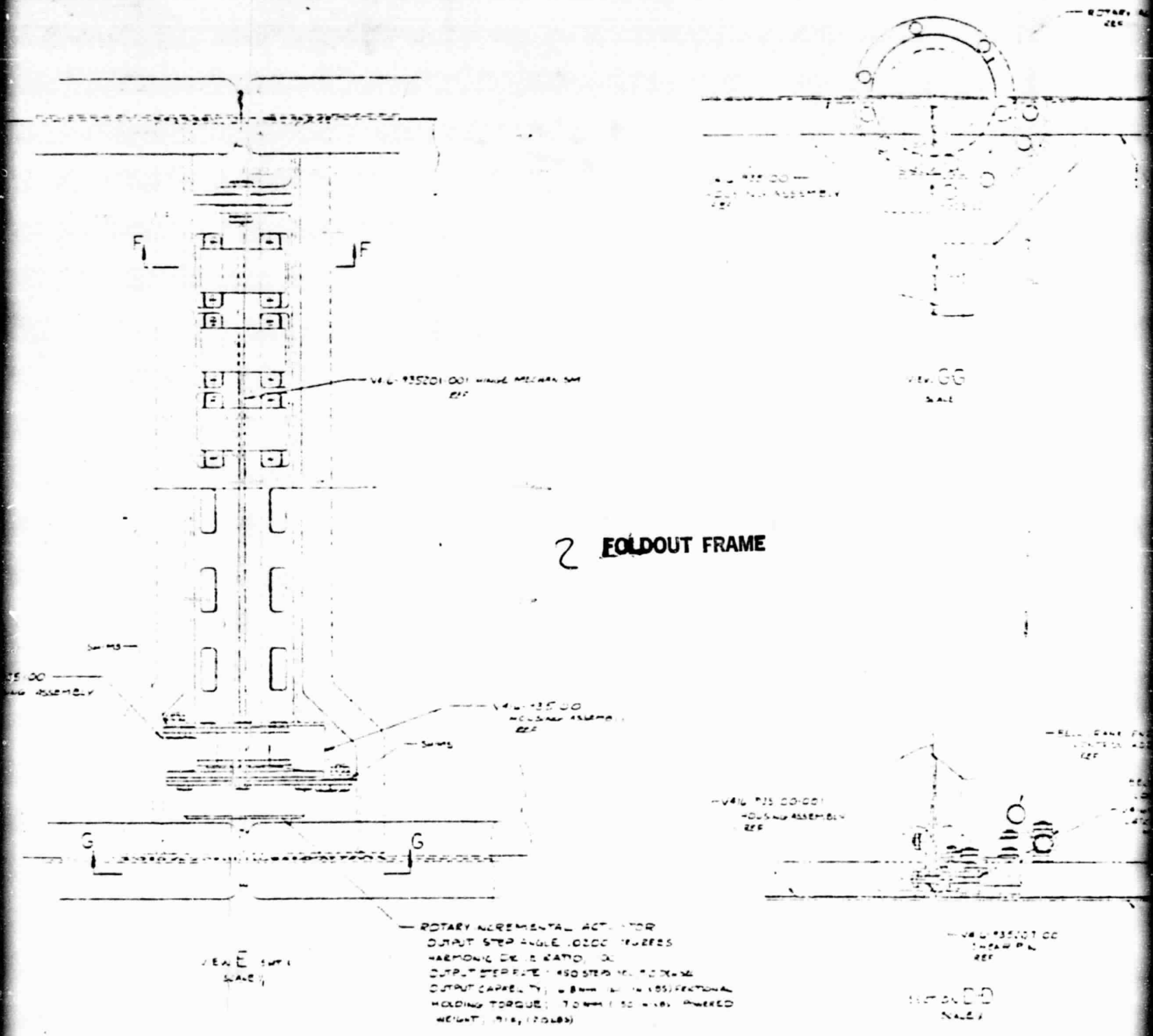

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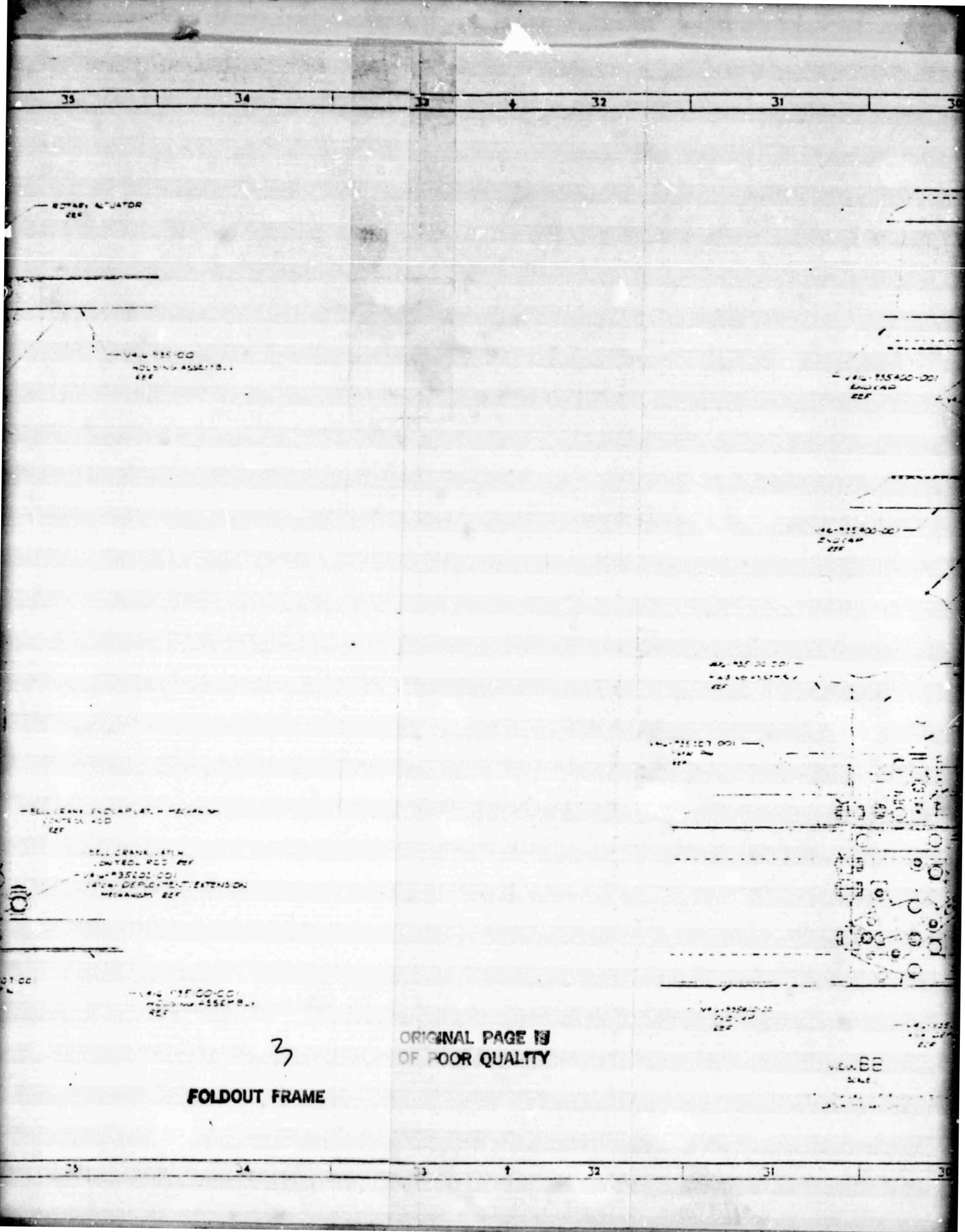

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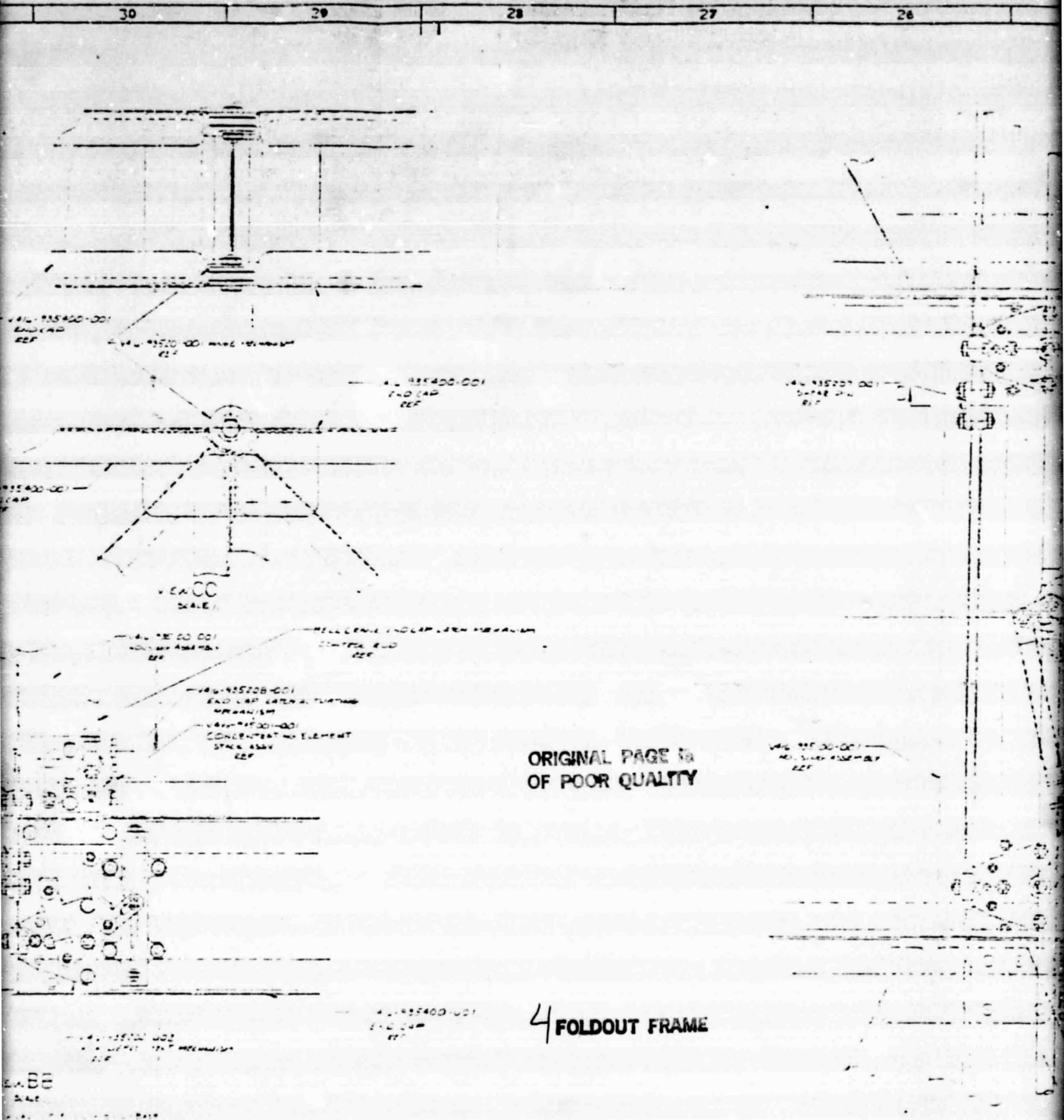
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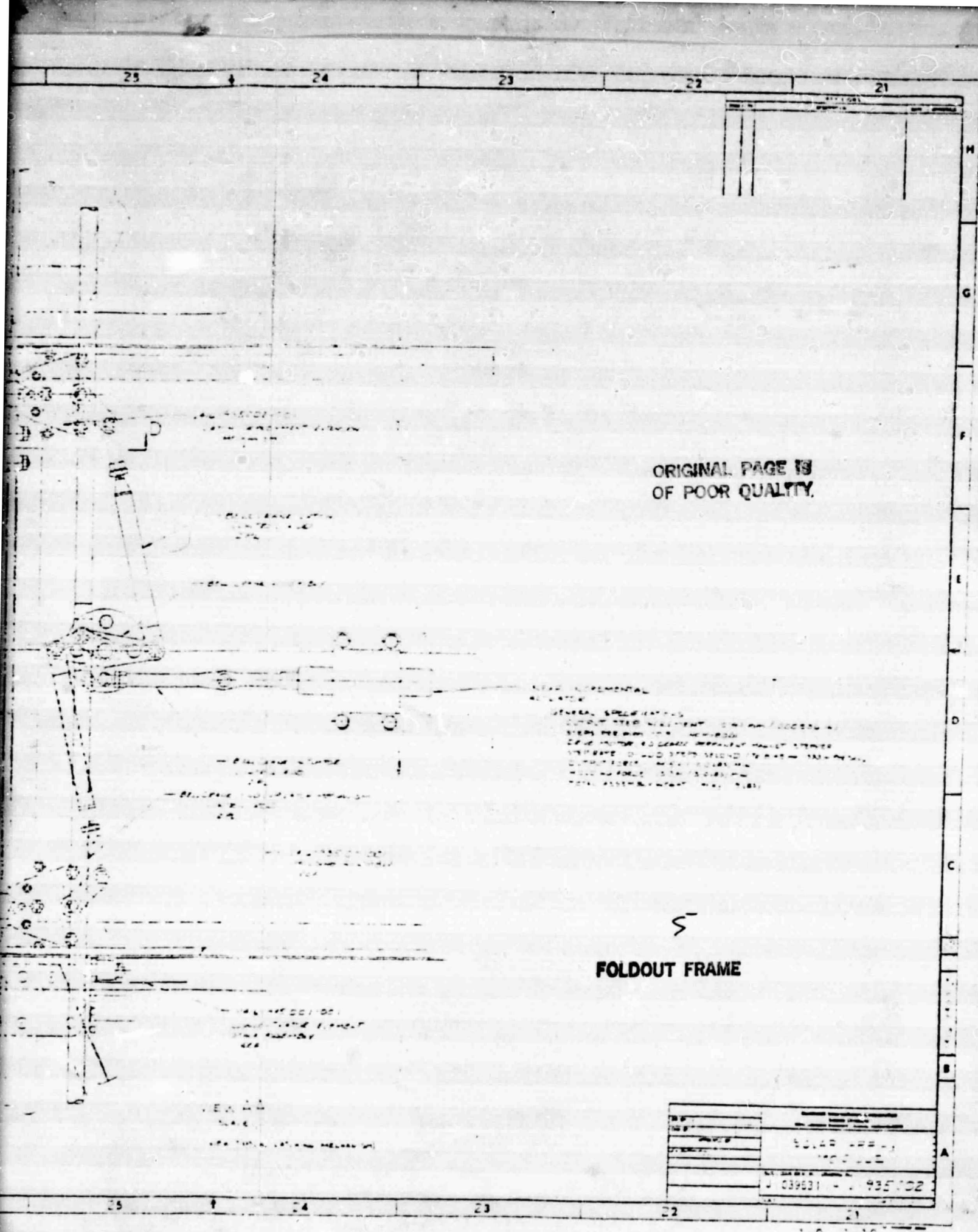

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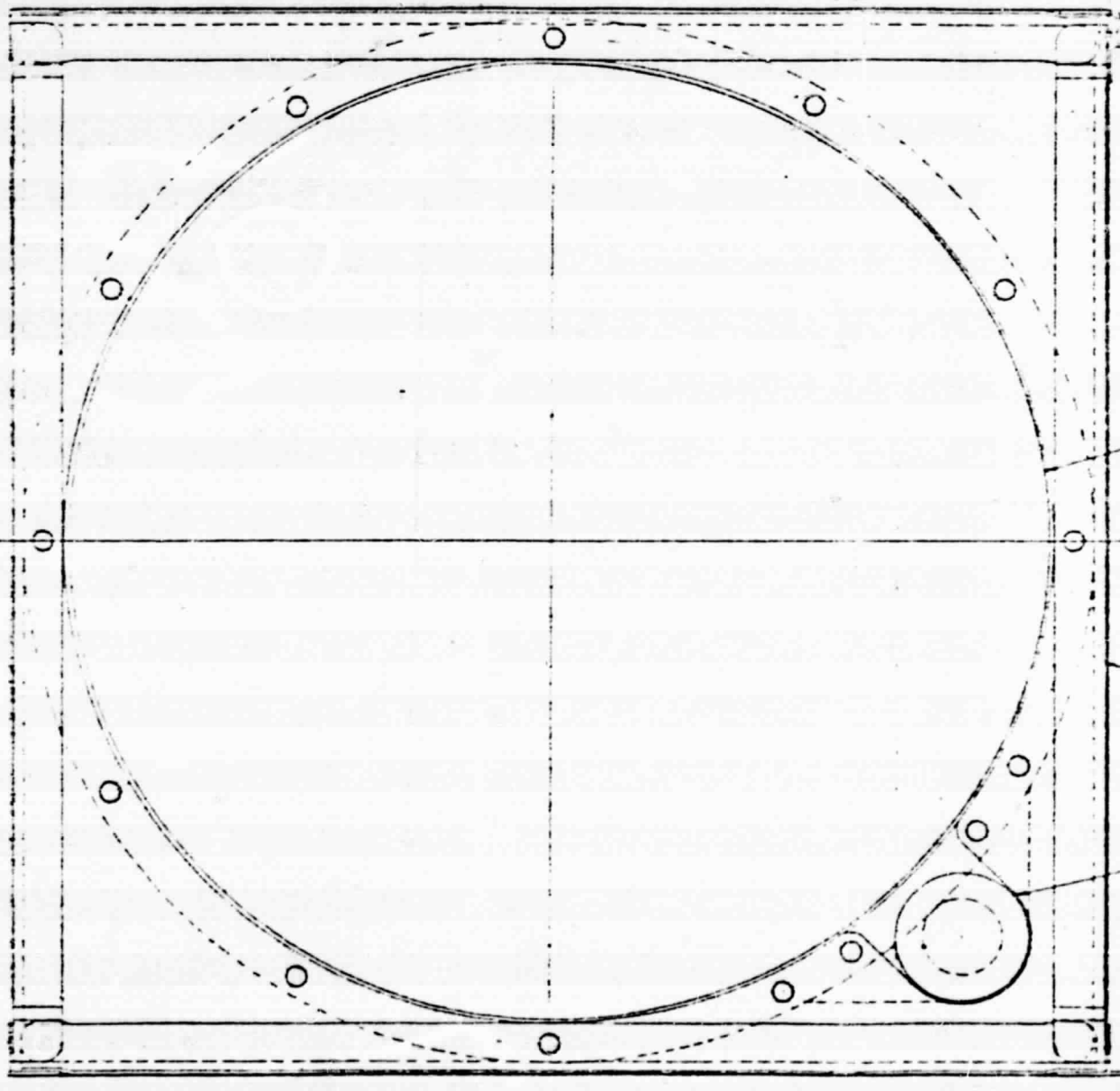

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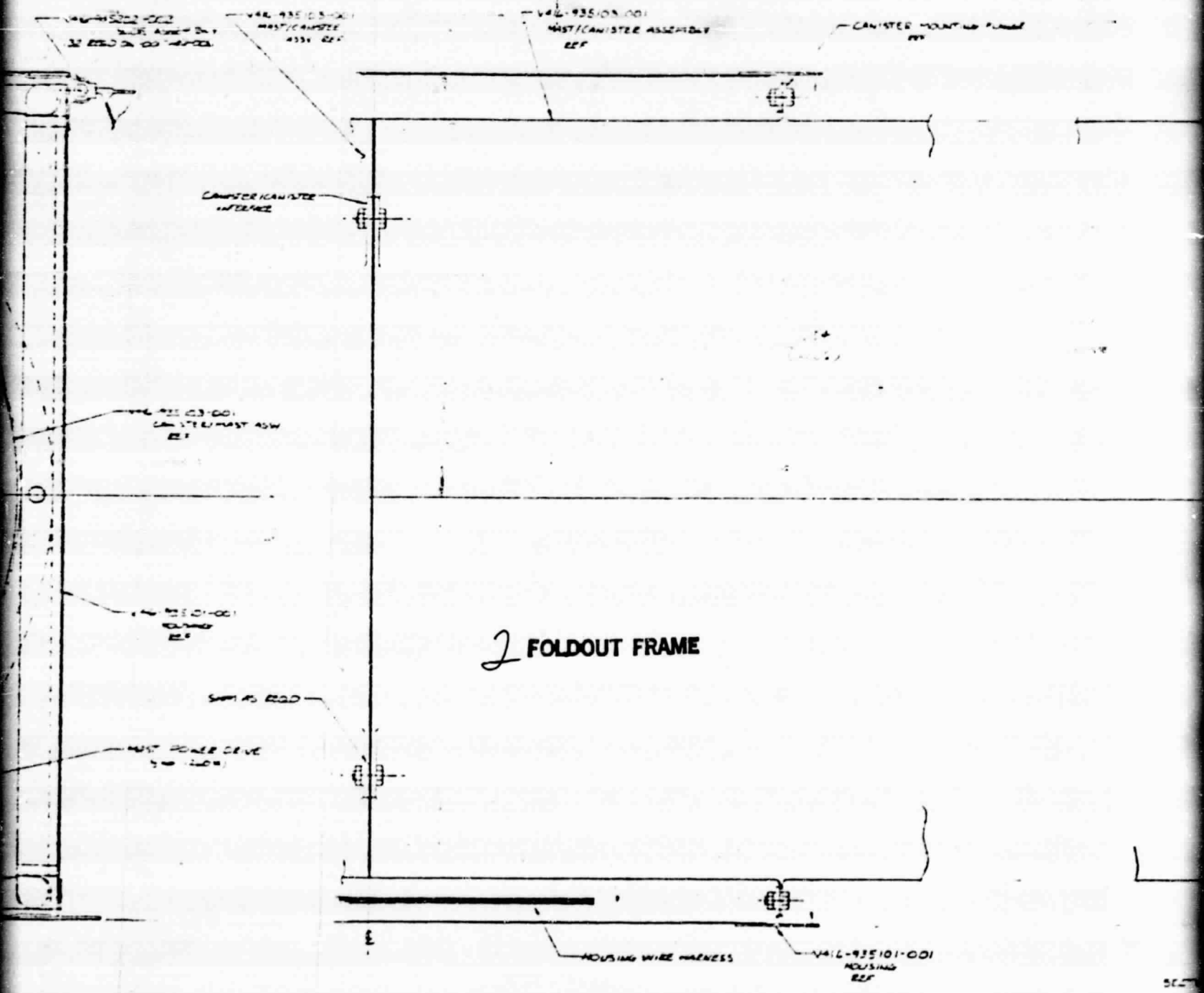

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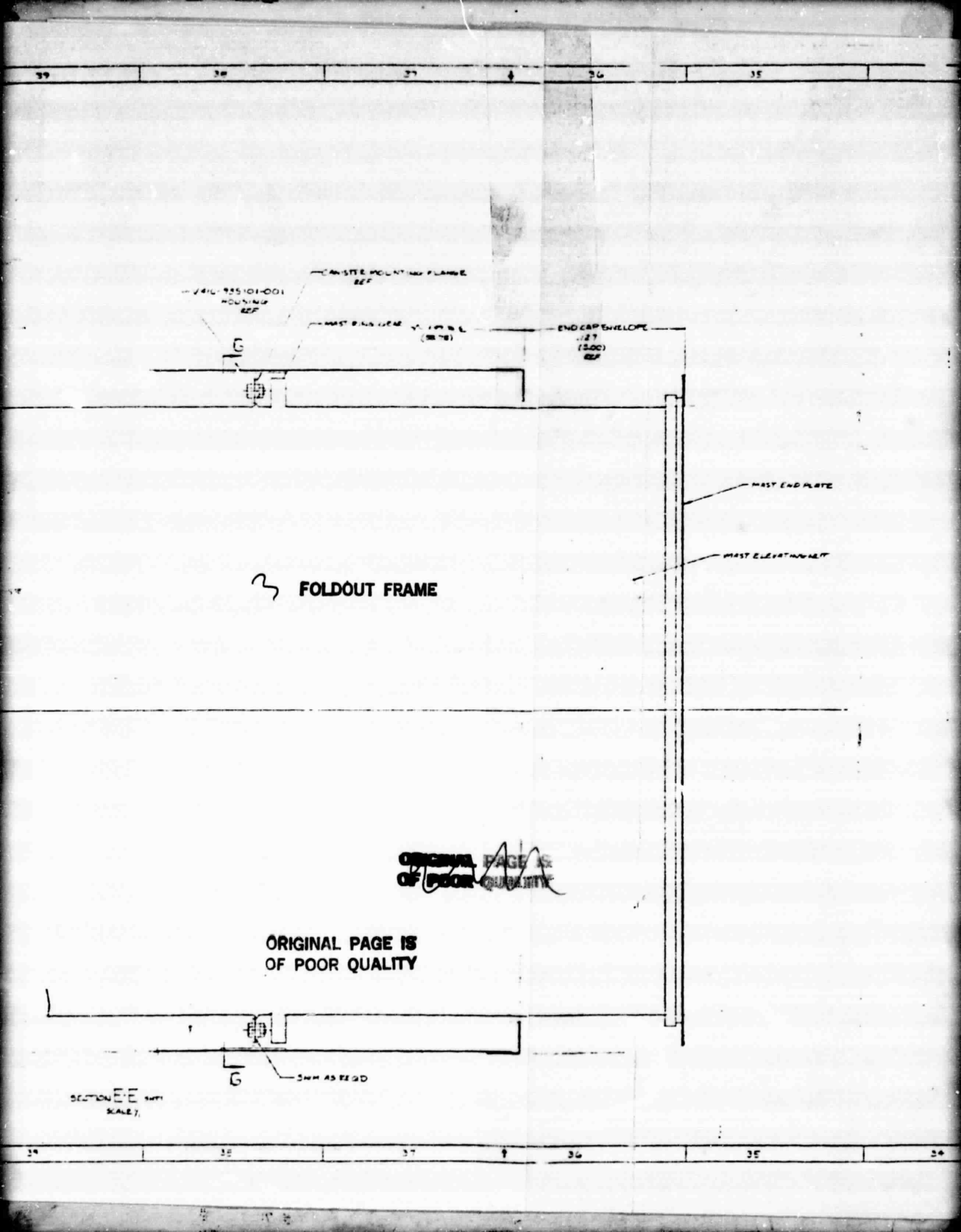
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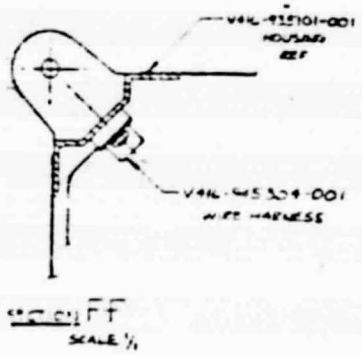

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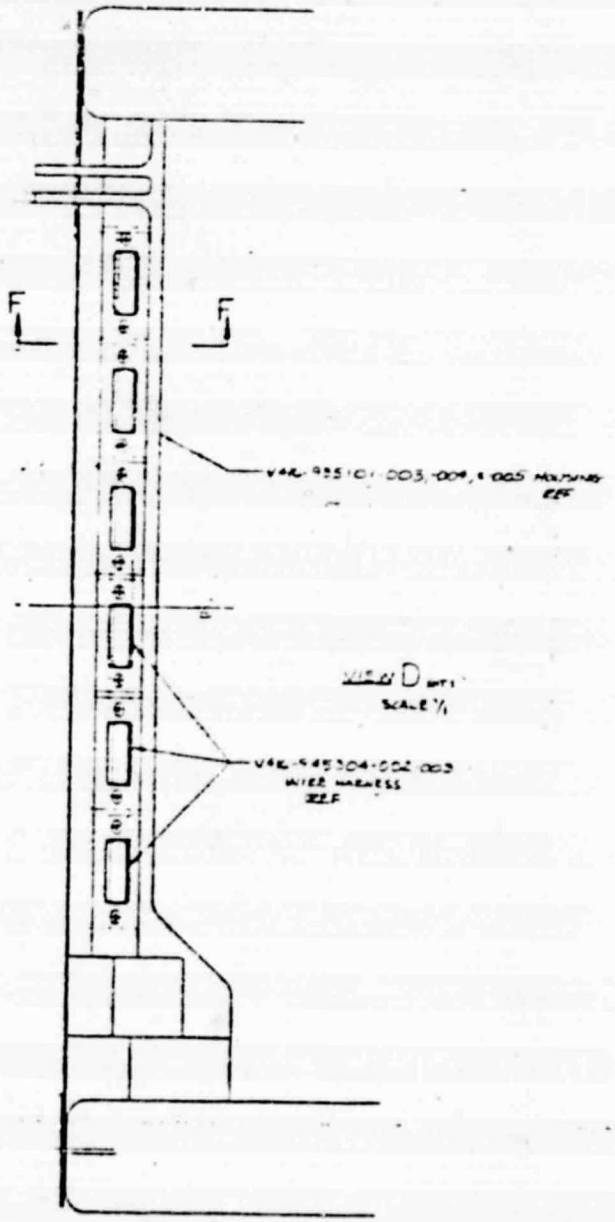

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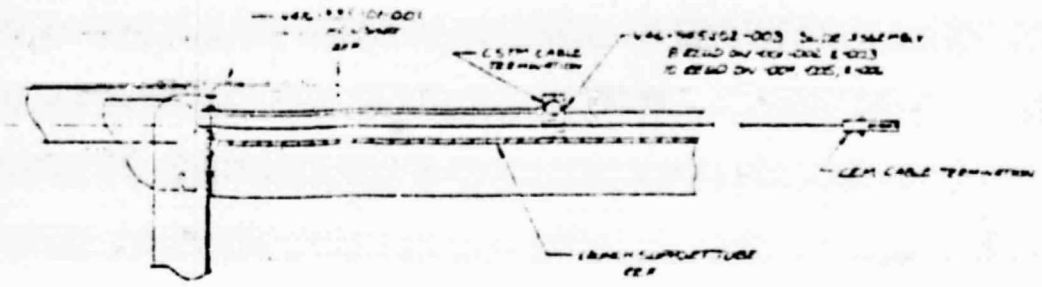

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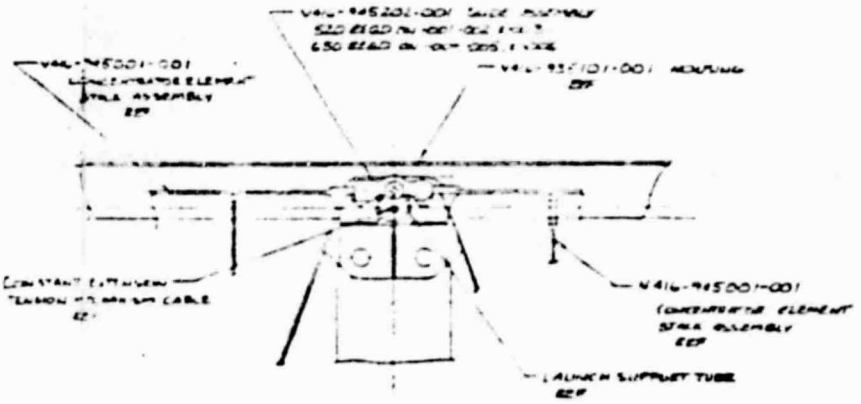

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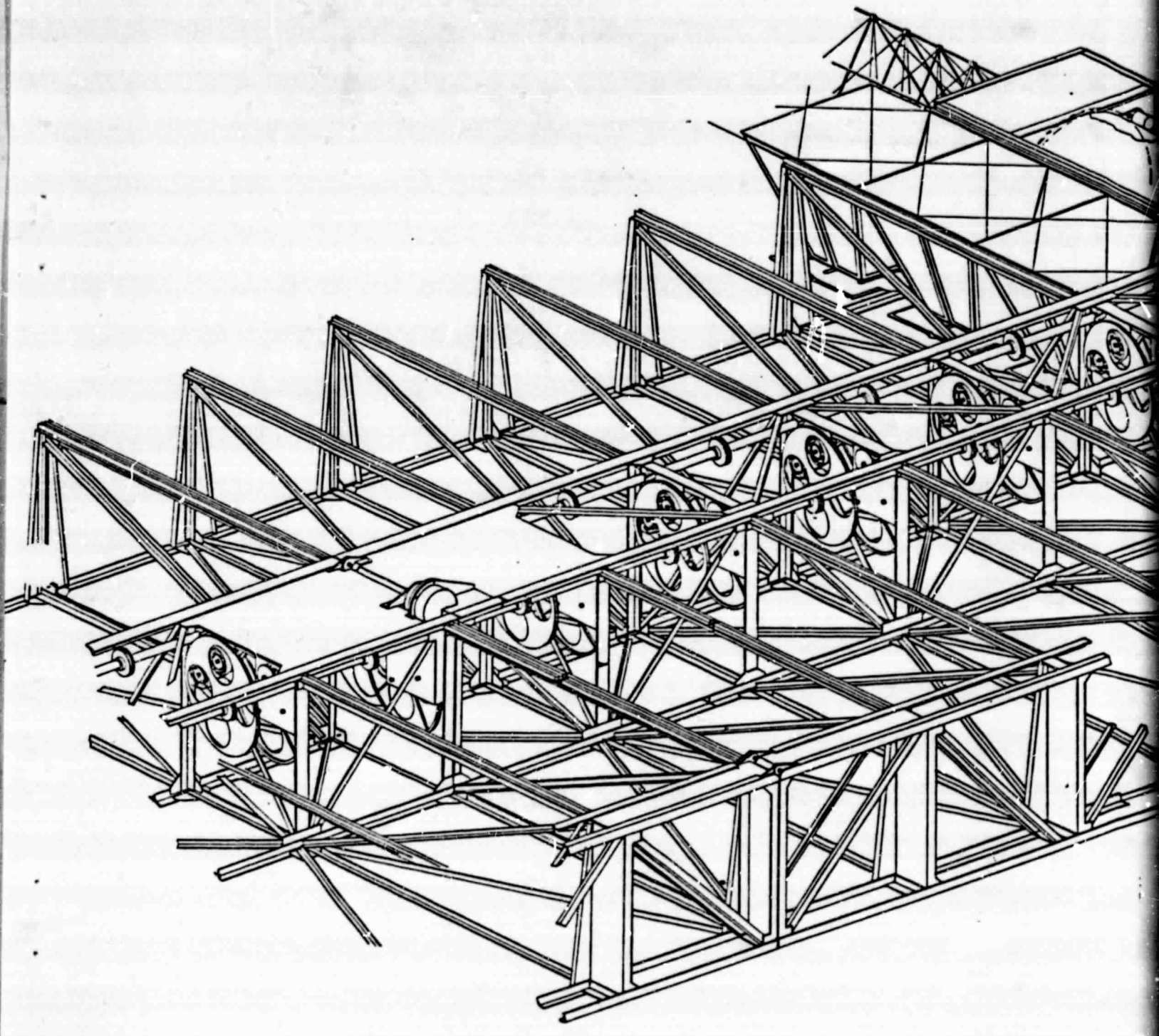

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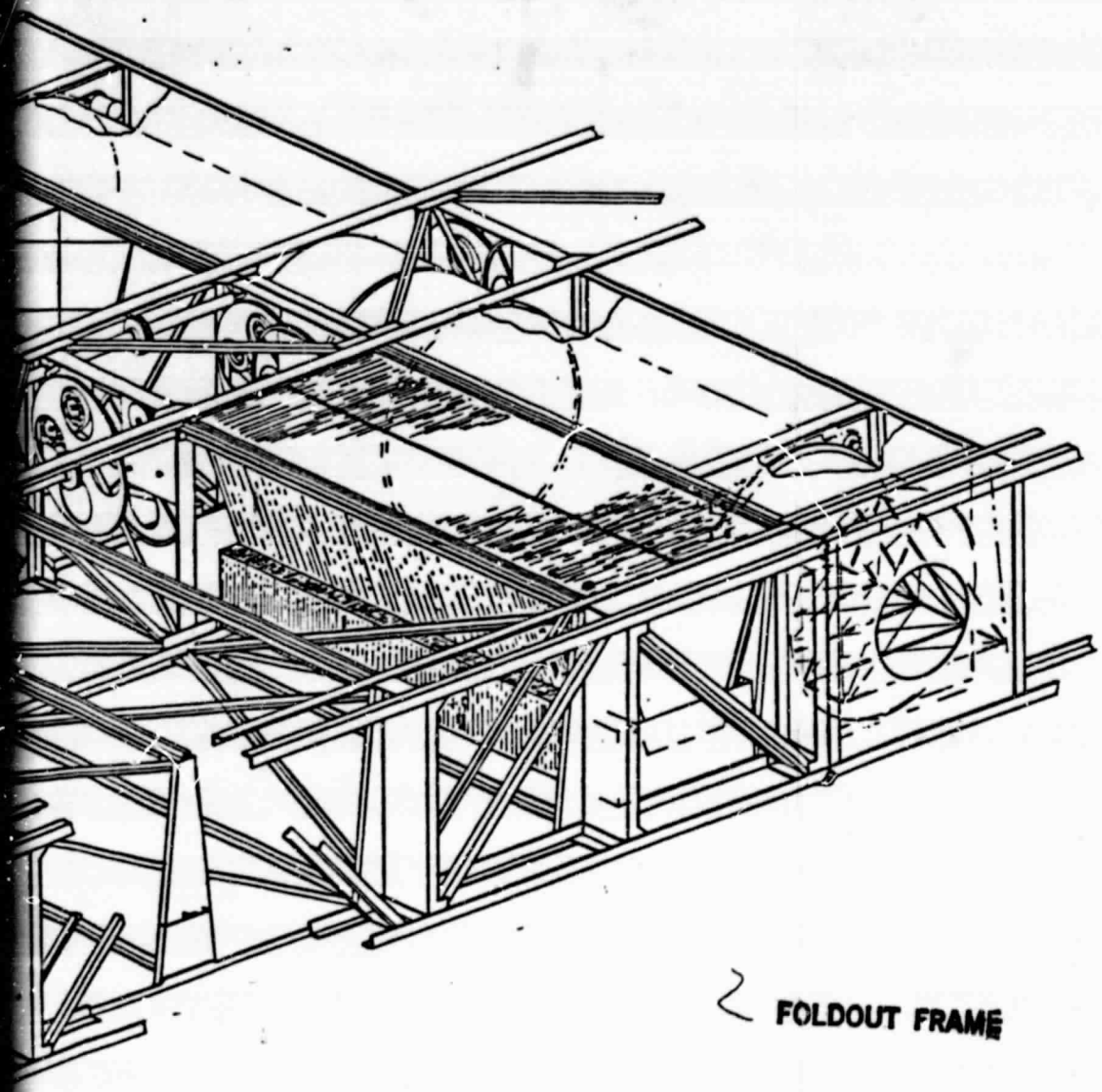

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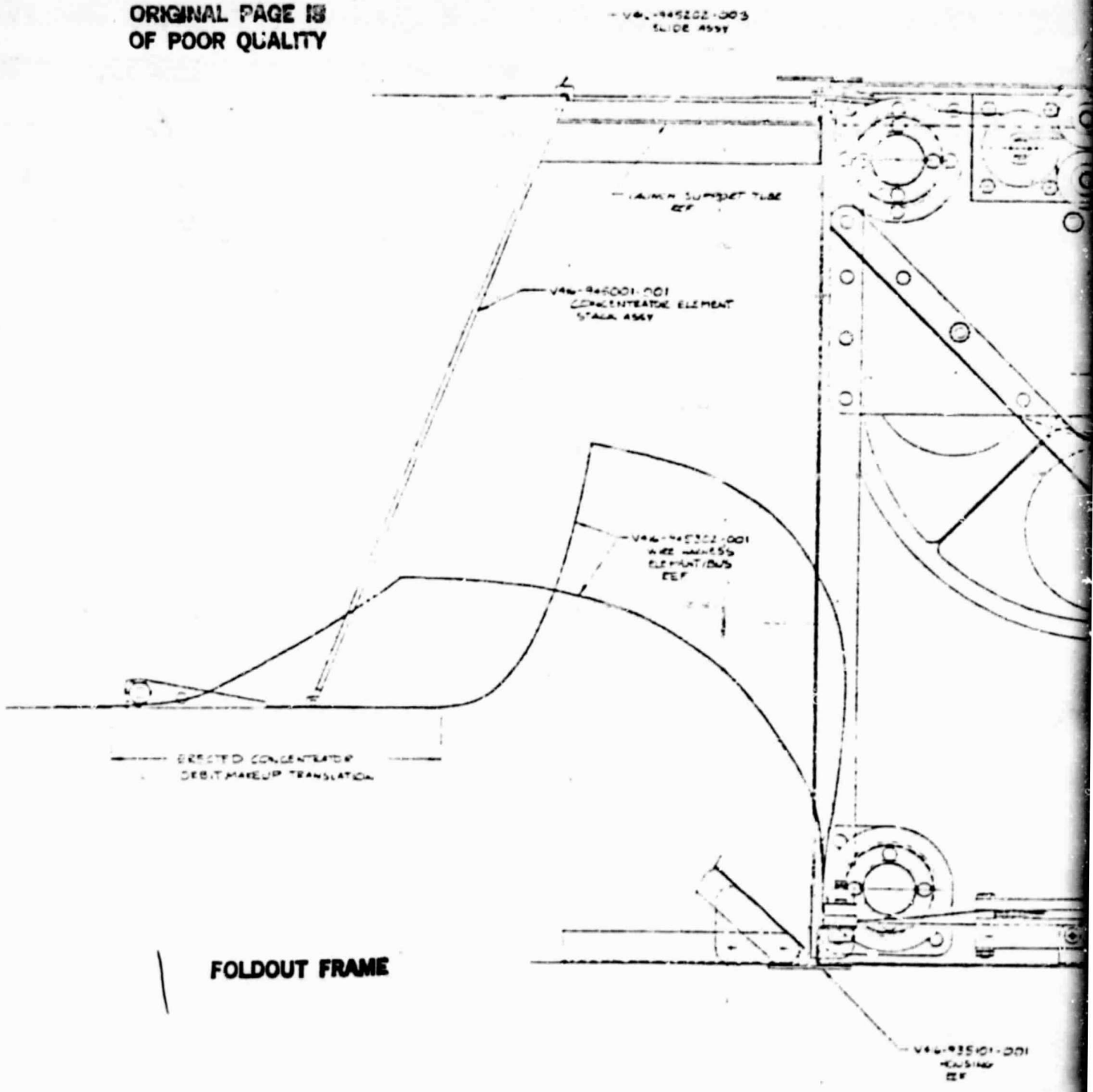

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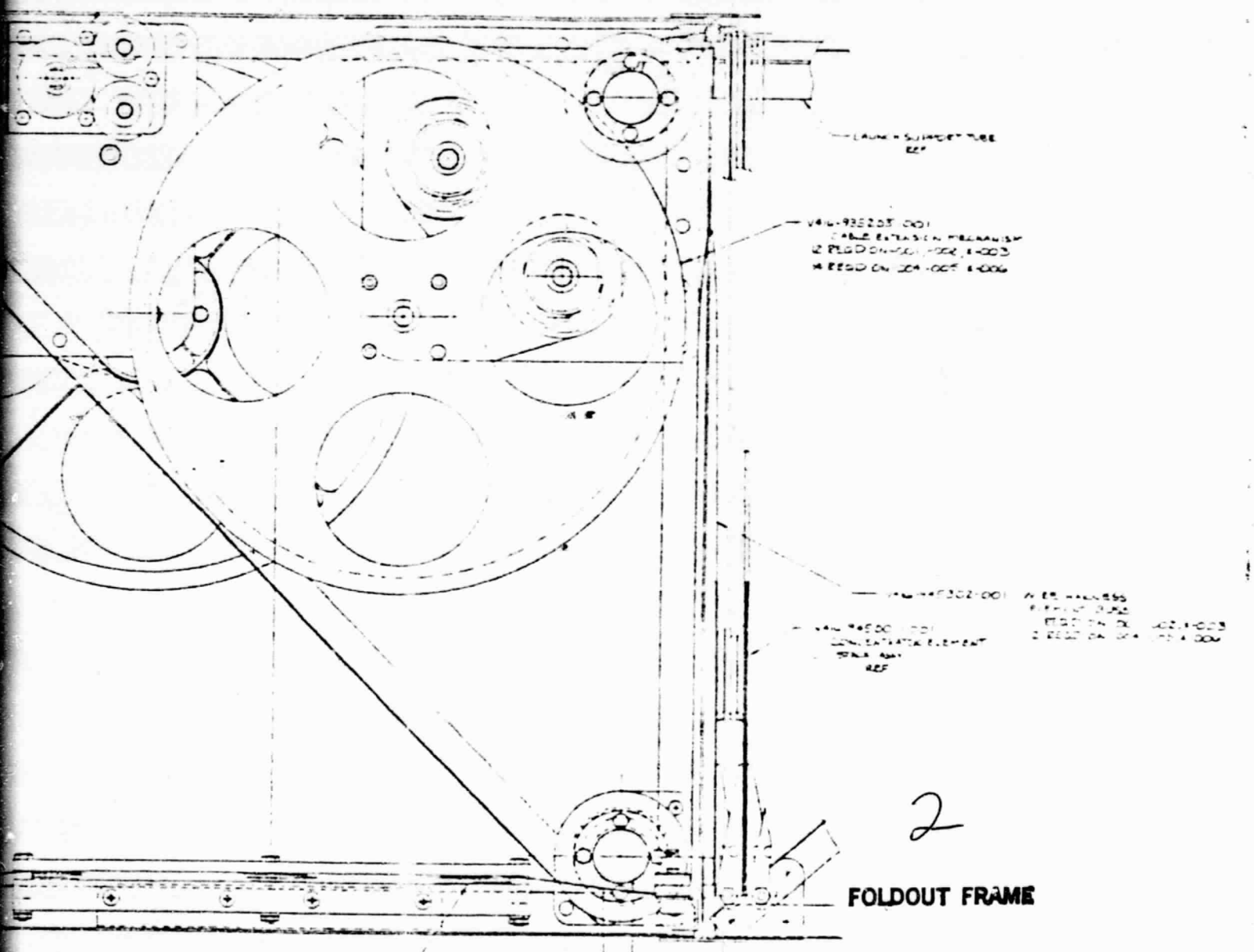

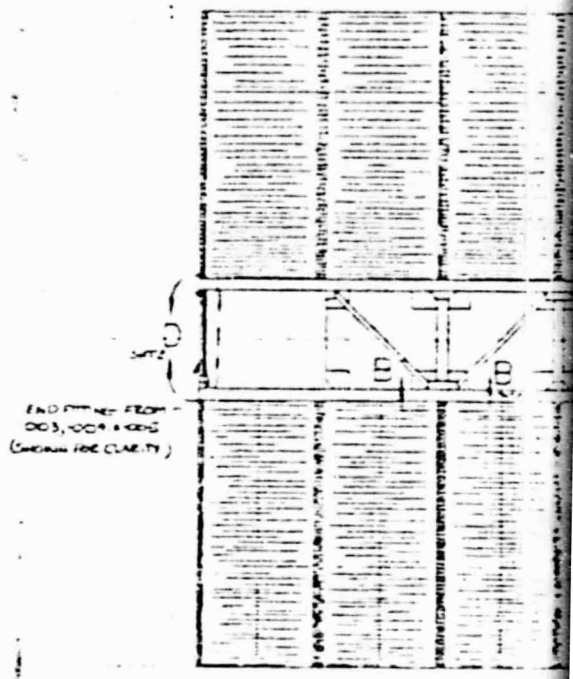

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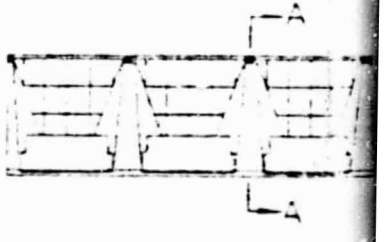

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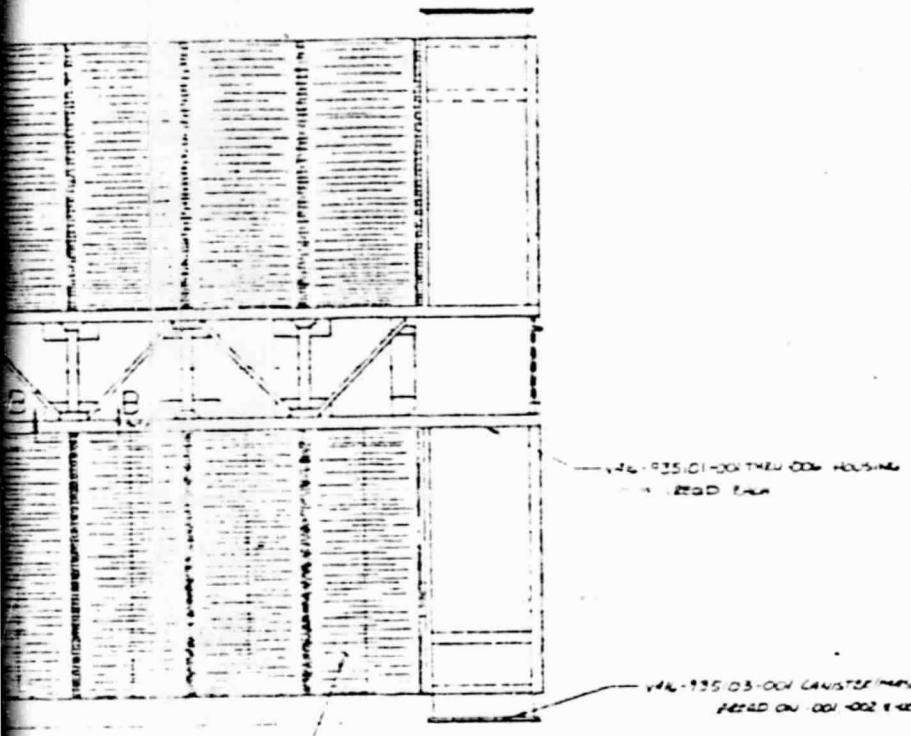

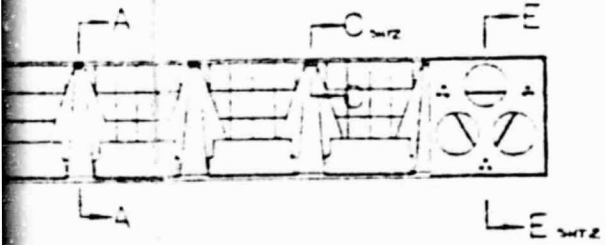

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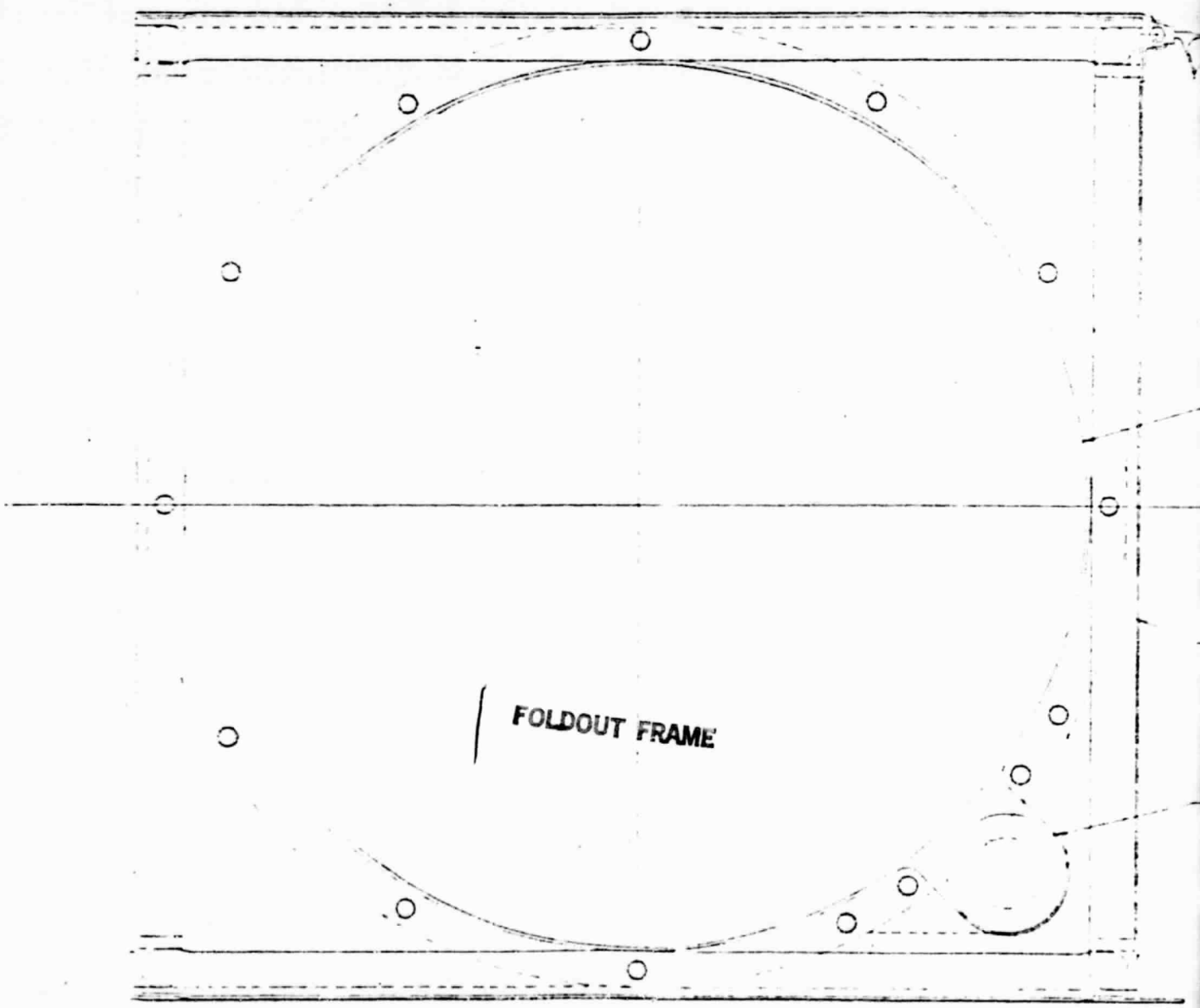
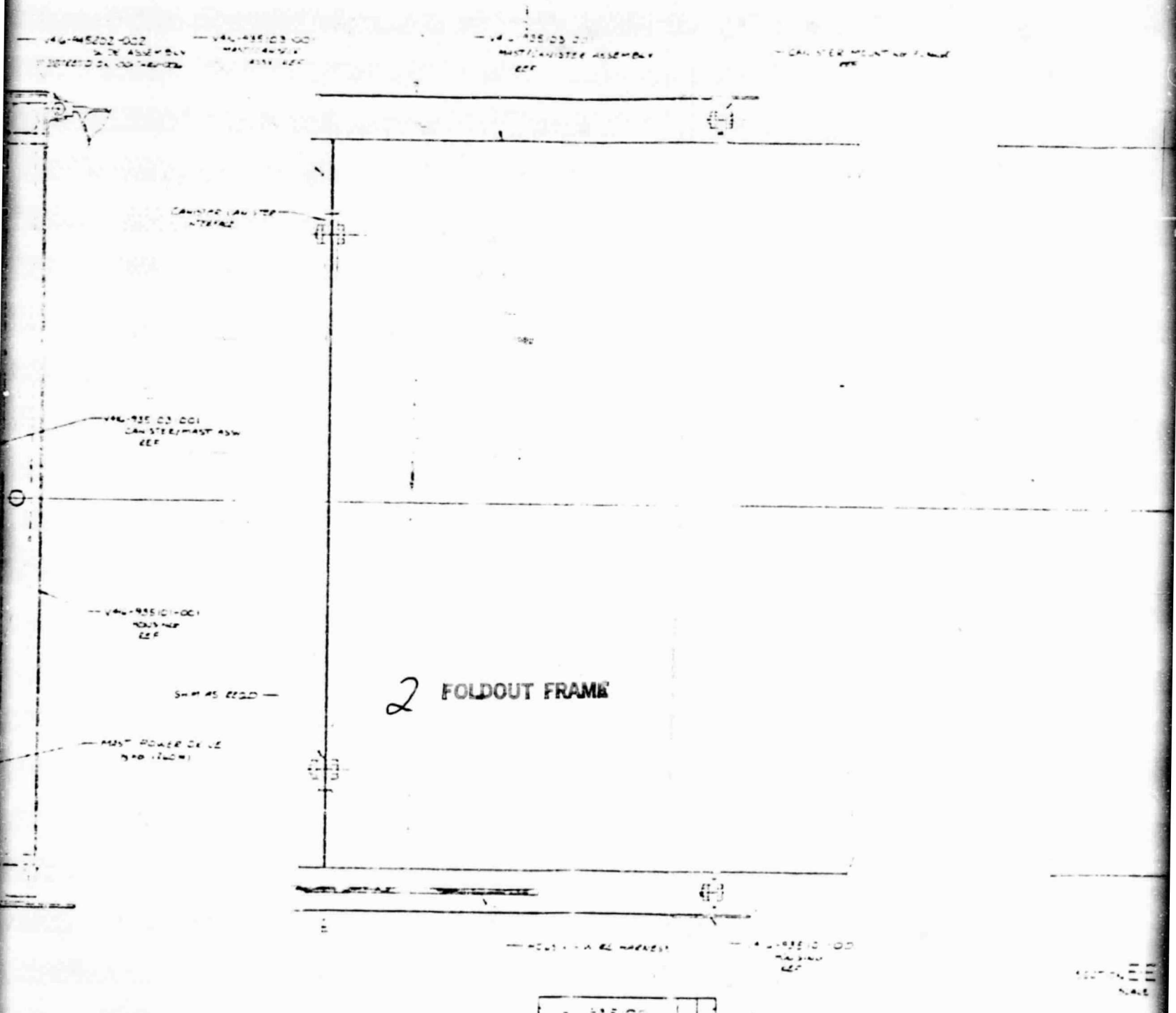
-001 SHOWN

1-15, 1-16



SECTION G G
SCALE



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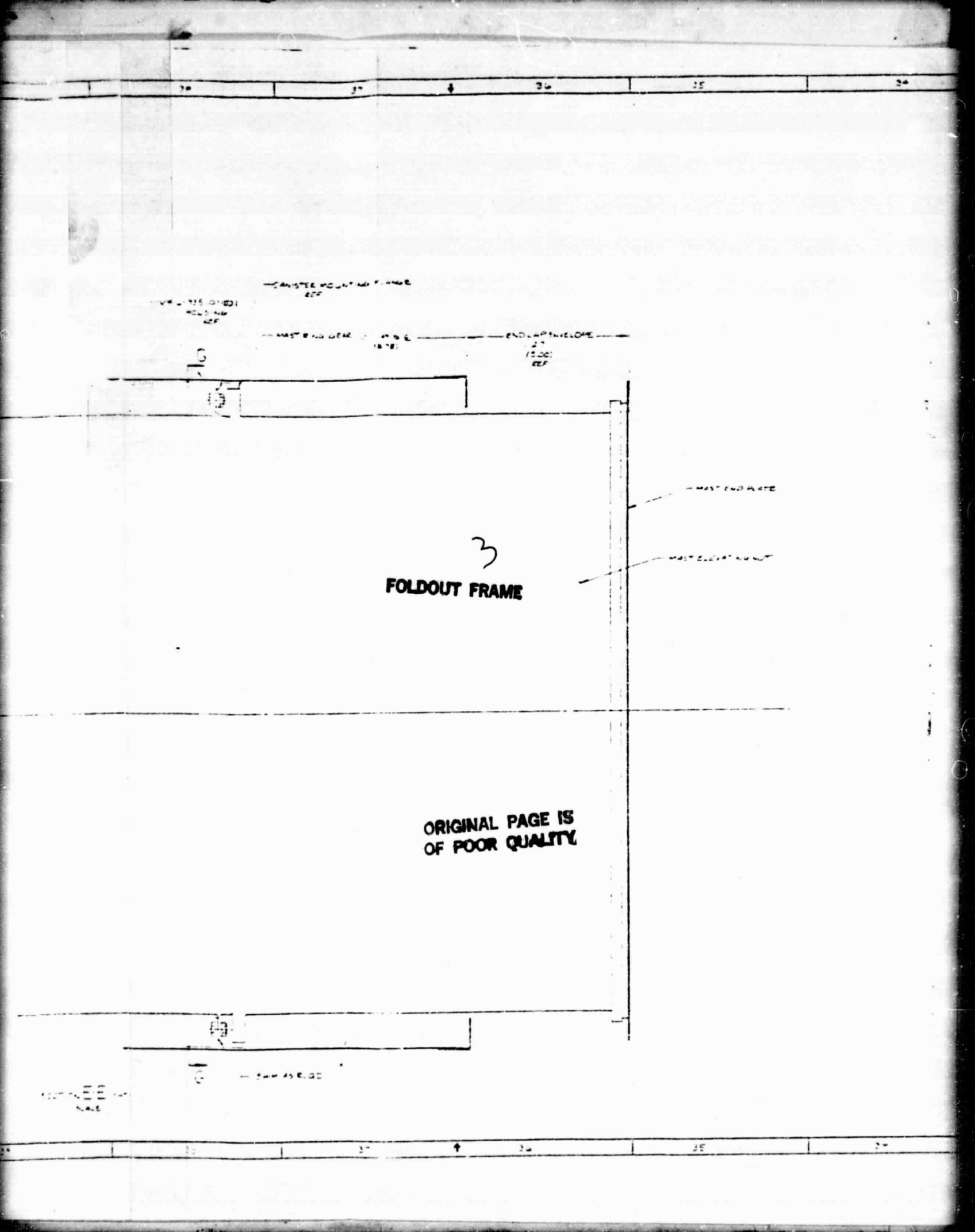

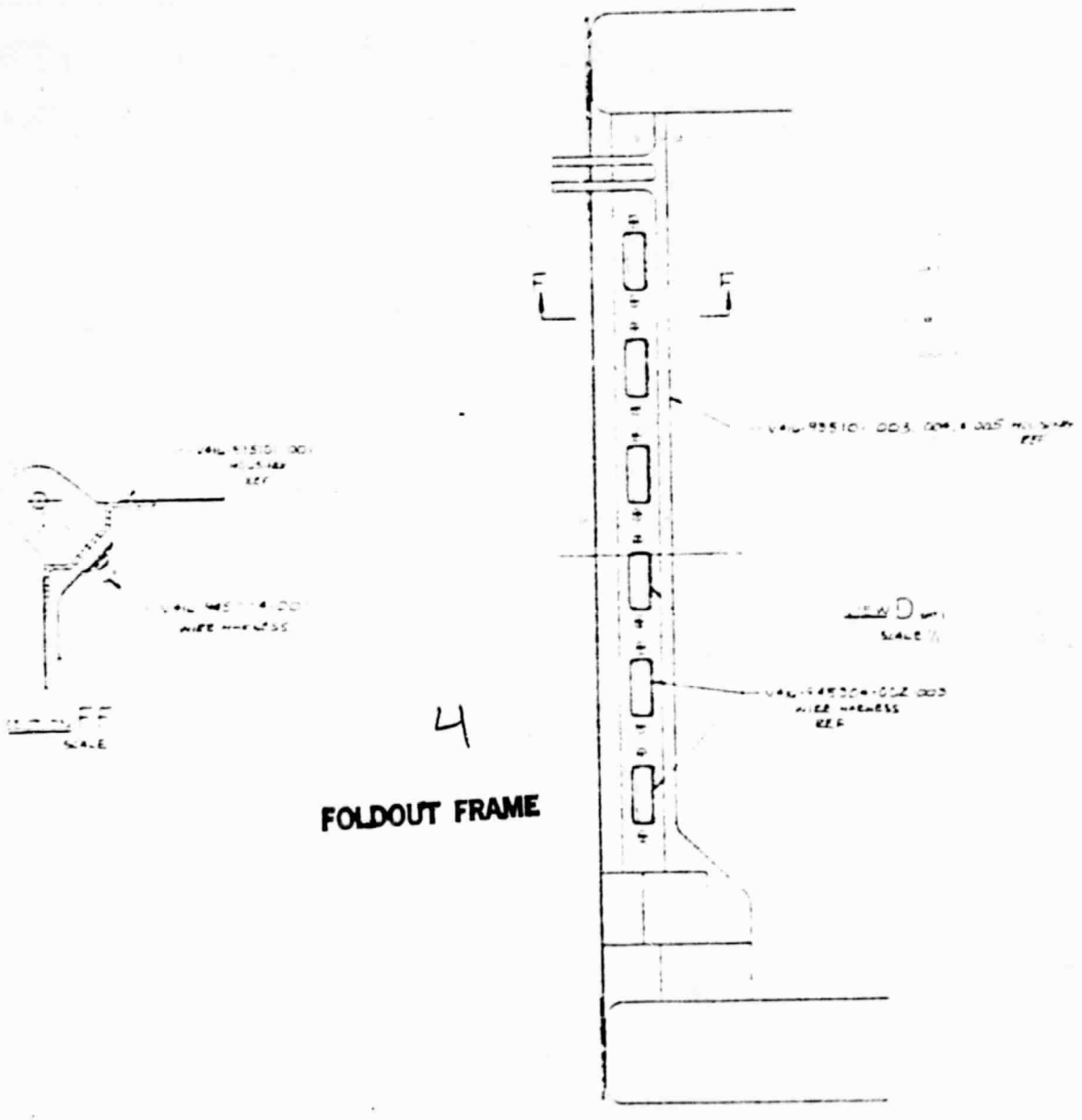

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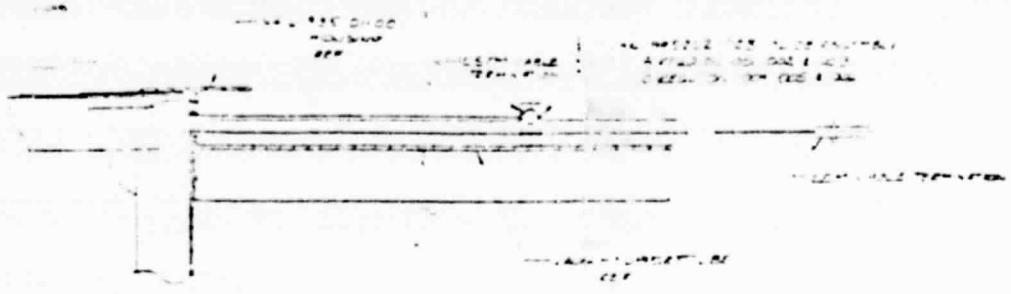

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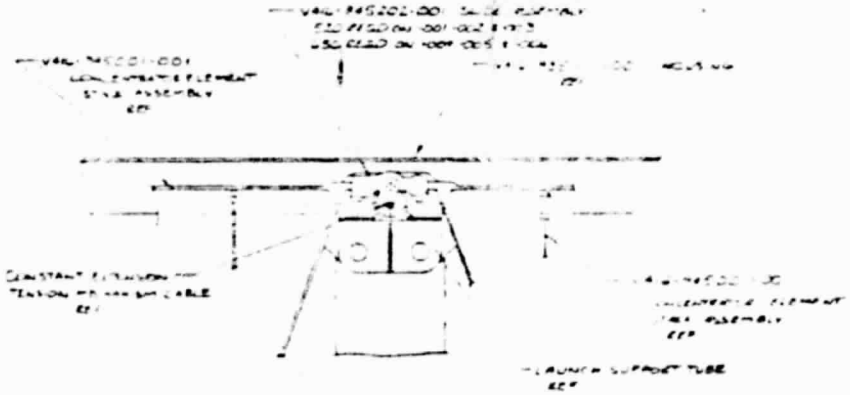

SECTION BB

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16 15 14 13 12

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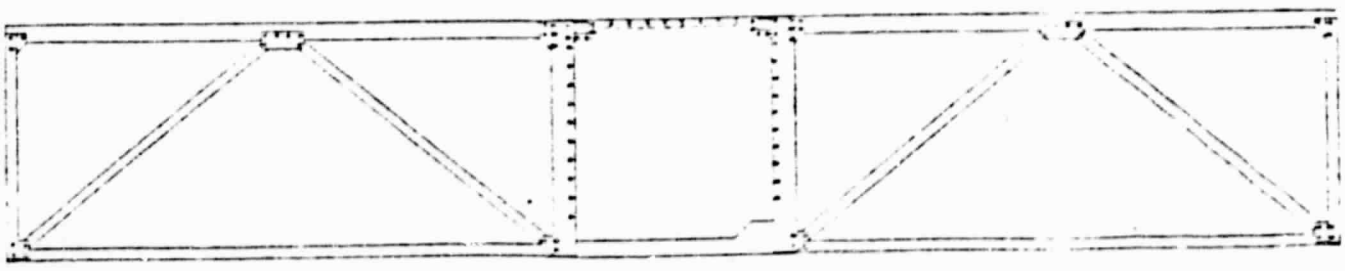

16 15 14 13 12

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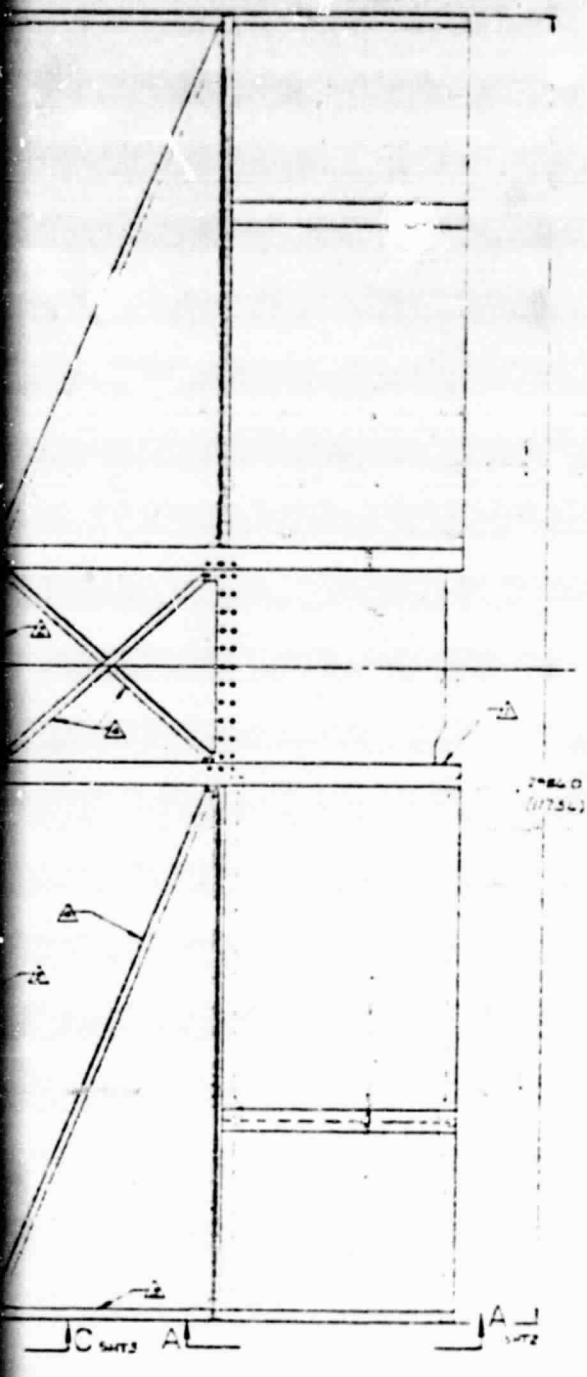

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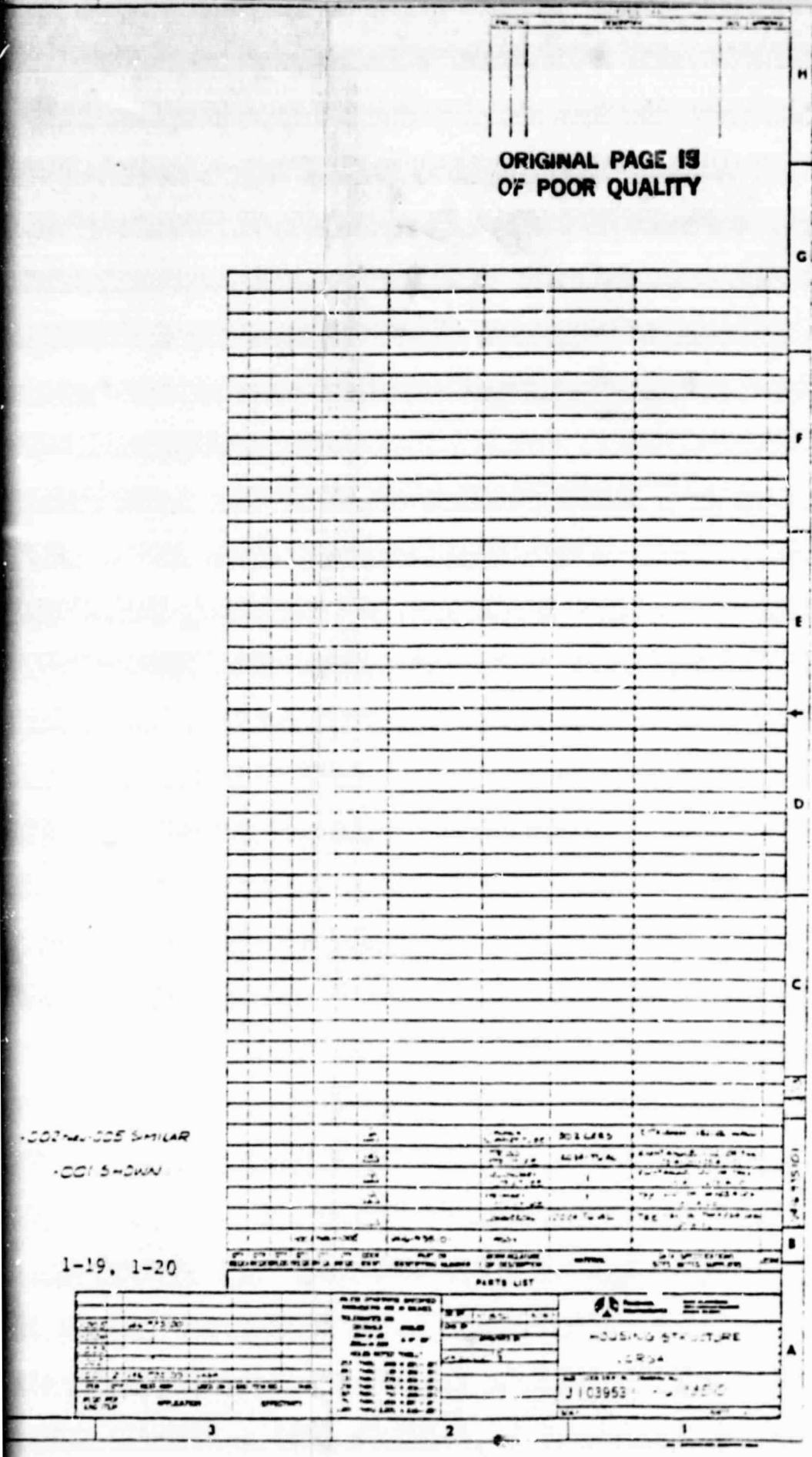
-002 THRU -005 SIMILAR

-001 SHOWN

1-19, 1-20



-002 thru -005 SIMILAR

-001 SHOWN

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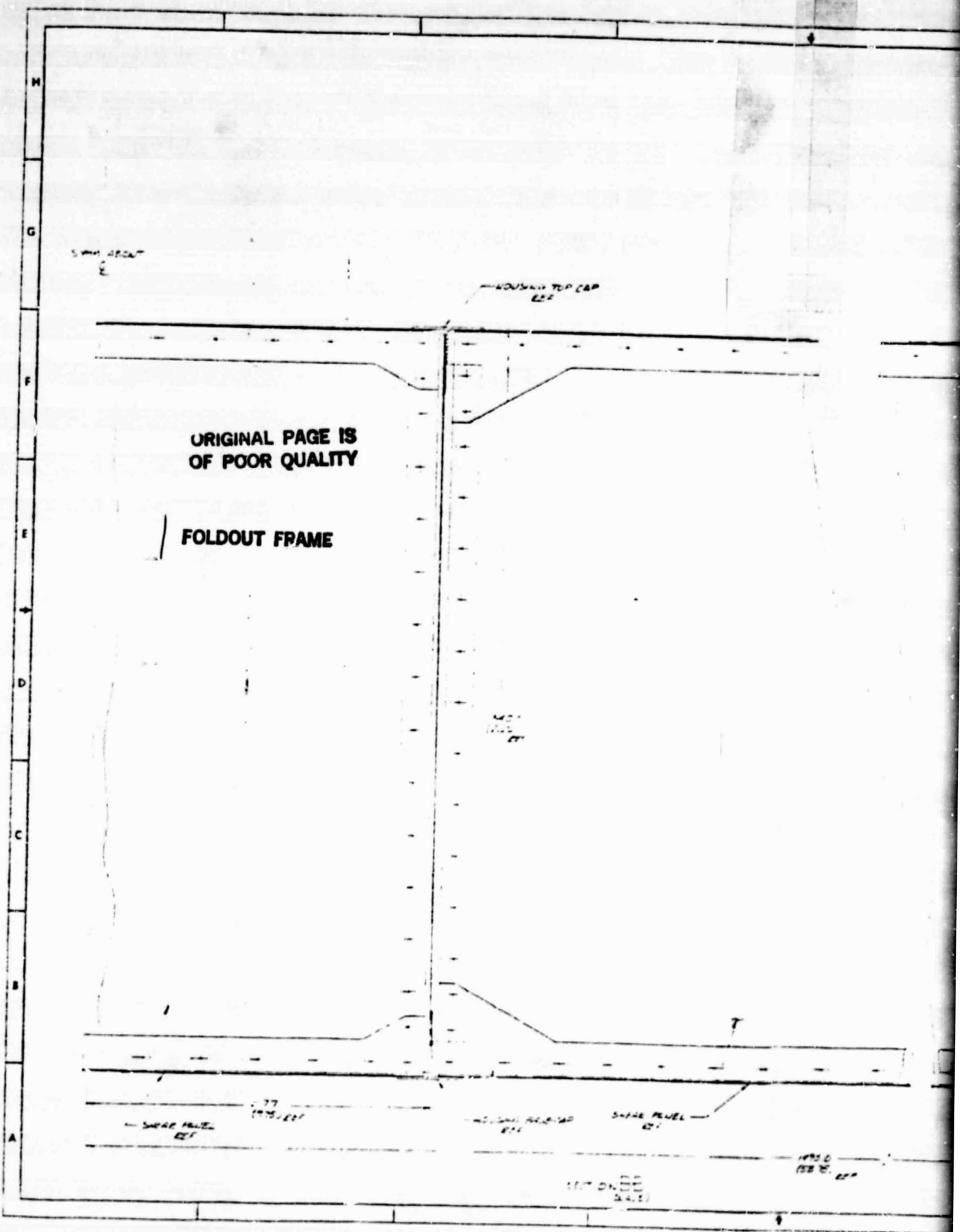
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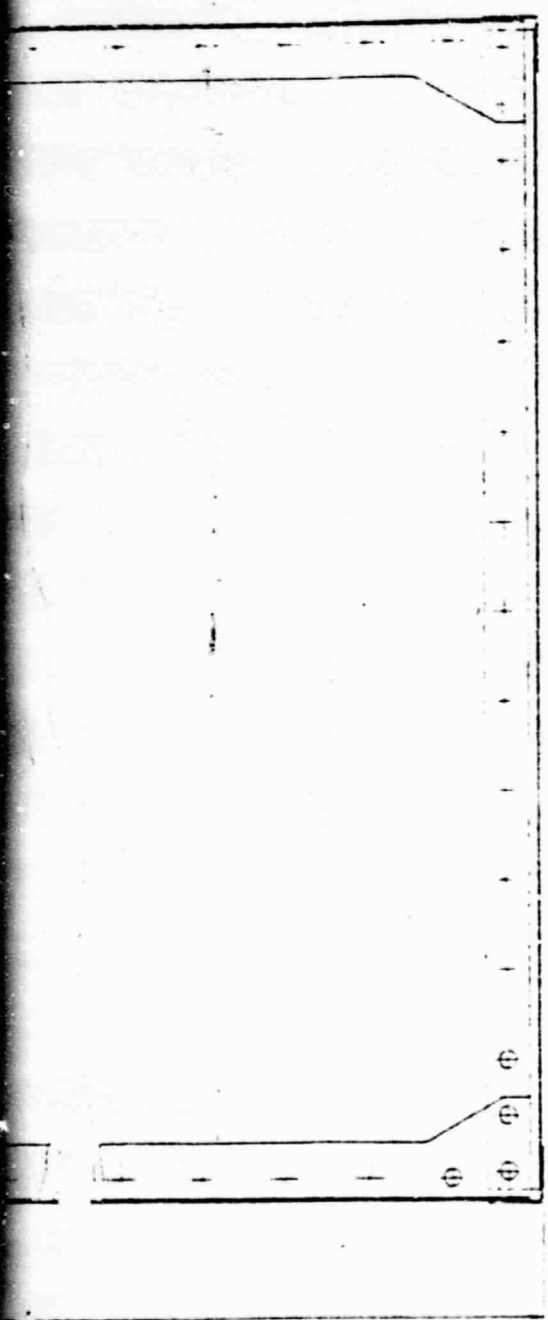

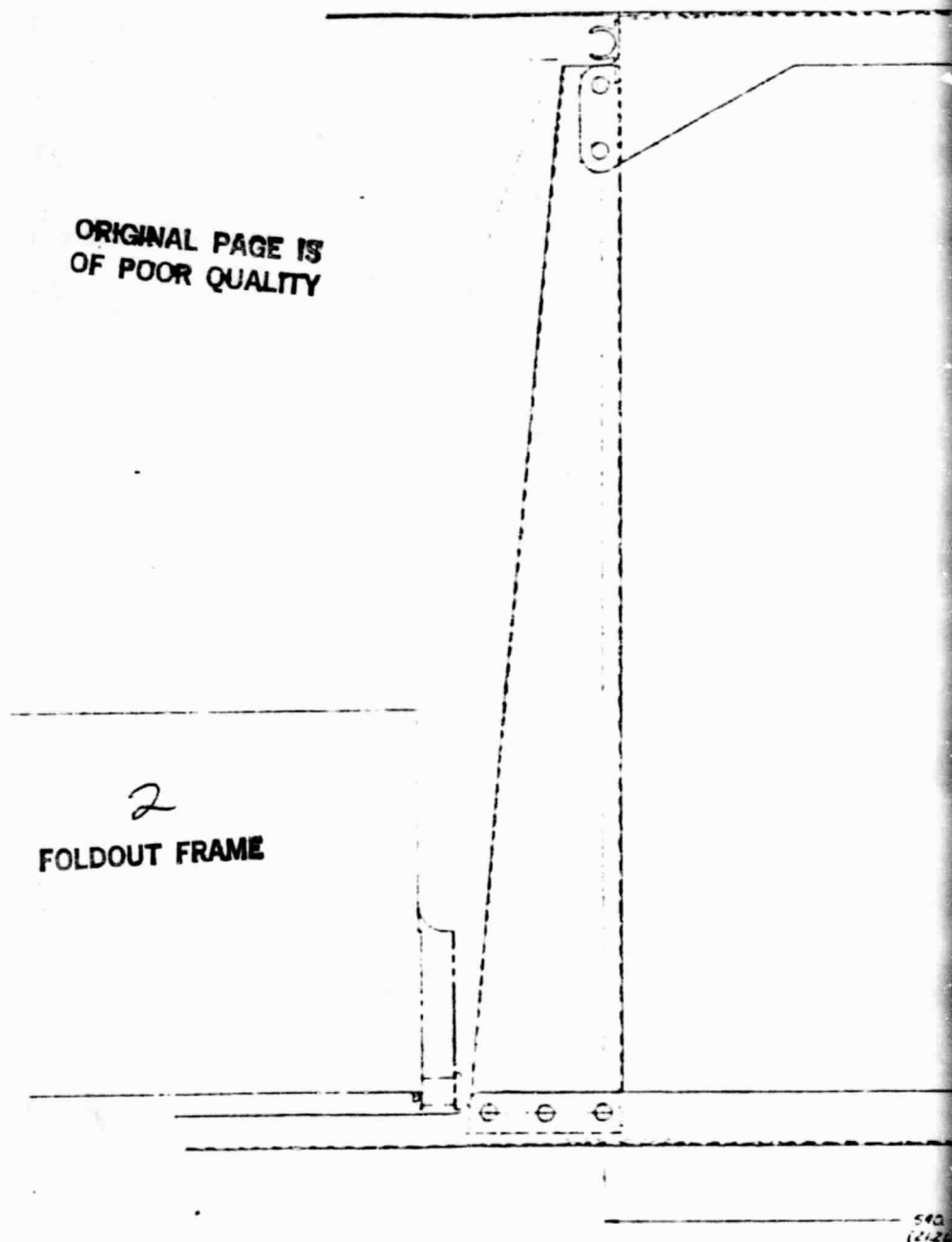

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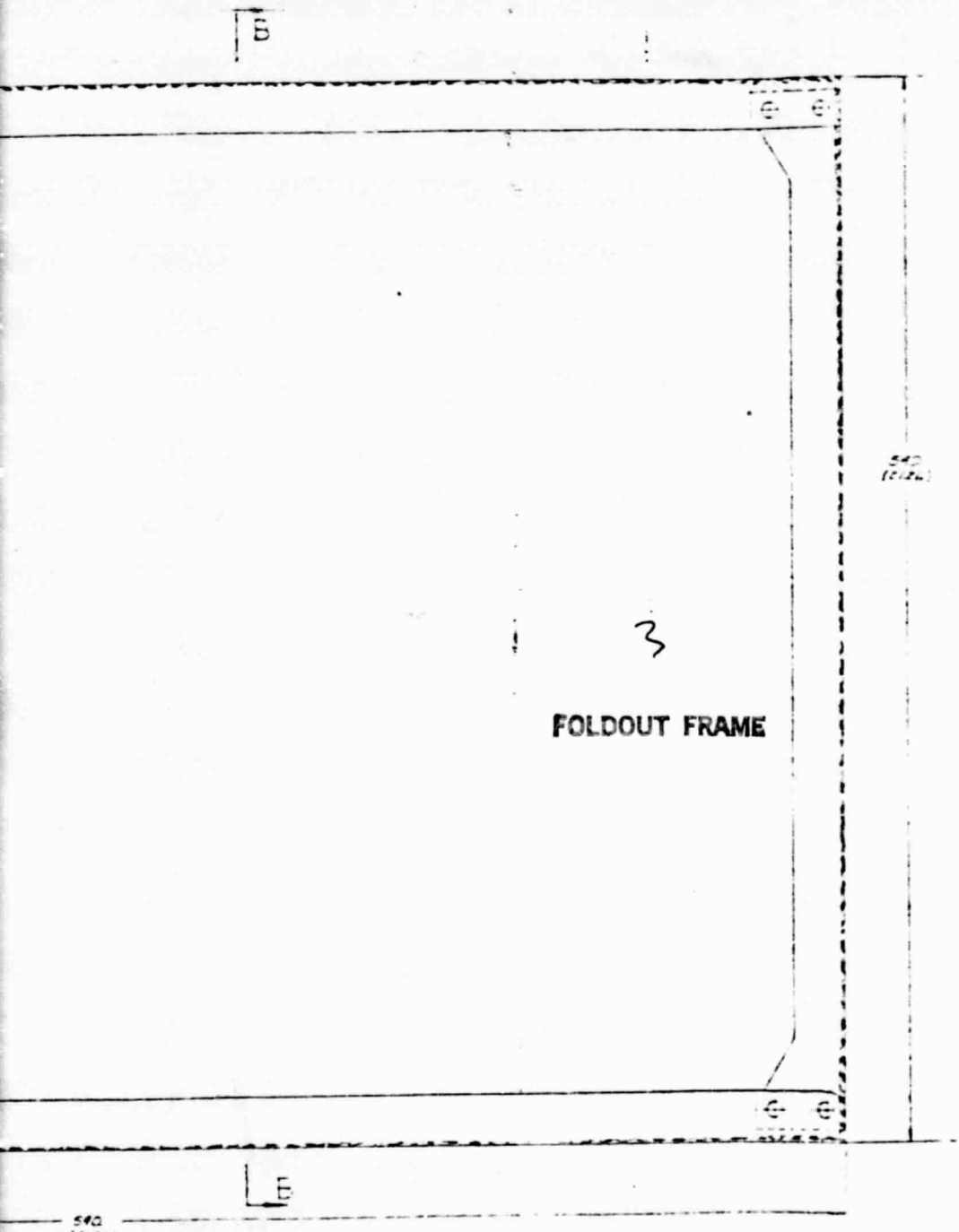

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1-21, 1-22

J 10395 | V414-935101

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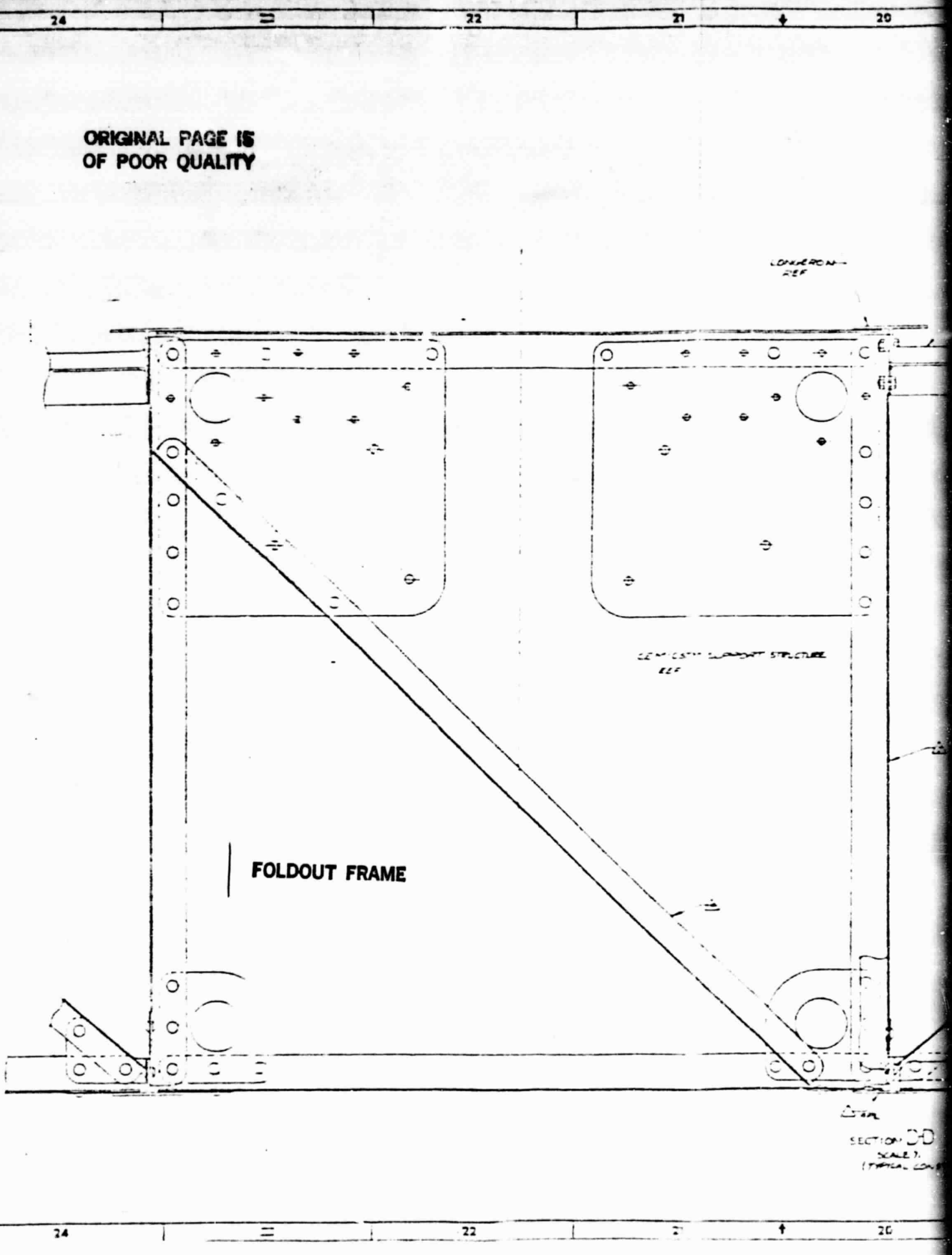

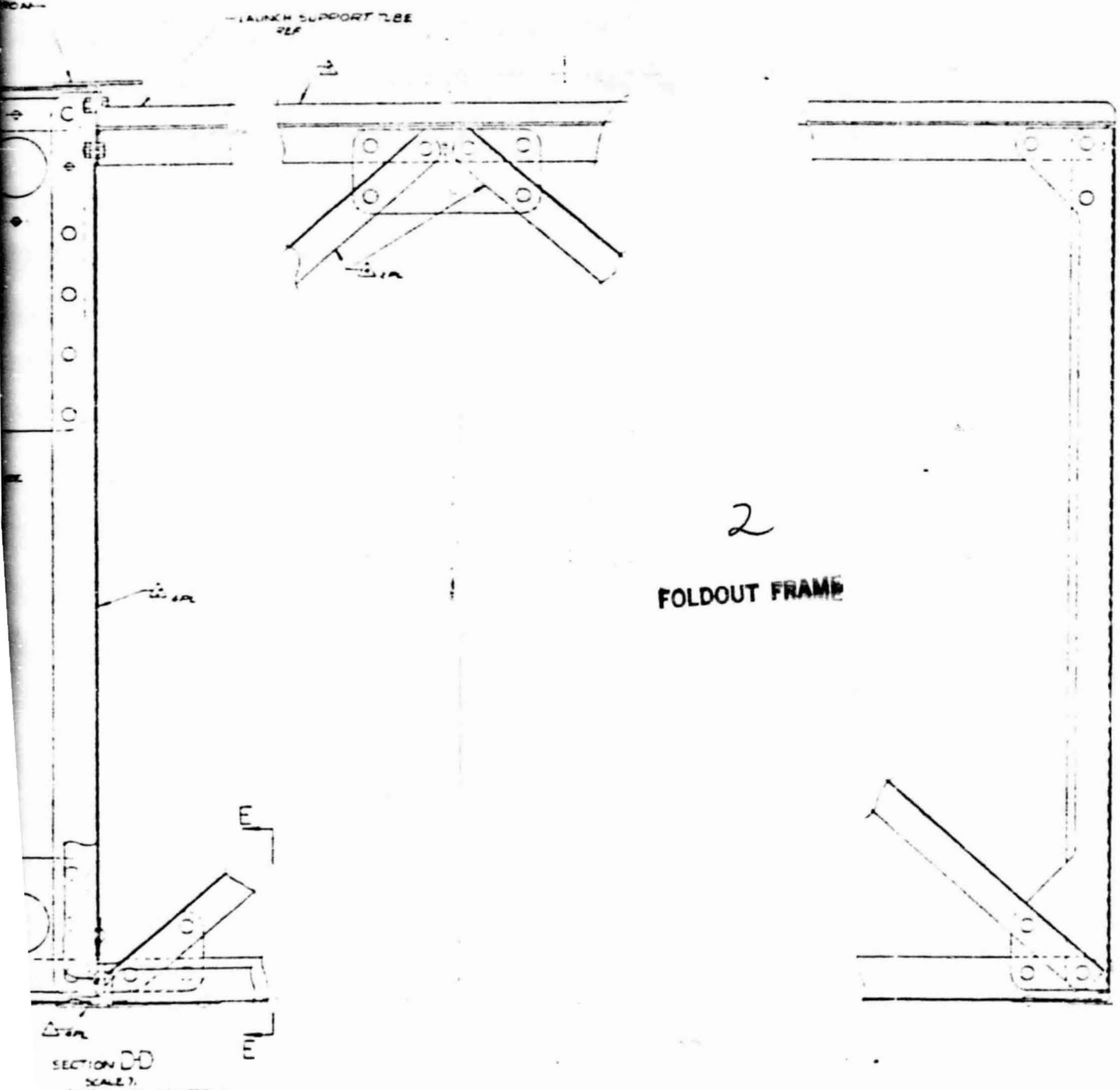

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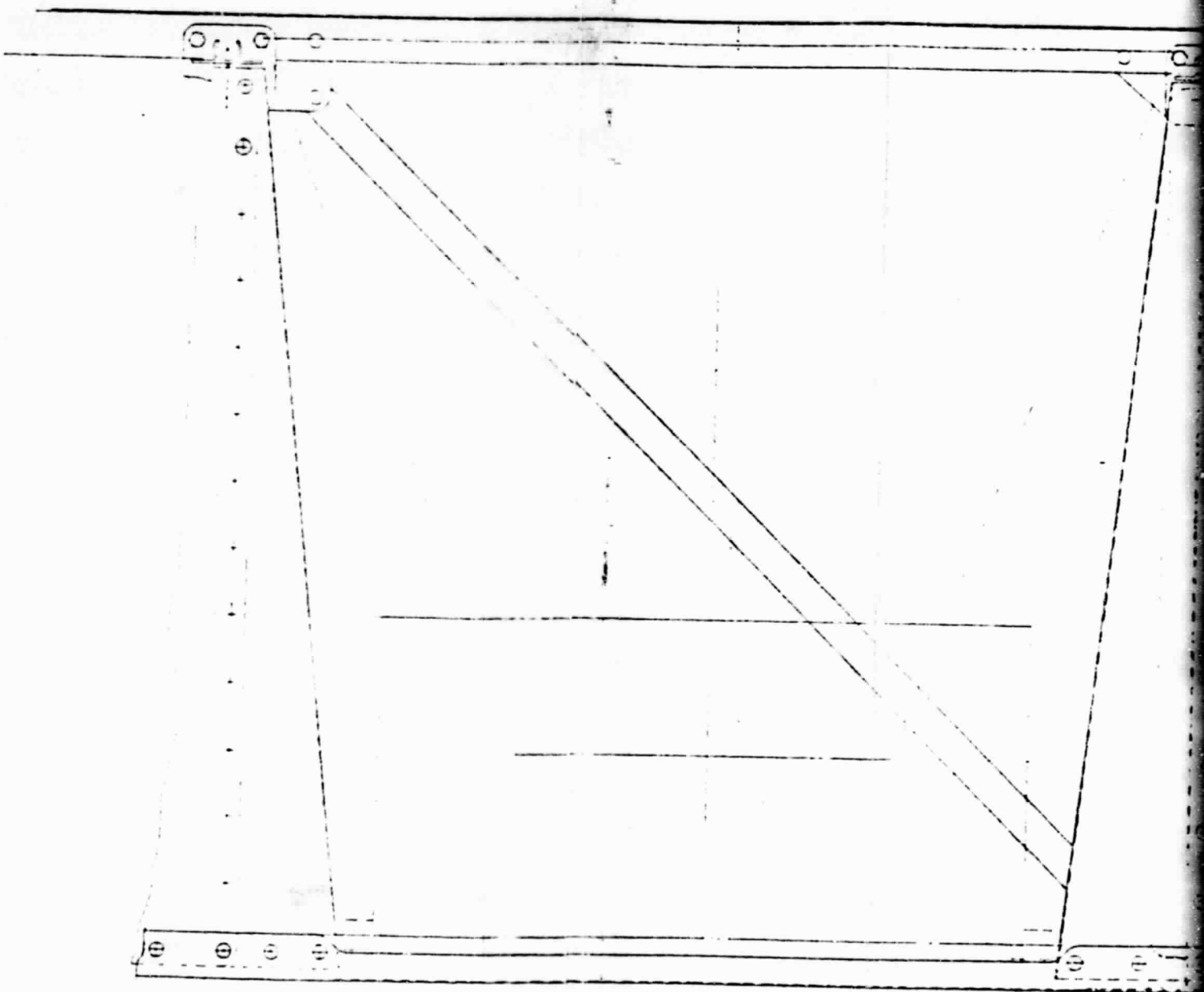

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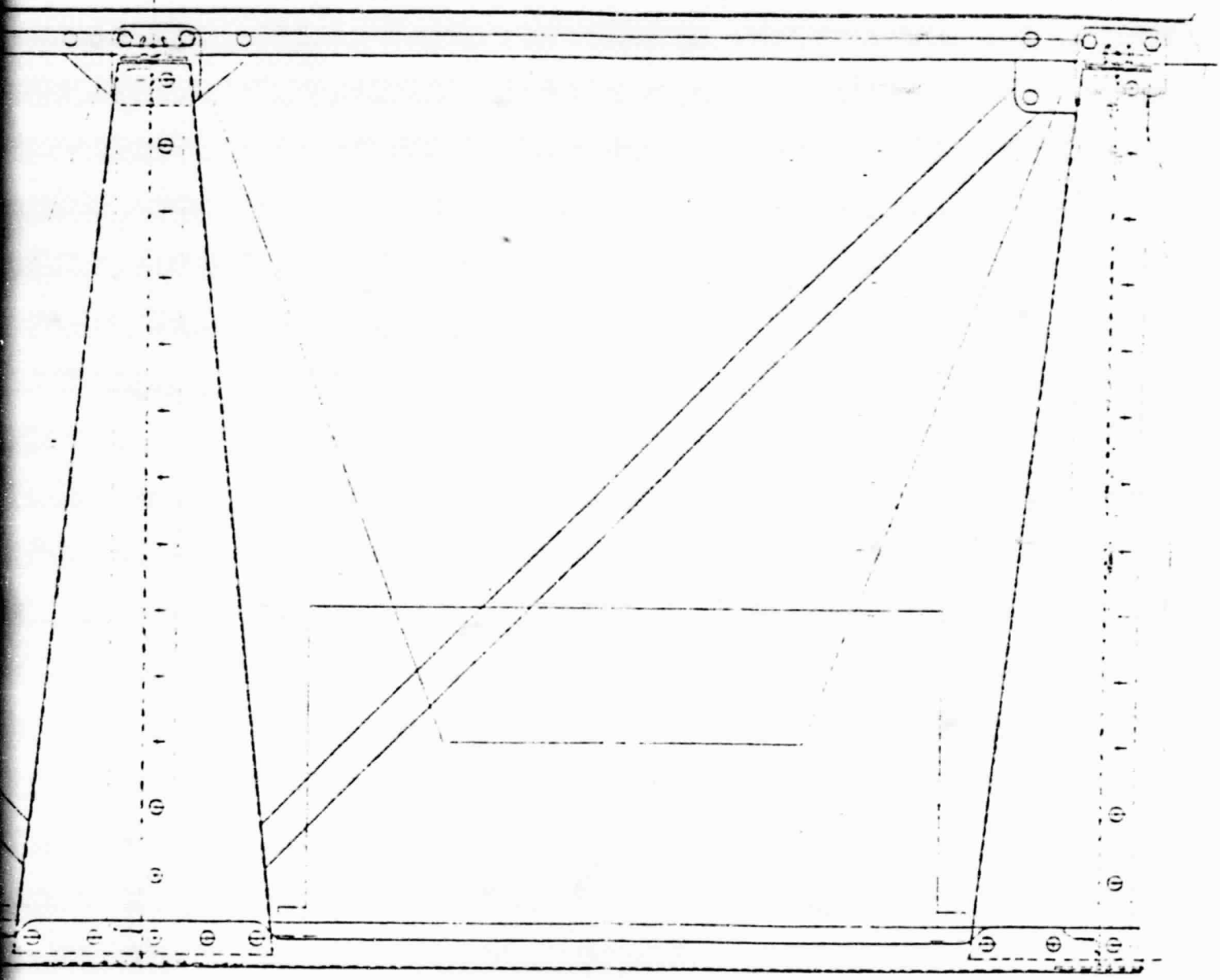

SECTION C-C
SCALE ½
TYPICAL STRUCTURE

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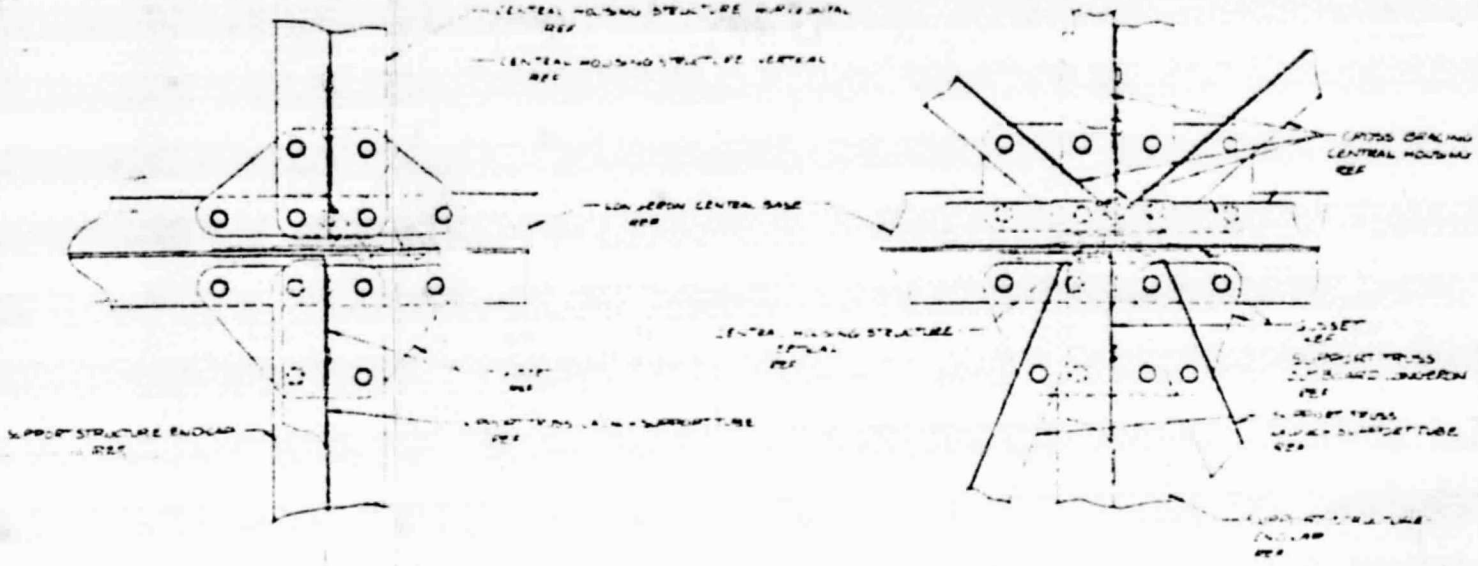

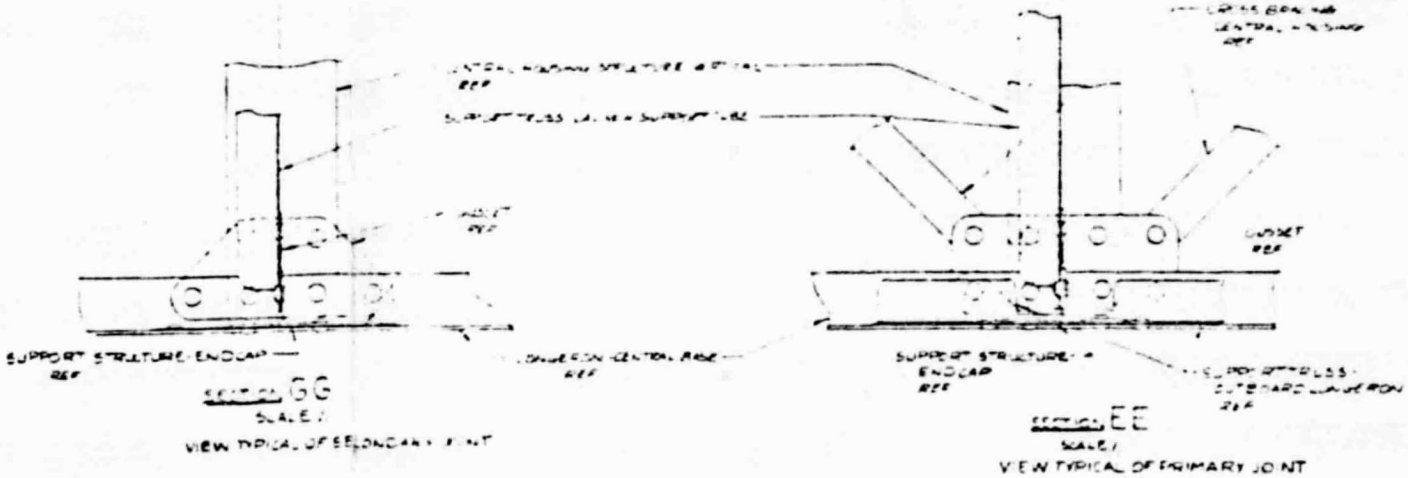

VIEW TYPICAL OF SECONDARY JOINT

VIEW TYPICAL OF PRIMARY JOINT

HOUSING STRUCTURE

1-23, 1-24

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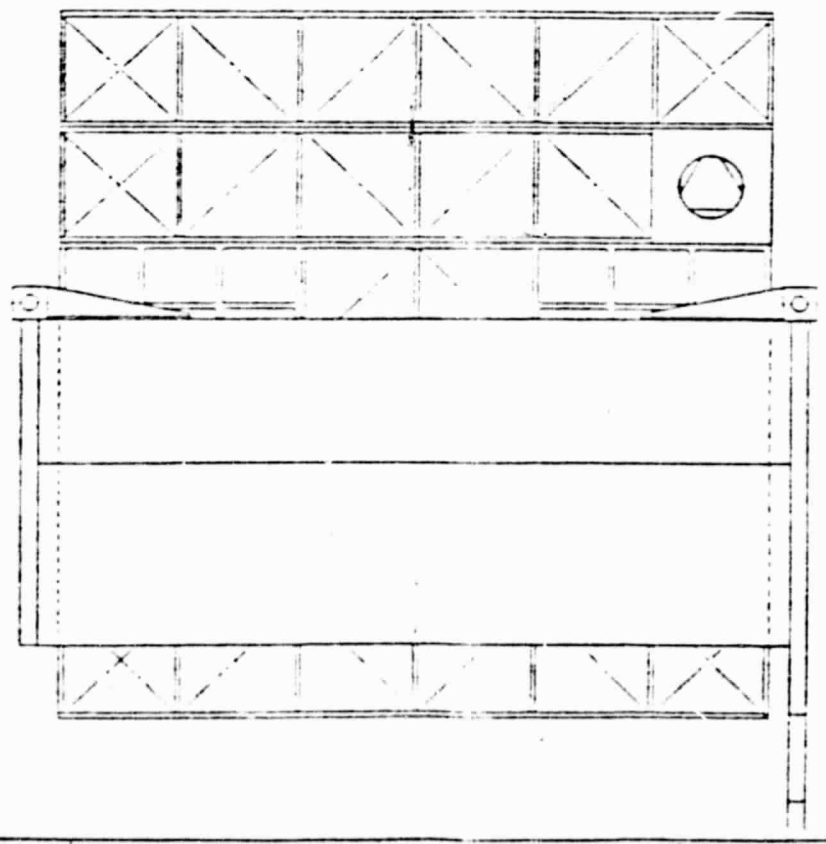
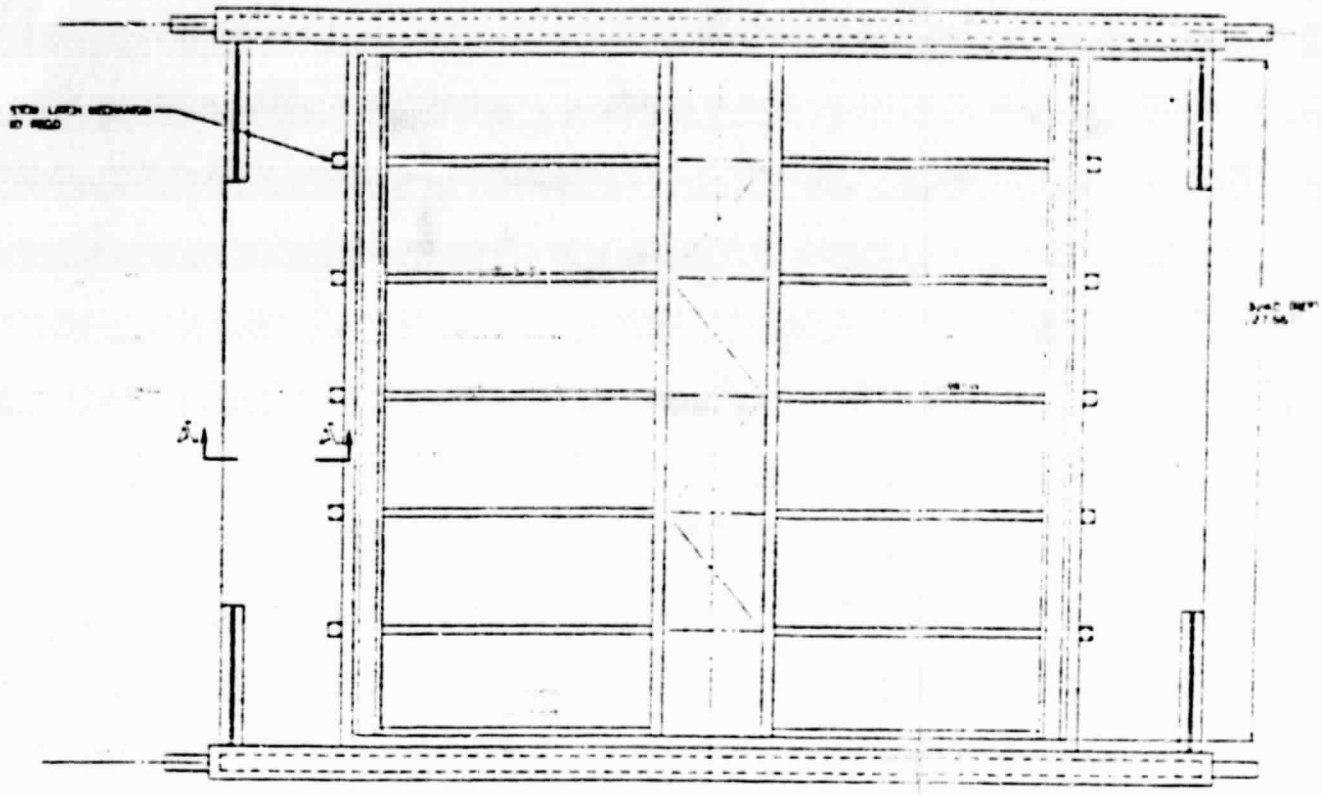
SECTION A-A





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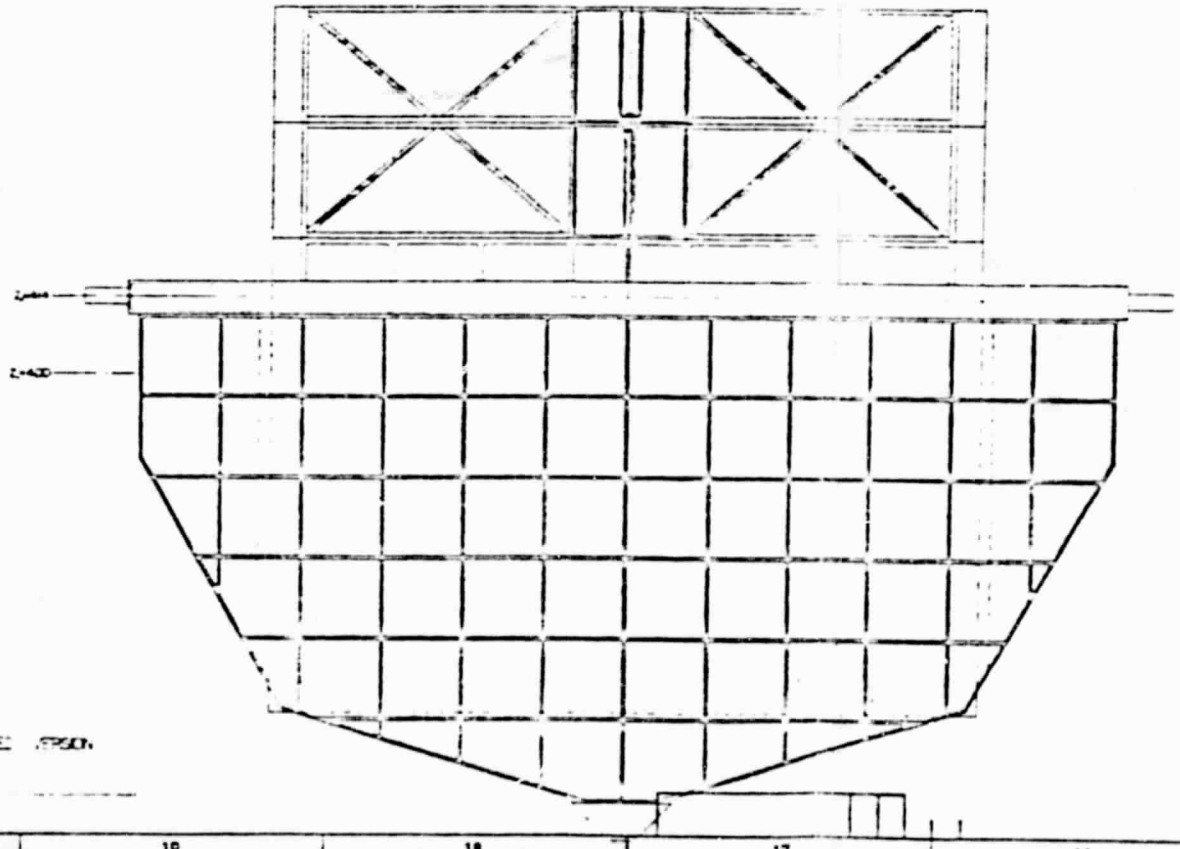

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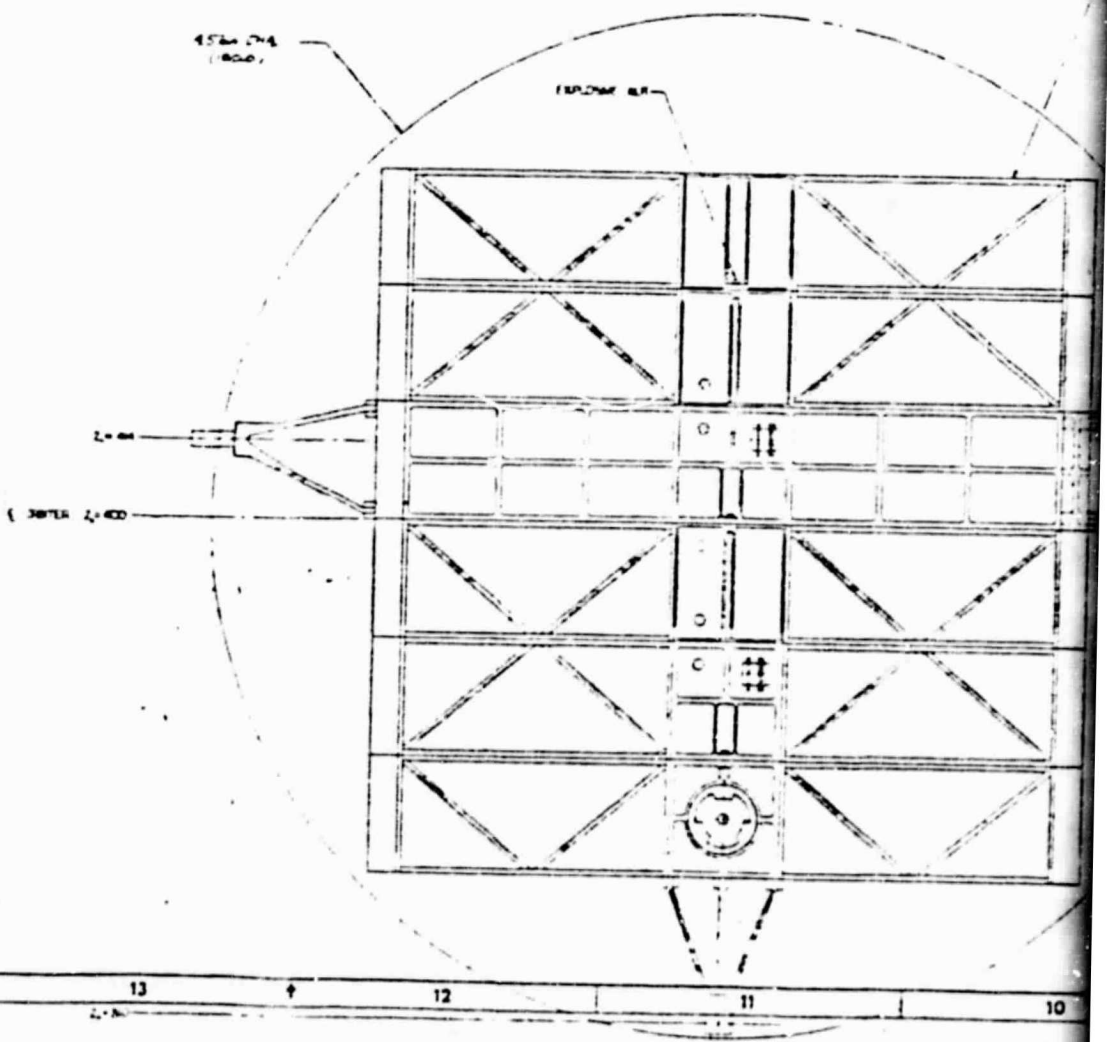

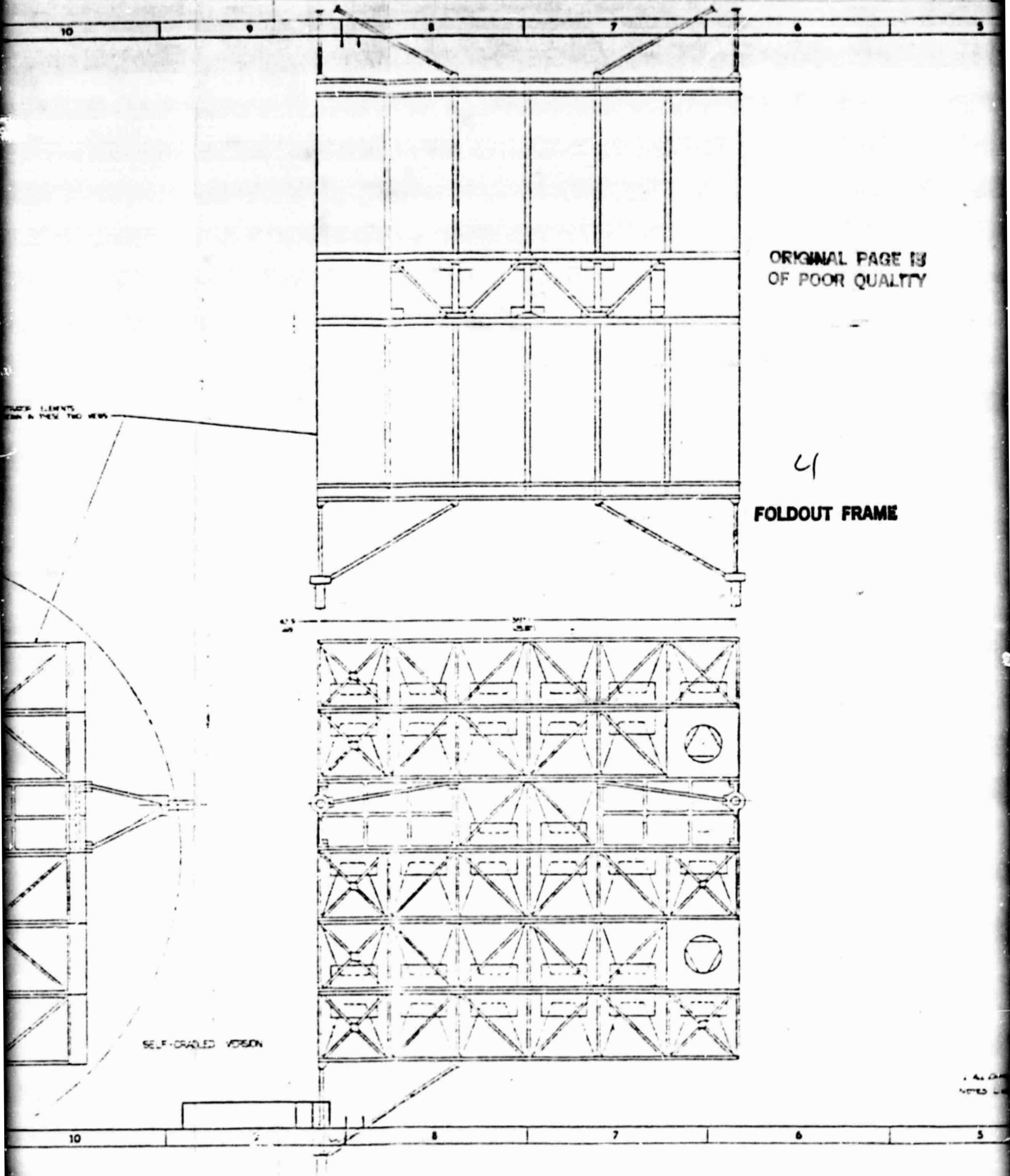

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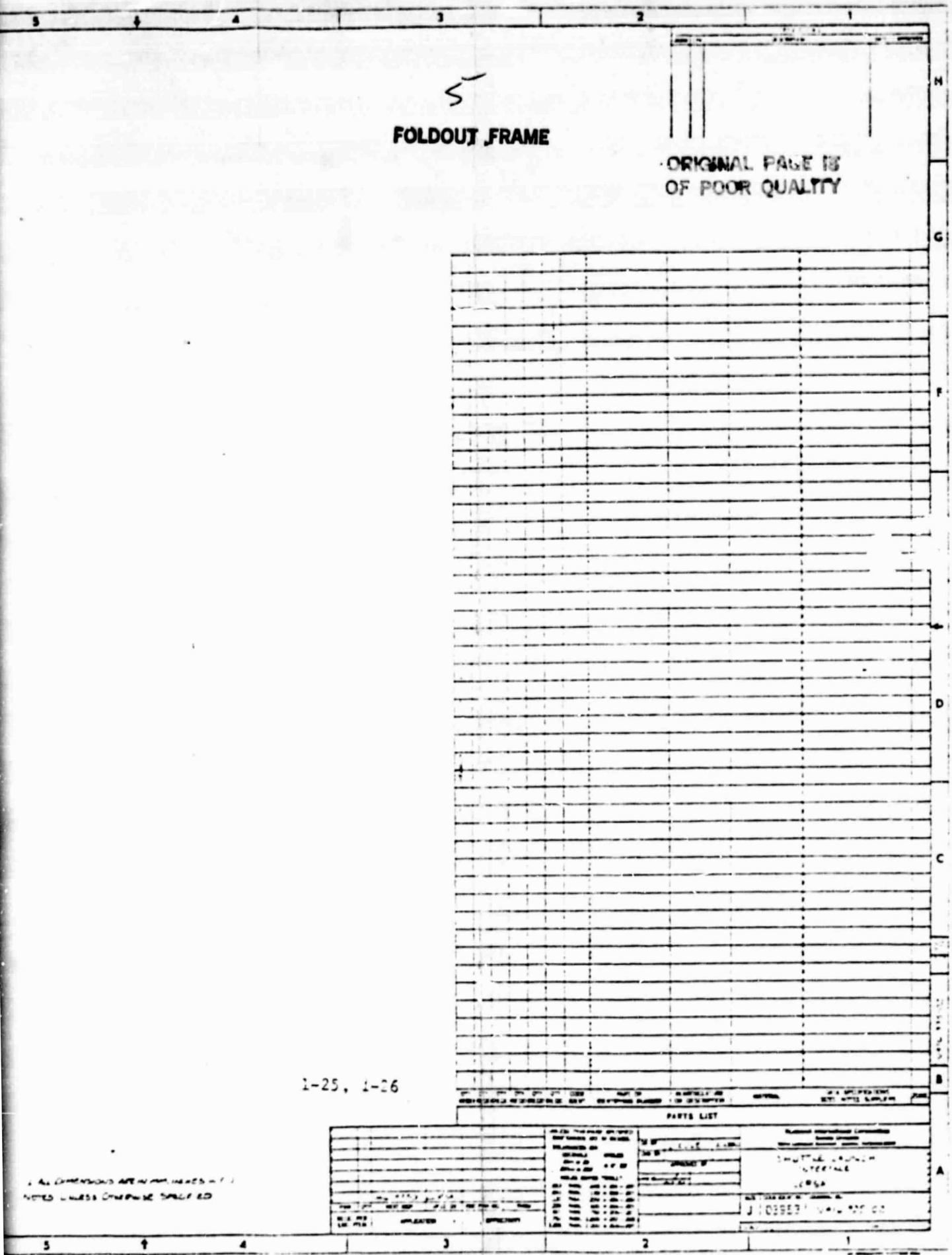

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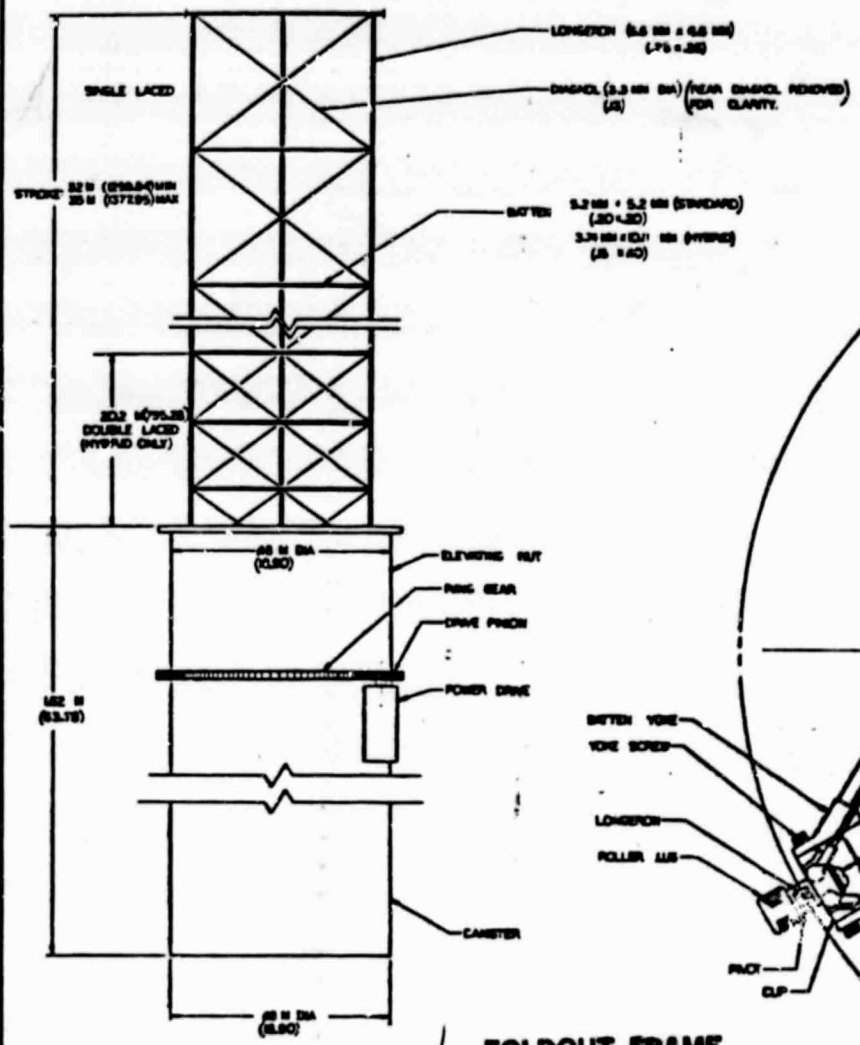

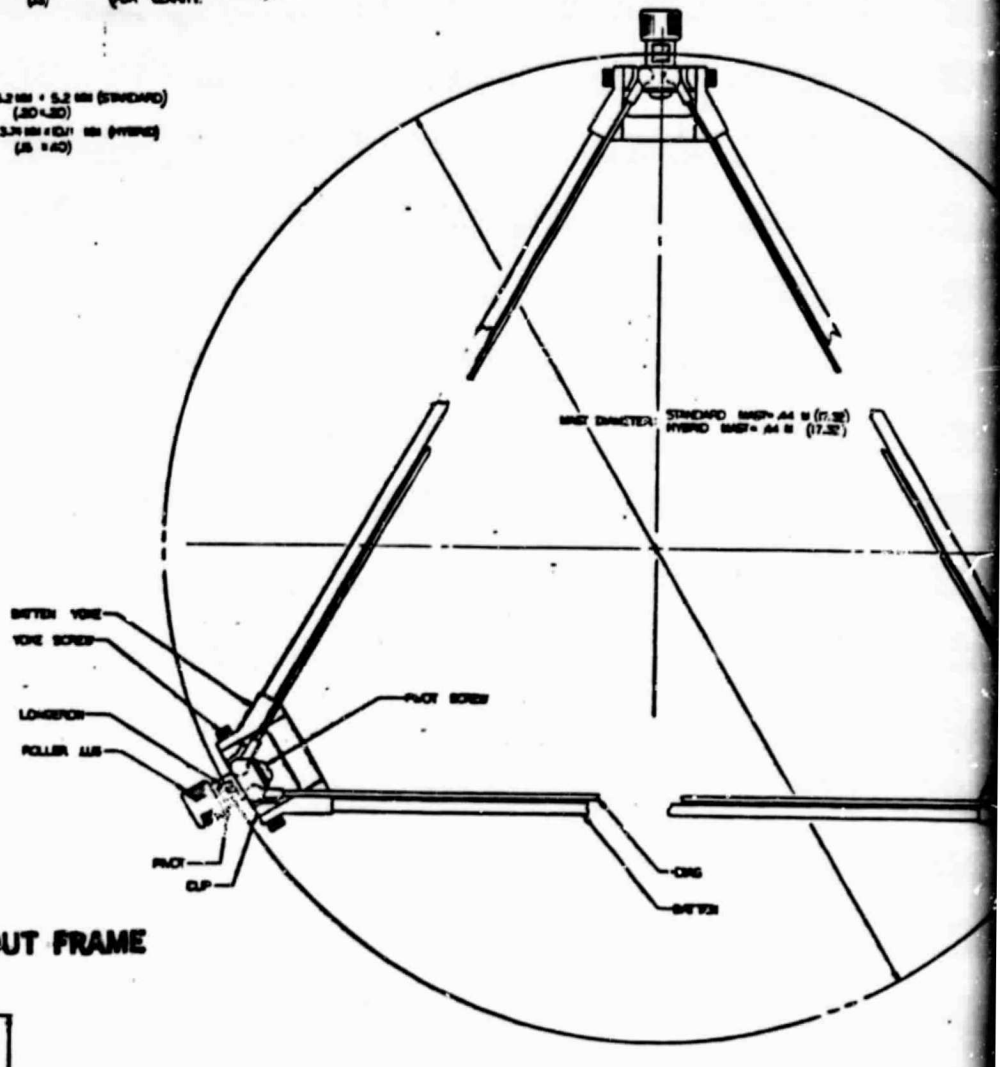

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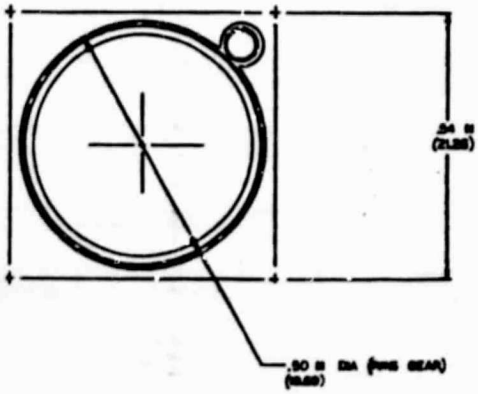

(ALL DIM IN METERS, INCHES IN ( ).
NOTES: UNLESS OTHERWISE SPECIFIED

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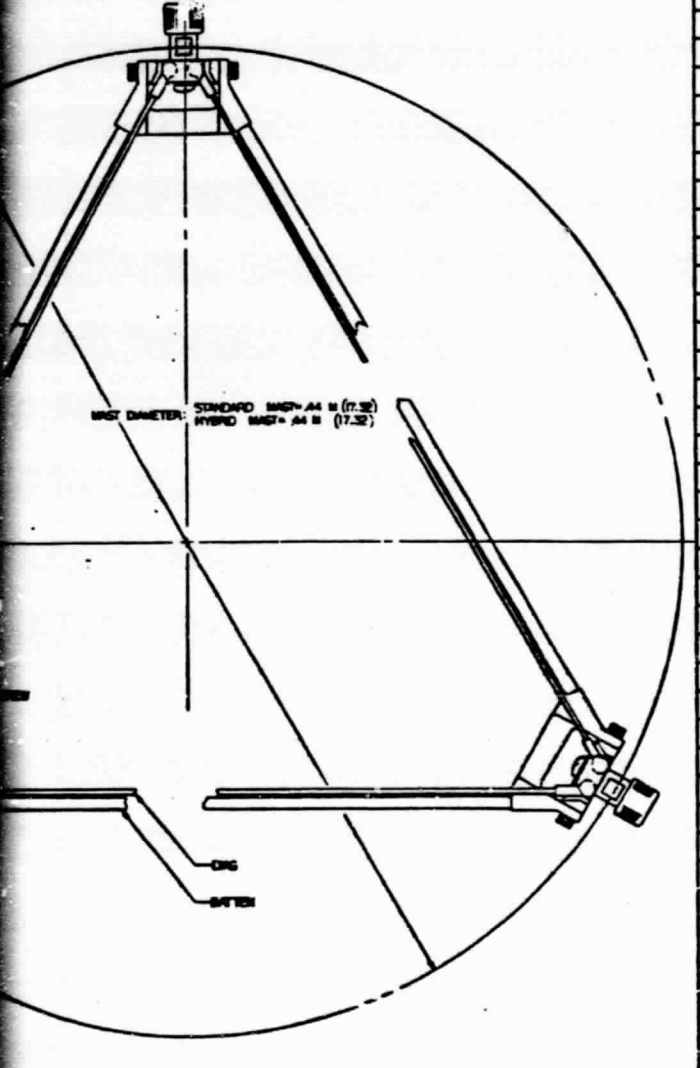

1-27, 1-28

PARTS LIST

QTY REQD	QTY REQD	QTY REQD	QTY REQD	QTY REQD	QTY REQD	CODE IDENT	PART OR IDENTIFYING NUMBER	NOMENCLATURE OR DESCRIPTION	MATERIAL	DATA SPECIFICATIONS MODS. NOTES. SUPPLIERS	ZONE

REVISIONS			
ZONE	LTR	DESCRIPTION	DATE / APPROVED

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON:
DECIMALS .XX ± .01 .XXX ± .005
ANGLES ± 0° 30'
HOLES NOTED "WELL" .XX ± .010 — .001
.XXX ± .005 — .001

DR BY: JIM CULE 12-7-82
CHK BY:
APPROVED BY:
MFG APPROVAL:

CANISTER/MAST DESIGN
LERSA

SIZE	CAGE IDENT NO.	DRAWING NO.
E	03953	V416-935103

SCALE: NONE SHEET

-001	A	V46-935100	LERSA
ITEM	QTY	NEXT ASSY	USED ON

USED ON: APPLICATION — EFFECTIVITY — DWG REV NO. — SHELL

ALL DIM IN METERS, INCHES IN ( ).
NOTES: UNLESS OTHERWISE SPECIFIED

V416-935103 B 1/1

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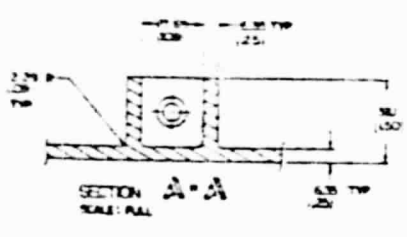
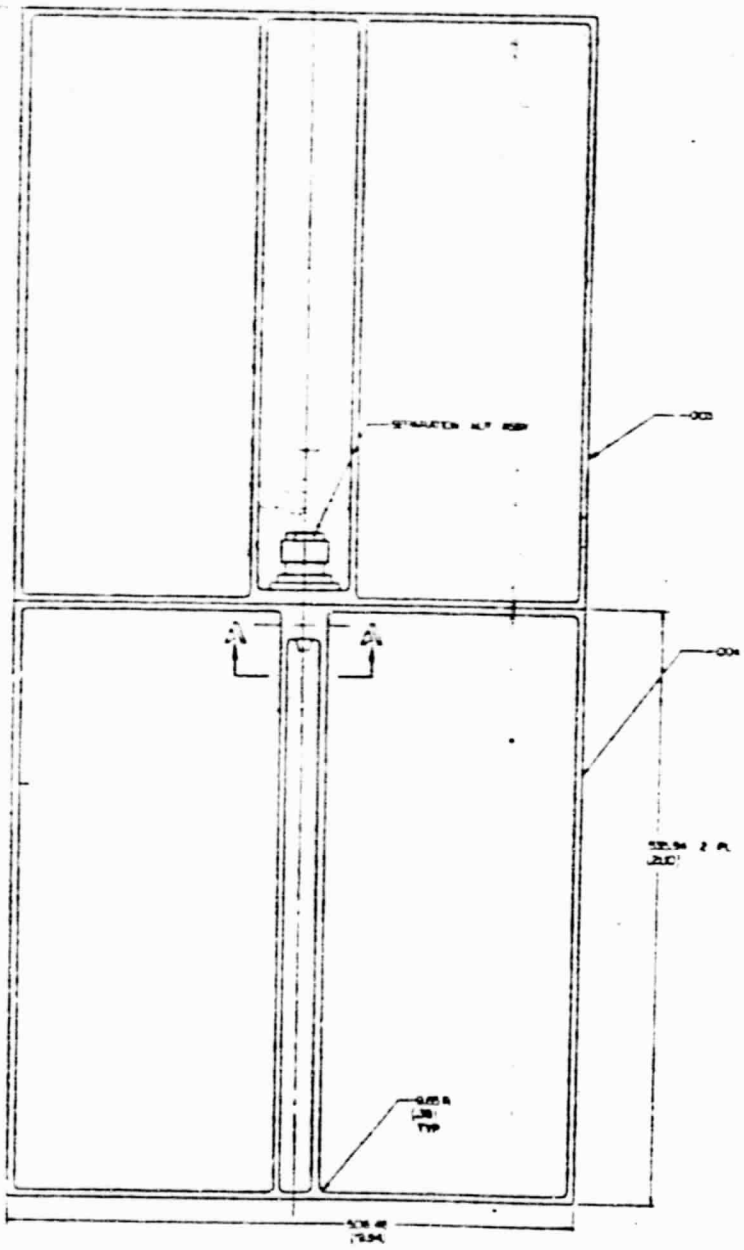


SECTION A-A



LAUNCH LOCKDOWN FITTINGS

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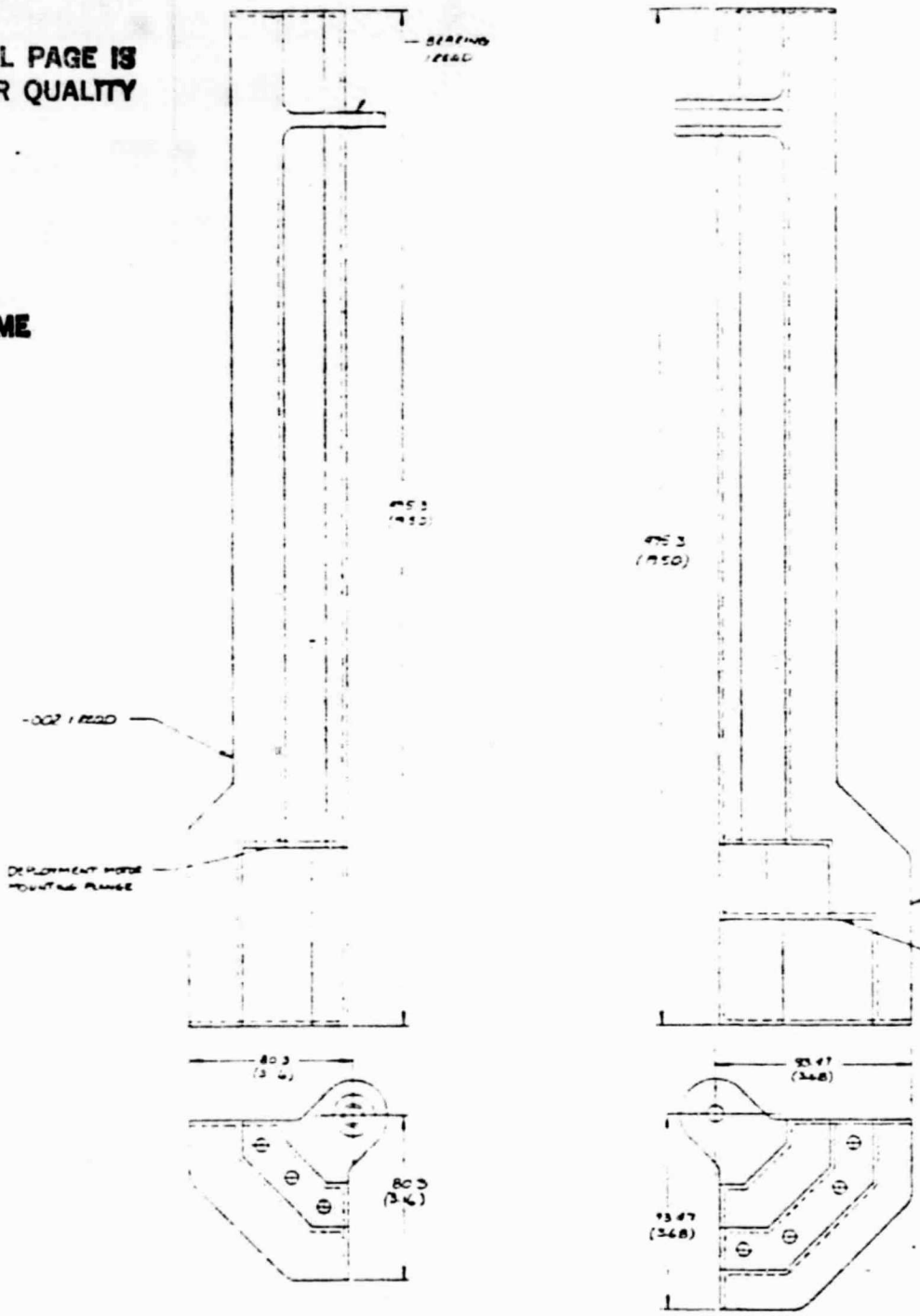

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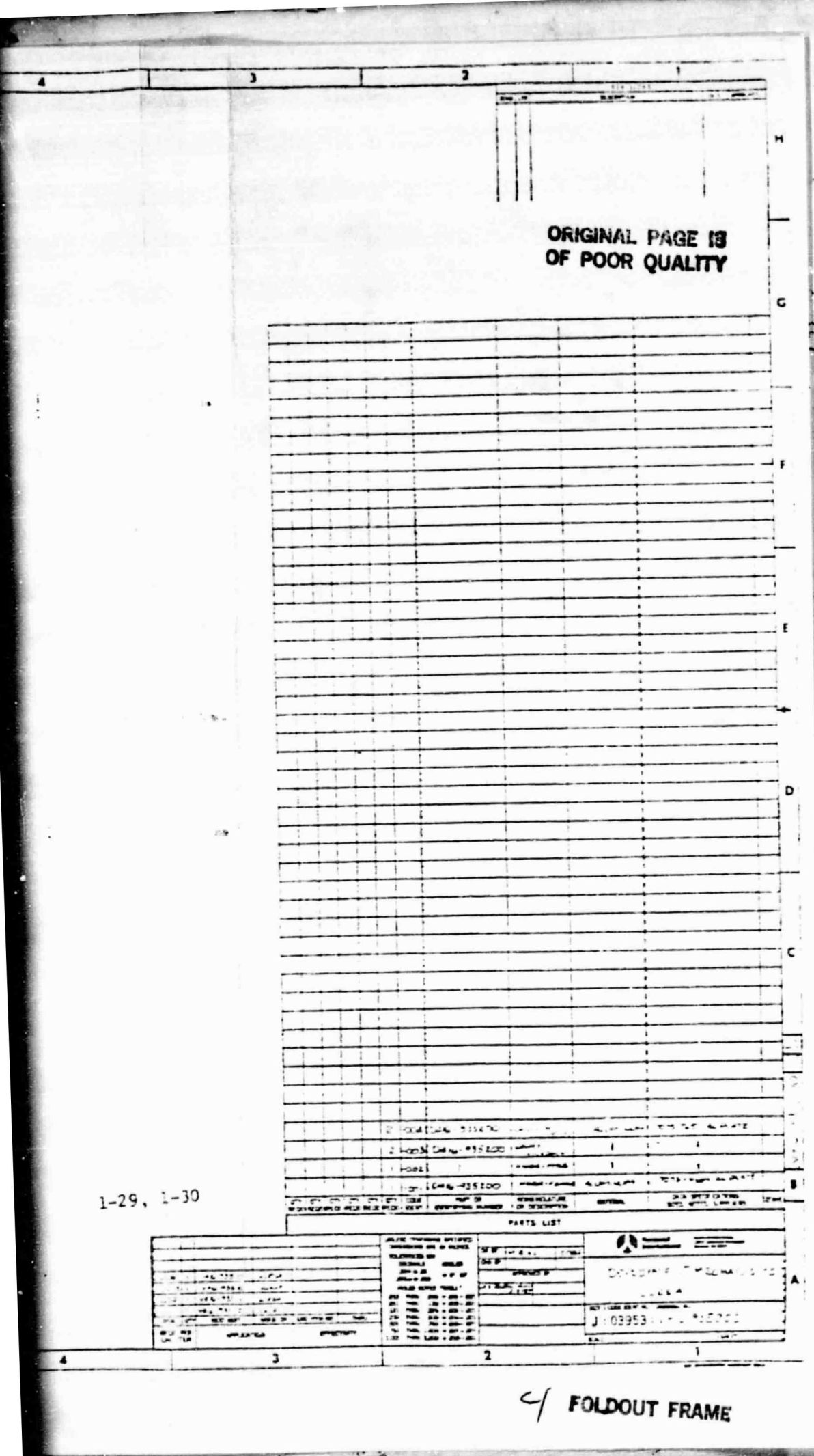
1-29, 1-30



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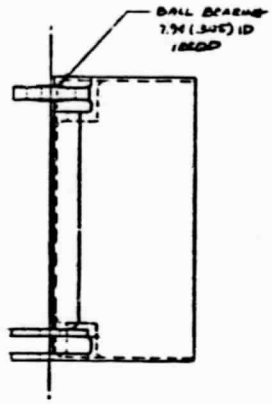

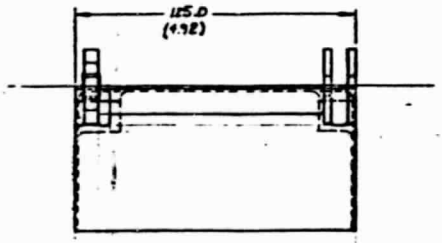

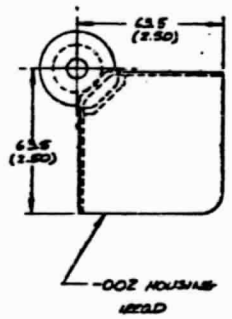

FOLDOUT FRAME

1-31

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NOTES: UNLESS OTHERWISE SPECIFIED
1. ALL DIMENSIONS ARE IN mm, INCHES IN ( )

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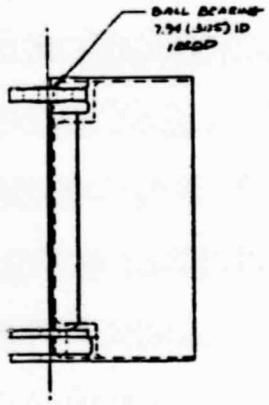

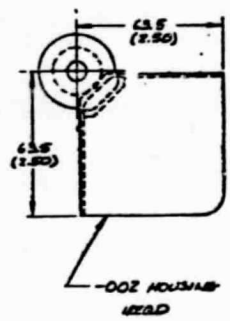

1-31, 1-32

-001 SHOWN

ITEM	QTY	CODE IDENT	PART OR IDENTIFYING NUMBER	NOMENCLATURE OR DESCRIPTION	MATERIAL	DATA SPECIFICATIONS SPEC. NOTES, SUPPLIERS
				BEARING		
				HOUSING	ALUMINUM	2015-T651 AL PLATE
2	-001	V41G-935201	4554			

PARTS LIST

ITEM	QTY	PART OR IDENTIFYING NUMBER	NOMENCLATURE OR DESCRIPTION
-001	2	V41G-935400	

APPLICATION — SPECIFICATION

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES

TOLERANCES ON: DECIMALS, ANGLES, FRACTIONS

DRAWN M Bliss 11/4/82

CHECKED

APPROVED

MATERIAL

FINISH

NEXT ASSY

USED ON

APPLICATION

DO NOT SCALE DRAWING

HINGE MECHANISM
LCRSA

SIZE	CAGE IDENT NO.	DRAWING NO.
E	03953	V41G-935201

SCALE 1/1 SHEET 1/1

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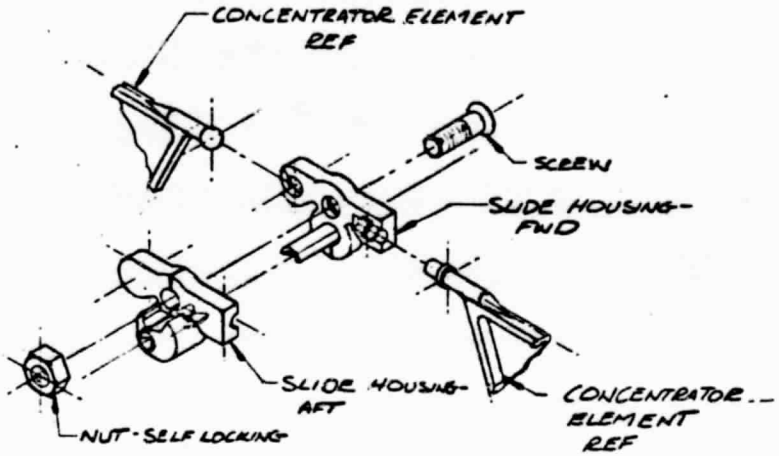
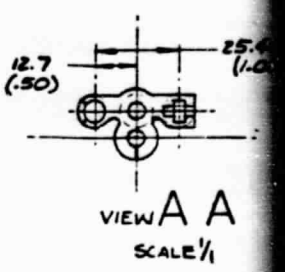
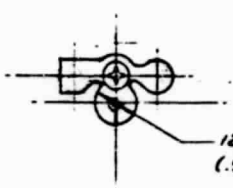
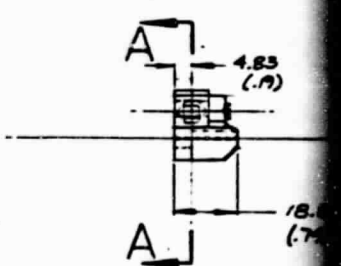
NOTES: UNLESS OTHERWISE SPECIFIED

V41G-935201







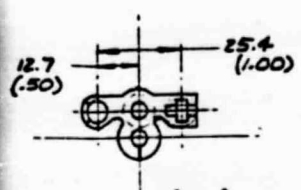


FOLDOUT FRAME

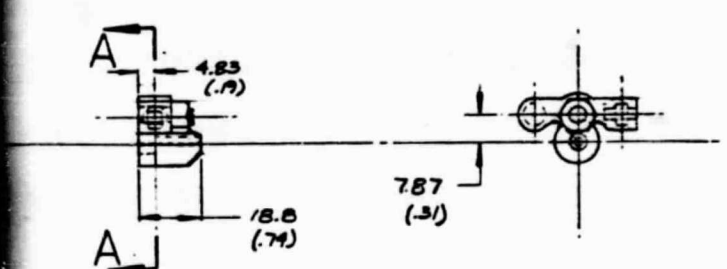
2. FAB FI
1. ALL DIM
NOTES: UN

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED

2 - FOLDOUT FRAME



VIEW A A
SCALE 1/1



-001 SHOWN

DR BY M. BISS 3/15/82	Rockwell International Corporation Space Division	
CHK BY		
APPROVED BY	SLIDE ASSEMBLY - EXTENSION CABLE LCRSA	
N/A V41-935002	SIZE D / CODE IDENT NO. 03953	V41-915202
	SCALE FULL	SHEET 1/1

2. FAB FROM GRAPHITE IMPREGNATED POLYSULFONE
1. ALL DIMENSIONS ARE IN mm, INCHES ARE IN ( ).
NOTES: UNLESS OTHERWISE SPECIFIED

V41-915202

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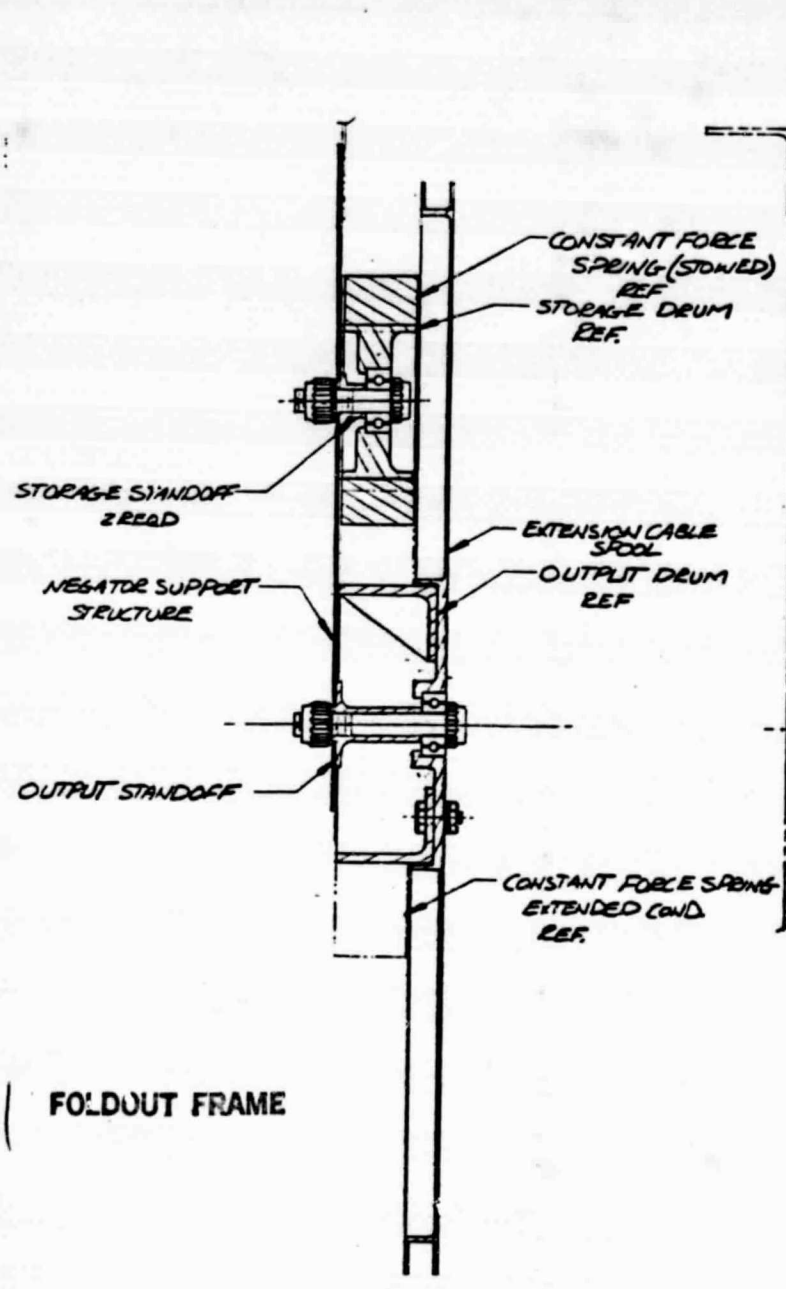
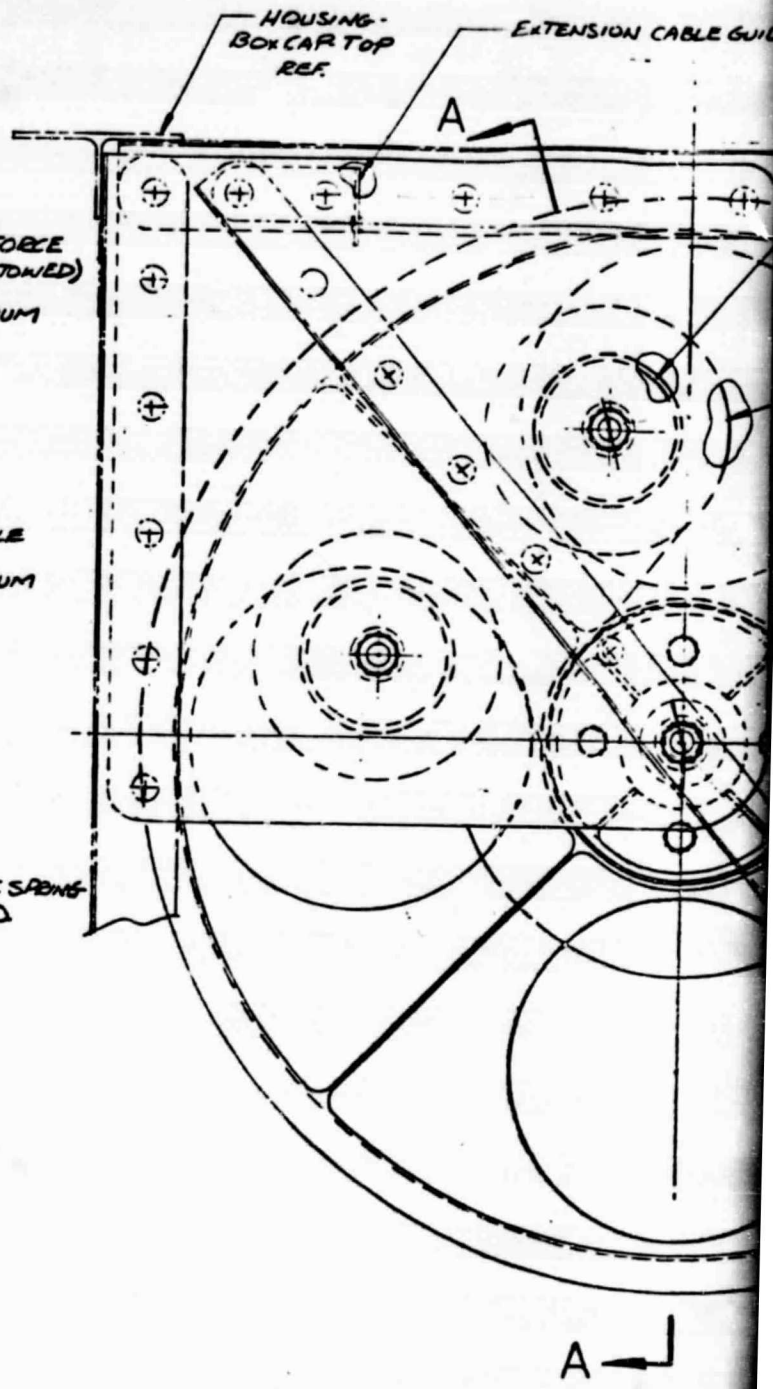


SECTION A-A



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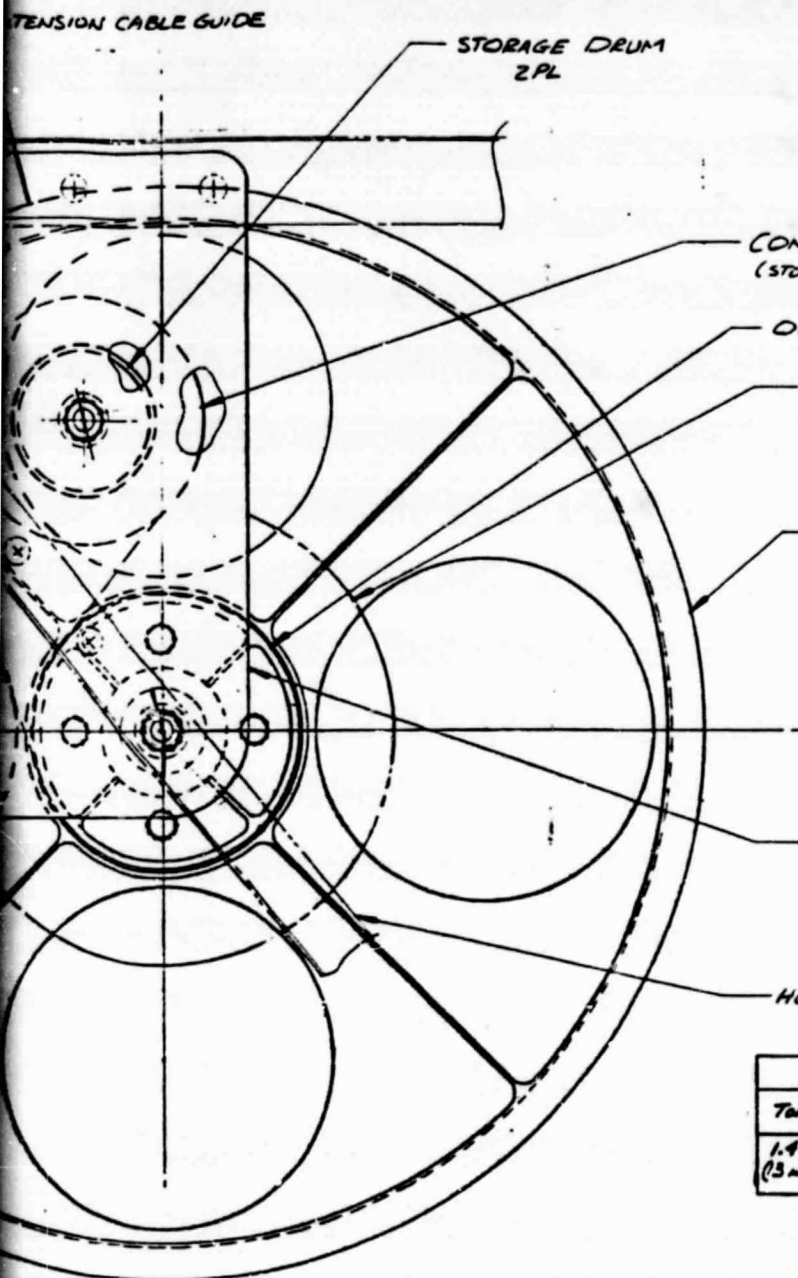
REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED



2 FOLDOUT FRAME

NEGATOR SPRING DETAILS						
TORQUE	STORAGE DRUM DIA	OUTPUT DRUM DIA.	THICKNESS	WIDTH	LENGTH	MAT'L
1.47 NM (13 IN-LBS)	46.5 (1.83)	81.3 (3.20)	.36 (.014)	22.3 (.88)	12.95 M (50')	302 SST

2. ALL DIM'S ARE IN MM, INCHES IN ( )
1. ALL PARTS MOLDED FROM GRAPHITE IMPREGNATED POLYSULFONE
NOTES: UNLESS OTHERWISE SPECIFIED

DR BY	M BISS	3/22/82
CHK BY		
APPROVED BY		
N/A	V416-935100	

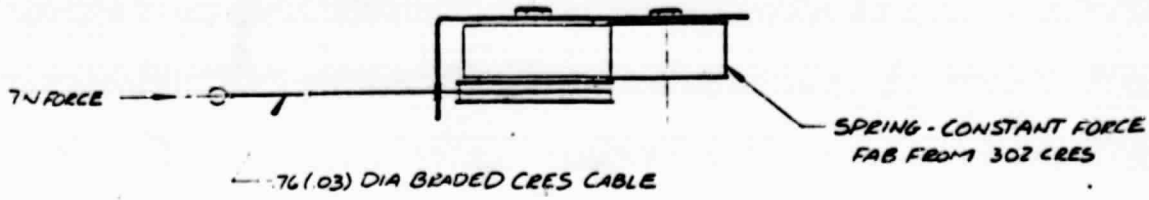
Rockwell International Corporation
Space Division
12214 Lakewood Boulevard • Downey, California 90241

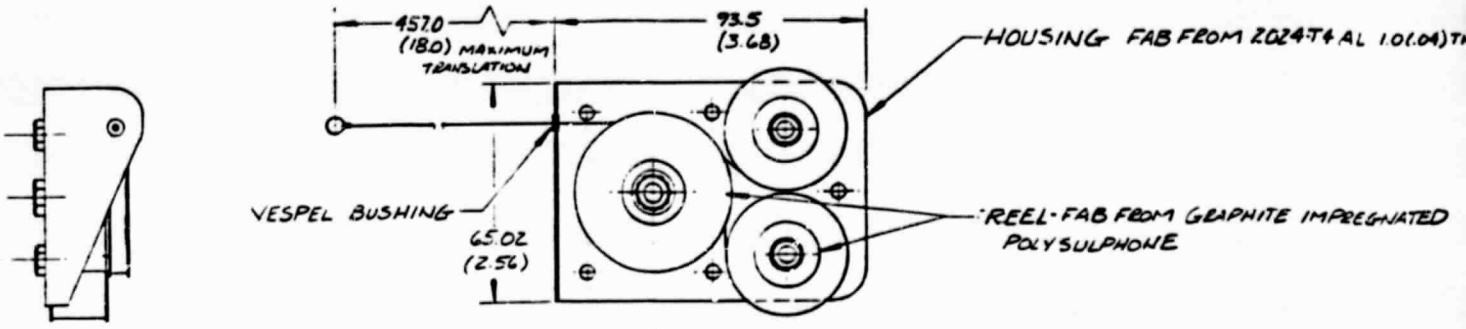
MECHANISM - CABLE EXTENSION LCRSA

SIZE	CODE IDENT NO.	
D	03953	V416-935203

SCALE FULL SHEET 1/1

V416-935203





FOLDOUT FRAME

1. ALL DIMENSIONS ARE IN MM, INCHES IN ( )
NOTES: UNLESS OTHERWISE SPECIFIED

001	14	VE
001	12	VE
ITEM	QTY.	
REQD PER END ITEM		

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED

2 FOLDOUT FRAME

2024-T4 AL 1.0(.04) THK

TE IMPREGNATED

QTY REQD	QTY REQD	QTY REQD	QTY REQD	QTY REQD	QTY REQD	CODE IDENT	PART OR IDENTIFYING NUMBER	NOMENCLATURE OR DESCRIPTION	MATERIAL	DATA: SPECIFICATIONS SIZES: NOTES, SUPPLIERS	ZONE

PARTS LIST

ITEM	QTY	NEXT ASSY	USED ON	END ITEM NO	THRU
001	16	V416-935100	LCESA	-004,005,006	
001	12	V416-935100	LCESA	-001,002,003	

REQ'D PER END ITEM | APPLICATION | EFFECTIVITY

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON DECIMALS: XX = ± .03, XXX = ± .010; ANGLES ± 0° 30'
HOLES NOTED "DRILL"

.013	THRU	.040	+ .001 − .001
.041	THRU	.130	+ .002 − .001
.131	THRU	.229	+ .003 − .001
.230	THRU	.500	+ .004 − .001
.501	THRU	.750	+ .005 − .001
.751	THRU	1.000	+ .007 − .001
1.001	THRU	2.000	+ .010 − .001

DR BY	M BISS	3/16/83
CHK BY		
APPROVED BY	C T Thompson 3-16-83	

Rockwell International

CONCENTRATOR STACK TRANSLATOR MECHANISM LCESA

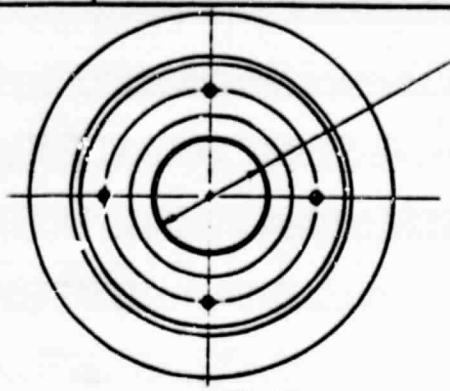
SIZE	CODE IDENT NO	DRAWING NO
D	03953	V416-935204

SCALE FULL | SHEET 1/1

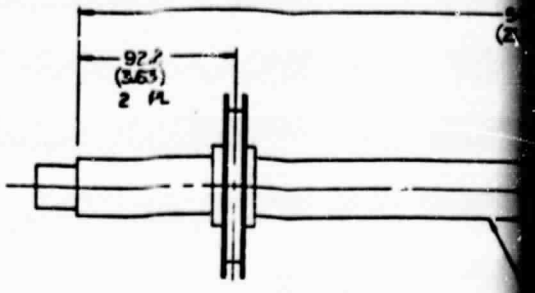
V416-935204

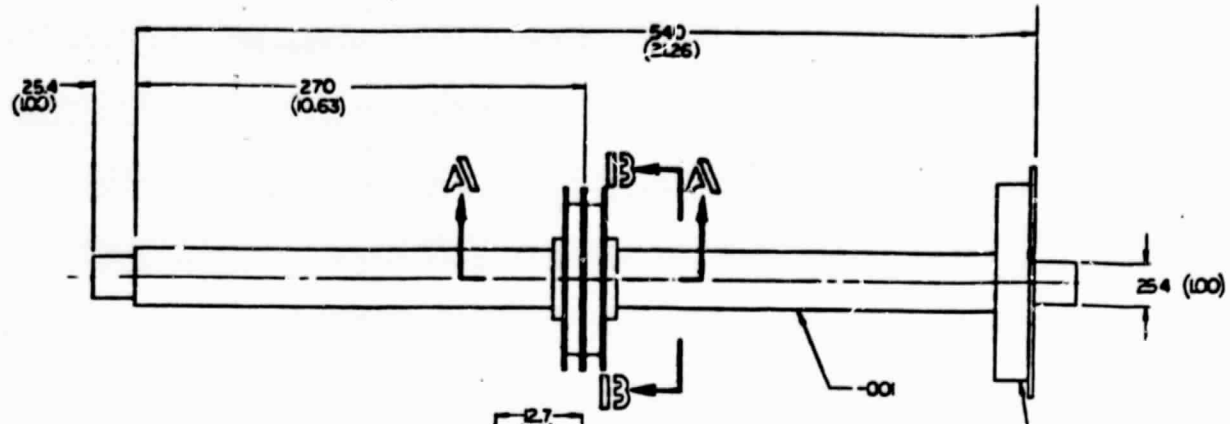
FOLDOUT FRAME

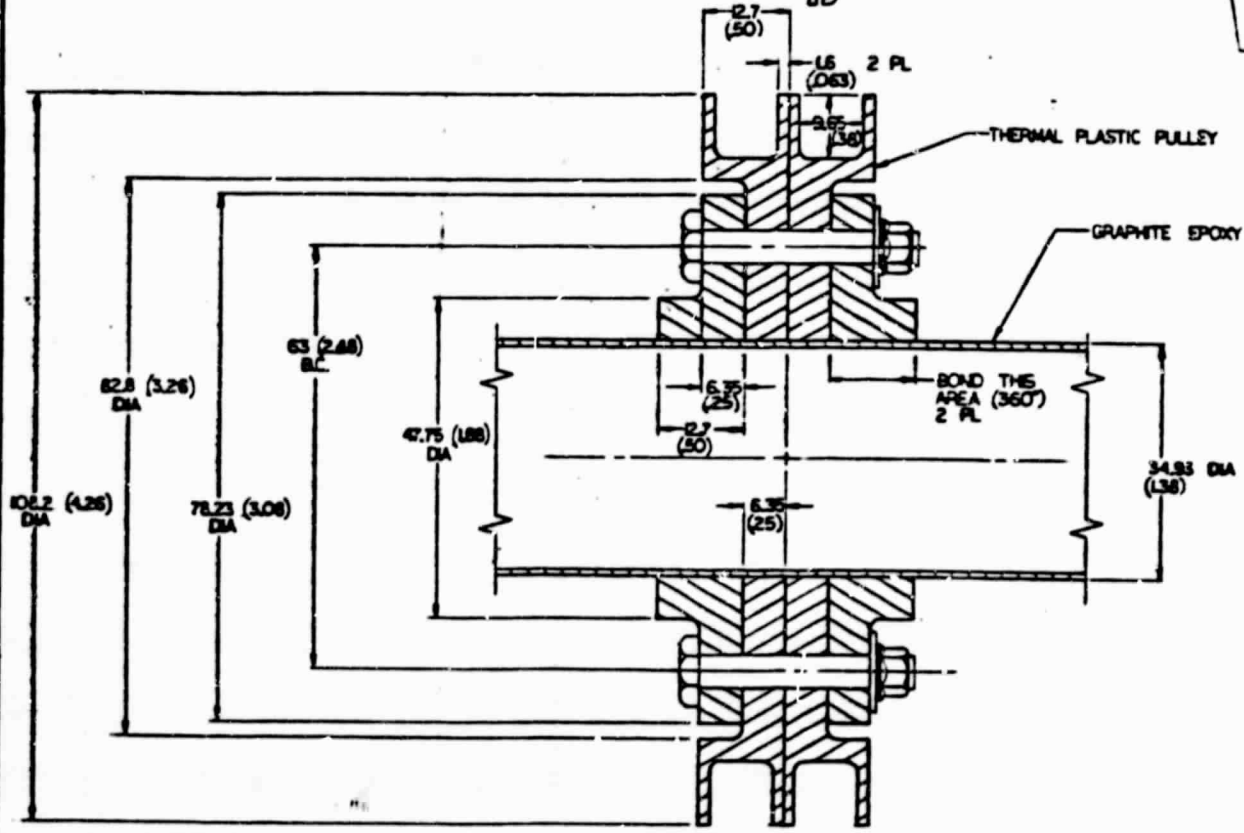
ORIGINAL PAGE IS
OF POOR QUALITY



SECTION 13-13
SCALE: FULL



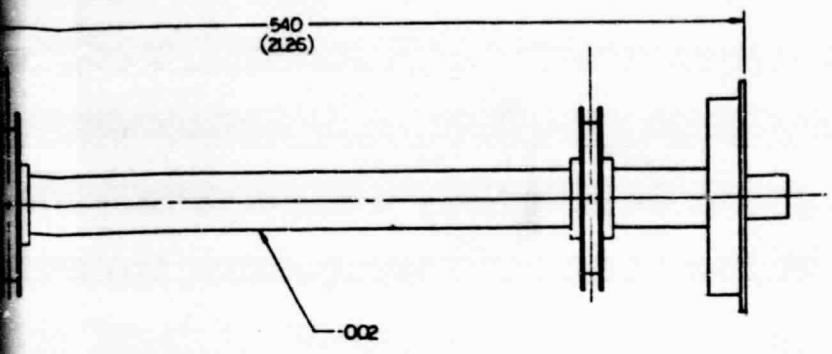




SECTION A1-A1 (TYP)
SCALE: 2/1

1. ALL DIMS. IN MM, INCHES IN
NOTES: UNLESS OTHERWISE SPECI

ITEM	QTY	NEXT AS
-002		V414-93
-001		V414-93
REQD PER END ITEM		AP



REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED

2

FOLDOUT FRAME

254 (.100)

FULL ROTATION BRUSHLESS DC TORQUE MOTOR

TORQUE TUBE

QTY REQD	QTY REQD	QTY REQD	QTY REQD	QTY REQD	QTY REQD	CODE IDENT	PART OR IDENTIFYING NUMBER	NOMENCLATURE OR DESCRIPTION	MATERIAL	DATA: SPECIFICATIONS SIZES, NOTES, SUPPLIERS	ZONE
							-002	TRIP WIRE ASSY RADIATOR			
							V416 935205-001	TRIP WIRE ASSY REFLECTOR			

PARTS LIST

1. ALL DIMS. IN MM, INCHES IN ( )
2. NOTES: UNLESS OTHERWISE SPECIFIED

ITEM	QTY	NEXT ASSY	USED ON	END ITEM NO	THRU
-002		V416-935100	LCRSA		
-001		V416-935100	LCRSA		

REQD PER END ITEM — APPLICATION — EFFECTIVITY

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES

TOLERANCES ON:

DECIMALS	ANGLES
XX = ± .03	± 0° 30'
XXX = ± .010	

HOLES NOTED "DRILL"

.013	THRU	.040	+.001 −.001
.041	THRU	.130	+.002 −.001
.131	THRU	.229	+.003 −.001
.230	THRU	.500	+.004 −.001
.501	THRU	.750	+.005 −.001
.751	THRU	1.000	+.007 −.001
1.001	THRU	2.000	+.010 −.001

DR BY JIM CULE 11-30-82
CHK BY
APPROVED BY
2-11-83

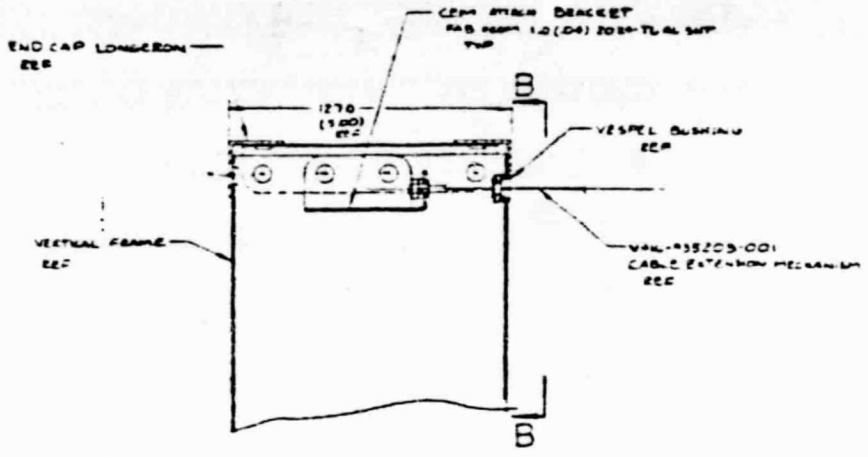
Rockwell International

TRIP WIRE ASSY
REFLECTOR – RADIATOR

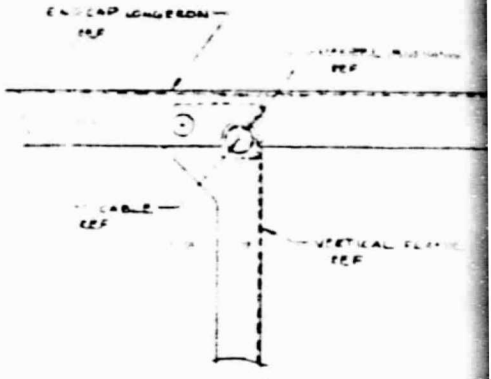
SIZE	CODE IDENT NO	DRAWING NO.
D	03953	V416-935205

SCALE 1/2 & NOTED SHEET

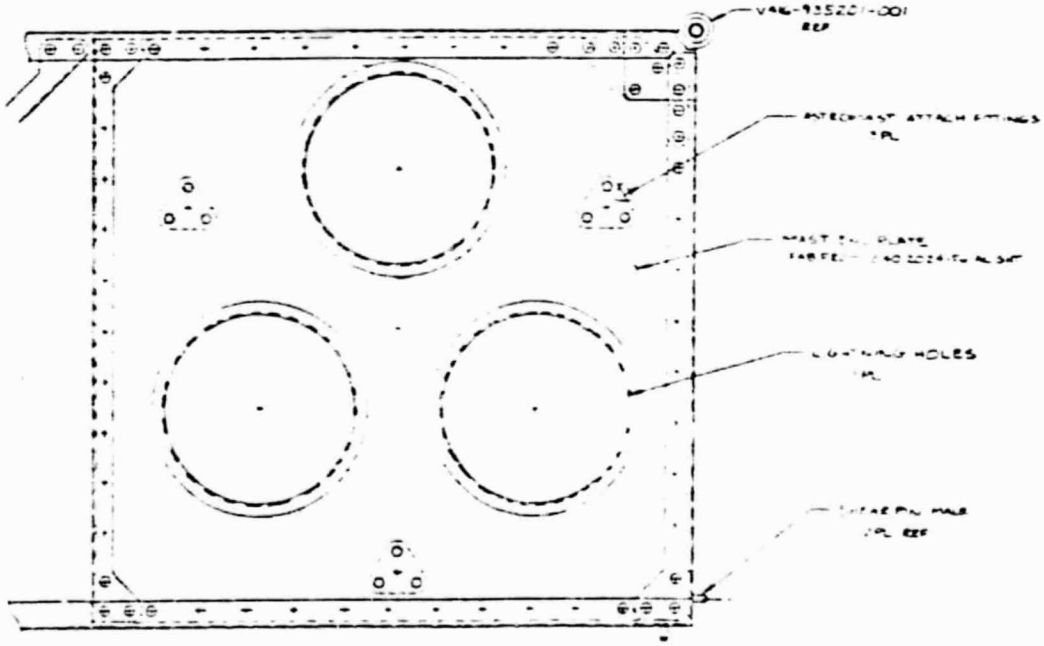
1-39, 1-40



SECTION A-A
SCALE 1/4
(TYPICAL CONSTRUCTION)

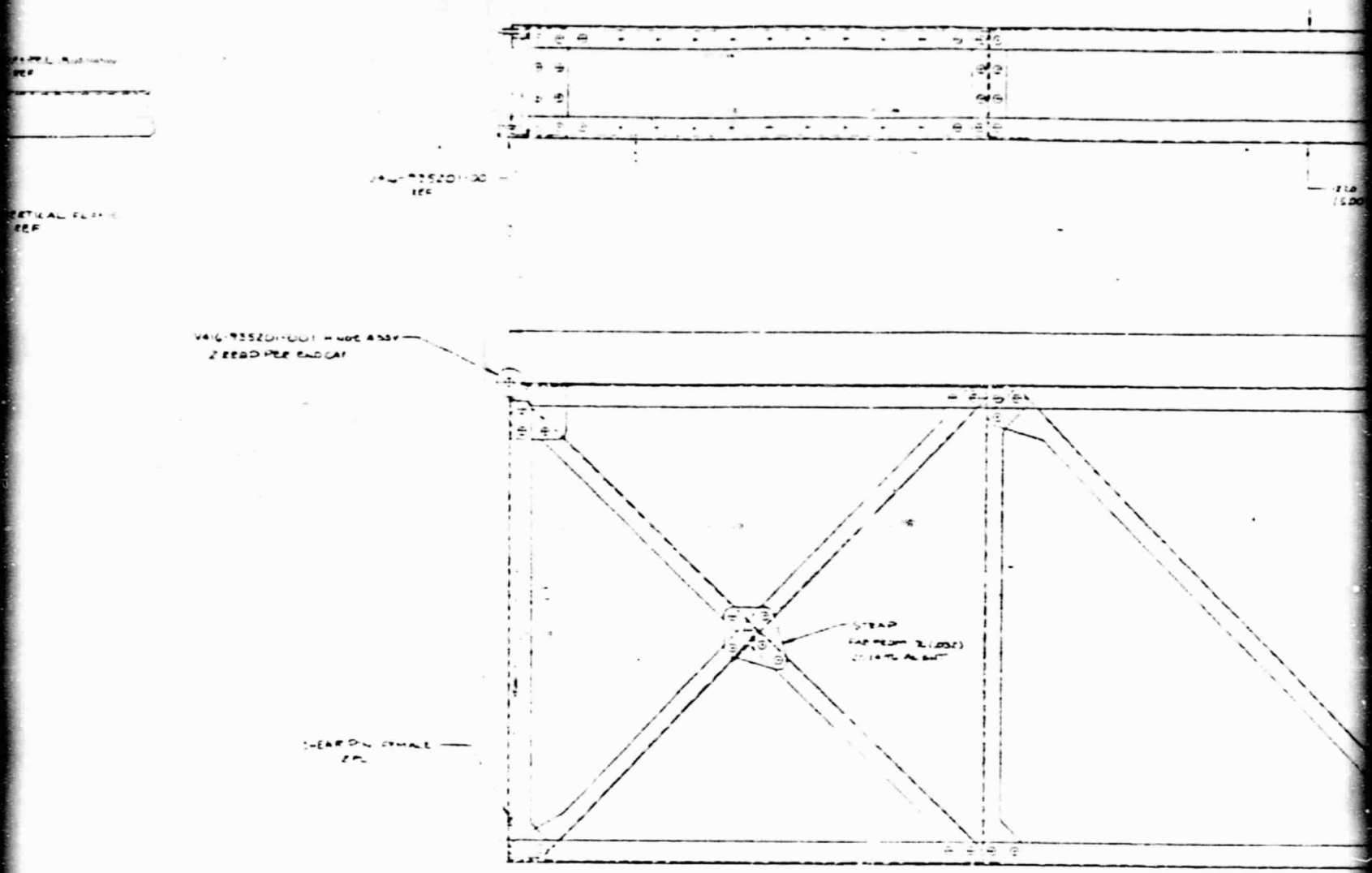


VIEW BB
SCALE 1/4



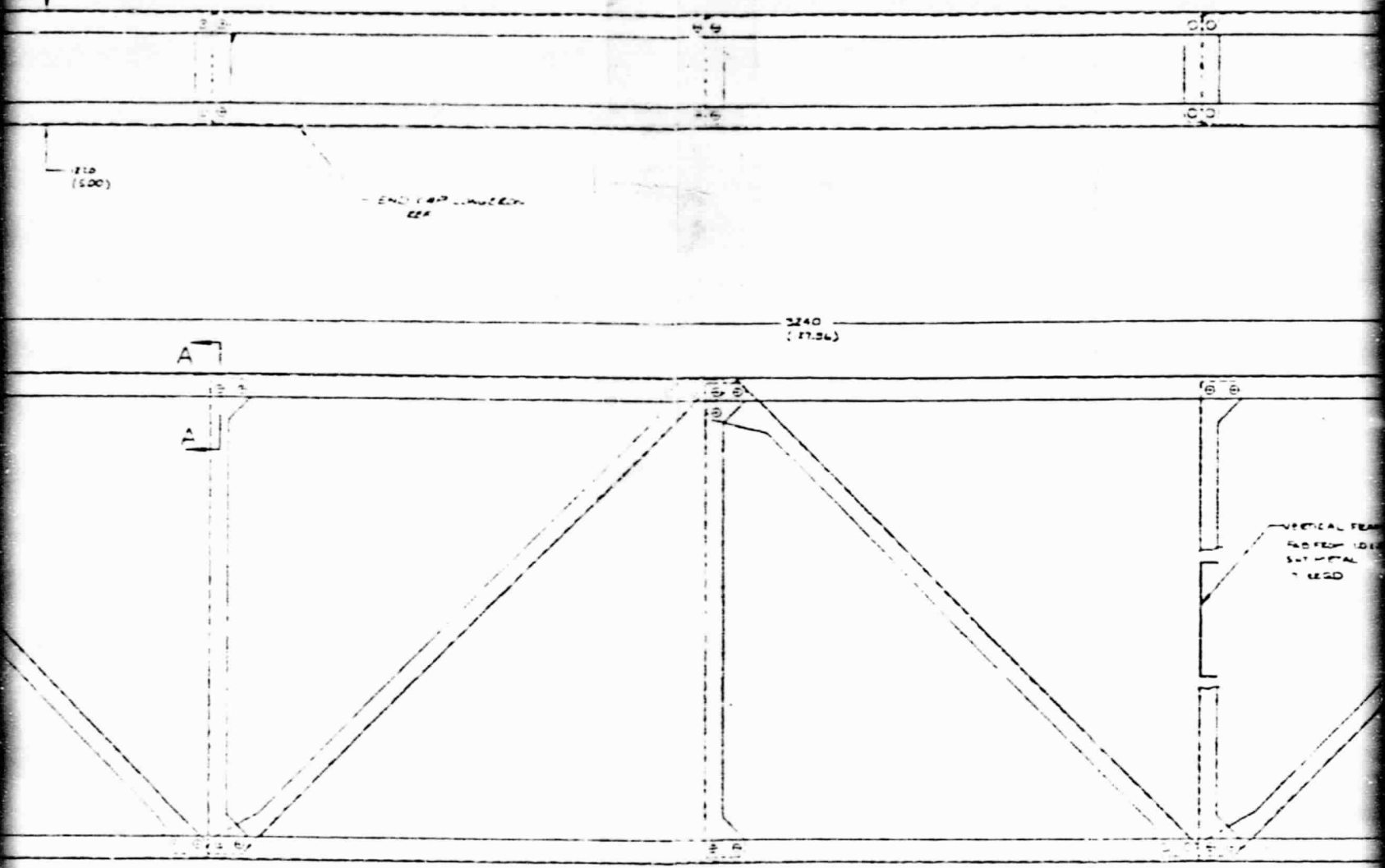
FOLDOUT FRAME

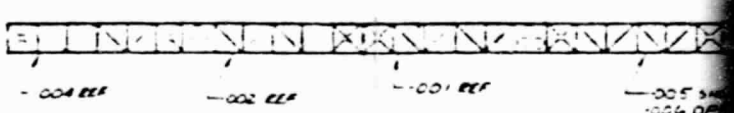
-001 END CAP END SHOWN
CONSTRUCTION TYPICAL



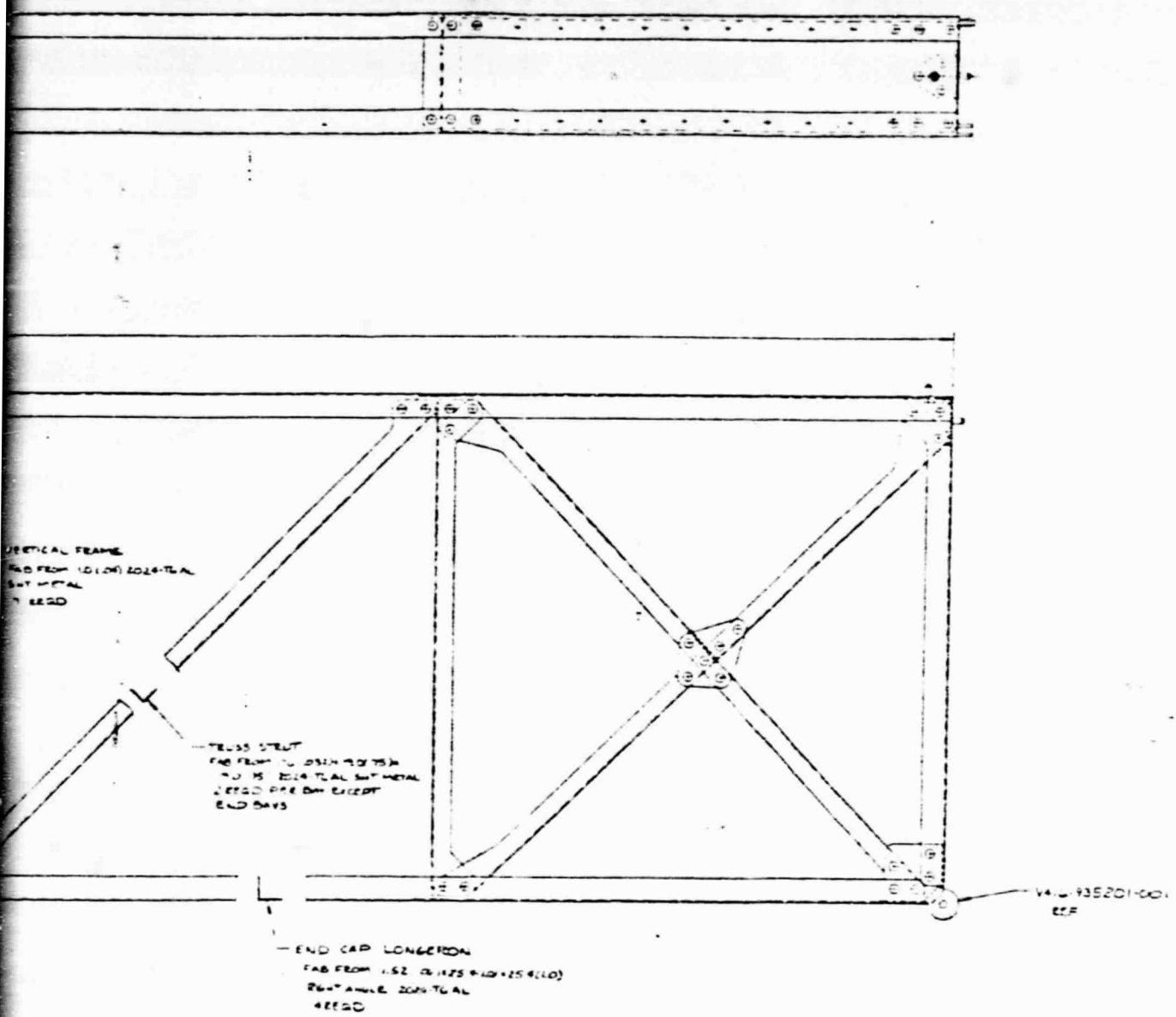
2 FOLDOUT FRAME

3 FOLDOUT FRAME



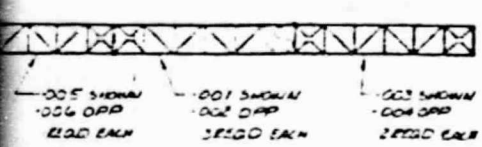


END CAPS SHOWN ASSEMBLED
SCALE 1/60



4

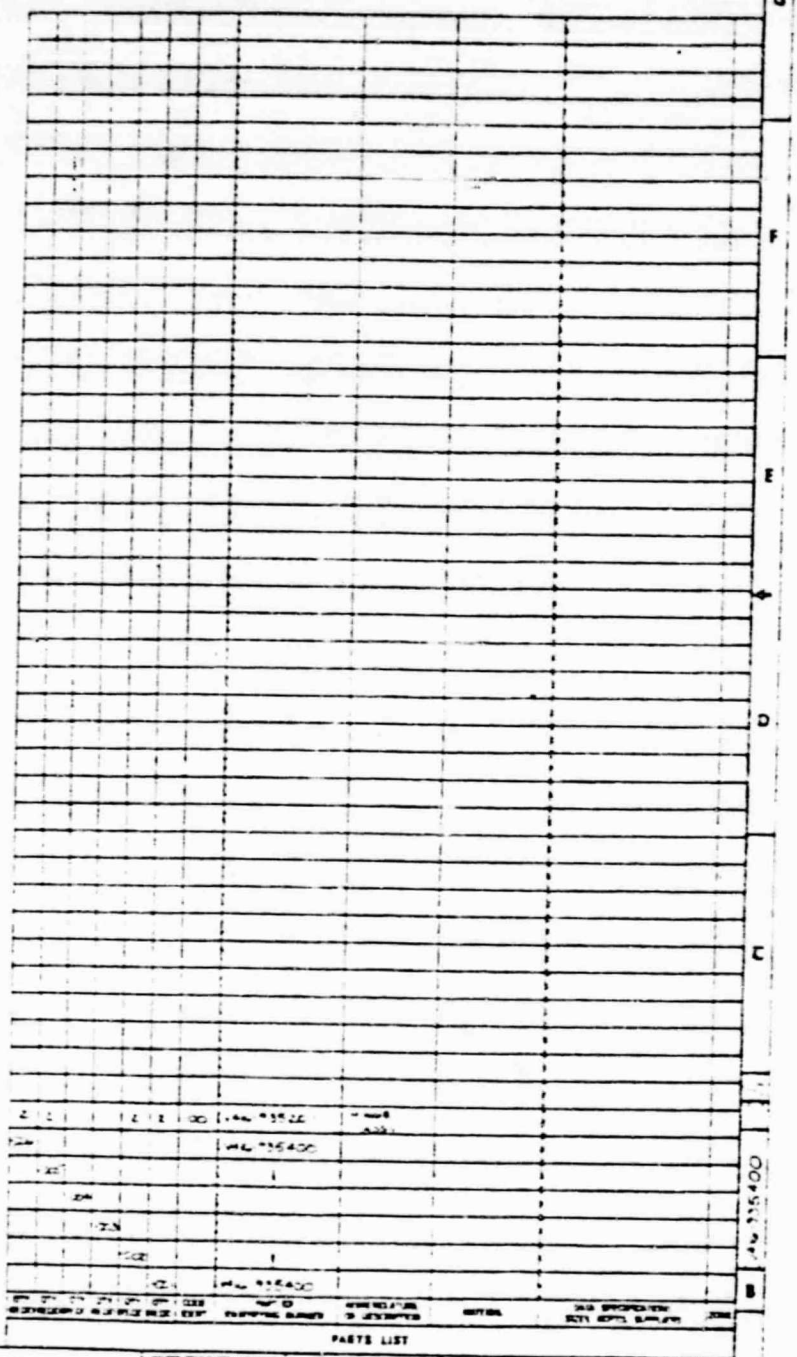
FOLDOUT FRAME



5

FOLDOUT FRAME

ORIGINAL PAGE IS
OF POOR QUALITY



DCE SHOWN
ALL OTHERS SAME
EXCEPT AS NOTED

1-41, 1-42

PARTS LIST

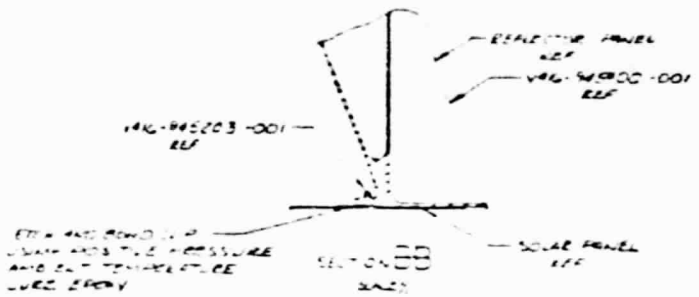
ENDCAP
ASSEMBLY

J103953 V46-935400

1. ALL DIMENSIONS ARE IN MM (INCHES IN).
2. CONSTRUCTION SHOWN TYPICAL FOR ALL ENDCAPS.
ALL MALE SHELL PINS ON RIGHT SIDE OF FEMALE DE SHELL
NOTES: UNLESS OTHERWISE SPECIFIED

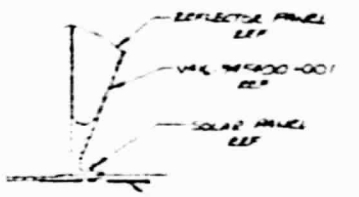
H G F E D C B A

5 4 3 2 1



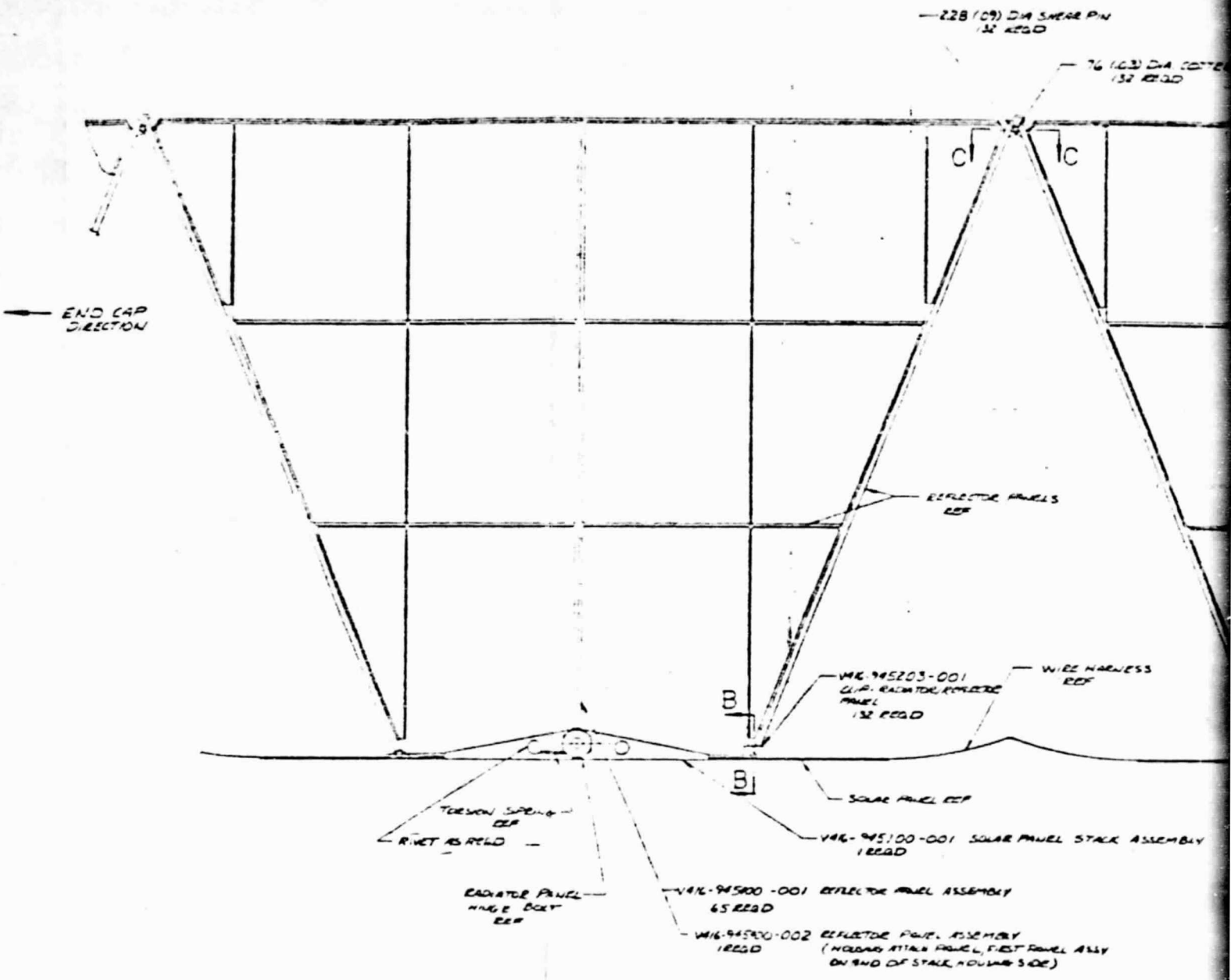
SECTION BB
SCALE

SECTION CC
SCALE



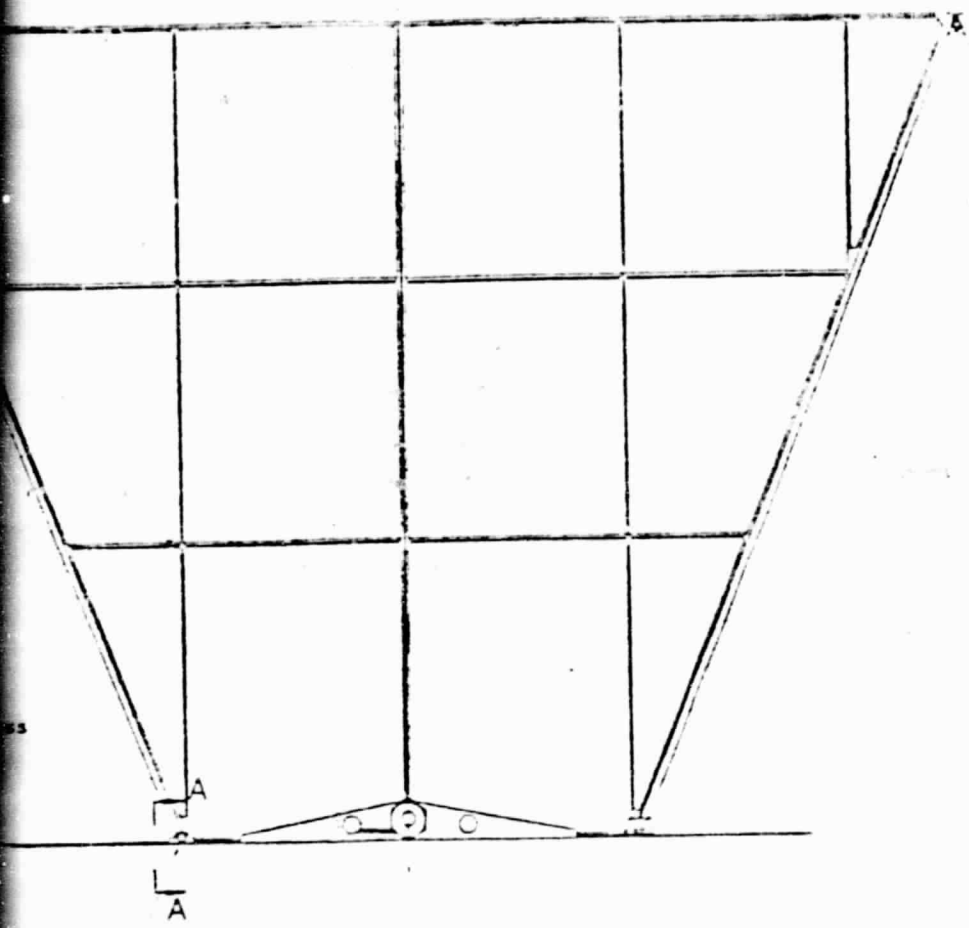
SECTION A-A
SCALE

FOLDOUT FRAME



2 FOLDOUT FRAME

DIA COTTER PIN
REQD



HOUSING DIRECTION

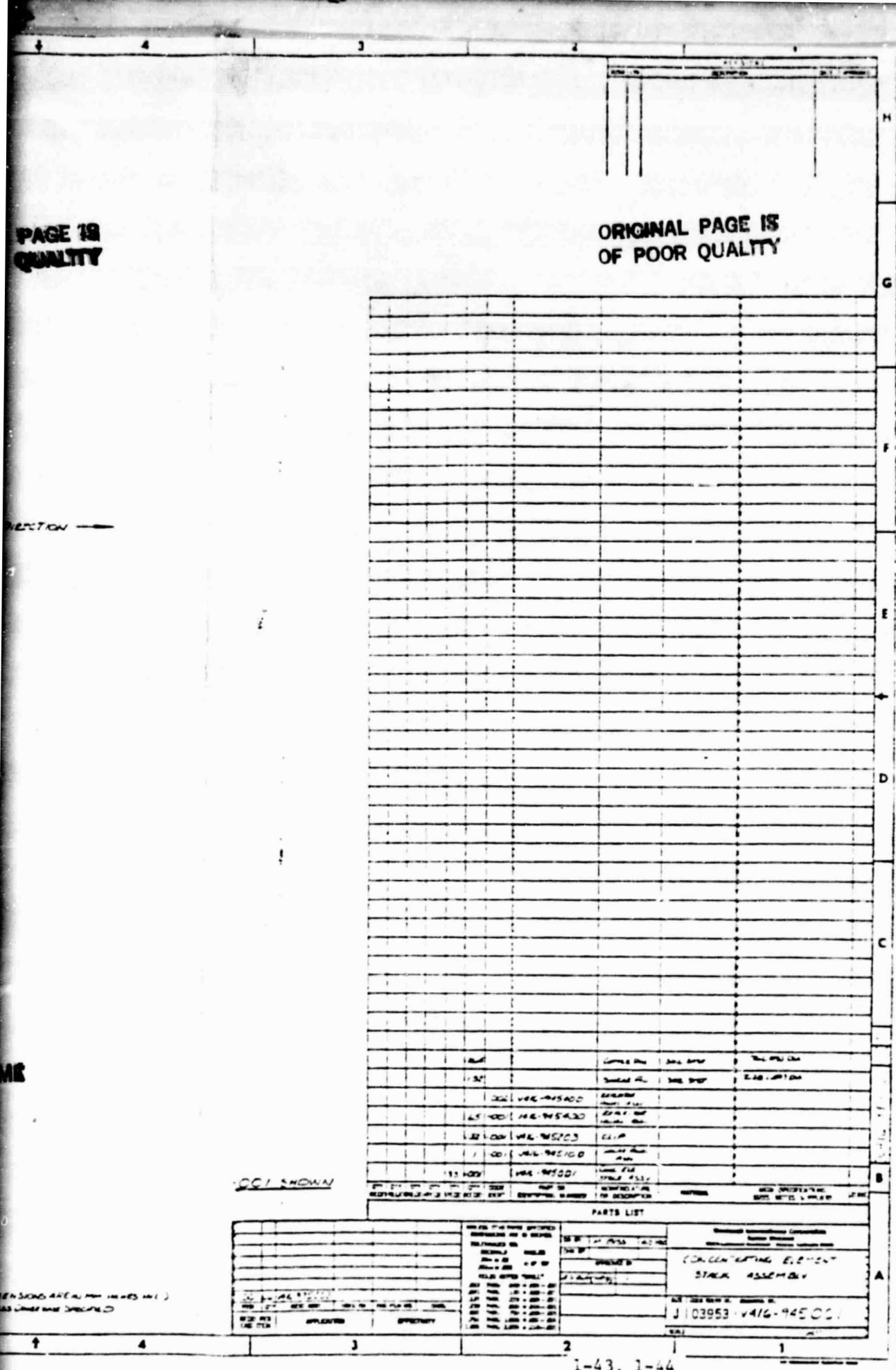
ASSEMBLY

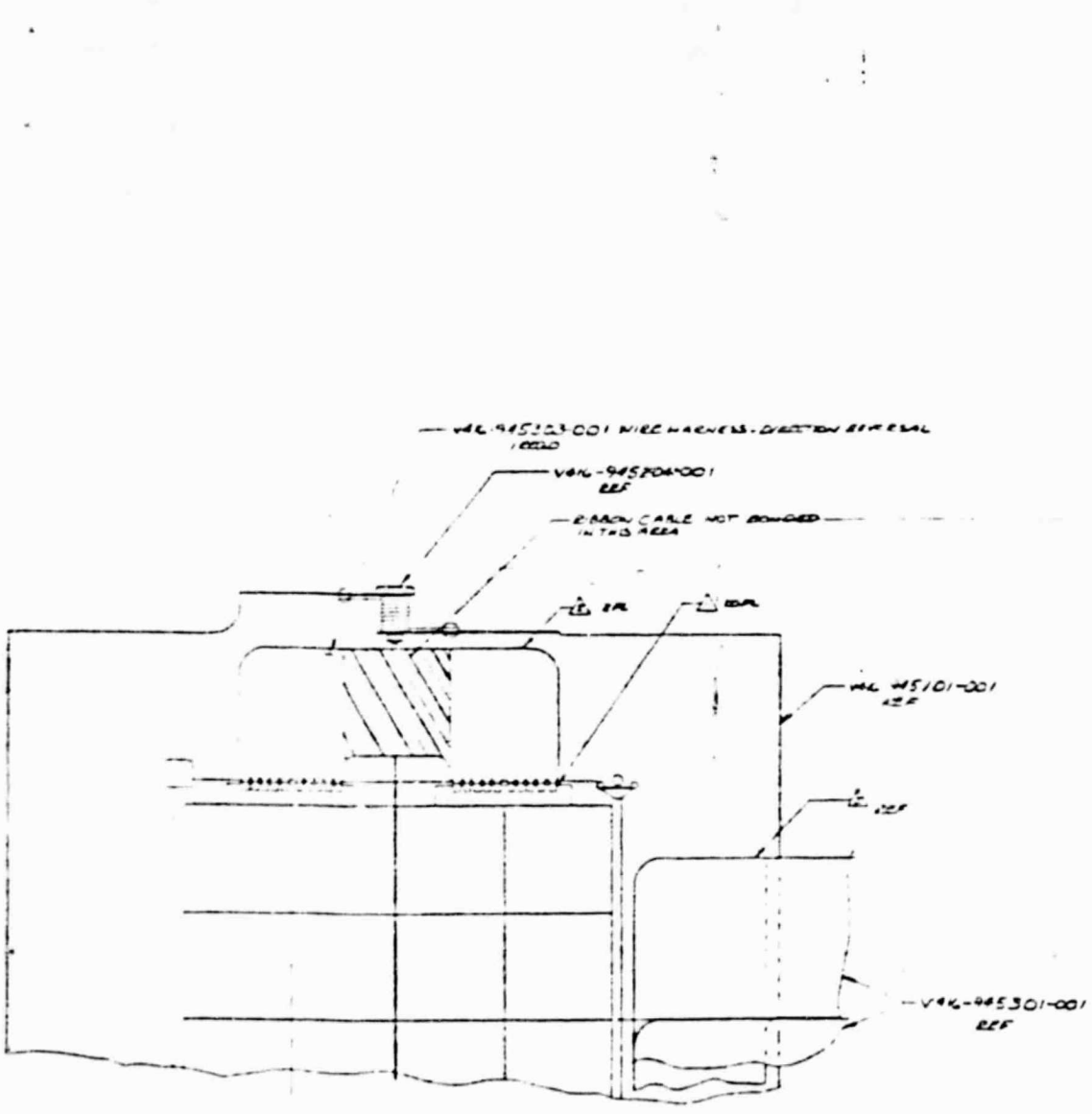
76 (.03) DIA COTTER PIN
132 REQD

3 FOLDOUT FRAME

CC/ SHOWN

ALL DIMENSIONS ARE IN
NOTES: UNLESS

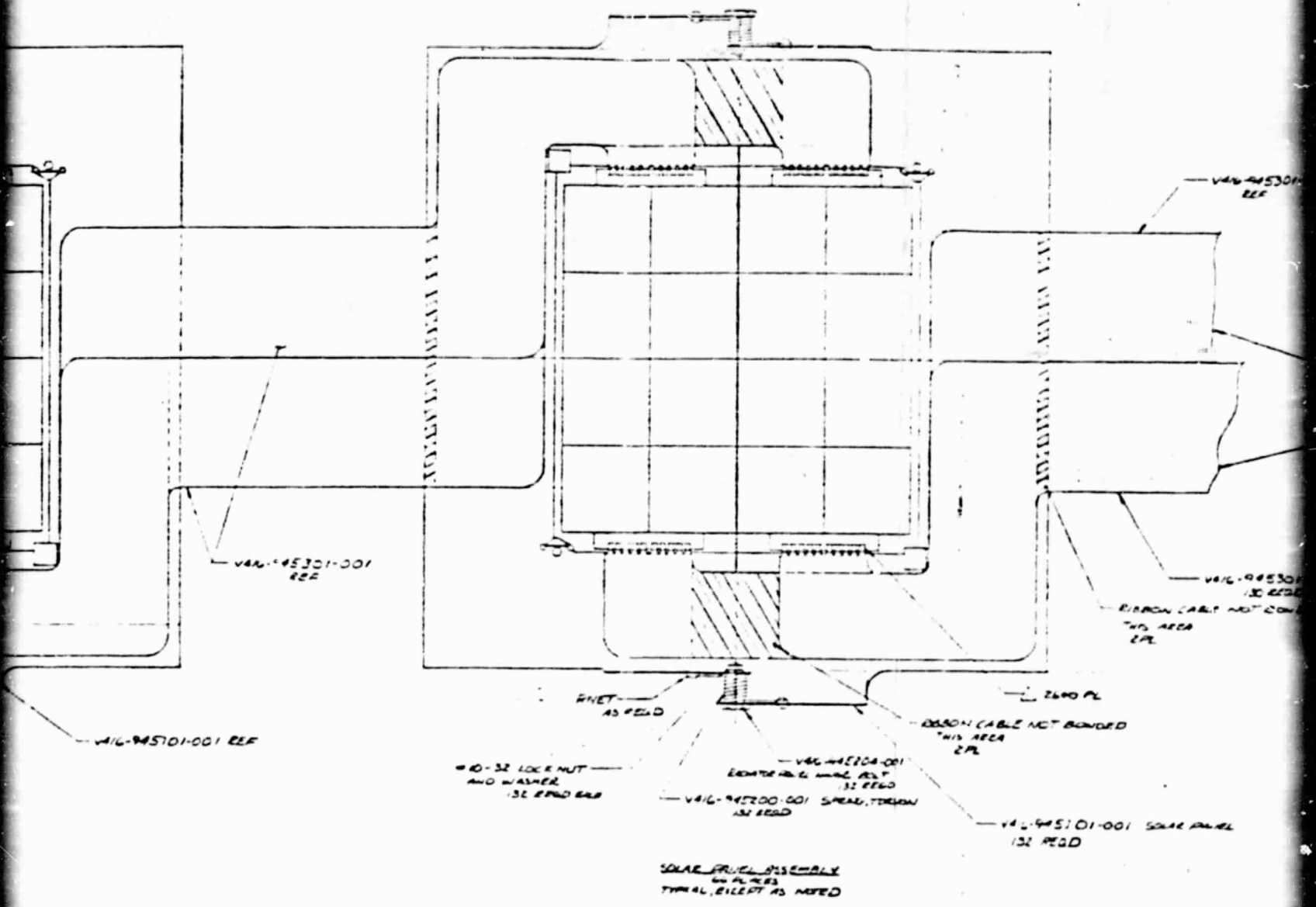




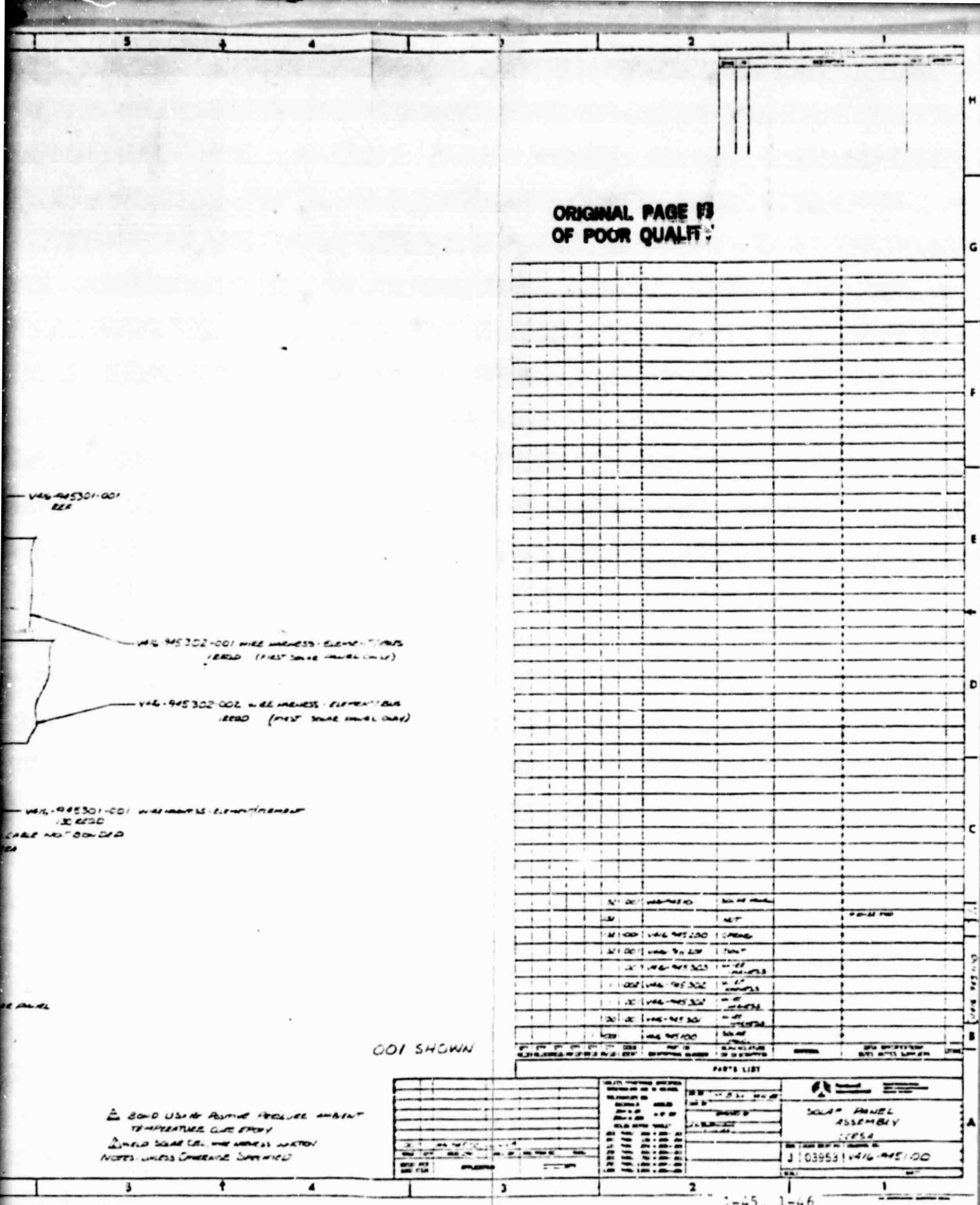
VIEW OF LAST SOLAR PANEL IN ROW (END CAP SIDE)
SCALE A

FOLDOUT FRAME

2 FOLDOUT FRAME



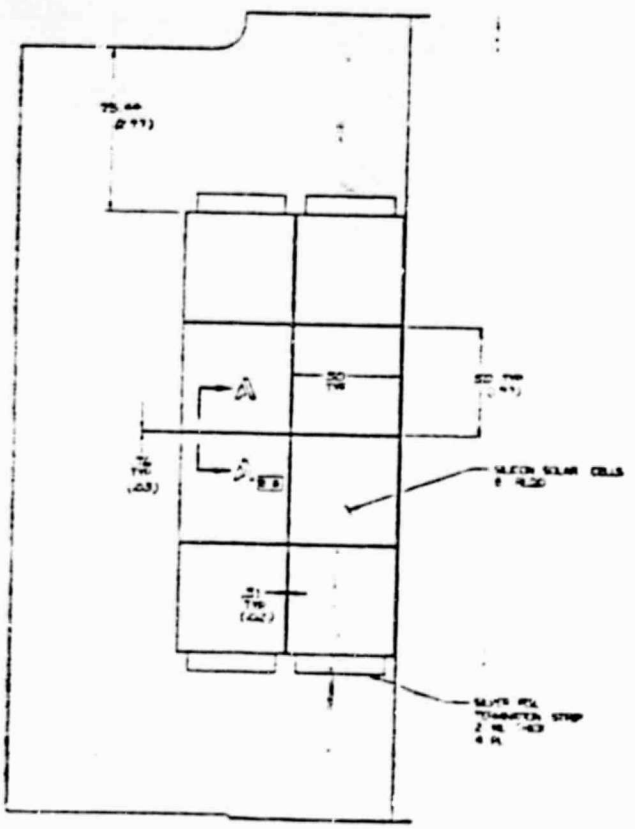
SOLAR PANEL ASSEMBLY
66 PLACES
TYPICAL, EXCEPT AS NOTED

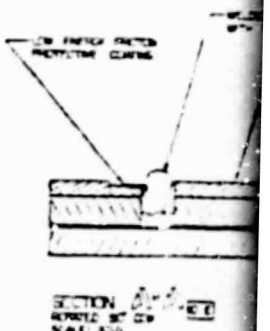


1-45, 1-46

3 FOLDOUT FRAME

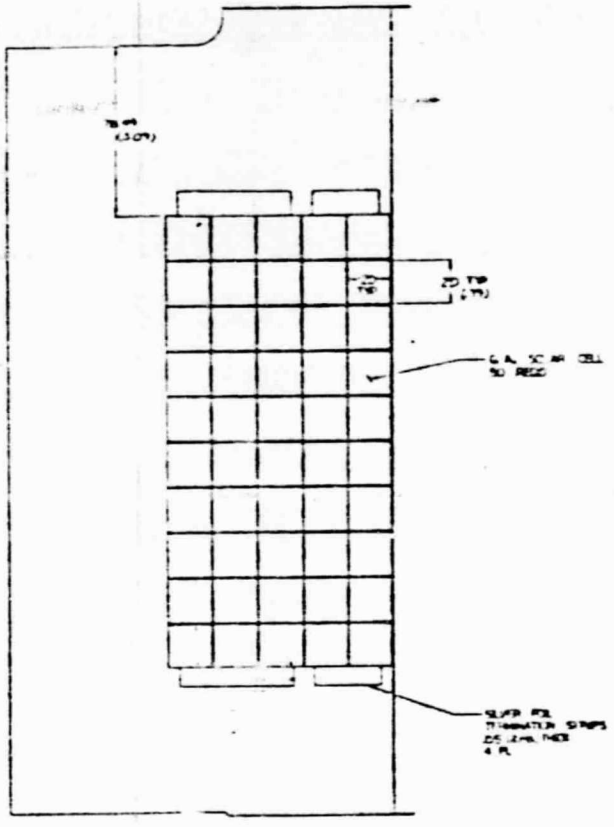
ORIGINAL PAGE IS
OF POOR QUALITY

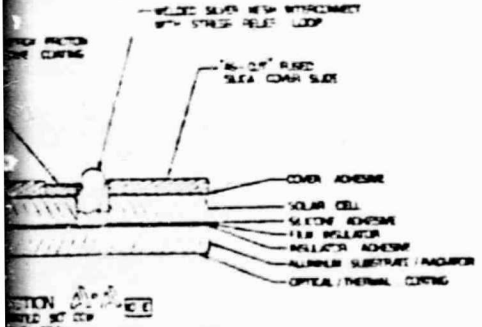




SILICON SOLAR PANEL ASSY
-002 SHOWN

FOLDOUT FRAME





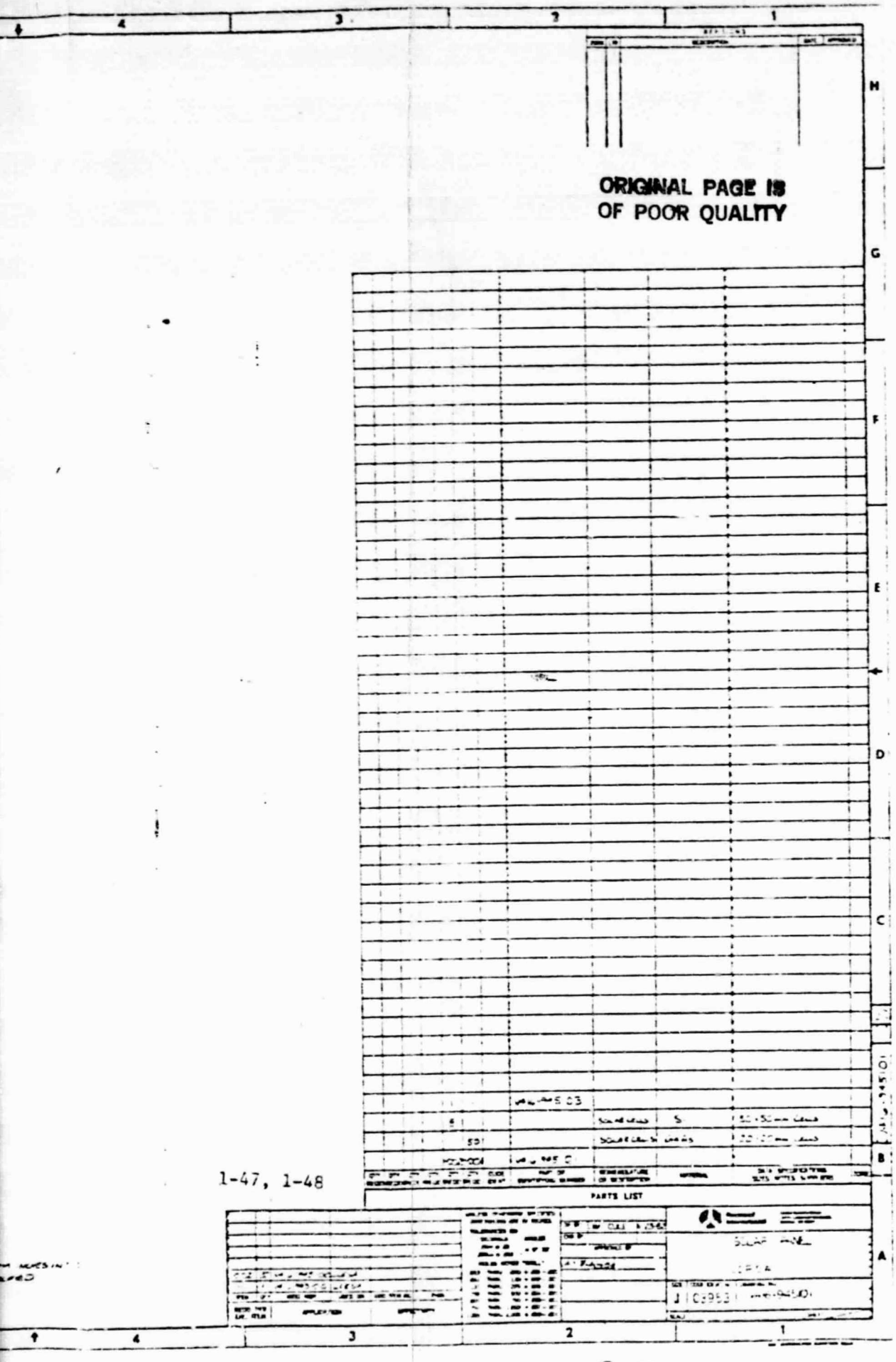
GaAs SOLAR PANEL ASSY
-CO1 SHOWN

2

FOLDOUT FRAME

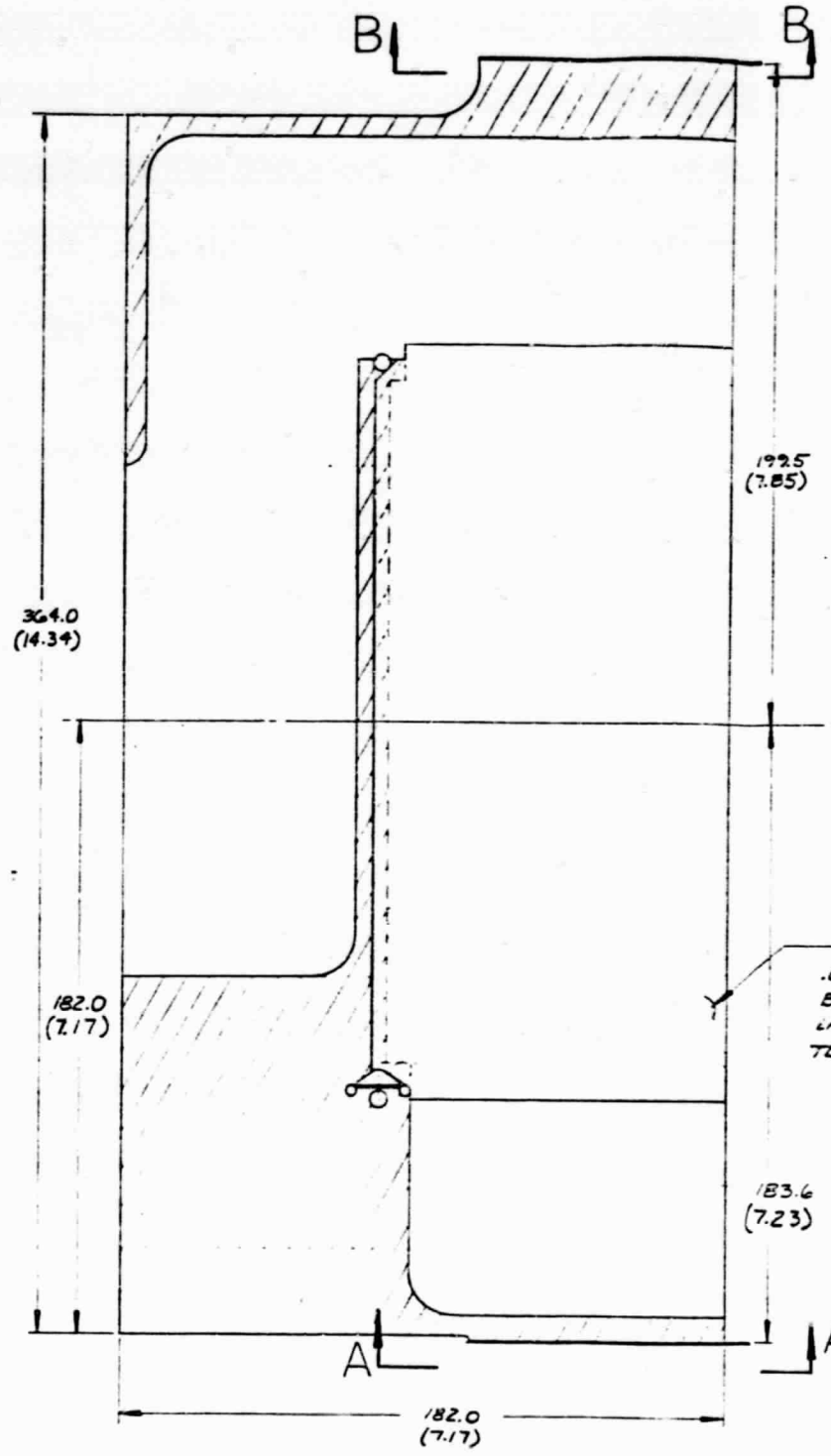
1-

1. ALL DIMENSIONS ARE IN MILLIMETERS [INCHES] UNLESS OTHERWISE SPECIFIED

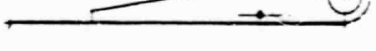


3 FOLDOUT FRAME

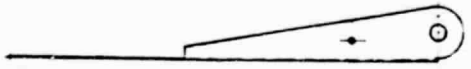
FOLDOUT FRAME



TOP OF PANEL SHOWN
REF



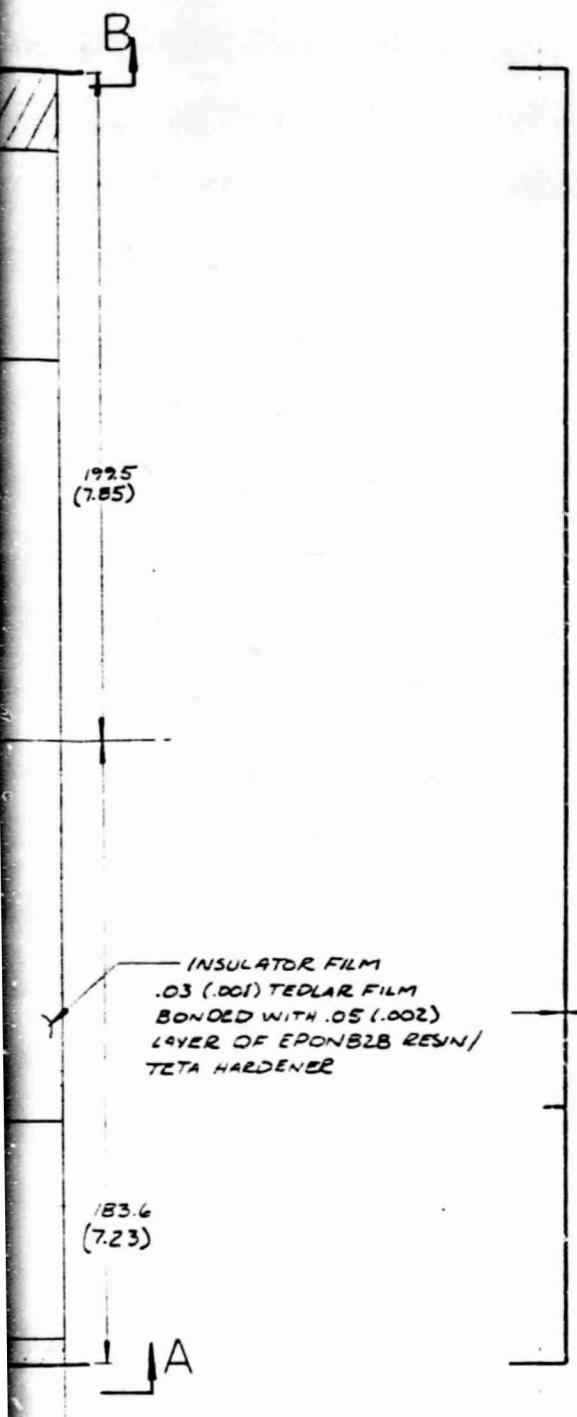
VIEW B-B
SCALE 1/1



VIEW A-A
SCALE 1/1

3. FINISH BOTT
(92.25, E2.8
2. FAB FROM
1. ALL DIMENSI
NOTES: UNLESS C

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED



2 FOLDOUT FRAME

-001 SHOWN

3. FINISH BOTTOM, FLANGES, & HASHED AREA PER MF004-001, III-2 (92.25 E2.84, MAX SERVICE TEMP = 200°C)
2. FAB FROM 6061-0 AL, HEAT TREAT TO-T6 CONDO
1. ALL DIMENSIONS ARE IN MM., INCHES IN ( )

NOTES: UNLESS OTHERWISE SPECIFIED

1-49, 1-50

DR BY	M BESS	4/14/82
CHK BY		
APPROVED BY		
N/A	V416-945101	

Rockwell International Corporation
Space Division
12214 Lakewood Boulevard • Downey, California, 90241

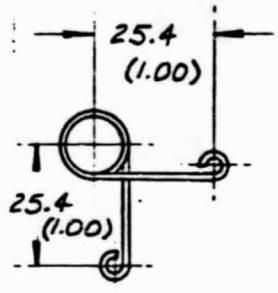
PANEL - RADIATOR

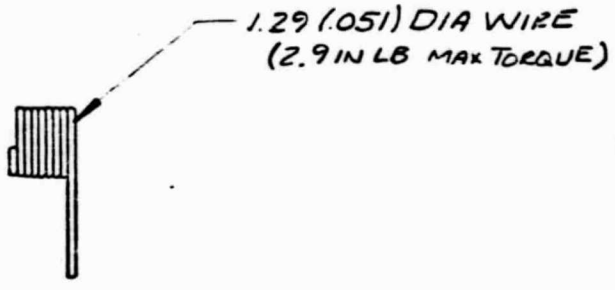
LCRSA

SIZE	CODE IDENT NO.	
D	03953	V416-945103

SCALE 1/1 SHEET 1/1

V416-945103





FOLDOUT FRAME

1. ALL DIMENSIONS ARE IN MM, INCHES IN ( )
NOTES: UNLESS OTHERWISE SPECIFIED

QTY REQD	QTY REQD	QTY REQD	QTY REQD	QTY REQD	QTY REQD	CODE IDENT	PART IDENTIFYING
							V416-9452

ITEM	QTY	NEXT ASSY	USED ON	END ITEM NO.	THRU
-001	132	V416-945100	LCRSA		

REQD PER END ITEM | APPLICATION | EFFECTIVITY

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES.
TOLERANCES ON:

DECIMALS	ANGLES
XX= ± .03	± 0° 30'
XXX= ± .010	

HOLES NOTED "DRILL"

.013	THRU	.040	+.001 −.001
.041	THRU	.130	+.002 −.001
.131	THRU	.229	+.003 −.001
.230	THRU	.500	+.004 −.001
.501	THRU	.750	+.005 −.001
.751	THRU	1.000	+.007 −.001
1.001	THRU	2.000	+.010 −.001

2 1

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED

D

1.29 (.051) DIA WIRE
(2.9 IN LB MAX TORQUE)

C

2 FOLDOUT FRAME

QTY REQD	QTY REQD	QTY REQD	QTY REQD	QTY REQD	CODE IDENT	PART OR IDENTIFYING NUMBER	NOMENCLATURE OR DESCRIPTION	MATERIAL	DATA: SPECIFICATIONS SIZES, NOTES, SUPPLIERS	ZONE
						V416-945200-001	SPRING TORSION	CRES	QQ-W-423 COMP FS302, AMS-5688	

V416-945200

B

PARTS LIST

A

ITEM NO. THRU

EFFECTIVITY

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES.
TOLERANCES ON:
DECIMALS: .XX = ±.03, .XXX = ±.010
ANGLES: ± 0° 30'
HOLES NOTED "DRILL"

.013	THRU .040	+.001 −.001
.041	THRU .130	+.002 −.001
.131	THRU .229	+.003 −.001
.230	THRU .500	+.004 −.001
.501	THRU .750	+.005 −.001
.751	THRU 1.000	+.007 −.001
1.001	THRU 2.000	+.010 −.001

DR BY	M BISS	3/16/83
CHK BY		
APPROVED BY		
A.G. Hollander	3/16/83	

Rockwell International Corporation
Space Division
12214 Lakewood Boulevard • Downey, California 90241

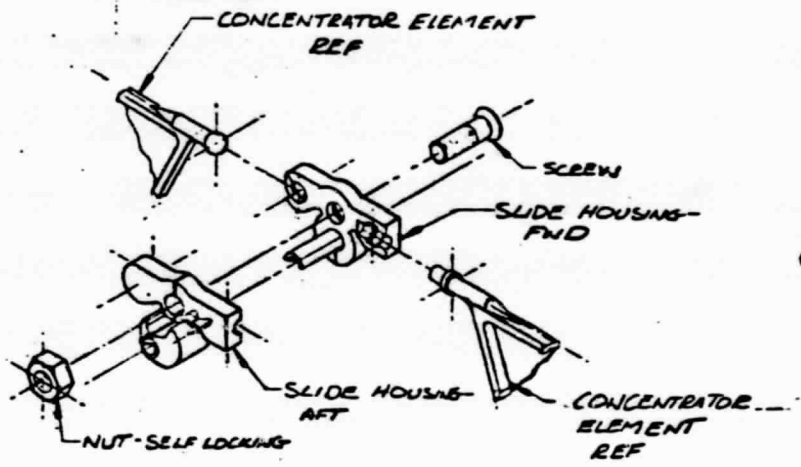
TORSION SPRING
SOLAR PANEL
LCRSA

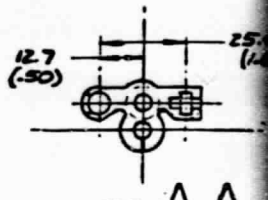
SIZE	CODE IDENT NO.	DRAWING NO.
C	03953	V416-945200

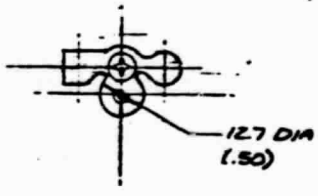
SCALE FULL SHEET 1/1

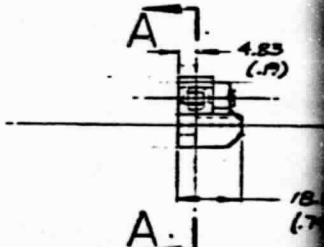
2 1

1-51, 1-52





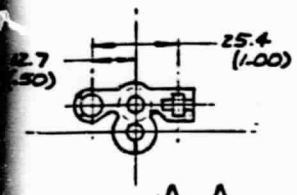




FOLDOUT FRAME

2. FAB F
1. ALL DI
NOTES: U

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED



VIEW A A
SCALE 1/1

2 FOLDOUT FRAME

-001 SHOWN

2. FAB FROM GRAPHITE IMPREGNATED POLYSULFONE
1. ALL DIMENSIONS ARE IN mm, INCHES ARE IN ( ).
NOTES: UNLESS OTHERWISE SPECIFIED

DR BY	M.B/SS	3/15/82
CHK. BY		
APPROVED BY		
		3-11-83
N/A	V416-935002	

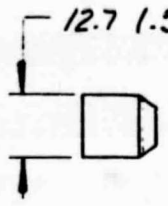
Rockwell International Corporation
Space Division
12214 Lakewood Boulevard • Downey, California 90241

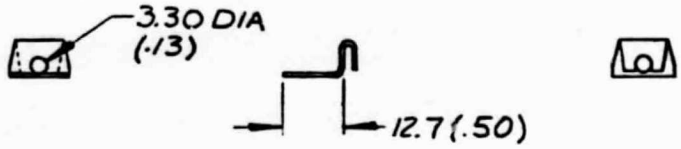
SLIDE ASSEMBLY-
EXTENSION CABLE
LCRSA

SIZE	CODE IDENT NO.	
D	03953	V416-945202

SCALE FULL SHEET 1/1

V416-945202





FOLDOUT FRAME

3. FINISH PER MF004-001, III-2 (WHITE SILICONE PAINT
$\alpha \leq .25, \varepsilon \geq .84$ MAX SERVICE TEMP 200°C)
2. FAB FROM .032 AL HEAT TREAT TO T-6 COND
1. ALL DIMENSIONS ARE IN mm, INCHES IN ( )
NOTES: UNLESS OTHERWISE SPECIFIED

QTY REQD	QTY REQD	QTY REQD	QTY REQD	QTY REQD	QTY REQD	CODE IDENT	PAR IDENTIFYI
					132		V416-945

ITEM	QTY	NEXT ASSY	USED ON	END ITEM NO.	THRU
-001	132	V416-945001	LCRSA		

REQD PER END ITEM	APPLICATION	EFFECTIVITY

UNLESS OTHERWISE SPECIFI
DIMENSIONS ARE IN INCHE
TOLERANCES ON:

DECIMALS	ANGLES
.XX = ± .03	± 0° 30'
.XXX = ± .010	

HOLES NOTED "DRILL"

.013	THRU	.040	+.001 –
.041	THRU	.130	+.002 –
.131	THRU	.229	+.003 –
.230	THRU	.500	+.004 –
.501	THRU	.750	+.005 –
.751	THRU	1.000	+.007 –
1.001	THRU	2.000	+.010 –

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED

ORIGINAL PAGE IS
OF POOR QUALITY

50)

2 FOLDOUT FRAME

QTY REQD	QTY REQD	QTY REQD	QTY REQD	QTY REQD	CODE IDENT	PART OR IDENTIFYING NUMBER	NOMENCLATURE OR DESCRIPTION	MATERIAL	DATA: SPECIFICATIONS SIZES, NOTES, SUPPLIERS	ZONE
				132		V416-945203-001	CLIP	AL SHT	6061-0 AL PER QQ-A-250/11 .81 x 12.7 x 38.1	

PARTS LIST

ITEM NO.	THRU
EFFECTIVITY	

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES.
TOLERANCES ON:

DECIMALS	ANGLES
XX = ± .03	± 0° 30'
XXX = ± .010	

HOLES NOTED "DRILL"

.013	THRU	.040	+.001 −.001
.041	THRU	.130	+.002 −.001
.131	THRU	.229	+.003 −.001
.230	THRU	.500	+.004 −.001
.501	THRU	.750	+.005 −.001
.751	THRU	1.000	+.007 −.001
1.001	THRU	2.000	+.010 −.001

DR BY	M. BISS	4/13/82
CHK BY		
APPROVED BY		

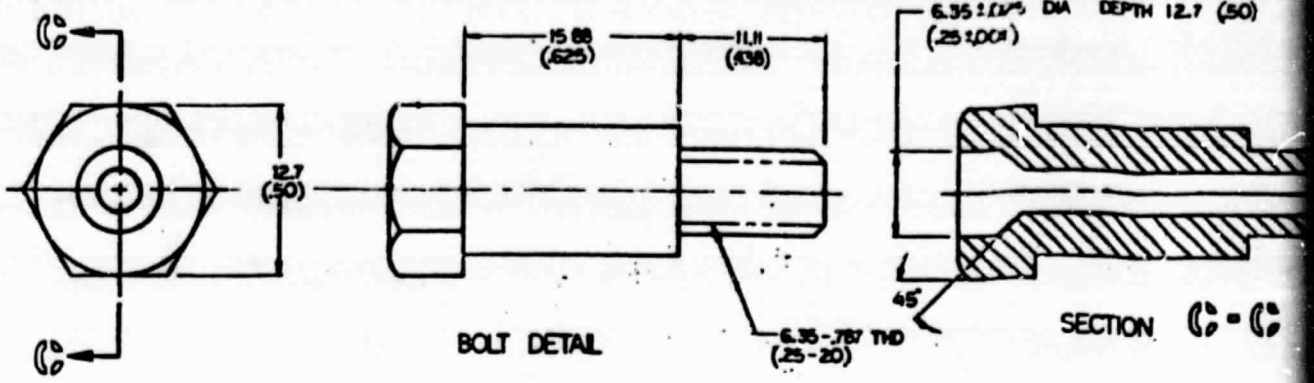
Rockwell International Corporation
Space Division
12214 Lakewood Boulevard • Downey, California 90241

CLIP - RADIATOR PANEL / REFLECTOR PANEL
LCRSA

SIZE	CODE IDENT NO.	DRAWING NO.
C	03953	V416-945203

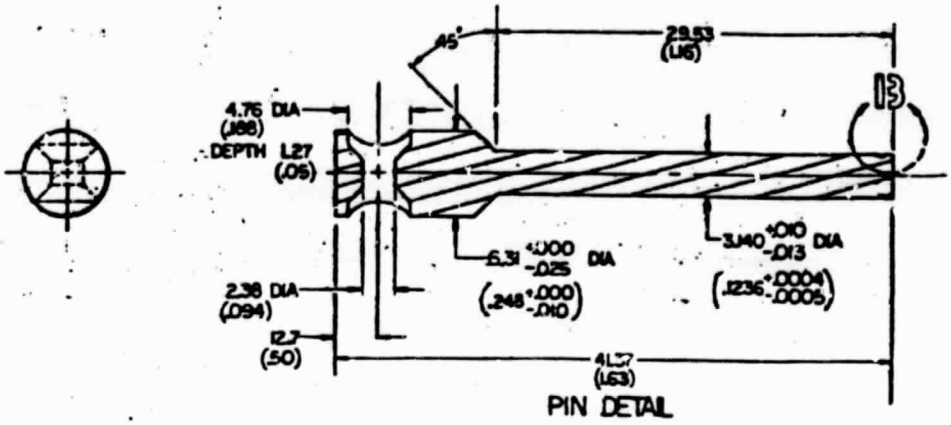
SCALE 1/1 SHEET 1/1

1-55, 1-56

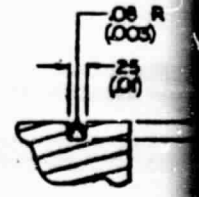


BOLT DETAIL

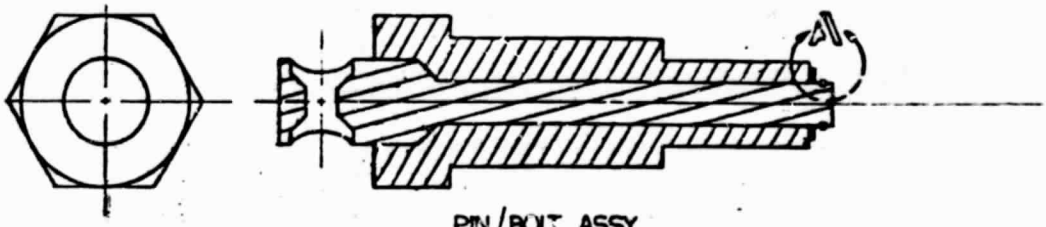
SECTION C - C



PIN DETAIL

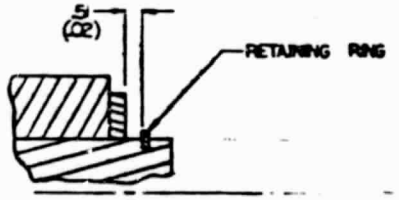


DETAIL B
SCALE: 20/1



PIN/BOLT ASSY

FOLDOUT FRAME

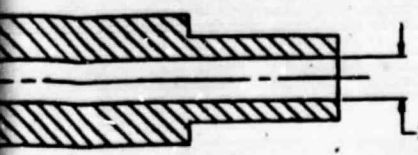


DETAIL A
SCALE: 10/1

1. ALL DIM. IN MM, INCHES IN ( )
NOTES: UNLESS OTHERWISE SPECIFIED

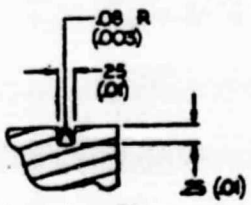
-001	132	M4S-94
ITEM	QTY	NEXT
REQD PER END ITEM		

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
	A	REVISED & REDRAWN	11/6/82	[illegible]



SECTION C-C

FOLDOUT FRAME



DETAIL B
SCALE: 20/1

QTY REQD	QTY REQD	QTY REQD	QTY REQD	QTY REQD	QTY REQD	CODE IDENT	PART OR IDENTIFYING NUMBER	NOMENCLATURE OR DESCRIPTION	MATERIAL	DATA: SPECIFICATIONS SIZES, NOTES, SUPPLIERS	ZONE
					132	-001	V416-945204	PIN/BOLT ASSY			

PARTS LIST

ITEM	QTY	NEXT ASSY	USED ON	END ITEM NO.	THRU
-001	132	V416-945100	LCRSA		

REQD PER END ITEM | APPLICATION | EFFECTIVITY

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON DECIMALS: .XX = ± .03, .XXX = ± .010; ANGLES: ± 0° 30'
HOLES NOTED "DRILL"

.013	THRU	.040	+.001 -.001
.041	THRU	.130	+.002 -.001
.131	THRU	.229	+.003 -.001
.230	THRU	.500	+.004 -.001
.501	THRU	.750	+.005 -.001
.751	THRU	1.000	+.007 -.001
1.001	THRU	2.000	+.010 -.001

DR BY: JM CULE 2-6-82
CHK BY:
APPROVED BY: [signature]

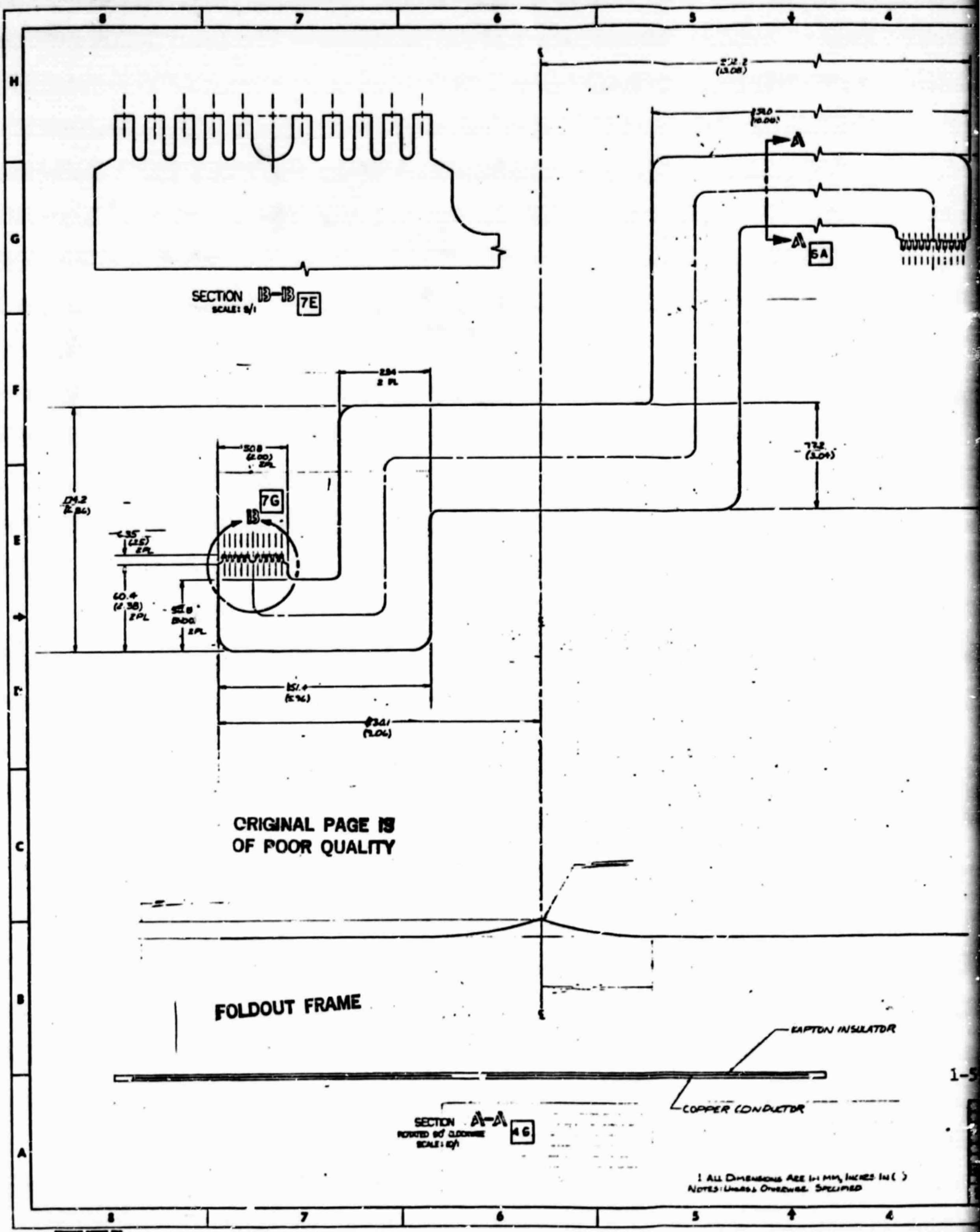
Rockwell International

PIN/BOLT ASSY-
RADIATOR PANEL HINGE
LCRSA

SIZE	CODE IDENT NO	DRAWING NO.
D	03953	V416-945204 A

SCALE 4/1 & NOTED | SHEET

IN MM, INCHES IN ( )
OTHERWISE SPECIFIED



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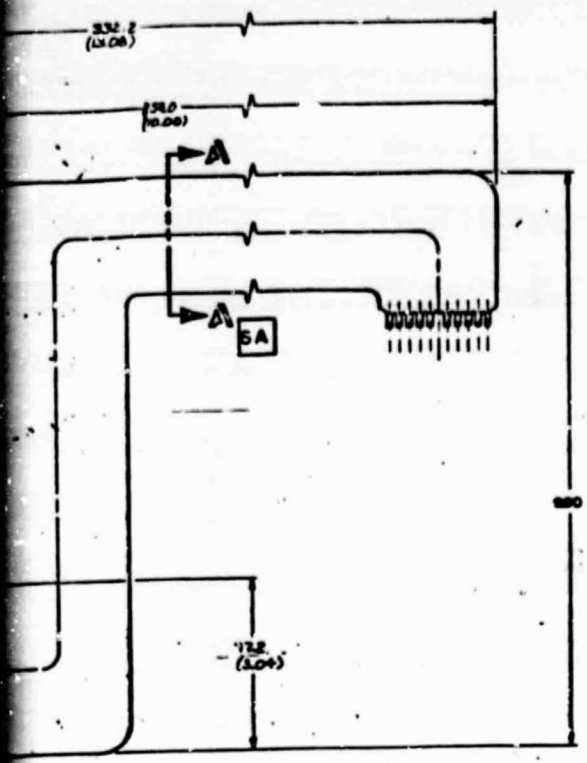
OF POOR QUALITY



FOLDOUT FRAME

ORIGINAL PAGE IS
OF POOR QUALITY

KAPTON INSULATOR

COPPER CONDUCTOR

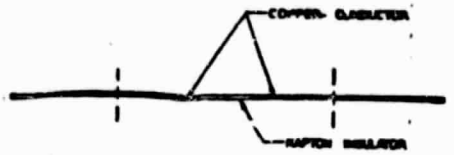
1-59, 1-60

1. ALL DIMENSIONS ARE IN MM, INCHES IN ( )
NOTES: UNLESS OTHERWISE SPECIFIED

PARTS LIST

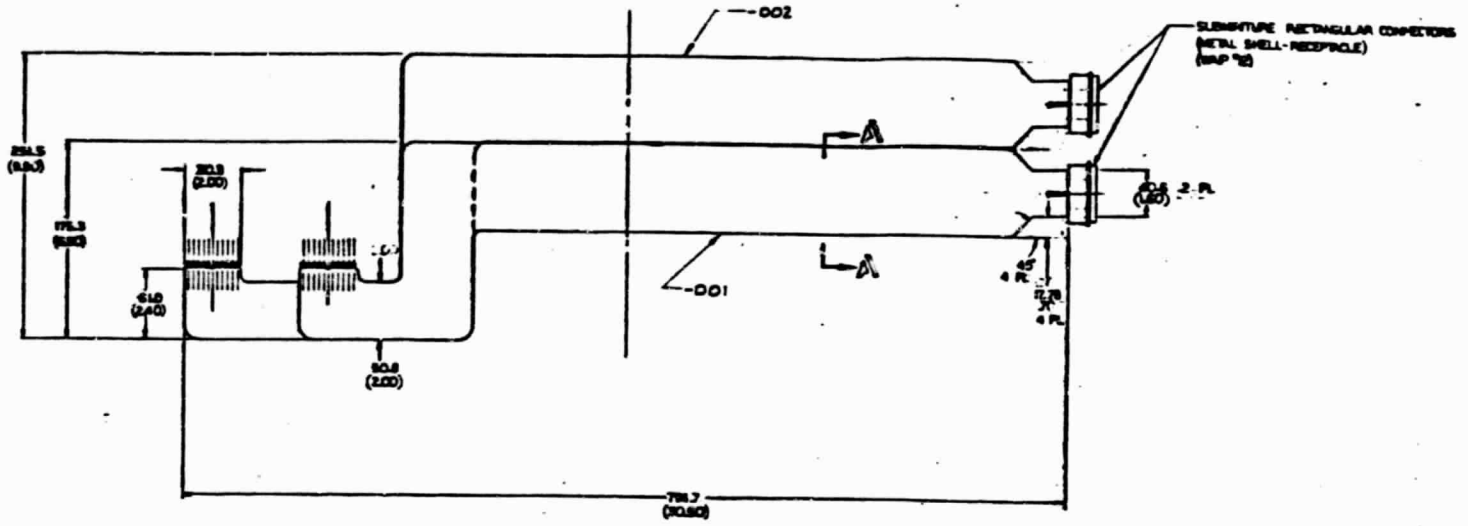
WIRE HARNESS
ELEMENT - ELEMENT
LCR5A

E | 03953 | V416-945301

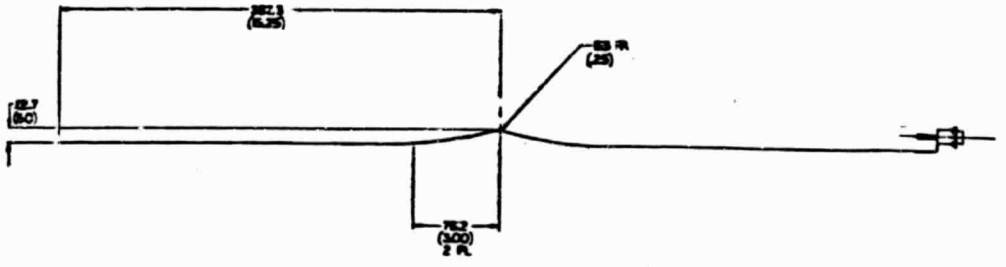


SECTION A-A

ORIGINAL PAGE IS
OF POOR QUALITY



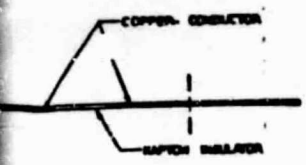
FOLDOUT FRAME



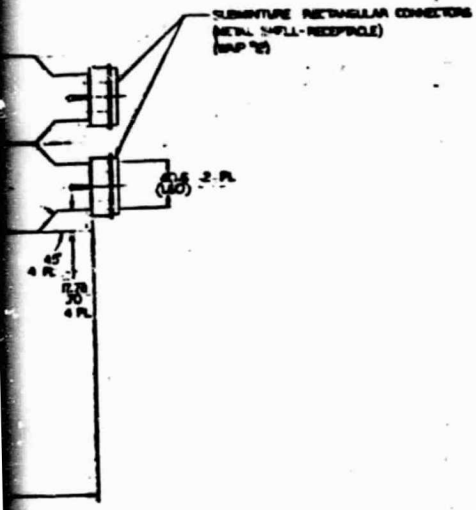
1-6

C-2

1. ALL DIMENSIONS ARE IN MM, INCHES IN ( )
NOTES: UNLESS OTHERWISE SPECIFIED



SECTION A-A



2 FOLDOUT FRAME

1-61, 1-62

QTY REQD	QTY REQD	QTY REQD	QTY REQD	QTY REQD	QTY REQD	CODE IDENT	PART OR IDENTIFYING NUMBER	NOMENCLATURE OR DESCRIPTION	MATERIAL	DATA SPECIFICATIONS SIZES NOTES SUPPLIERS	REF
						-001	V416-945302	WIRE HARNESS			

PARTS LIST

-002	V416-935100	LCRSA			
-001	V416-935400	LCRSA			

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON:
DECIMALS ANGLES
.XX ± .02 ± .5°
.XXX ± .010
HOLES NOTED "SHALL"

DR BY JIM CULE 9-11-82
CHK BY
APPROVED BY

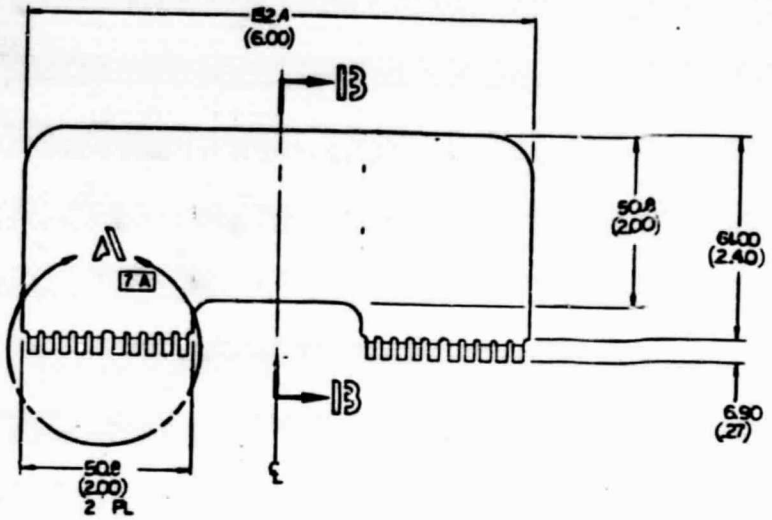
Rockwell International

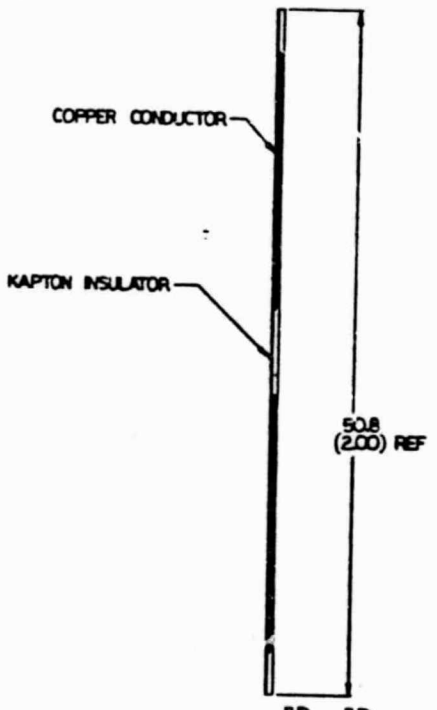
WIRE HARNESS
ELEMENT - BUSS
LCRSA

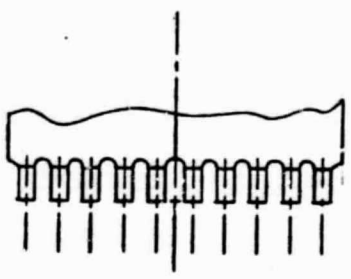
SIZE	CODE IDENT NO	DRAWING NO
E	03953	V416-945302

SCALE 1/2

1. ALL DIMENSIONS ARE IN MM, (INCHES IN ( )
NOTES: UNLESS OTHERWISE SPECIFIED







DETAIL A1 = A1
SCALE: 2/1
6 C

SECTION B = B
SCALE: 5/1

FOLDOUT FRAME

NOTES: UNLESS OTHERWISE SPECIFIED
1. ALL DIMENSIONS IN MM, INCHES IN ( )

ITEM	QTY	
001	1	V416-945
REQD PER END ITEM		NEXT

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED

2 FOLDOUT FRAME

QTY REQD	QTY REQD	QTY REQD	QTY REQD	QTY REQD	QTY REQD	CODE IDENT	PART OR IDENTIFYING NUMBER	NOMENCLATURE OR DESCRIPTION	MATERIAL	DATA: SPECIFICATIONS SIZES, NOTES, SUPPLIERS	ZONE
					1	-001	V416-945303	WIRE HARNESS DIRECTION REV.			

PARTS LIST

ITEM	QTY	NEXT ASSY	USED ON	ENG ITEM NO.	THRU
001	1	V416-945400	LCRSA		

REQD PER END ITEM | APPLICATION | EFFECTIVITY

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON DECIMALS: XX = ± .03, XXX = ± .010; ANGLES = ± 0° 30'
HOLES NOTED "DRILL"

.013	THRU	.040	+ .001 − .001
.041	THRU	.130	+ .002 − .001
.131	THRU	.229	+ .003 − .001
.230	THRU	.500	+ .004 − .001
.501	THRU	.750	+ .005 − .001
.751	THRU	1.000	+ .007 − .001
1.001	THRU	2.000	+ .010 − .001

DR BY: JIM CULE 11-5-62
CHK BY:
APPROVED BY:

Rockwell International

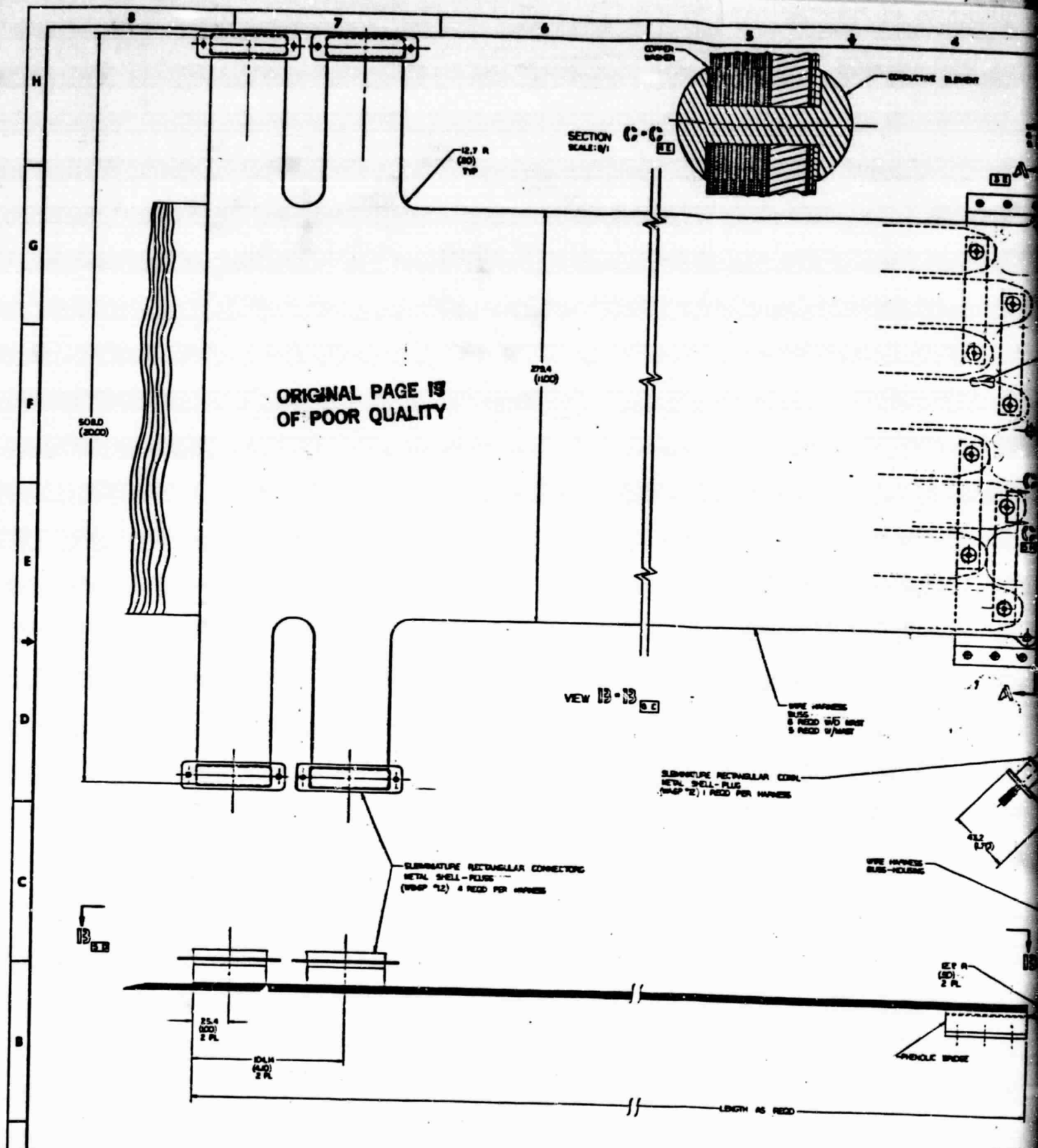
WIRE HARNESS - DIRECTION REVERSAL LCRSA

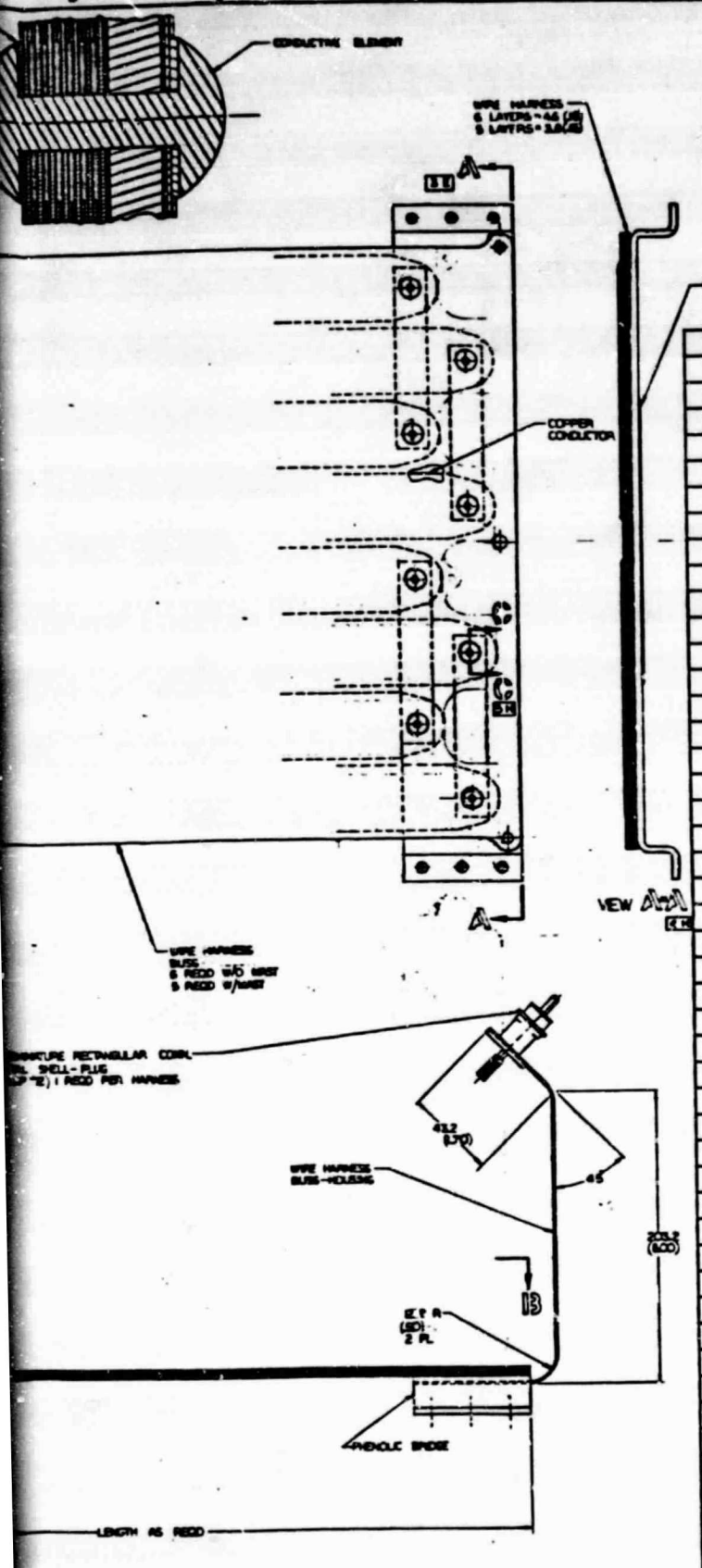
SIZE	CODE IDENT NO	DRAWING NO.
D	03953	V416-945303

SCALE: FULL SHEET

V416-942202

1-63, 1-64


COPPER WASHER
CONDUCTIVE ELEMENT
SECTION C-C
SCALE: 8/1
12.7 R (.50) TYP
ORIGINAL PAGE IS OF POOR QUALITY
SOLID (2000)
279.4 (11.00)
VIEW B-B
WIRE HARNESS BUSS 8 REQD W/O MAST 5 REQD W/MAST
SUBMINIATURE RECTANGULAR CONN. METAL SHELL - PLUG (MSP "E") 1 REQD PER HARNESS
SUBMINIATURE RECTANGULAR CONNECTORS METAL SHELL - PLUGS (MSP "E") 4 REQD PER HARNESS
WIRE HARNESS BUSS-HOUSING
25.4 (1.00) 2 PL
101.6 (4.00) 2 PL
PHENOLIC SPACE
LENGTH AS REQD
FOLDOUT FRAME
1. ALL DIMENSIONS IN MM INCHES IN ( )
NOTES: UNLESS OTHERWISE SPECIFIED



2

FOLDOUT FRAME

ORIGINAL PAGE IS
OF POOR QUALITY

ITEM	QTY REQD	QTY REQD	QTY REQD	QTY REQD	QTY REQD	QTY REQD	CODE IDENT	PART OR IDENTIFYING NUMBER	NOMENCLATURE OR DESCRIPTION	MATERIAL	DATA SPECIFICATIONS SIZES NOTES SUPPLIERS	ZONE
-001							V416-945304		WIRE HARNESS			

PARTS LIST

1-65, 1-66

V416-945304 1/1

-001		V416-945304	LCRSA									
ITEM	QTY	NEXT ASSY	USED ON									
NEXT ITEM		APPLICATION		EFFECTIVITY								

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
FRACTIONS ±1/64
.XX ± .02 .X ± .1
.XXX ± .010 ANGLES ± 1°
MACHINED SURFACES "SMALL"
.125 125 .250 ± .010 - .251
.126 126 .251 ± .010 - .252
.127 127 .252 ± .010 - .253
.128 128 .253 ± .010 - .254
.129 129 .254 ± .010 - .255
.130 130 .255 ± .010 - .256
.131 131 .256 ± .010 - .257
.132 132 .257 ± .010 - .258
.133 133 1.000 ± .010 - .251

DR BY JAN CALE 8-8-82
CHK BY
APVD BY
QUALITY ASSY

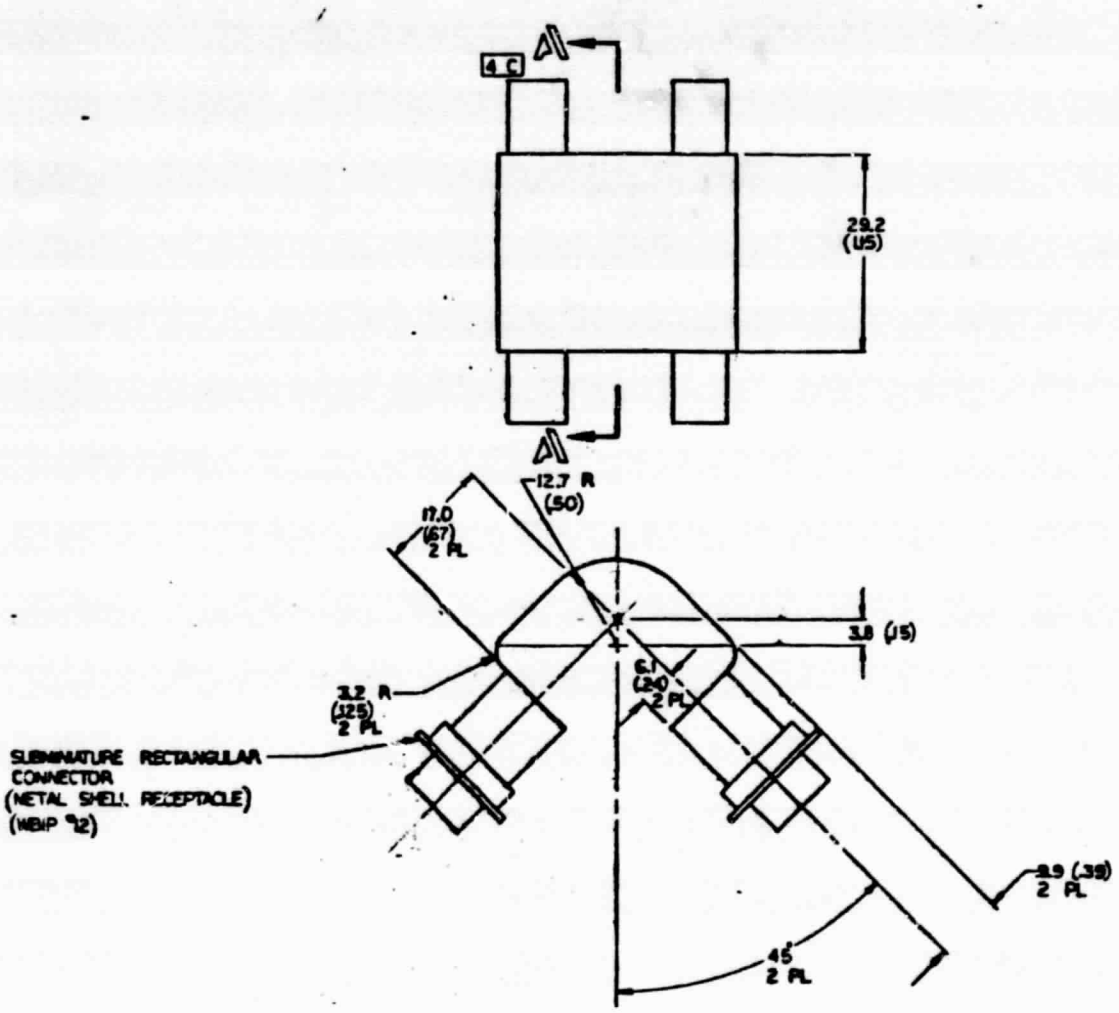
Rockwell International

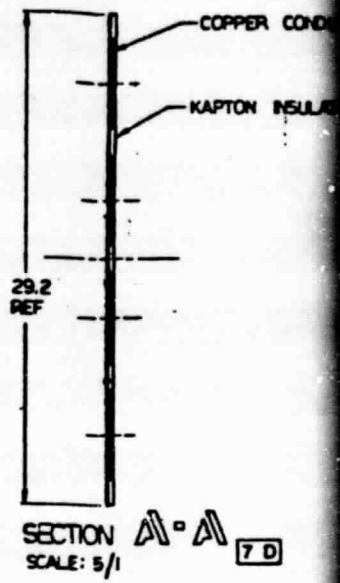
WIRE HARNESS
HOUSING ASSY
LCRSA

SIZE E | CAGE CODE 03953 | V416-945304

SCALE FULL | SHEET

1. ALL DIMENSIONS IN MM INCHES IN ( )
NOTES: UNLESS OTHERWISE SPECIFIED





SECTION A-A 7 D
SCALE: 5/1

FOLDOUT FRAME

L ALL DIMENSIONS IN MM, INCHES IN ( )
NOTES: UNLESS OTHERWISE SPECIFIED

-001		VHM6-93
ITEM	QTY	NEXT A
REQD PER END ITEM		

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED

2

CTION A-A 7 D
LE: 5/1

QTY REQD	QTY REQD	QTY REQD	QTY REQD	QTY REQD	QTY REQD	CODE IDENT	PART OR IDENTIFYING NUMBER	NOMENCLATURE OR DESCRIPTION	MATERIAL	DATA, SPECIFICATIONS SIZES, NOTES, SUPPLIERS	ZONE
						-001	V416-945305-001	WIRE HARNESS			

PARTS LIST

ITEM	QTY	NEXT ASSY	USED ON	END ITEM NO.	THRU
-001		V416-935100	LCRSA		
REQD PER END ITEM		APPLICATION		EFFECTIVITY	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS: .XX = ± .03; .XXX = ± .010
ANGLES: ± 0° 30'
HOLES NOTED "DRILL"

.013	THRU	.040 +.001 -.001
.041	THRU	.130 +.002 -.001
.131	THRU	.229 +.003 -.001
.230	THRU	.500 +.004 -.001
.501	THRU	.750 +.005 -.001
.751	THRU	1.000 +.007 -.001
1.001	THRU	2.000 +.010 -.001

DR BY	JIM CULE	1-16-82
CHK BY		
APPROVED BY		

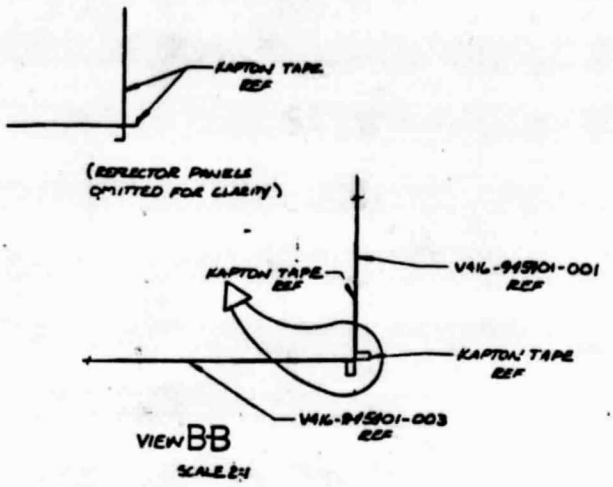
Rockwell International

WIRE HARNESS
HOUSING - HOUSING
LCRSA

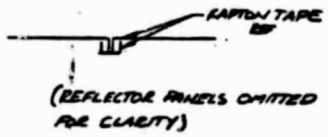
SIZE	CODE IDENT NO	DRAWING NO.
D	03953	V416-945305

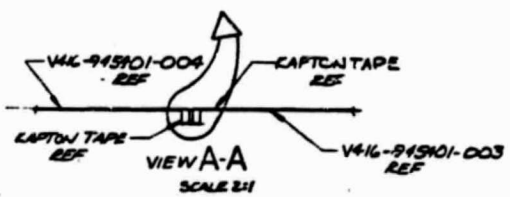
SCALE: 2/1 & NOTED SHEET

1-67, 1-68



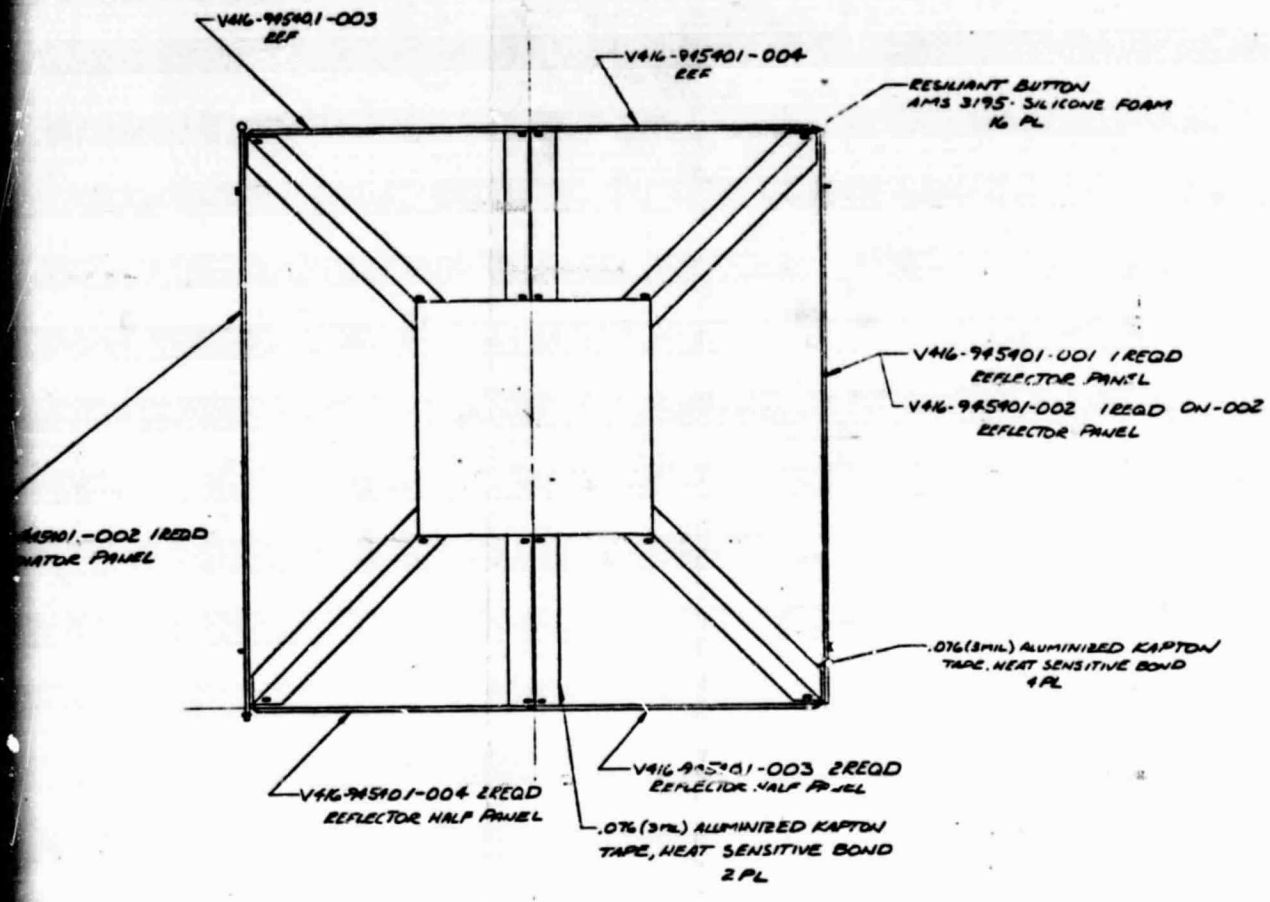
V416-945901-002 (REF) RADIATOR PANEL

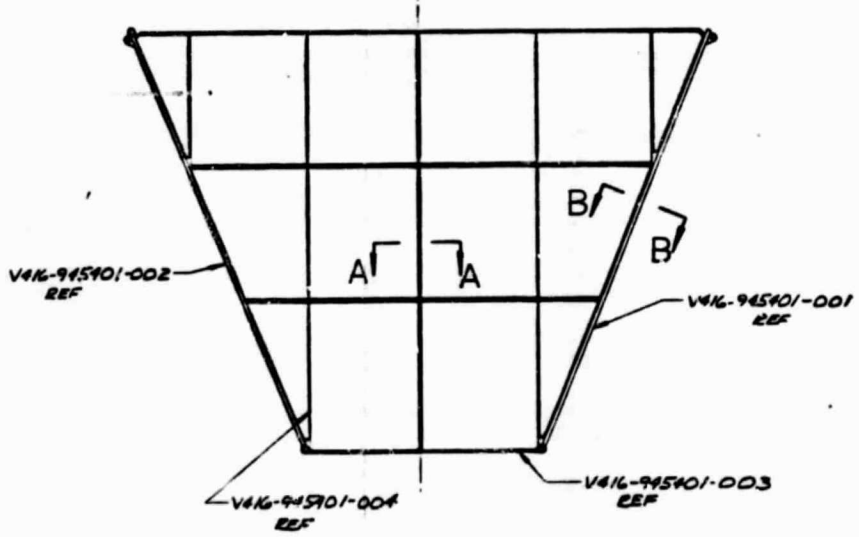




V416-945901 REF

FOLDOUT FRAME





2
FOLDOUT FRAME

-001 SHOWN
-002 SAME EXCEPT
AS NOTED

1-69, 1-70

ALL DIMENSIONS ARE IN MM, INCHES IN ( )
NOTES: UNLESS OTHERWISE SPECIFIED

-002	1	V416-945401
-001	1	V416-945401
ITEM	QTY	

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FOLDOUT FRAME

3

									ELEMENT BUTTON	SILICONE FOAM	AMS 3195 (W/B)TYPE 3.500(88.9)DIA
									HINGE	AL KAPTON TAPE	.014(.3mm) × 500(12)
				2	2	-004	V416-945401		REFLECTOR PANEL		
				2	2	-003					
				2	1	-002					
					1	-001	V416-945401		REFLECTOR PANEL ASSEMBLY		
			1	-001			V416-945400		REFLECTOR PANEL ASSY		
				LS	-001		V416-945400		REFLECTOR PANEL ASSY		
ITEM	QTY	QTY REQUIRED	QTY NEEDED	QTY PREV'S	QTY REQ'D	CODE IDENT	PART OR IDENTIFYING NUMBER		NOMENCLATURE OR DESCRIPTION	MATERIAL	DATA, SPECIFICATIONS, SIZES, NOTES, SUPPLIERS

PARTS LIST

-001 SHOWN
-002 SAME EXCEPT AS NOTED

1-69, 1-70

-002	1	V416-945001	LCRSA	
-001	LS	V416-945001	LCRSA	
ITEM	QTY	NEXT ASSY	USED ON	EFF ITEM NO. THRU
NEXT ASSY	APPLICATION		EFFECTIVITY	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS FRACS
.XX = ± .02 ± 0° 30'
.XXX = ± .005
MOLDED NOTED "SHALL"
.010 THRU .030 = ± .005 – .005
.031 THRU .120 = ± .010 – .010
.121 THRU .250 = ± .015 – .015
.251 THRU .500 = ± .020 – .020
.501 THRU .750 = ± .025 – .025
.751 THRU 1.000 = ± .030 – .030
1.001 THRU 2.000 = ± .035 – .035

DR BY M Bass 4/19/82
CHK BY
APPROVED BY
MFG APPROVAL

Rockwell International

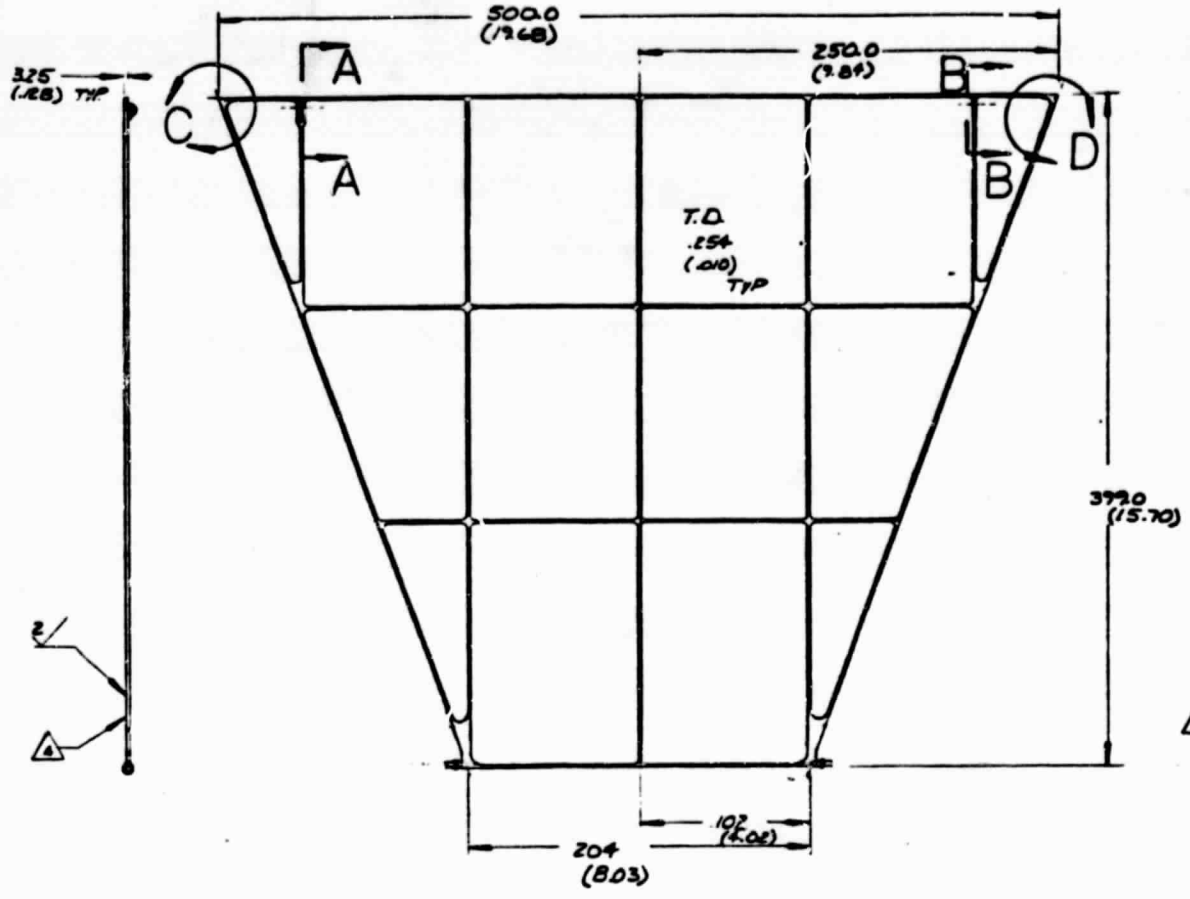
REFLECTOR PANEL ASSEMBLY
LCRSA

SIZE	CODE IDENT NO.	DRAWING NO.
J	03953	V416-945400

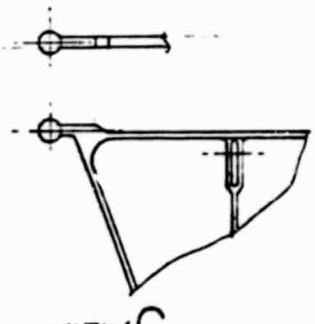
SCALE 3/4 SHEET 1/1

V416-945400

4 3 2 1



-001 SHOWN
-002 SIMILAR EXCEPT AS SHOWN



VIEW C
SCALE 1/1
(-002 ONLY)

SECTION A A
SCALE 1/1
(FEMALE LUG REF)

SECTION BB
SCALE 1/1
(MALE LUG REF)

4. ALUMI
SPEC
EMIS
3. FLATNE
AT A
2. ALL CU
1. FAB AL
NOTES: UNL

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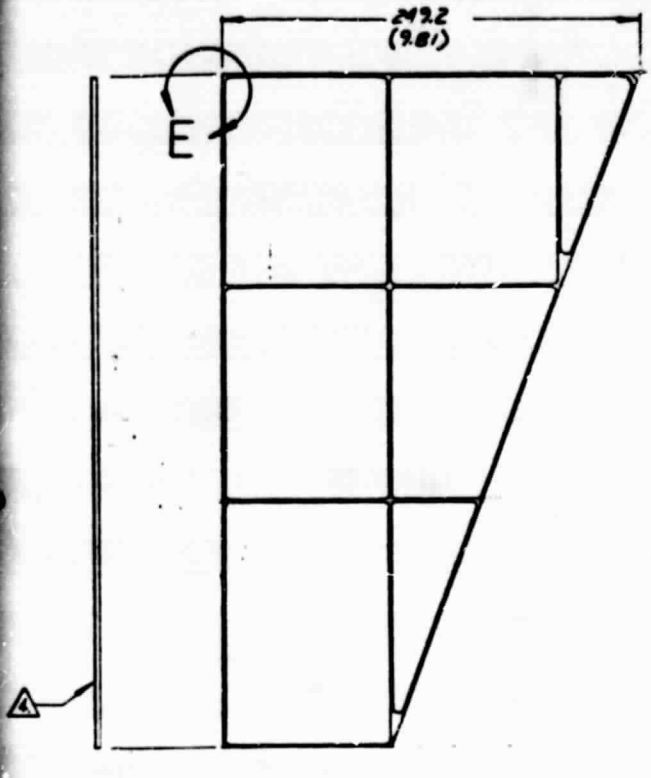
FOLDOUT FRAME

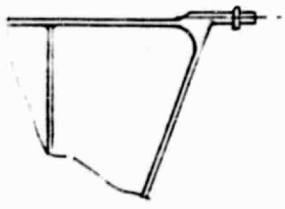
REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED



-003 SHOWN
-004 OPP. EXCEPT AS SHOWN

2
FOLDOUT FRAME

VIEW E
SCALE 1/1
(-004 ONLY)



VIEW D
SCALE 1/1
(-002 ONLY)

V416-945401

ON BB
1/1
LUG)

4. ALUMINIZE SURFACE TO 500Å THICKNESS, SPECULAR REFLECTIVITY OF .90 AND AN EMISSIVITY OF .05
3. FLATNESS AND WAVINESS MAY DEVIATE AT A RATE OF .0005 mm PER mm (.0005 in. PER INCH)
2. ALL DIMENSIONS ARE IN mm, INCHES IN ( )
1. FAB ALL PARTS FROM GRAPHITE IMPREGNATED POLYSULFONE

NOTES: UNLESS OTHERWISE SPECIFIED

DR BY M BISS 4/12/82	Rockwell International Corporation Space Division 12214 Lakewood Boulevard • Downey, California 90241	
CHK BY		
APPROVED BY	REFLECTOR PANEL - CONCENTRATOR ELEMENT LCRSA	
N/A V416-945400	SIZE D	CODE IDENT NO. 03953 V416-945401
	SCALE 1/2	SHEET 1/1

2.0 TEST HARDWARE DRAWINGS

2.1 DISCUSSION

The hardware required to carry out experimental activities under this program are listed in the drawing tree depicted in Figure 2. There are a total of 21 drawings, of several types. Some provide information for subcontractors; others were used to construct Rockwell-fabricated components. The tests and experiments performed using the resulting hardware are fully described in Vol. 1 of this report.

2.2 TEST HARDWARE DRAWINGS

1. D416-340010
2. D416-340020
3. D416-450000
4. D416-450001
5. D416-451000
6. D416-451001
7. D416-451002
8. D416-451003
9. D416-451004
10. D416-451005
11. D416-451006
12. D416-451007
13. D416-452000
14. D416-452001
15. D416-453000
16. D416-454000
17. D416-454001
18. D416-454002
19. D416-454003
20. D416-454004
21. D416-455000

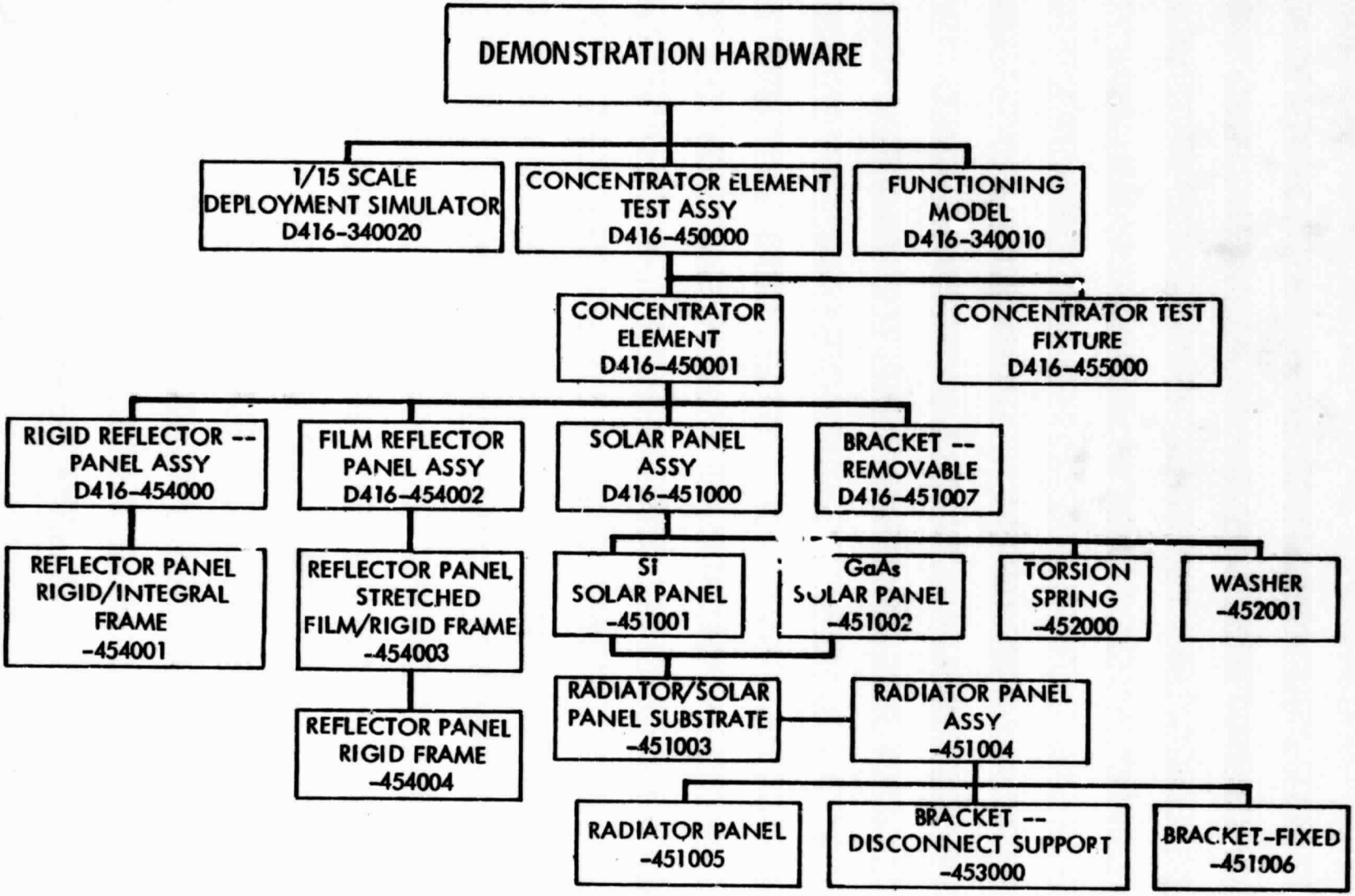
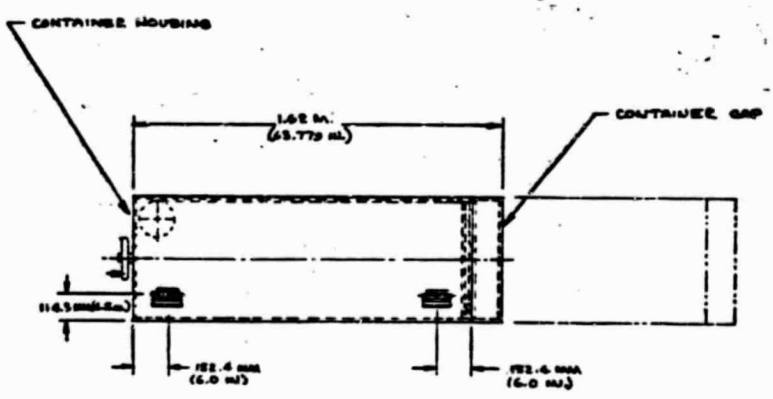


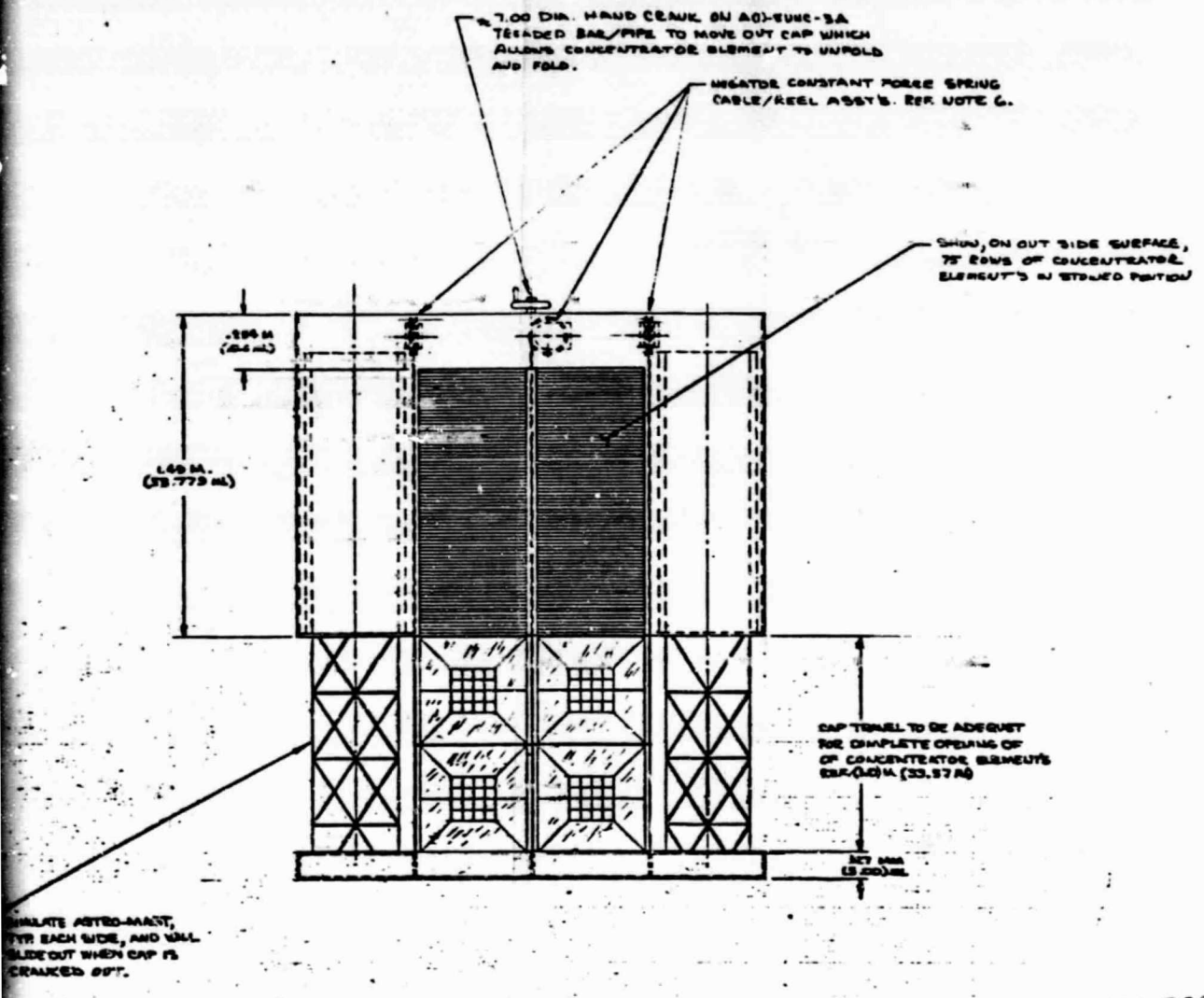
Figure 2. Test Hardware Drawing Tree

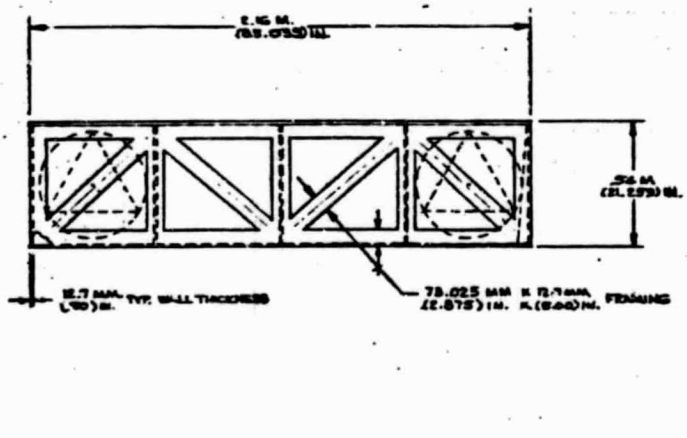
FOLDOUT FRAME



2

FOLDOUT FRAME





NOTE:
1. FABRICA
PER ACC
VERBAL
2. CONTAIN
TO BE OF
STRUCTU
AND TRA
APPEARAN
MODELS
CAN BE
PROVIDE
CONCEAL

FRAME

3 FOLDOUT FRAME

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LITY

NOTE:
1. FABRICATE PER BEST MODEL SHOP PRACTICES, PER ACCOMPANING NOTE SHEETS AND VERBAL DISCUSSIONS.
2. CONTAINER HOUSING AND CAP ASSEMBLIES TO BE OF LIGHTEST WEIGHT MATERIALS BUT STRUCTURALLY SOUND FOR DEMONSTRATION AND TRANSPORTING. MAINTAIN THE EXTERNAL APPEARANCE DIMENSIONS TO SHOW ACTUAL MODULE SIZE. THE INTERNAL STRUCTURE CAN BE MADE TO ANY CONFIGURATION SO AS TO PROVIDE THE OPENING AND CLOSING OF THE CONCENTRATOR ELEMENTS.

2-3, 2-4

		Rocketdyne International Corporation	
		LOW CONCENTRATION RATIO SOLAR ARRAY N=6, GCR=6 FUNCTIONING MODEL	
		SIZE J	CODE IDENT NO. 03953
		DRAWING NO. D416-34000	
		SCALE 1/2	SHEET

4 3 2 1

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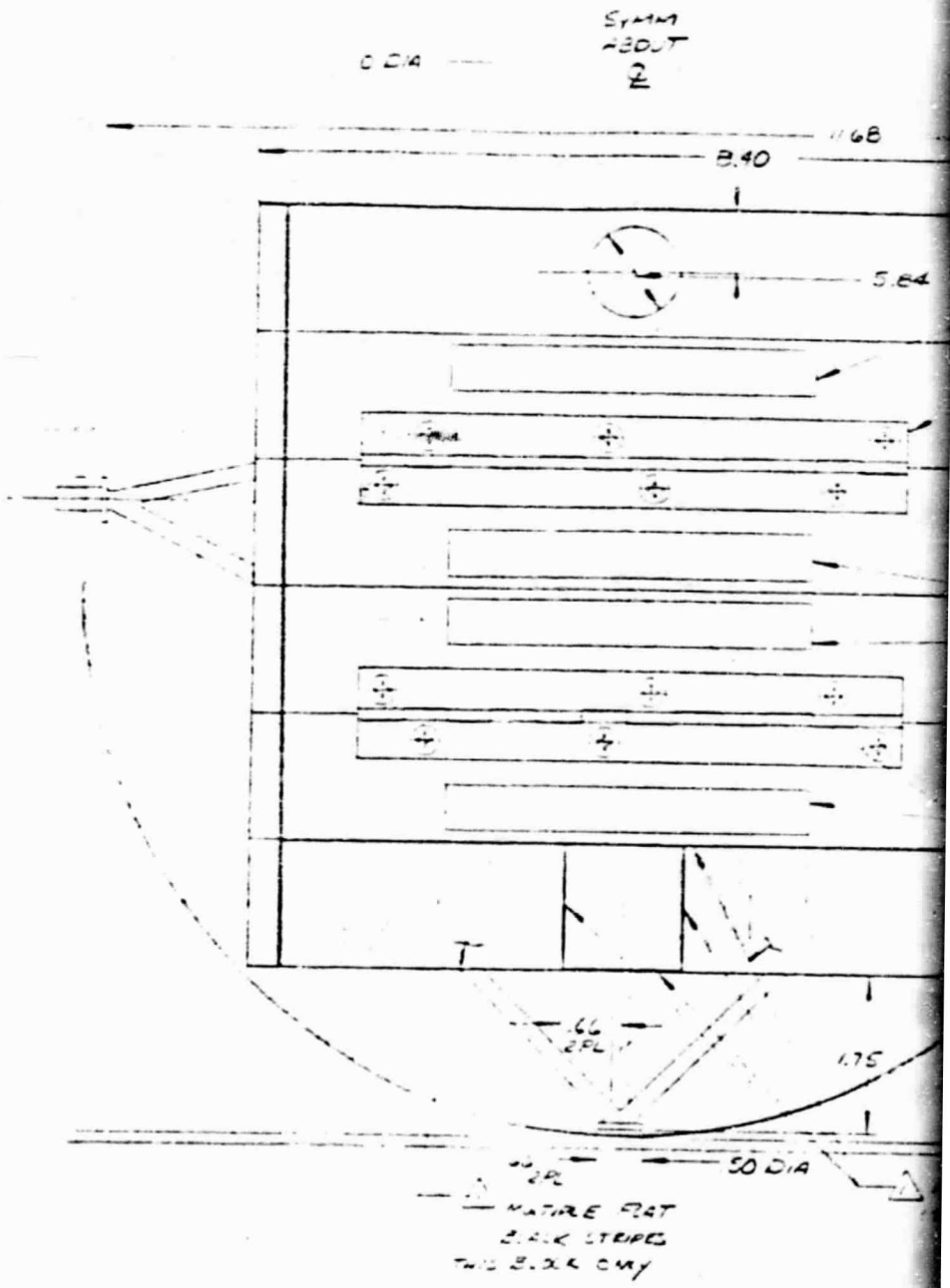

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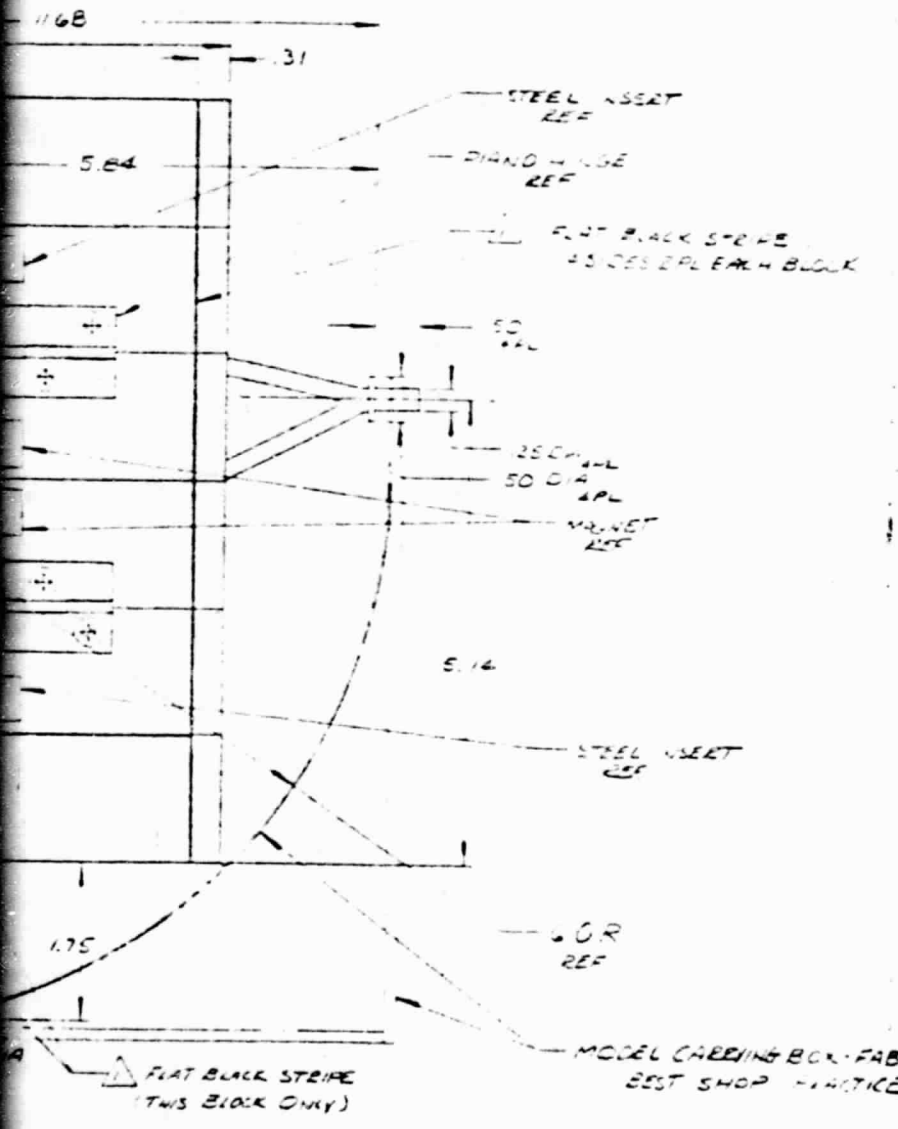
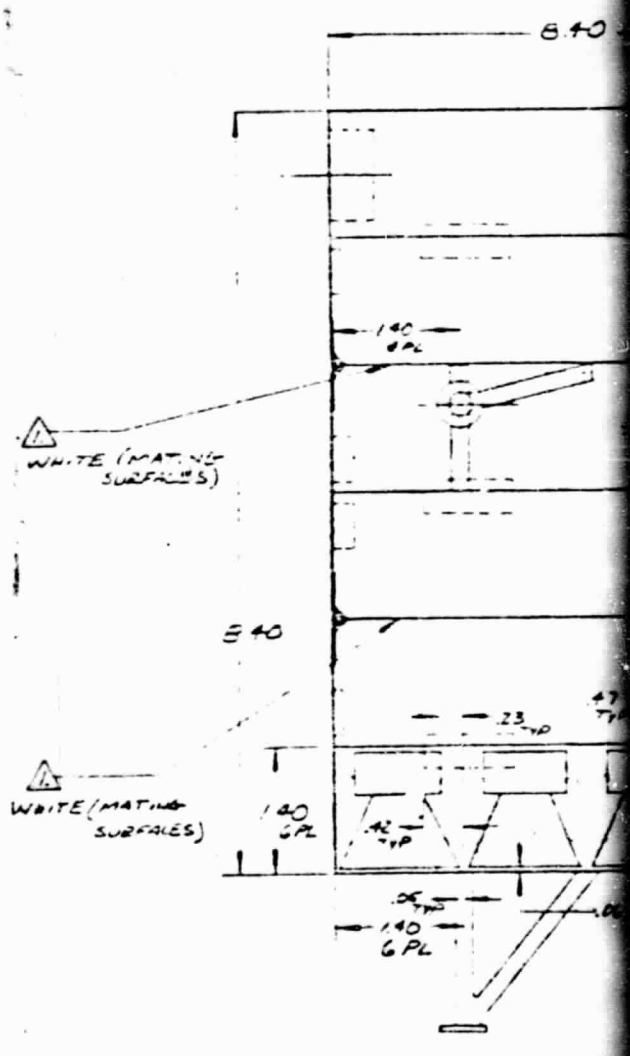
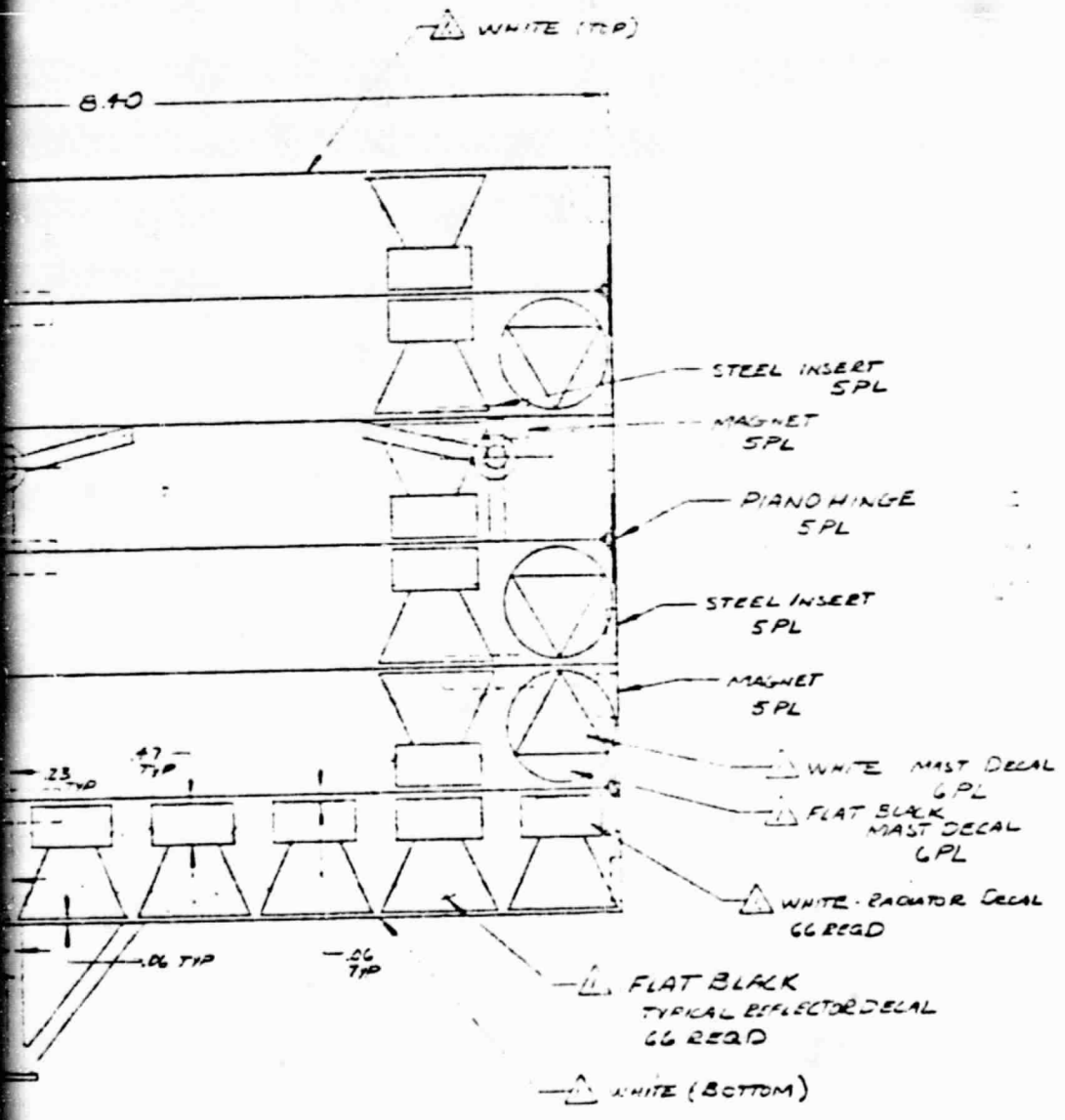






5. REMOVABLE - SMALL
4. MATERIALS - METAL
MODEL MAKING M
STAND ABOUSE OF R
3. SCALE FOR MISSION
2. NAIL, SCREW, OR GLUE
1. PAINT ALL SURFACES
NOTES: UNLESS OTHERWI

FOLDOUT FRAME 2

6 5 4

	2	REVISED DETAILS 100 - DIA HOLE	3 3/82

24 FOLDOUT FRAME

MOVEABLE - SHARE CARRIER CASE TO BE ... MED
MATERIALS. METAL, PLASTIC WOOD OR OTHER
MODEL MAKING MATERIAL THAT CAN BE ...
STAND ABUSE OF REPEATED HANDLING
SCALE FOR MISSION DIMS
GLUE, SCREW, OR GLUE. AS BEST SHOP PRACTICE
PAINT ALL SURFACES SILVER (ALUMINUM)
UNLESS OTHERWISE SPECIFIED

DR BY	[illegible]
CHK BY	
APPROVED BY	

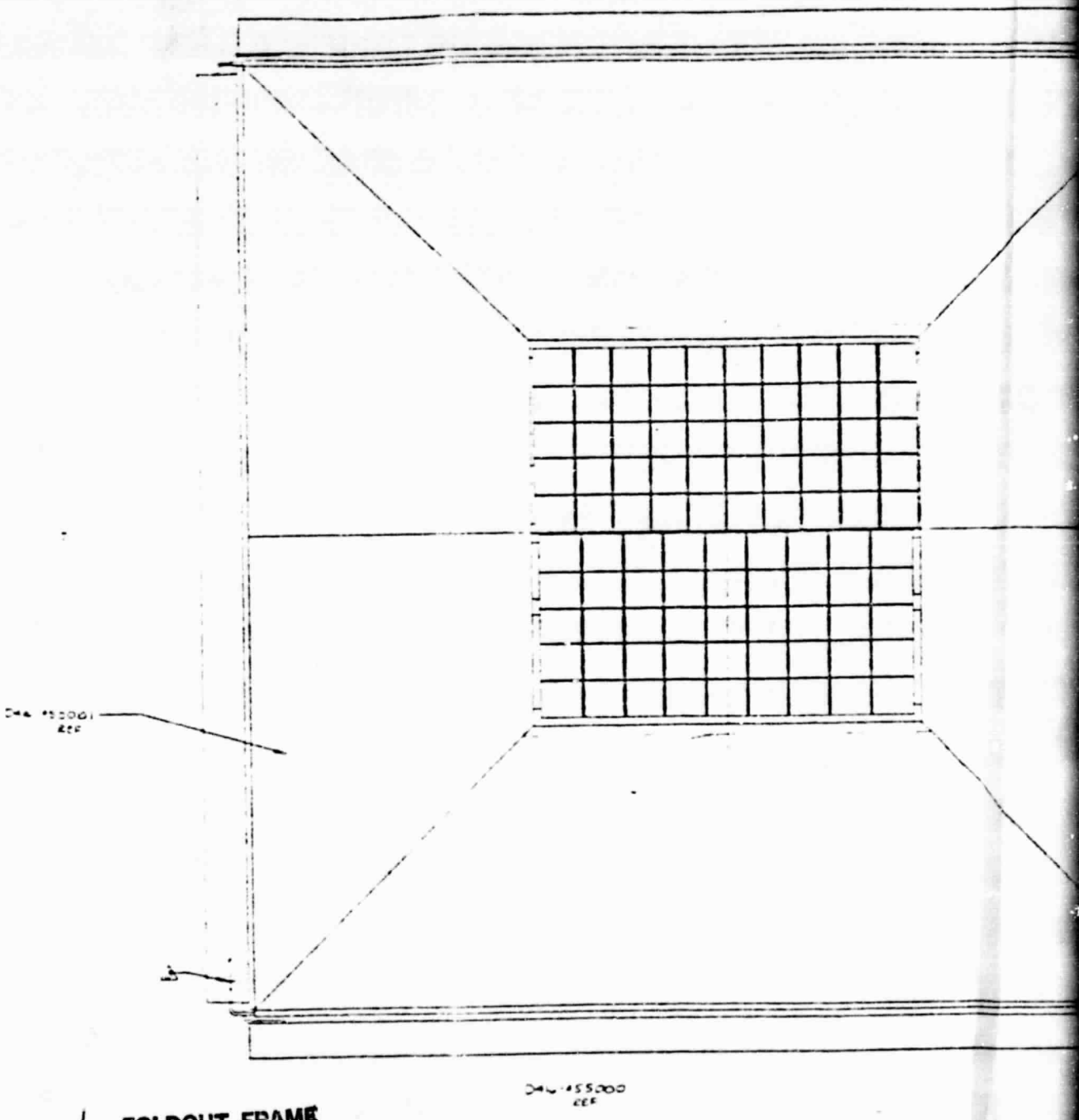
Rockwell International Corporation
Space Division
[illegible]

SOLAR HEATH MODULE DEMONSTRATION
MODEL SATTLE STRONGBOX
[illegible] SCALE 1/2

SIZE | CODE IDENT NO. | DRAWING NO.
L | 03953 | D4 [illegible]-340020

SCALE | SHEET

2-5, 2-6



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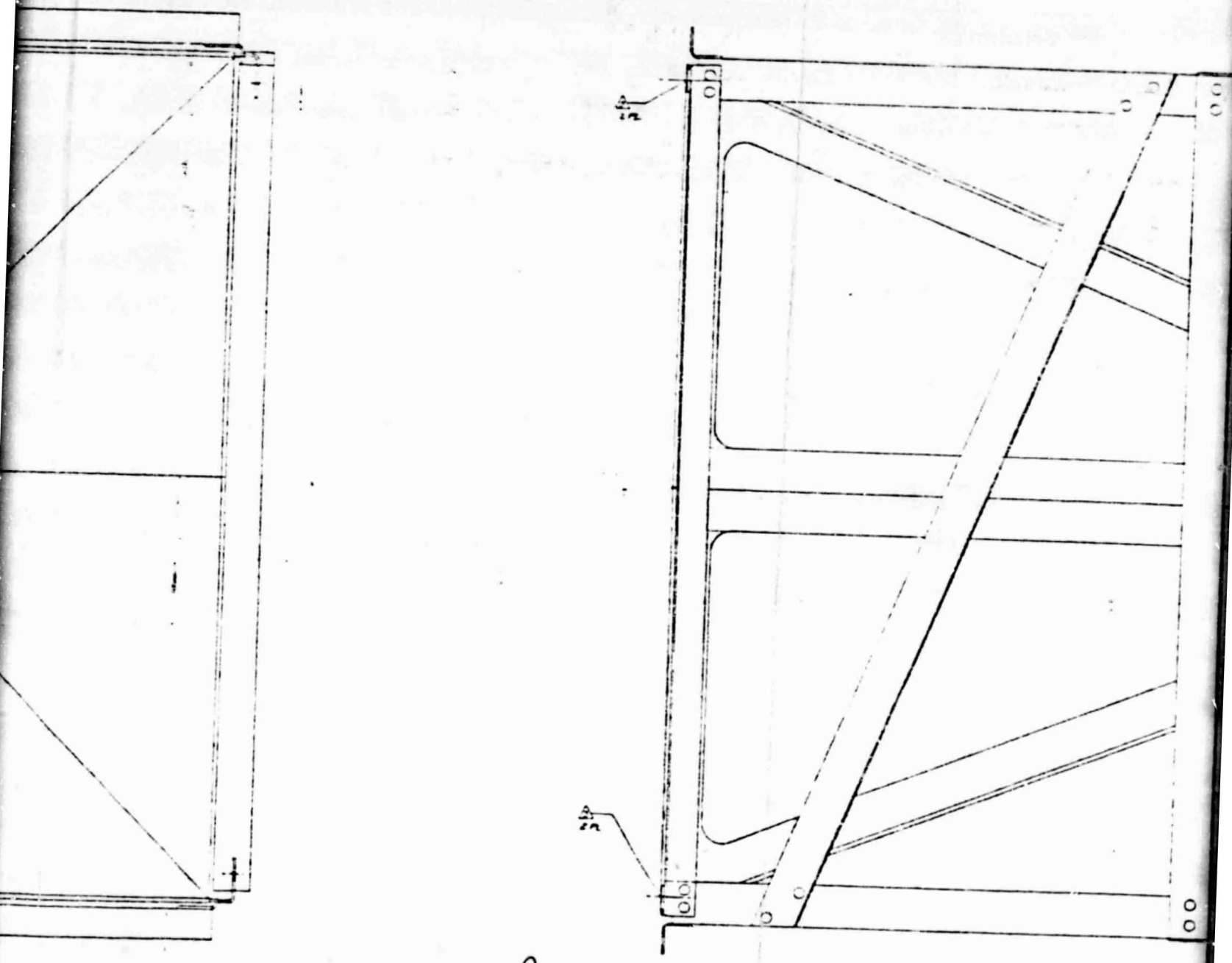
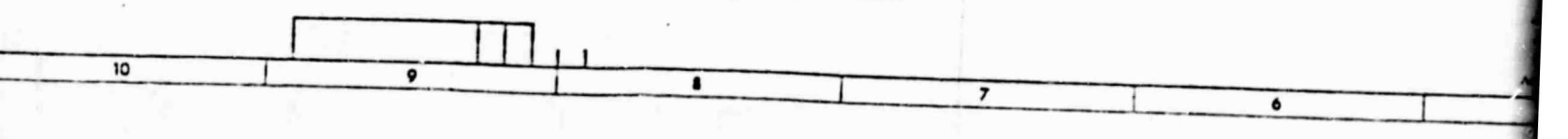
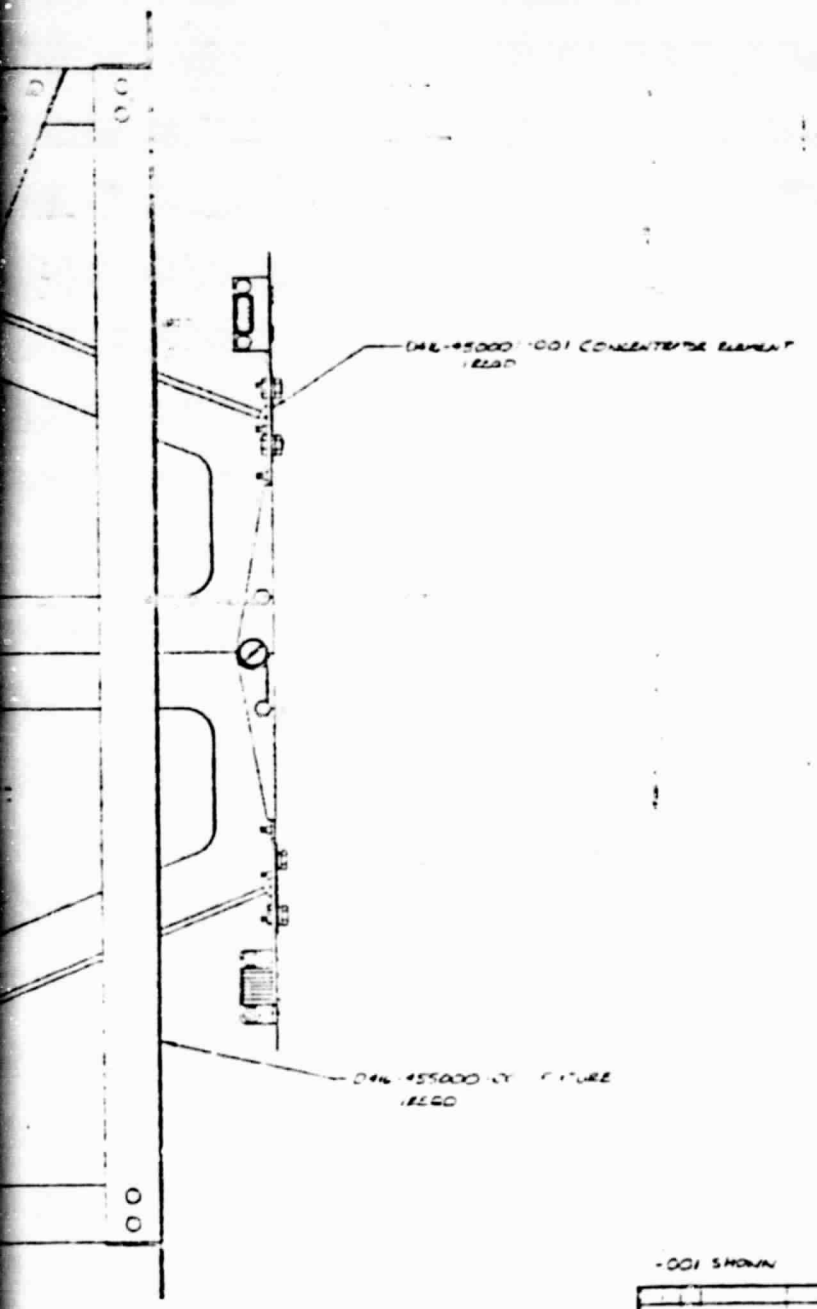


2.

FOLDOUT FRAME





PARTS LIST

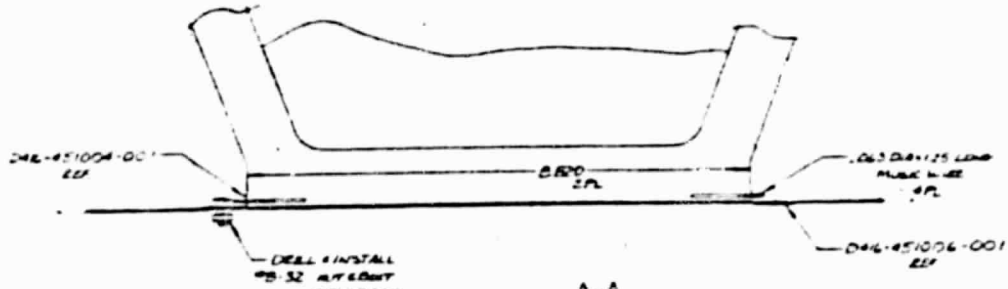
4 CLAMP AT LOCATION SHOWN
2 SAFETY WIRE C CLAMPS TO FIXTURE (SHOWN)
1 CONTAIN WATER CONTROL TIE WRAP
NOTE: UNLESS OTHERWISE SPECIFIED

CONCENTRATOR ELEMENT TEST ASSEMBLY
SERIES

J103953 D46-450000

2-7, 2-8

3 FOLDOUT FRAME

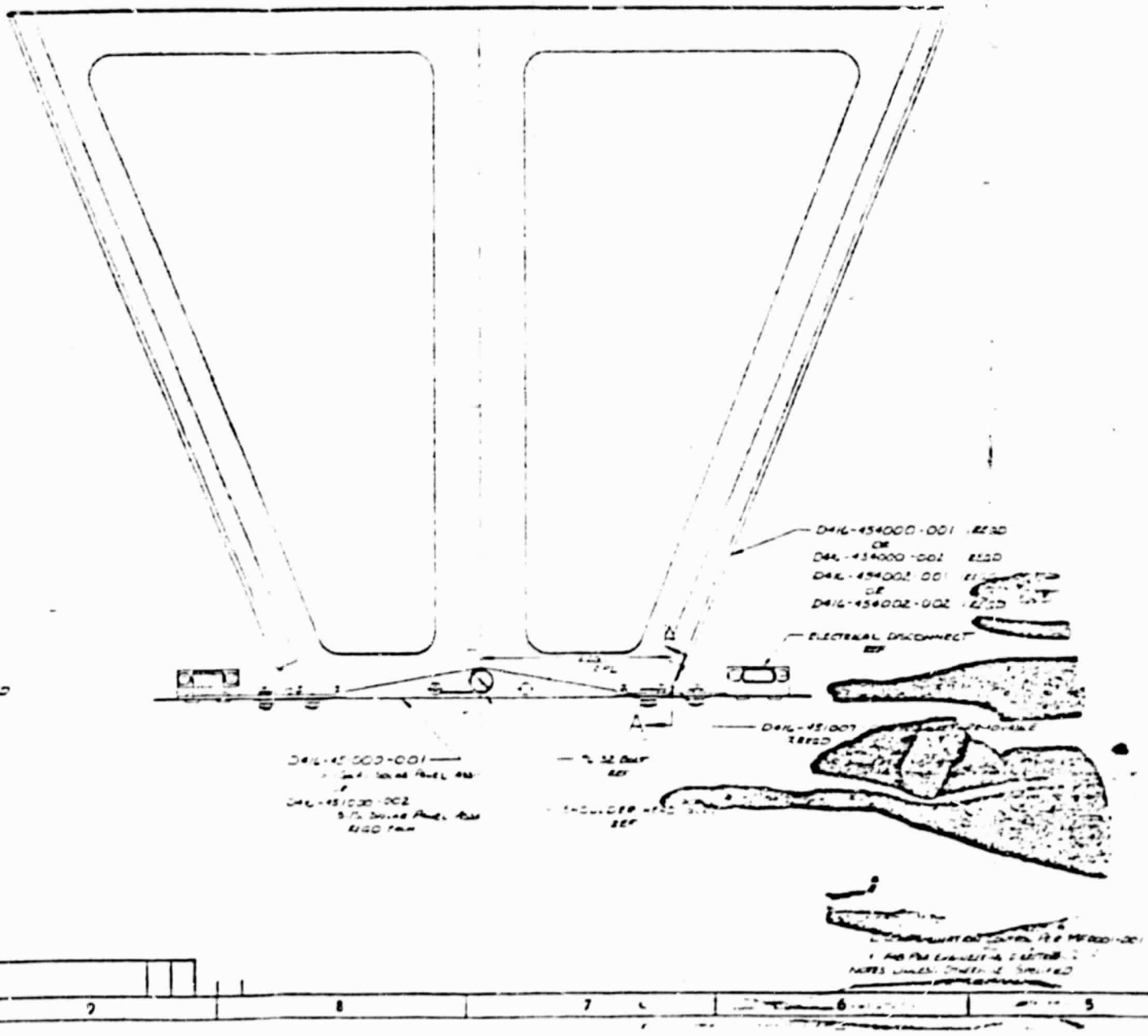


SECTION A-A
SCALE 2/1

FOLDOUT FRAME

2

FOLDOUT FRAME



ITEM	QTY	PART NO.	DESCRIPTION	MATERIAL
	4		NUT	
	4	MS-32	BOLT	CRES
	4	MS 32	NUT	CRES
	1	-004	D46-45 1000	
	1	-003	D46-45 000	
	2	-001	D46-45 007	BRACKET
	1	-005	D46-45 4002	
	1	-001	D46-45 4002	
	1	-002	D46-45 4000	
	1	-001	D46-45 000	
	1	-004	D46-450001	

PARTS LIST

CONCENTRATOR
ELEMENT ASSEMBLY
LERSA TEST

J 039531 D46-450001

2-9, 2-10

-001 SHOWN

3

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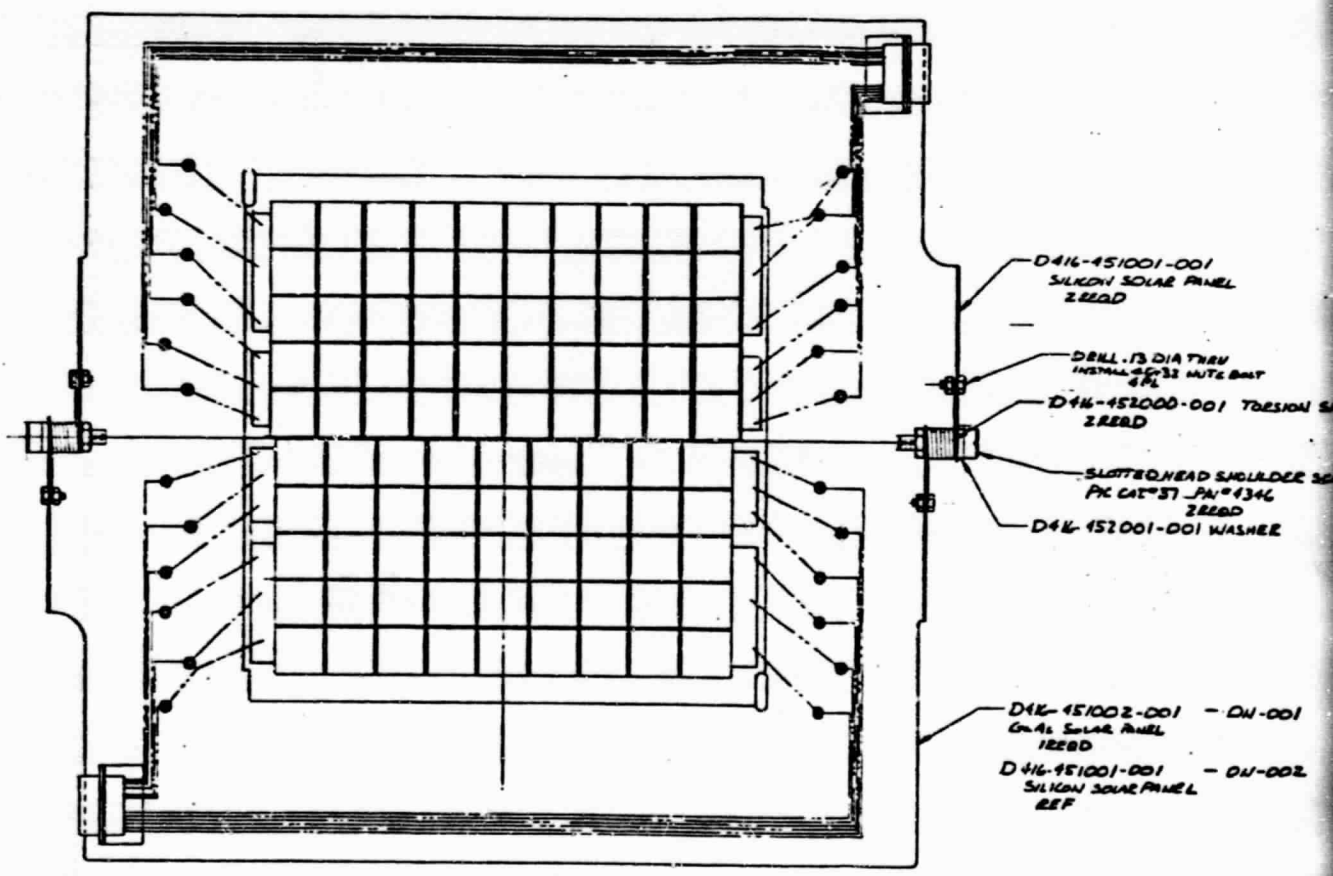
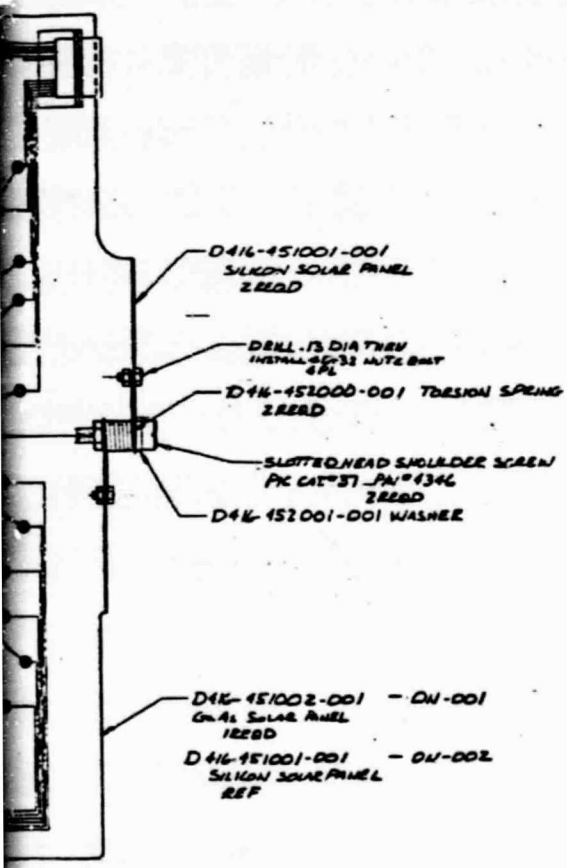


FOLDOUT FRAME

2. IDENTIFY PART PER MA0104-301
CONTAMINATION CONTROL PER MA0001-301
NOTES: UNLESS OTHERWISE SPECIFIED

2 FOLDOUT FRAME



-002 SAME (EXCEPT AS NOTED)

-001 SHOWN

ITEM	QTY	QTY REQD	QTY REQD	QTY REQD	QTY REQD	CODE IDENT	PART OR IDENTIFYING NUMBER	NOMENCLATURE OR DESCRIPTION	MATERIAL	SIZE SPECIFICATIONS MFRS. NOTES, SUPPLIERS	ZONE
					6		4-32	BOLT	CRES		
					4		6-32	SCREW	CRES		
					2		4346	SHOULDER SCREW	303 CRES	PIC CATALOG # 37 P. 57	
					2	-001	D416-452001	WASHER			
					2	-001	D416-452000	TORSION SPRING			
					1	-001	D416-451002	GaAs Solar Panel			
				2	1	-001	D416-451001	SILICON SOLAR PANEL			
			1	-002			D416-451000				
			1	-001			D416-451000				

PARTS LIST

REV	DESCRIPTION	DATE	APPROVED

REVISED PER ENG MOD	APPLICATION	EFFECTIVITY
-002	D416-451001	
-001	D416-451001	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES ON DECIMALS ANGLES ± ° ′ ″ HOLES OVER .500" DIA

M 8/85 9/26/85

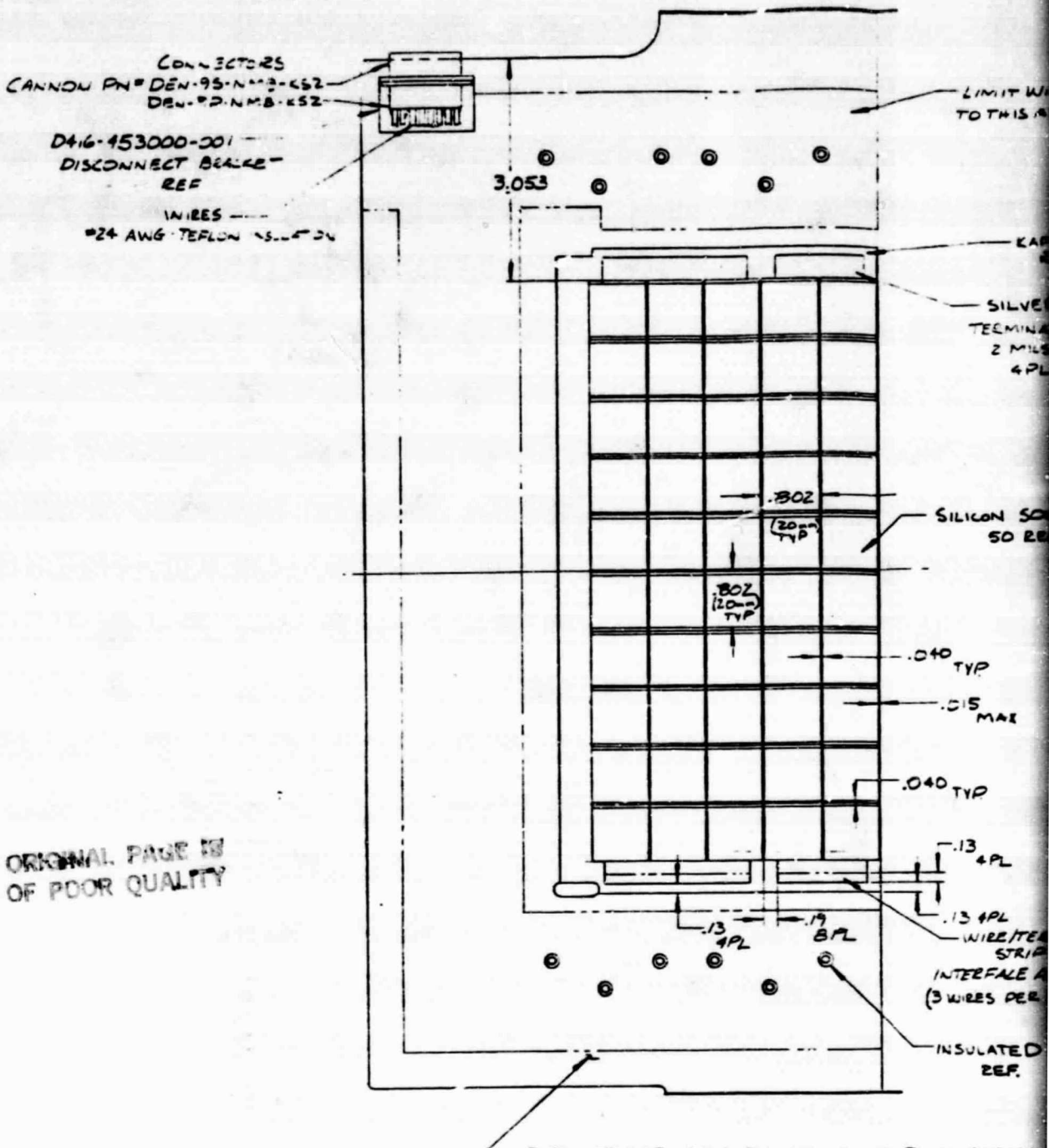
Rockwell International

SOLAR PANEL ASSEMBLY LCRSA TEST

SIZE E | CODE IDENT NO. 03053 | DRAWING NO. D416-451000

SCALE | SHEET

* PER MA0104-301
CONTROL PER MS0001-001
UNLESS SPECIFIED



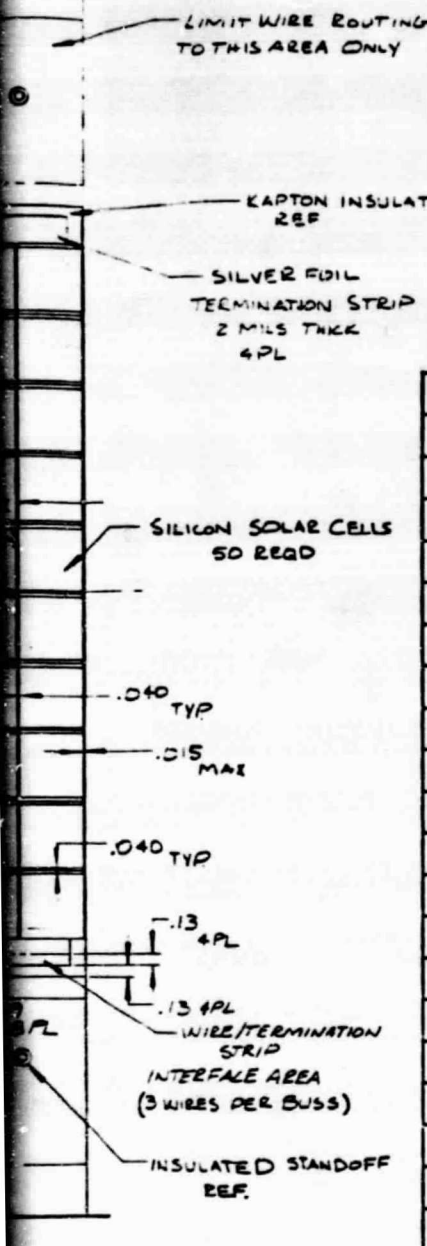
FOLDOUT FRAME

-001 SI

5. CONTAMINATION CONTROL PER MF0001-001
4. IDENTIFY PART PER MA0104-301
3. INTERCONNECT SHALL BE SILVER 'EXMET'
2. BOND CELLS USING RTV577 ADHESIVE
1. FAB PER STATEMENT OF WORK SOLAR PANEL LCRSA SYSTEM SILICON

NOTES: UNLESS OTHERWISE SPECIFIED

-001	2	D416
ITEM	QTY	
REQD PER END ITEM		



-001 SHOWN

REVISIONS

ZONE	LTR	DESCRIPTION	DATE	APPROVED

2 FOLDOUT FRAME

QTY REQD	QTY REQD	QTY REQD	QTY REQD	QTY REQD	QTY REQD	CODE IDENT	PART OR IDENTIFYING NUMBER	NOMENCLATURE OR DESCRIPTION	MATERIAL	DATA SPECIFICATIONS SIZES NOTES SUPPLIERS	ZONE
					4			BUSS	TERMINATION STRIP	2 MIL THICK	
					1		DEM-9P-NMB-ESZ	CONNECTORS		CANNON	
					1		DEM-9S-NMB-ESZ	CONNECTORS		CANNON	
					50			SOLAR CELLS	SILICON		
					6		IN-6081	DIODES		SEMTECH	
					2		D416-451003	RADIATOR/ SOLAR PANEL			
				2	-001		D416-451001				

PARTS LIST

ITEM	QTY	NEXT ASSY	USED ON	END ITEM NO	THRU
-001	2	D416-451000	HCESA TEST		

REQD PER END ITEM | APPLICATION | EFFECTIVITY

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES

TOLERANCES ON DECIMALS: XX = ± .03, .XXX = ± .010; ANGLES = 0° 30'

HOLES NOTED "DRILL"

.013	THRU	.040	+ .001 − .001
.041	THRU	130	+ .002 − .001
131	THRU	.229	+ .003 − .001
230	THRU	500	+ .004 − .001
501	THRU	750	+ .005 − .001
751	THRU	1 000	+ .007 − .001
1 001	THRU	2 000	+ .010 − .001

DR BY: M BISS 8/24/82

CHK BY:

APPROVED BY

Rockwell International

SILICON SOLAR PANEL ASSEMBLY

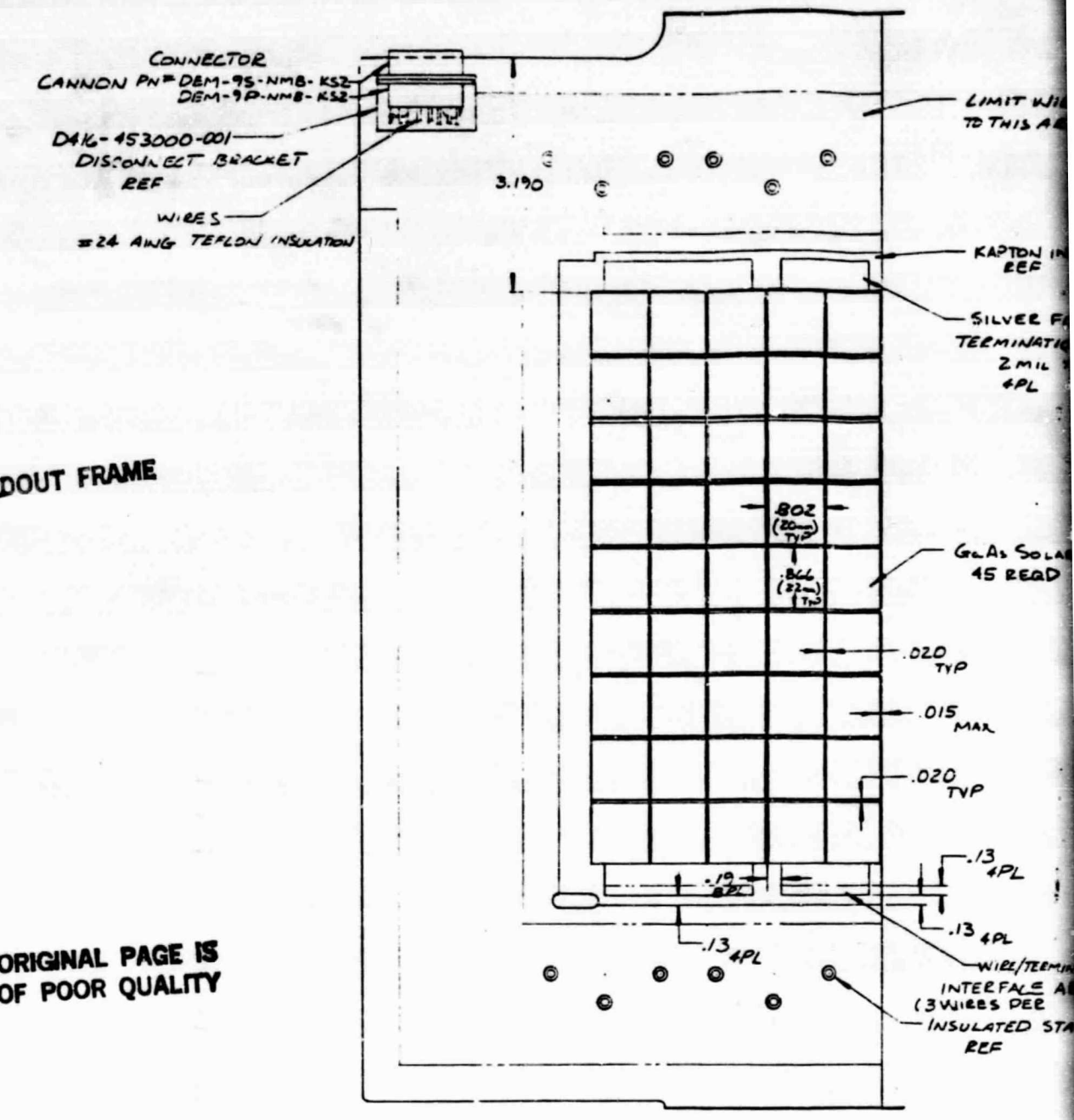
LCRSA - TEST

SIZE	CODE IDENT NO	DRAWING NO
D	03953	D416-451001

SCALE FULL | SHEET 1/1

D416-451001

2-13, 2-14



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-001 SHO

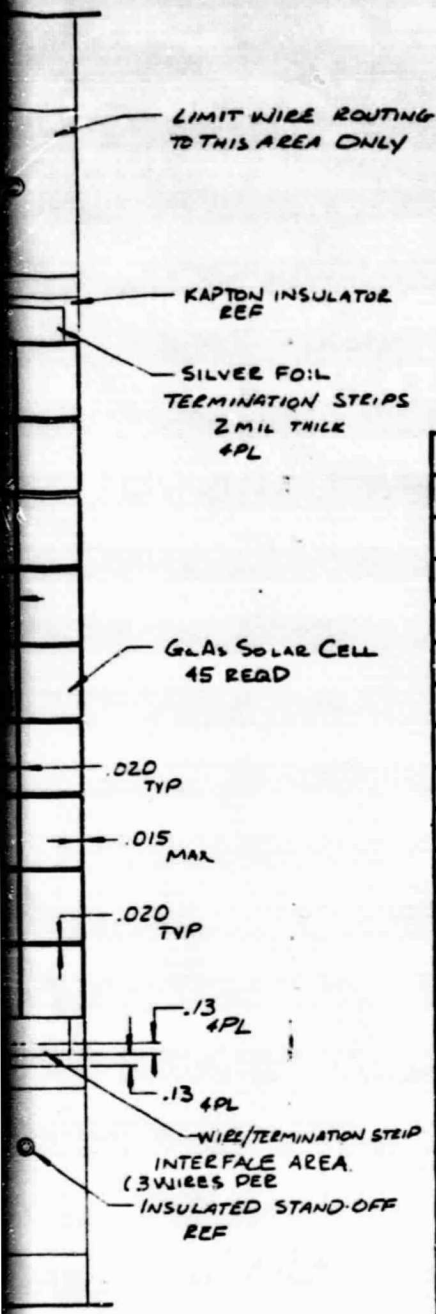
5. CONTAMINATION CONTROL PER MF0001-001
4. IDENTIFY PART PER MA0104-301
3. INTERCONNECT SHALL BE KOVAR 'SOLAFER'
2. BOND CELLS USING DC 93-500 ADHESIVE
1. FAB PER STATEMENT OF WORK SOLAR PANEL LCRSA SYSTEM GaAs

NOTES: UNLESS OTHERWISE SPECIFIED

-001	1	D4K-45
ITEM	QTY	NEXT A
REQD PER END ITEM		

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED

2 FOLDOUT FRAME



-001 SHOWN

QTY REQD	QTY REQD	QTY REQD	QTY REQD	QTY REQD	QTY REQD	CODE IDENT	PART OR IDENTIFYING NUMBER	NOMENCLATURE OR DESCRIPTION	MATERIAL	DATA: SPECIFICATIONS SIZES, NOTES, SUPPLIERS	ZONE
					4			TERMINATION STRIPS	SILVER FOIL	2 MIL THICK	
					1		DEM-9P-NMB-K52	CONNECTORS		CANNON	
					1		DEM-9S-NMB-K52	CONNECTORS		CANNON	
					45			SOLAR CELLS	GaAs		
					6		IN-6081	DIODES		SEMTECH	
					1	-001	D416-451003	RADIATOR/ SOLAR PANEL			
					-001						

PARTS LIST

D416-451002

ITEM	QTY	NEXT ASSY	USED ON	END ITEM NO.	THRU
-001	1	D416-451000	LCRSA TEST		

REQD PER END ITEM | APPLICATION | EFFECTIVITY

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON DECIMALS: XX = ± .03, XXX = ± .010; ANGLES: ± 0° 30'
HOLES NOTED "DRILL"

.013	THRU	.040	+.001 −.001
.041	THRU	.130	+.002 −.001
.131	THRU	.229	+.003 −.001
.230	THRU	.500	+.004 −.001
.501	THRU	.750	+.005 −.001
.751	THRU	1.000	+.007 −.001
1.001	THRU	2.000	+.010 −.001

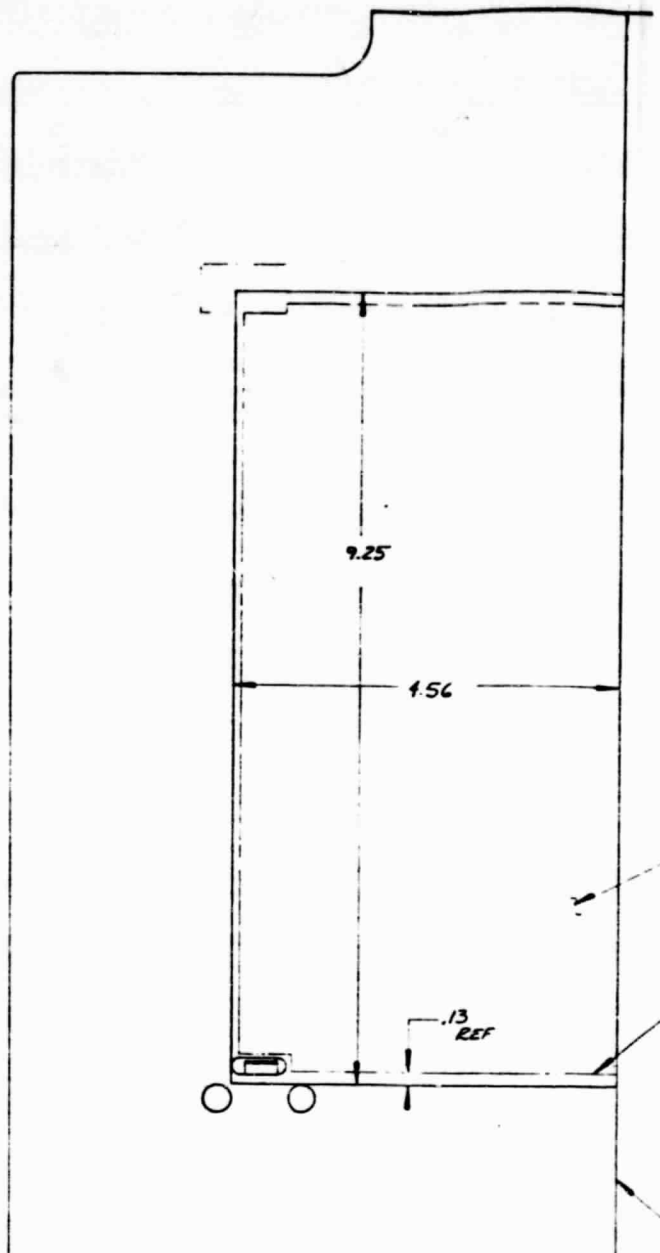
DR BY M. Bliss 8/26/82
CHK BY
APPROVED BY

Rockwell International

GaAs SOLAR PANEL ASSEMBLY LCRSA TEST

SIZE	CODE IDENT NO	DRAWING NO.
D	03953	D416-451002

SCALE 1/1 SHEET 1/1



FOLDOUT FRAME

-001 SA

-001	1	SPARE
-001	1	D41-9
-001	2	D41-9
ITEM	QTY	NEXT
REQD PER END ITEM		

3. CONTAMINATION CONTROL PER ME0001-001
2 BOND WITH AB0120-003 TYPE I, PER AA0106-044
1. MARK PART NO. PER MA0104-301, CODE-BL-08-NG-16
NOTES: UNLESS OTHERWISE SPECIFIED

REVISIONS

ZONE	LTR	DESCRIPTION	DATE	APPROVED

ORIGINAL PAGE IS
OF POOR QUALITY

2 FOLDOUT FRAME

-002 INSULATOR
1 REQD
2 2 MIL. THKK
ADHESIVE MAX.

PAINT LINE
REF.

D416-451004-001
RADIATOR PANEL
1 REQD

-001 SHOWN

QTY REQD	QTY REQD	QTY REQD	QTY REQD	QTY REQD	QTY REQD	CODE IDENT	PART OR IDENTIFYING NUMBER	NOMENCLATURE OR DESCRIPTION	MATERIAL	DATA, SPECIFICATIONS SIZES, NOTES, SUPPLIERS	ZONE
					1	-001	D416-451004	RADIATOR PANEL ASSY			
					1	-002	D416-451003	INSULATOR	TEDLAR FILM	.001 x 4.75 x 9.38 PER MEP RQMTS	
				4	-001		D416-451003	RAD/SOLAR PANEL ASSY			

PARTS LIST

ITEM	QTY	NEXT ASSY	USED ON	END ITEM NO	THRU
-001	1	SPARE			
-001	1	D416-451002	LCRSA TEST		
-001	2	D416-451001	LCRSA TEST		

REQD PER END ITEM | APPLICATION | EFFECTIVITY

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON DECIMALS XX= ± 03 XXX= ± 010 ANGLES ± 0° 30'
HOLES NOTED "DRILL"

.013	THRU	.040	+ .001 − .001
.041	THRU	.130	+ .002 − .001
.131	THRU	.229	+ .003 − .001
.230	THRU	.500	+ .004 − .001
.501	THRU	.750	+ .005 − .001
.751	THRU	1.000	+ .007 − .001
1.001	THRU	2.000	+ .010 − .001

DR BY M BISS 5/14/82
CHK BY
APPROVED BY
ELECTRICAL

Rockwell International

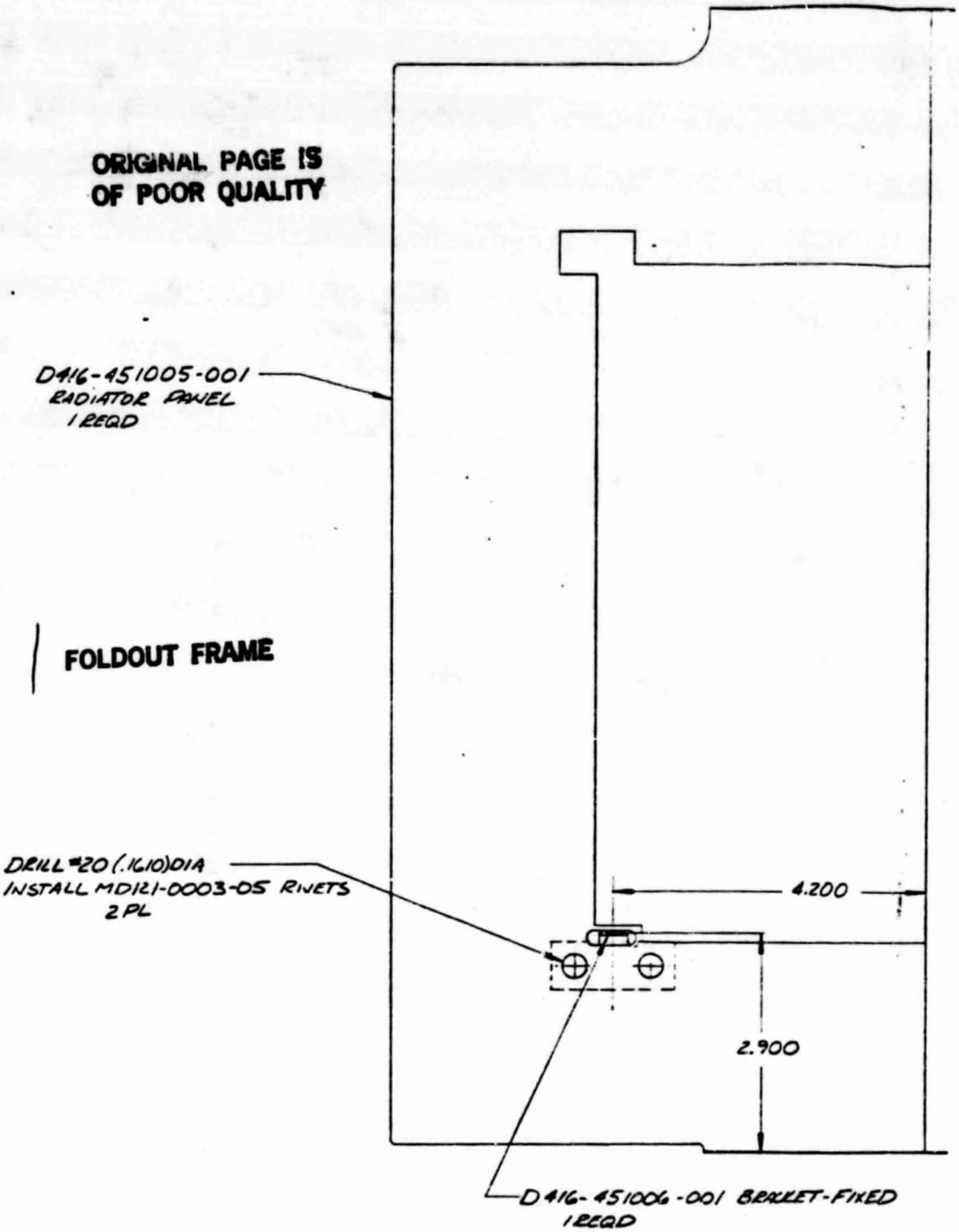
RADIATOR/SOLAR PANEL
SUBSTRATE
LCRSA TEST

SIZE	CODE IDENT NO	DRAWING NO.
D	03953	D416-451003

SCALE 1/1 SHEET 1/1

D416-451003

2-17, 2-18



-001 S

Notes: Unless Otherwise Specified
1. Contamination Control Per MF0001-001
2. Mark Part No Per MA0104-301, Code BL-08-NG-16
3. Install Rivets Per MA0101-302,
Finish Per MF0004-001 Item I-9

-001	4	D4
ITEM	QTY	
REQD PER END ITEM		

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED

FOLDOUT FRAME

ORIGINAL PAGE IS
OF POOR QUALITY

QTY REQD	QTY REQD	QTY REQD	QTY REQD	QTY REQD	QTY REQD	CODE IDENT	PART OR IDEN NUMBER	NOMENCLATURE OR DESCRIPTION	MATERIAL	DATA, SPECIFICATIONS SIZES, NOTES, SUPPLIES	ZONE
					1	-001	D416-451005	RADIATOR PANEL			
					2		MDRI-0003-05	RIVET	2219 AL	RIVET-UNIVERSAL HEAD 2219-T62 AL ALLOY	
					1	-001	D416-451006	BRACKET FIELD			
				4	-001		D416-451004	PANEL ASSY			

PARTS LIST

-001 SHOWN

ITEM	QTY	NEXT ASSY	USED ON	END ITEM NO	THRU
-001	4	D416-451003	LCRSA TEST		
REQD PER END ITEM		APPLICATION		EFFECTIVITY	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS: XX = ± .03, XXX = ± .010
ANGLES: ± 0° 30'
HOLES NOTED "DRILL"

.013	THRU	.040 + .001 − .001	
.041	THRU	.130 + .002 − .001	
.131	THRU	.229 + .003 − .001	
.230	THRU	.500 + .004 − .001	
.501	THRU	.750 + .005 − .001	
.751	THRU	1.000 + .007 − .001	
1.001	THRU	2.000 + .010 − .001	

DR BY M BISS 5/20/8_
CHK BY
APPROVED BY

Rockwell International

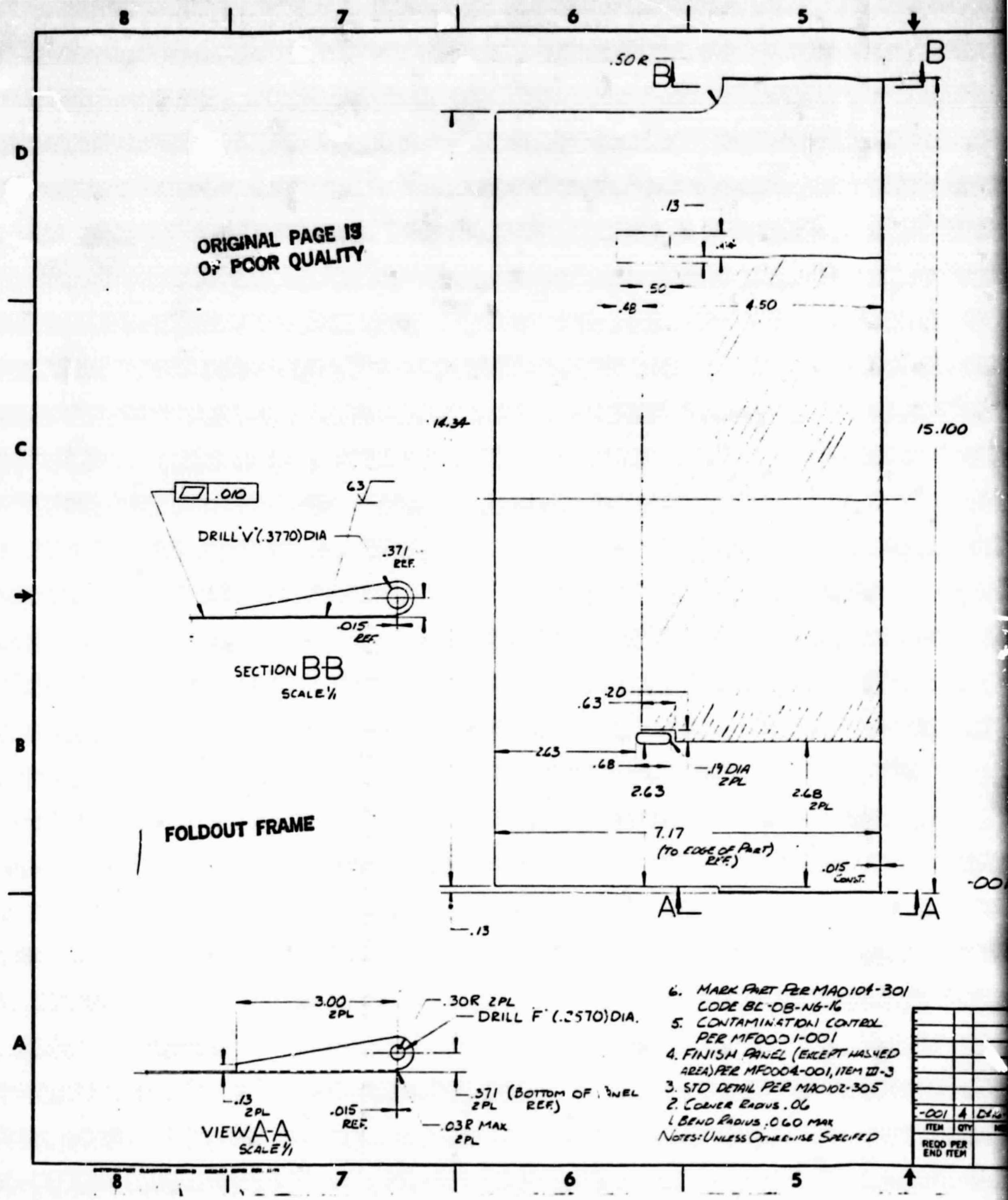
RADIATOR PANEL ASSEMBLY LCRSA-TEST

SIZE	CODE IDENT NO	DRAWING NO.
D	03953	D416-451004

SCALE 1/1 SHEET 1/1

D416-451004

2-19, 2-20



6. MARK PART PER MA0104-301 CODE BC-08-N6-16
5. CONTAMINATION CONTROL PER MF0001-001
4. FINISH PANEL (EXCEPT HASHED AREA) PER MF0004-001, ITEM III-3
3. STD DETAIL PER MA0102-305
2. CORNER RADIUS .06
1. BEND RADIUS .060 MAX

NOTES: UNLESS OTHERWISE SPECIFIED

ITEM	QTY	DASH NO.
-001	4	

REQD PER END ITEM

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED

2

FOLDOUT FRAME

15.100

-001 SHOWN

QTY REQD	QTY REQD	QTY REQD	QTY REQD	QTY REQD	QTY REQD	CODE IDENT	PART OR IDENTIFYING NUMBER	NOMENCLATURE OR DESCRIPTION	MATERIAL	DATA, SPECIFICATIONS SIZES, NOTES, SUPPLIERS	ZONE
					4	-001	D416-451005	RADIATOR PANEL	AL SHT	LOC-76 AL SHT QQ-A-250/11 .040 x 7.75 x 16.75	

PARTS LIST

ITEM	QTY	NEXT ASSY	USED ON	END ITEM NO	THRU
-001	4	D416-451004	LCRSA		
REQD PER END ITEM		APPLICATION		EFFECTIVITY	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS: XX = ± .03; XXX = ± .010
ANGLES = 0° 30'
HOLES NOTED "DRILL"

.013	THRU	.040 ± .001
.041	THRU	.130 ± .002
.131	THRU	.229 ± .003
.231	THRU	.500 ± .004
.501	THRU	.750 ± .005
.751	THRU 1.000	± .007
1.001	THRU 2.000	± .010

DR BY M. BASS 5/7/82
CK BY
APPROVED BY
5-17-82

Rockwell International

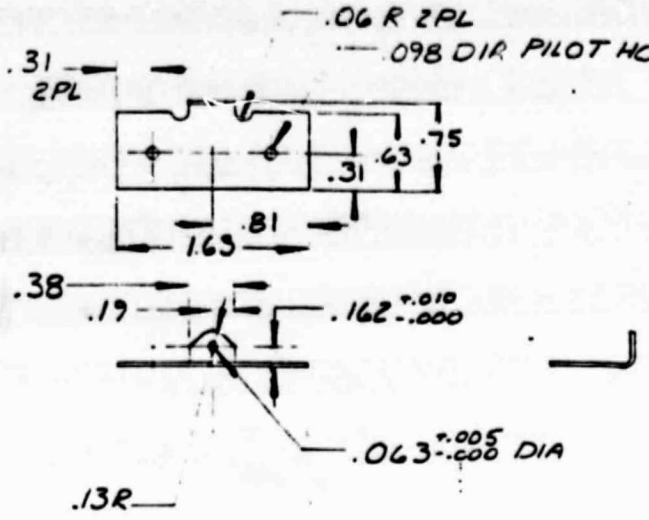
RADIATOR PANEL
LCRSA TEST

SIZE	CODE IDENT NO	DRAWING NO
D	03953	D416-451005

SCALE 1/1 SHEET 1/1

D416-451005

2-21, 2-22



-001 SHOWN

7. FINISH PER MF0004-001, ITEM I-1
6. MARK PART NO. PER MA0104-301 CODE BL-08-NG-16
5. CONTAMINATION CONTROL PER MF0001-001
4. INSPECT PER MT0501-508 CLASS 2
3. STD DETAIL PER MA0102-305
2. BREAK SHARP CORNERS & EDGES
1. BEND RADIUS .060 MAX

NOTES: UNLESS OTHERWISE SPECIFIED

QTY REQD	QTY REQD	QTY REQD	QTY REQD	QTY REQD	QTY REQD	CODE IDENT	PART O IDENTIFYING N
					4	-001	D416-451

FOLDOUT FRAME

ITEM	QTY	NEXT ASSY	USED ON	END ITEM NO.	THRU
-001	4	D416-451004	LCESA EST		

REQD PER END ITEM | APPLICATION | EFFECTIVITY

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES.
TOLERANCES ON:

DECIMALS	ANGLES
XX= ± .03	± 0° 30'
XXX= ± .010	

HOLES NOTED "DRILL"

.013	THRU	.040	+.001 −.001
.041	THRU	.130	+.002 −.001
.131	THRU	.229	+.003 −.001
.230	THRU	.500	+.004 −.001
.501	THRU	.750	+.005 −.001
.751	THRU	1.000	+.007 −.001
1.001	THRU	2.000	+.010 −.001

FORM M130-N-2 REV. 6-66 DIETERICH-POST CLEARPRINT 3000H-30

2 1

HOLE

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED

D

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C

N

QTY REQD	QTY REQD	QTY REQD	QTY REQD	QTY REQD	CODE IDENT	PART OR IDENTIFYING NUMBER	NOMENCLATURE OR DESCRIPTION	MATERIAL	DATA: SPECIFICATIONS SIZES, NOTES, SUPPLIERS	ZONE
				4	-001	D416-451006	BRACKET	AL-SHT	6061-T6 AL QQ-A-250/11 .032 x 1.12 x 1.75	

D416-451006

B

PARTS LIST

A

END ITEM NO.	THRU
EFFECTIVITY	

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES.
TOLERANCES ON:

DECIMALS	ANGLES
XX = ± .03	± 0° 30'
XXX = ± .010	

HOLES NOTED "DRILL"

.013	THRU	.040	+.001 −.001
.041	THRU	.130	+.002 −.001
.131	THRU	.229	+.003 −.001
.230	THRU	.500	+.004 −.001
.501	THRU	.750	+.005 −.001
.751	THRU	1.000	+.007 −.001
1.001	THRU	2.000	+.010 −.001

DR BY	MS BISS	5/19/82
CHK BY		

APPROVED BY

MSE [illegible] 5-20 | [illegible] STATIC
Edward [illegible] 5/19 | MFG. [illegible] 5-20-82

Rockwell International Corporation
Space Division
12214 Lakewood Boulevard • Downey, California 90241

BRACKET-FIXED

LCESA TEST

SIZE	CODE IDENT NO.	DRAWING NO.
C	03953	D416-451006

SCALE 1/1 SHEET 1/1

2-23, 2-24

2 1

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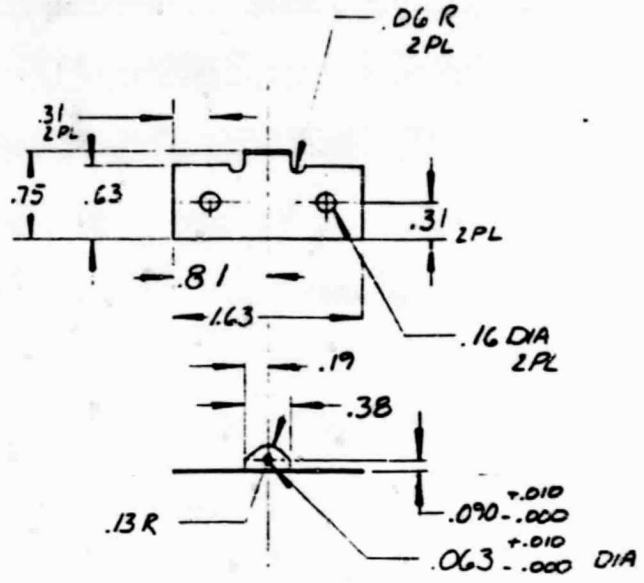


FOLDOUT FRAME

6. FINISH PANEL PER MF0004-001, ITEM III-3
5. MARK PART NO. PER MA0104-301 CODE BL-08-N6-16
4. CONTAMINATION CONTROL PER MF0001-001
3. STD DETAIL PER MA0102-305
2. BREAK SHARP CORNERS & EDGES
1. BEND RADIUS .060 MAX

NOTES: UNLESS OTHERWISE SPECIFIED

QTY REQD	QTY REQD	QTY REQD	QTY REQD	QTY REQD	QTY REQD	CODE IDENT	PART OR IDENTIFYING NU
					4	-001	D416-451

ITEM	QTY	NEXT ASSY	USED ON	END ITEM NO.	THRU
-001	4	D416-45000	LCESA TEST		

REQD PER END ITEM | APPLICATION | EFFECTIVITY

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES.
TOLERANCES ON:

DECIMALS	ANGLES
.XX = ± .03	± 0° 30'
.XXX = ± .010	

HOLES NOTED "DRILL"

.013	THRU	.040	+.001 −.001
.041	THRU	.130	+.002 −.001
.131	THRU	.229	+.003 −.001
.230	THRU	.500	+.004 −.001
.501	THRU	.750	+.005 −.001
.751	THRU	1.000	+.007 −.001
1.001	THRU	2.000	+.010 −.001

FORM [illegible] REV. 6-74 [illegible]

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED

2 FOLDOUT FRAME

QTY REQD	QTY REQD	QTY REQD	QTY REQD	QTY REQD	CODE IDENT	PART OR IDENTIFYING NUMBER	NOMENCLATURE OR DESCRIPTION	MATERIAL	DATA: SPECIFICATIONS SIZES, NOTES, SUPPLIERS	ZONE
				4	-001	D416-451007	BRACKET	AL SHT	6061-T6 AL QQ-A-250/11 .032 x 1.12 x 1.75	B

D416-451007

PARTS LIST

ND ITEM NO.	THRU
EFFECTIVITY	

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES.
TOLERANCES ON:

DECIMALS	ANGLES
XX = ± .03	± 0° 30'
XXX = ± .010	

HOLES NOTED "DRILL"

.013	THRU	.040	+.001 −.001
.041	THRU	.130	+.002 −.001
.131	THRU	.229	+.003 −.001
.230	THRU	.500	+.004 −.001
.501	THRU	.750	+.005 −.001
.751	THRU	1.000	+.007 −.001
1.001	THRU	2.000	+.010 −.001

DR BY	M BISS	6/14/82
CHK BY		
APPROVED BY		

Rockwell International Corporation
Space Division
12214 Lakewood Boulevard • Downey, California 90241

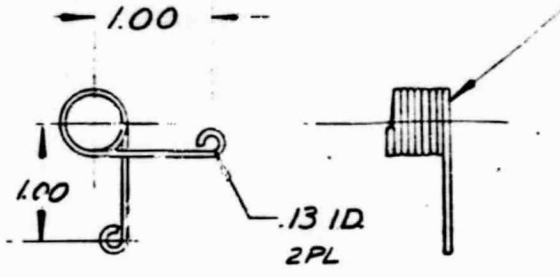
BRACKET - REMOVABLE

LCRSA - TEST

SIZE	CODE IDENT NO.	DRAWING NO.
C	03953	D416-451007

SCALE 1/1 SHEET 1/1

2-25, 2-26



FOLDOUT FRAME

-001 SHOWN

QTY REQD	QTY REQD	QTY REQD	QTY REQD	QTY REQD	QTY REQD	CODE IDENT	PART OR IDENTIFYING NU
					3	-001	D416-45200

6. STD DETAIL PER MA0102-305
5. INSPECT PER MT0501-508 CLASS 2
4. CONTAMINATION CONTROL PER MF0001-001
3. FINISH PER MF0004-001, ITEM I-23
2. IDENTIFY PER MA0104-301
1. FAB TORSION SPRING FROM PART No. T051-270-359-R ASSOCIATED SPRING CATALOG PG. 60, OR EQUIV

NOTES: UNLESS OTHERWISE SPECIFIED

ITEM	QTY	NEXT ASSY	USED ON	END ITEM NO.	THRU
-001	1	SPARE	LCRSA TEST		
-001	2	D416-451000	LCRSA TEST		
REQD PER END ITEM		APPLICATION		EFFECTIVITY	

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES.
TOLERANCES ON:

DECIMALS	ANGLES
XX = ± .03	± 0° 30'
XXX = ± .010	

HOLES NOTED "DRILL"

.013	THRU	.040: +.001 −.001
.041	THRU	.130: +.002 −.001
.131	THRU	.229: +.003 −.001
.230	THRU	.500: +.004 −.001
.501	THRU	.750: +.005 −.001
.751	THRU	1.000: +.007 −.001
1.001	THRU	2.000: +.010 −.001

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED

2 FOLDOUT FRAME

.051 DIA, 2.9 IN-LB TORQUE
x.52 AXIAL LENGTH, RIGHT HAND HELIX

-001 SHOWN

QTY REQD	QTY REQD	QTY REQD	QTY REQD	QTY REQD	CODE IDENT	PART OR IDENTIFYING NUMBER	NOMENCLATURE OR DESCRIPTION	MATERIAL	DATA: SPECIFICATIONS SIZES, NOTES, SUPPLIERS	ZONE
				3	-001	D416-452000	SPRING TORSION	ST. ST.	QQ-W-423 Comp FS 302, AMS 5688	B

PARTS LIST

END ITEM NO.	THRU
EFFECTIVITY	

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES.
TOLERANCES ON:

DECIMALS	ANGLES
.XX = ± .03	± 0° 30'
.XXX = ± .010	

HOLES NOTED "DRILL"

.013	THRU	.040	+.001 −.001
.041	THRU	.130	+.002 −.001
.131	THRU	.229	+.003 −.001
.230	THRU	.500	+.004 −.001
.501	THRU	.750	+.005 −.001
.751	THRU	1.000	+.007 −.001
1.001	THRU	2.000	+.010 −.001

DR BY	M BISS	5/6/82
CHK BY		
APPROVED BY		

Rockwell International Corporation
Space Division
12214 Lakewood Boulevard • Downey, California 90241

TORSION SPRING-
SOLAR PANEL
LCRSA

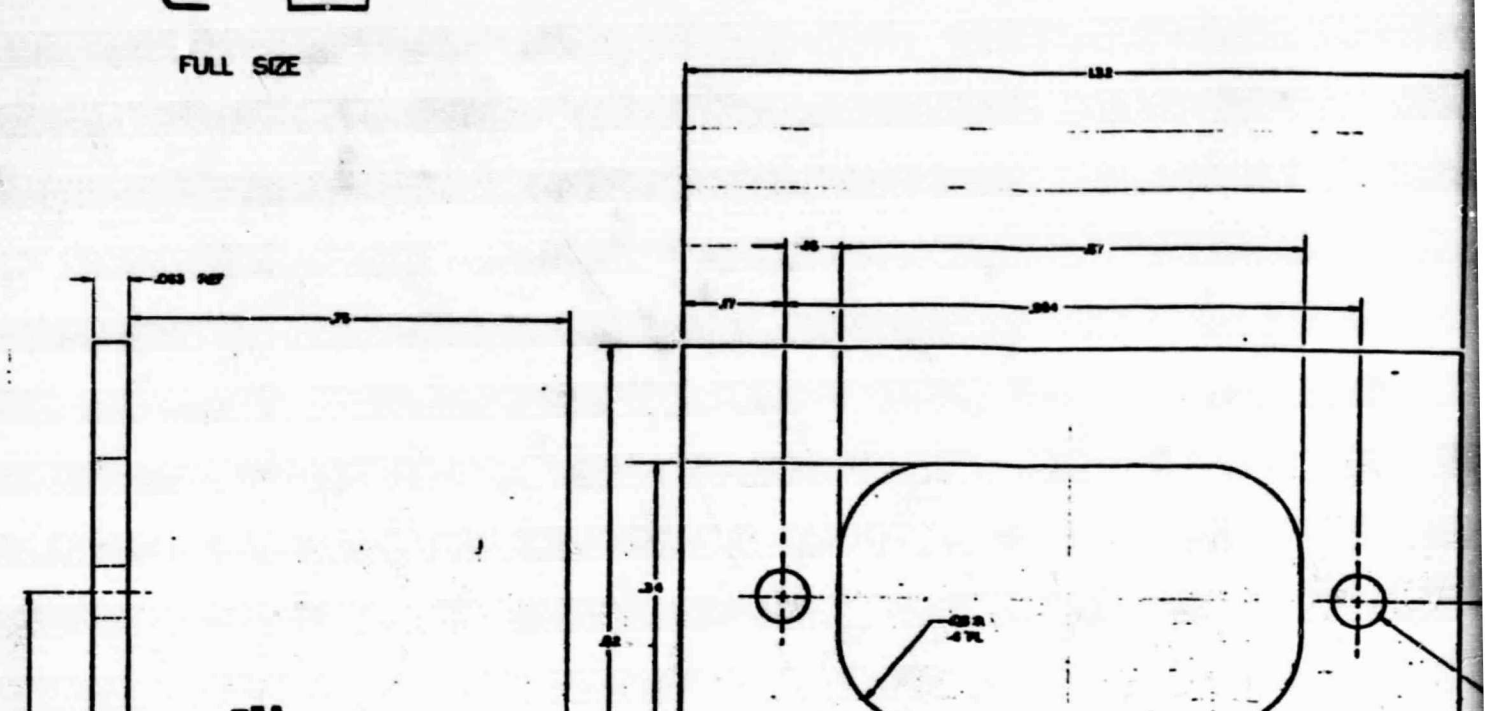
SIZE	CODE IDENT NO.	DRAWING NO.
C	03953	D416-452000

SCALE 1/1 SHEET 1/1

D416-452000

2-27, 2-28

FULL SIZE



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2.

FOLDOUT FRAME

2. FINISH PER MF0004-001, ITEM 3-4
3. MARK PART NO. PER MA0004 301 - CODE 81-09-05-15
4. CONFIGURATION CONTROL PER MF0009-001
5. INSPECT PER MT0501-505 CLASS 2
6. STD DETAIL PER MA0002-305
7. BREAK SHARP CORNERS & EDGES
8. SEND RADIUS .060 MAX

NOTES: UNLESS OTHERWISE SPECIFIED

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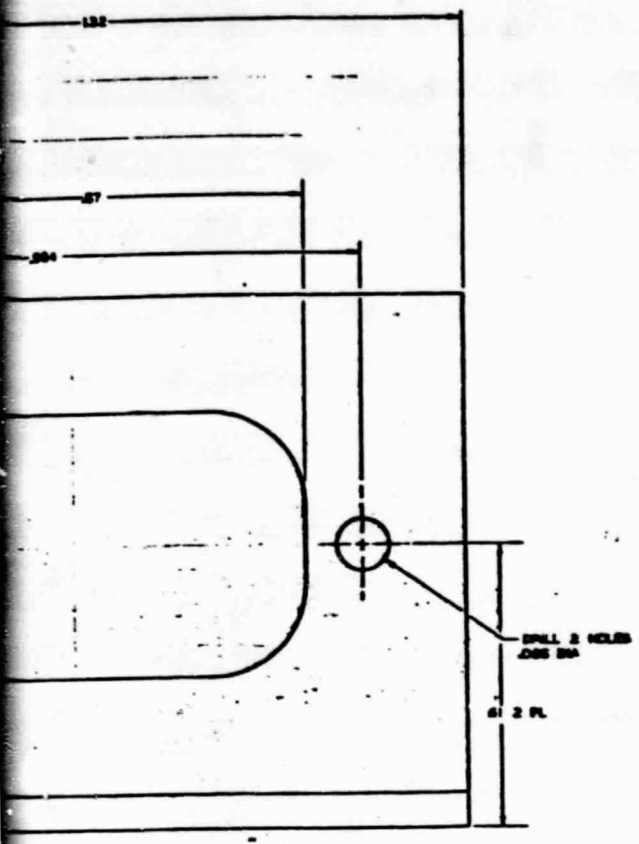

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2-29, 2-30

2-31, 2-32

QTY	QTY	QTY	QTY	QTY	QTY	CODE IDENT	PART OR IDENTIFYING NUMBER	NOMENCLATURE OR DESCRIPTION	MATERIAL	DATA SPECIFICATIONS, DRILL ROUTED, SUPPLIERS
					4	-001	D416-453000	BRACKET	AL SHT	6061-T6 AL QQ-A-250/8 .063 x LBD x LBD

PARTS LIST

-001	4	D416-45 3004			
ITEM	QTY	NEXT ASSY	USED ON	END ITEM NO.	THRU
USED ON END ITEM		APPLICATION		EFFECTIVITY	

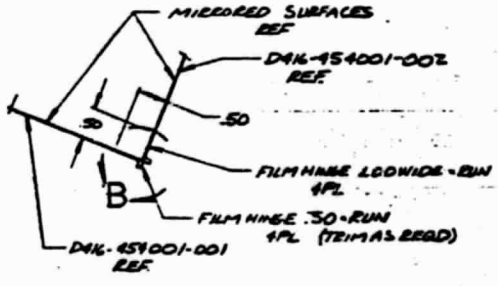
DR BY	JAN CULP	7/6/82
CHK BY		
APPROVED BY		
MATL ENGR APPROVAL		

BRACKET - DISCONNECT SUPPORT LCRSA TEST

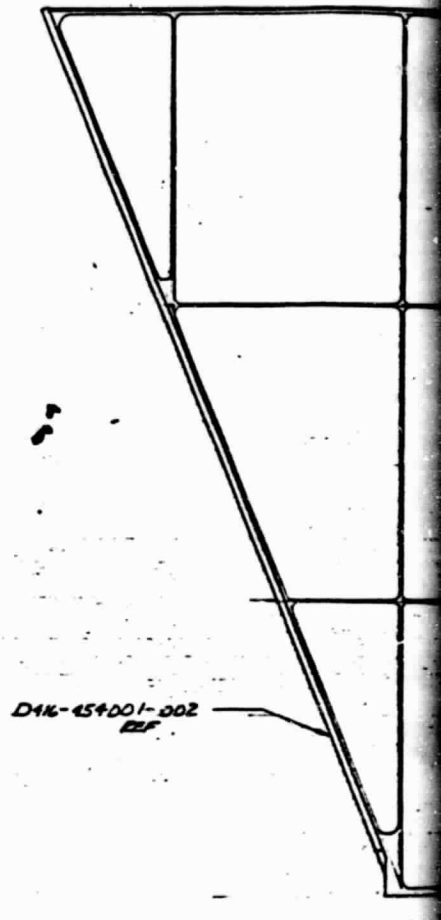
SIZE	CAGE EQUIP NO	DRAWING NO
E	03953	D416-453000

SCALE 1/1 WT

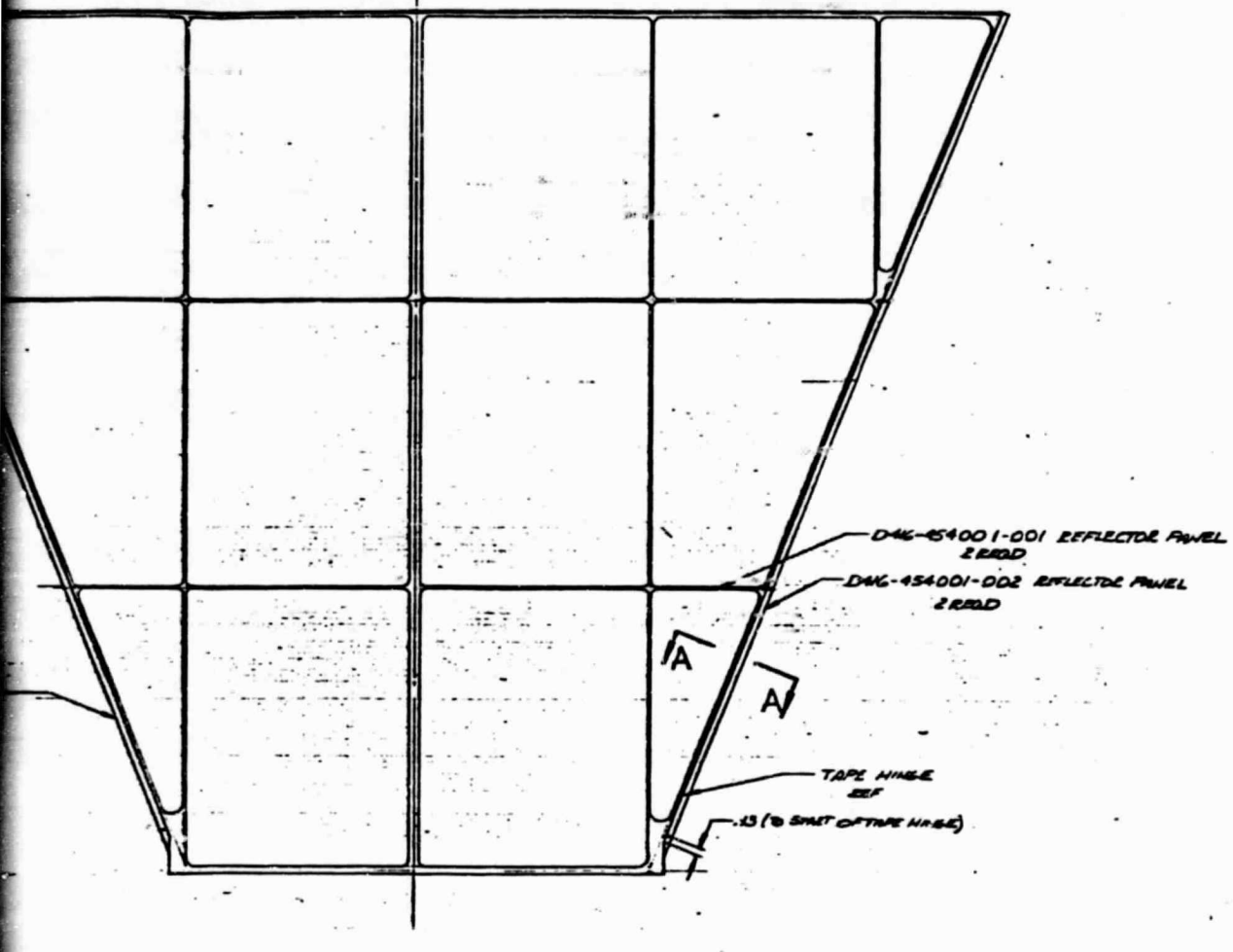
VIEW B
SCALE 3/1
(PANELS OMITTED FOR CLARITY)



SECTION A A
SCALE 3/1
(TYPICAL ALL 4 CORNERS)



FOLDOUT FRAME



2 FOLDOUT FRAME

5. HANDLE KAPTON TAPE PER MFOOO4-001 TABLE III-B
4. CONTAMINATION CONTROL PER MFOOO1-001
3. PEEL BACK MYLAR COVER PRIOR TO TAPING
2. APPLY TAPE HINGE PER ENGINEERING INSTRUCTION
1. MARK PART NO. PER MA0104-301, CODE BL-08-NG-16
NOTES: UNLESS OTHERWISE SPECIFIED

9 8 7 6 5 4 4

QTY REQD	QTY REQD	QTY REQD	QTY REQD	QTY REQD	QTY REQD	CODE IDENT	PART OR IDENTIFYING NUMBER	NOMENCLATURE OR DESCRIPTION	MATERIAL	DATA SPECIFICATIONS SIZES, NOTES, SUPPLIERS	ZONE
					2	-002	D416-454001	TAPE REFLECTOR PANEL	ALUMINIZED KAPTON	MBD175-067, TYPE I 1/4 in, Tape 1.00 in OD	
					2	-001	D416-454001	REFLECTOR PANEL			
					1	-001	D416-454000				

PARTS LIST

2-33, 2-34

-001 SHOWN

TAPE PER MF0004-001 TABLE III-B
CONTROL PER MF0001-001
COVER PER TAPING
PER ENGINEERING INSPECTION
PER MA0104-301, CODE BL-08-NG-16
SPECIFIED

-CC1	1	D416-45200[illegible]	-01[illegible]			
ITEM	QTY	NEXT ASSY	USED ON	END ITEM NO.	THRU	

RECEIP PER END ITEM | APPLICATION | EFFECTIVITY

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS ANGLES
.XX ± .02 ± 0° 30'
.XXX ± .010
HOLES NOTED "DRILL"
.000 THRU .250 + .001 - .000
.251 THRU .500 + .002 - .000
.501 THRU .750 + .003 - .000
.751 THRU 1.000 + .004 - .000
1.001 THRU 1.500 + .005 - .000
1.501 THRU 2.000 + .006 - .000
2.001 THRU 2.500 + .007 - .000

DR BY M Bass 4/30/82
DATE
ENGINEER
APPROVED
DATE

National Semiconductor

RIGID REFLECTOR PANEL ASSY
LCRSAT-TEST

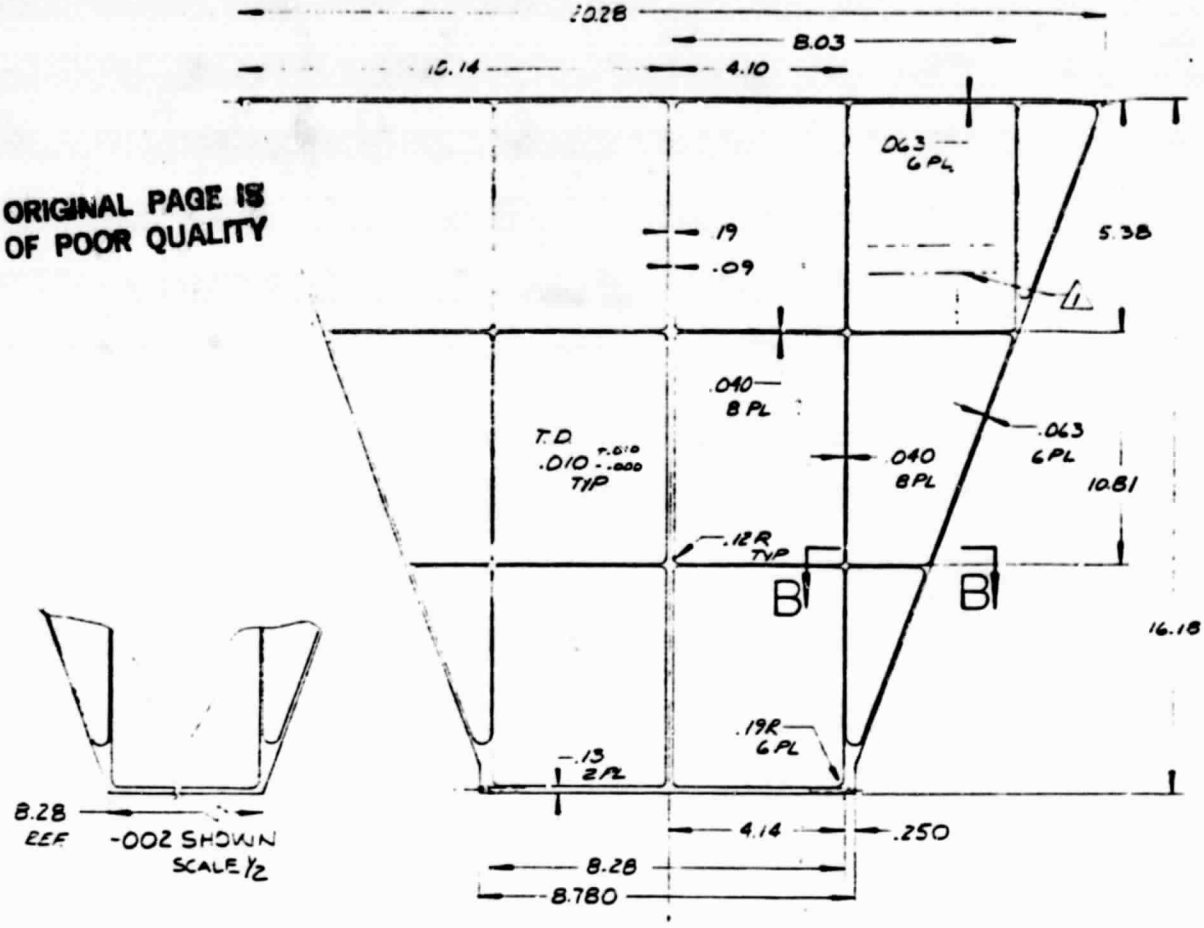
SIZE J | CAGE SHEET NO. 03953 | DRAWING NO. D416-454000
SCALE | SHEET

5	4	4	3	2	1

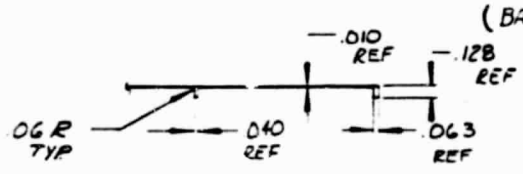
3

FOLDOUT FRAME

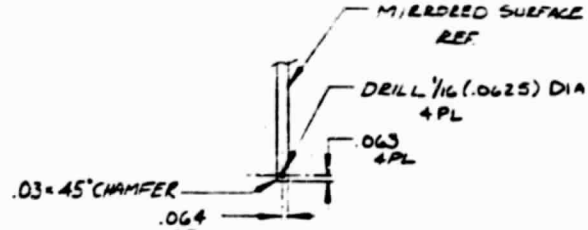
FOLDOUT FRAME



(BACKSIDE OF PANEL SHOWN)



SECTION BB
SCALE 1/1



VIEW A
SCALE 1/1

5 ALUMINIZE BACKSIDE TO AN EMISSIVITY OF ≤.15 PER M&P REQMTS

4 ALUMINIZE SURFACE TO 500 Å THICKNESS, SPECULAR REFLECTIVITY OF ≥.90, AND EMISSIVITY OF .05, PER M&P REQMTS

3 T.D. DENOTES THICKNESS DIMENSION

2. CONTAMINATION CONTROL PER MF0001-001, COVER MIRROR WITH LABEL CRAFT LPCM 320 BLUE, OR EQU

1 MARK PART NO PER MA0104-301 CODE BL-08-NG-16

NOTES: UNLESS OTHERWISE SPECIFIED

-002	2	D
-001	1	
-001	2	D
ITEM	QTY	
REQD PER END ITEM		

REVISIONS				
ZONE	NO.	DESCRIPTION	DATE	APPROVED

ORIGINAL PAGE IS
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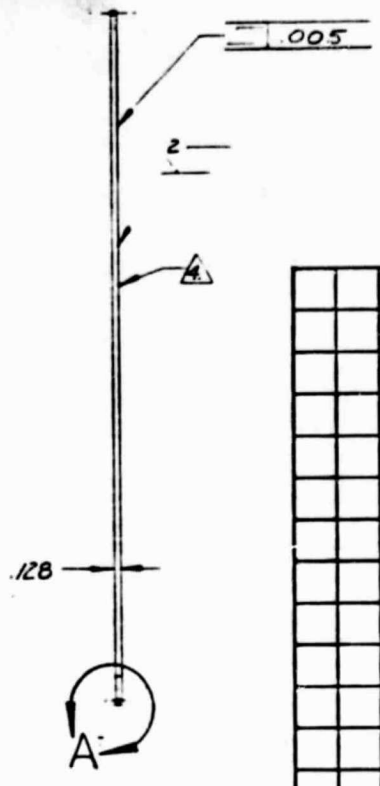
2 FOLDOUT FRAME



QTY REQD	QTY REQD	QTY REQD	QTY REQD	QTY REQD	QTY REQD	CODE IDENT	PART OR IDENTIFYING NUMBER	NOMENCLATURE OR DESCRIPTION	MATERIAL	DATA, SPECIFICATIONS SIZES, NOTES, SUPPLIERS	ZONE
					2	-002	D416-454001	REFLECTOR PANEL	POLYSULFONE/ GRAPHITE	MIXTURE PER MRP RQMTS	
					3	-001	D416-454001	REFLECTOR PANEL	POLYSULFONE/ GRAPHITE	MIXTURE PER MRP RQMTS	

PARTS LIST

D416-454001

O SURFACE

.0625) DIA = 1.0 DEEP MIN

-001 SHOWN
-002 SAME, EXCEPT AS NOTED

ITEM	QTY	NEXT ASSY	USED ON	END ITEM NO.	THRU
-002	2	D416-454000	LCRSA TEST		
-001	1	SPARE	1		
-001	2	D416-454000	LCRSA TEST		
REQD PER END ITEM		APPLICATION		EFFECTIVITY	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS: .XX = ± .03; .XXX = ± .010
ANGLES: ± 0° 30'
HOLES NOTED "DRILL"

.013 THRU	.040	+.001 −.001
.041 THRU	.130	+.002 −.001
.131 THRU	.229	+.003 −.001
.230 THRU	.500	+.004 −.001
.501 THRU	.750	+.005 −.001
.751 THRU	1.000	+.007 −.001
1.001 THRU	2.000	+.010 −.001

DR BY M.S. BISS 5/18/92
CHK BY
APPROVED BY

Rockwell International

REFLECTOR PANEL
RIGID/INTEGRAL FRAME
LCRSA-TEST

SIZE	CODE IDENT NO	DRAWING NO.
D	03953	D416-454001

SCALE ½ ENLRGD SHEET 1/1

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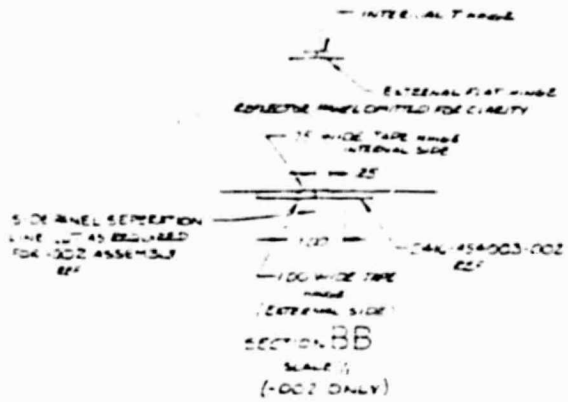
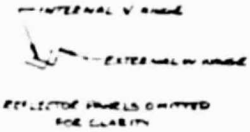


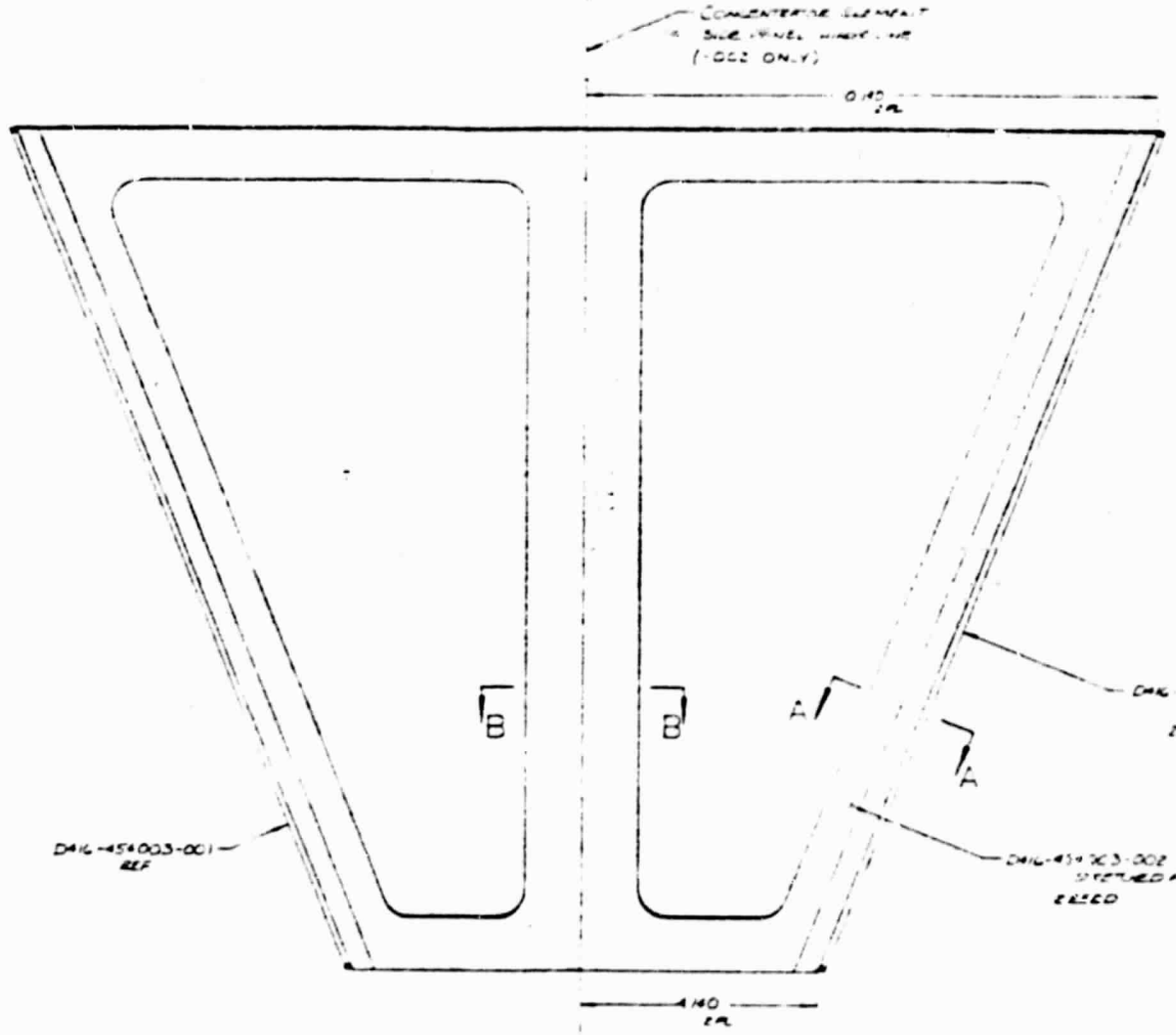
SECTION BB
SCALE 1/1
(-002 ONLY)



SECTION AA
SCALE 1/1
(SECTION TYP (AL ALL 4 CORNERS)

FOLDOUT FRAME

2 FOLDOUT FRAME



ORIGINAL PAGE IS
OF POOR QUALITY

3 FOLDOUT FRAME

ORIGINAL PAGE IS
OF POOR QUALITY

454003-001 REFLECTOR PANEL
STEERABLE 11.4M RIGID FRAME
W/ FEED

REFLECTOR PANEL
11.4M RIGID FRAME

2-37, 2-38

-002 SIMILAR IMAGE
FROM GD AFTER
FINAL TESTS)
-001 SHOWN

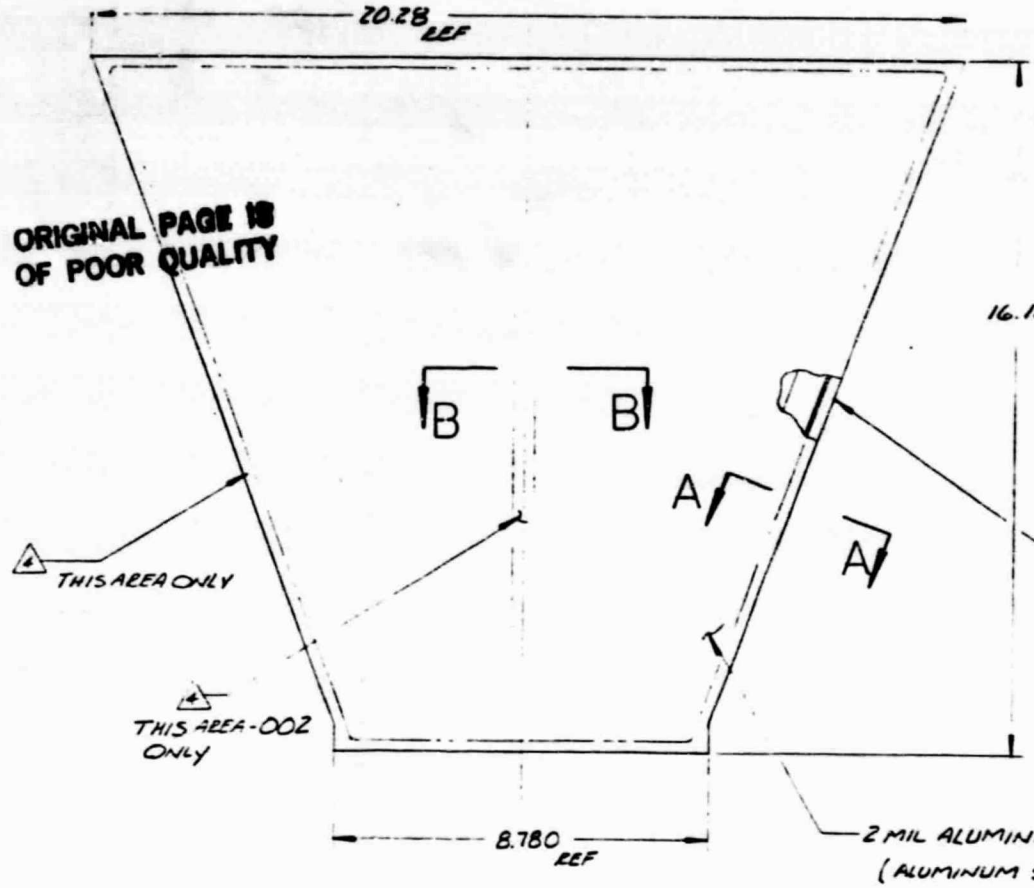
PARTS LIST

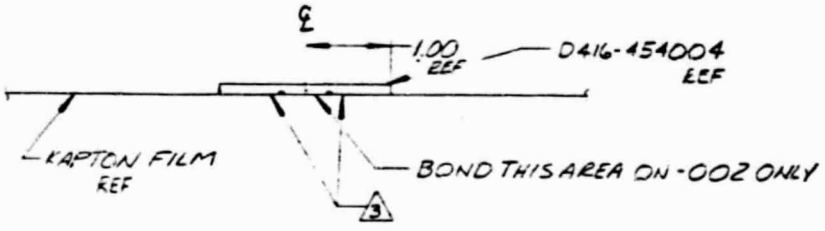
E.M. REFLECTOR
PANEL ASSEMBLY
11.4M

J 10393 | 454002

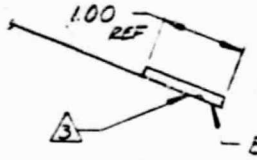
PER MFG004-001 TABLE III-P
OL PER MFG001-001
ACE PROF TO TAPING
ENGINEERING INTENTION
001 CODE B: 08-NOV-16
ELETED

FOLDOUT FRAME





SECTION BB
SCALE 1/1



SECTION AA
SCALE 1/1

-001 SHO
-002 SAM
AS NOTE

4. BOND THIS AREA PER M&P RQMTS 3M JETMELT ADHESIVE 3779
3. DO NOT BOND THIS AREA
2. CONTAMINATION CONTROL PER MF0001-001,
COVER MIRROR WITH LABEL CRAFT LPCM 320 BLUE, OR EQIV.
1. MARK PART NO PER MA0104-301, CODE BL-08-NG-16

NOTES: UNLESS OTHERWISE SPECIFIED

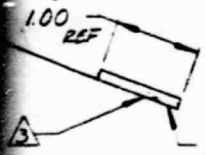
ITEM	QTY	
-001	1	SA
-002	2	D41
001	2	D41
REQD PER END ITEM		

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED

2 FOLDOUT FRAME

D416-454004-001 (SHOWN)
REFLECTOR PANEL

D KAPTON FILM
E SHOWN)



— BOND THIS AREA ONLY, TOP, SIDES, & BOTTOM REF.

CTION AA
SCALE 1/1

-001 SHOWN
-002 SAME (EXCEPT AS NOTED)

QTY REQD	QTY REQD	QTY REQD	QTY REQD	QTY REQD	QTY REQD	CODE IDENT	PART OR IDENTIFYING NUMBER	NOMENCLATURE OR DESCRIPTION	MATERIAL	DATA SPECIFICATIONS SIZES NOTES SUPPLIERS	ZONE
								MYLAR	ALUMINUMIZED KAPTON	MB0125-046 2 MIL	
				1		-002	D416-454004	REFLECTOR PANEL RIGID FRAME			
					1	-001	D416-454004	REFLECTOR PANEL RIGID FRAME			
			2	-002		-	D416-454003				
				3	-001	-	D416-454003				

PARTS LIST

ITEM	QTY	NEXT ASSY	USED ON	END ITEM NO.	THRU
-001	1	SPARE	LCPSA TEST		
-002	2	D416-454002	LCPSA TEST		
001	2	D416-454002	LCPSA TEST		

REQD PER END ITEM — APPLICATION — EFFECTIVITY

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS: XX = ± .03, XXX = ± .010
ANGLES: ± 0° 30'
HOLES NOTED "DRILL"

.013	THRU	.040 + .001 − .001
.041	THRU	.130 + .002 − .001
.131	THRU	.229 + .003 − .001
.230	THRU	.500 + .004 − .001
.501	THRU	.750 + .005 − .001
.751	THRU	1.000 + .007 − .001
1.001	THRU	2.000 + .010 − .001

DR BY: M Biss 4/8/82
CHK BY:
APPROVED BY:

Rockwell International

REFLECTOR PANEL STRETCHED FILM / RIGID FRAME
LCPSA TEST

SIZE	CODE IDENT NO.	DRAWING NO.
D	03953	D416-454003

SCALE 1/8 & NONE | SHEET 1/1

D416-454003

ORIGINAL PAGE IS
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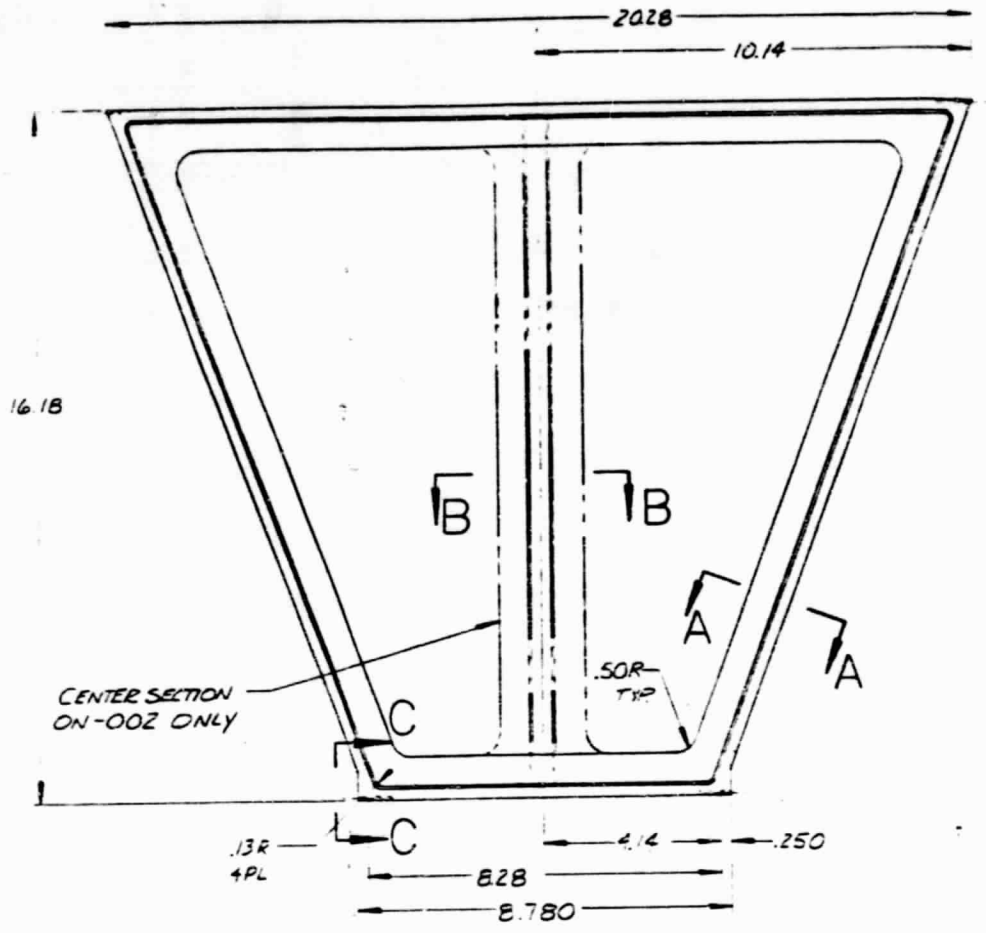
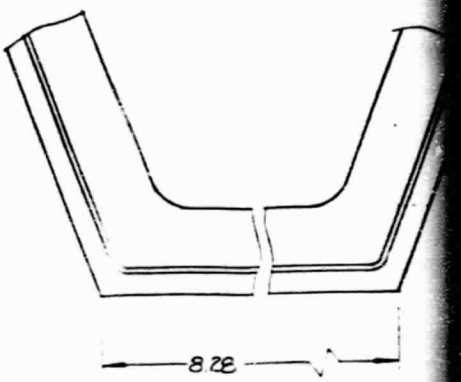
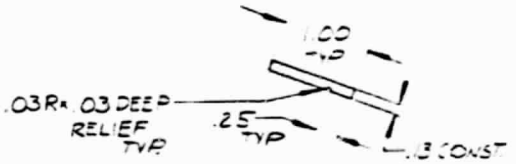
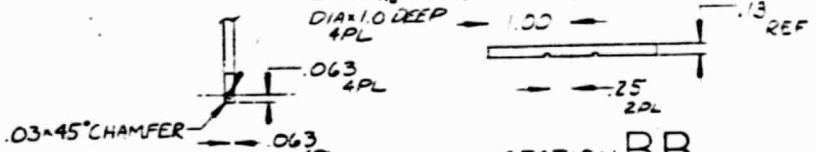




-002 SHOWN
SCALE 1/1



SECTION AA
SCALE 1/1



VIEW CC
SCALE 1/1

SECTION BB
SCALE 1/1
(-002 ONLY REF)

-002 SAME AS NO
-001 SHOWN

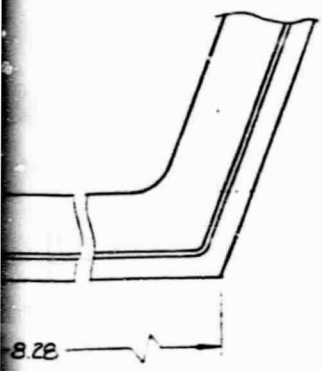
FOLDOUT FRAME

2. CONTAMINATION CONTROL PER MF0001-001
1. MARK PART NO PER MA0104-301, CODE BL-08-NG-16
NOTES: UNLESS OTHERWISE SPECIFIED

ITEM	QTY	REQD PER END ITEM
-002	2	0416
-001	3	0416

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED

FOLDOUT FRAME



002 SHOWN
SCALE 1/1

.3 CONST

A

E 1/1

QTY REQD	QTY REQD	QTY REQD	QTY REQD	QTY REQD	QTY REQD	CODE IDENT	PART OR IDENTIFYING NUMBER	NOMENCLATURE OR DESCRIPTION	MATERIAL	DATA, SPECIFICATIONS SIZES NOTES SUPPLIERS	ZONE
					2	-002	D416-454004	REFLECTOR PANEL	POLYSULFONE/ GRAPHITE	PER MLP RQMTS	
					3	-001	D416-454004	REFLECTOR PANEL	POLYSULFONE/ GRAPHITE	PER MLP RQMTS	

PARTS LIST

-002 SAME (EXCEPT AS NOTED)
-001 SHOWN

ITEM	QTY	NEXT ASSY	USED ON	END ITEM NO	THRU
002	2	D416-454003	LLRSA TEST		
001	3	D416-454003	LLRSA TEST		

REQD PER END ITEM — APPLICATION — EFFECTIVITY

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS: XX = ± 03; XXX = ± 010
ANGLES: ± 0° 30'
HOLES NOTED "DRILL"
013 THRU 040 + 001 − 001
041 THRU 130 + 002 − 001
131 THRU 229 + 003 − 001
230 THRU 500 + 004 − 001
501 THRU 750 + 005 − 001
751 THRU 1 000 + 017 − 001
1 001 THRU 2 000 + 010 − 001

DR BY M. BISS 5/12/82
CHK BY
APPROVED BY

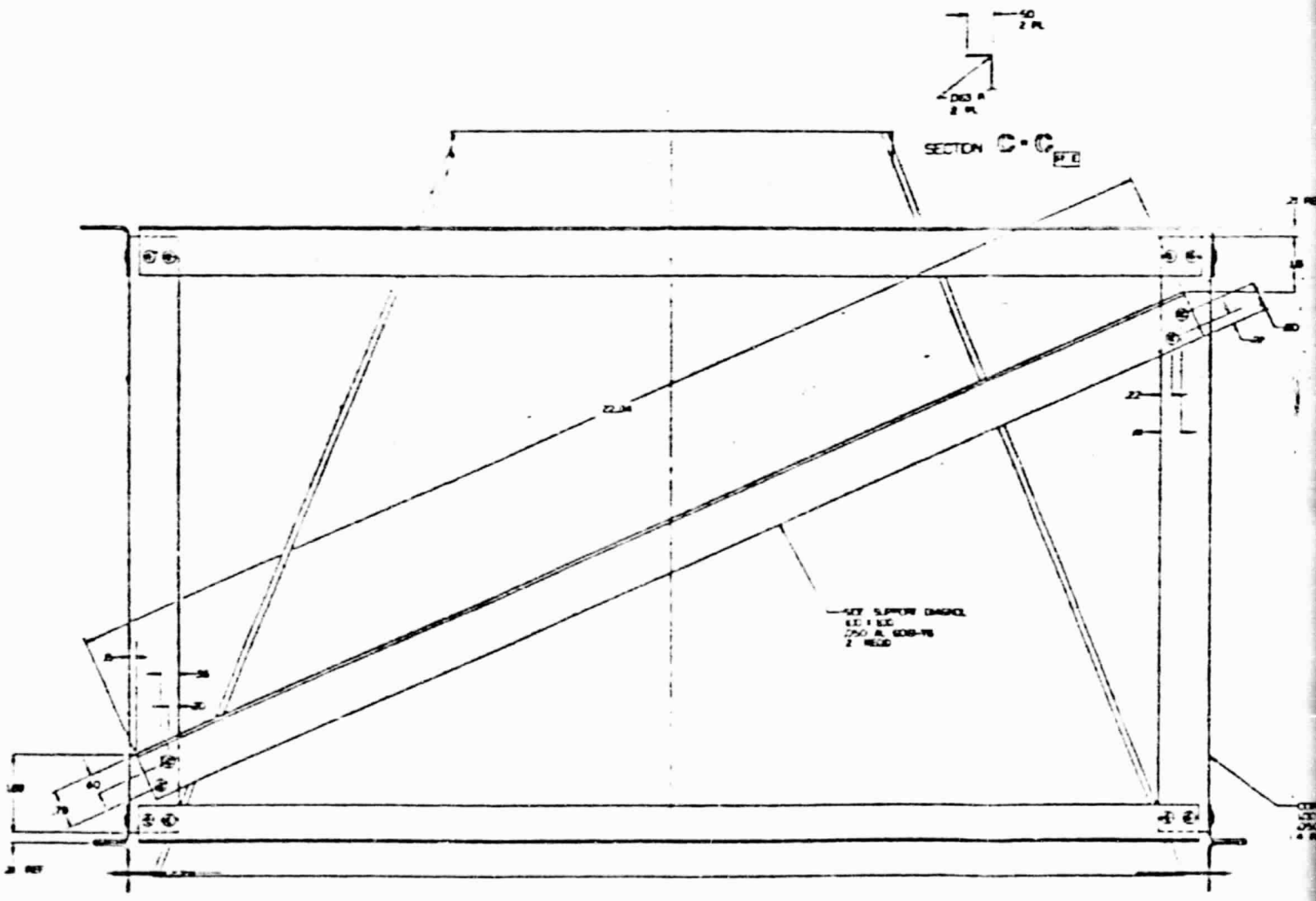
Rockwell International

REFLECTOR PANEL
RIGID FRAME
LLRSA TEST

SIZE	CODE IDENT NO	DRAWING NO
D	03953	D416-454004

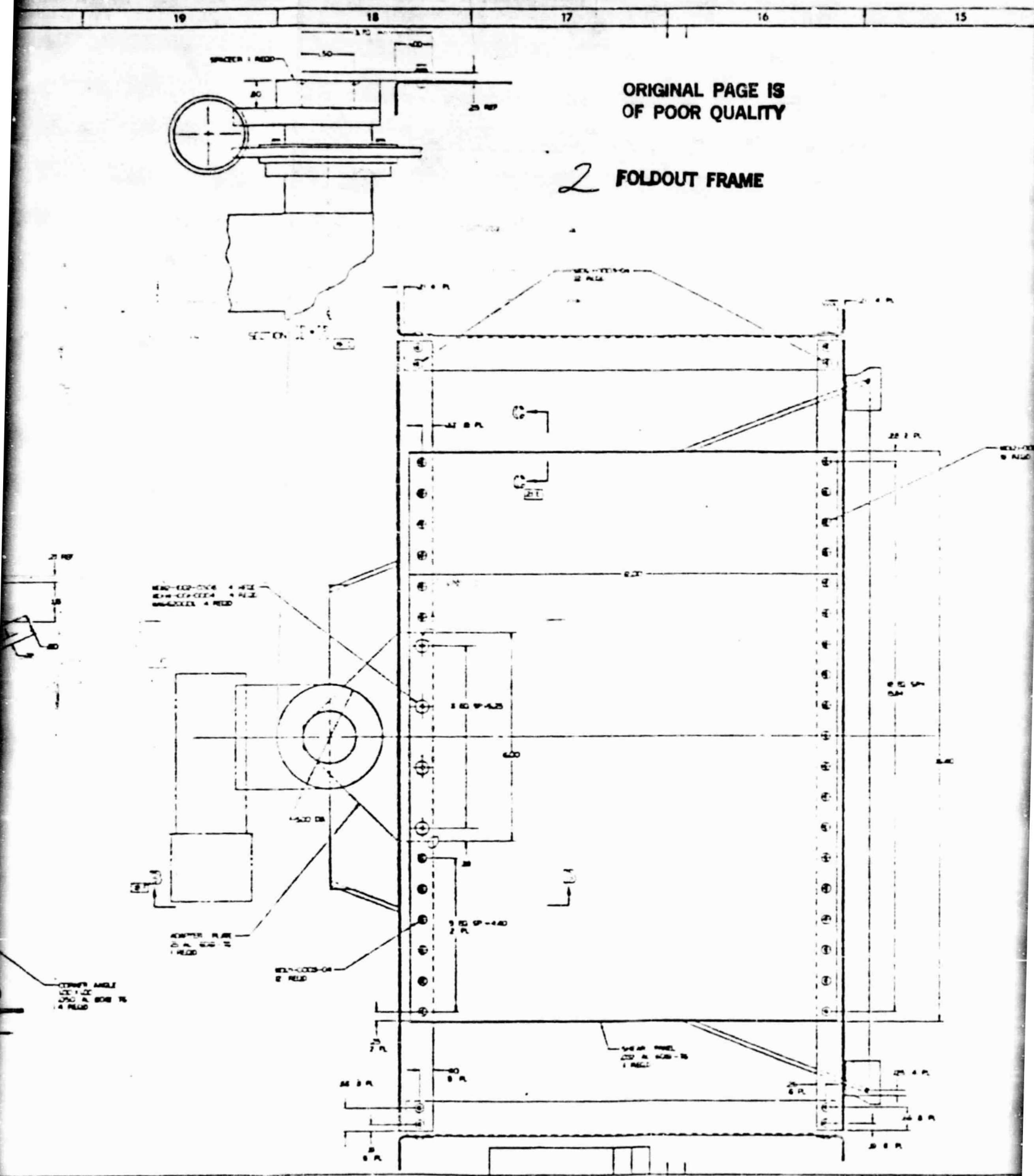
SCALE 1/2 | SHEET 1/1

D416-454004



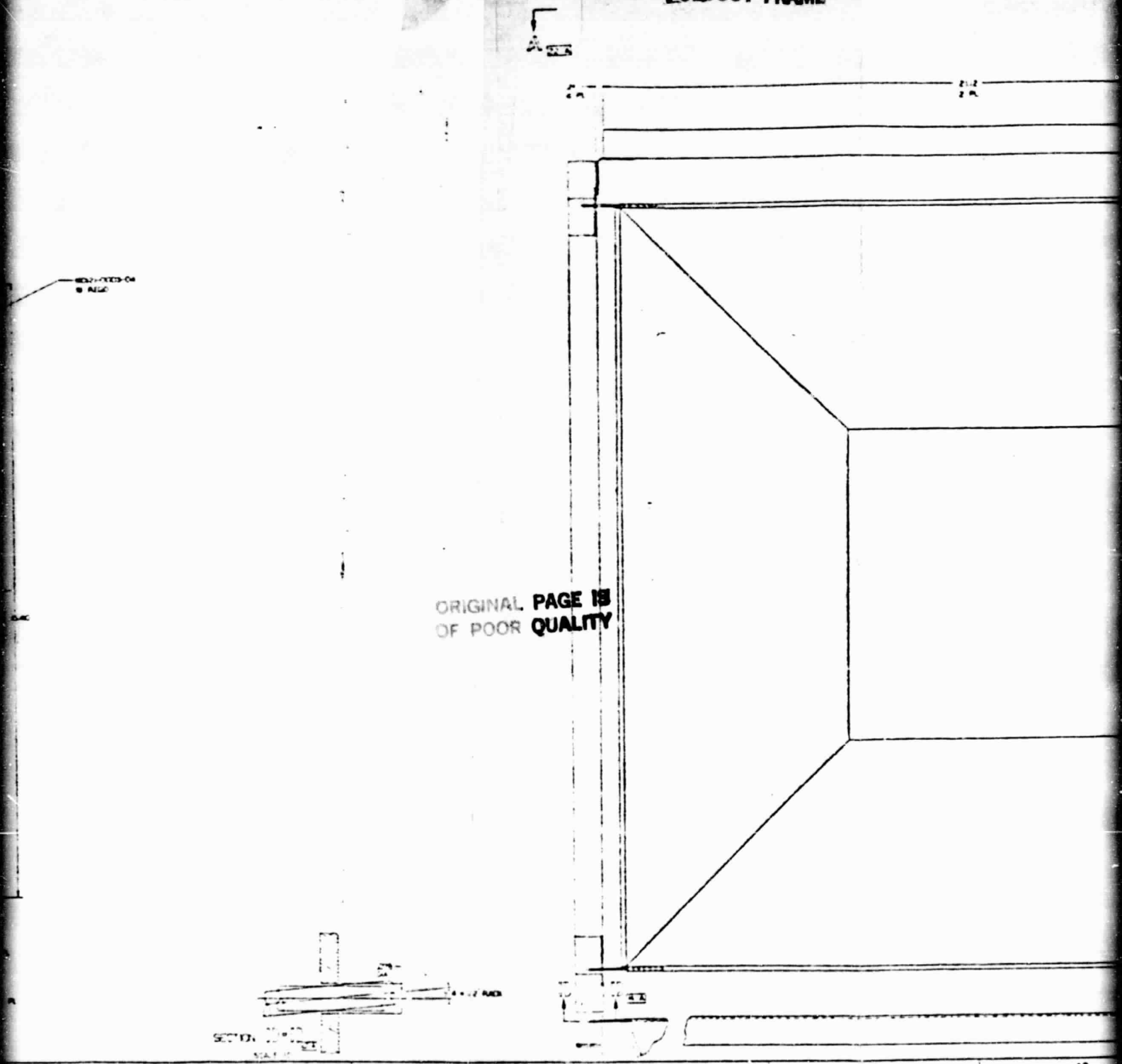
FOLDOUT FRAME

2 FOLDOUT FRAME

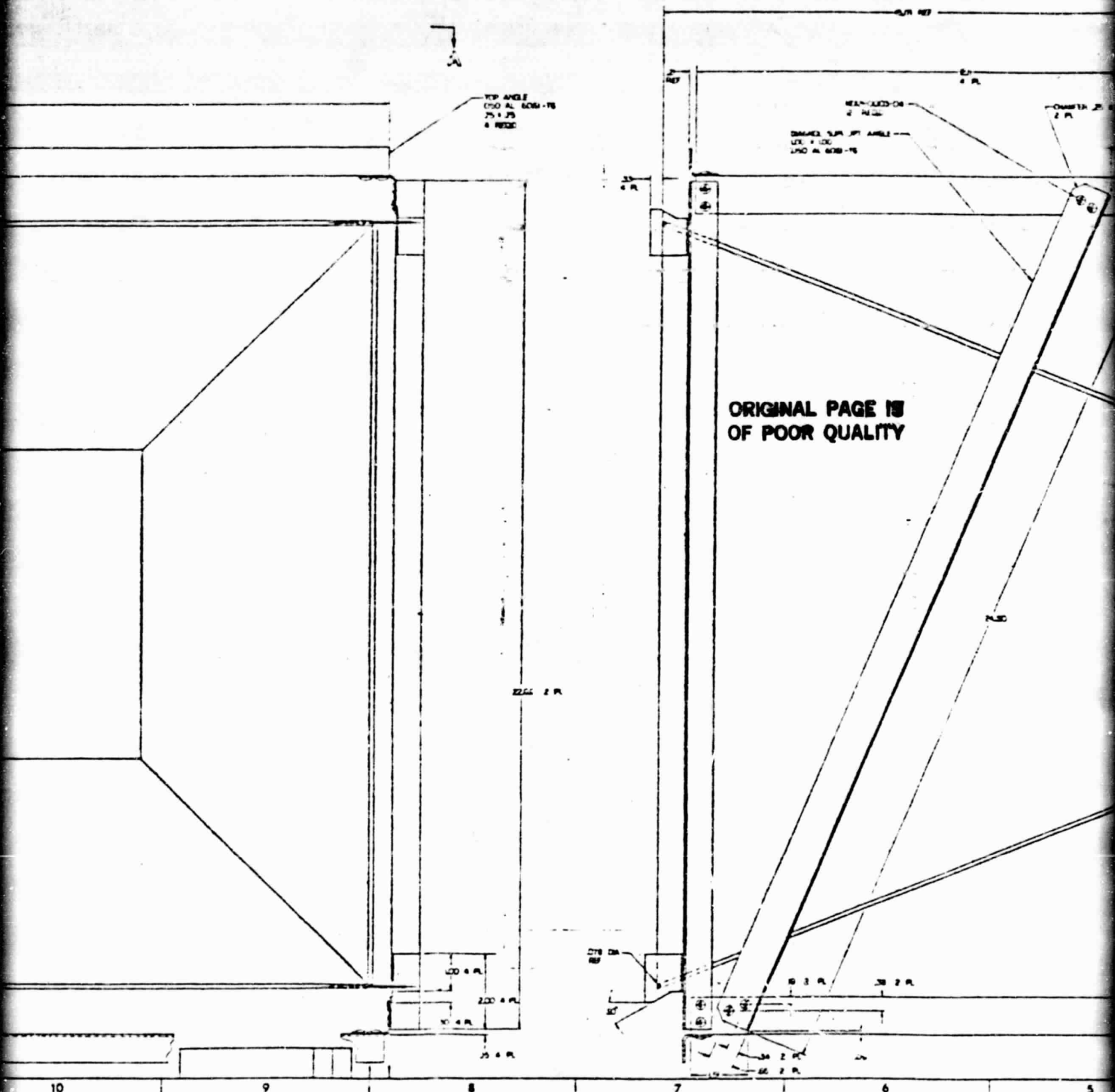


3.

FOLDOUT FRAME



4 FOLDOUT FRAME



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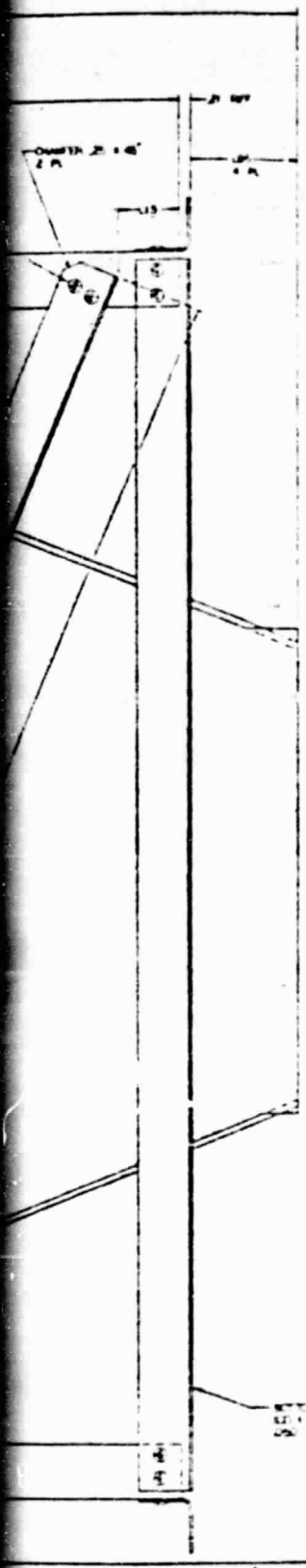
ORIGINAL PAGE IS
OF POOR QUALITY

5 FOLDOUT FRAME



2-43, 2-44

PARTS LIST

CONCENTRATOR-TEST FIXTURE

3.0 PRELIMINARY MANUFACTURING FLOW AND BUILD PLAN

3.1 DISCUSSION

In Section 8.3 of Volume 1 a test plan is described for a ground and flight demonstration array. The following two diagrams show the fabrication sequence for assembling the basic unit of such an array (see Section 4.0 of Volume 1), consisting of one pair of canister-mast assemblies and eight rows of concentrators. The first diagram shows assembly of concentrator rows and solar panels. The second diagram describes construction of the structural elements and their integration with the rows of concentrator elements.

3.2 FLOW AND BUILD DIAGRAMS

1. Assembly of Concentrator Elements
2. Assembly Sequence for Flight Test Configuration

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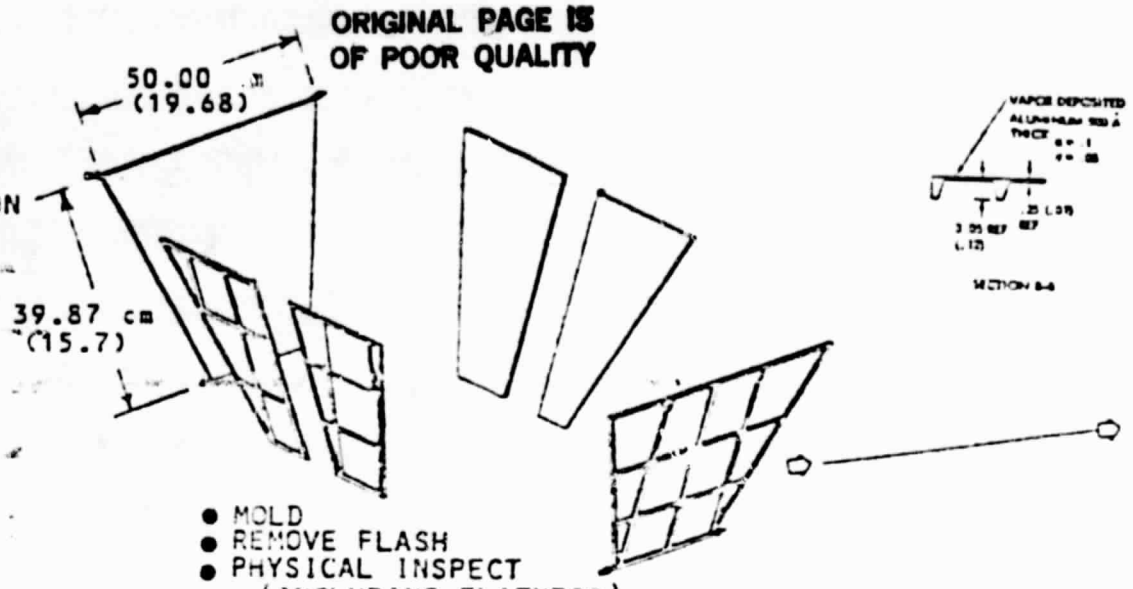
ALTERNATE REFLECTOR PANELS

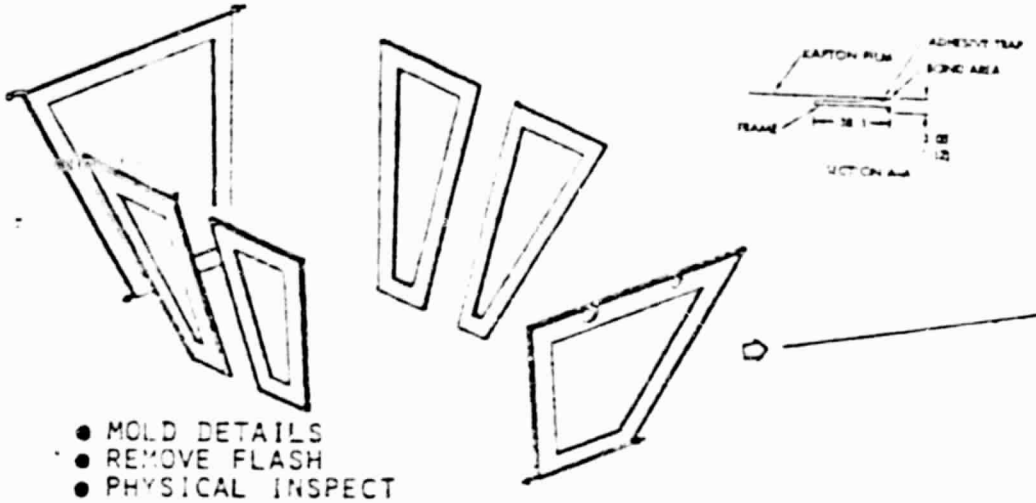
RIGID PANEL - VAPOR DEPOSITED ALUMINUM ON MOLDED POLYSULFONE GRAPHITE



- MOLD
- REMOVE FLASH
- PHYSICAL INSPECT (INCLUDING FLATNESS)

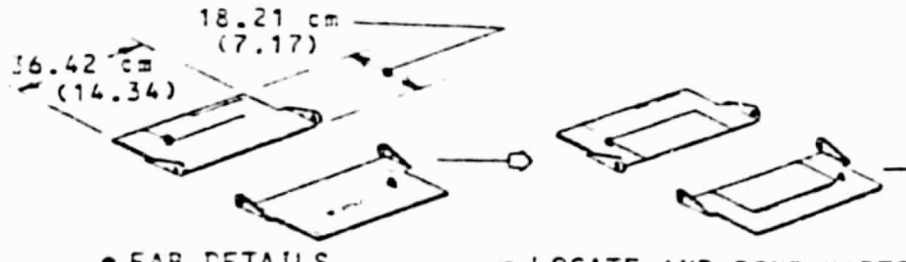
BASELINE REFLECTOR PANELS V416-945401

STRETCHED FILM ON RIGID FRAME



- MOLD DETAILS
- REMOVE FLASH
- PHYSICAL INSPECT

PANEL-RADIATOR V416-945103

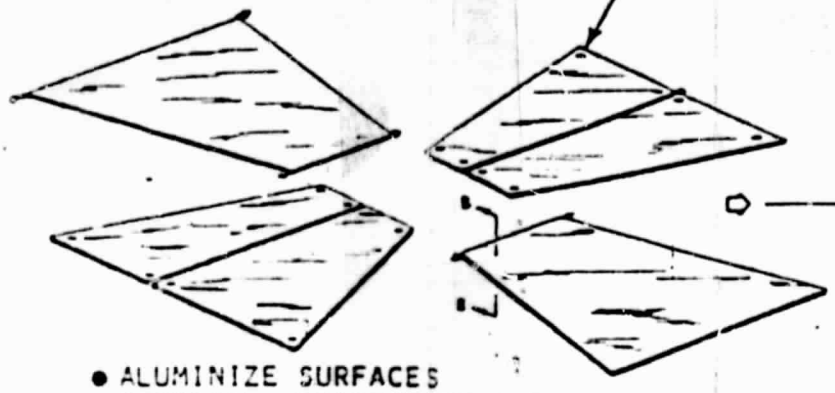


- FAB DETAILS
- MASK AND PAINT PER MF004-001-111-2
- LOCATE AND BOND KAPTON FILM TO PANELS

FOLDOUT FRAME

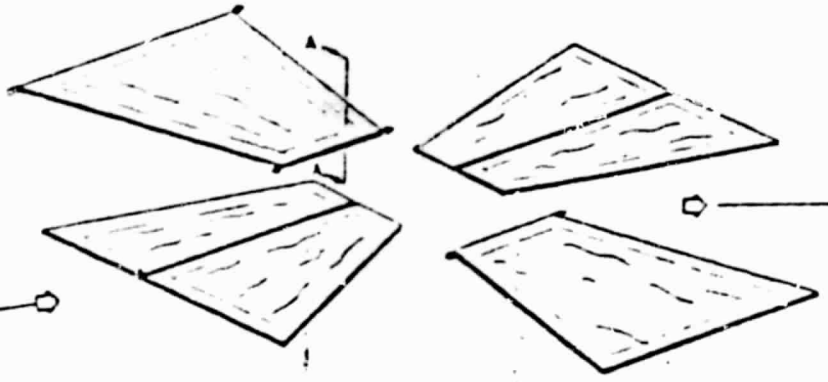
REFLECTOR PANEL ASSEMBL
V416-945400

RESILIENT BUTTONS



- ALUMINIZE SURFACES
- PHYSICAL, EMISSIVITY AND REFLECTIVITY INSPECT
- BOND RESILIENT BUTTONS ON -003 AND -004

OR



- APPLY METALIZED FILM

ASSEMBLY AND TAPING SEQUENCES

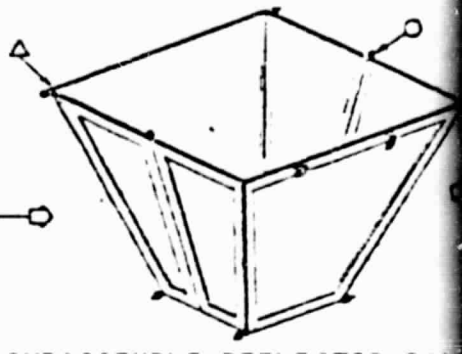
SEQUENCE #1

TAPE #1

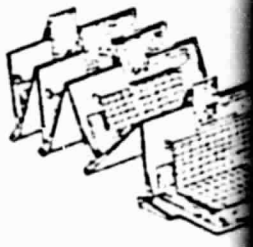
SEQUENCE #2

TAPE

NOTE:
△ TAPE IN SEQUENC
○ REVERSE TAPING
TWO PLACES

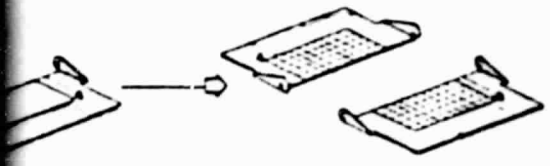


- SUBASSEMBLE REFLECTOR PAN WITH TAPE



PANEL-RADIATOR
V416-945101

SOLAR PANEL ASSEMBLY
V416-945100



ND KAPTON
ANELS

- BOND SOLAR CELLS TO PANELS

- ASSEMBLE PANEL SUBASSEMBLIES WITH SPRINGS, BOLTS, WASHERS AND NUTS

- ASSEMBLE
- INSTALL D

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OF POOR QUALITY

2 FOLDOUT FRAME

EL ASSEMBLY
5400
ICES
2
——TAPE #1 REF.
——TAPE #2
IN SEQUENCE SHOWN, 4 PLCS
RSE TAPING SEQUENCES,
TWO PLACES

CONCENTRATOR TO CONCENTRATOR INTERFACE
(TYPICAL, TWO PLACES, EACH PANEL JOINT)

PIN

CONCENTRATING
V4

• ASSEMBLE PANEL SUBASSEMBLIES

FLECTOR PANELS

WIRE HARNESS ASSEMBLIES

V416-945301

V416-945302

• ASSEMBLE REFLECTOR
INSTALL AND BO

• ASSEMBLE AND BOND SOLAR PANEL ASSEMBLIES AND WIRE HARNESSES
• INSTALL DIODES

3

FOLDOUT FRAME

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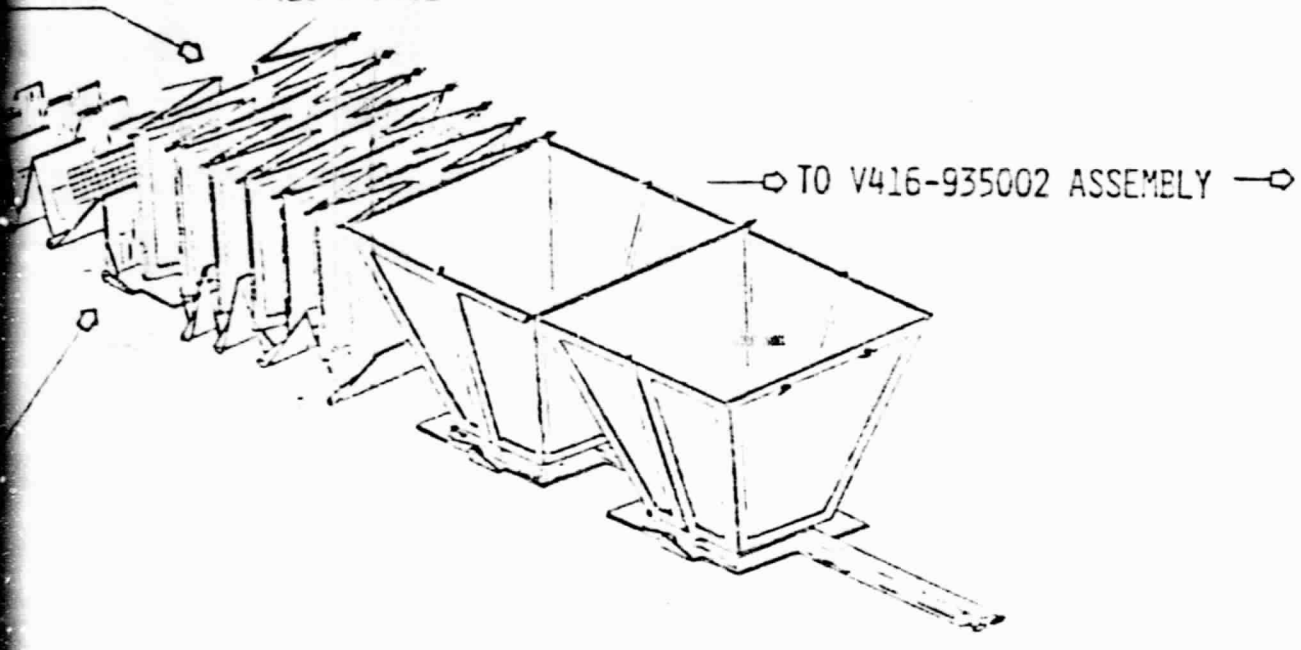
OF POOR QUALITY

CONCENTRATING ELEMENT STACK ASSEMBLY
V416-945001



MBLE REFLECTOR PANEL ASSEMBLY AND SOLAR PANEL ASSEMBLY,
INSTALL AND BOND CLIPS

ASSEMBLY OF
CONCENTRATOR
ELEMENTS

PRELIMINARY MANUFACTURING FLOW AND BUILD PLAN
LOW CONCENTRATION RATIO SOLAR ARRAY

PREPARED BY: K.M HICKS DEPT.: 761 EXT.: 3618
DATE: JAN 19, 1983 REVISED: FEB. 22, 1983

3-3, 3-4

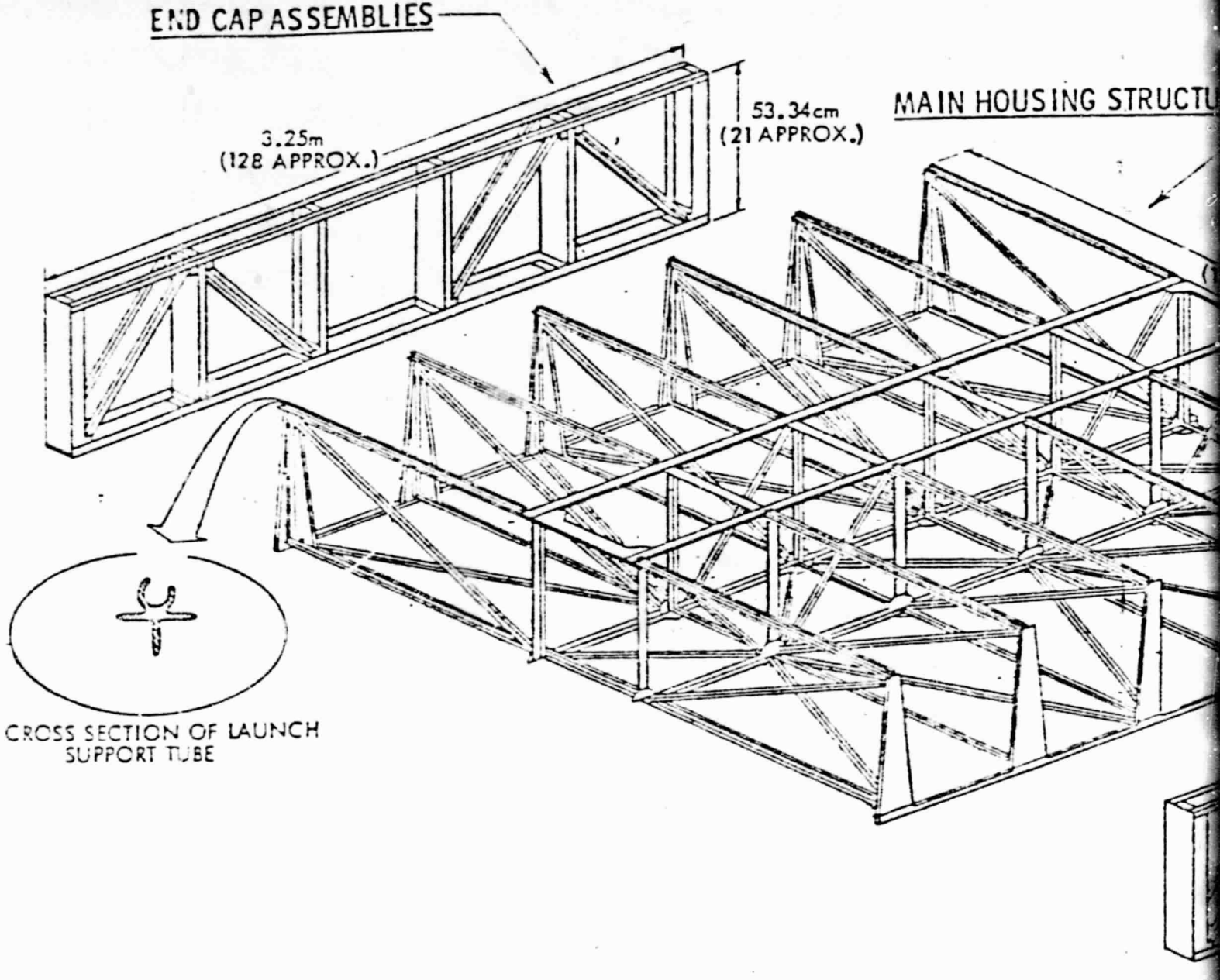
4 FOLDOUT FRAME

PRECEDING PAGE BLANK NOT FILMED

HOUSING ASSEMBLY

V416-935101

REPRESENT



- FABRICATE DETAILS
- ASSEMBLE STRUCTURE AND INSTALL LAUNCH SUPPO

FOLDOUT FRAME

REPRESENTATIVE RIVETED JOINT CONFIGURATION

REFLECTO

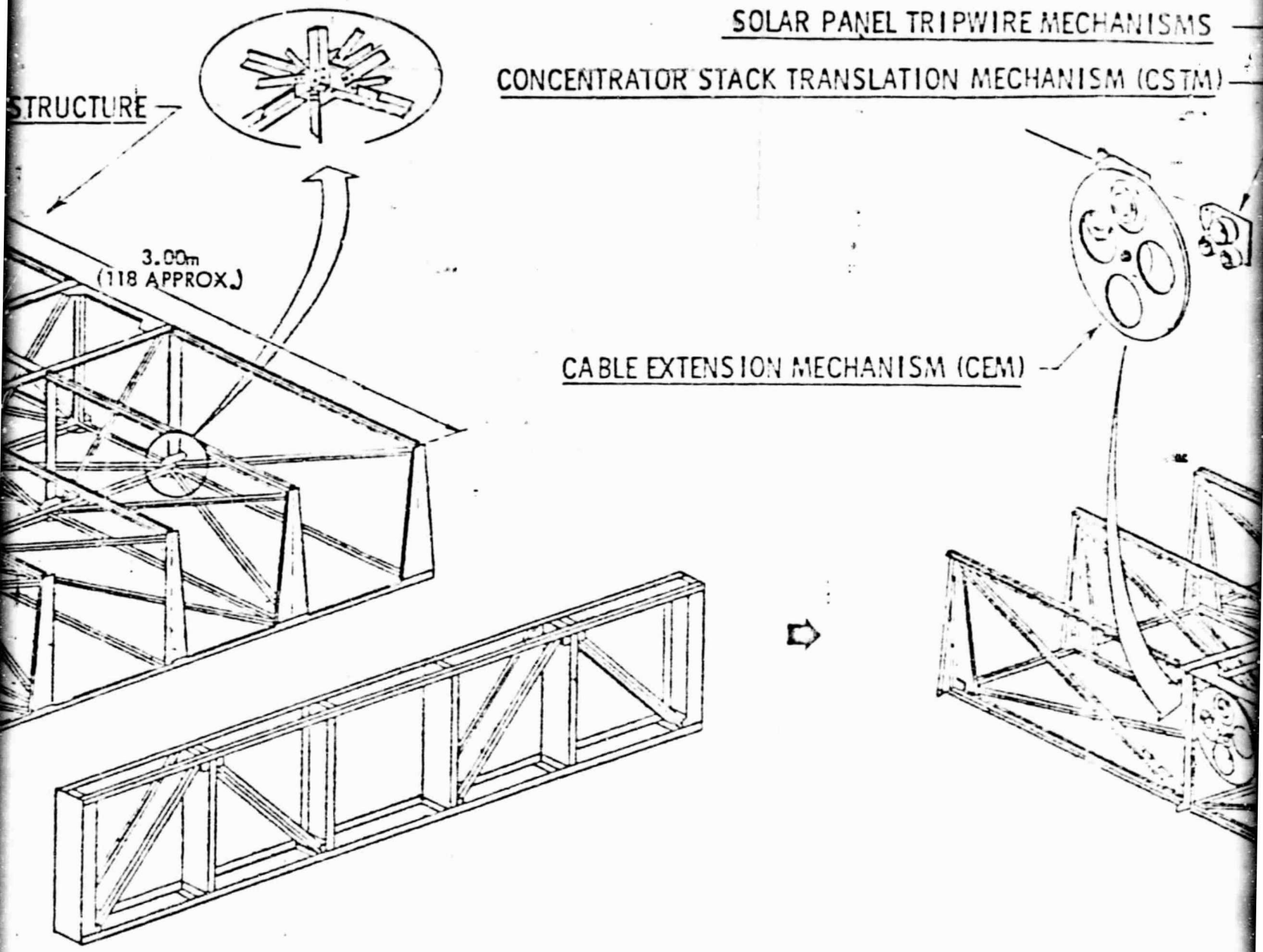
SOLAR PANEL TRIPWIRE MECHANISMS

CONCENTRATOR STACK TRANSLATION MECHANISM (CSTM)

STRUCTURE

3.00m
(118 APPROX.)

CABLE EXTENSION MECHANISM (CEM)



CH SUPPORT TUBES

2 FOLDOUT FRAME

REFLECTOR PANEL TRIPWIRE MECHANISMS

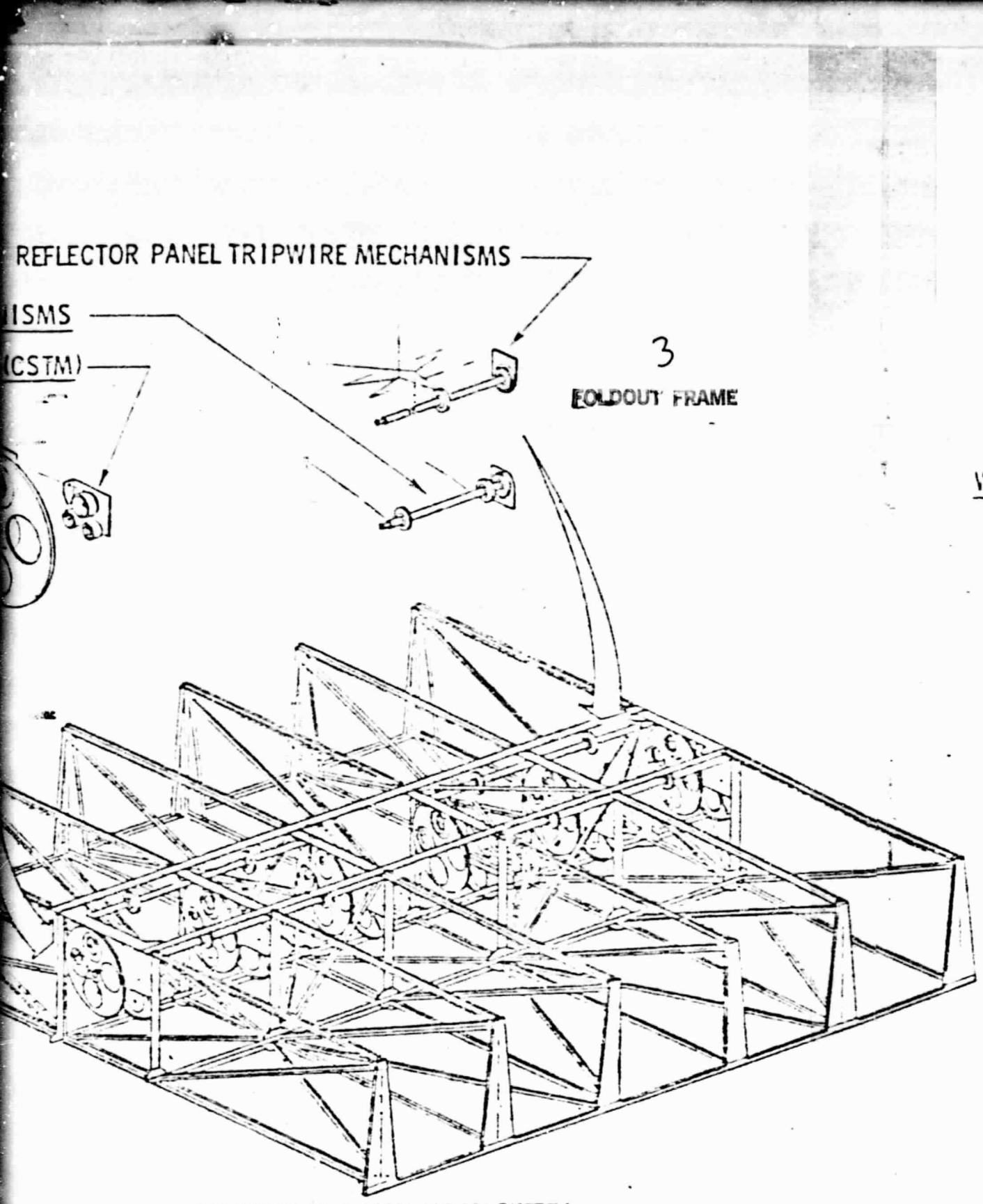
ISMS

(CSTM)

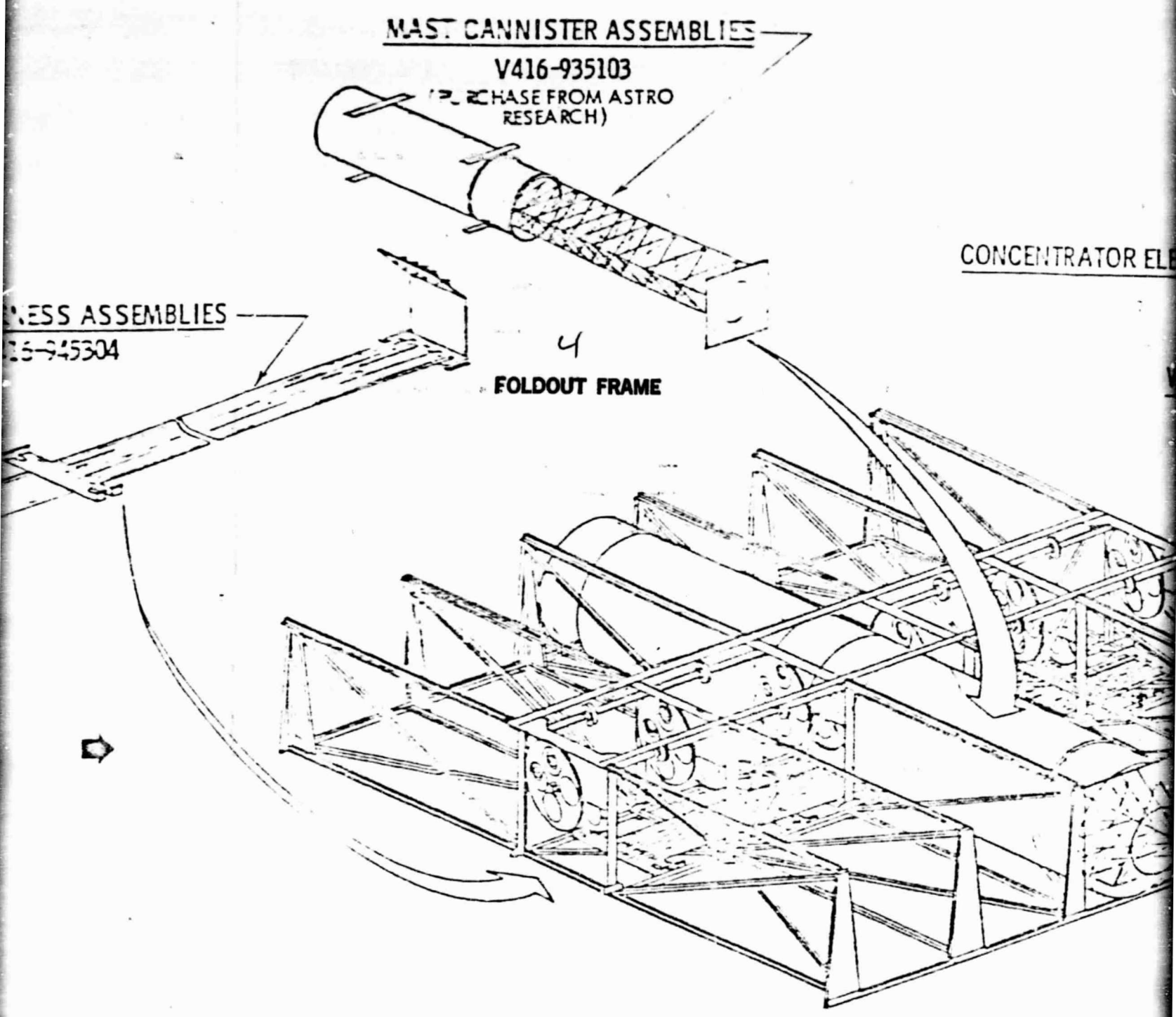
3

FOLDOUT FRAME

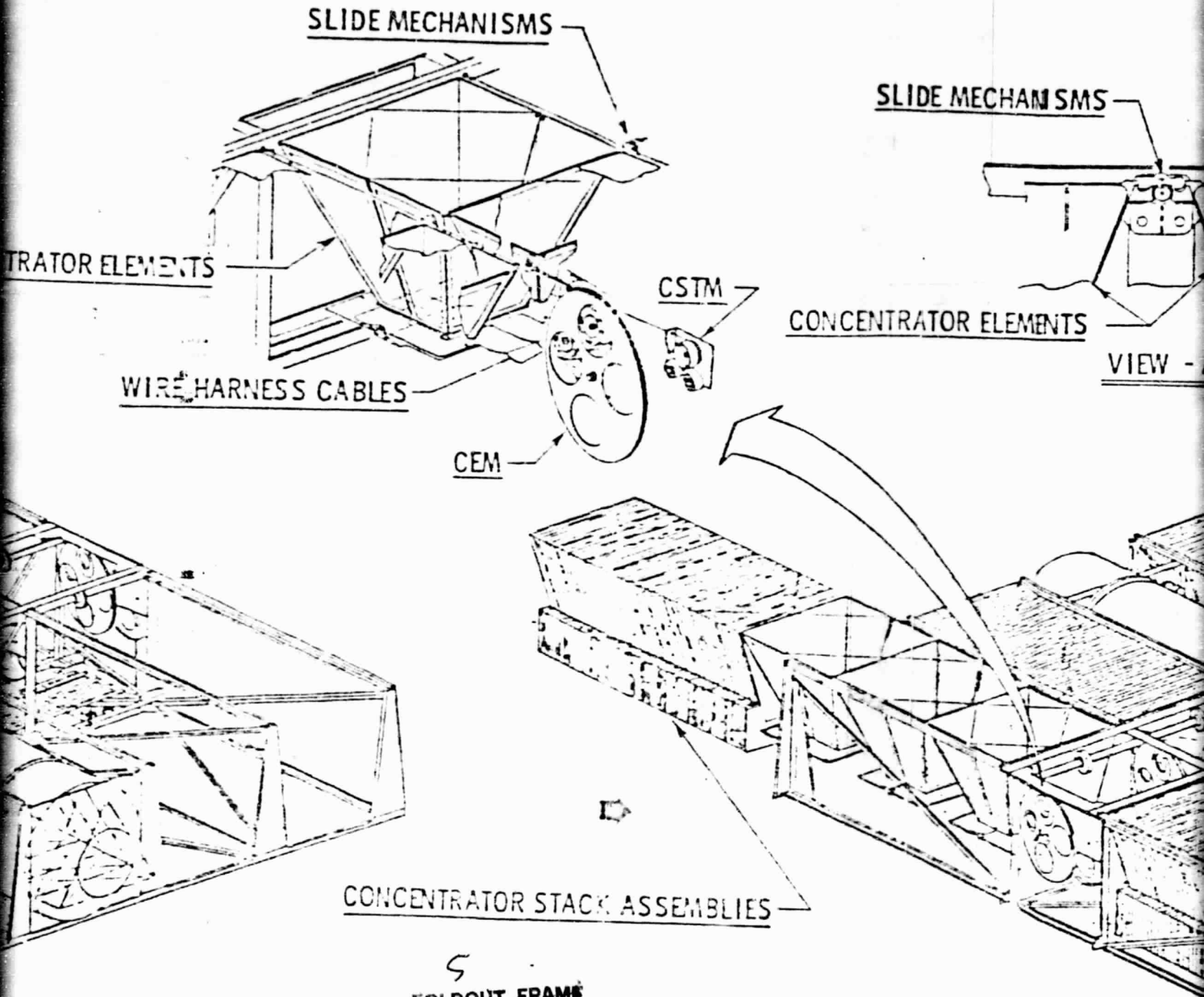
WIRE HARNESS



- FABRICATE AND ASSEMBLE BRACKETRY
- INSTALL BRACKETRY
- FABRICATE AND ASSEMBLE MECHANISMS
- INSTALL MECHANISMS



- INSTALL WIRE HARNESS ASSEMBLIES
- INSTALL MAST/CANNISTER ASSEMBLIES



5

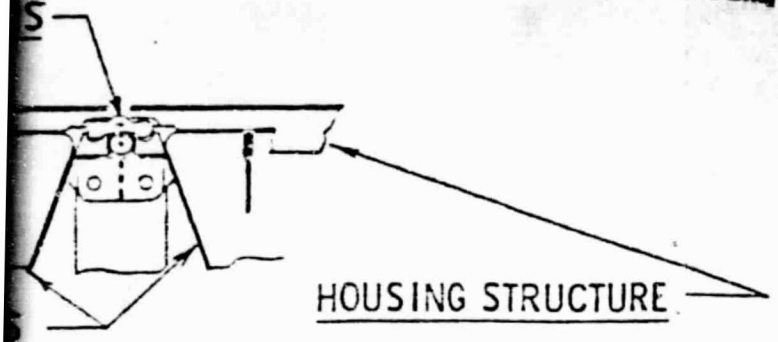
FOLDOUT FRAME

LIES
MBLIES

- INSTALL C
  CONC
- PERFORM

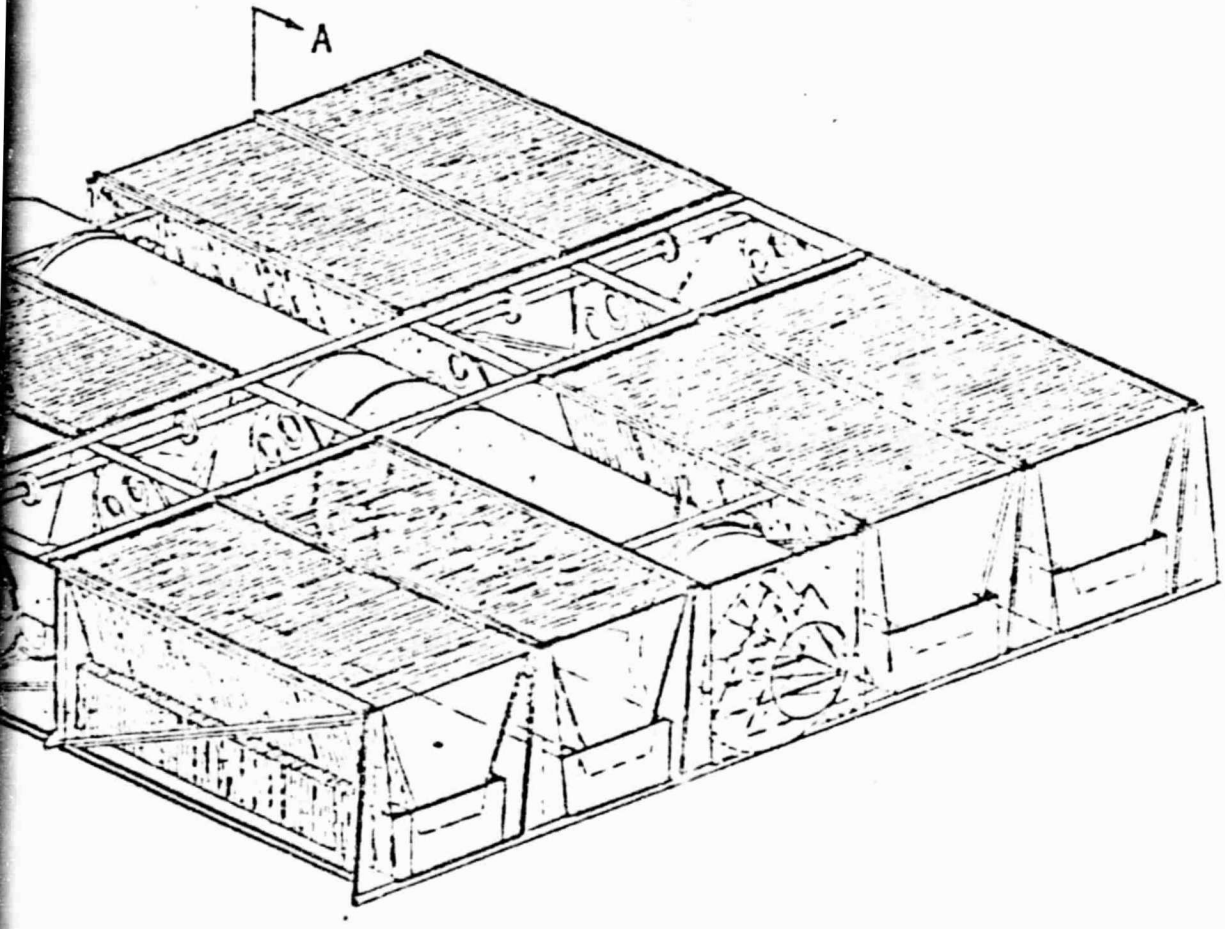
6

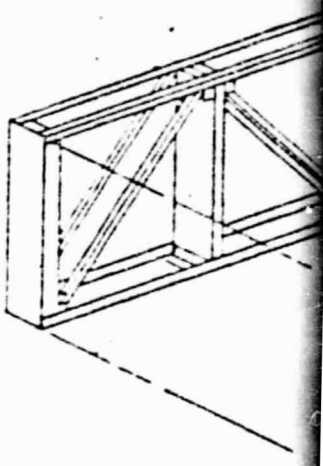
FOLDOUT FRAME



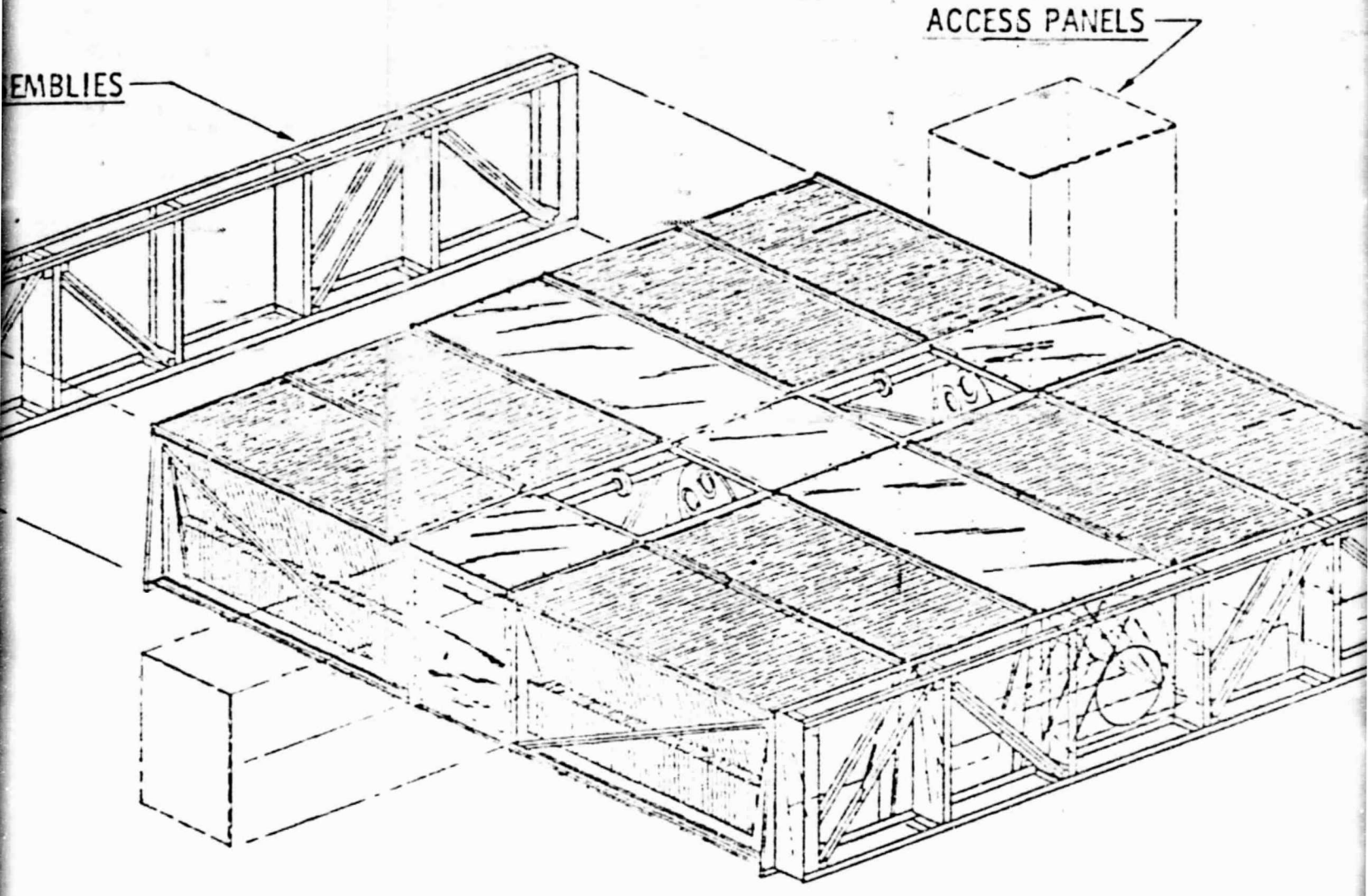
VIEW - A

END CAP ASSEMBLIES





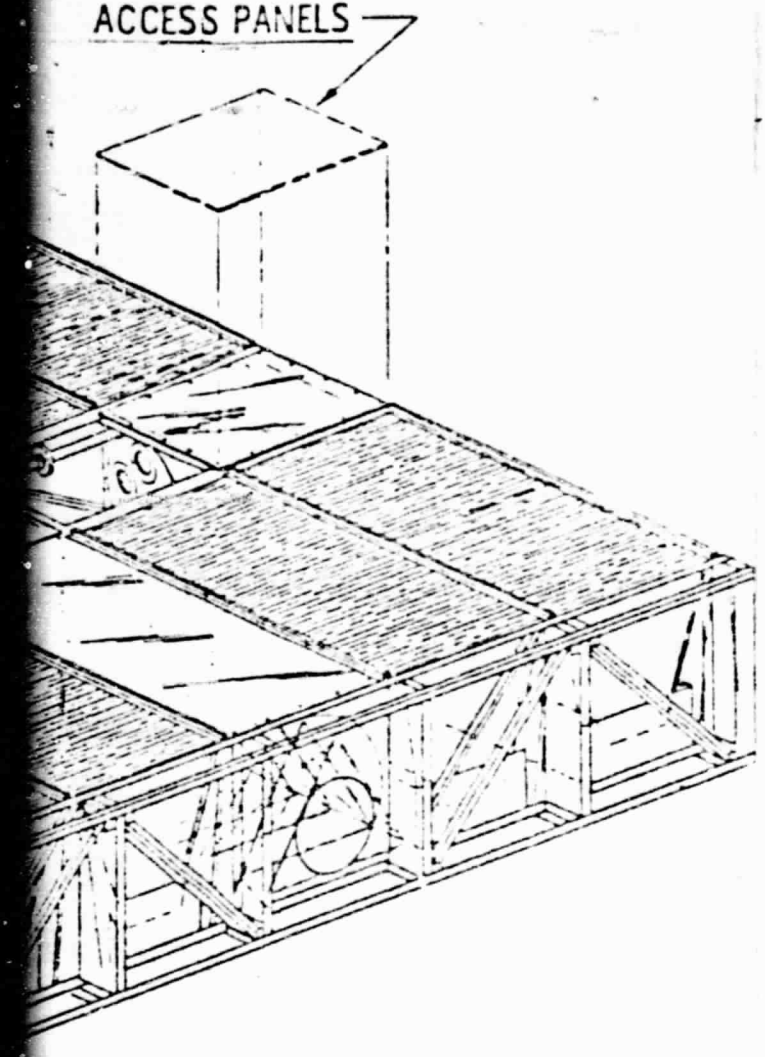
- INSTALL CONCENTRATOR STACK ASSEMBLIES AND SLIDE ASSEMBLIES CONCURRENTLY
- PERFORM ELECTRICAL HOOKUP AND CHECKOUT



- INSTALL END CAP ASSEMBLIES - SECURE TO MAST/CANNISTER ASSEMBLIES
- SECURE CABLES TO END CAP ASSEMBLIES
- INSTALL ACCESS PANELS (TOP, BOTTOM AND ENDS, AS SHOWN)
- INSPECT COMPLETE

7

FOLDOUT FRAME



&

FOLDOUT FRAME

TO TEST

ASSEMBLY SEQUENCE
FOR FLIGHT TEST
CONFIGURATION

...IPE TO MAST/CANNISTER ASSEMBLIES
...S
...TTOM AND ENDS, AS SHOWN)

MANUFACTURING FLOW AND BUILD PLAN
LOW CONCENTRATION RATIO SOLAR COLLECTOR

PREPARED BY: K.M. HICKS DEPT: 761
EXT: 3618 DATE: JAN. 25, 1983 REVISED: FEB 4, 1983

3-5, 3-6