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APRIL 20, 1972

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

1 STANDARDS
2 SEQUENTIAL EVENTS SYSTEM
3 ELECTRICAL SYSTEM
4 ENVIRONMENTAL CONTROL SYS
5 FUEL CELL/ CRYOGENICS SYSTEM
6 COMMUNI-CATIONS SYSTEM
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8 GUIDANCE AND CONTROL SYSTEM
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10 REACTION CONTROL SYSTEM
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SKYLAB

COMMAND SERVICE MODULE SYSTEMS HANDBOOK

CSM 116 - 119

APRIL 20, 1972

PREPARED BY

FLIGHT CONTROL DIVISION

MANNED SPACECRAFT CENTER

HOUSTON, TEXAS

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CSM

SYSTEMS HANDBOOK

CSM 116 - 119

APRIL 20, 1972

SKYLAB

COMMAND/SERVICE MODULE SYSTEMS HANDBOOK

CSM 116-119

PREFACE

This document, prepared by the Flight Control Division, NASA, Manned Spacecraft Center, Houston, Texas, with technical support by North American Rockwell (NR) and Service Technology Corporation (STC), reflects the Command/Service Module Systems for S/C 116 through 119 as of April 20, 1972.

Omitted from this first publication are Sections 5, 7, 8, 9, 10, three figures in Section 3 and one in Section 11. When this material is subsequently published, it will be distributed in document change packages, which may also include revisions to previously published data.

Major emphasis is on material for use by the flight crew and flight controllers during mission operations. Caution should be exercised in using the systems drawings or other information in the handbook for other purposes.

Comments concerning the general contents of this handbook should be directed to FC3/Mr. Fred Whitehead, Jr., NR, Flight Operations Support, 713-483-6206.

Approved by:

Melvin F. Brooks
Acting Chief, CSM Systems Branch

Melvin F. Brooks for
Eugene F. Kranz
Chief, Flight Control Division

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TABLE OF CONTENTS AND ITEM EFFECTIVITY (CONCLUDED)

1 STANDARDS

SECTION 1

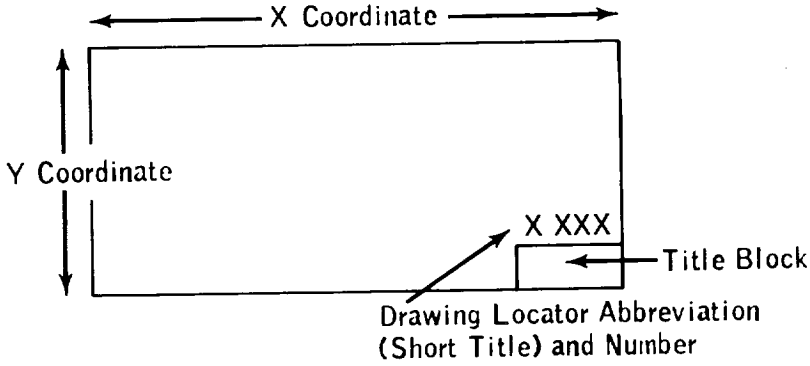
STANDARDS

1.1 GENERAL DRAWING INFORMATION

1.1.1 Cross-indexing

1.1.1.1 General drawing configuration

The X coordinate zones are marked alphabetically from the right-hand edge of the sheet (including the 1/2 inch margin). The Y coordinate zones are marked numerically from the bottom right-hand and left-hand corners of the sheet.



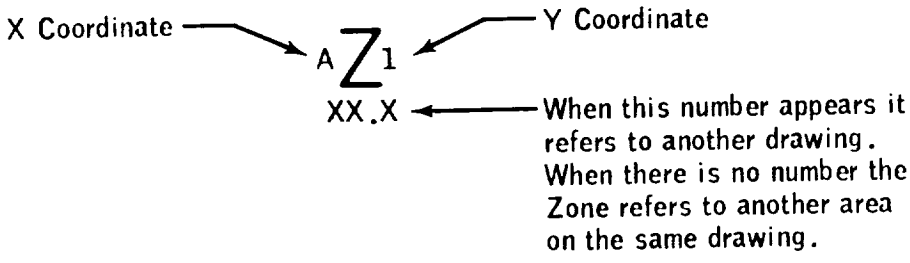
1.1.1.2 Component location code

The component location code is used to reference controls (on the control-display figure) and components (on the overview drawing) into the detail system drawings.

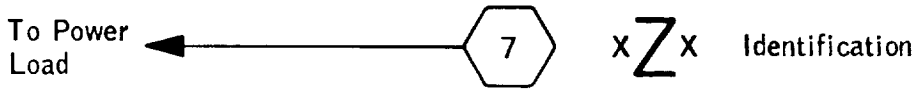
3 - Drawing Locator Number for the given detail subsystem drawing
K - X Coordinate
4 - Y Coordinate

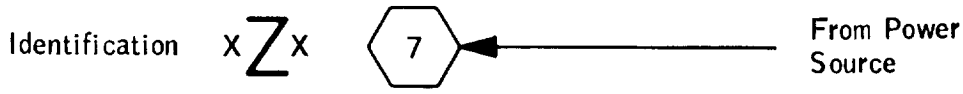
1.1.2 Technical Zone References

1.1.2.1 Zone reference

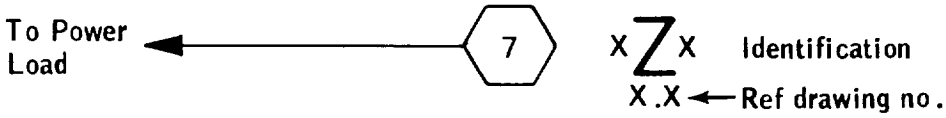


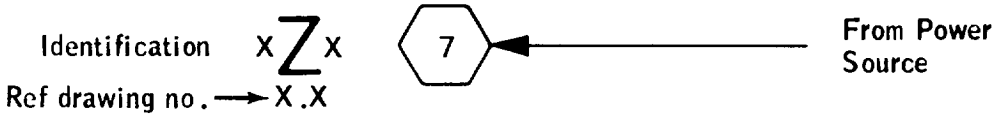
1.1.2.2 Power intra-drawing
(Section to section within the same drawing)





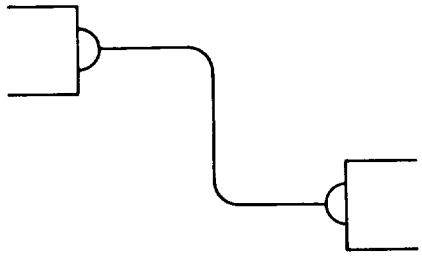
1.1.2.3 Power inter-drawings
(Drawing to drawing)





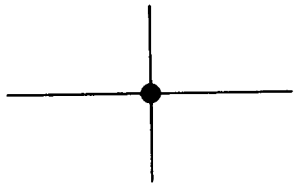
1.2 LINE LEGEND

1.2.1 RF Cable

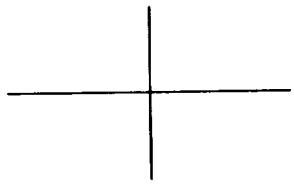


1.2.2 Electrical Line, Power and control

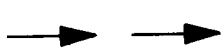
1.2.2.1 Electrical connected



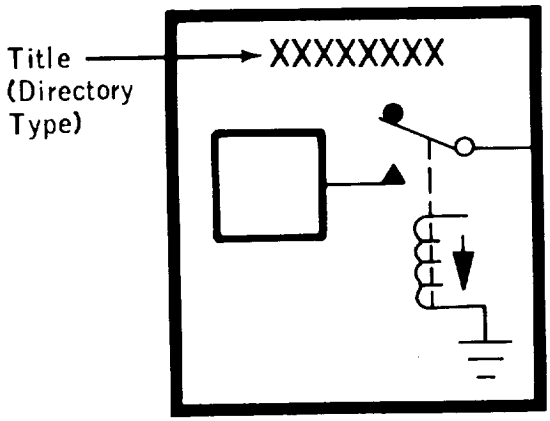
1.2.2.2 Electrical crossover



1.2.3 Directional Flow Arrows



1.2.4 Component Enclosures



1.2.4.1 Main enclosure
1/16-inch solid black line

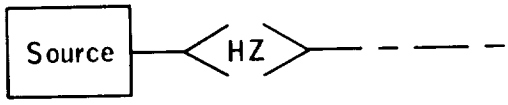
1.2.4.2 Sub enclosure
1/32-inch solid black line

1.2.4.3 Component enclosure with crew (manual control)
1/16-inch dashed black line

1.2.4.4 Module interface and systems assembly
1/8-inch dashed black line

1.2.5 Mechanical Linkage

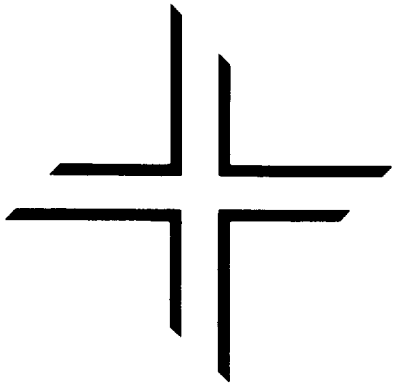
1.2.6 Timing Pulses



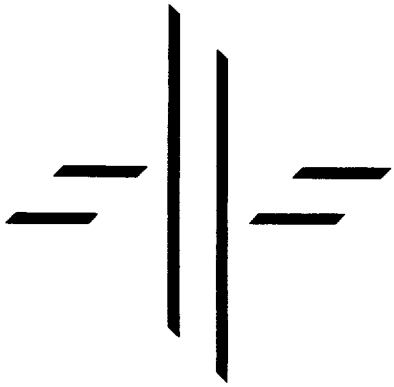
1.3 PIPE LEGEND

1.3.1 General

1.3.1.1 Plumbing connected



1.3.1.2 Plumbing crossover



1.3.2 Line designation

1.3.2.1 Water

1.3.2.2 Oxygen

1.3.2.3 Nitrogen

1.3.2.4 Helium

1.3.2.5 Primary Coolant

1.3.2.6 Secondary Coolant

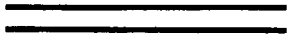
1.3.2.7 Fuel

1.3.2.8 Hydrogen

1.3.2.9 Steam

1.3.2.10 Suit Loop

1.3.2.11 Sense Lines

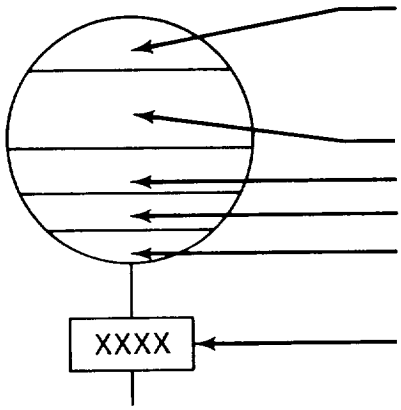


1.3.2.12 Oxidizer

1.3.2.13 Others

1.4 TELEMETRY SYMBOLS

1.4.1 Measurements Telemetered



Measurement Number: Should include the letter associating it with the transducer type. Alternate system measurement numbers and PCM codes may appear near the TM bubble.

Measurement Name

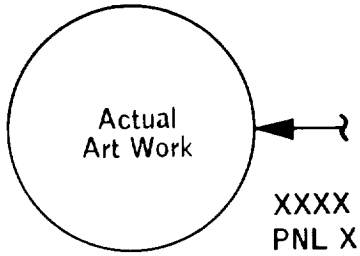
Measurement Range

High Bit Sample Rate

Low Bit Sample Rate

TM Signal Conditioner: To be located on the input line next to TM bubble, positioned at 0°, 90°, 180° and 270° around bubble.

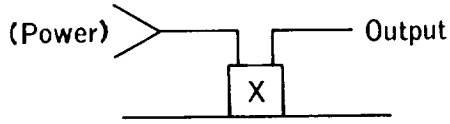
1.4.2 Onboard Meters



Meters should be placed close to their associated TM bubble wherever possible.

1.4.3 Sensors

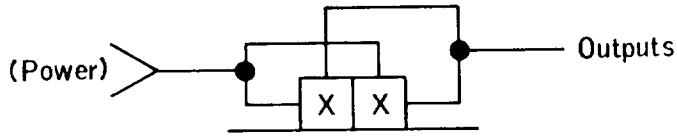
1.4.3.1 Single source



Example: Letter indicates the type:

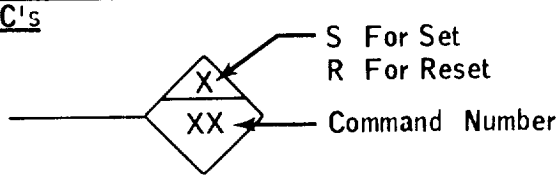
P - Pressure
T - Temperature
Q - Quantity
W - Wetness
R - Rate

1.4.3.2 Double source



1.4.4 Ground Commands (Contents Optional by Vehicle)

1.4.4.1 RTC's



1.5 ELECTRICAL SYMBOLS

1.5.1 Switches

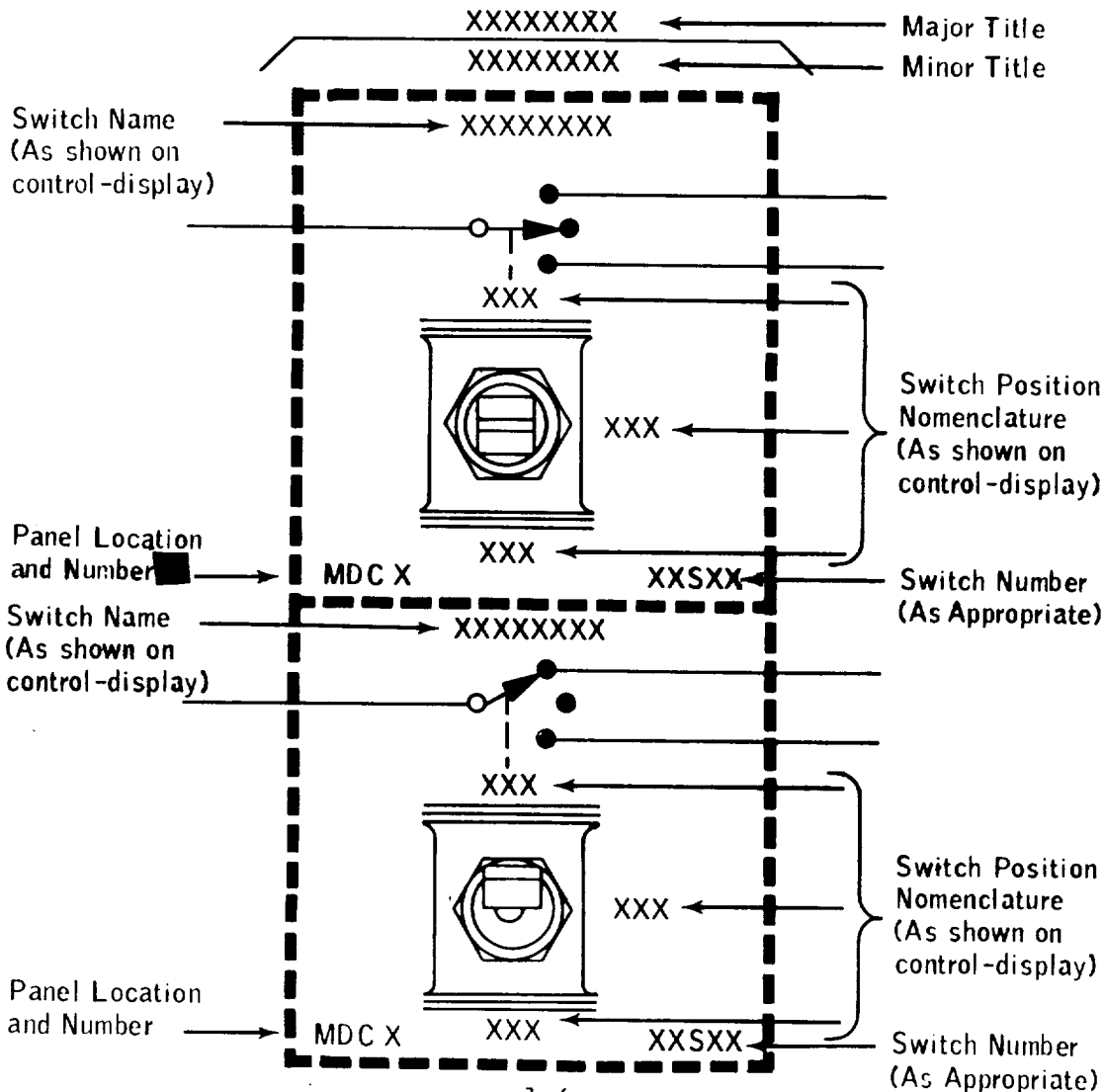
All switches will be shown in the de-energized position (if possible). When a switch has more than one set of contacts, only one set needs to have switch contact nomenclature.

1.5.1.1 Switch nomenclature

Major Title: The title given to a group of switches on the panel.

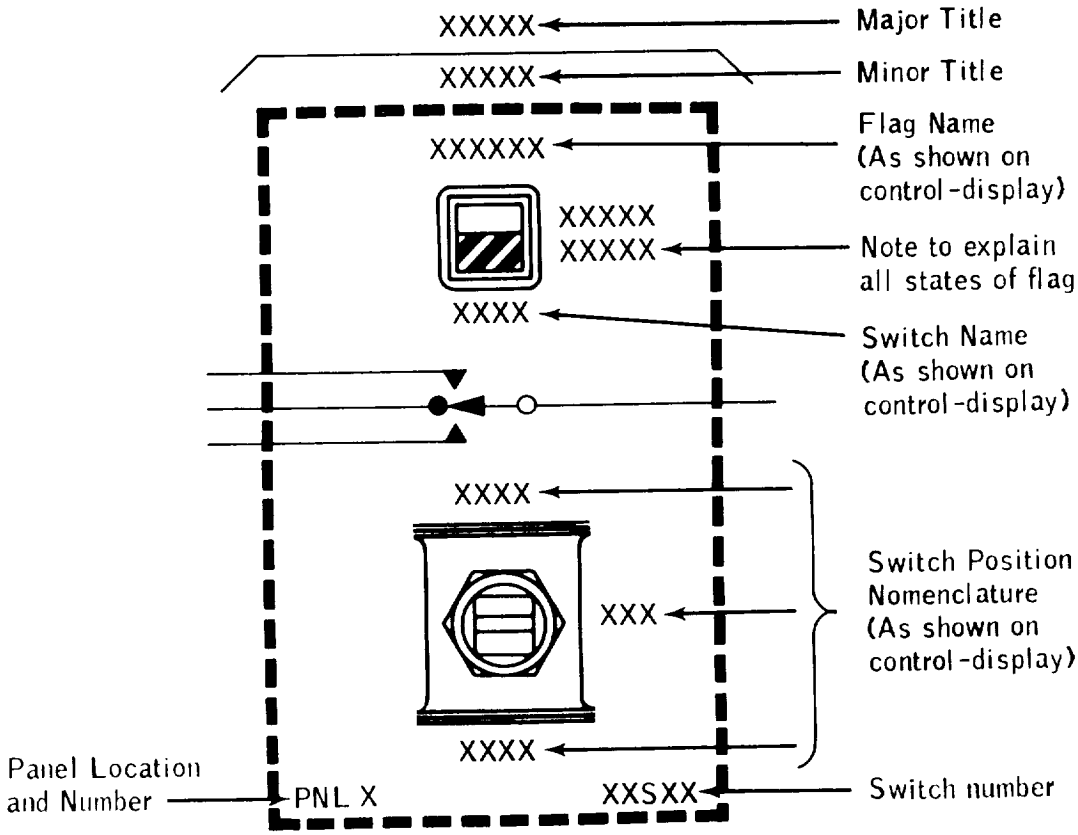
Minor Title: The title given to a sub-group of switches

Note: If more than one switch has identical major and minor titles, they may be stacked without repeating these titles.

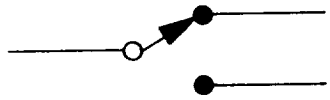


1.5.1.2 Switch controlled flag

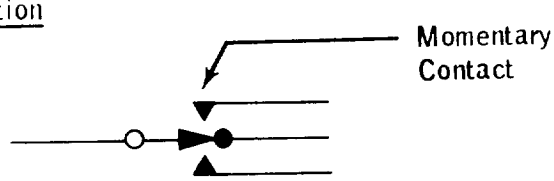
If a flag is directly controlled by a switch, it may be shown in the following manner:



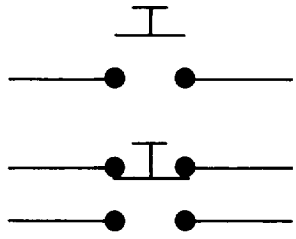
1.5.1.3 Two-position



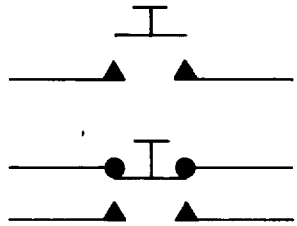
1.5.1.4 Three-position



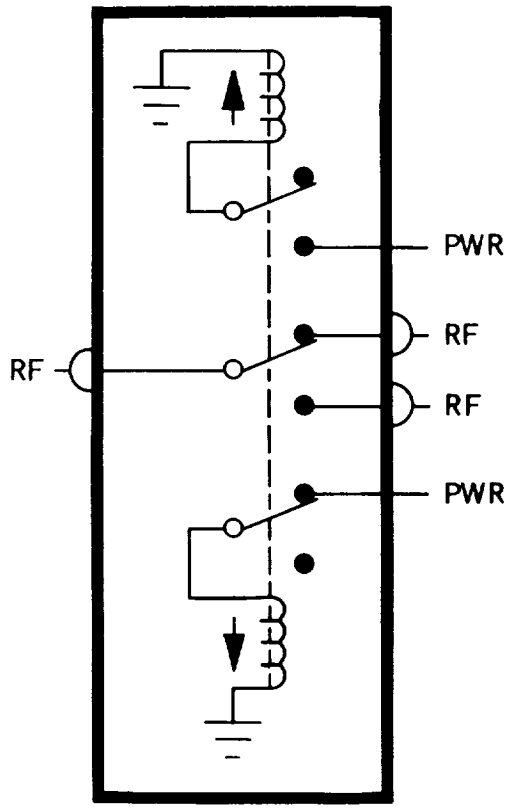
1.5.1.5 Pushbutton
1.5.1.5.1 Latching



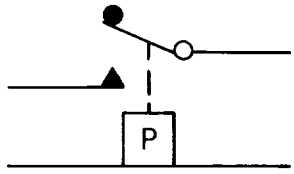
1.5.1.5.2 Momentary



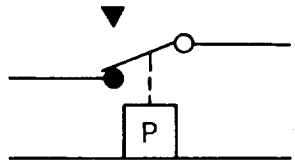
1.5.1.6 Coax



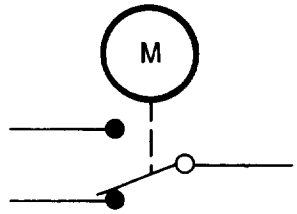
1.5.1.7 Pressure
1.5.1.7.1 Closed decreased pressure



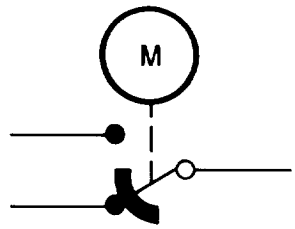
1.5.1.7.2 Closed increased pressure



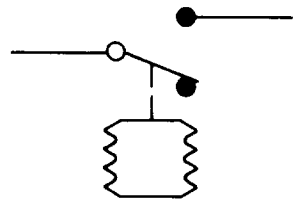
1.5.1.8 Motor
1.5.1.8.1 Break before make



1.5.1.8.2 Make before break



1.5.1.9 Baro



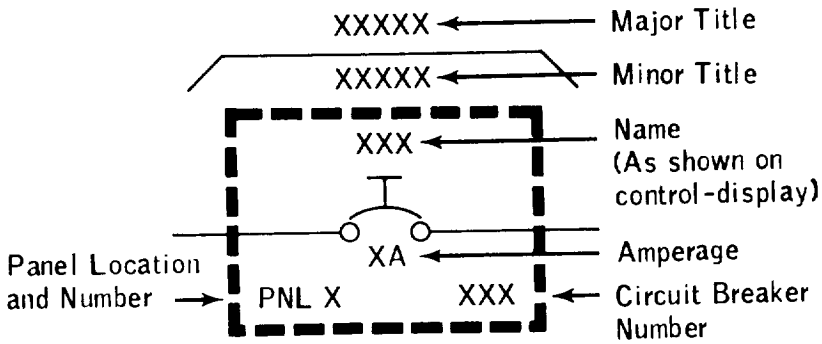
Close XXX psi or altitude

Open XXX psi or altitude

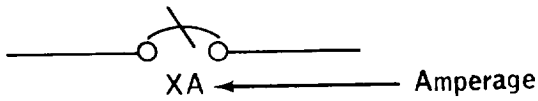
1.5.2 Circuit Breakers

The circuit breaker should be placed near the associated bus whenever possible. For the difference between major and minor titles see remark under switches (1.5.1.1).

1.5.2.1 Pushbutton

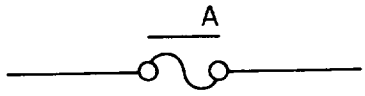


1.5.2.2 Automatic



1.5.3 Fuses

1.5.3.1 General

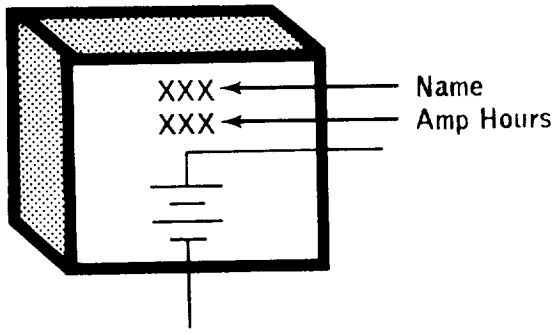


1.5.3.2 Fusistor

1.5.4 Battery

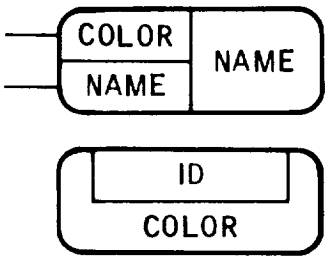
1/16-inch black tape

Size varies with number of cells and drawing arrangement.

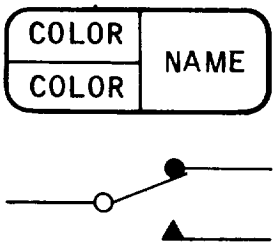


1.5.5 Lights

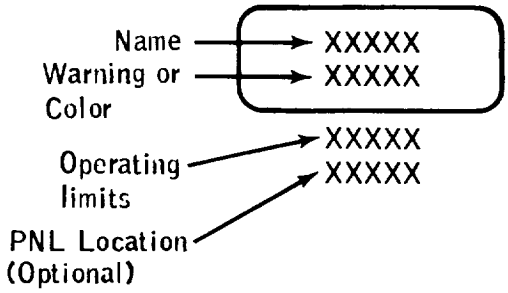
1.5.5.1 Telelights



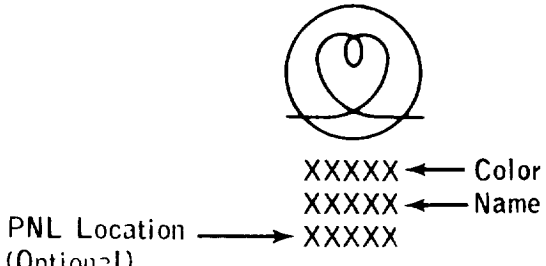
1.5.5.2 Switching



1.5.5.3 Caution and warning

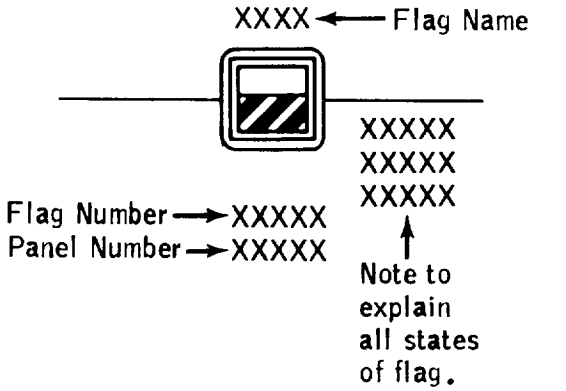


1.5.5.4 Component



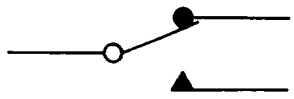
1.5.6 Annunciator Flag

Flag symbol will not reflect switch position of the associated switch.

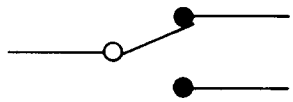


1.5.7 Relays

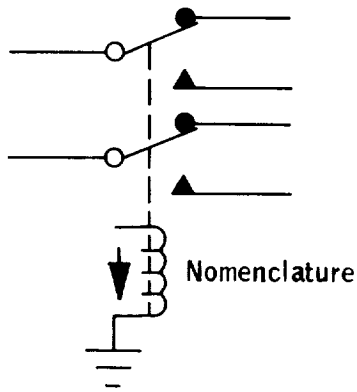
1.5.7.1 Momentary contact



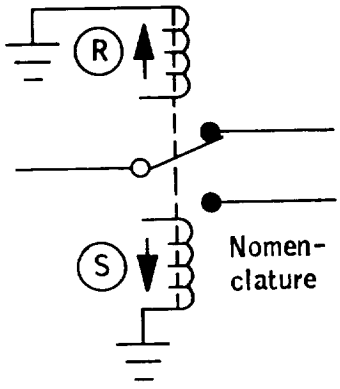
1.5.7.2 Latching contacts



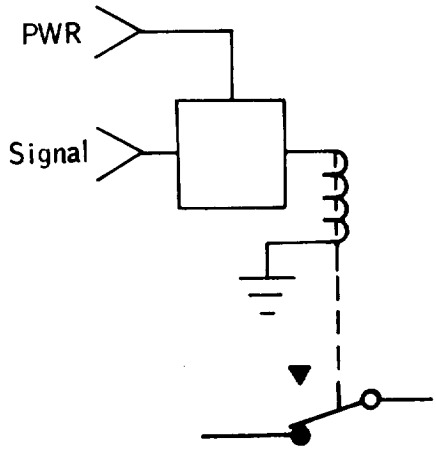
1.5.7.3 Non-Latching relay



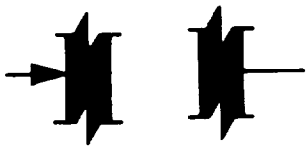
1.5.7.4 Latching relay



1.5.8 Relay or Solenoid Driver



1.5.9 Buses
1.5.9.1 Symbol
Length can vary depending on the bus function on a given drawing.

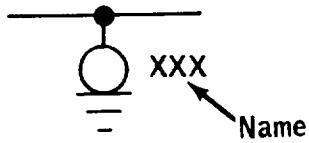


1.5.9.2 Designation
See bus designation list.

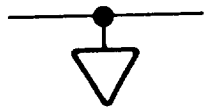
1.5.10 Grounds
1.5.10.1 System

1.5.10.2 Frame

1.5.10.3 Floating or Controlled



1.5.10.4 Signal



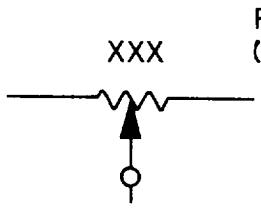
1.5.11 Diodes
1.5.11.1 General

1.5.11.2 Zener

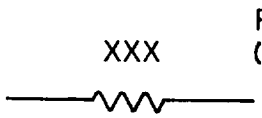
1.5.11.3 Tunnel

1.5.11.4 Control rectifier (SCR)

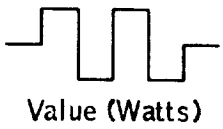
1.5.12 Potentiometer



1.5.13 Fixed Resistor

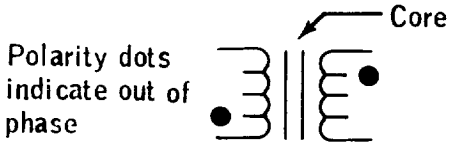


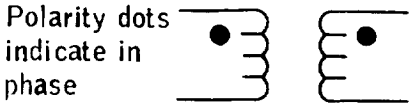
1.5.14 Heater



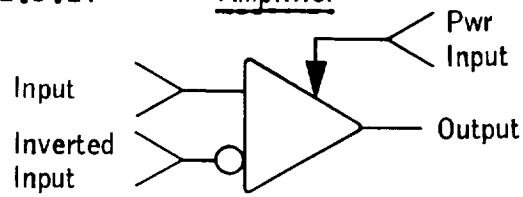
1.5.15 Thermostat

1.5.16 Transformers

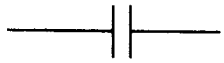




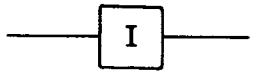
1.5.17 Amplifier



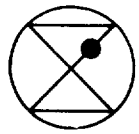
1.5.18 Capacitor



1.5.19 Digital Inverter



1.5.20 Wire Resolver



= Sine Winding

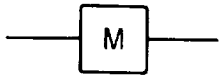
= Minus Sine

= Cosine Winding

1.5.21 Time Delay

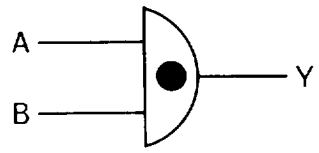
1.5.22 Electrical Filter

1.5.23 Modulator



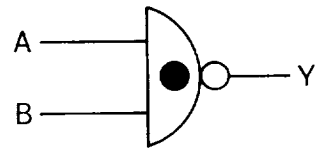
1.5.24 Gates

1.5.24.1 And



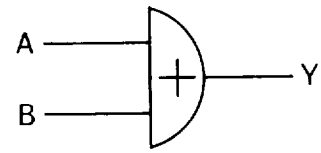
A	B	Y
1	1	1
1	0	0
0	1	0
0	0	0

1.5.24.2 Nand



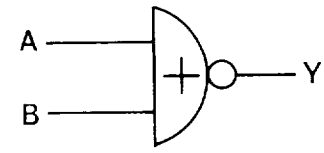
A	B	Y
1	1	0
1	0	1
0	1	1
0	0	1

1.5.24.3 Or



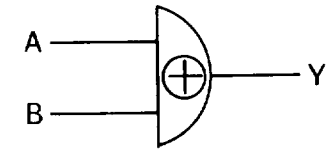
A	B	Y
1	1	1
1	0	1
0	1	1
0	0	0

1.5.24.4 Nor



A	B	Y
1	0	0
0	1	0
1	0	0
0	0	1

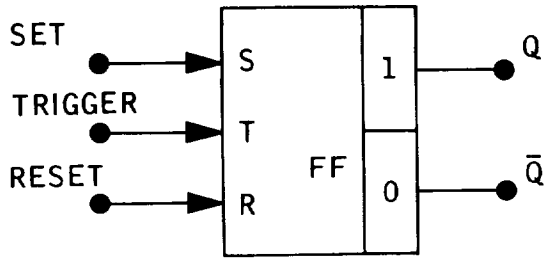
1.5.24.5 Exclusive Or



A	B	Y
1	1	0
1	0	1
0	1	1
0	0	0

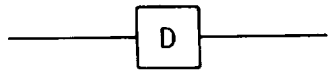
Open circle means it is an inverter and may appear on any of the lines on the gate.

1.5.24.6 SRT Flip-Flop

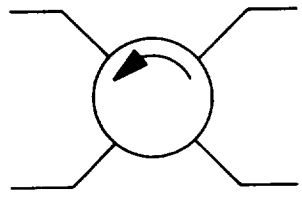


INPUT	OUTPUT
S	Sets Q to "1" Sets $\bar{Q}$ to "0"
T	Q and $\bar{Q}$ Change States
R	Resets Q to "0" Resets $\bar{Q}$ to "1"

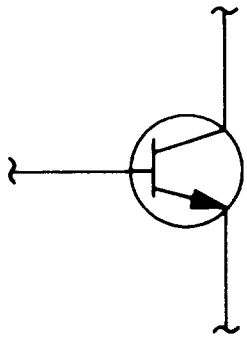
1.5.25 Demodulator



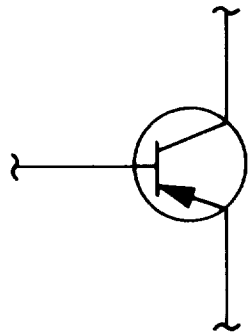
1.5.26 RF Circulator



1.5.27 Transistor
1.5.27.1 NPN

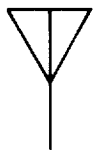


1.5.27.2 PNP



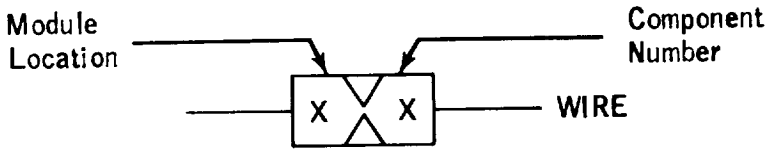
1.5.28 Antenna

Name
(Type or Function)

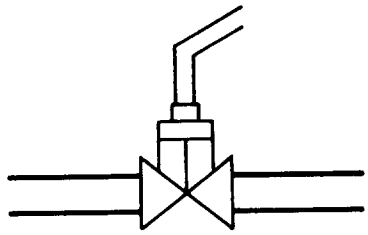


1.6 PYROTECHNIC SYMBOLS

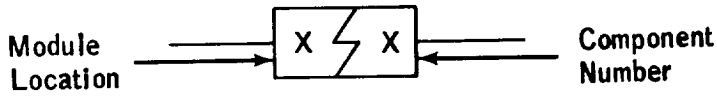
1.6.1 Pyro Guillotine



1.6.2 Pyro Valve with Single Initiator

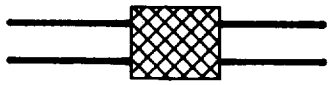


1.6.3 Electrical Circuit Interrupter

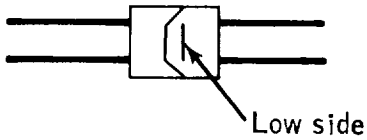


1.7 MECHANICAL SYMBOLS

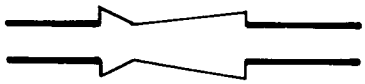
1.7.1 Mechanical Filter



1.7.2 Burst Diaphragm

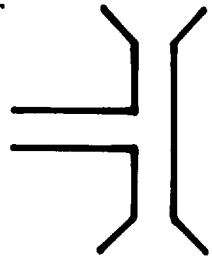


1.7.3 Venturi



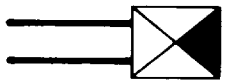
1.7.4 Vent

1.7.5 Thrust Neutralized Vent



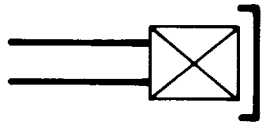
1.7.6 Disconnects

1.7.6.1 Self-sealing

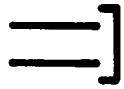


1.7.6.2 Quick

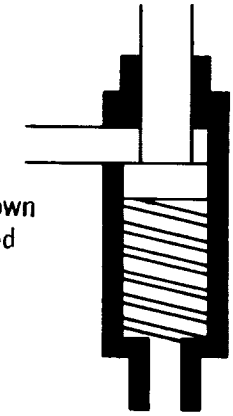
1.7.7 Quick Disconnect Fill and Drain



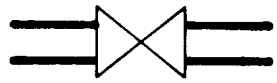
1.7.8 Fill and Drain



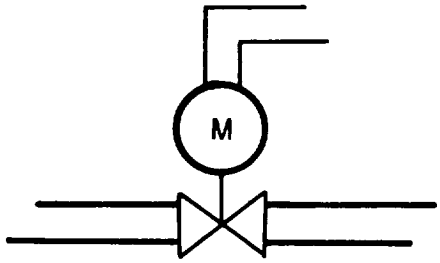
1.7.9 Ball Valve Actuator



1.7.10 Valves

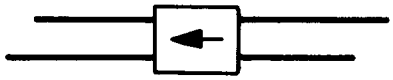


1.7.10.1 Motor Control



1.7.10.2 Manual Control

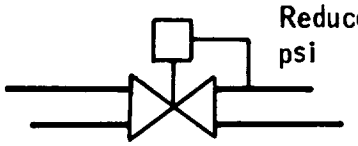
1.7.10.3 Check Valve



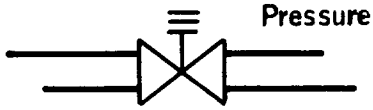
1.7.10.4 Orifice

(Flow Rate)

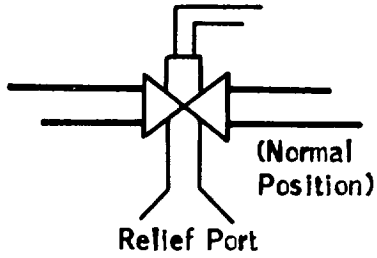
1.7.10.5 Pressure regulator



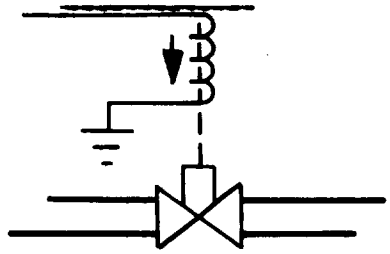
1.7.10.6 Relief Valve



1.7.10.7 Pneumatic controlled valve with line bleed



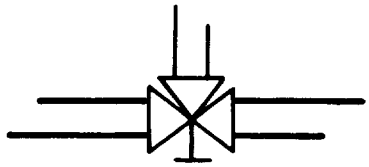
1.7.10.8 Solenoid valve



Name (Normal Position)

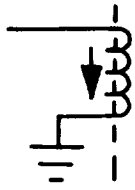
1.7.10.9 Three-way valve

1.7.10.9.1 Manual



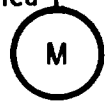
1.7.10.9.2 Solenoid

Or



Or

1.7.10.9.3 Motor controlled



1.7.10.10 Ball valve

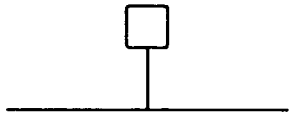
1.8 MISCELLANEOUS SYMBOLS

1.8.1 Drawing Note Reference

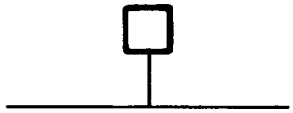
1.8.2 Overview Drawing Instrumentation Legend

1.8.2.1 Automatic control only

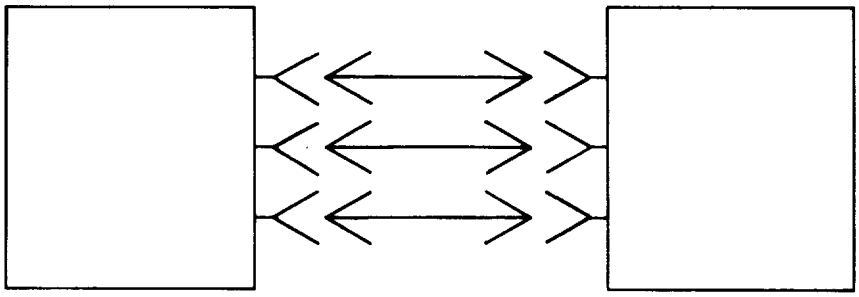
1.8.2.2 PCM only



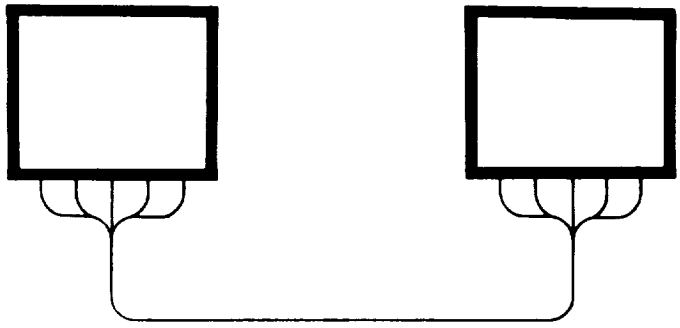
1.8.2.3 PCM and/or onboard display



1.8.3 Two-unit Interface



1.8.4 Two-unit Cable Connection



1.8.5 Buses

1.8.5.1 Power buses.-

		Prime CSH generation dwg No.
V_{MA}	- MAIN BUS A	3.2
V_{MB}	- MAIN BUS B	3.2
V_{BA}	- BATTERY BUS A	3.2
V_{BB}	- BATTERY BUS B	3.2
V_{BR}	- BATTERY RELAY BUS	3.2
V_{FP}	- FLIGHT AND POSTLANDING BUS	3.2
V_{E}	- EXPERIMENT BUS	3.2
V_{AC1}	- AC BUS 1	3.3
V_{AC2}	- AC BUS 2	3.3
V_{F}	- FLIGHT BUS	3.2
V_{SMA}	- SERVICE MODULE BUS A	3.2
V_{SMB}	- SERVICE MODULE BUS B	3.2

1.8.5.2 Sequential buses.-

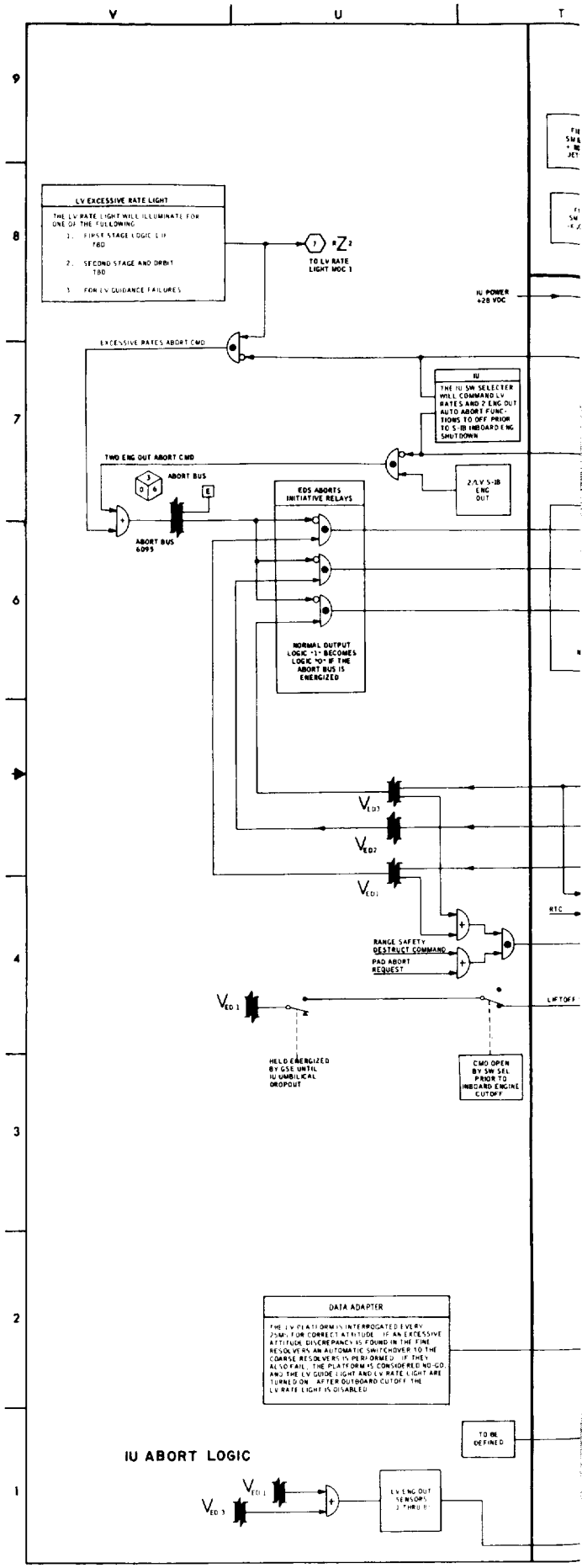
		Prime CSH generation dwg No.
V_{SQA}	- SEQUENTIAL PYRO BUS A	2.2
V_{RQA}	- RCS CONTROLLER PYRO BUS A	2.2
V_{RLA}	- RCS CONTROLLER LOGIC BUS A	2.2
V_{SLA}	- SEQUENTIAL LOGIC BUS A	2.2
V_{SAA}	- SEQUENTIAL ARM BUS A	2.2
V_{ELA}	- EARTH LANDING BUS A	2.5
V_{SQB}	- SEQUENTIAL PYRO BUS B	2.2
V_{RQB}	- RCS CONTROLLER PYRO BUS B	2.2
V_{RLB}	- RCS CONTROLLER LOGIC BUS B	2.2
V_{SLB}	- SEQUENTIAL LOGIC BUS B	2.2
V_{SAB}	- SEQUENTIAL ARM BUS B	2.2
V_{ELB}	- EARTH LANDING BUS B	2.5
$V_{ED\ 1}$	- EMERGENCY DETECTION SYSTEM BUS NO 1	2.3
$V_{ED\ 2}$	- EMERGENCY DETECTION SYSTEM BUS NO 2	2.3

		Prime CSH generation dwg No.
	Sequential buses (cont'd) .-	
	$V_{ED\ 3}$ - EMERGENCY DETECTION SYSTEM BUS NO 3	2.3
	V_{6D95} - IU ABORT BUS	2.3
1.8.5.3	Instrumentation buses.-	
	V_{1} - CM ESS INST BUS PWR FROM RHEB PNL 276-CB1	7.1
	V_{2} - CM ESS INST BUS PWR FROM RHEB PNL 276-CB2	7.1
	V_{3S} - SM ESS INST BUS PWR FROM RHEB PNL 276-CB3	7.1
	V_{4S} -SM ESS INST BUS PWR FROM RHEB PNL 276-CB4	7.1
	V_{SC} - SCE PWR REQ'D FOR SIGNAL CONDITIONING (+20, -20, and/or +10Vdc)	7.1 and Page 7-18
	V_{SC5} - SCE CM +5Vdc PWR	7.1
	V_{RCS} - SM RCS INDICATOR BUS POWER FROM SM MAIN BUS	10.2
	V_{RCS} - SM RCS INDICATOR BUS POWER FROM SM MAIN BUS	10.2

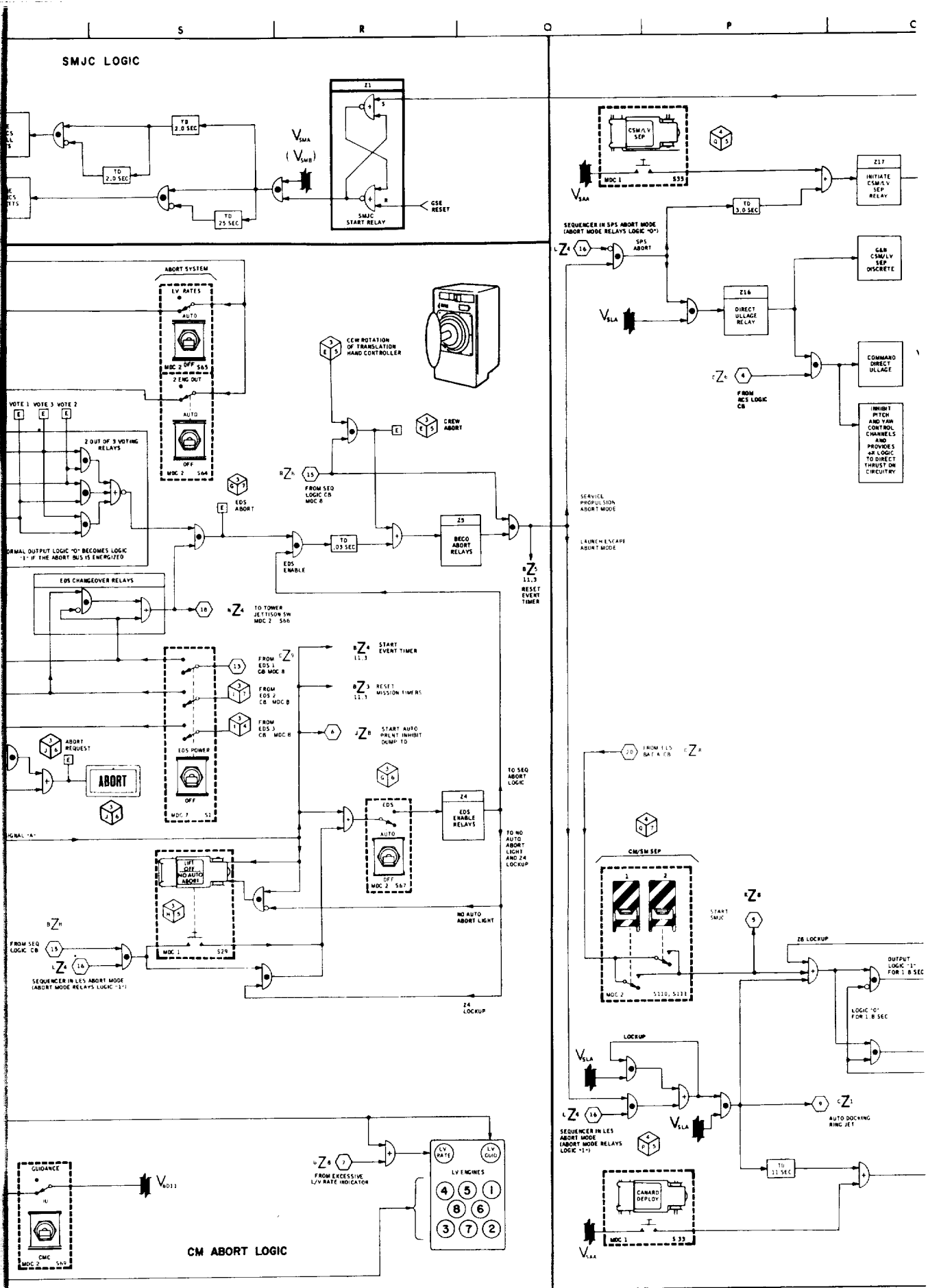
1.8.5.4 SCS logic buses .-

		Prime CSH generation dwg No.
V_{LB1}	- LOGIC BUS 1	8.2
V_{LB2}	- LOGIC BUS 2	8.2
V_{LB3}	- LOGIC BUS 3	8.2
V_{LB4}	- LOGIC BUS 4	8.2

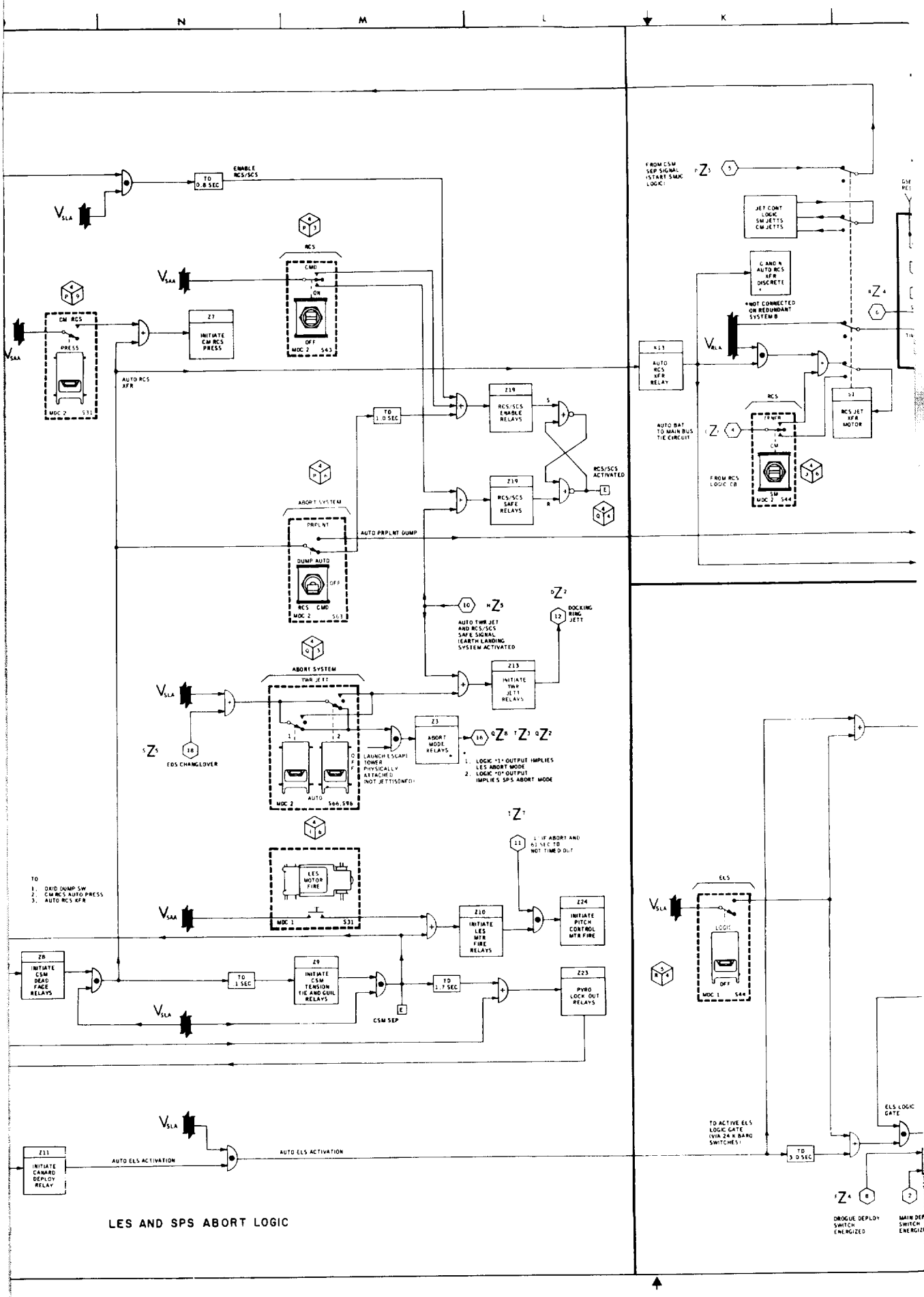

2 SEQUENTIAL
EVENTS SYSTEM



FOLDOUT FRAME 1

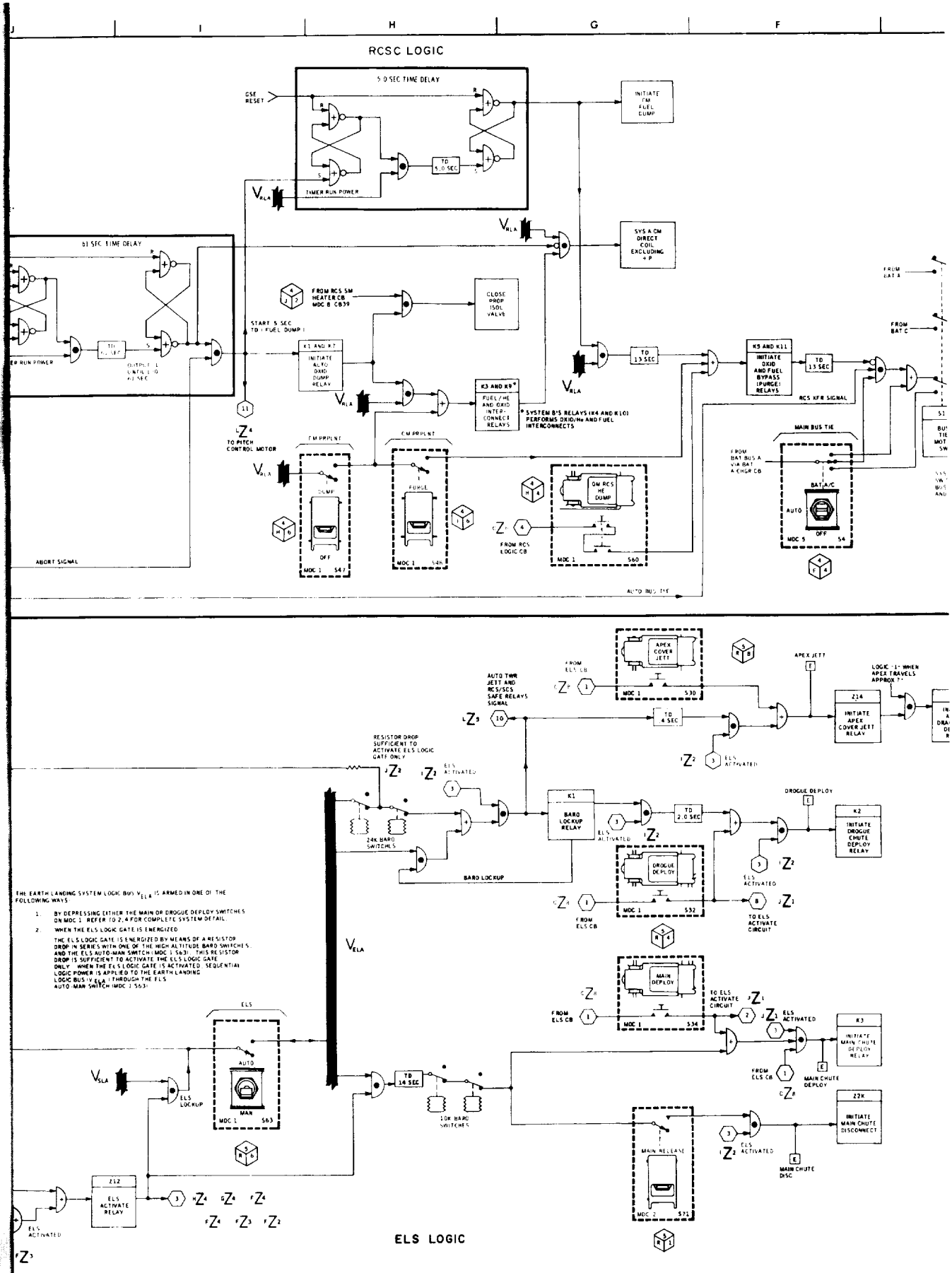


FOLDOUT FRAME 2



LES AND SPS ABORT LOGIC

FOLDOUT FRAME 3



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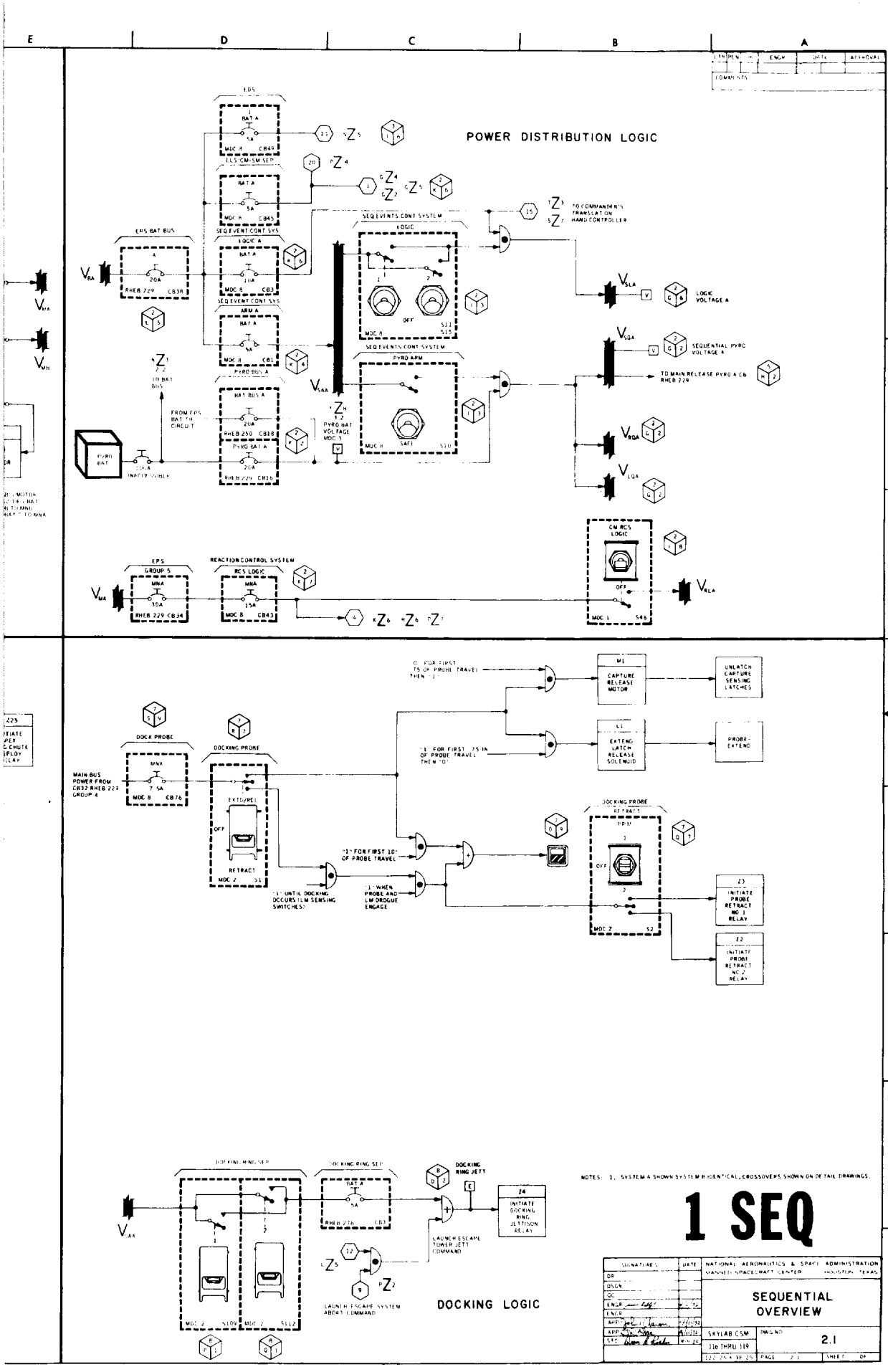

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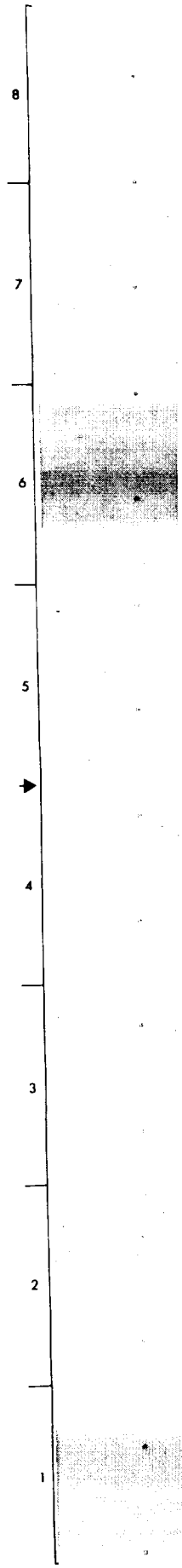

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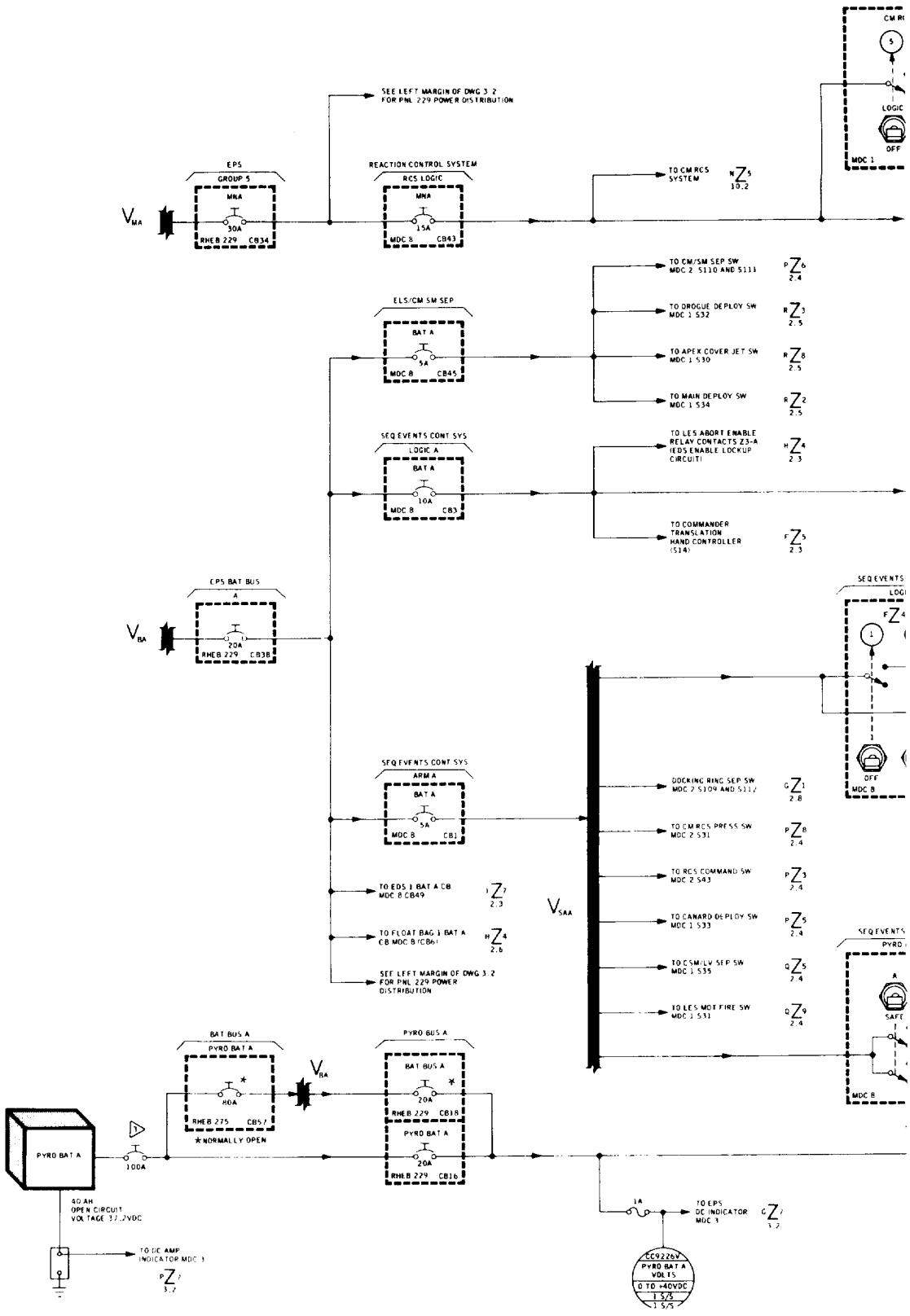
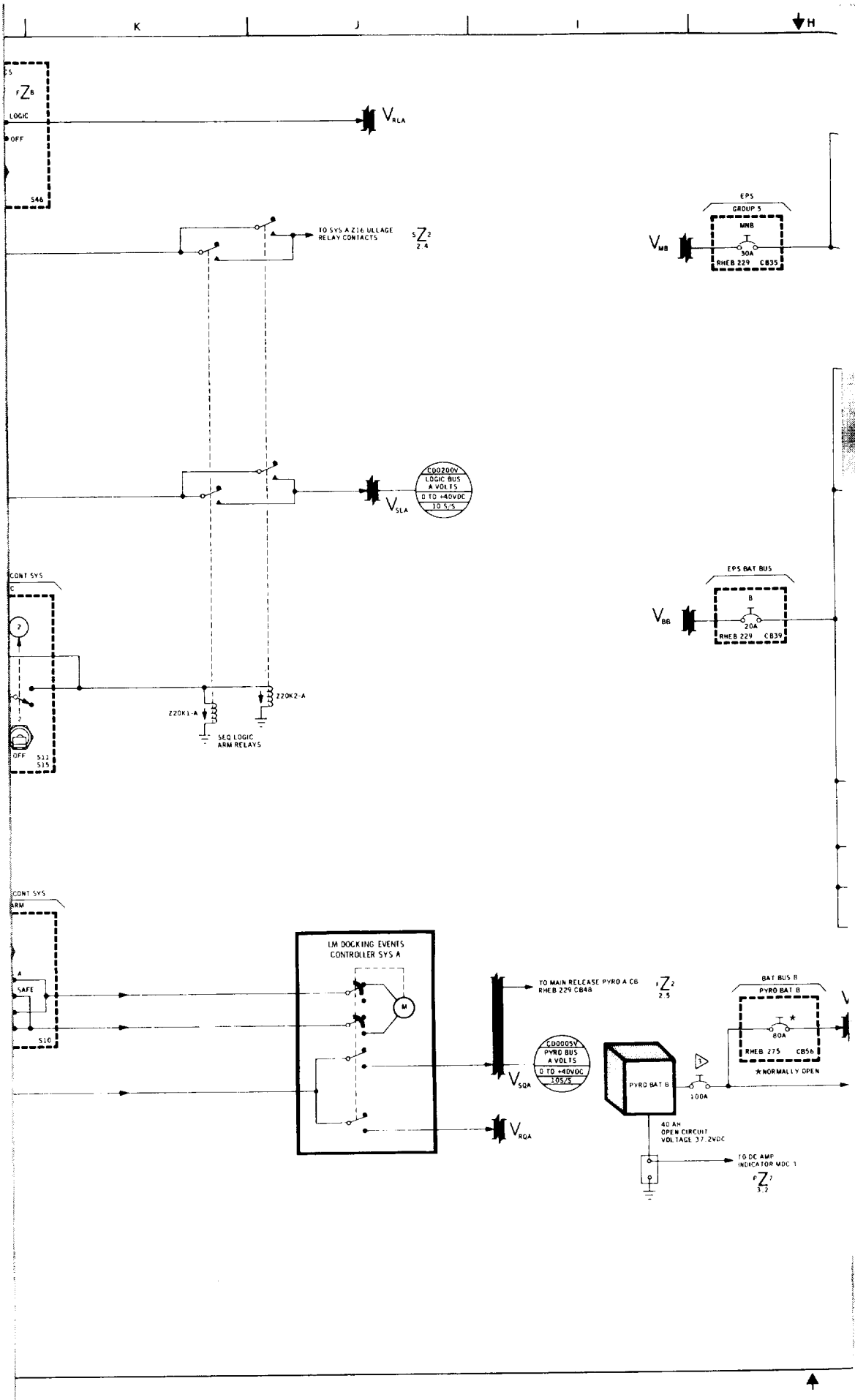
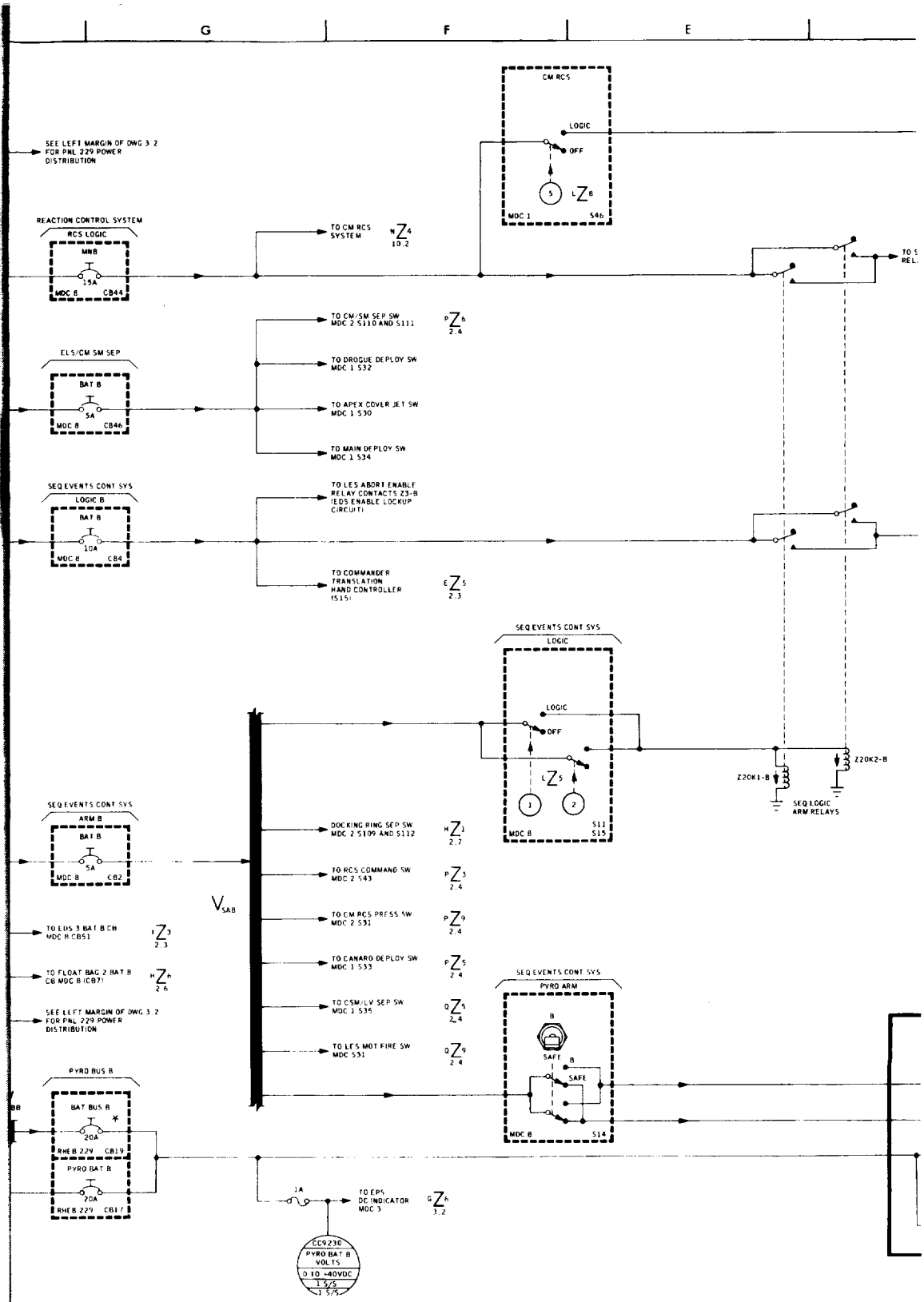


FOLDOUT FRAME 2



FOLDOUT FRAME 3



FOLDOUT FRAME 4

D. C B A

LTR	PCN	DR	ENGR	DATE	APPROVAL
COMMENTS					

8 7 6 5 4 3 2 1

V_{RLB}

YS B Z16 ULLAGE
AY CONTACTS

CD0201V
LOGIC BUS
B VOLTS
0 TO +40VDC
10 S/S

V_{SLB}

LM DOCKING EVENTS
CONTROLLER SYS B

M

TO MAIN RELEASE PYRO B CB
RHEB 229 CB49 (SYS B NOT SHOWN)

CD0006V
PYRO BUS
B VOLTS
0 TO +40VDC
10S/S

V_{SQB}

V_{RQB}

▷ INACCESSIBLE CIRCUIT BREAKERS

2

V_{ELA}	EARTH LANDING BUS A
V_{ELB}	EARTH LANDING BUS B
V_{RQA}	REACTION CONTROL SYSTEM CONTROLLER PYRO BUS A
V_{RQB}	REACTION CONTROL SYSTEM CONTROLLER PYRO BUS B
V_{RLA}	REACTION CONTROL SYSTEM CONTROLLER LOGIC BUS A
V_{RLB}	REACTION CONTROL SYSTEM CONTROLLER LOGIC BUS B
V_{SLA}	SEQUENTIAL LOGIC BUS A
V_{SLB}	SEQUENTIAL LOGIC BUS B
V_{SAA}	SEQUENTIAL ARM BUS A
V_{SAB}	SEQUENTIAL ARM BUS B

NOTES 1. THIS DRAWING SHOWS ARMING OF SYSTEM A AND SYSTEM B OF THE SEQUENTIAL EVENT CONTROL SYSTEM. IN GENERAL, OTHER DRAWINGS IN THIS SECTION SHOW ONLY SYSTEM A WITH APPROPRIATE SYSTEM B CROSSOVERS.

2 SEQ PWR

SIGNATURES	DATE
DR	1-13-71
DSGN	
QC	
ENGR	1/14/72
ENGR	
APP	1/14/72
APP	1/14/72
STC	1-14-72

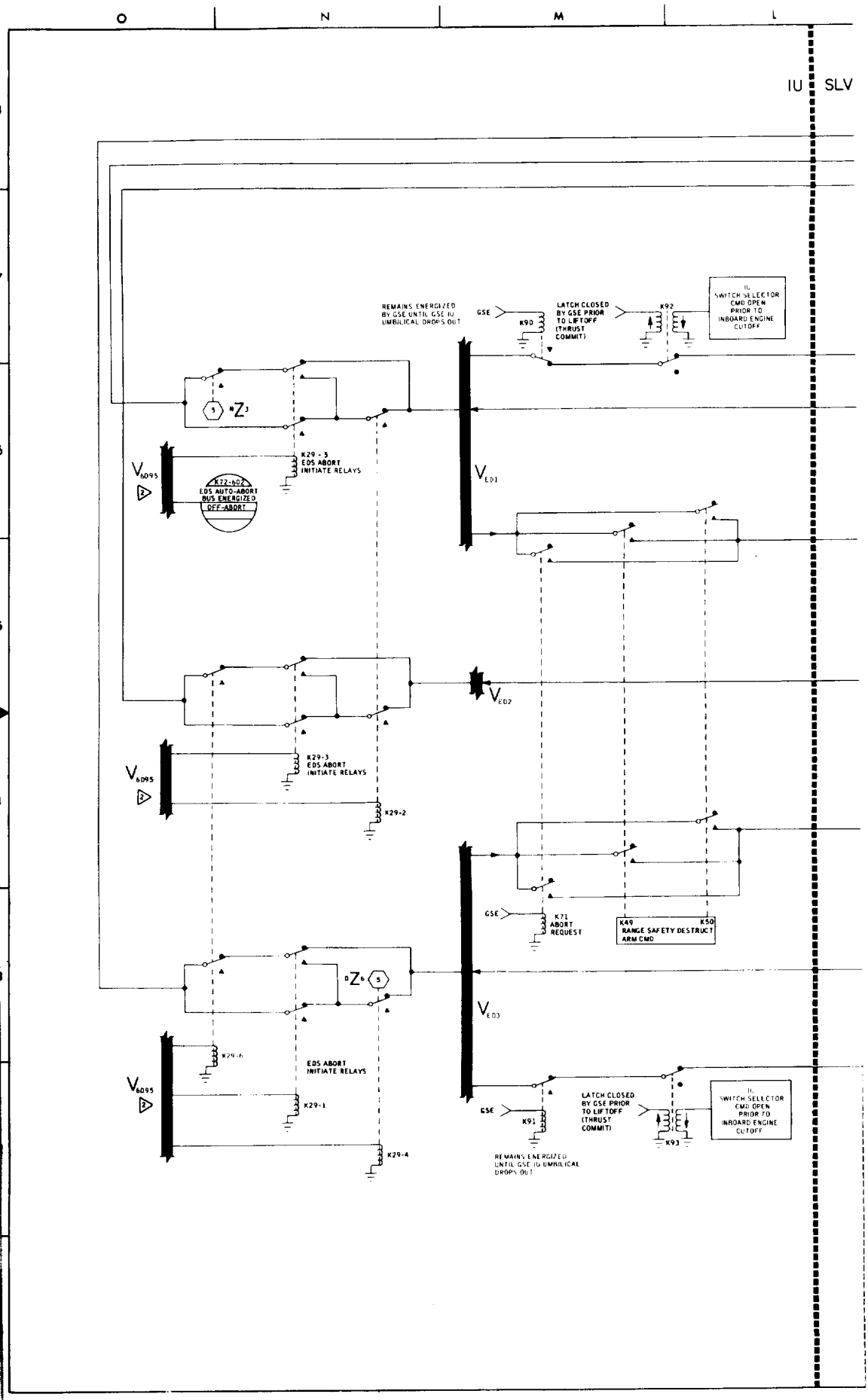
NATIONAL AERONAUTICS & SPACE ADMINISTRATION
MANNED SPACECRAFT CENTER . HOUSTON, TEXAS

SEQUENTIAL
POWER DISTRIBUTION

SKYLAB CSM	2.2
116 THRU 119	
82.5 X 34	PAGE 2-2 SHEET 1 OF 1

FOLDOUT FRAME 5

FOLDOUT FRAME /



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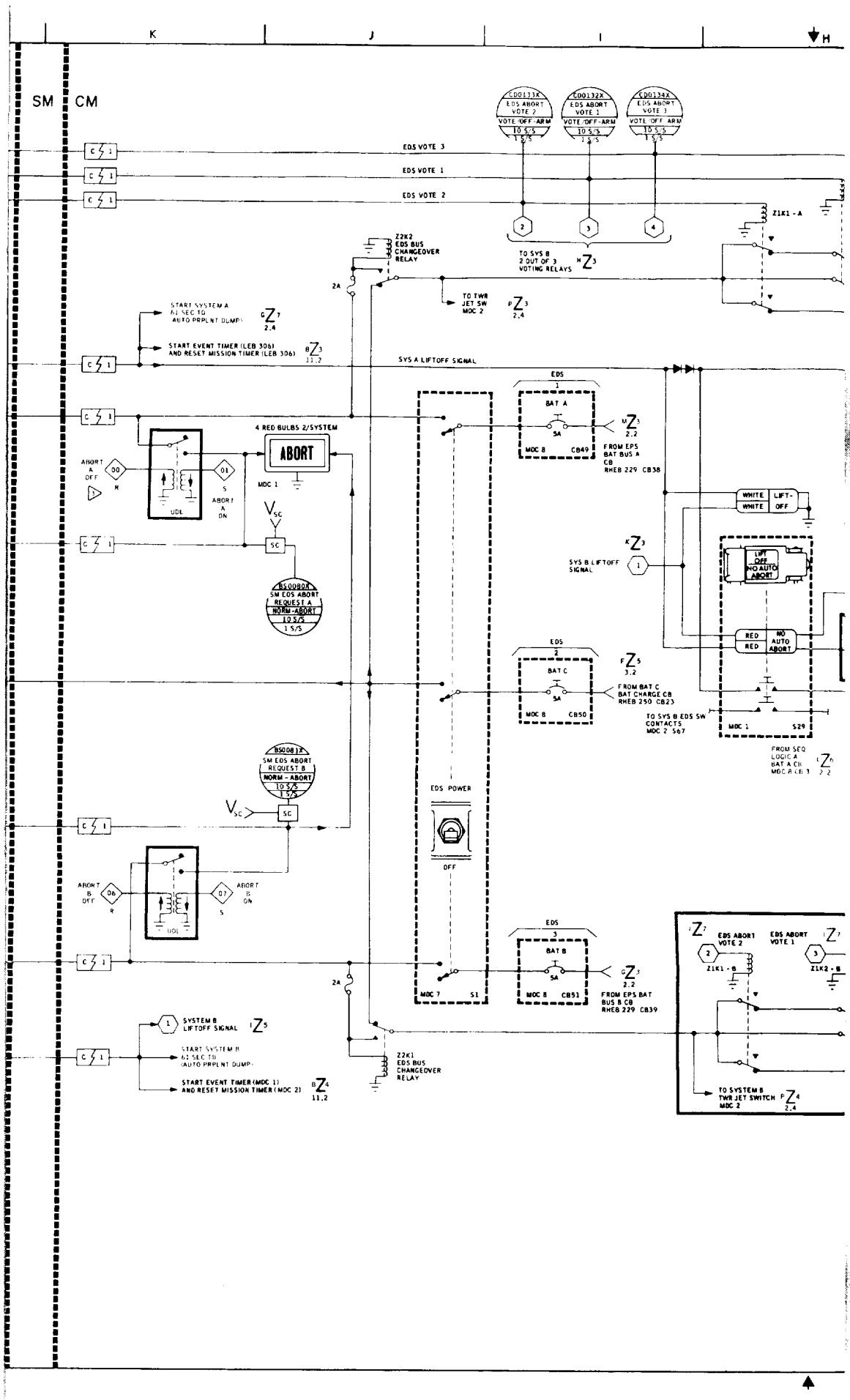
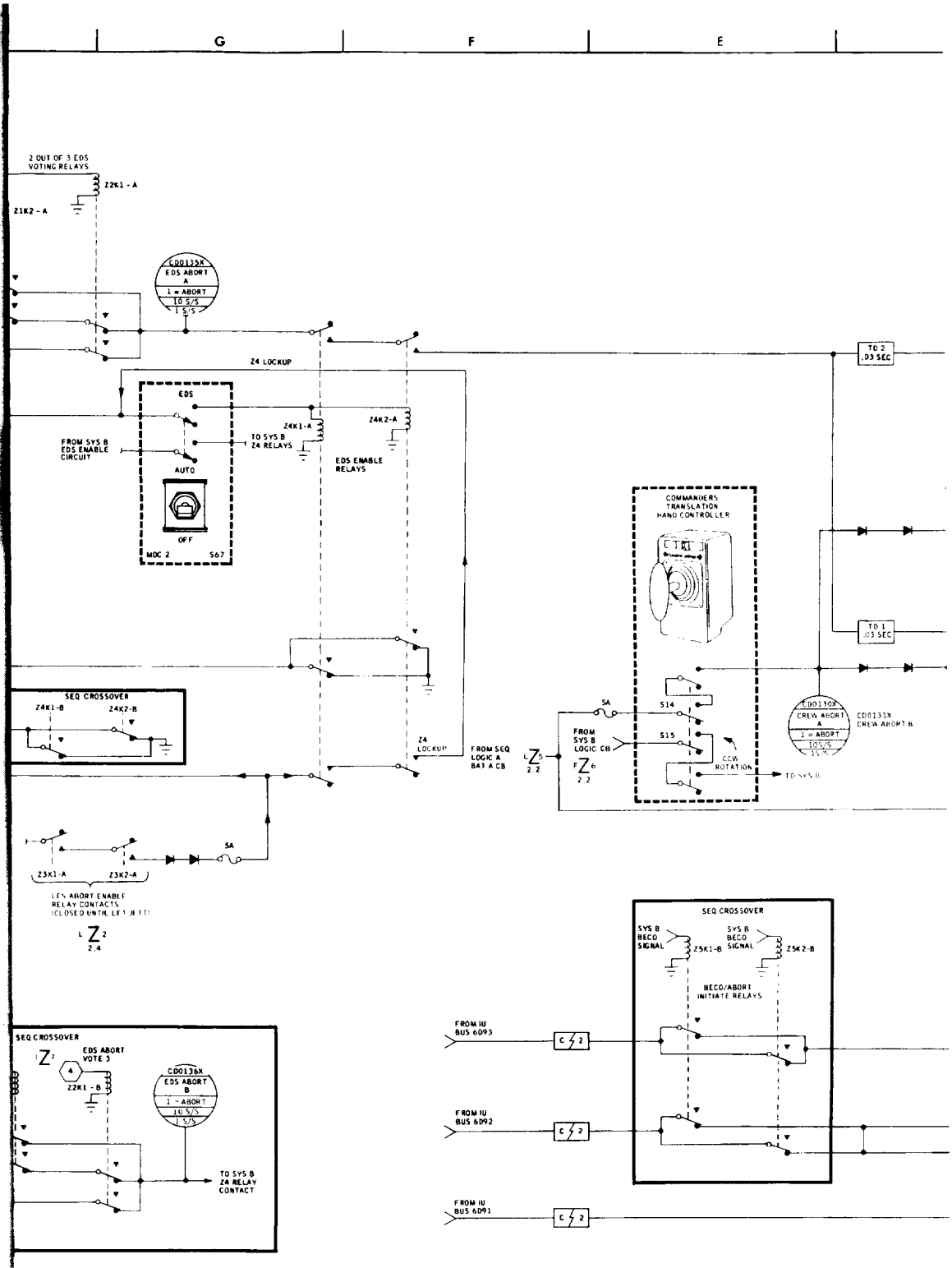


FOLDOUT FRAME 3

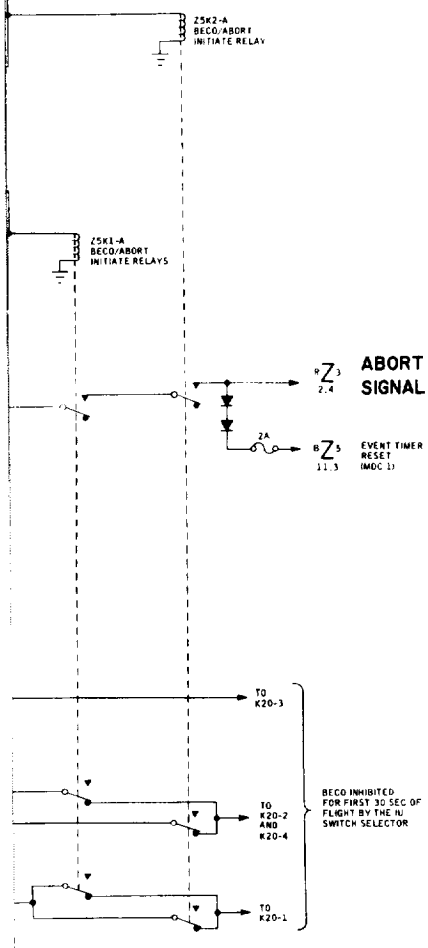


FOLDOUT FRAME 4

D C B A

LTR	PCN	DR	ENGR	DATE	APPROVAL

COMMENTS



1. UP TM EMR RESET SW WILL NOT RESET SYSTEM A ABORT REQUEST LIGHT

2. A. THE EDS ABORT BUS NO95 MAY BE ARMED IN ONE OF THE FOLLOWING MANNERS
   1. L/V PITCH AND YAW RATES > TBD
   2. L/V RATES > TBD DEG/SEC IN ROLL
   3. TWO FIRST STAGE ENGINES DEVELOP < 90 PCT RATED THRUST

   B. THE ABOVE ABORT INPUTS TO EDS ABORT BUS NO95 MAY BE DISABLED IN ONE OF THE FOLLOWING MANNERS
   1. L/V RATE BY L/V RATE SWITCH TO OFF (MDC 2 S65
   2. 2 ENG OUT BY 2 ENG OUT SWITCH TO OFF (MDC 2 S64
   3. BY IU SWITCH SELECTOR PRIOR TO S-IB/S-IVB STAGING
   4. BY GSE PRIOR TO THRUST COMMIT

NOTES: 1. SYSTEM A SHOWN WITH SYSTEM B CROSSOVERS. SYSTEM B IS IDENTICAL

3 ABORT INIT

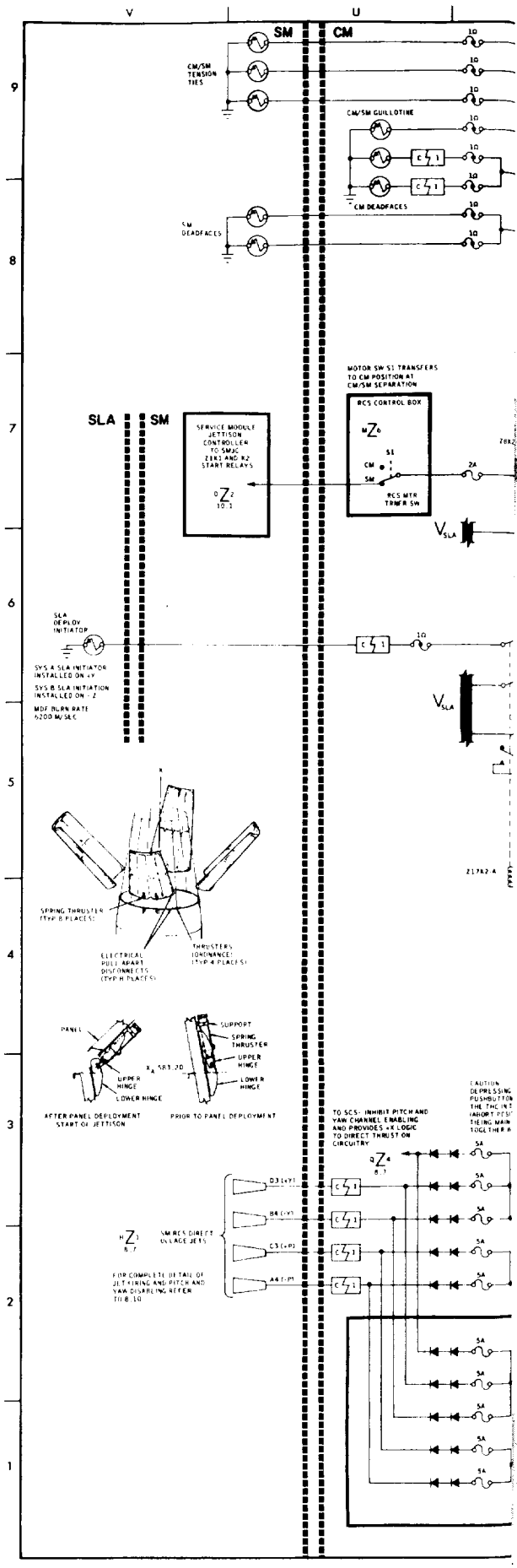
SIGNATURES	DATE
DR	
OSGN	
QC	
ENGR	
ENGR	
APP	
APP	
STC	

NATIONAL AERONAUTICS & SPACE ADMINISTRATION
MANNED SPACECRAFT CENTER - HOUSTON, TEXAS

SEQUENTIAL ABORT INITIATION

SKYLAB CSM 116 THRU 119	DWG NO 2.3
82.5 X 34	PAGE 2-3 SHEET 1 OF 1

FOLDOUT FRAME 5



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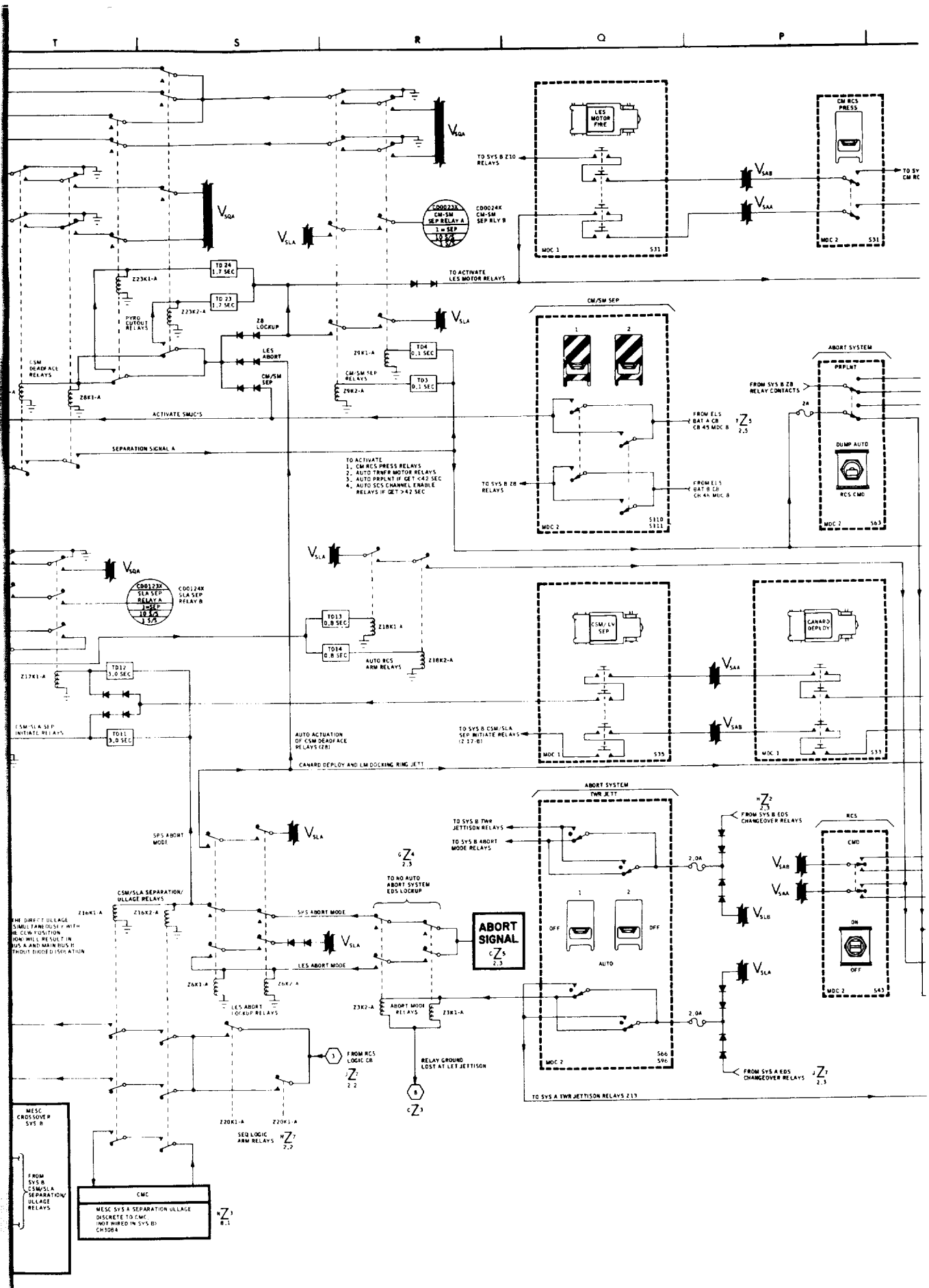
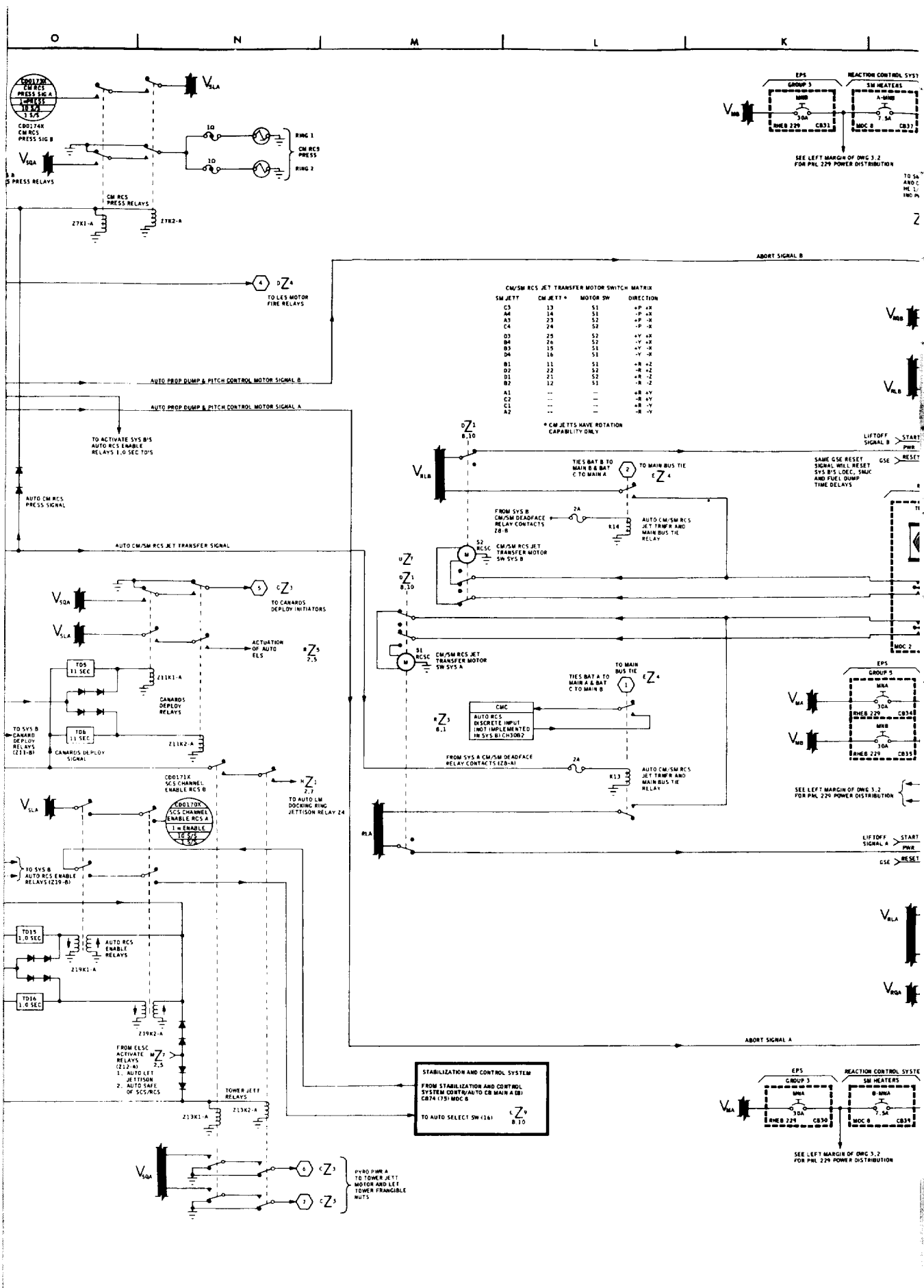


FOLDOUT FRAME 2



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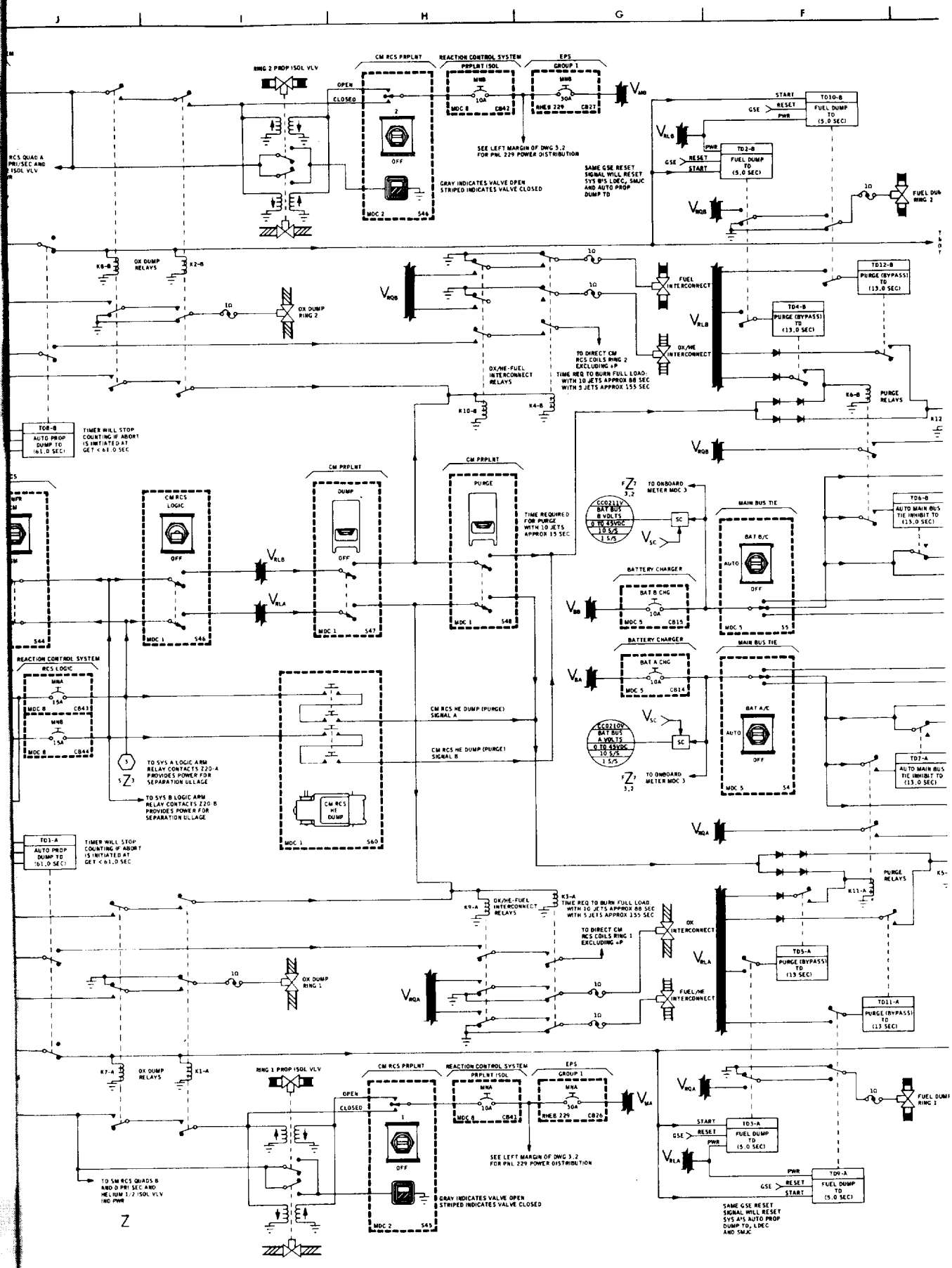

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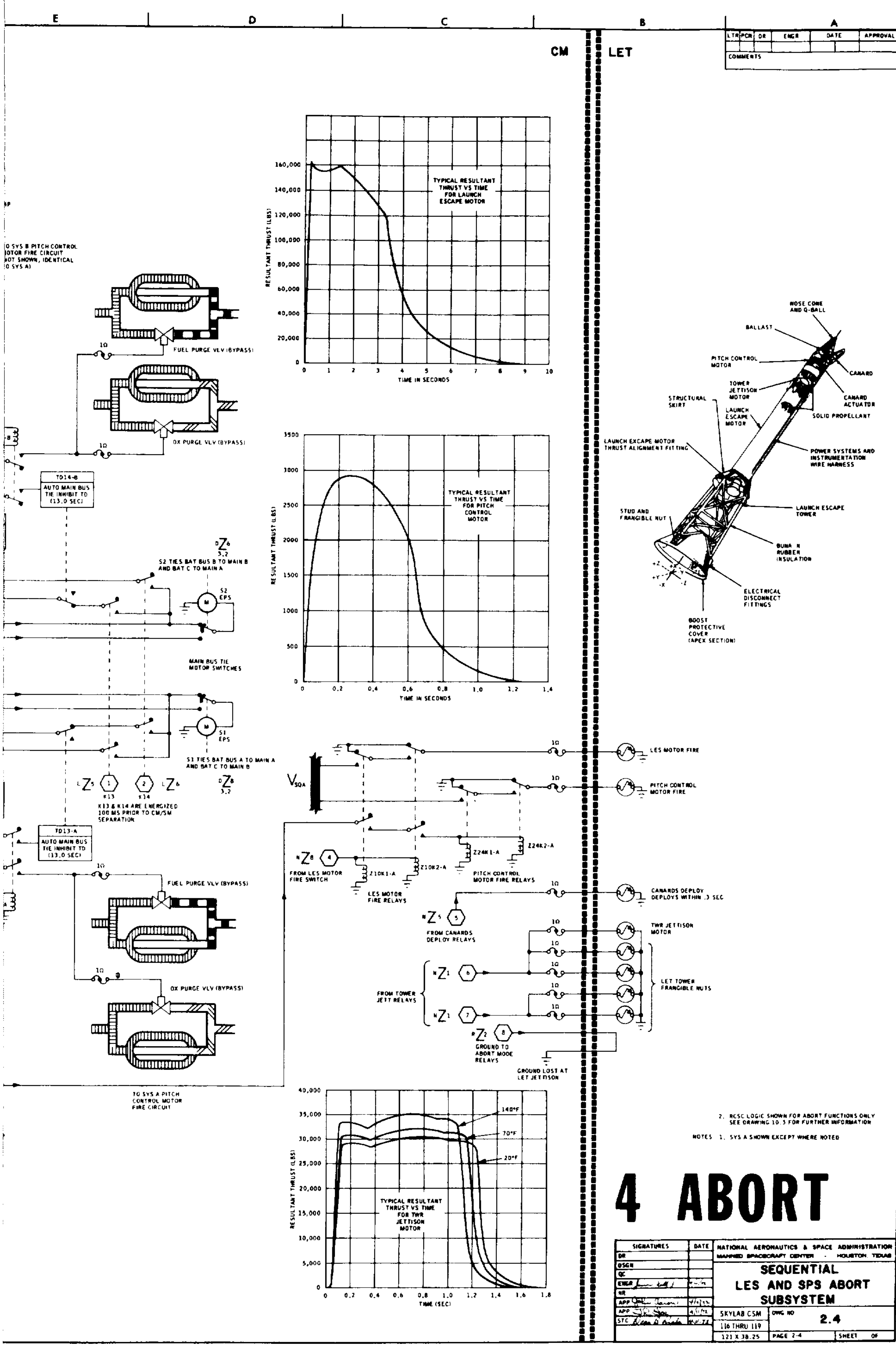
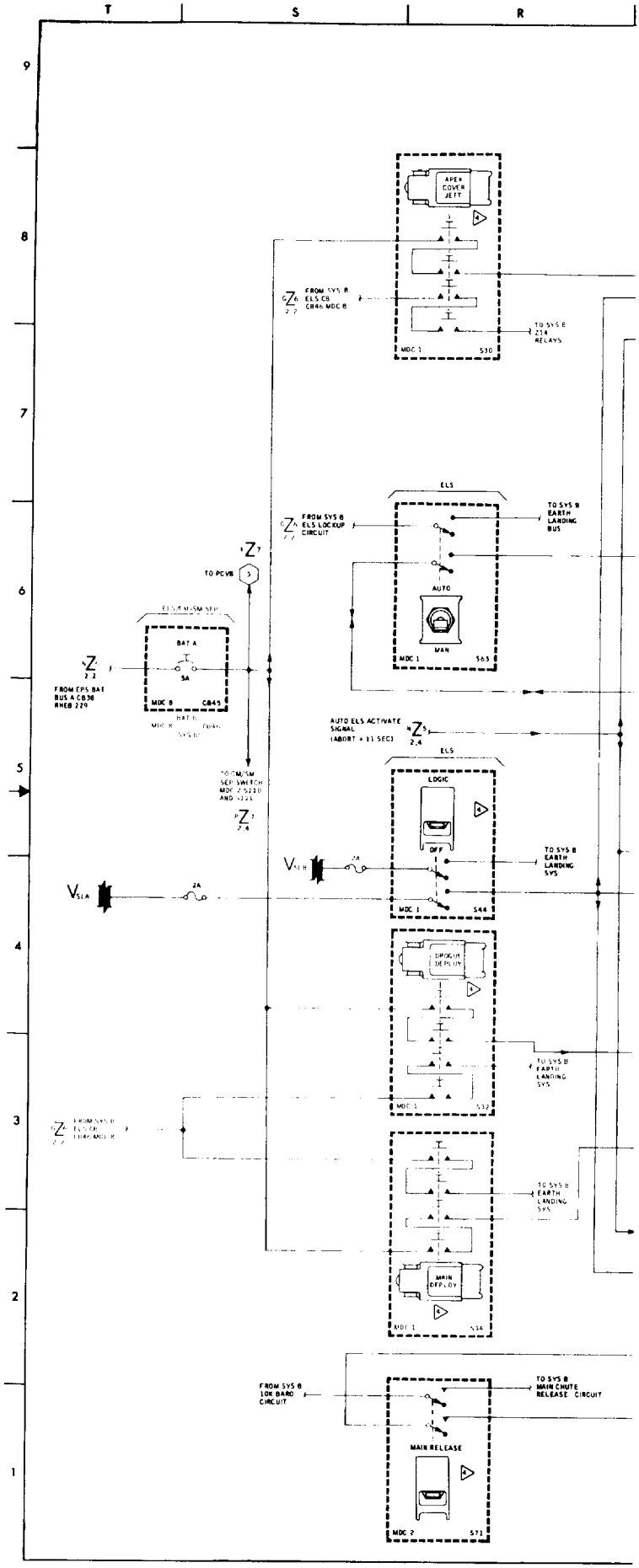


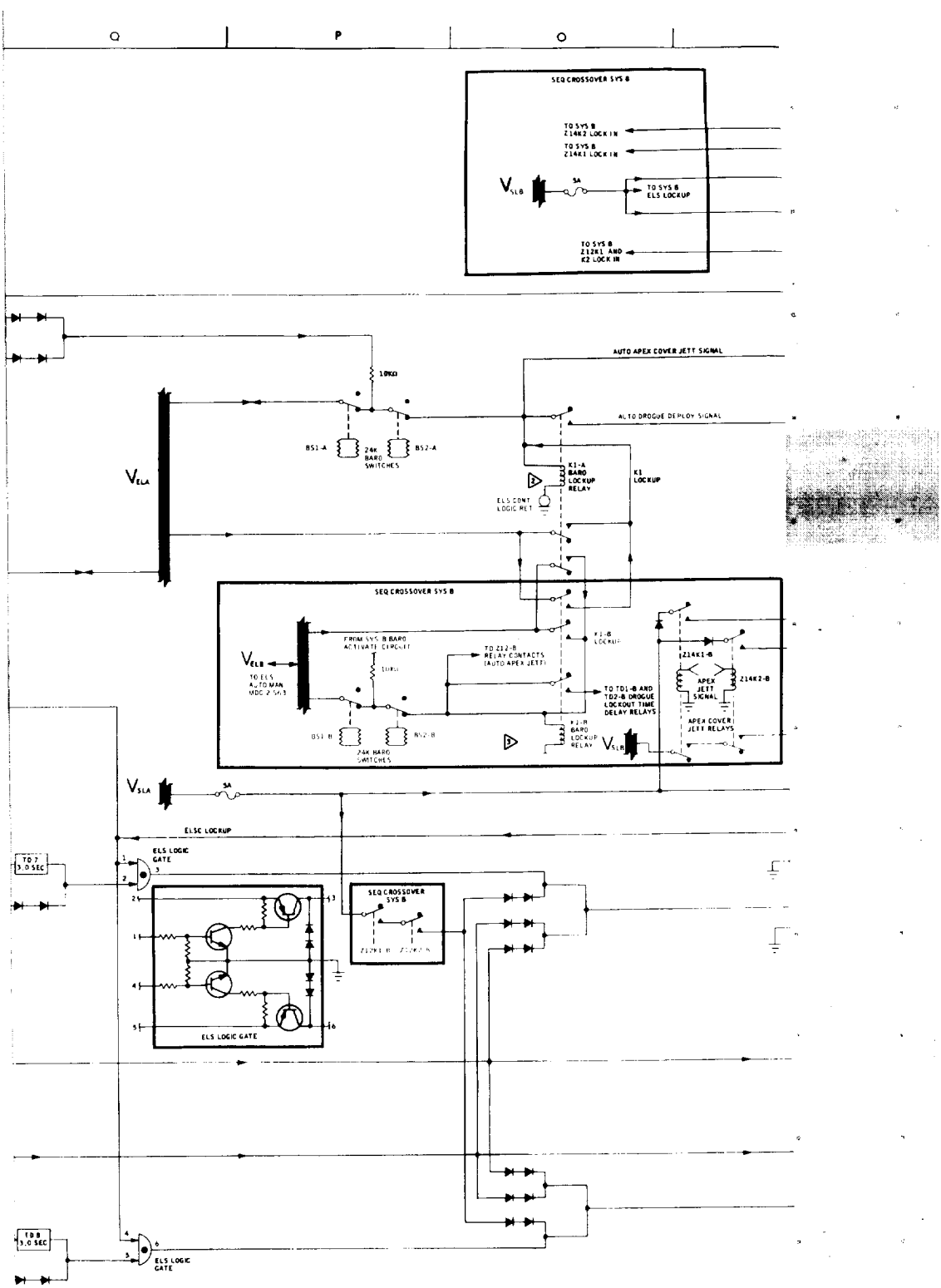
4 ABORT

SIGNATURES	DATE	NATIONAL AERONAUTICS & SPACE ADMINISTRATION MANNED SPACECRAFT CENTER - HOUSTON, TEXAS
DR		SEQUENTIAL LES AND SPS ABORT SUBSYSTEM
SKYLAB CSM 116 THRU 119		DWG NO 2.4
121 X 38.25	PAGE 2-4	SHEET OF

FOLDOUT FRAME 5



FOLDOUT FRAME



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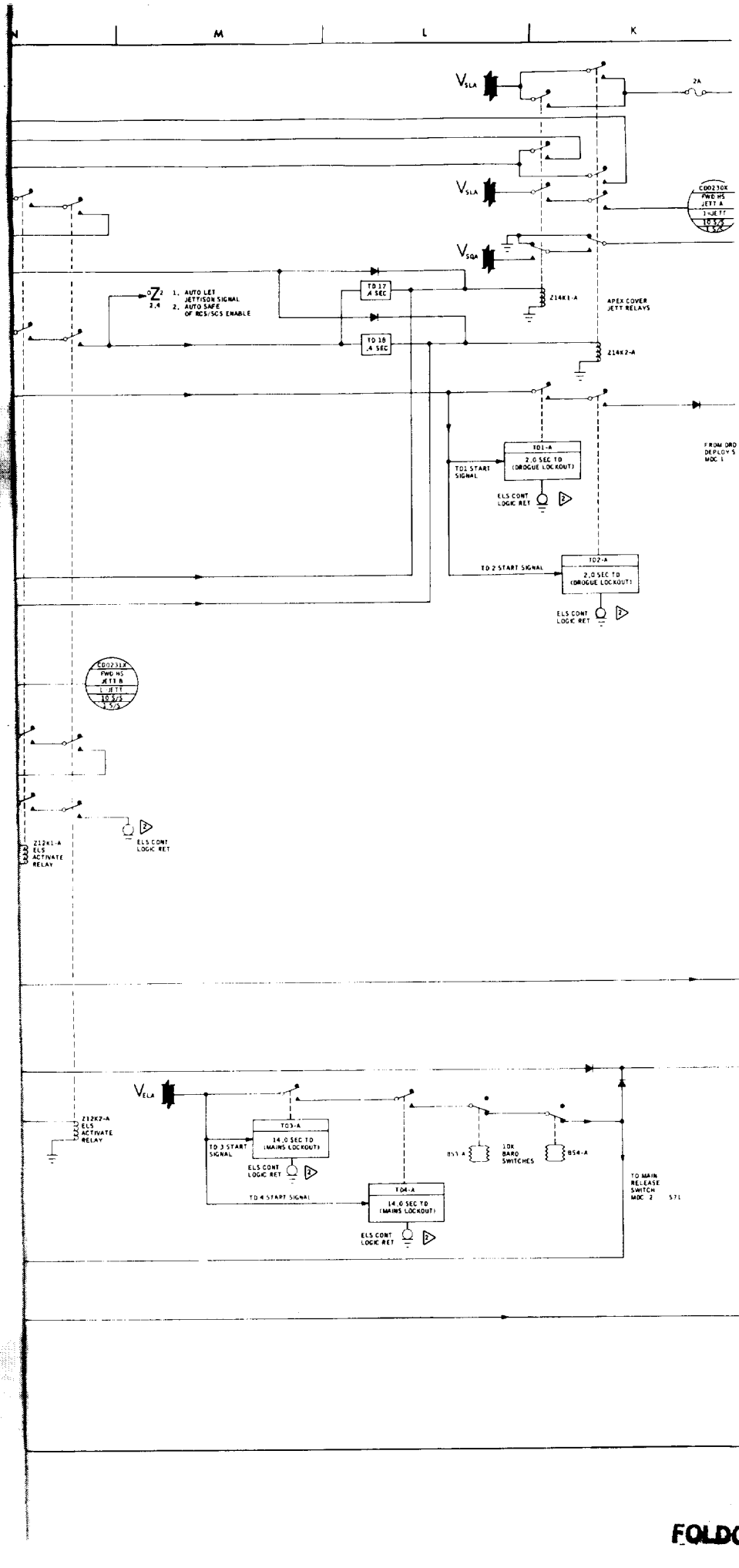

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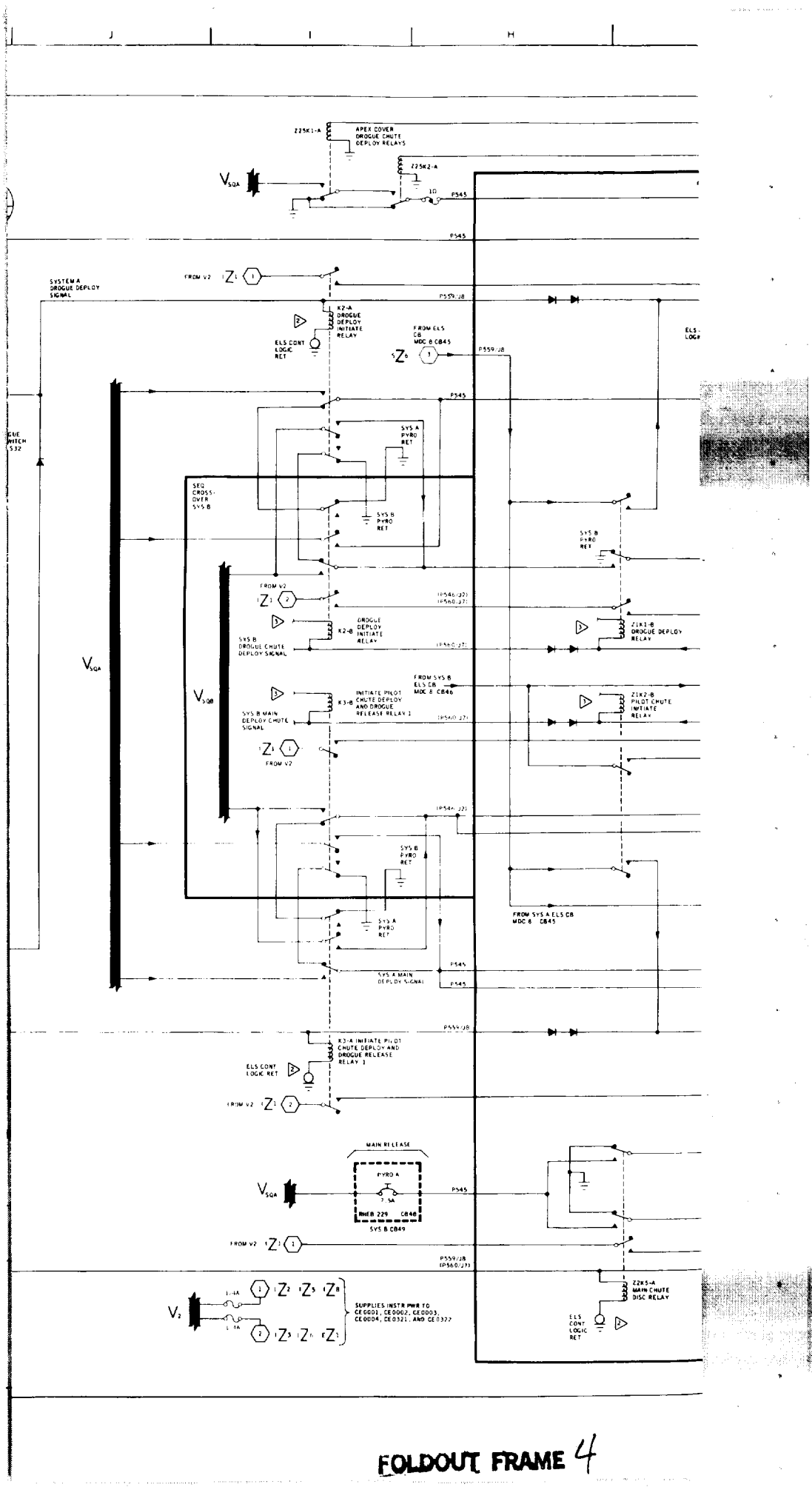
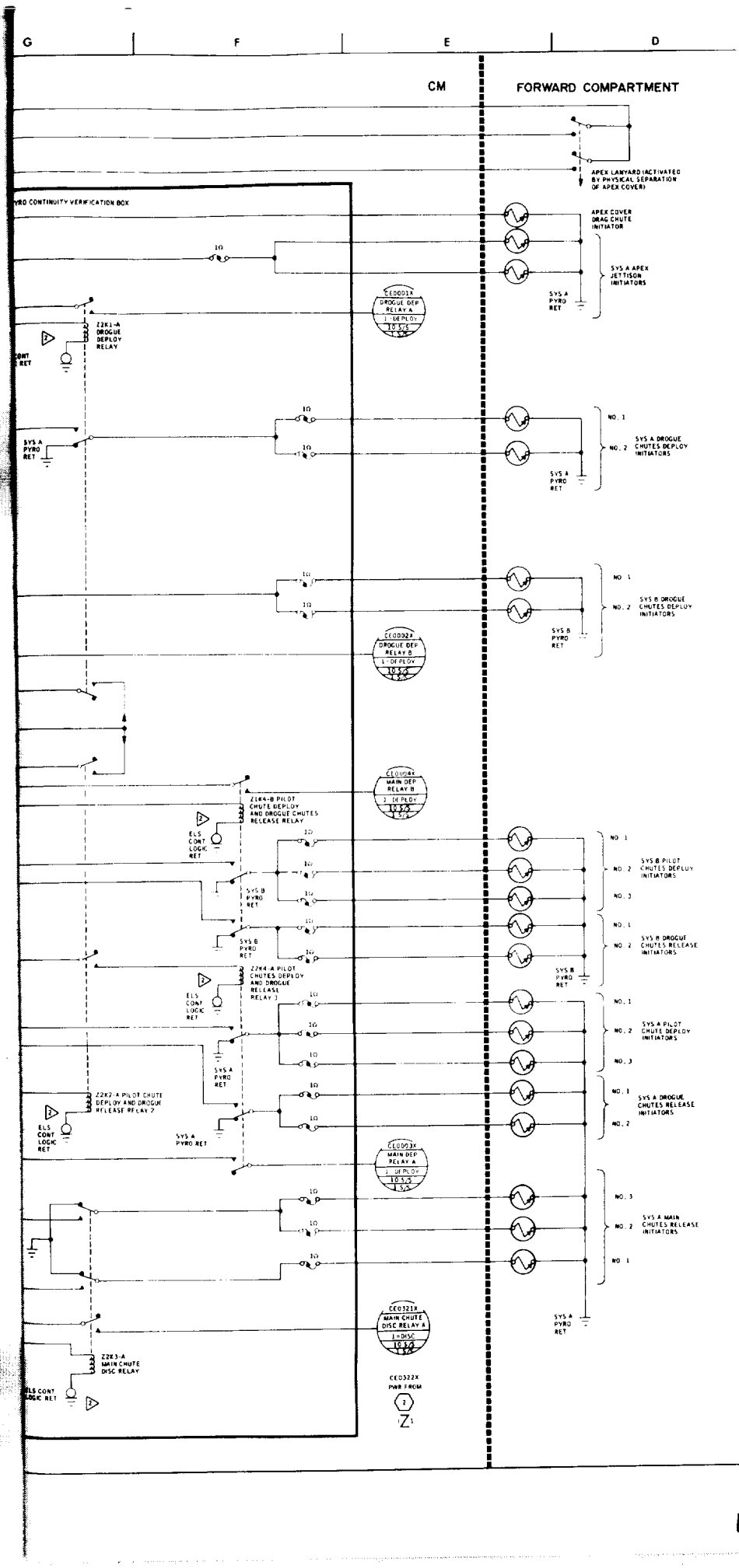
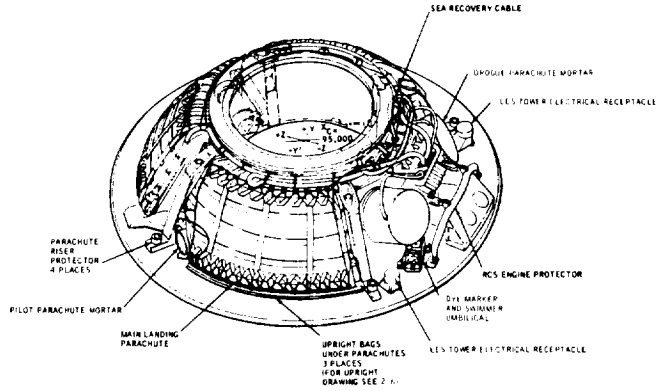


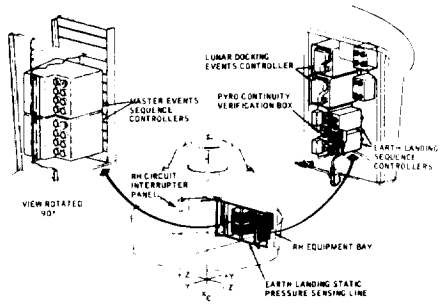
FOLDOUT FRAME 4



FOLDOUT FRAME 5

LTR	PCN	DR	ENGR	DATE	APPROVAL
COMMENTS					





△1 SWITCH LOCATED UNDER PROTECTIVE COVER

△2 RELAYS WILL NOT BE GROUNDED UNTIL ELS ACTIVATED RELAYS Z12(SYS B) ARE ENERGIZED

△3 RELAYS WILL NOT BE GROUNDED UNTIL THE ELS ACTIVATE RELAYS Z12(SYS A) ARE ENERGIZED

NOTES 1. SYSTEM A SHOWN EXCEPT WHERE NOTED. PYRO VERIFICATION BOX SHOWN WITH SYSTEM A FUNCTIONS AND SYSTEM B CROSSOVERS. SYSTEM B MAIN CHUTE RELEASE IDENTICAL TO SYSTEM A.

5 EARTH LDG

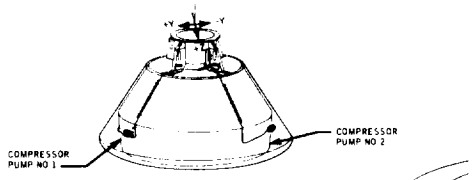
SIGNATURES	DATE
DR	
DSGN	
QC	
ENGR	
I-NC	
APP	
APP	
SPC	

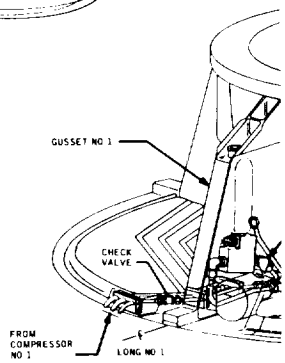
NATIONAL AERONAUTICS & SPACE ADMINISTRATION
MANNED SPACECRAFT CENTER · HOUSTON, TEXAS

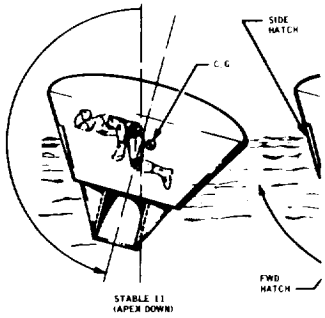
SEQUENTIAL EARTH LANDING SUBSYSTEM

SKYLAB CSM | DWG NO. 2.5
110 THRU 119
11.0 X 38.25 | PAGE 2-5 | SHEET 1 OF 1

FOLDOUT FRAME 6







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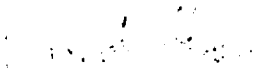
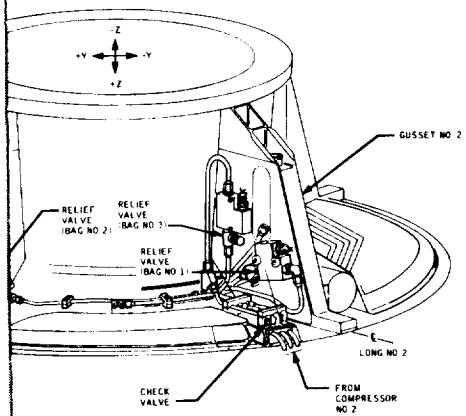
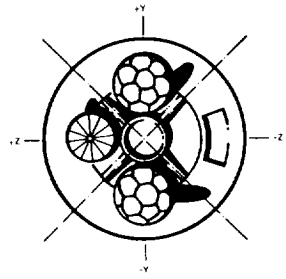
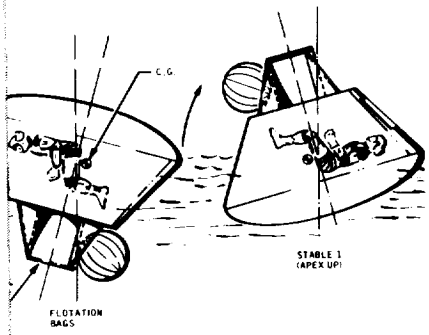
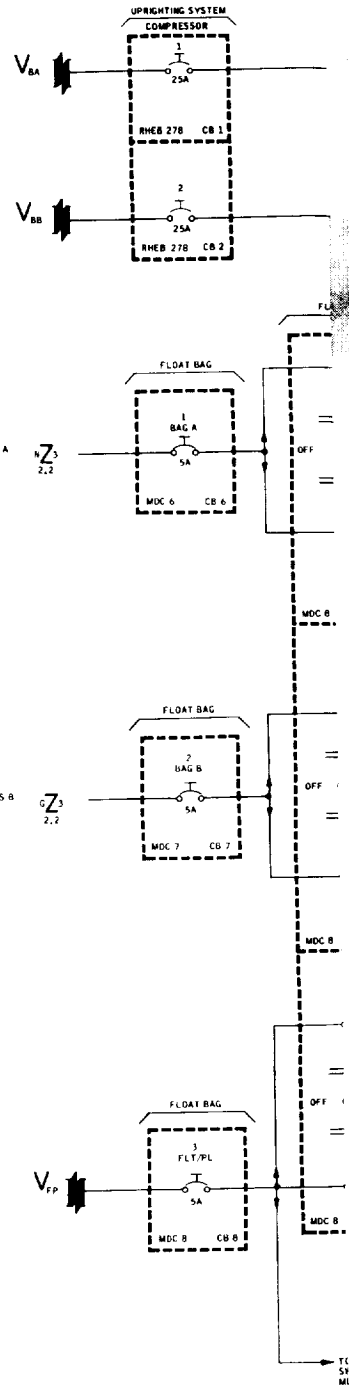


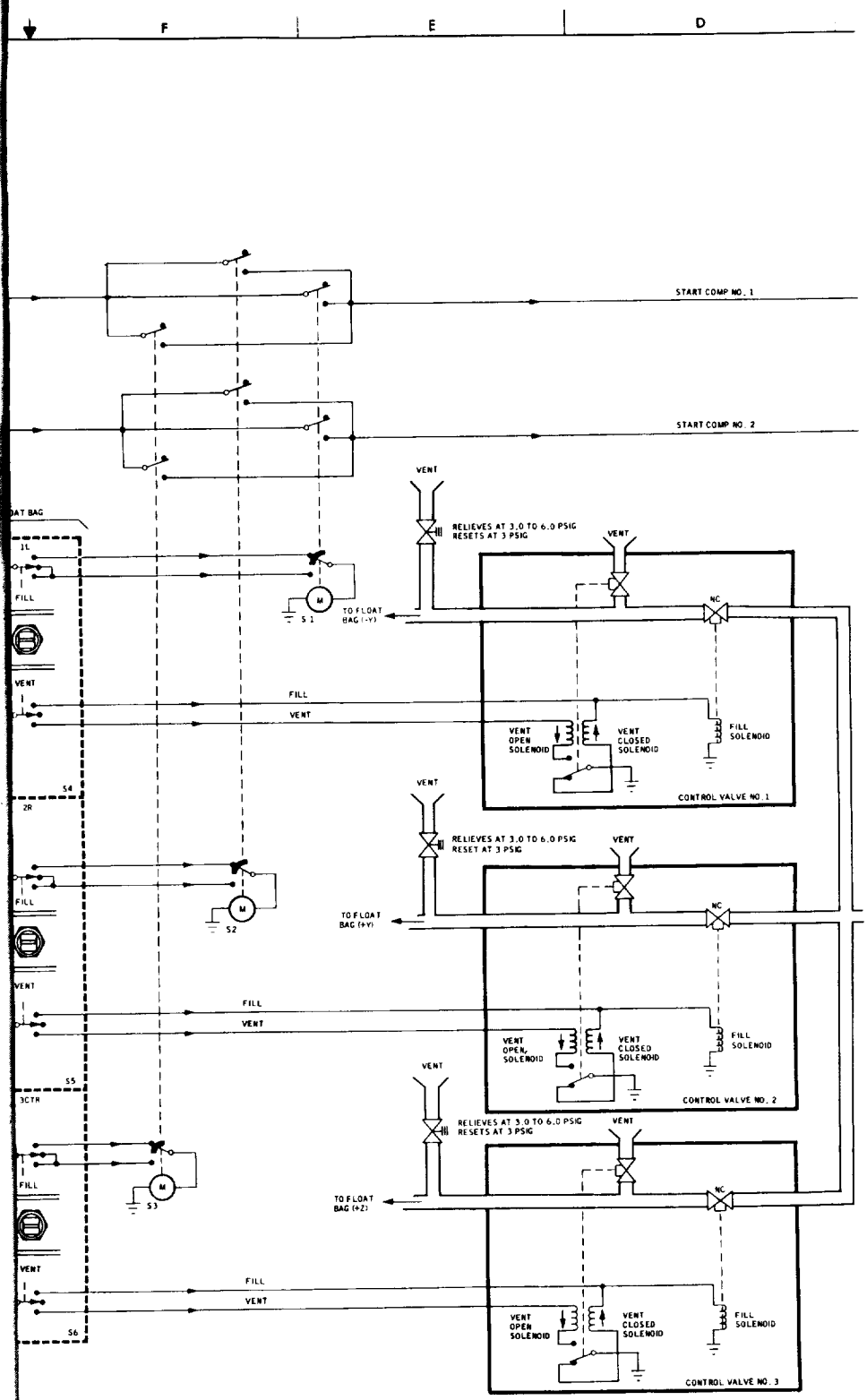






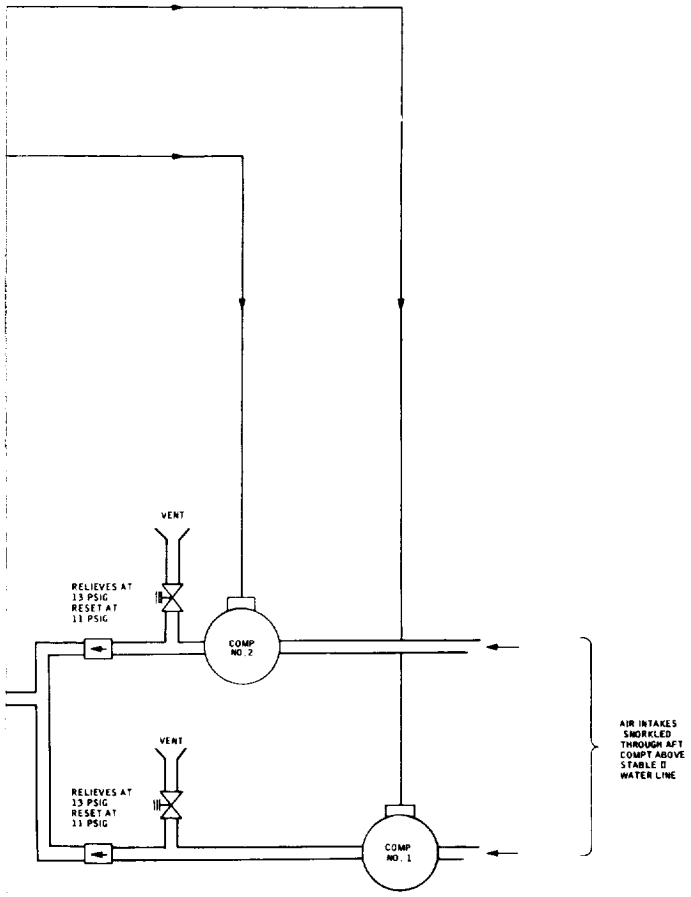


FOLDOUT FRAME 2



FOLDOUT FRAME 3

LTR	PCN	DR	ENGR	DATE	APPROVAL
COMMENTS					



3. APPROXIMATE TIME TO UPRIGHT
   1 COMPRESSOR, 3 BAGS-12 MINUTES
   2 COMPRESSOR, 3 BAGS-5 MINUTES
   2 COMPRESSOR, 2 BAGS-10 MINUTES

2. BAG CAPICITY
   + Y 43 IN DIA @ 24 CUBIC FEET
   - Y 43 IN DIA @ 24 CUBIC FEET
   + Z 34 IN DIA @ 12 CUBIC FEET

NOTES: 1. THIS DRAWING SHOWS BOTH SYSTEM A AND SYSTEM B OF THE COMMAND MODULE UPRIGHTING SYSTEM

6 UPRIGHTING

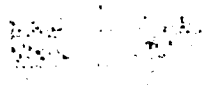
SIGNATURES	DATE
DR	5-2-72
DSGN	
QC	
ENGR	
ENGR	
APP	4/11/72
APP	4/11/72
STC	4-9-72

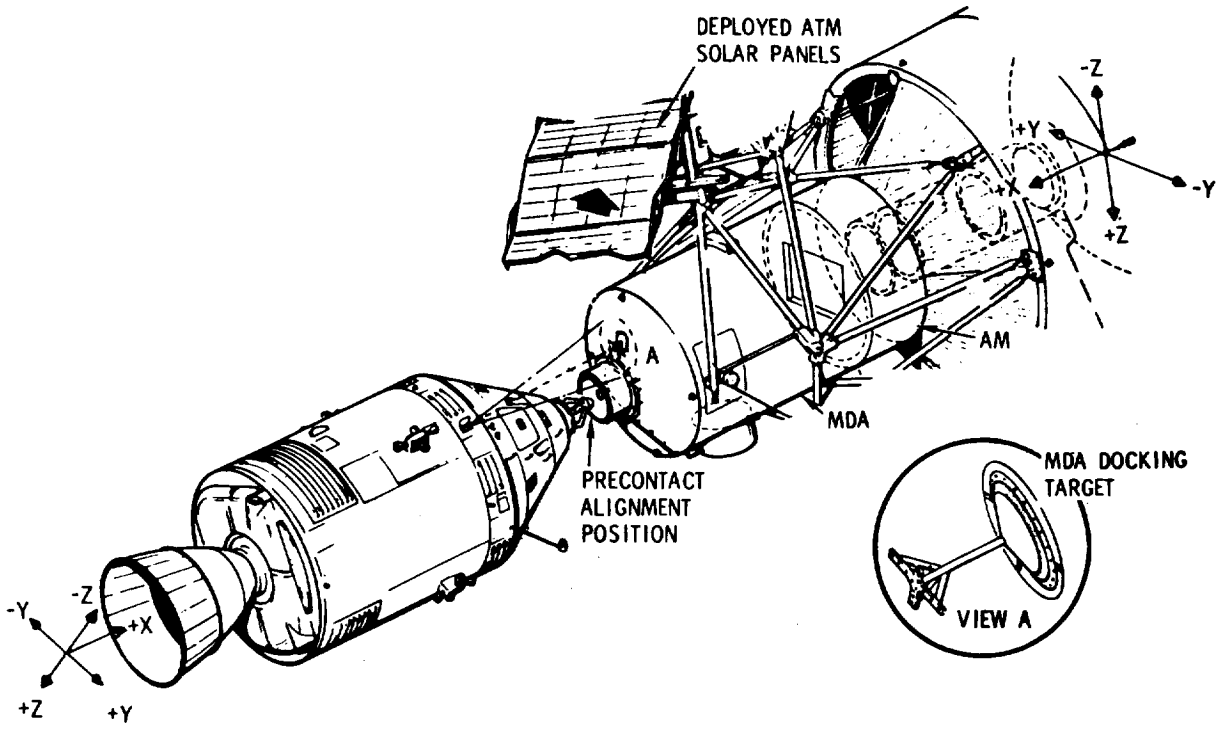
NATIONAL AERONAUTICS & SPACE ADMINISTRATION
MANNED SPACECRAFT CENTER - HOUSTON TEXAS

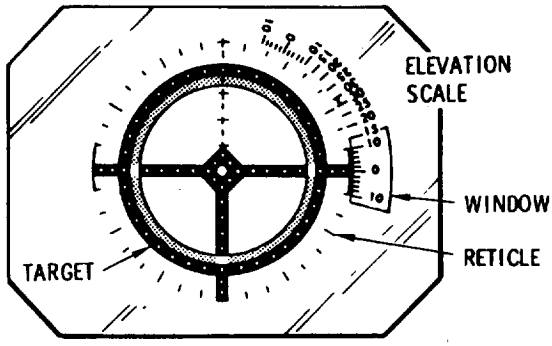
SEQUENTIAL UPRIGHTING SYSTEM

SKYLAB CSM	DWG NO 2.6
116 THRU 119	
34 X 66	PAGE 2-6 SHEET 1 OF 1

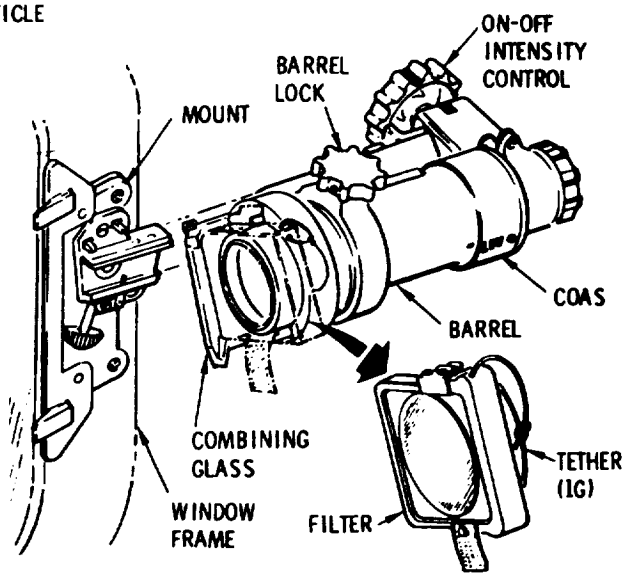
FOLDOUT FRAME 4





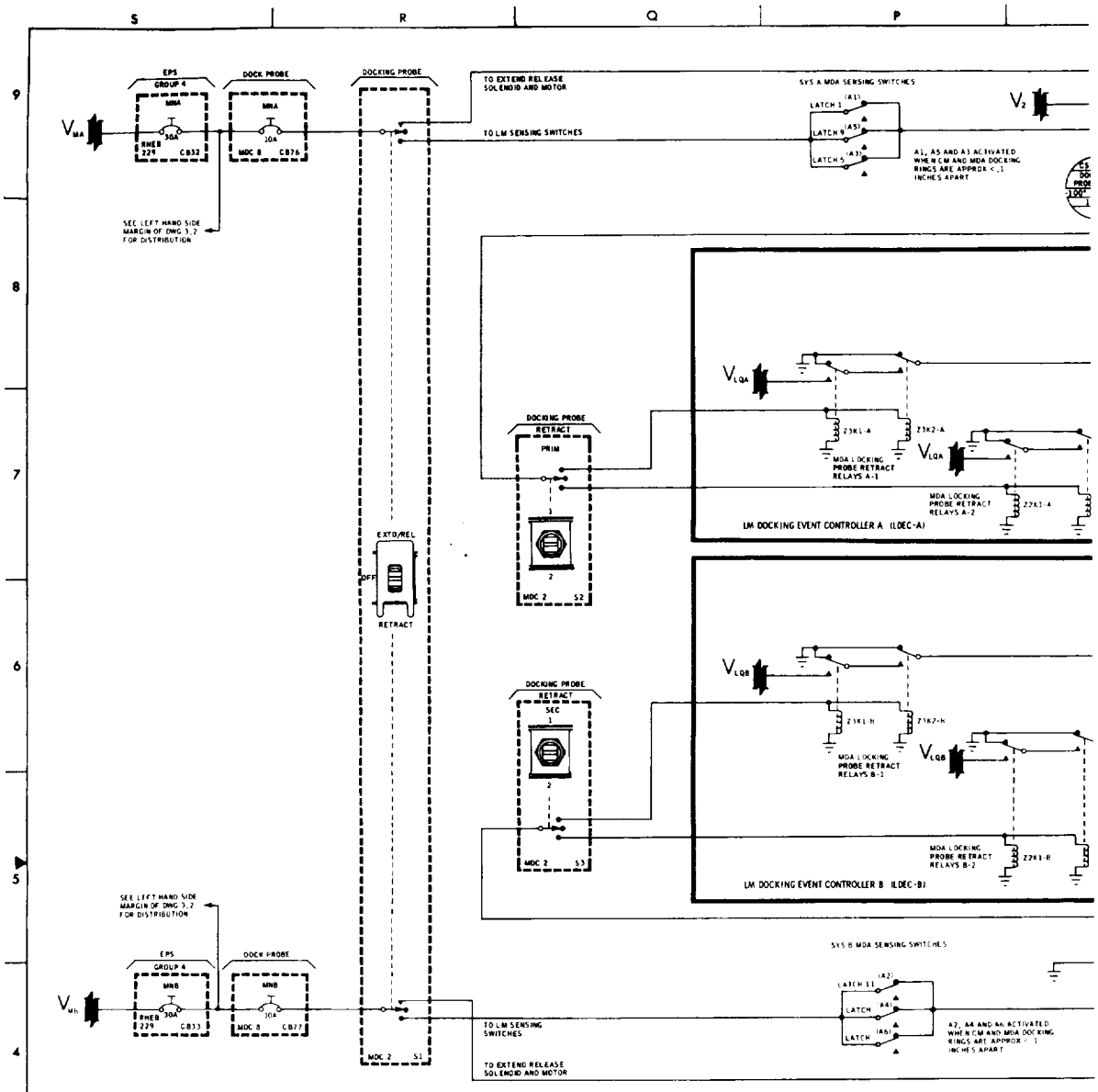


(PRE-CONTACT POSITION MODEL)



CREWMAN OPTICAL ALIGNMENT SIGHT SYSTEM
APRON ITEM DWG NO 2.7

FOLDOUT FRAME



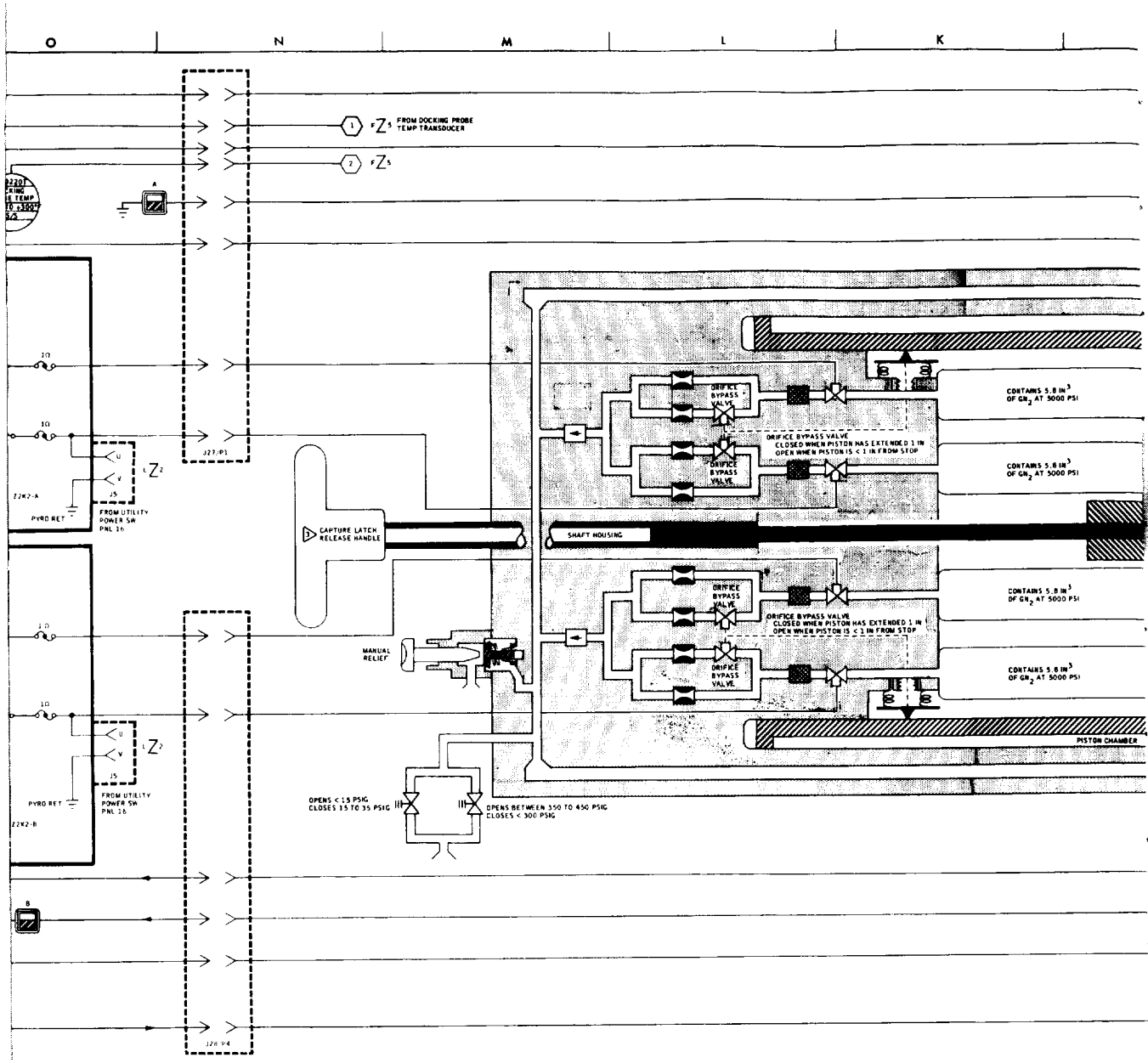
	DOCKING PROBE EXTD/REL-RET SWITCH POSITION	NORMAL EXTENSION PROBE >10 INCHES	PROBE < 3/4 IN	PROBE > 3/4 IN < 10 IN	NO PROBE POWER	PROBE >10 IN BUT CAPTURE LATCHES NOT COCKED
EXTENSION	EXTD					
	OFF					
	RET					
	SHOCK	YES	NO	NO	NO	YES

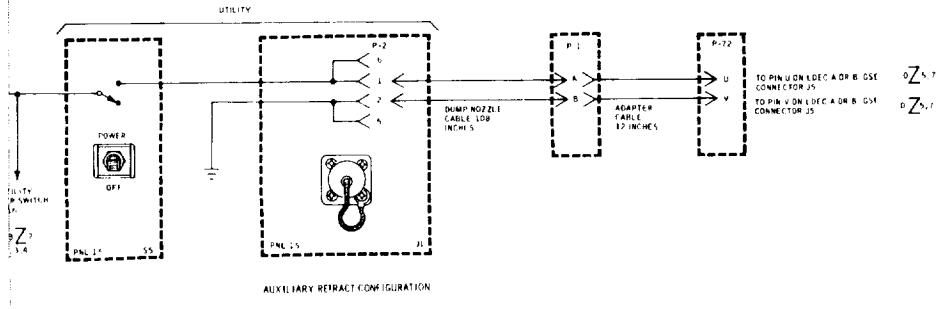
	DOCKING PROBE EXTD/REL-RET SWITCH POSITION	NORMAL PRIOR TO CAPTURE	NORMAL AT CAPTURE
CAPTURE	EXTD		
	OFF		
	RET		
	SHOCK	NO	YES

	DOCKING PROBE EXTD/REL-RET SWITCH POSITION	NORMAL RETRACTION (HARD DOCKED)
RETRACTION	EXTD	
	OFF	
	RET	
	SHOCK	YES

* DO NOT PLACE SWITCH IN THIS POSITION

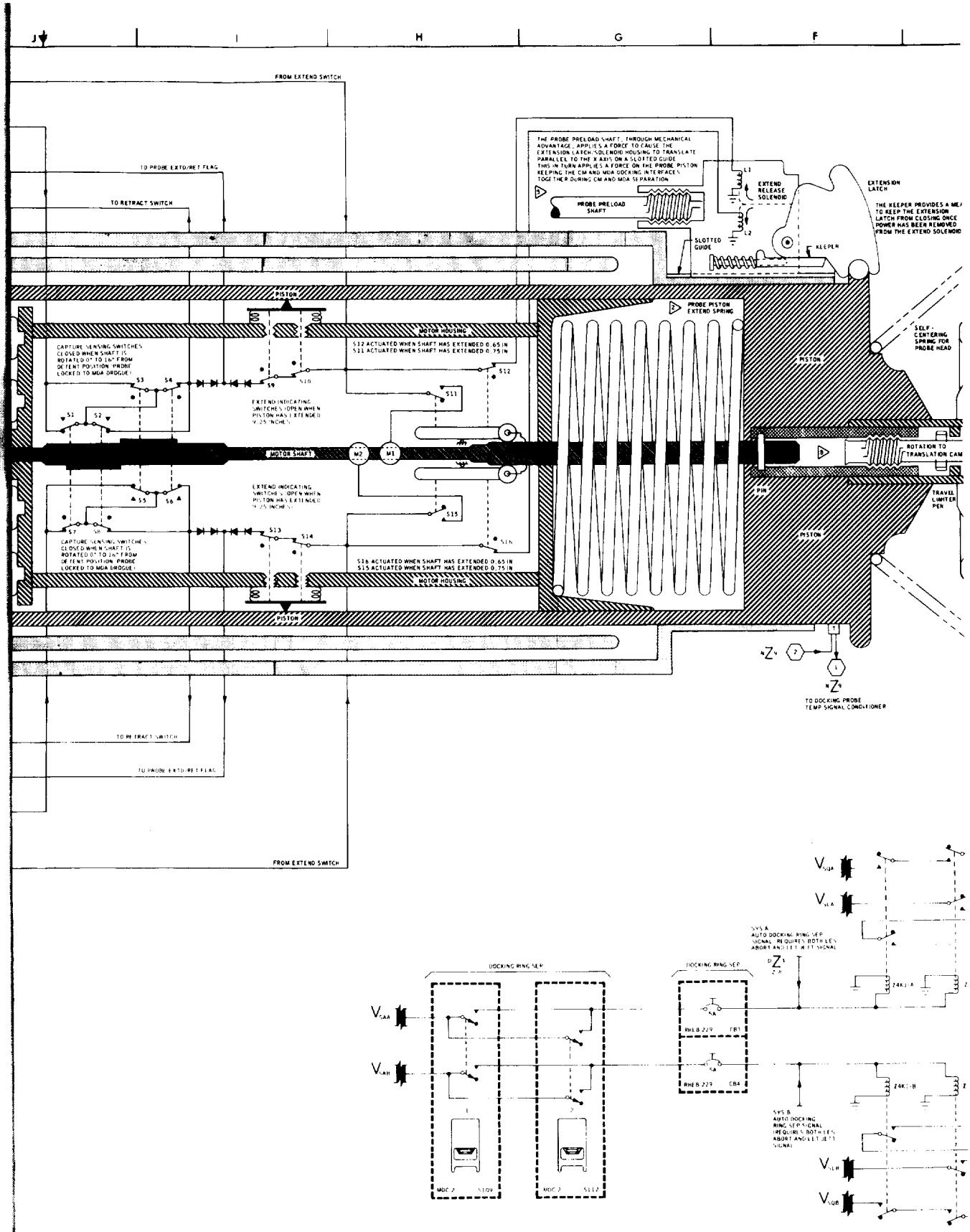
FOLDOUT FRAME 2





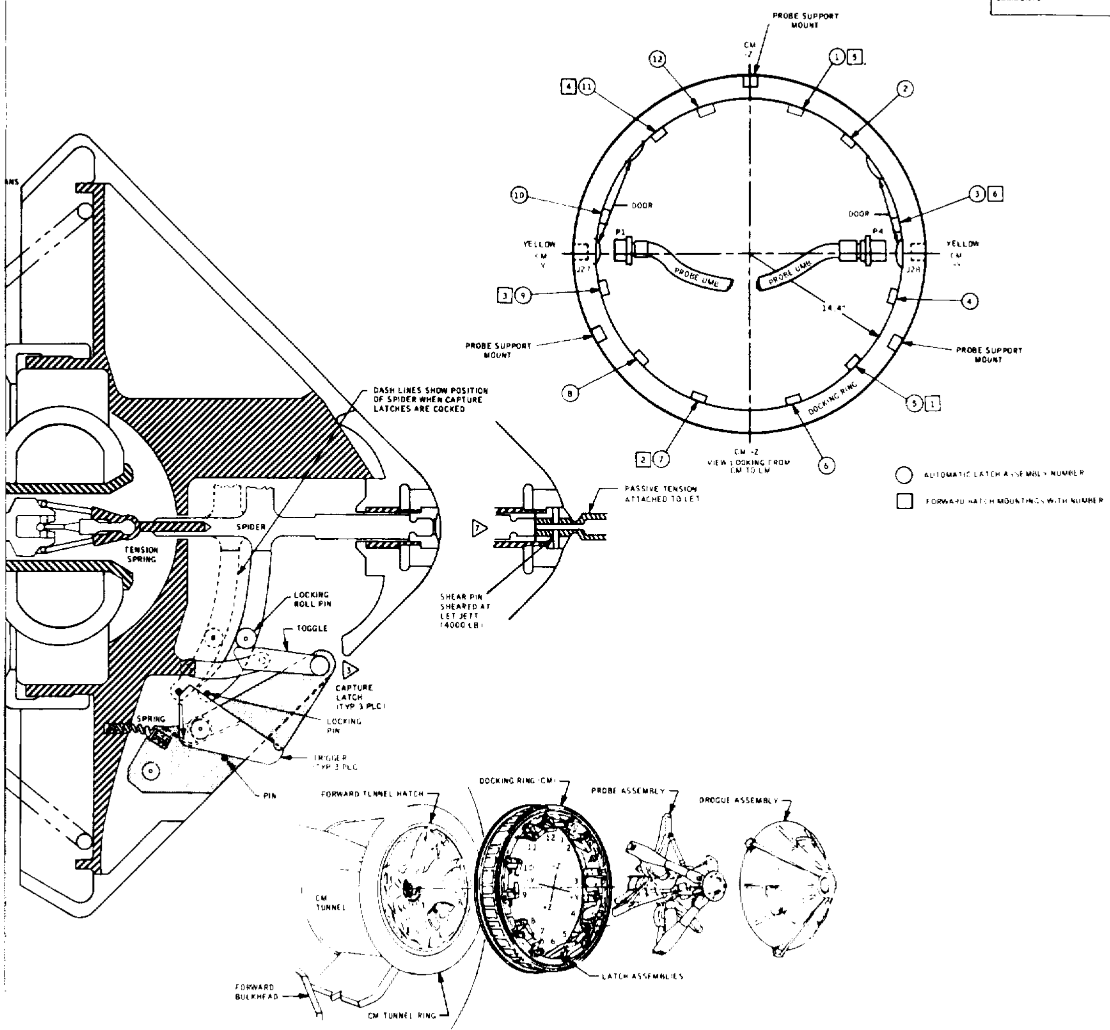
AUXILIARY RETRACT CONFIGURATION

FOLDOUT FRAME 3



FOLDOUT FRAME 4

LTR	PCN	DR	ENGR	DATE	APPROVAL
COMMENTS					



7▷ THE CAPTURE LATCHES ARE COCKED PRIOR TO LIFTOFF DUE TO INSTALLATION OF THE PASSIVE TENSION TIE

6 FOR LOCATION AND ELECTRIC CONTROL OF LIGHT AND TARGET SEE DRAWING IN SECTION 11

5▷ CSM/MDA SEPARATION IS ACCOMPLISHED BY THE CREW APPLYING A PRELOAD ON THE EXTENSION SHAFT BY MEANS OF A PERMANENTLY INSTALLED TORQUE PRELOAD HANDLE. WHEN A PRELOAD HAS BEEN APPLIED AT THE INTERFACE, THE CREW WILL MANUALLY RELEASE AND COCK THE 12 AUTOMATIC DOCKING LATCHES. AFTER THE FORWARD PRESSURE HATCH HAS BEEN INSTALLED, THE CREW WILL PLACE THE EXTD/REL-RETRACT SWITCH (MDC 2) TO THE EXTD/REL POSITION TO EFFECT CM/MDA UNDOCKING

4 ORIFICE BYPASS VALVE :

DURING THE LAST ONE INCH OF THE RETRACT CYCLE, THE ORIFICE BYPASS VALVE WILL BE OPEN ALLOWING THE PRESSURE CHAMBER TO BUILD UP TO 250 PSIG.

3▷ CAPTURE LATCHES/MOTOR SHAFT

A THE CAPTURE LATCHES ARE UNLOCKED BY THE MOTOR ROTATING THE MOTOR SHAFT FROM 0° TO 180° CLOCKWISE WHEN THE EXTD/REL-RETRACT SWITCH (S1 MDC 2) IS PLACED IN THE EXTD/REL POSITION AND PROBE HAS TRAVELED 3/4 INCH.

(1) THE MOTOR SHAFT APPLIES A TORQUING MOMENT TO THE ROTATION TO TRANSLATION CAM. THE ROTATION-TO TRANSLATION CAM IN TURN APPLIES A TENSION FORCE TO THE TENSION SPRING, PULLING THE SPIDER DOWN AND ALLOWING THE LOCKING PIN TO ENGAGE THE TRIGGER (COCKS THE CAPTURE LATCHES).

(2) THE MOTOR SHAFT IS KEPT IN A COCKED POSITION BY THE LOCKING PIN PREVENTS THE TENSION SPRING FROM ROTATING THE SHAFT COUNTERCLOCKWISE UNTIL THE PROBE HEAD AND MDA DROGUE MAKE PHYSICAL CONTACT CAPTURE

(3) AN INDICATION THAT THIS HAS OCCURRED IS THAT THE PROBE EXTD/RET A AND B FLAGS ON MDC 2 WILL CHANGE FROM GRAY TO BARBER AND THEN BACK TO GRAY WHEN THE PROBE HAS EXTENDED TEN INCHES.

B WHEN THE PROBE HEAD AND LM DROGUE MAKE CONTACT, THE THREE CAPTURE LATCHES, THROUGH MECHANICAL ACTION, RELEASE THE LOCKING PIN WHICH IS HOLDING THE SPIDER DOWN, ALLOWING THE TENSION SPRING TO DRIVE THE SHAFT BACK TO 0°.

(1) AN INDICATION THAT THIS HAS OCCURRED IS THE PROBE EXTD/RET A AND B FLAGS ON MDC 2 CHANGE FROM GRAY TO BARBER POLE

(2) IF THE EXTD/REL-RETRACT SWITCH (S1 MDC 2) HAS PREVIOUSLY BEEN PLACED IN THE RETRACT POSITION, AN AUTOMATIC GAS RETRACTION WILL OCCUR IF THE DOCKING PROBE - RETRACT PRIM OR SEC SWITCHES (MDC 2 S2 AND S3) HAVE BEEN PLACED TO AN UNUSED BOTTLE POSITION.

C THE SHAFT RETURNS TO 180° FROM DETENT WHEN THE CREW ROTATES THE CAPTURE LATCH RELEASE HANDLE CLOCKWISE TO REMOVE THE PROBE (UNLOCKS THE CAPTURE LATCHES).

2▷ THE PROBE PISTON SPRING ACTS AS A PRELOAD TO EXTEND THE PROBE ONCE THE PROBE EXTEND LATCH RELEASE SOLENOID HAS BEEN ENERGIZED. THE PROBE EXTENTION LATCH IS ENERGIZED BY PLACING THE EXTD/REL-RETRACT SWITCH (MDC 2 S1) TO THE EXTD/REL POSITION. IN THE RETRACTED POSITION, THE PROBE PISTON EXERTS A FORCE OF 130 LBS ON THE PROBE ASSEMBLY AND 700 LBS WHEN EXTENDED TEN INCHES.

NOTES 1 SYSTEM A AND B OF THE DOCKING PROBE AND RELATED ELECTRONIC COMPONENTS SHOWN.

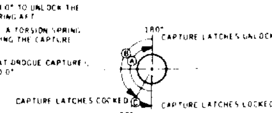
9 MDA RADIAL DOCKING PORT IDENTICAL TO AXIAL EXCEPT IT DOES NOT HAVE POWER TRANSFER CAPABILITY

8▷ TRANSLATION-TO ROTATION CAM DESCRIPTION

A THE MOTOR SHAFT TURNS THE CAM 180° FROM 0° TO UNLOCK THE CAPTURE LATCHES, PULLING THE TENSION SPRING AFT

B WHEN POWER IS RELEASED FROM THE MOTORS, A TORSION SPRING PULLS THE CAM BACK TO 30° (FROM 0°), COCKING THE CAPTURE LATCHES

C WHEN THE THREE TRIGGERS ARE DEPRESSED (AT DROGUE CAPTURE), THE TORSION SPRING DRIVES THE CAM BACK TO 0°

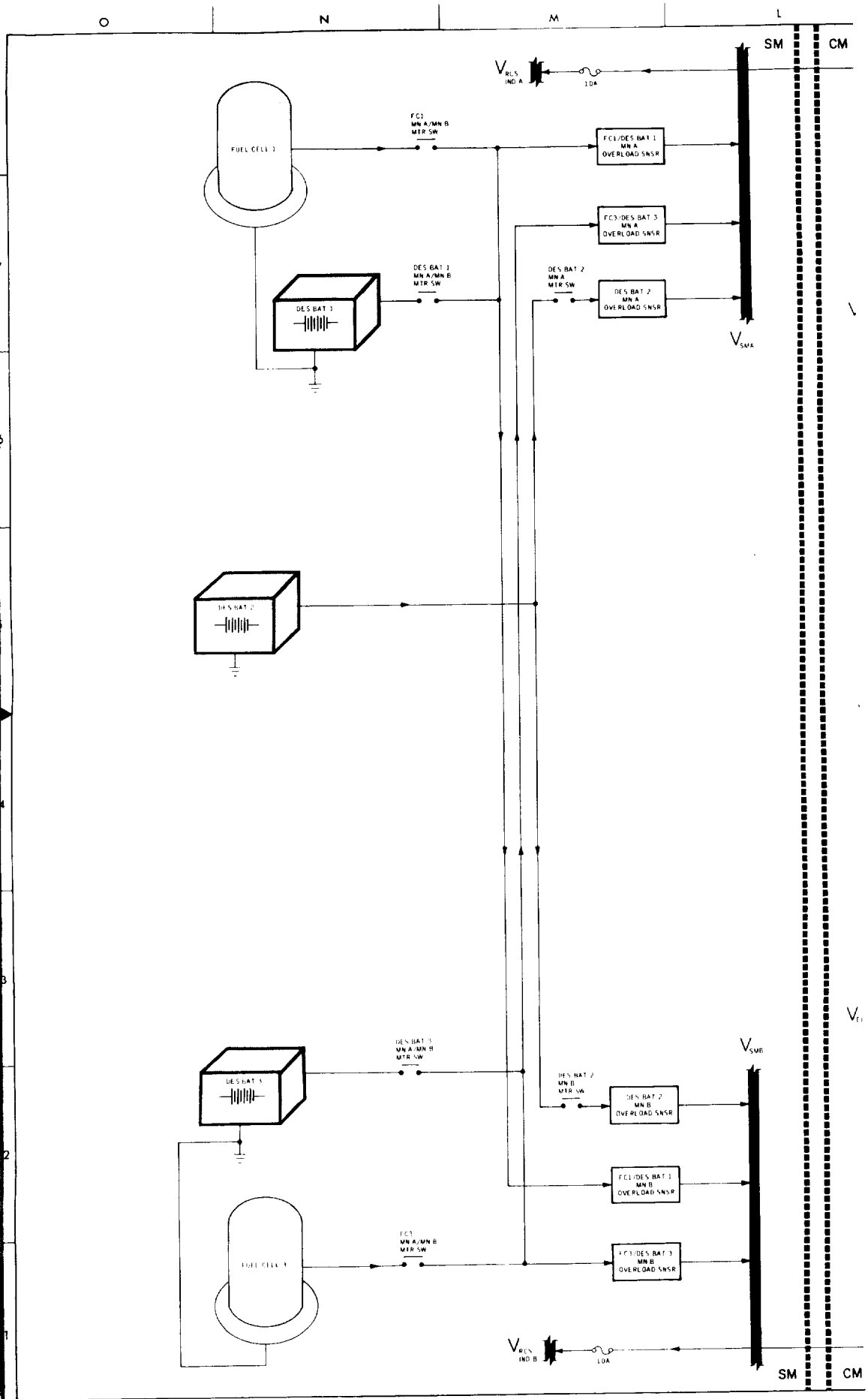


7 DOCKING

SIGNATURES	DATE	NATIONAL AERONAUTICS & SPACE ADMINISTRATION MANNED SPACECRAFT CENTER - HOUSTON, TEXAS
DR		
DSGN		
QC		
ENGR		DOCKING PROBE
ENGR		
APP		
APP		SKYLAB CSM 116 THRU 119 — 27
STC		
		104 S X 36.25 — PAGE 2-7 — SHEET 1 OF 1

FOLDOUT FRAME 5

3 ELECTRICAL SYSTEM



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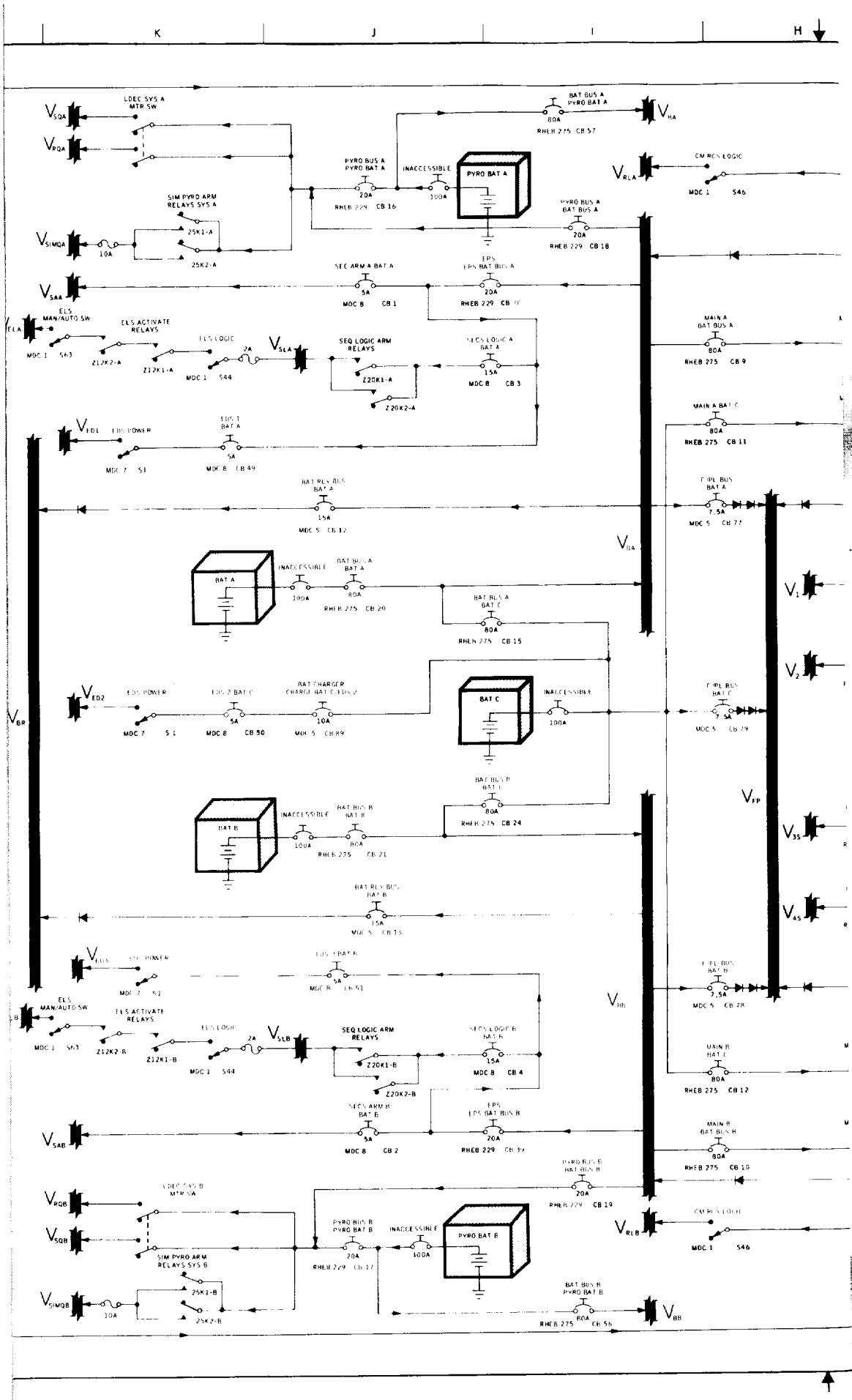
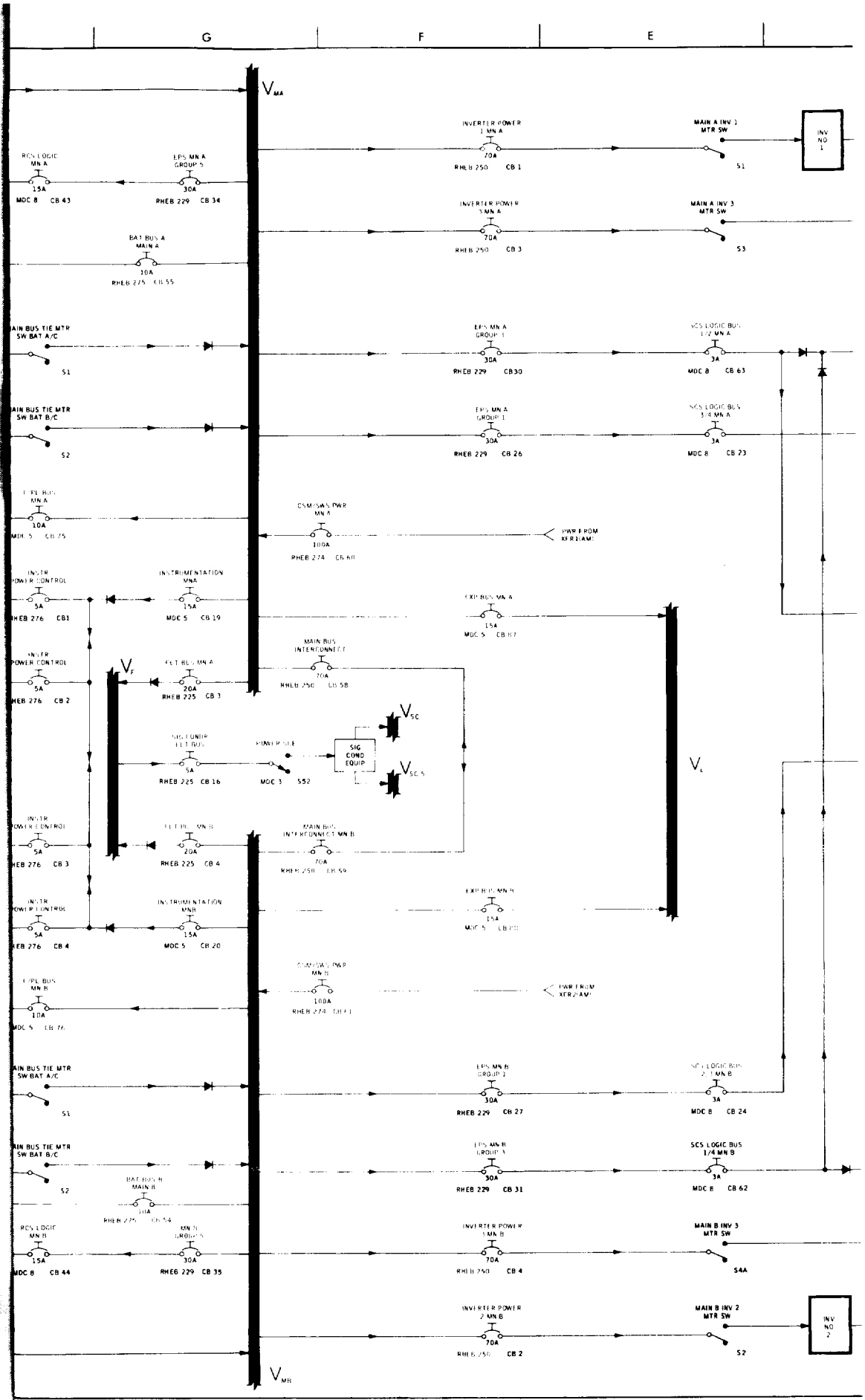
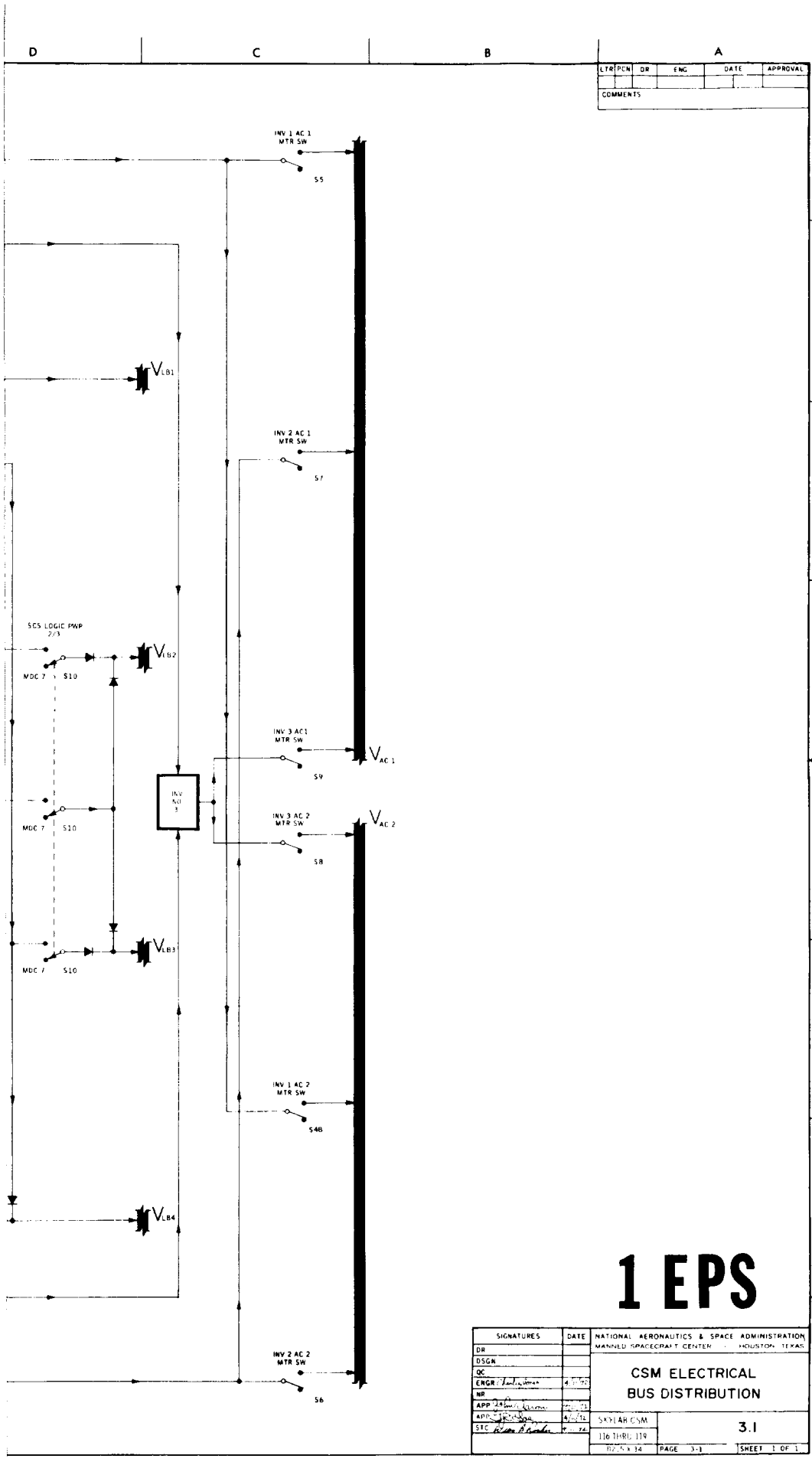


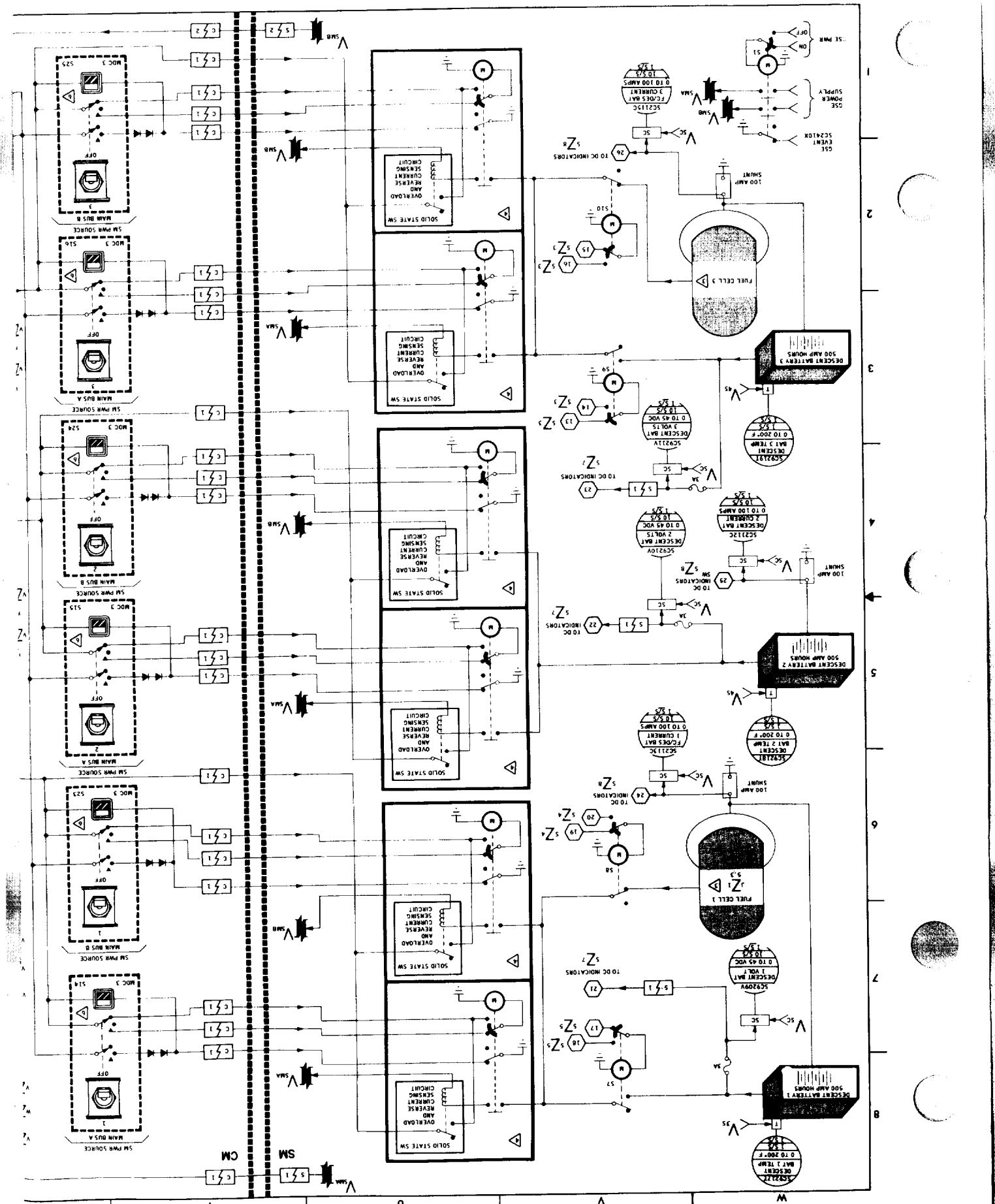
FOLDOUT FRAME 2



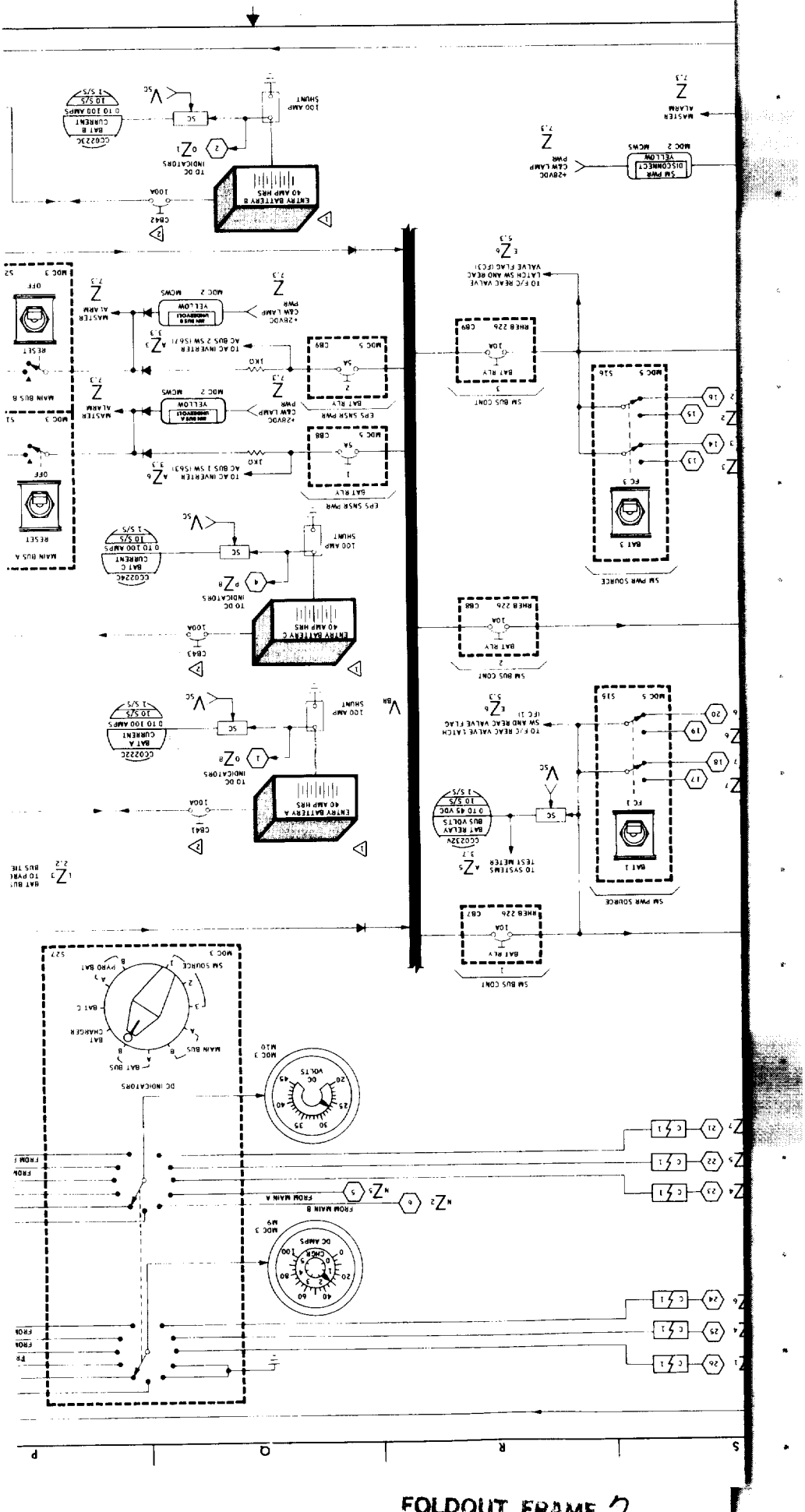
FOLDOUT FRAME 3



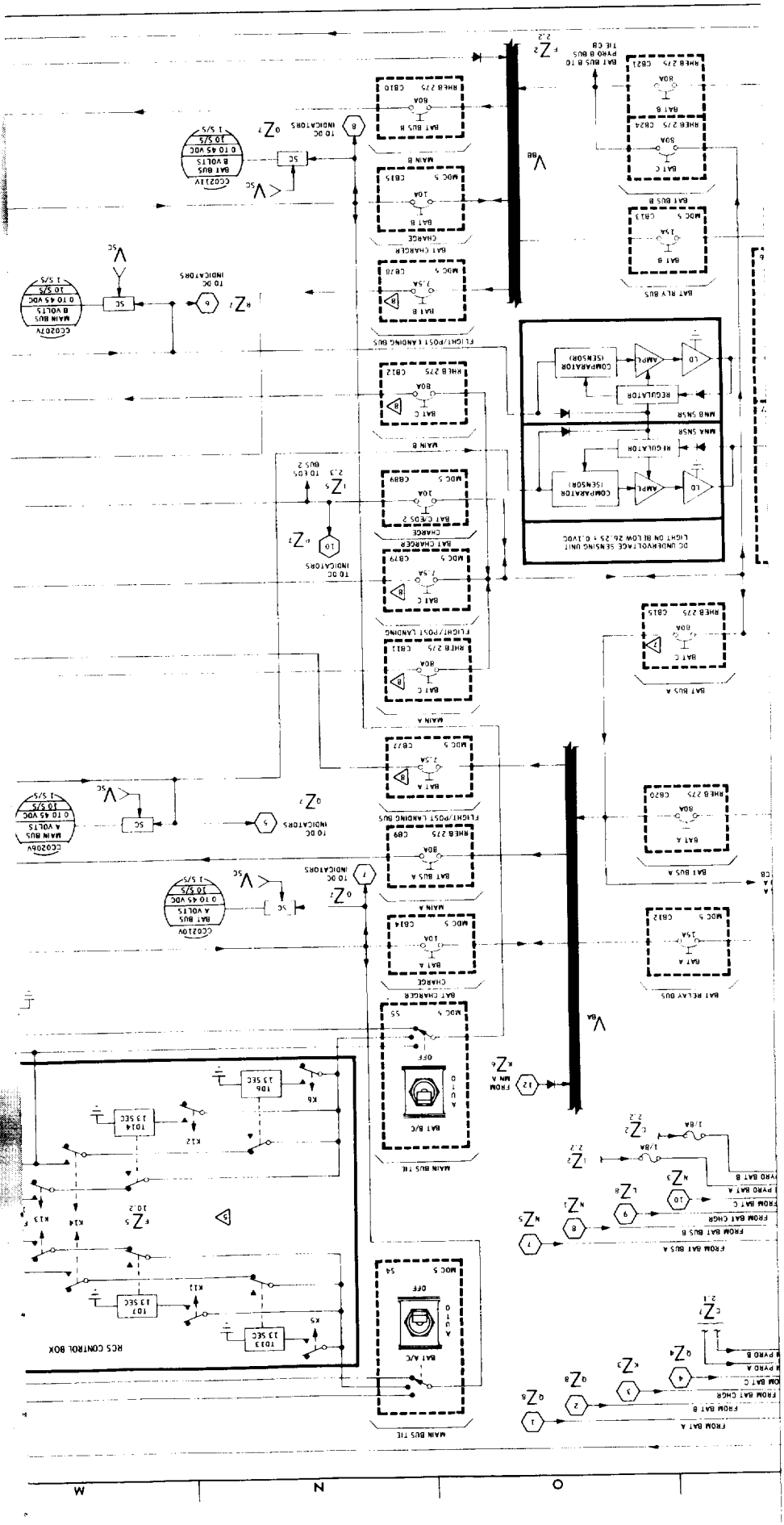
FOLDOUT FRAME 4



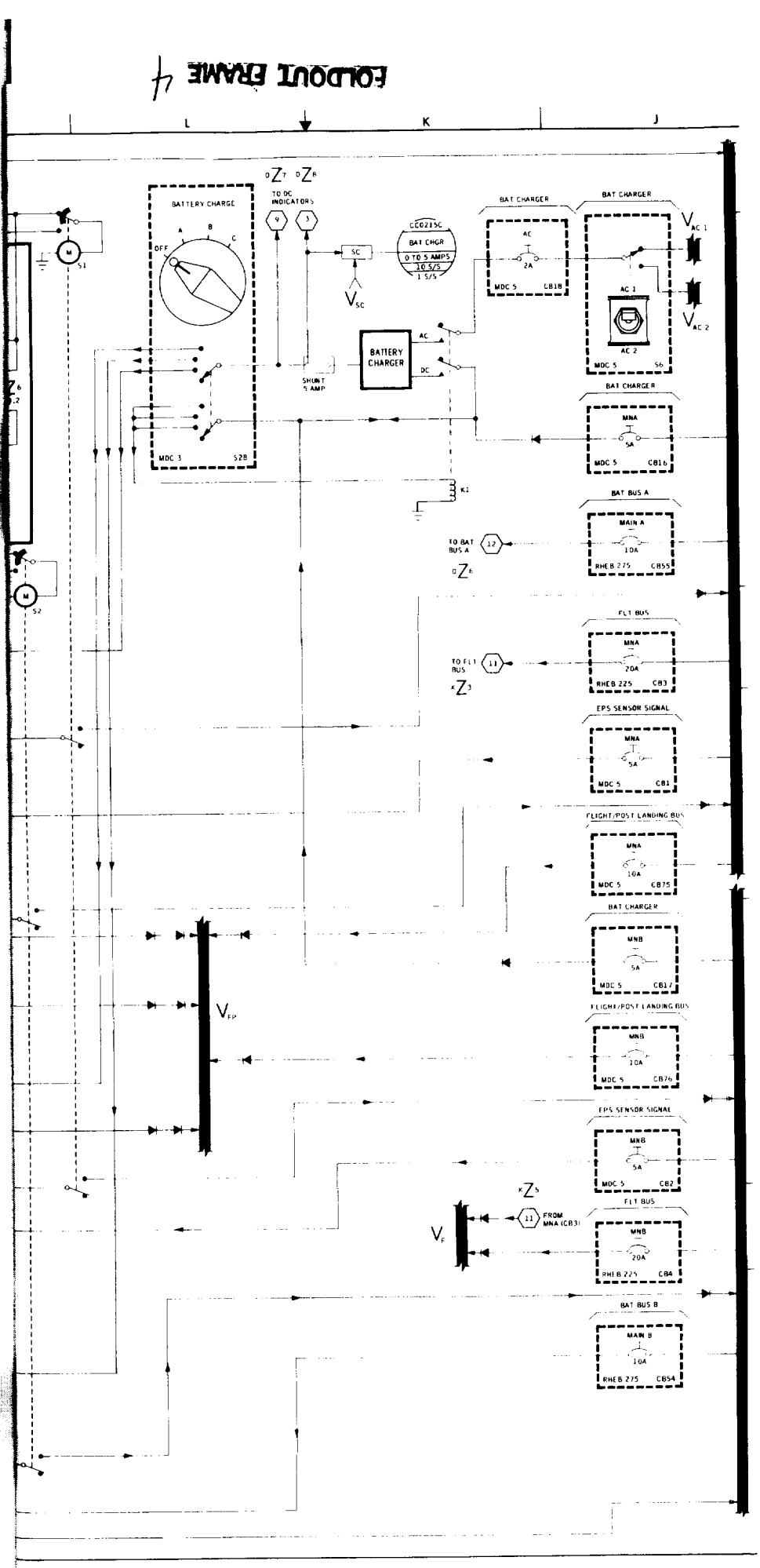
FOLDOUT FRAME



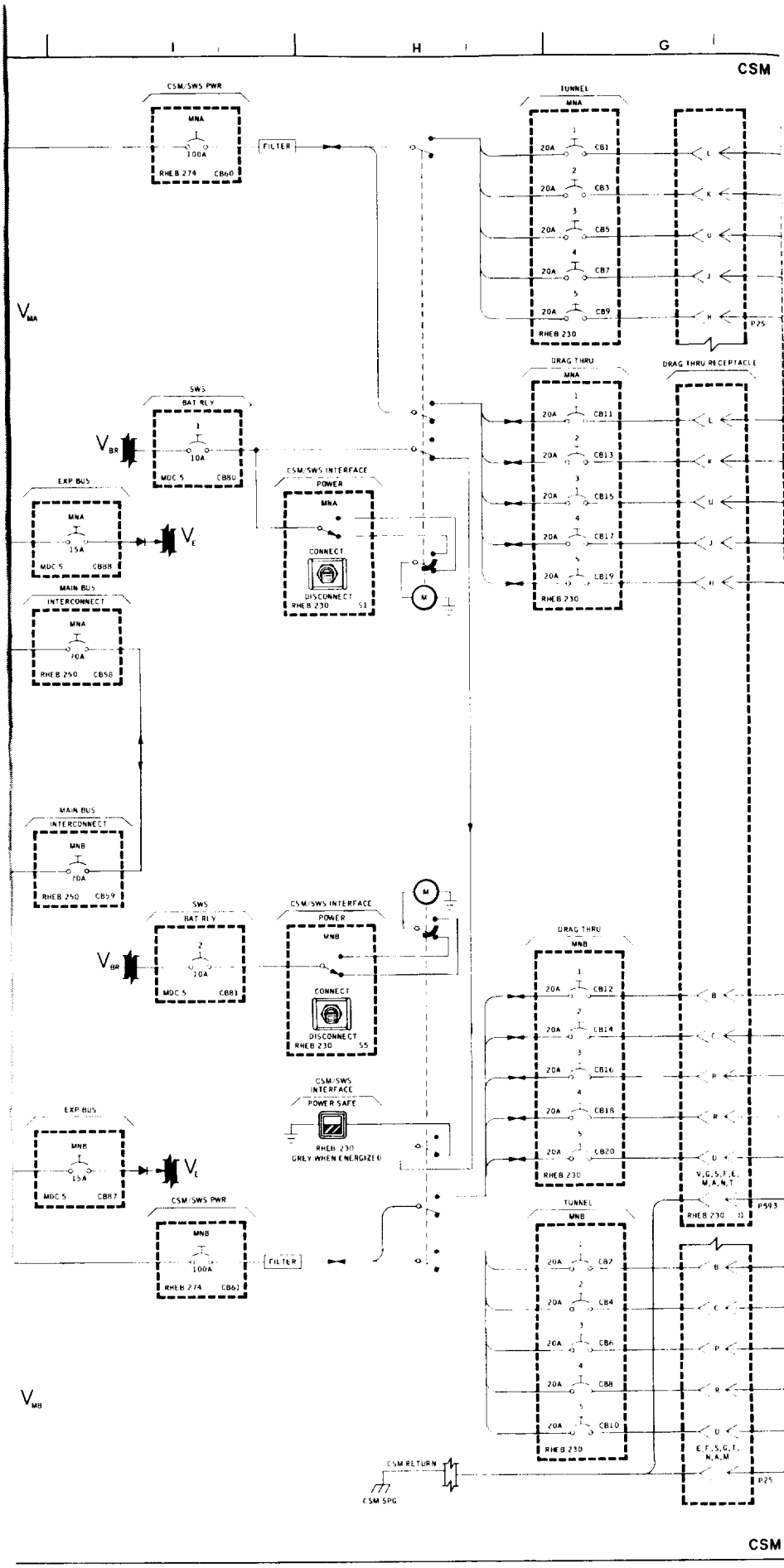
FOLDOUT FRAME 2

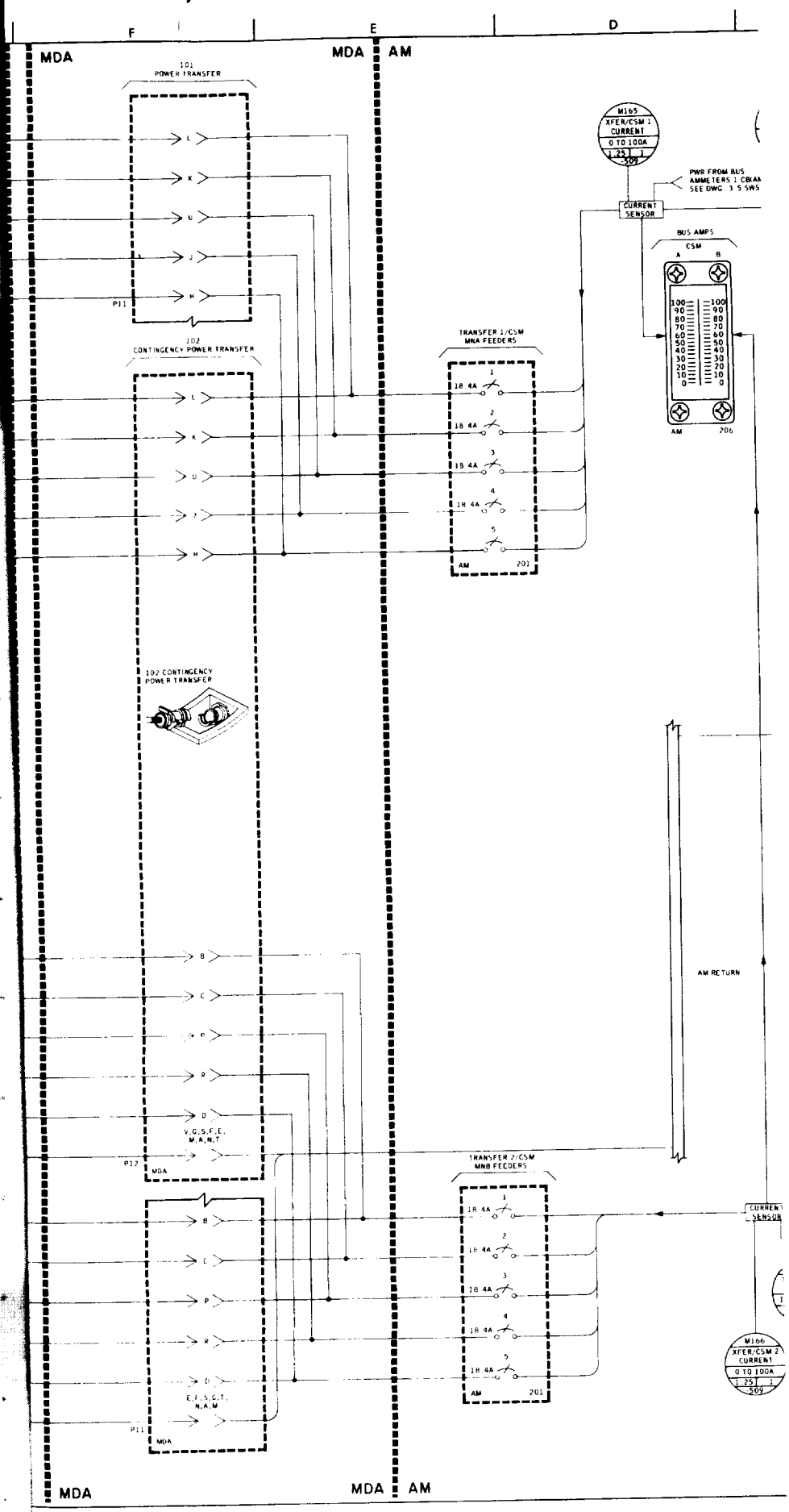


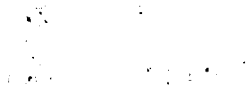
FOLDOUT FRAME 3


FOLDOUT FRAME 4
L
K
J
BATTERY CHARGE
OFF
A
B
C
MDC 3
S28
TO DC INDICATORS
SHUNT 5 AMP
SC
CC0215C
BAT CHGR
0 TO 5 AMPS
10 S/S
1 S/S
BATTERY CHARGER
AC
DC
BAT CHARGER
MDC 5
CB18
2A
AC 1
AC 2
S6
MNA
5A
CB16
K1
BAT BUS A
MAIN A
10A
RHEB 275
CB55
TO BAT BUS A
FLT BUS
20A
RHEB 225
CB3
TO FLT BUS
EPS SENSOR SIGNAL
CB1
FLIGHT/POST LANDING BUS
CB75
MNB
CB17
CB76
CB2
FROM MNA (CB3)
CB4
MAIN B
CB54
S1
S2

FOLDOUT FRAME 5




MDA
MDA
AM
101
POWER TRANSFER
L
K
U
J
H
P11
M165
XFER/CSM 1
CURRENT
0 TO 100A
1 25 1
509
PWR FROM BUS
AMMETERS 1 CB(AA
SEE DWG 3 5 SWS
CURRENT
SENSOR
BUS AMPS
CSM
A
B
100
90
80
70
60
50
40
30
20
10
0
AM
706
102
CONTINGENCY POWER TRANSFER
TRANSFER 1/CSM
MNA FEEDERS
1
2
3
4
5
18 4A
AM
201
102 CONTINGENCY
POWER TRANSFER
B
C
P
R
D
V,G,S,F,E,
M,A,M,T
P12
MDA
AM RETURN
TRANSFER 2/CSM
MNB FEEDERS
E,F,S,G,T,
N,A,M
P11
M166
XFER/CSM 2
CURRENT
MDA
MDA
AM



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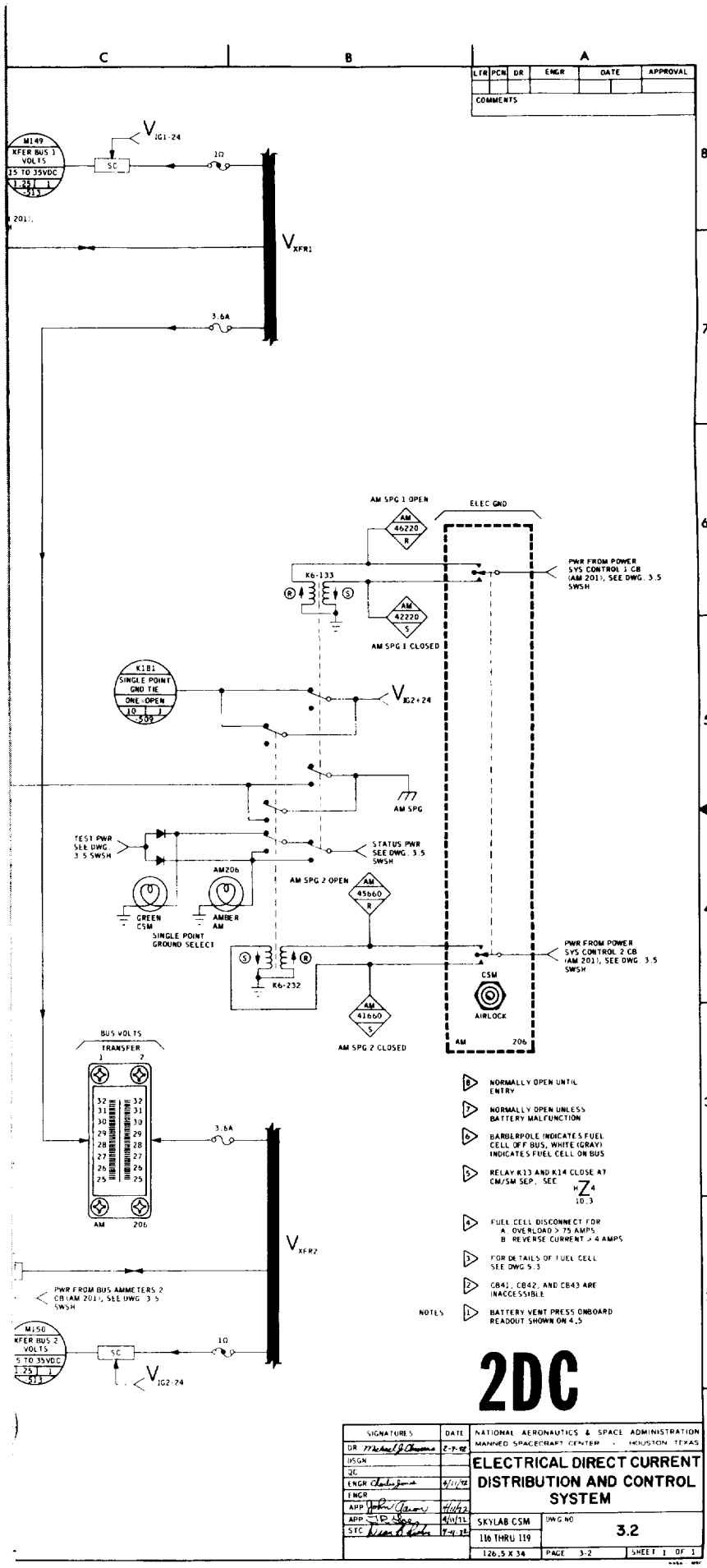
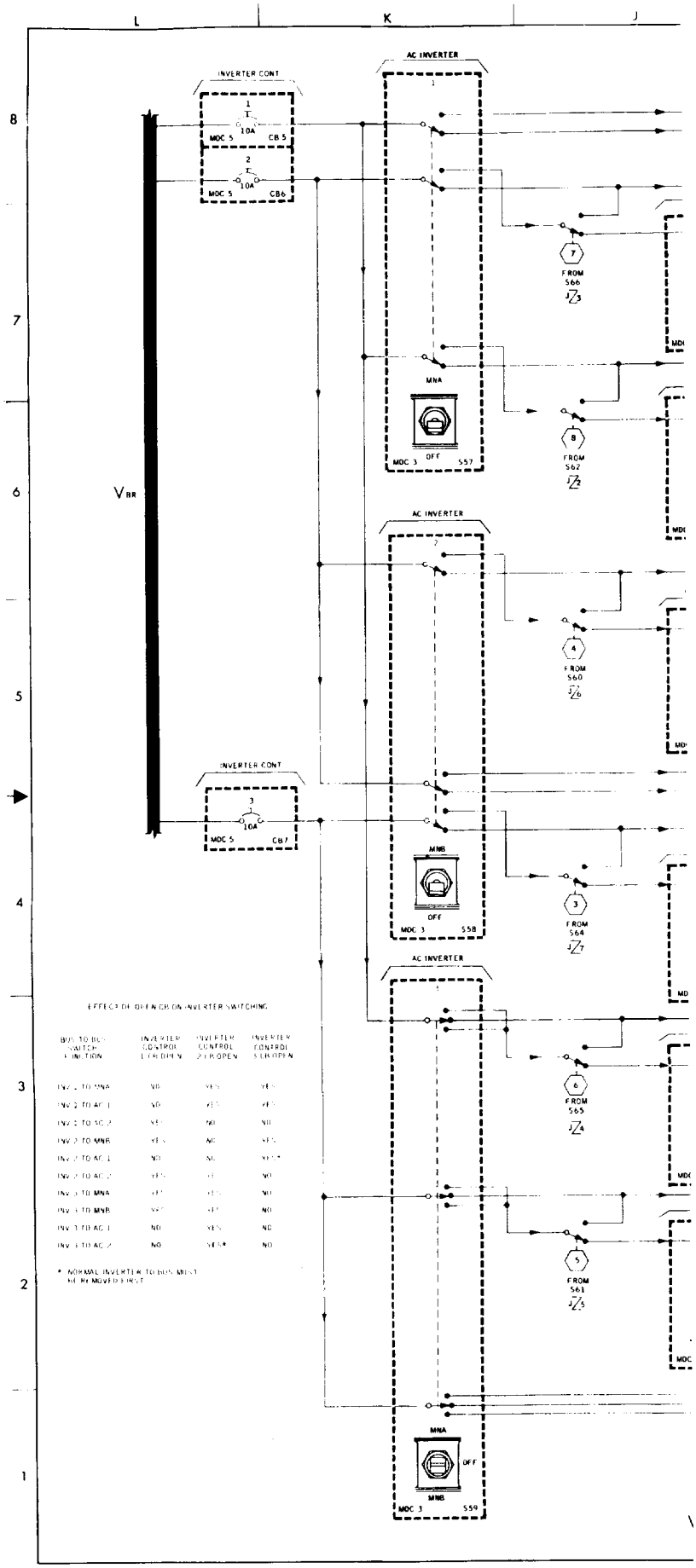


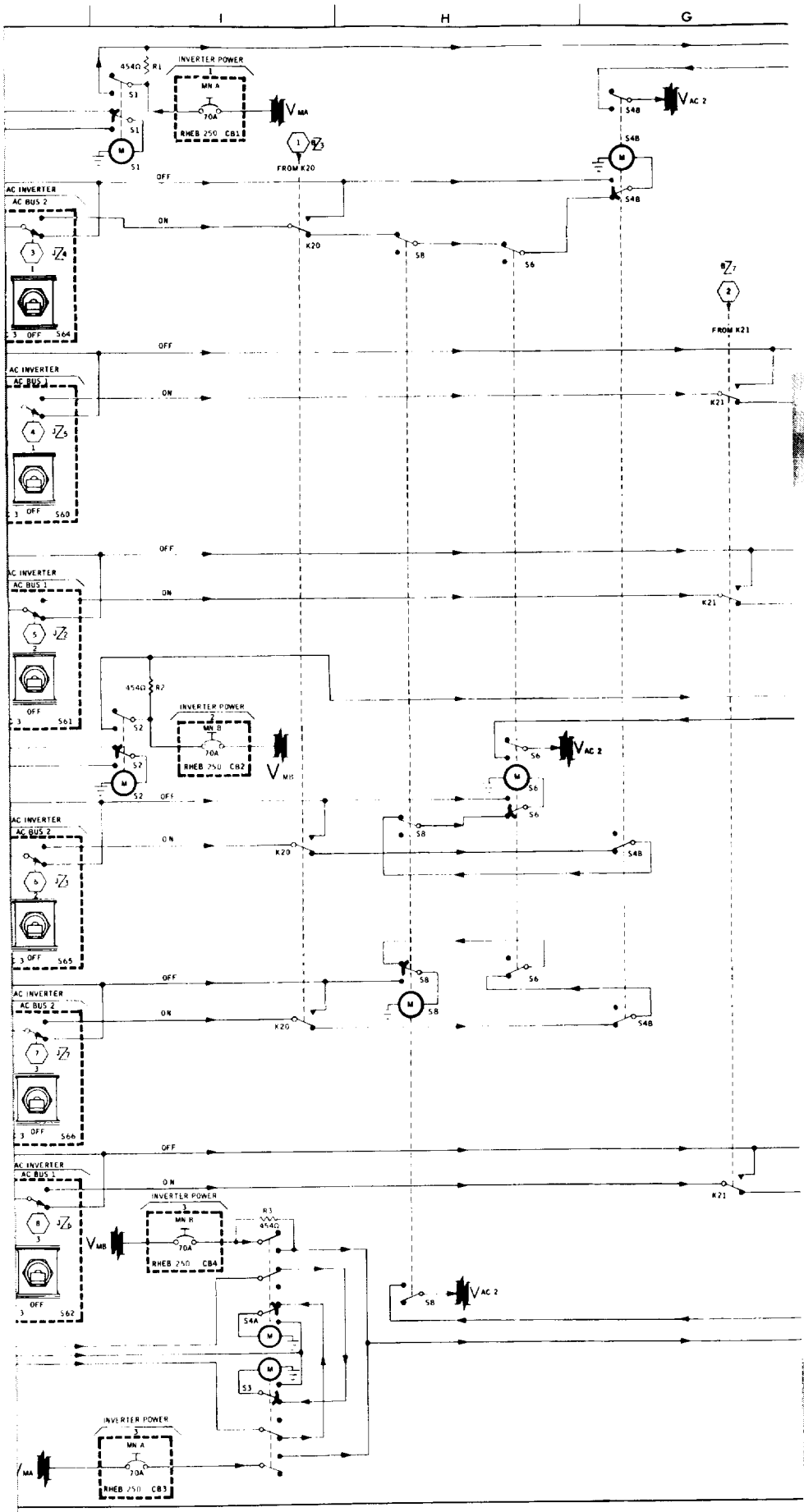


EFFECT OF OPEN CB ON INVERTER SWITCHING

BUS TO BUS SWITCH FUNCTION	INVERTER CONTROL 1 CB OPEN	INVERTER CONTROL 2 CB OPEN	INVERTER CONTROL 3 CB OPEN
INV 1 TO MNA	NO	YES	YES
INV 2 TO MNA	NO	YES	YES
INV 3 TO MNA	YES	NO	NO
INV 2 TO MNB	YES	NO	YES
INV 2 TO AC 1	NO	NO	YES *
INV 2 TO AC 2	YES	YES	NO
INV 3 TO MNA	YES	YES	NO
INV 3 TO MNB	YES	YES	NO
INV 3 TO AC 1	NO	YES	NO
INV 3 TO AC 2	NO	YES *	NO

* NORMAL INVERTER TO BUS INTERLOCK REMOVED FROM

FOLDOUT FRAME 1



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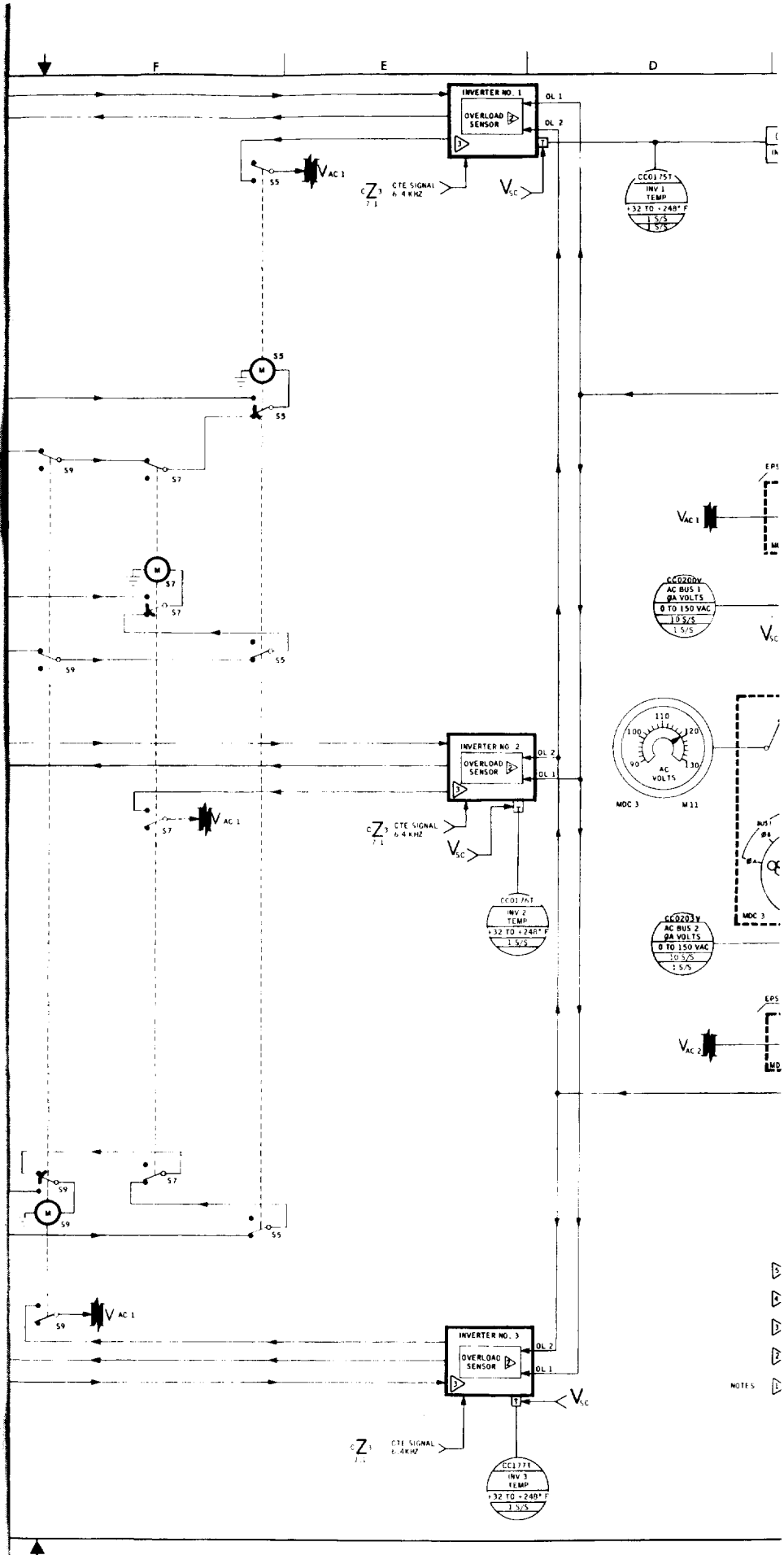

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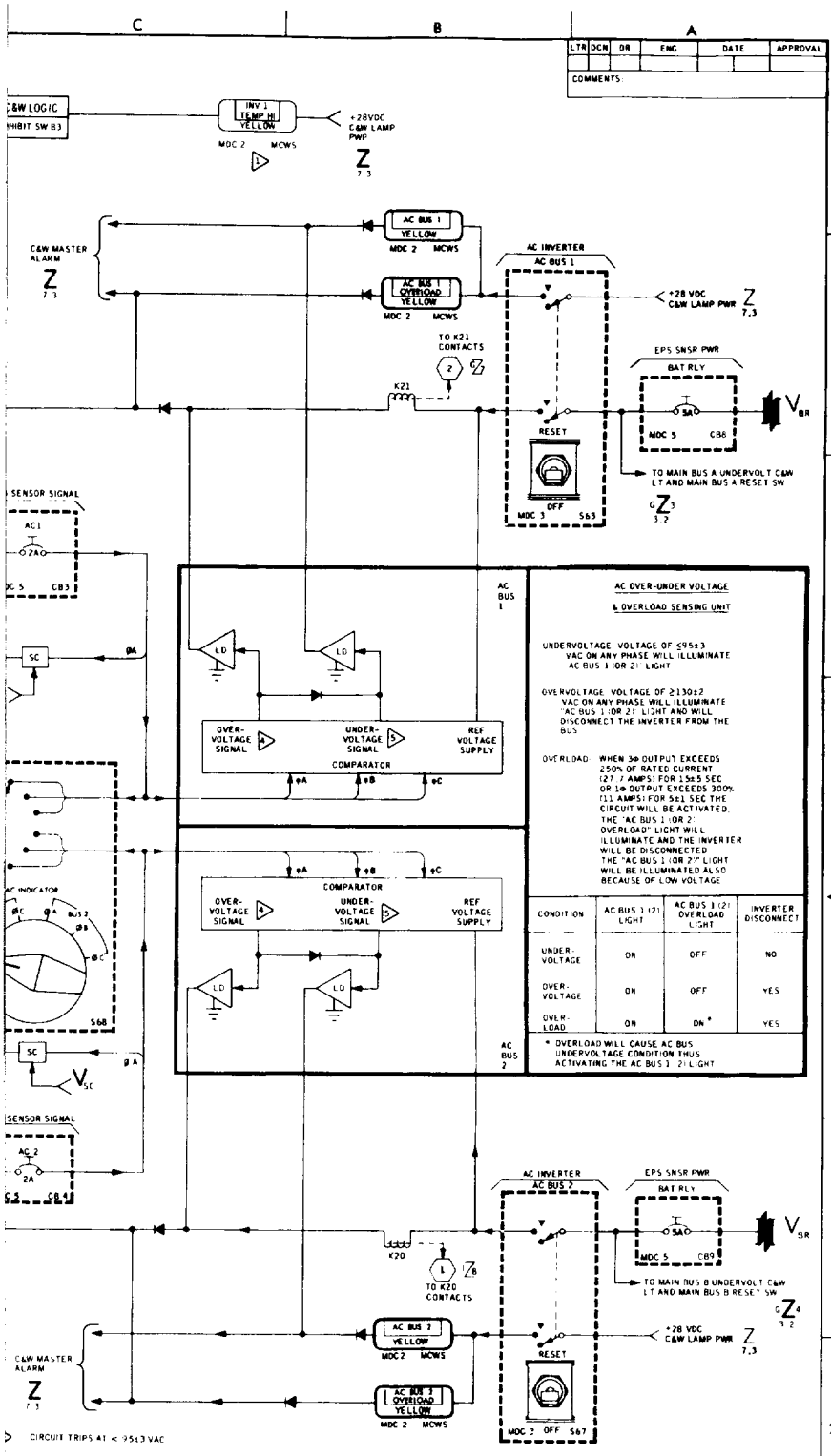

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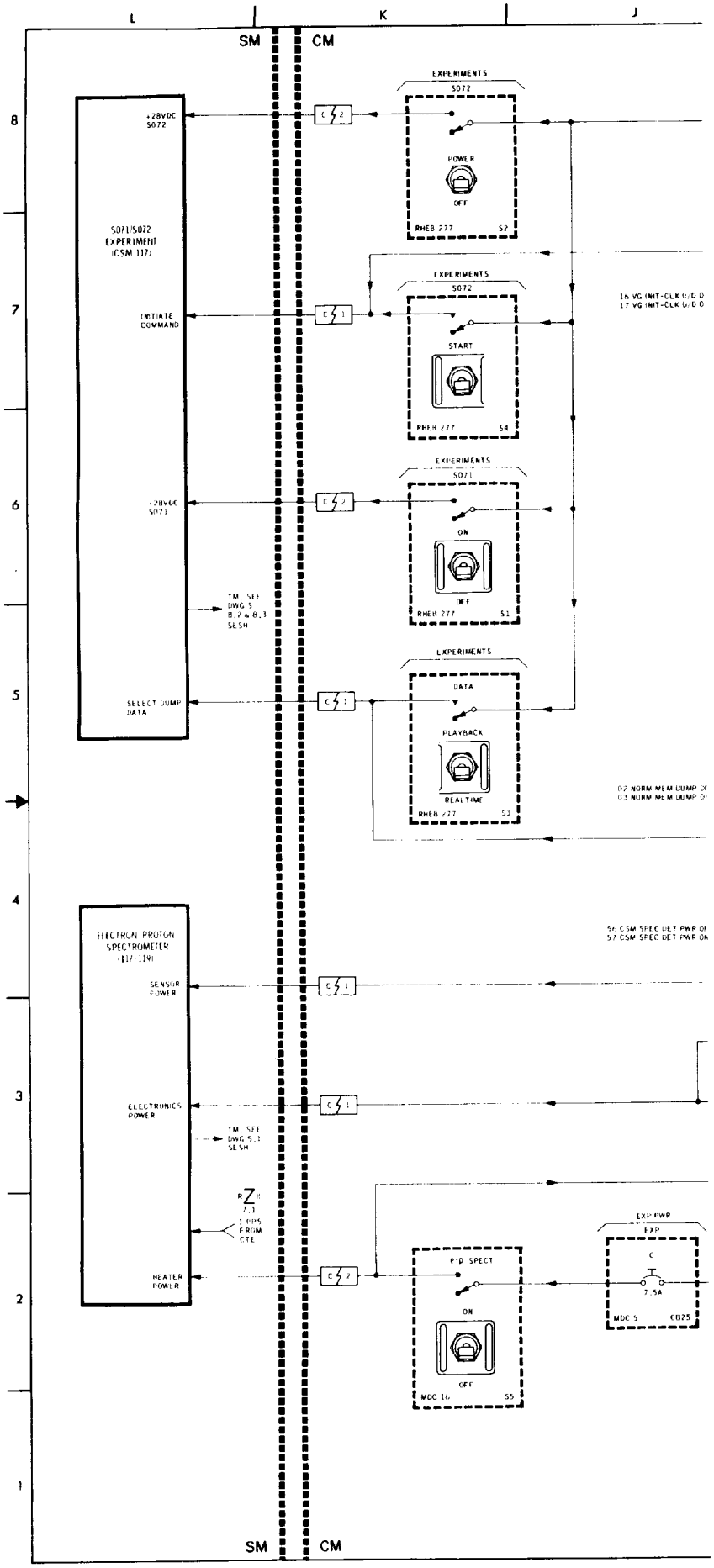
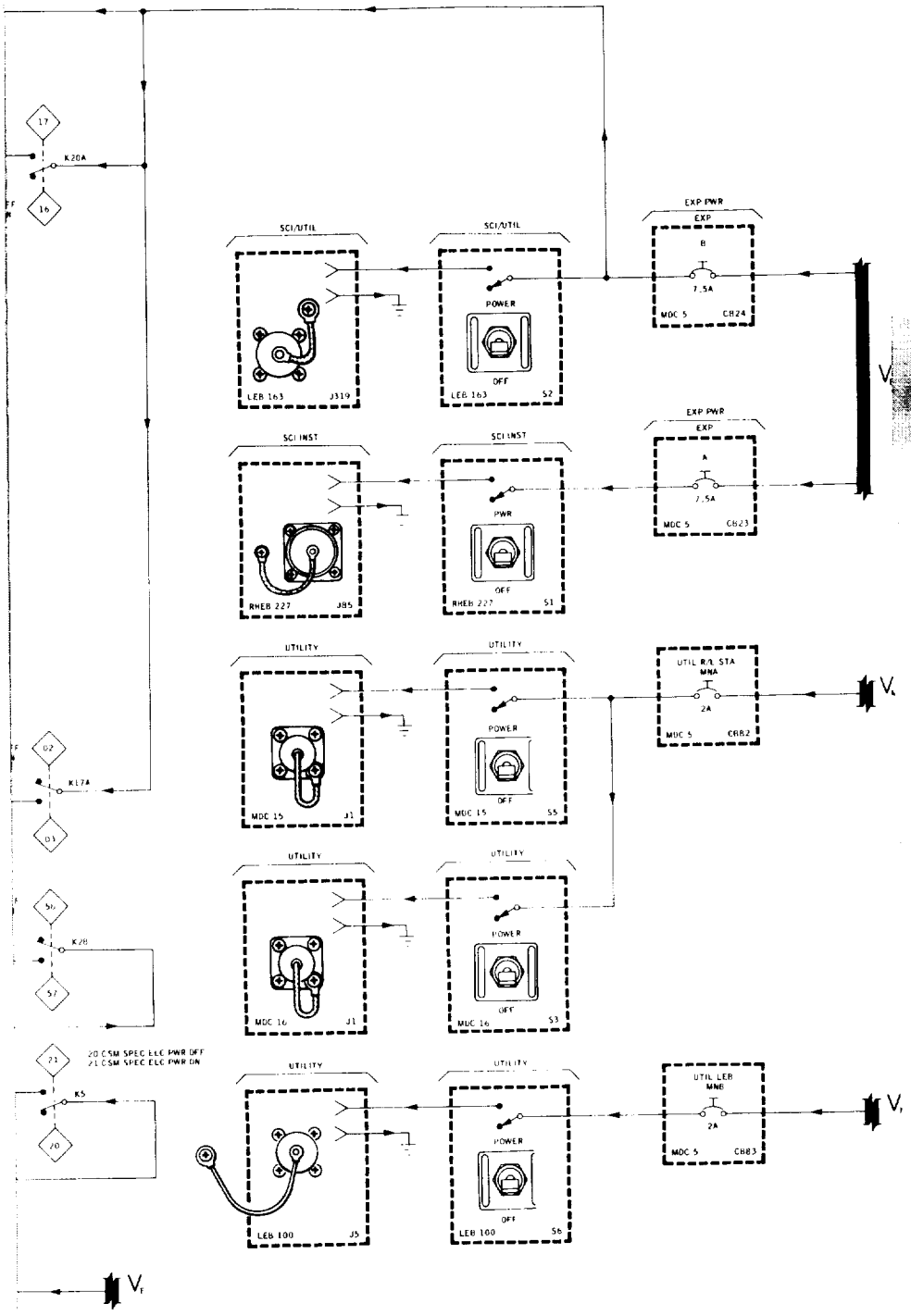

L
K
J
SM
CM
8
7
6
5
4
3
2
1
EXPERIMENTS
S072
POWER
OFF
RHEB 277
S2
+28VDC
S072
S071/S072
EXPERIMENT
(CSM 117)
INITIATE
COMMAND
START
S4
EXPERIMENTS
S071
ON
OFF
S1
+28VDC
S071
TM, SEE
DWG'S
8.2.6.8.3
SESH
SELECT DUMP
DATA
EXPERIMENTS
DATA
PLAYBACK
REAL TIME
S3
ELECTRON/PROTON
SPECTROMETER
(117-119)
SENSOR
POWER
ELECTRONICS
POWER
TM, SEE
DWG 5.1
SESH
1 PPS
FROM
CTE
HEATER
POWER
e-p SPECT
ON
OFF
MDC 16
S5
EXP PWR
EXP
C
7.5A
MDC 5
CB25
FOLDOUT FRAME

CSM 117, 118 & 119



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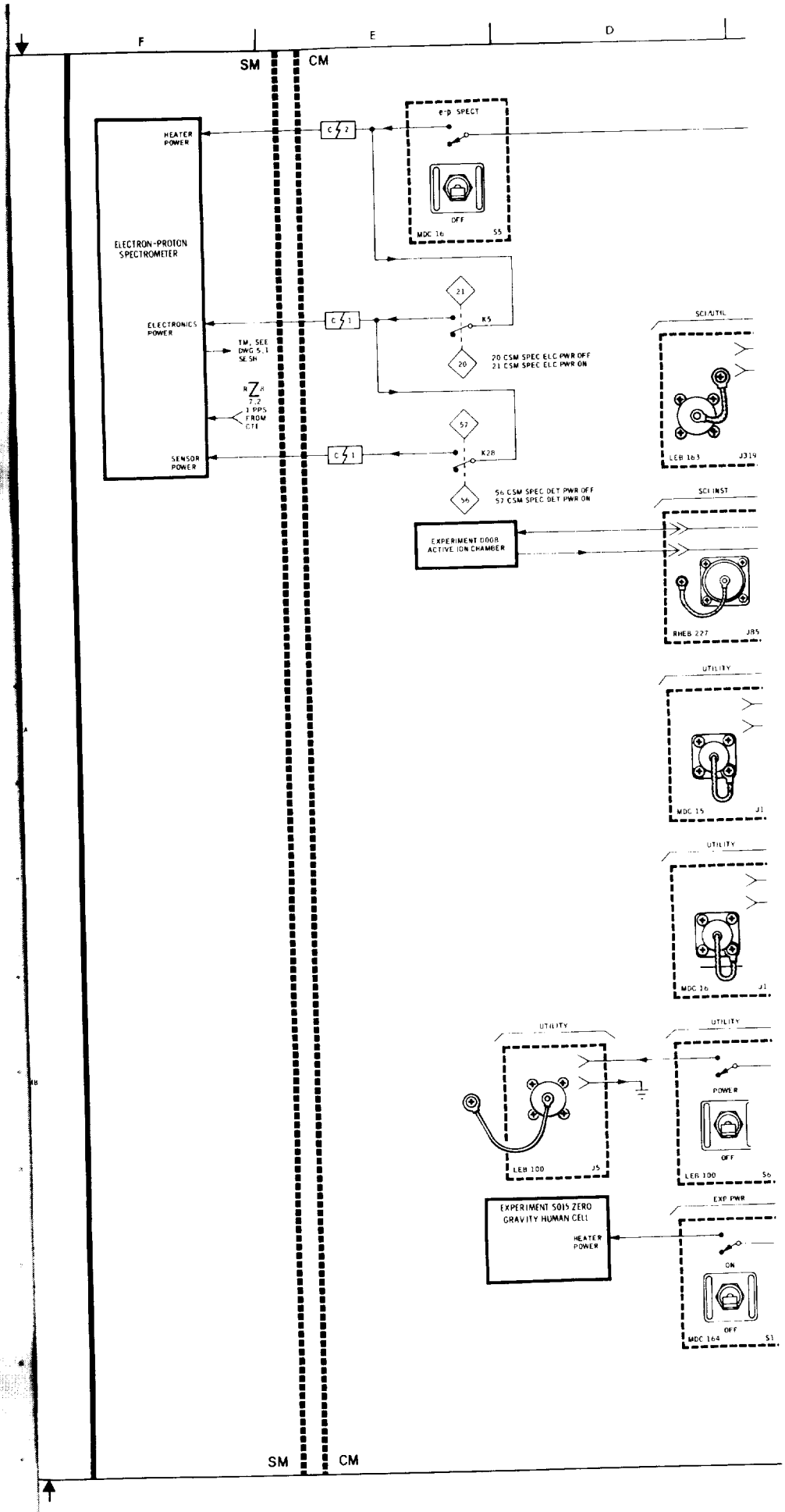

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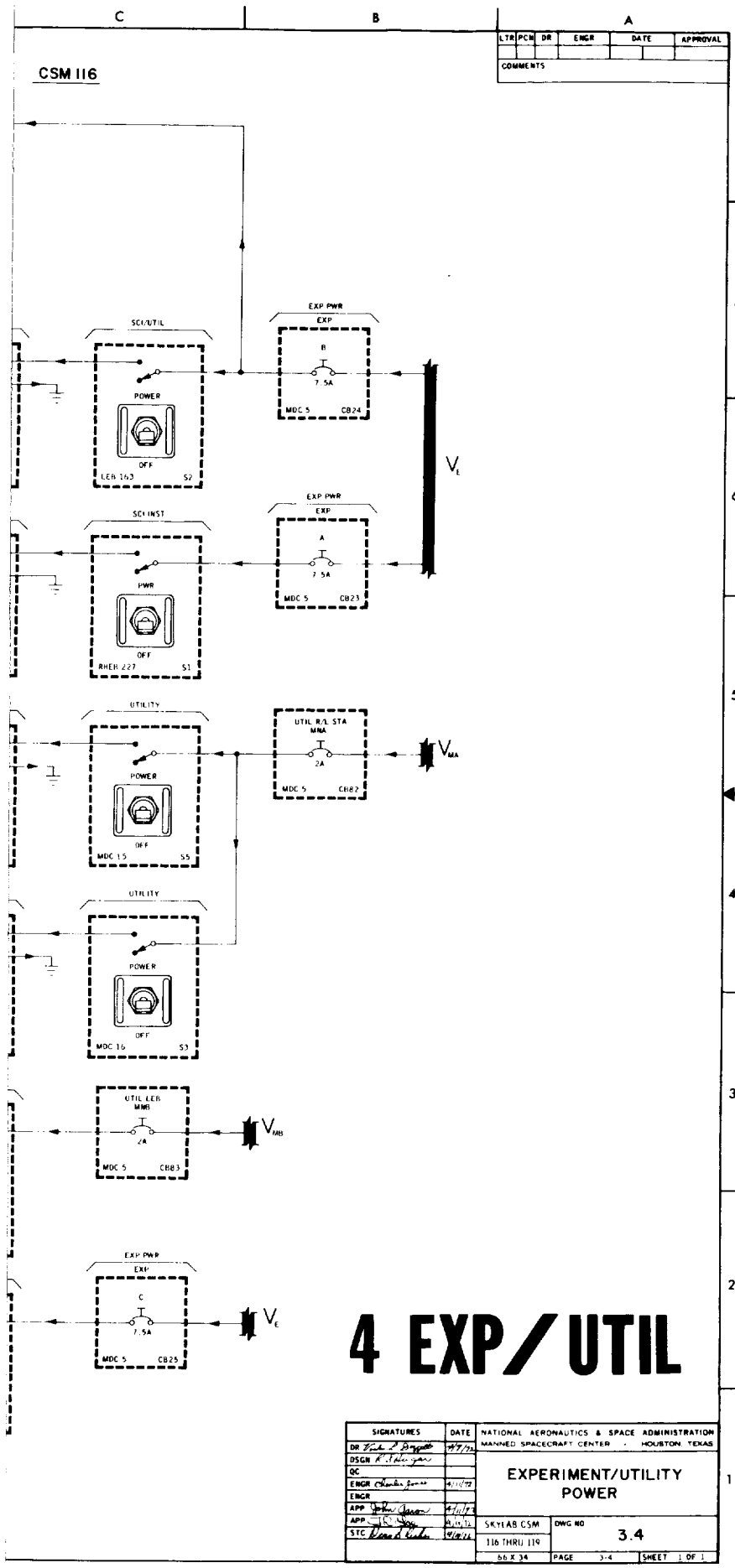

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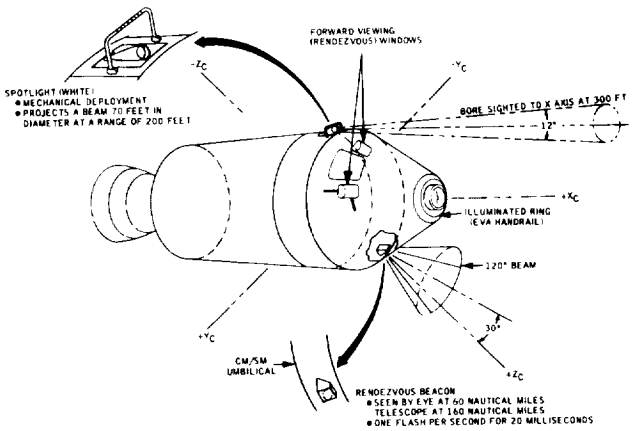
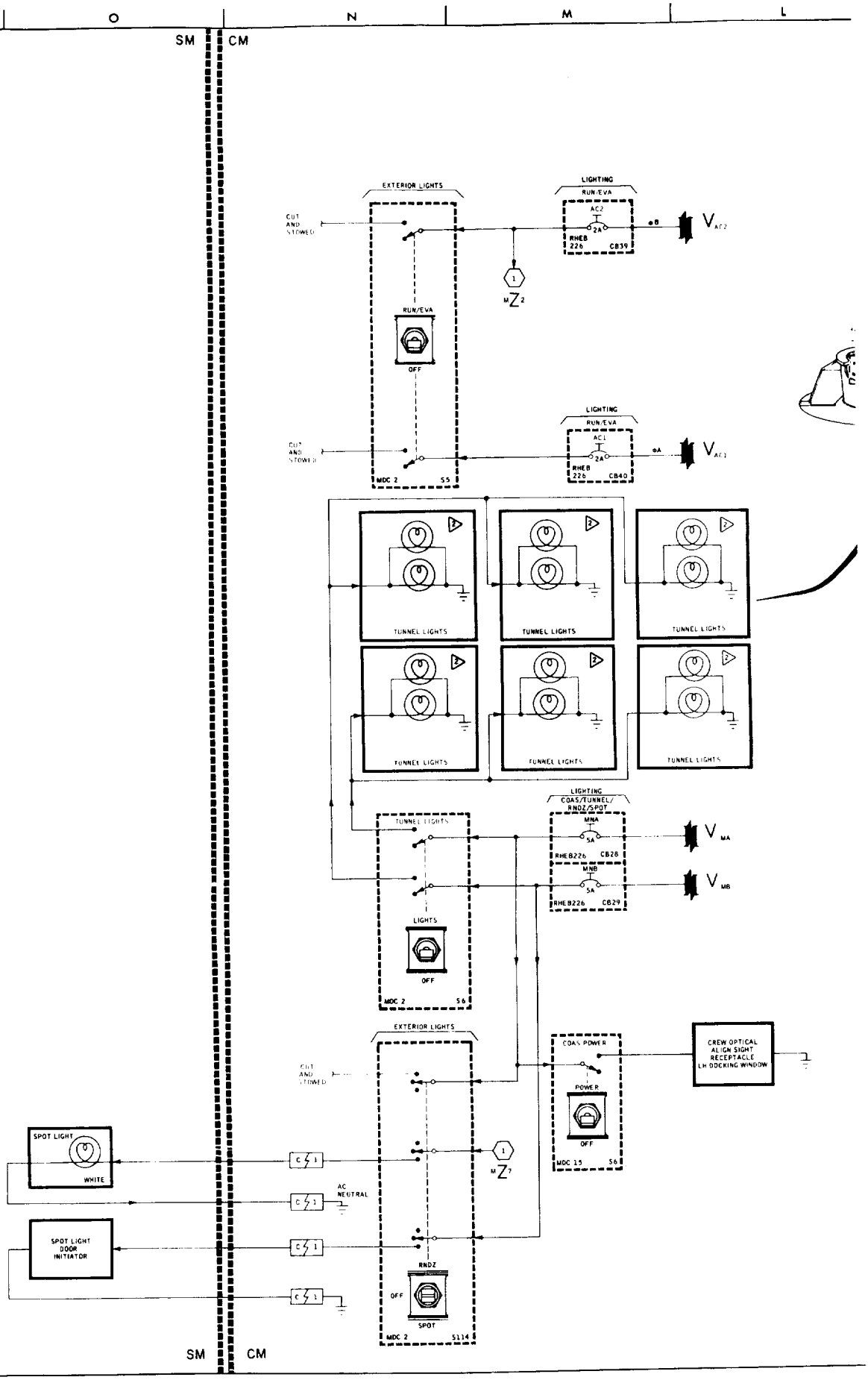
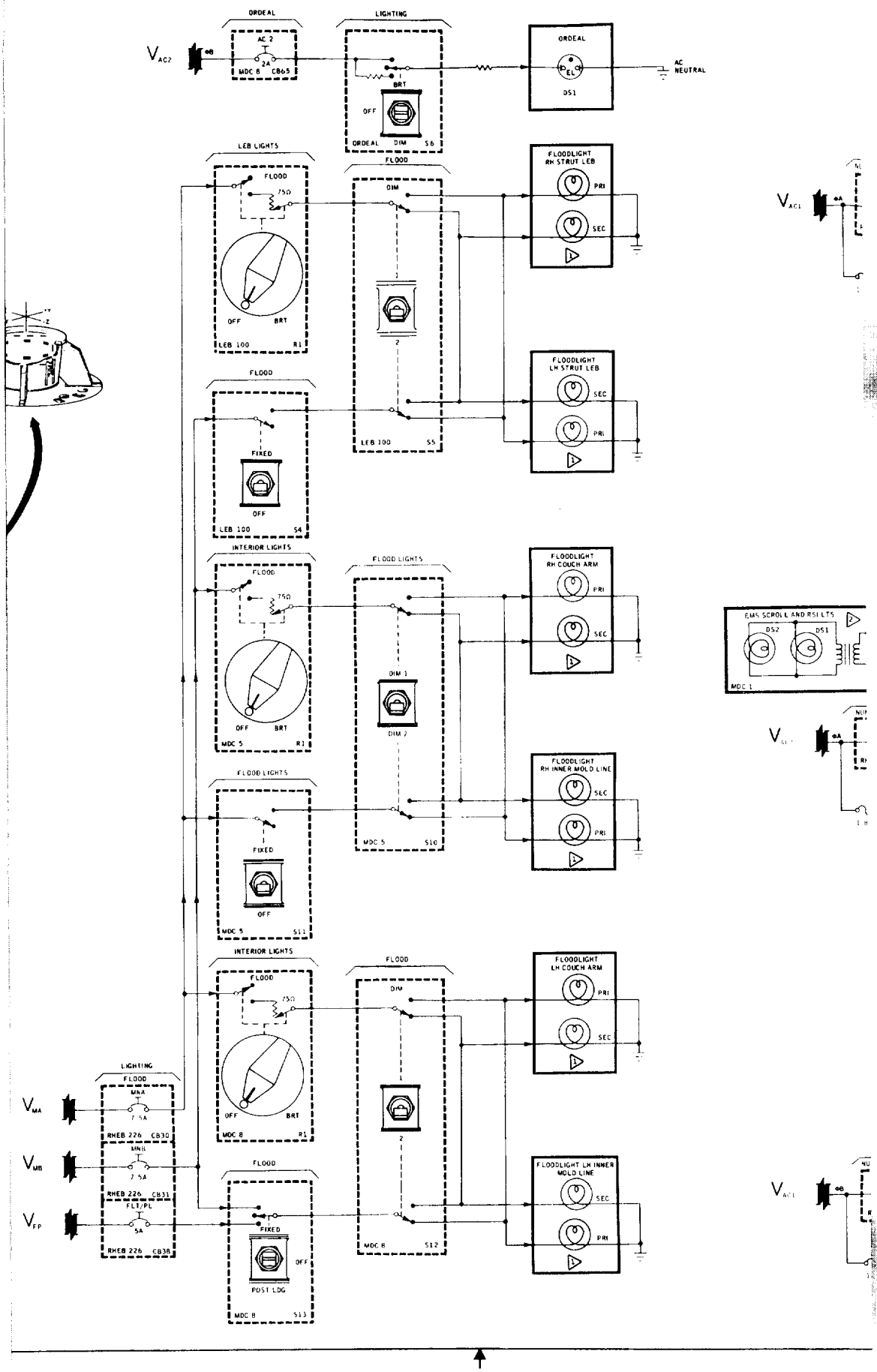


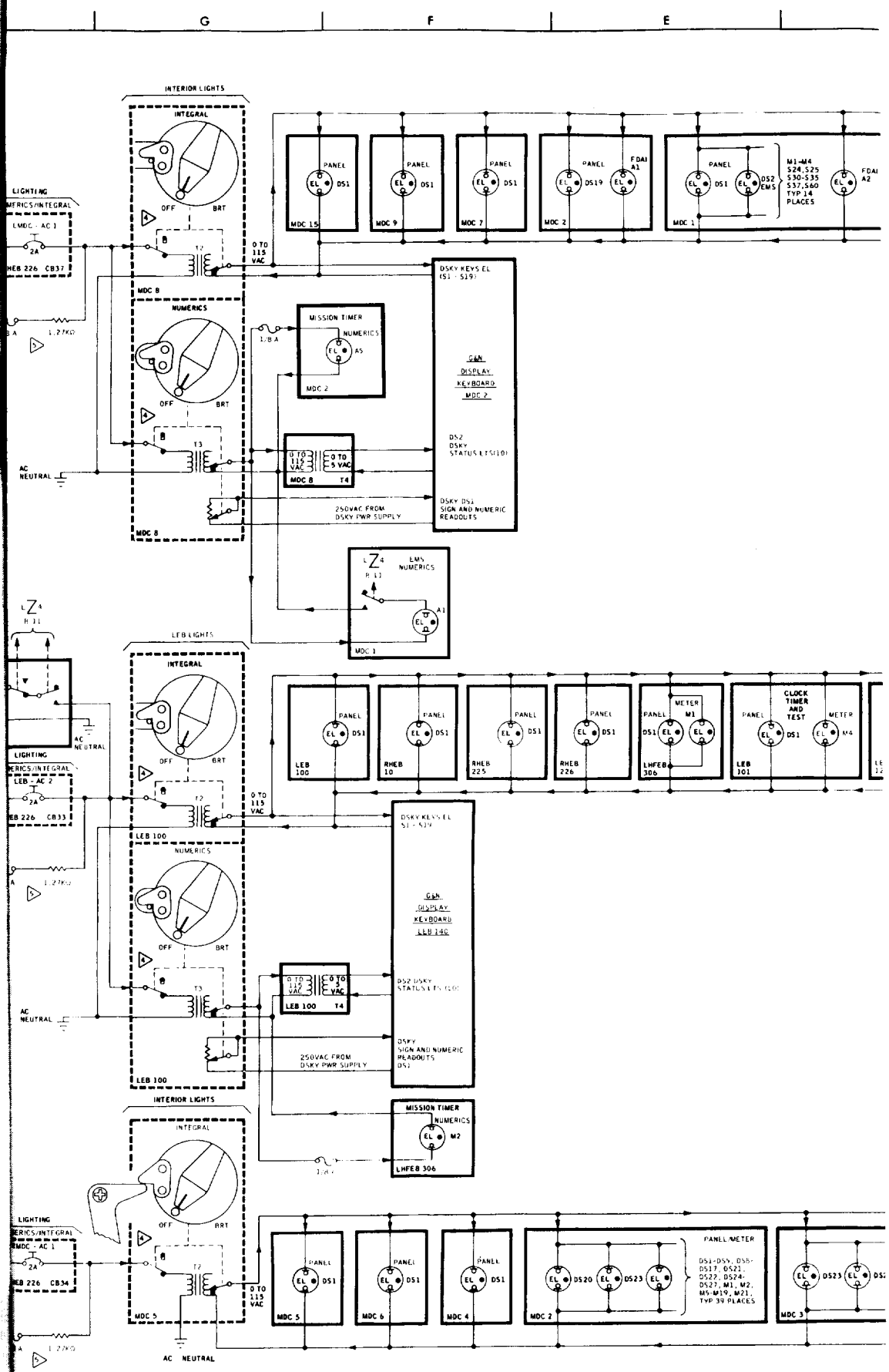
FOLDOUT FRAME 1



FOLDOUT FRAME 2

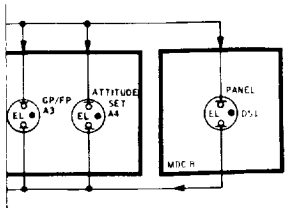


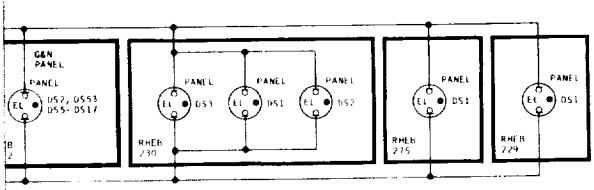
FOLDOUT FRAME 3



FOLDOUT FRAME 4

LTR	PCN	DR	ENG	DATE	APPROVAL
COMMENTS					





CODE A - ASSEMBLY (A1, ETC)
EL - ELECTROLUMINESCENT BACKGROUND LIGHTING
DS - DEVICE SIGNAL (TALKBACK)
M - METER (M1, ETC)
S - SWITCH (S1, ETC)

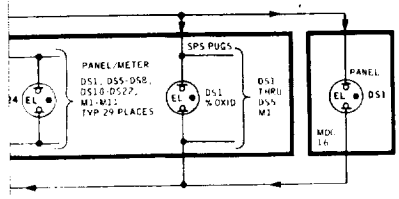
5 PREVENTS CURRENT SURGE - WHICH IN TURN PREVENTS SPURIOUS RCS JET FIRINGS

4 CONTROL KNOB IS MECHANICALLY INHIBITED FROM COMPLETE CCW ROTATION TO OFF

3 RECOVERY BEACON LIGHT SHOWN ON DWG 6.6

2 INCANDESCENT LIGHTS

NOTES 1 FLUORESCENT LIGHT - CONVERTER IN EACH LIGHT FIXTURE CONVERTS +28 VDC TO AC



5 LIGHTING

SIGNATURES	DATE
DR	3/4/72
DSGN	
QC	
ENGR	
ENGR	
APP	
APP	
STC	

NATIONAL AERONAUTICS & SPACE ADMINISTRATION
MANNED SPACECRAFT CENTER · HOUSTON, TEXAS

LIGHTING
INTERIOR AND EXTERIOR

SKYLAB CSM
116 THRU 119

3.5

94 X 34 | PAGE 3.5 | SHEET 1 OF 1

FOLDOUT FRAME 5

5

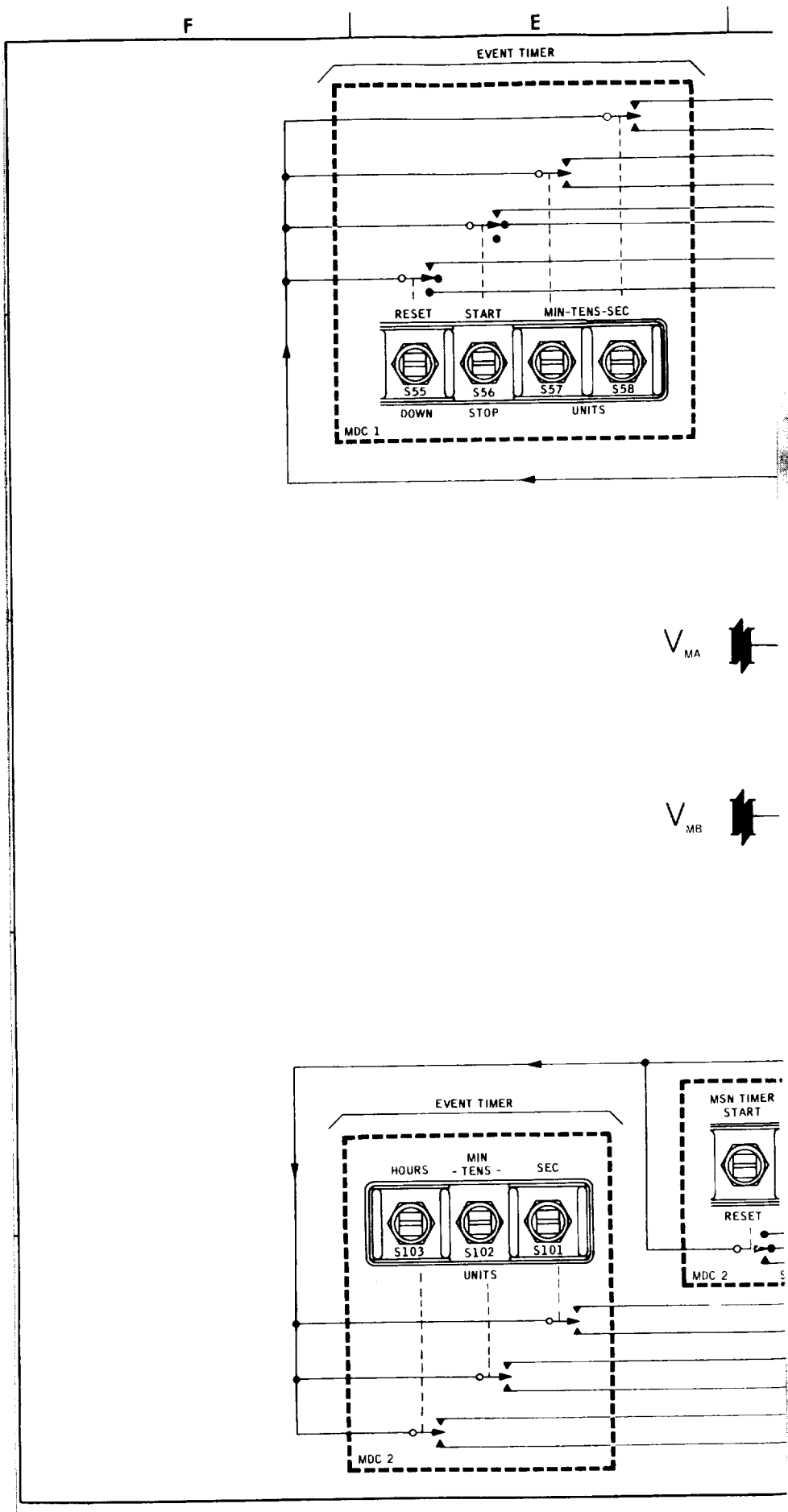
4

3

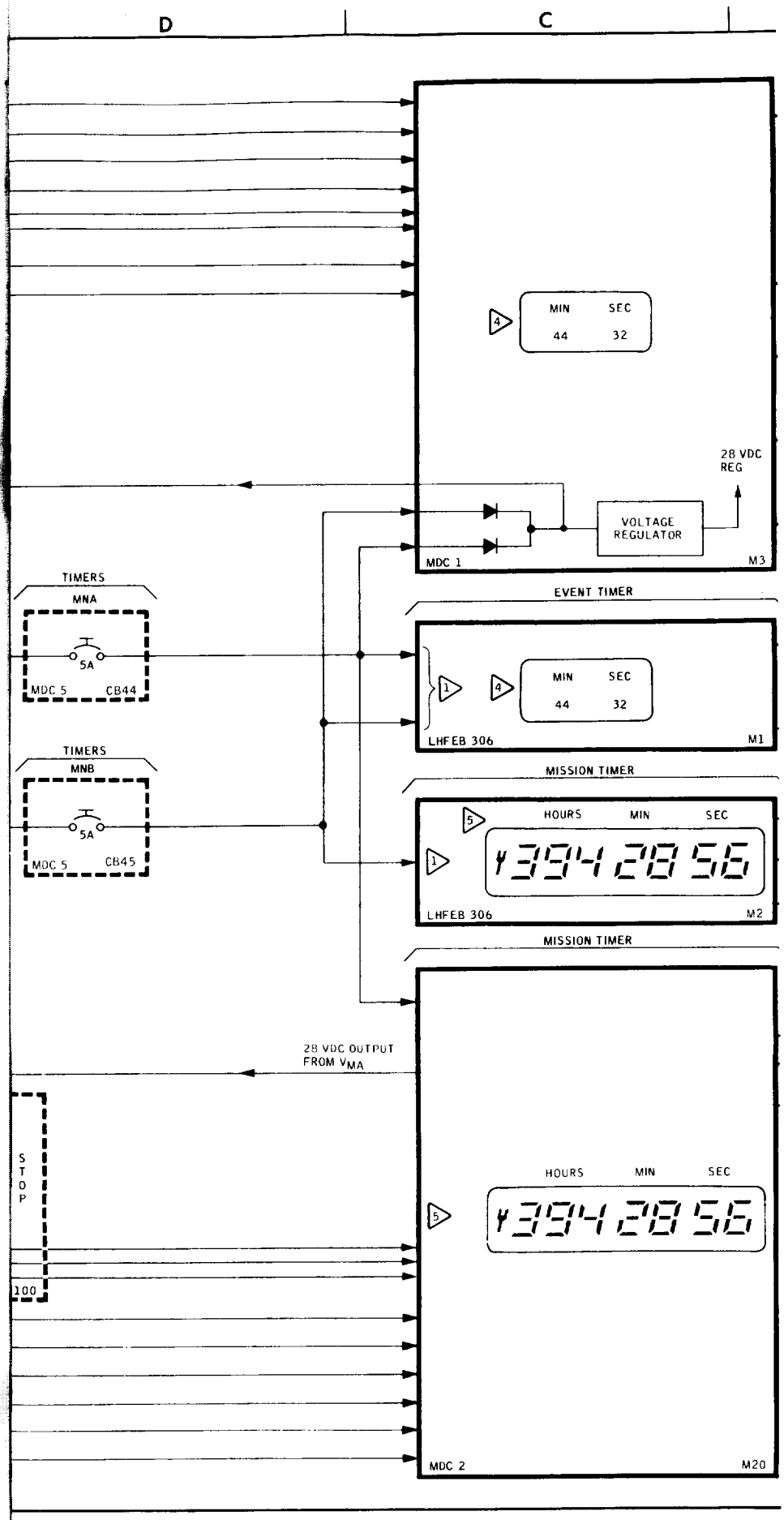
2

1

FOLDOUT FRAME



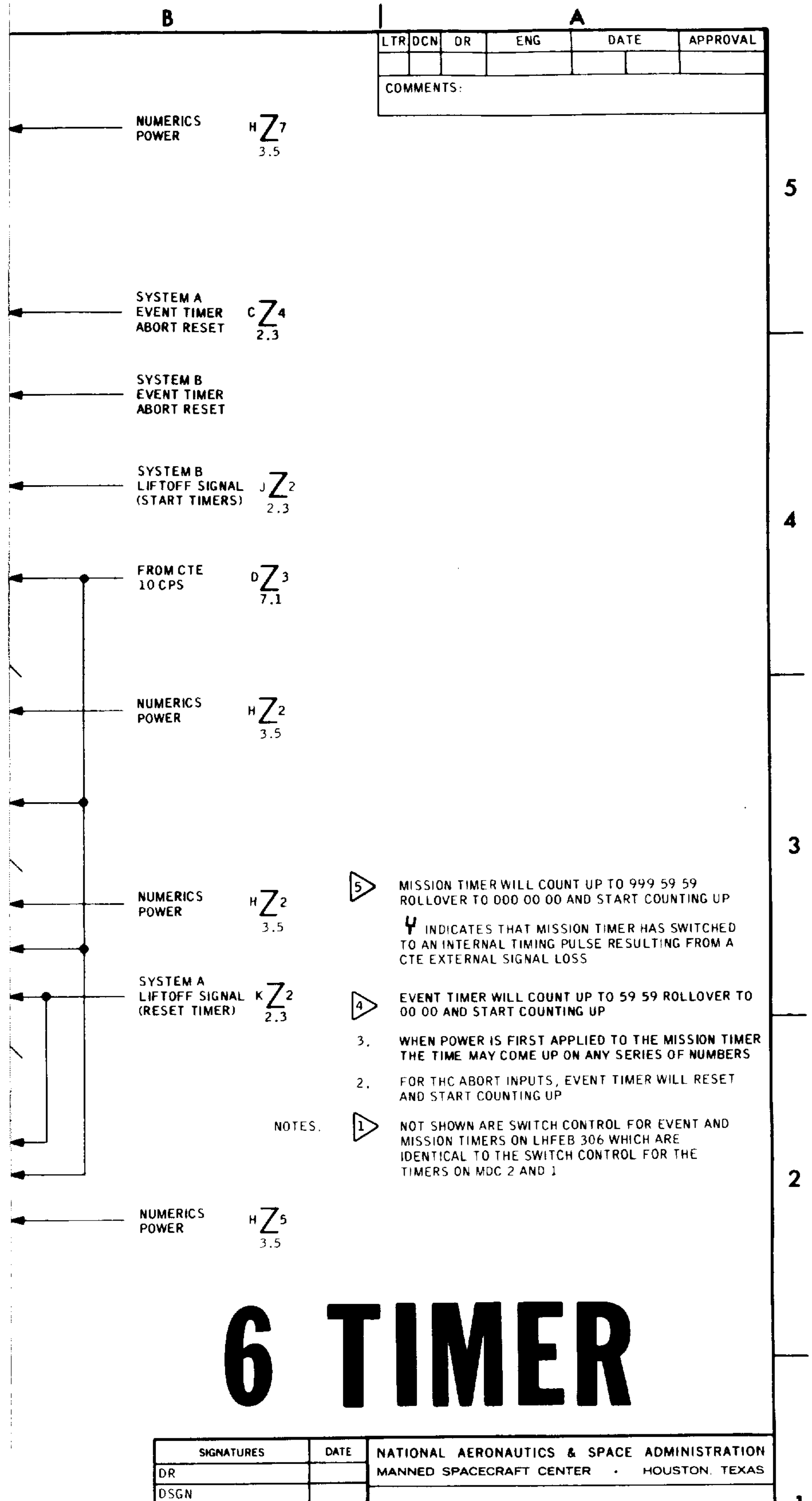
FOLDOUT FRAME 2



FOLDOUT FRAME 3

LTR	DCN	DR	ENG	DATE		APPROVAL

COMMENTS:



NOTES.

5. MISSION TIMER WILL COUNT UP TO 999 59 59 ROLLOVER TO 000 00 00 AND START COUNTING UP

   Ψ INDICATES THAT MISSION TIMER HAS SWITCHED TO AN INTERNAL TIMING PULSE RESULTING FROM A CTE EXTERNAL SIGNAL LOSS

4. EVENT TIMER WILL COUNT UP TO 59 59 ROLLOVER TO 00 00 AND START COUNTING UP

3. WHEN POWER IS FIRST APPLIED TO THE MISSION TIMER THE TIME MAY COME UP ON ANY SERIES OF NUMBERS

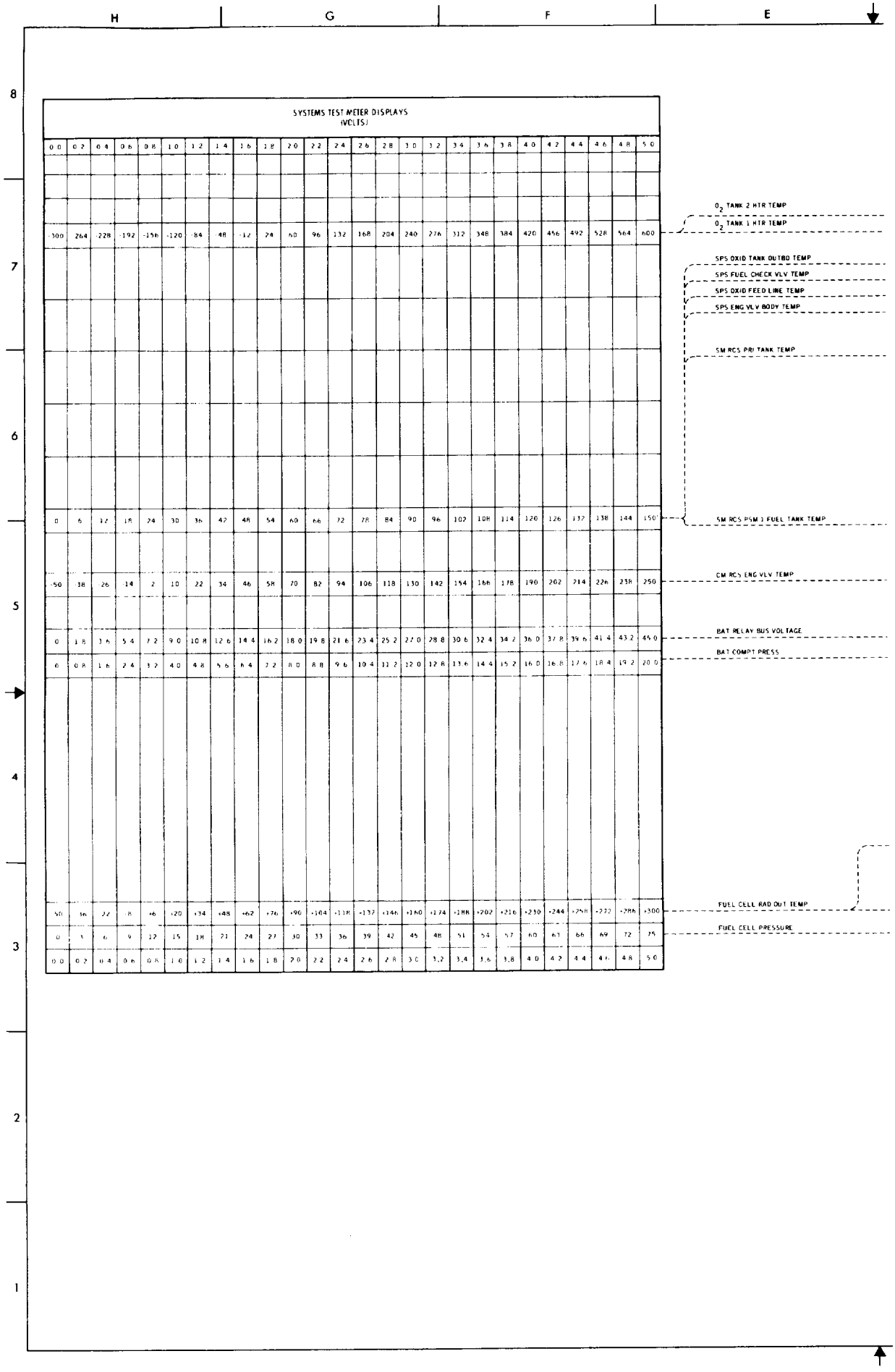
2. FOR THC ABORT INPUTS, EVENT TIMER WILL RESET AND START COUNTING UP

1. NOT SHOWN ARE SWITCH CONTROL FOR EVENT AND MISSION TIMERS ON LHFEB 306 WHICH ARE IDENTICAL TO THE SWITCH CONTROL FOR THE TIMERS ON MDC 2 AND 1

6 TIMER

SIGNATURES	DATE	NATIONAL AERONAUTICS & SPACE ADMINISTRATION MANNED SPACECRAFT CENTER · HOUSTON, TEXAS
DR		
DSGN		TIMER CONTROL
QC		
ENGR Charlie Jones	4/11/72	
ENGR		
APP John Aaron	4/11/72	
APP J R Joe	4/11/72	SKYLAB CSM — DWG NO 3.6
STC Dean B Lusher	4-11-72	116 THRU 119
		34 X 22 — PAGE 3-6 — SHEET 1 OF 1

FOLDOUT FRAME 4



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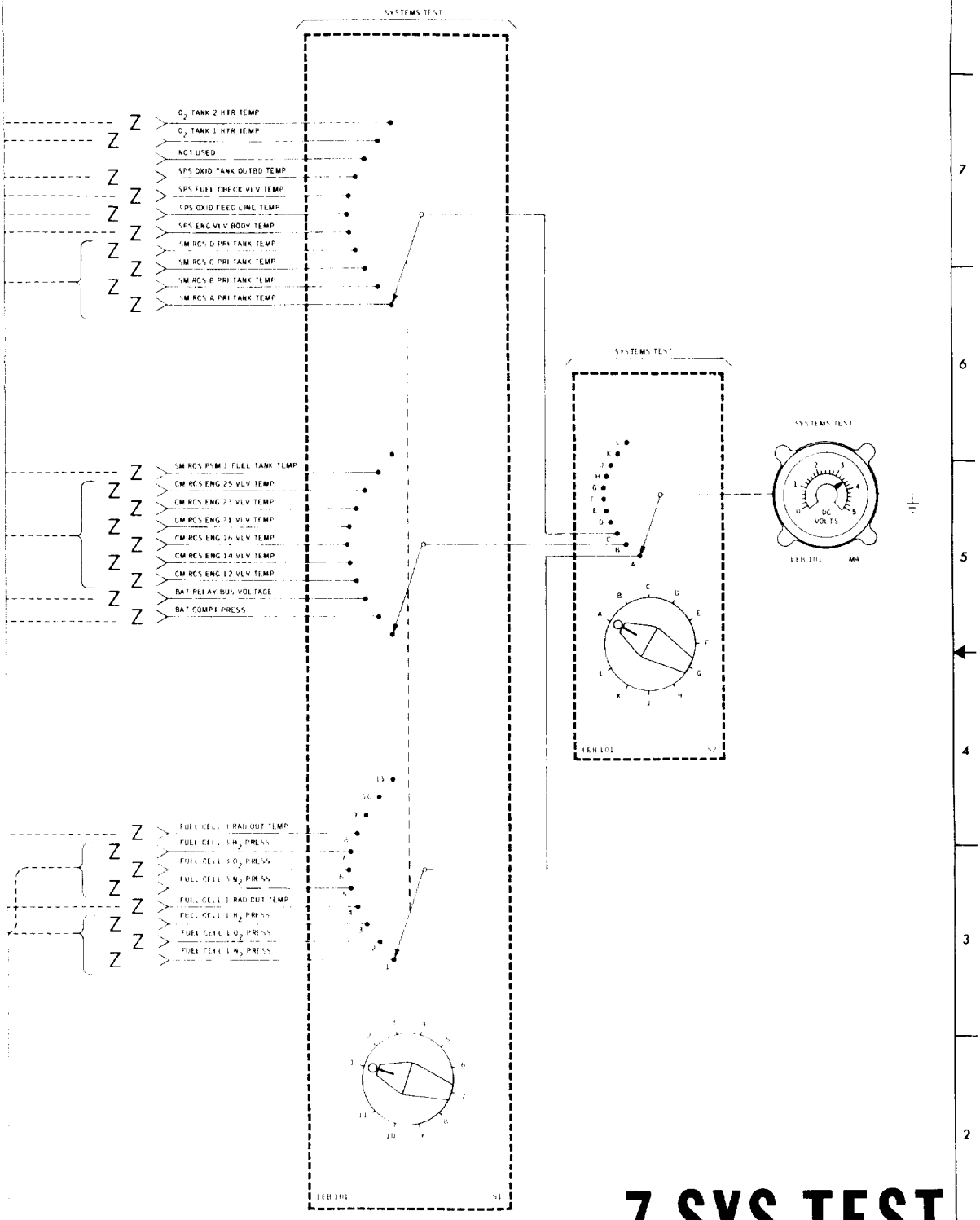


7 SYS TEST

SIGNATURES	DATE
DR	1/6/72
DSGN	
QC	
ENGR	
ENGR	
APP	
APP	
STC	

NATIONAL AERONAUTICS & SPACE ADMINISTRATION
MANNED SPACECRAFT CENTER — HOUSTON, TEXAS

SYSTEM TEST METER

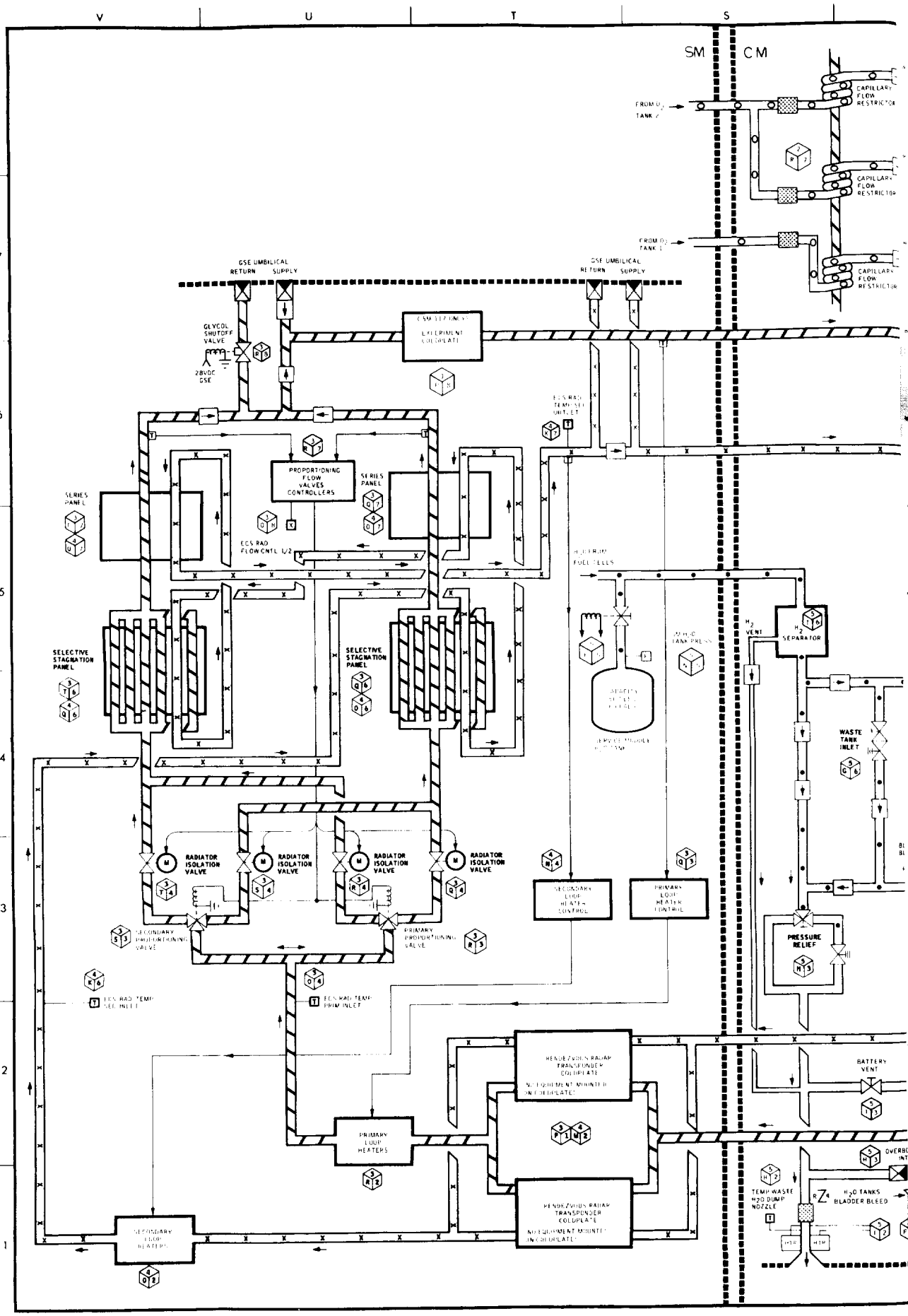
CSM SKYLAB
116 THRU 119

DWG NO 3.7

44 X 34 | PAGE 1-7 | SHEET 1 OF 1

FOLDOUT FRAME 7


4 ENVIRONMENTAL
CONTROL SYS



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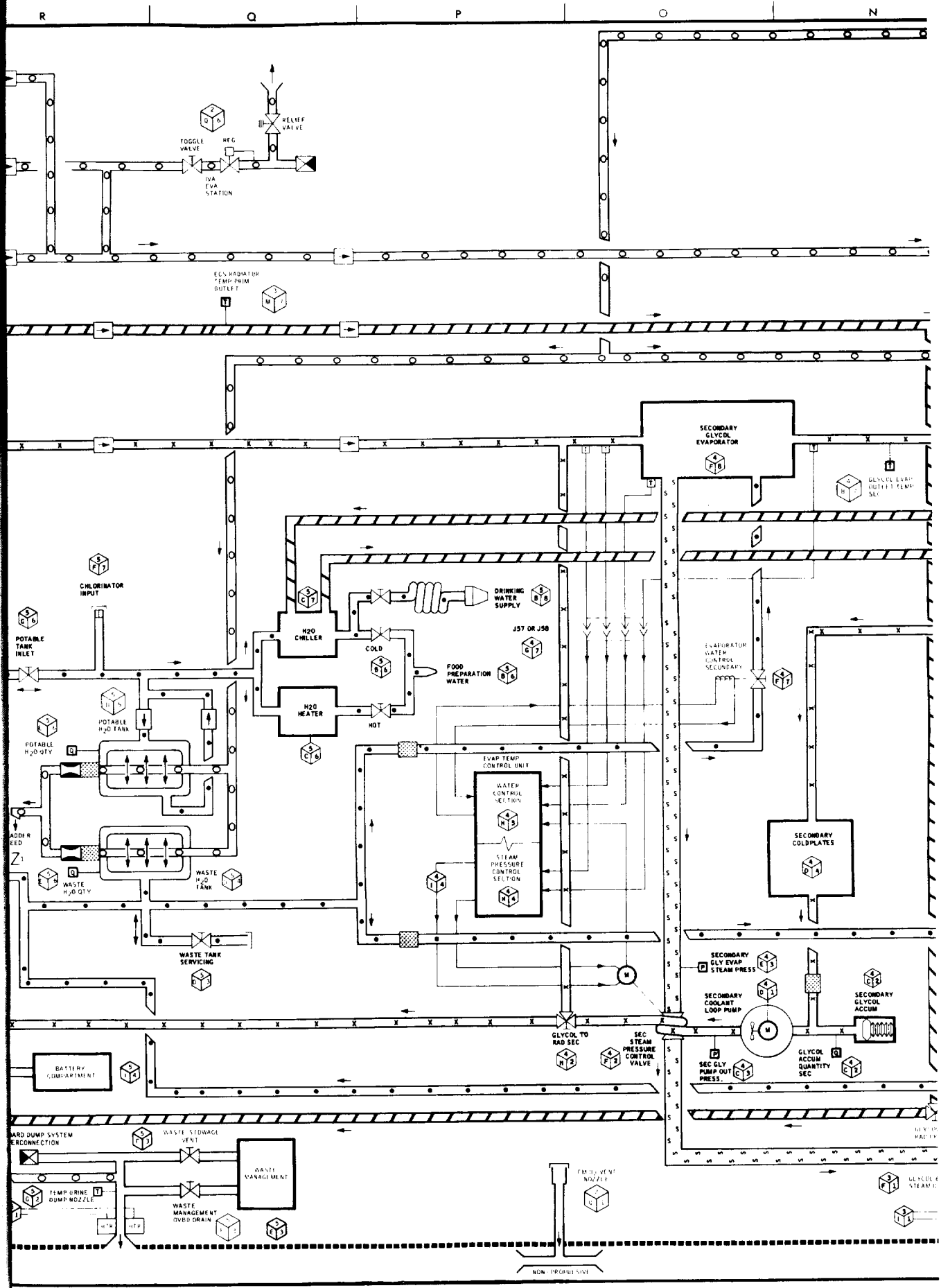

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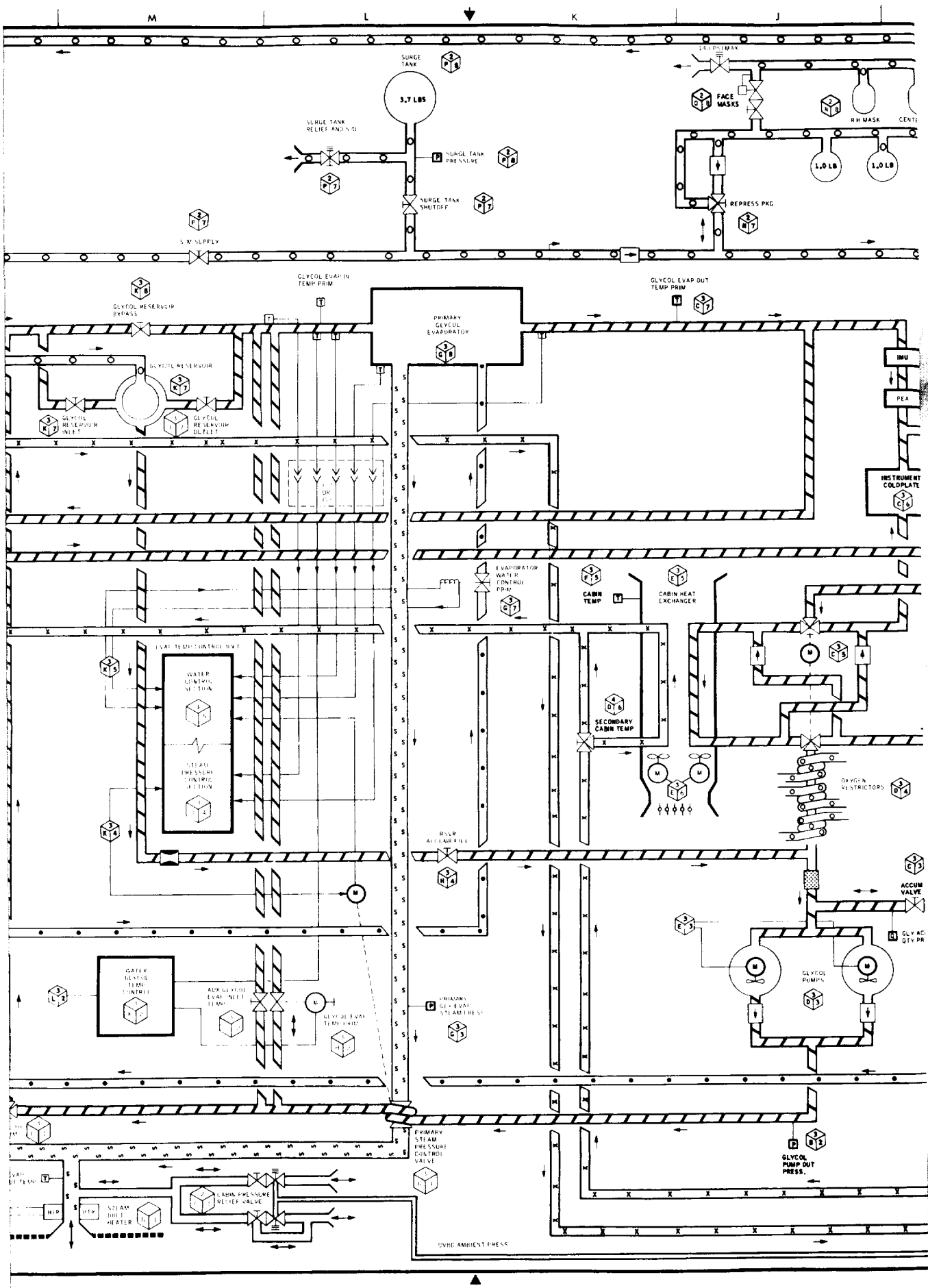

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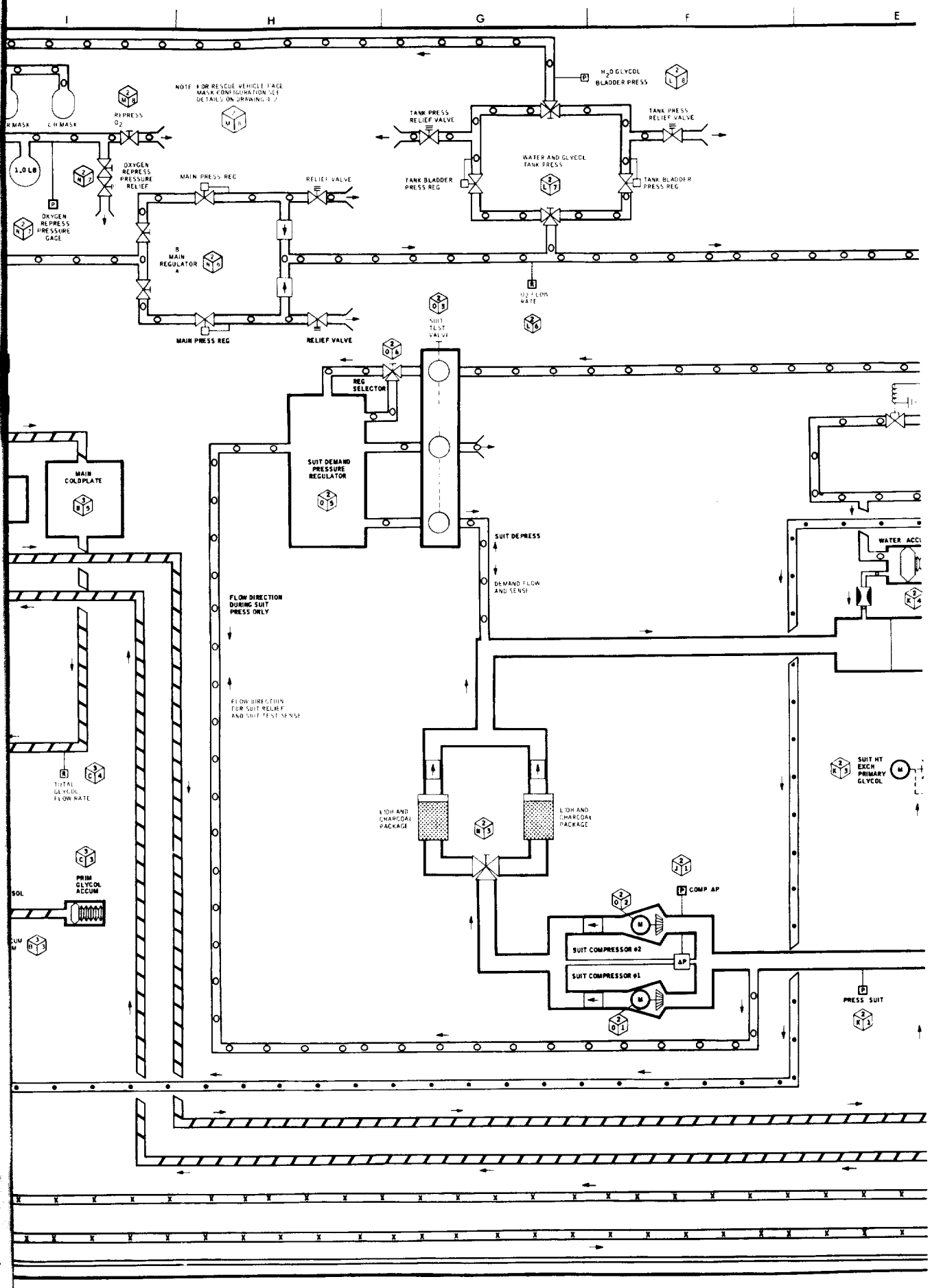

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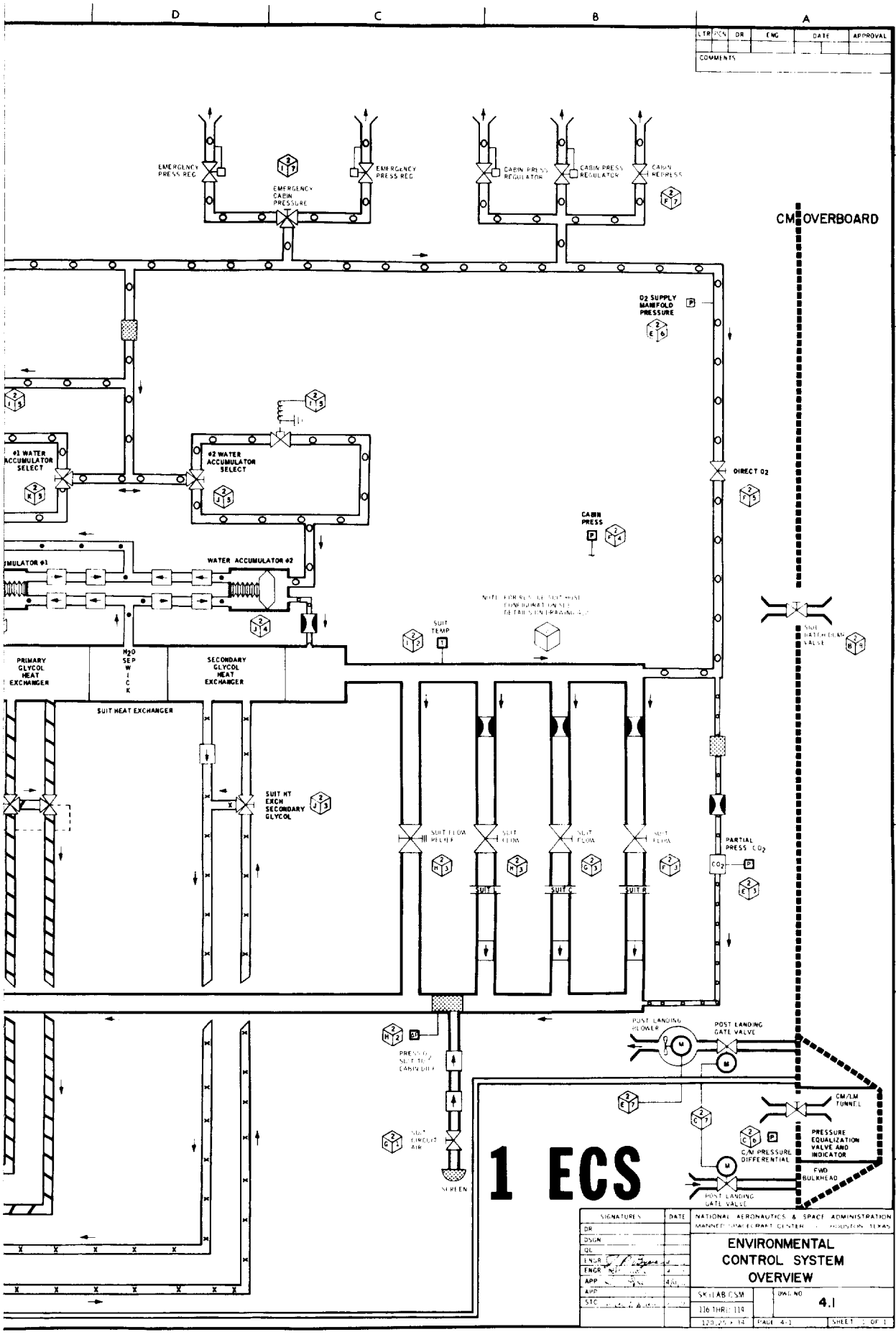

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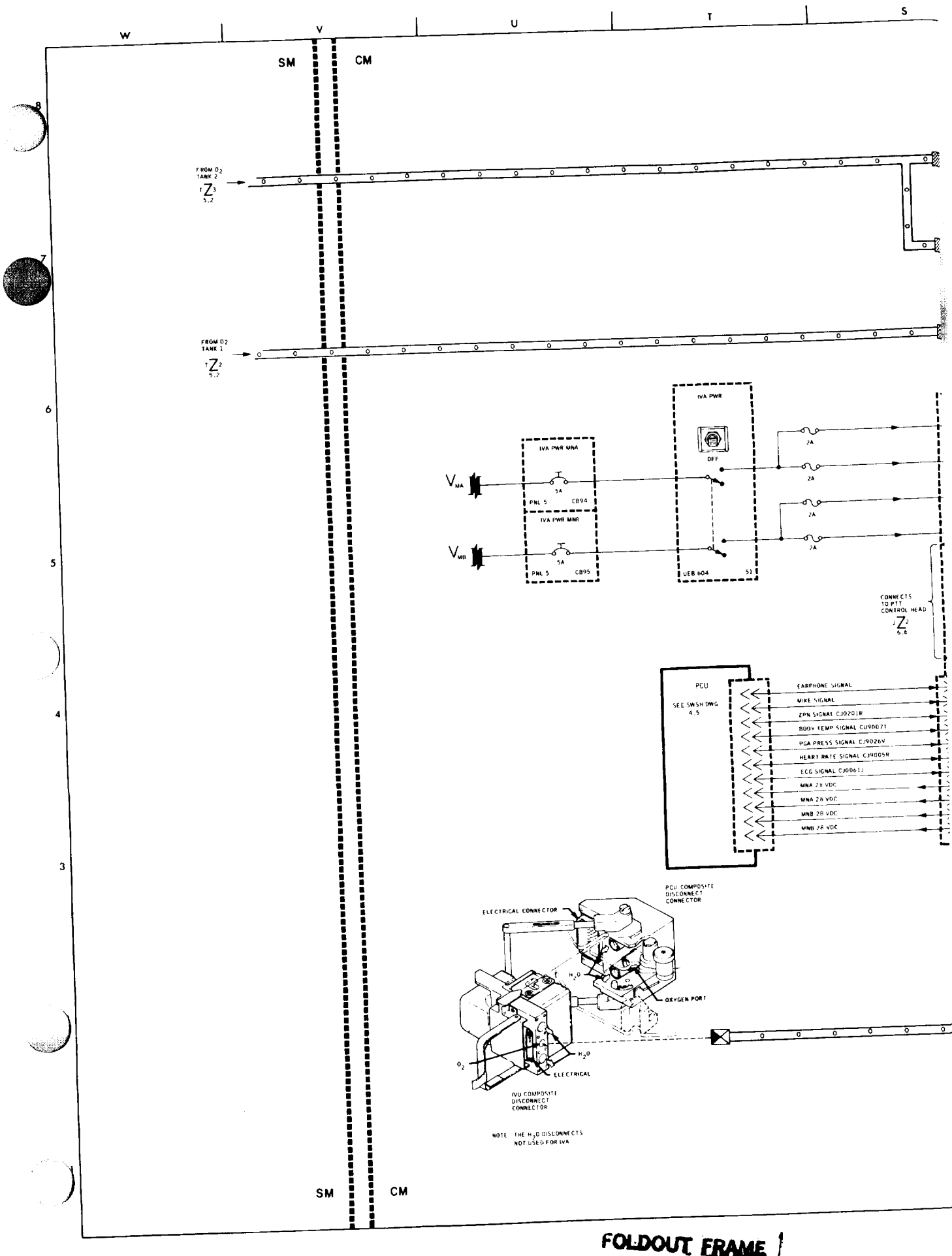

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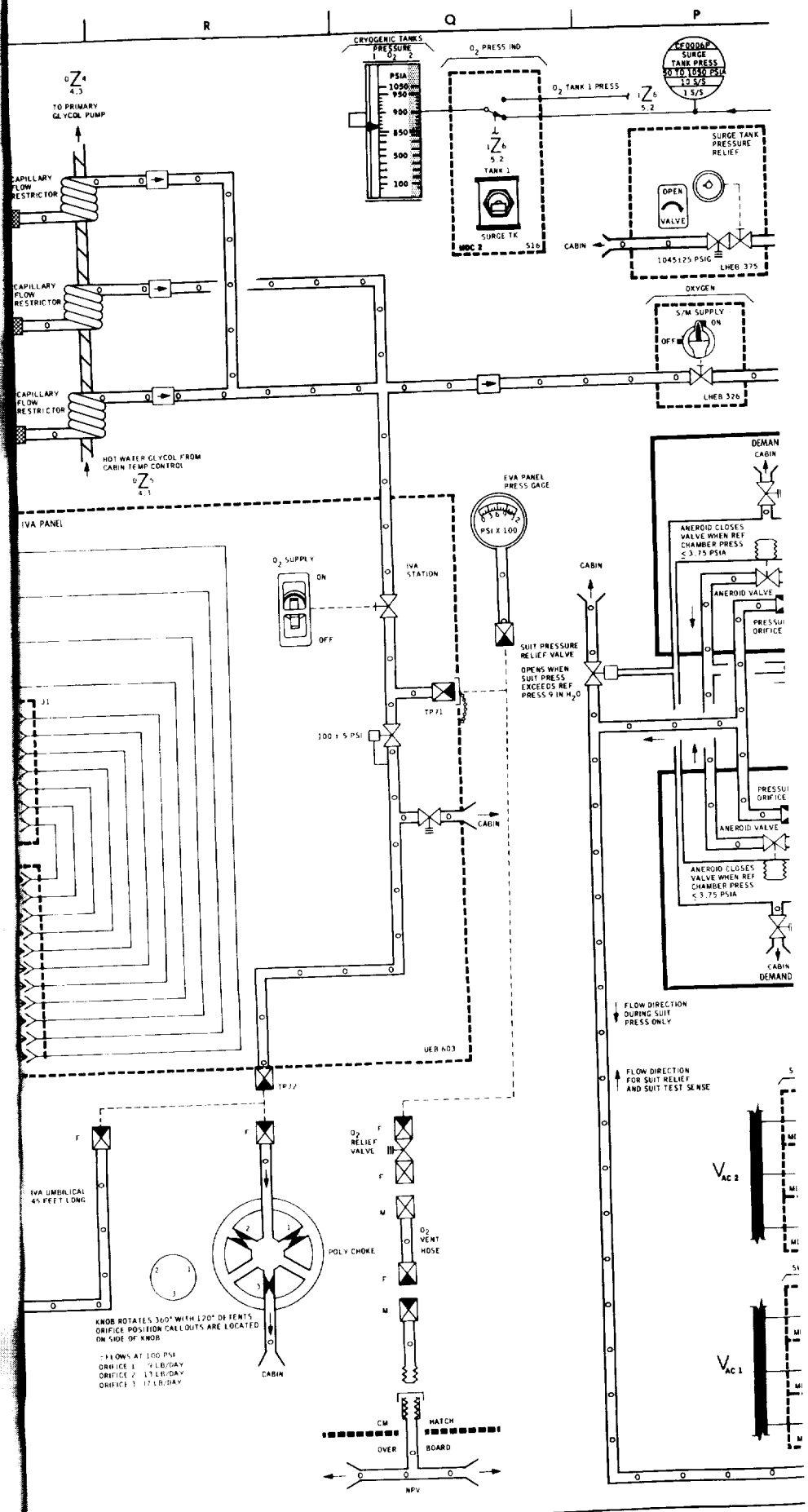

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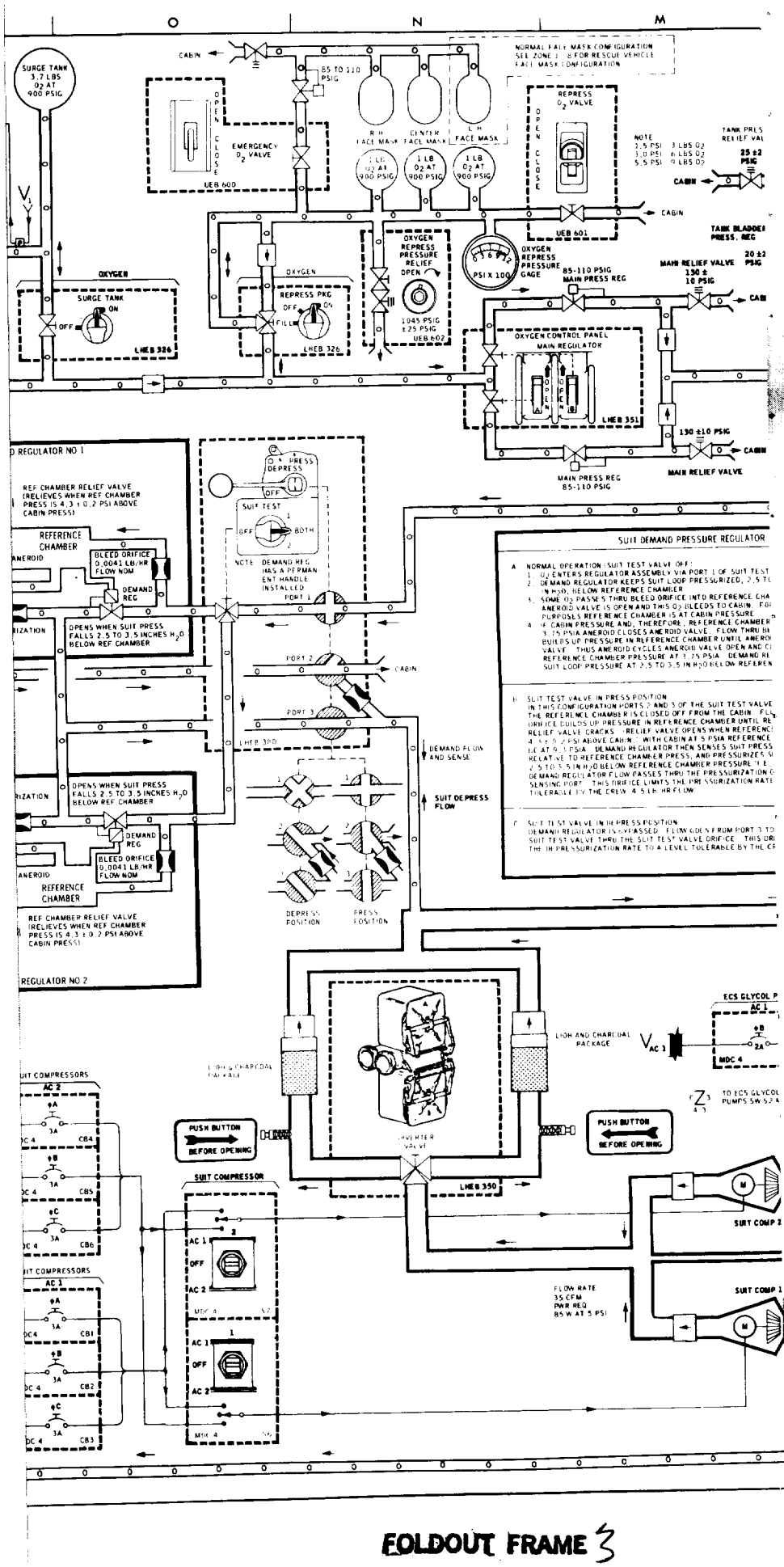

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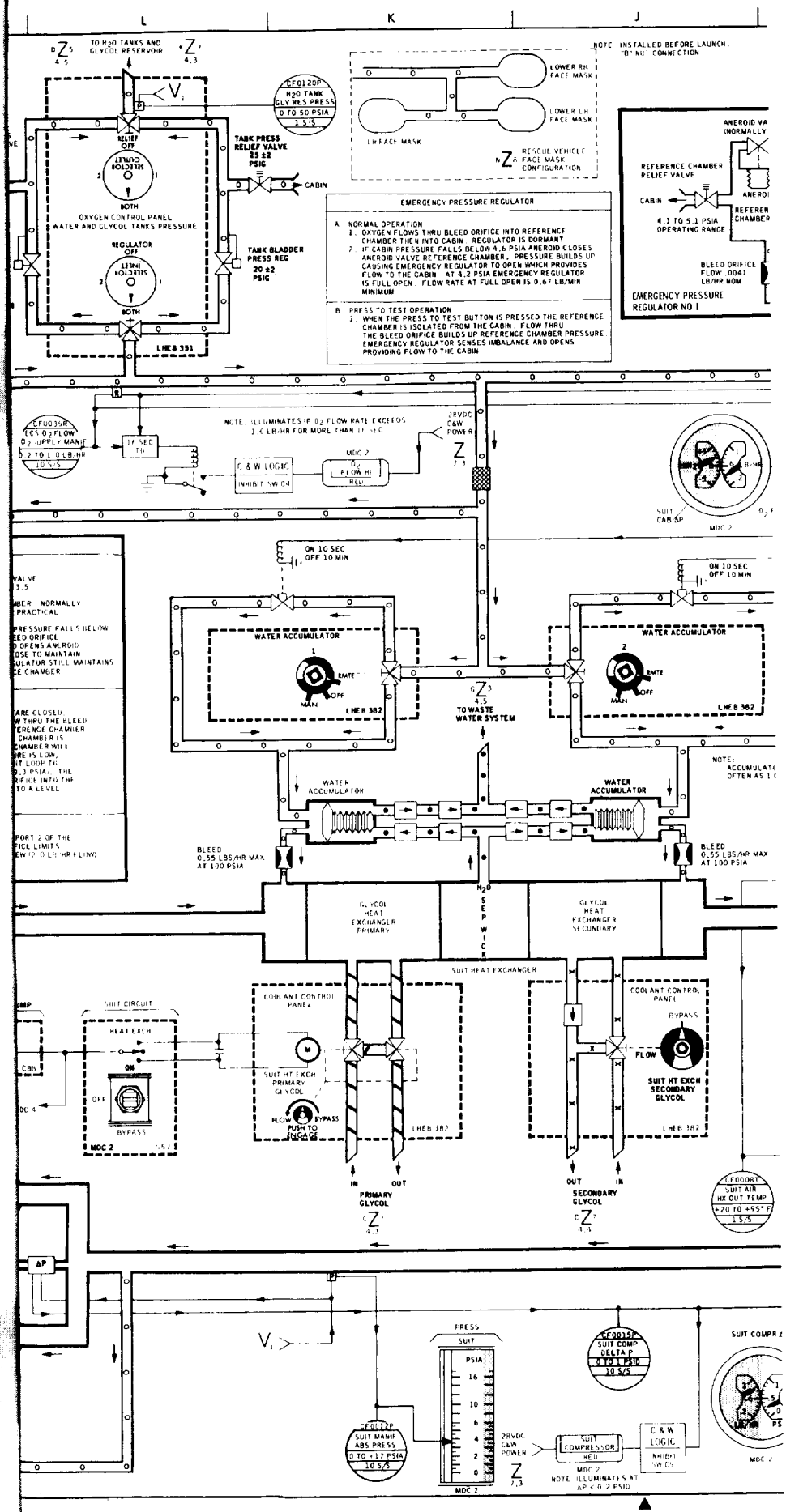

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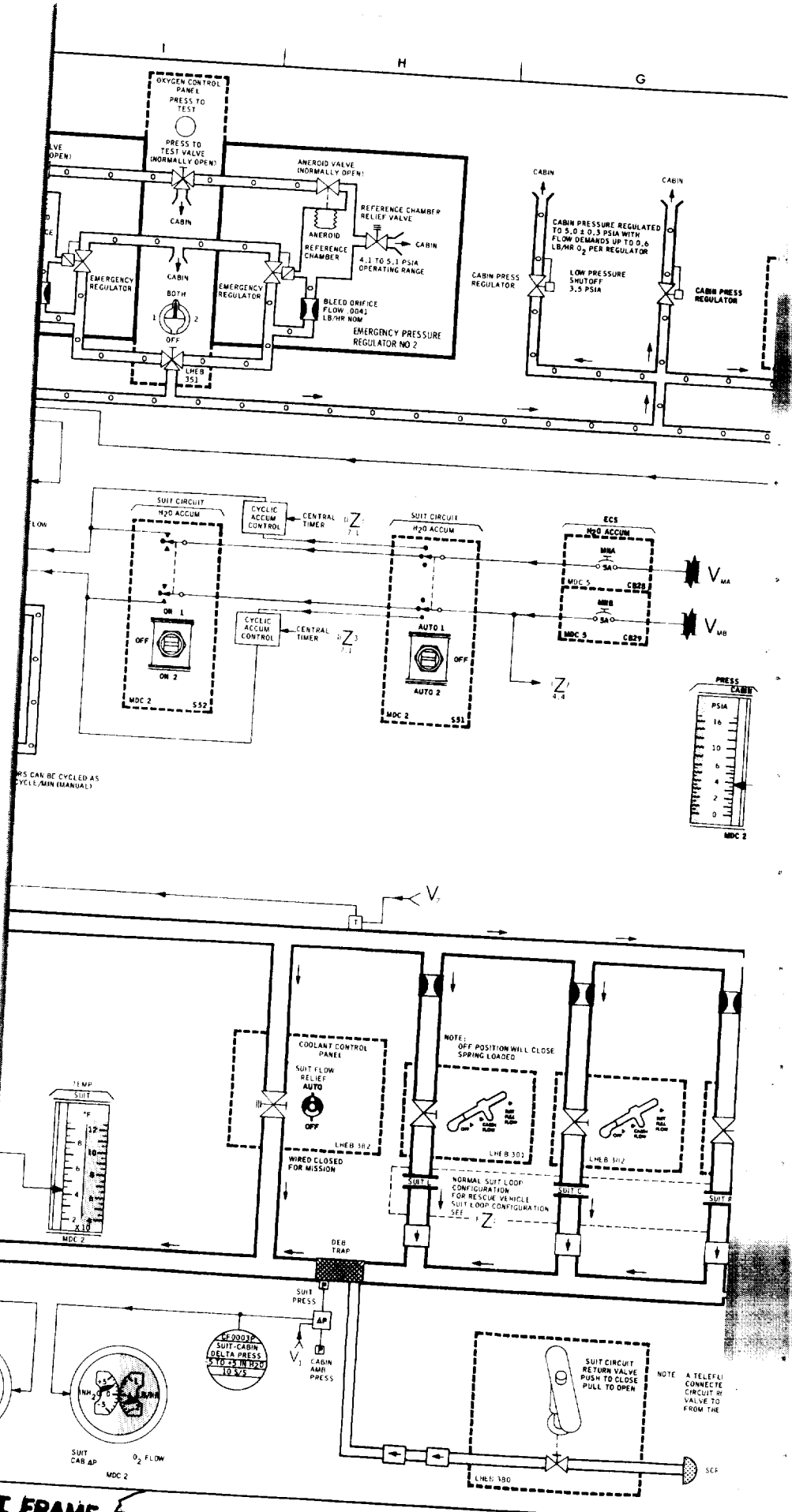

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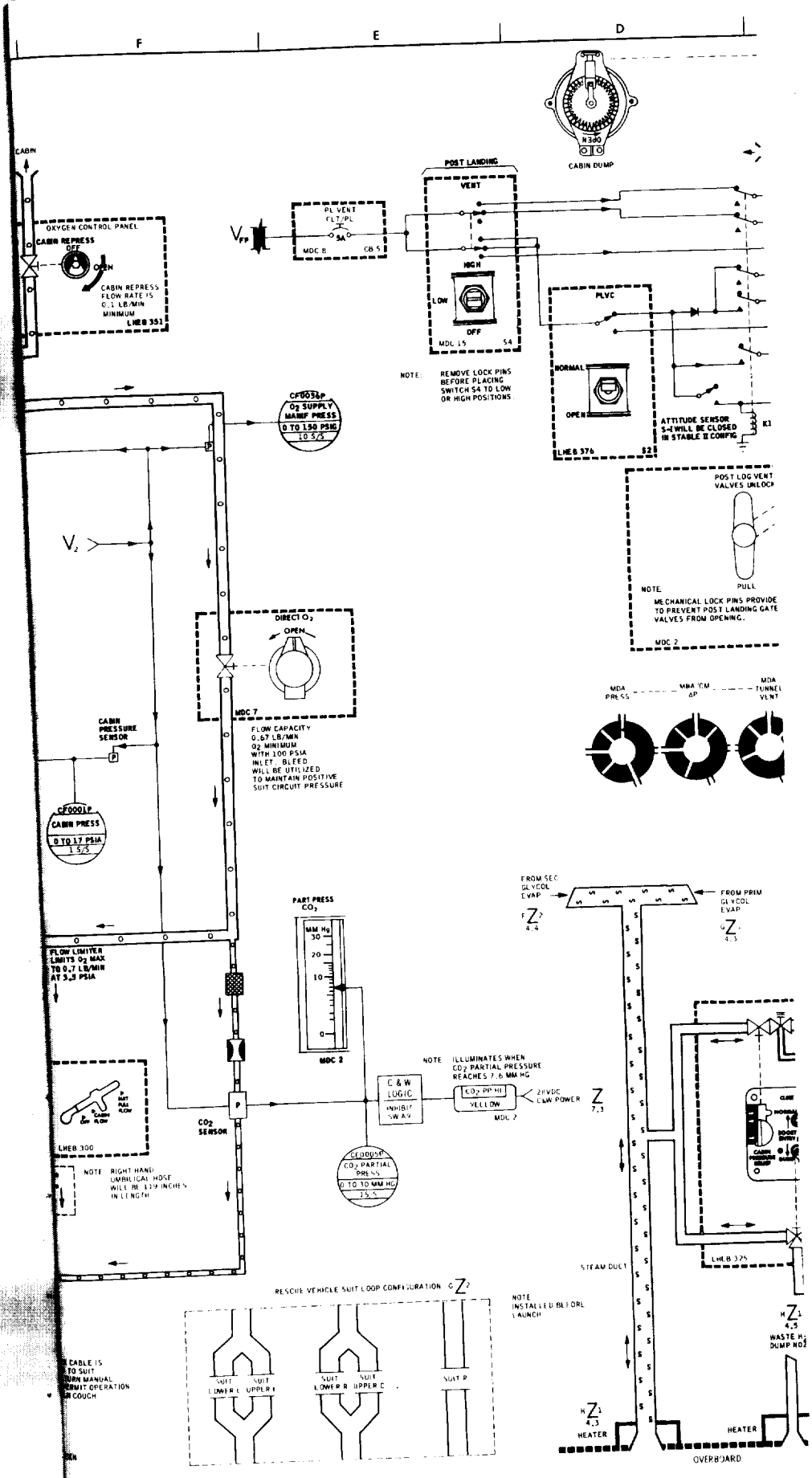

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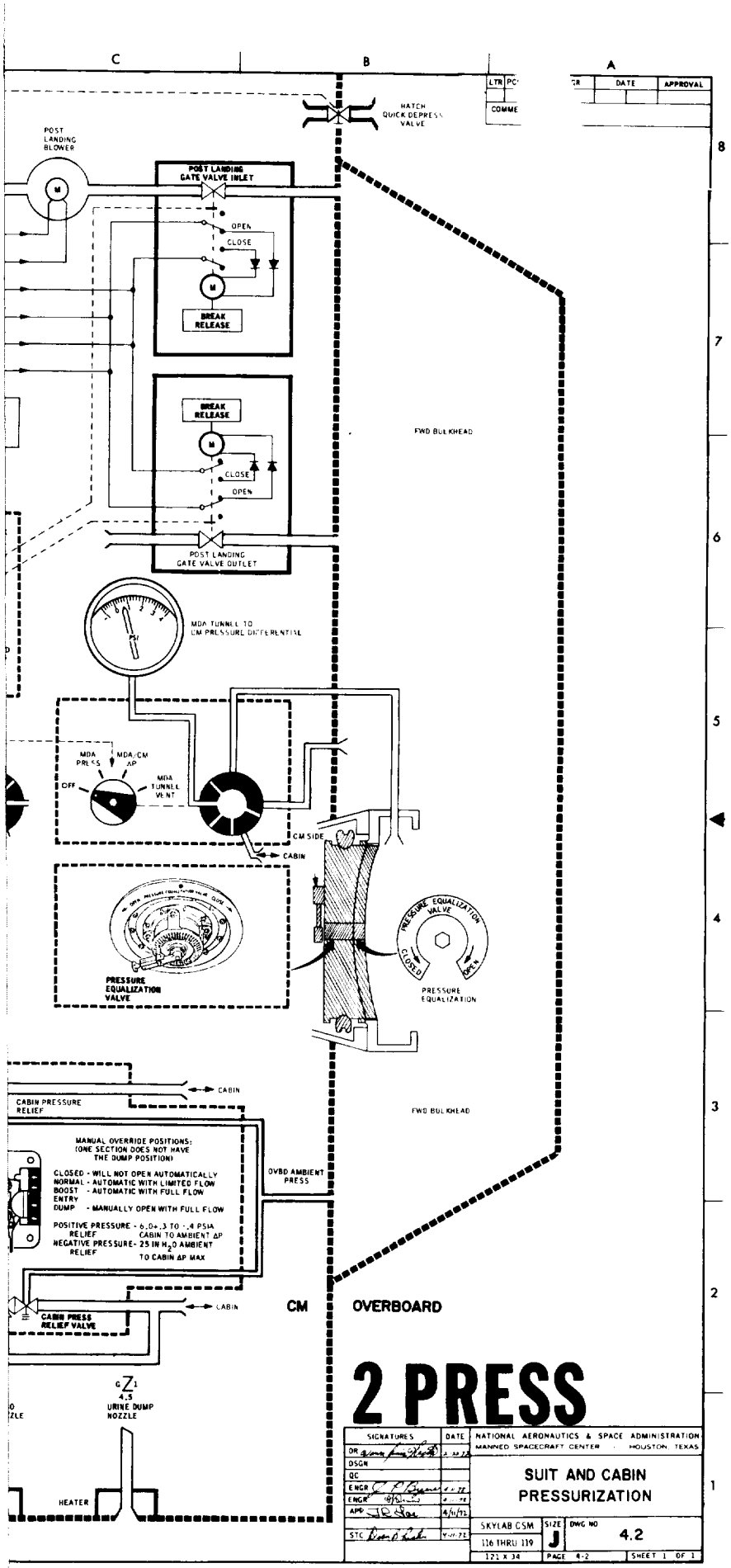

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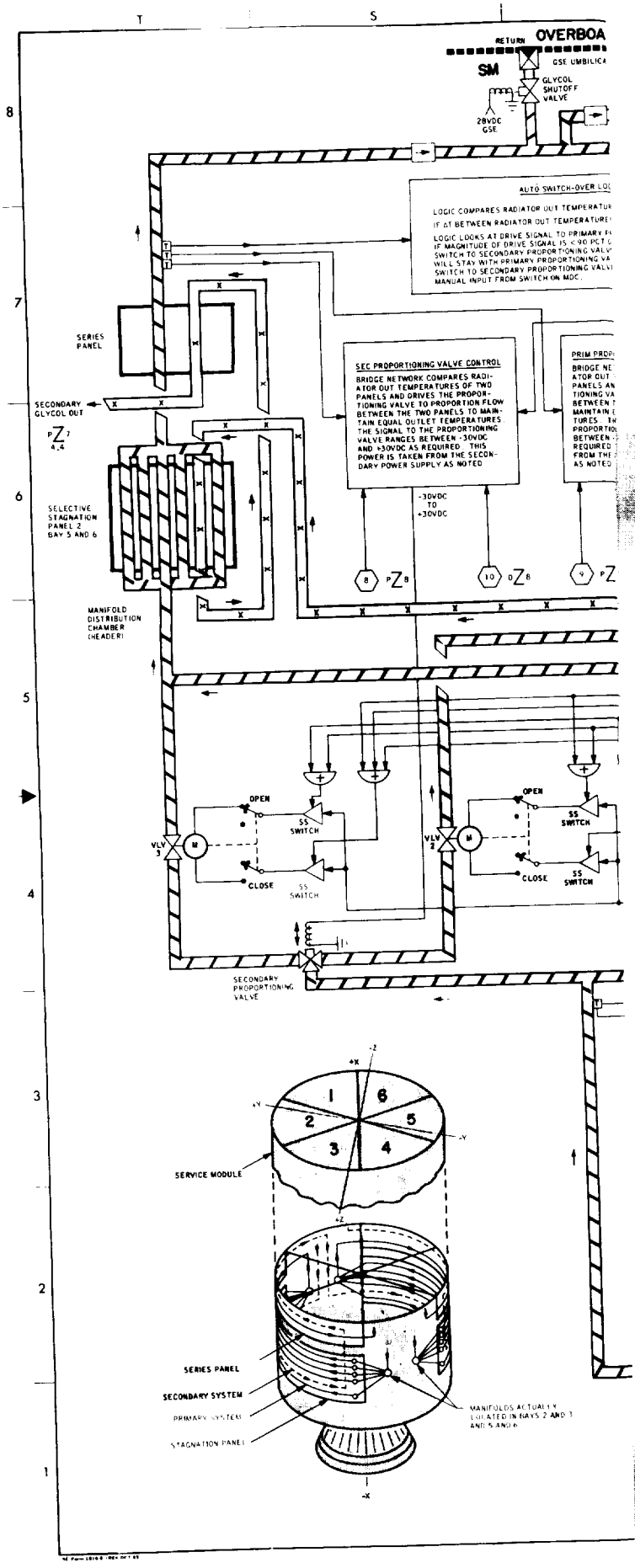

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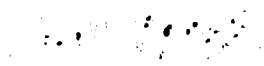

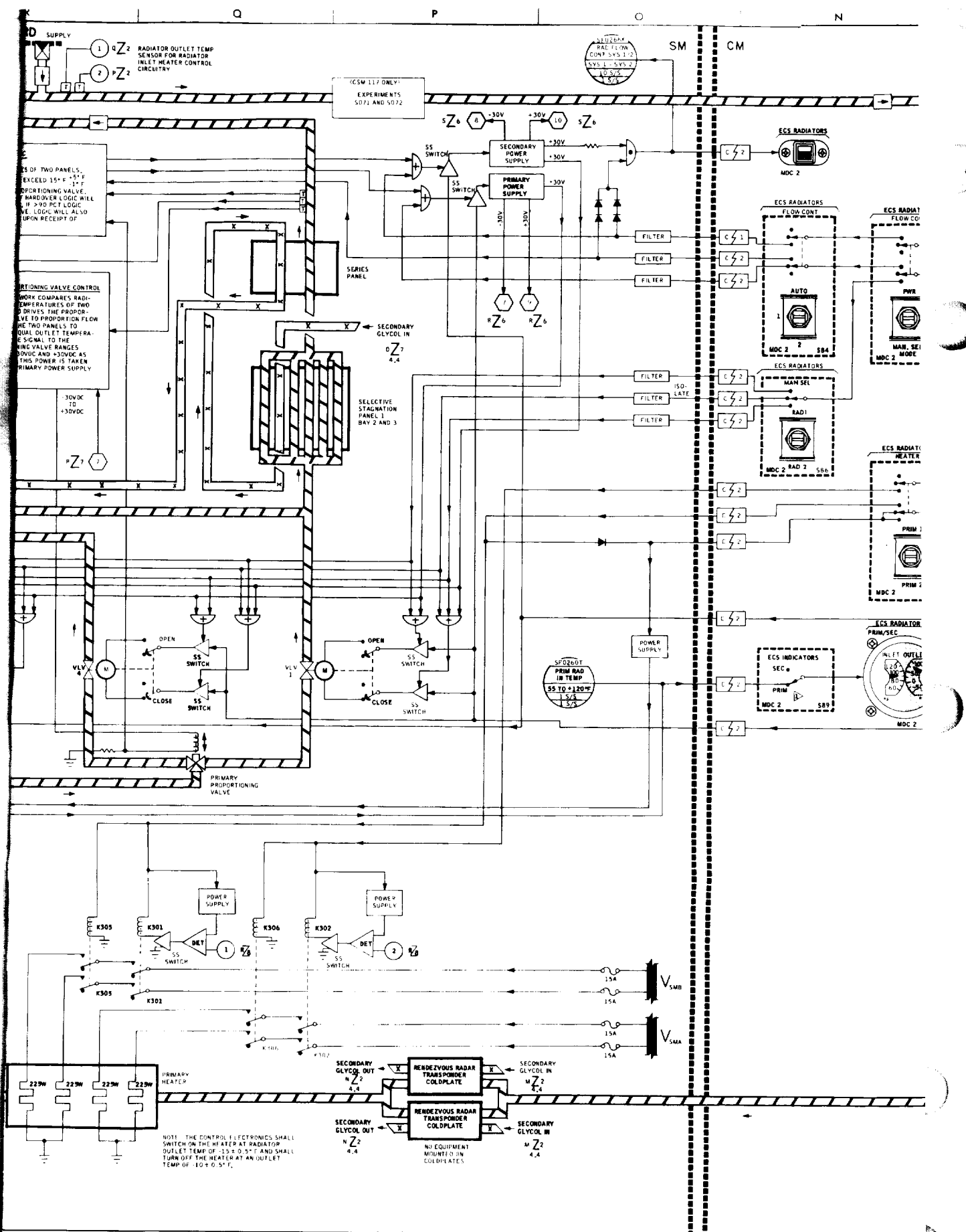

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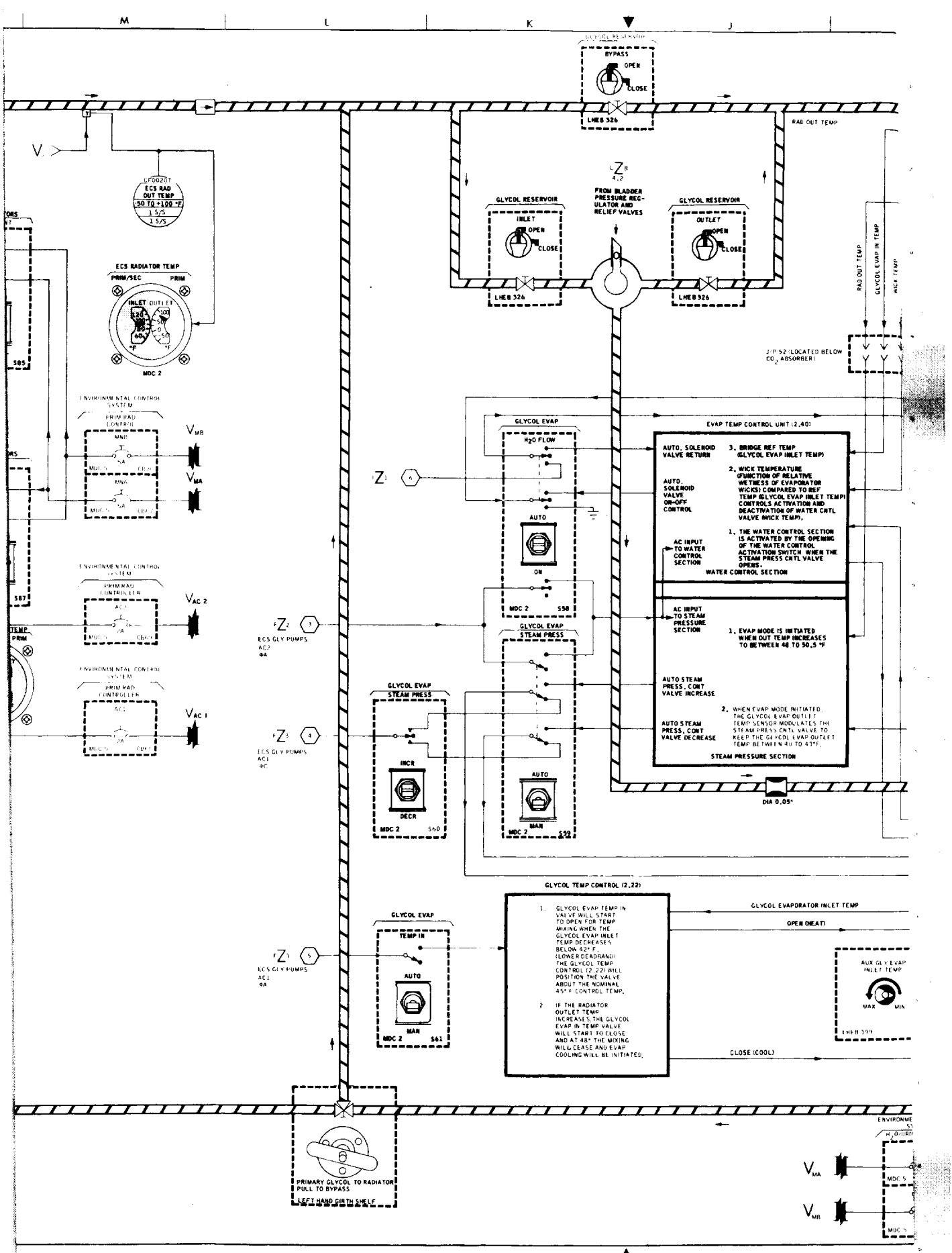

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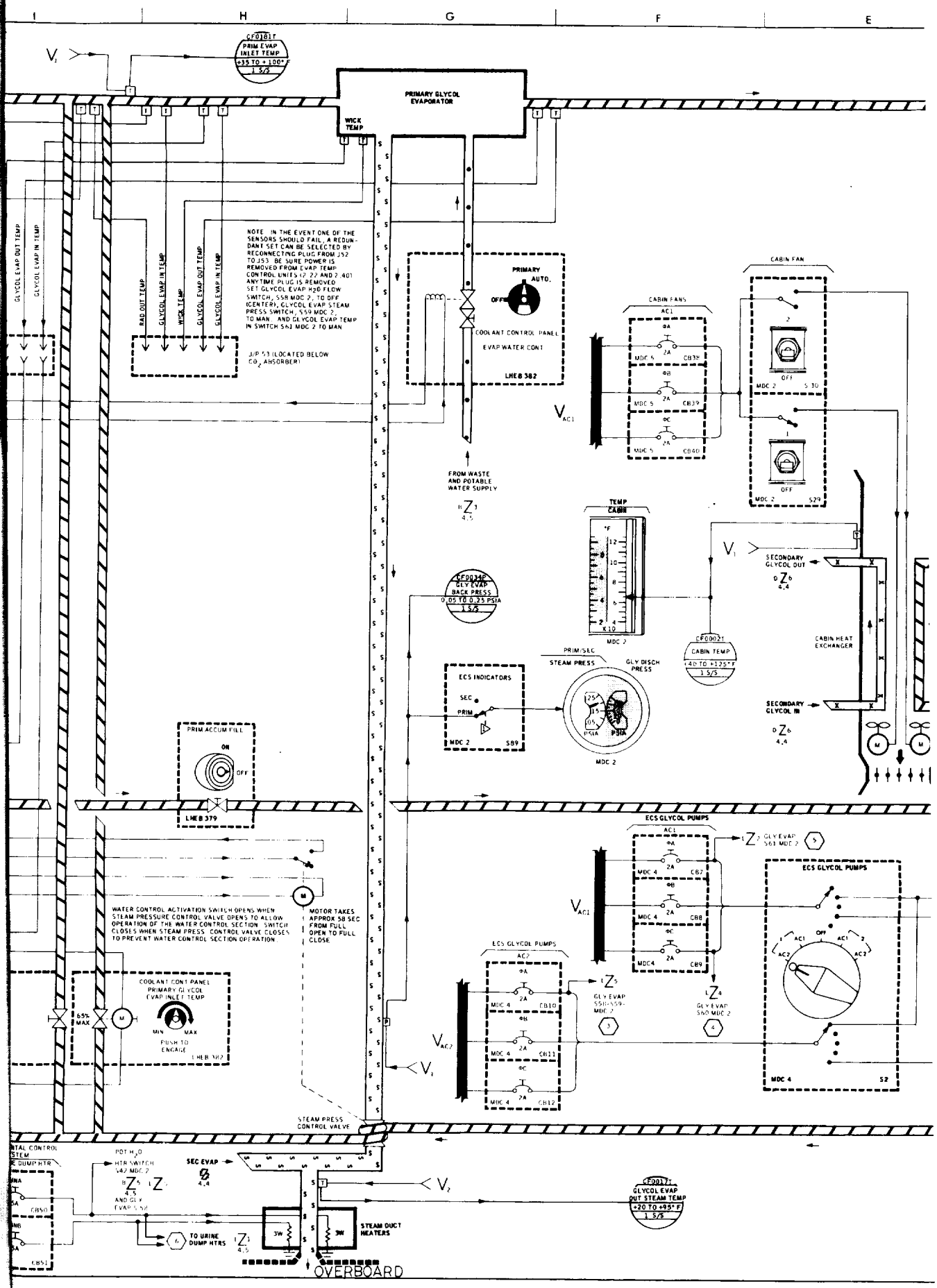

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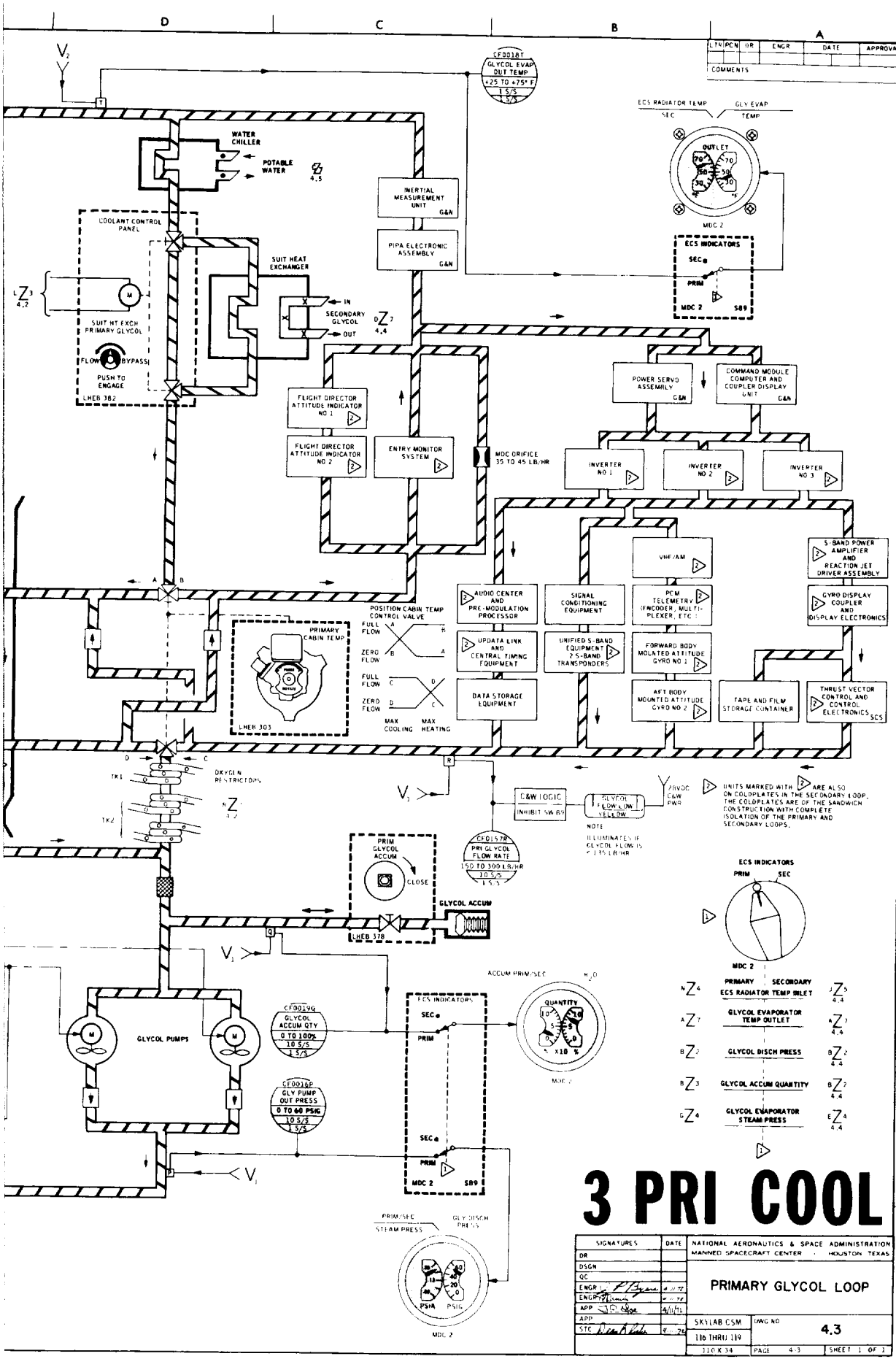


3 PRI COOL

SIGNATURES	DATE
DR	
DSGN	
QC	
ENGR	4/11/71
ENGR	4/11/71
APP	4/11/71
APP	
STC	4-21-71

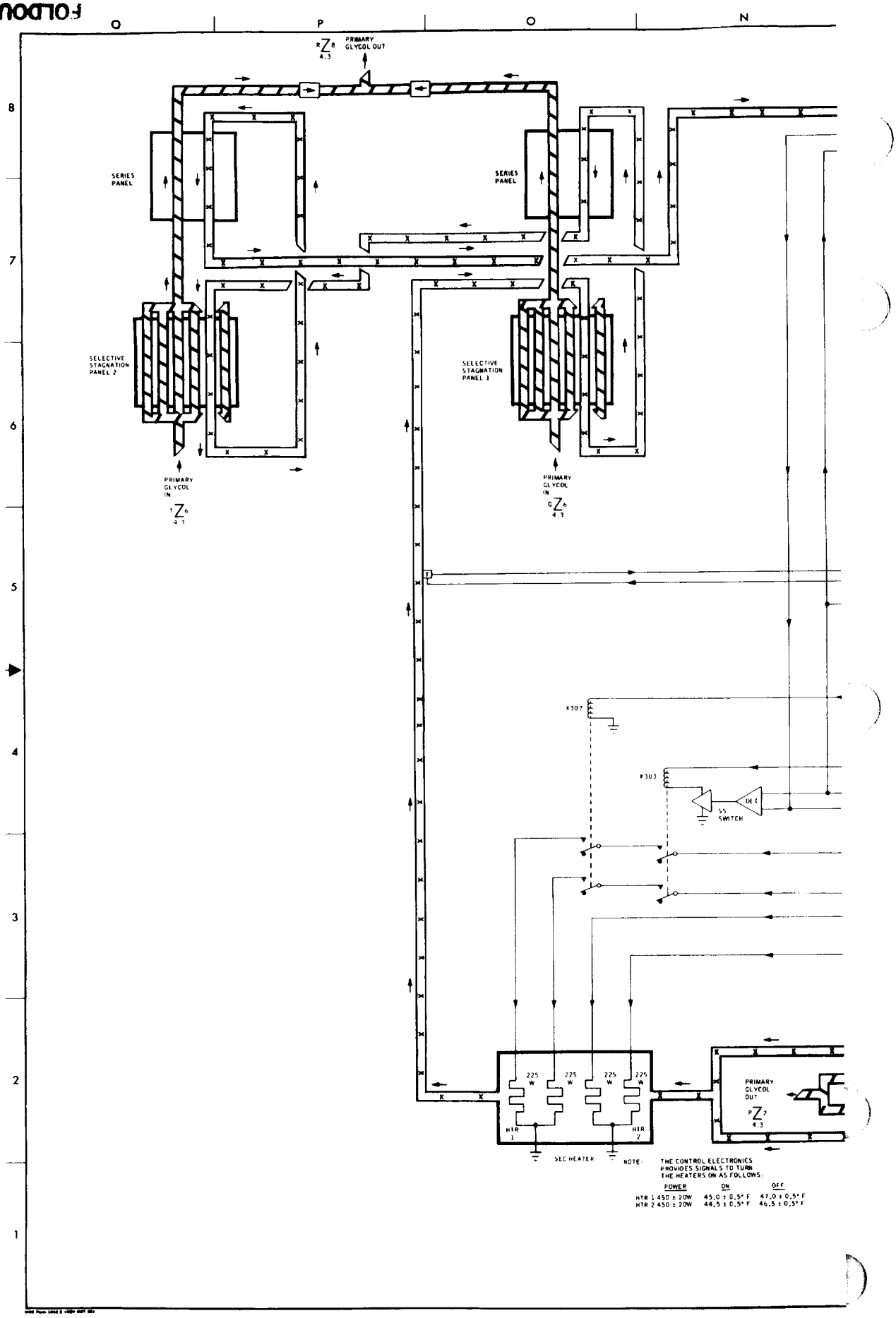
NATIONAL AERONAUTICS & SPACE ADMINISTRATION
MANNED SPACECRAFT CENTER HOUSTON, TEXAS

PRIMARY GLYCOL LOOP

SKYLAB CSM	DWG NO. 4.3
116 THRU 119	
11 0 X 34	PAGE 4-3 SHEET 1 OF 2

FOLDOUT FRAME 5

FOLDOUT FRAME



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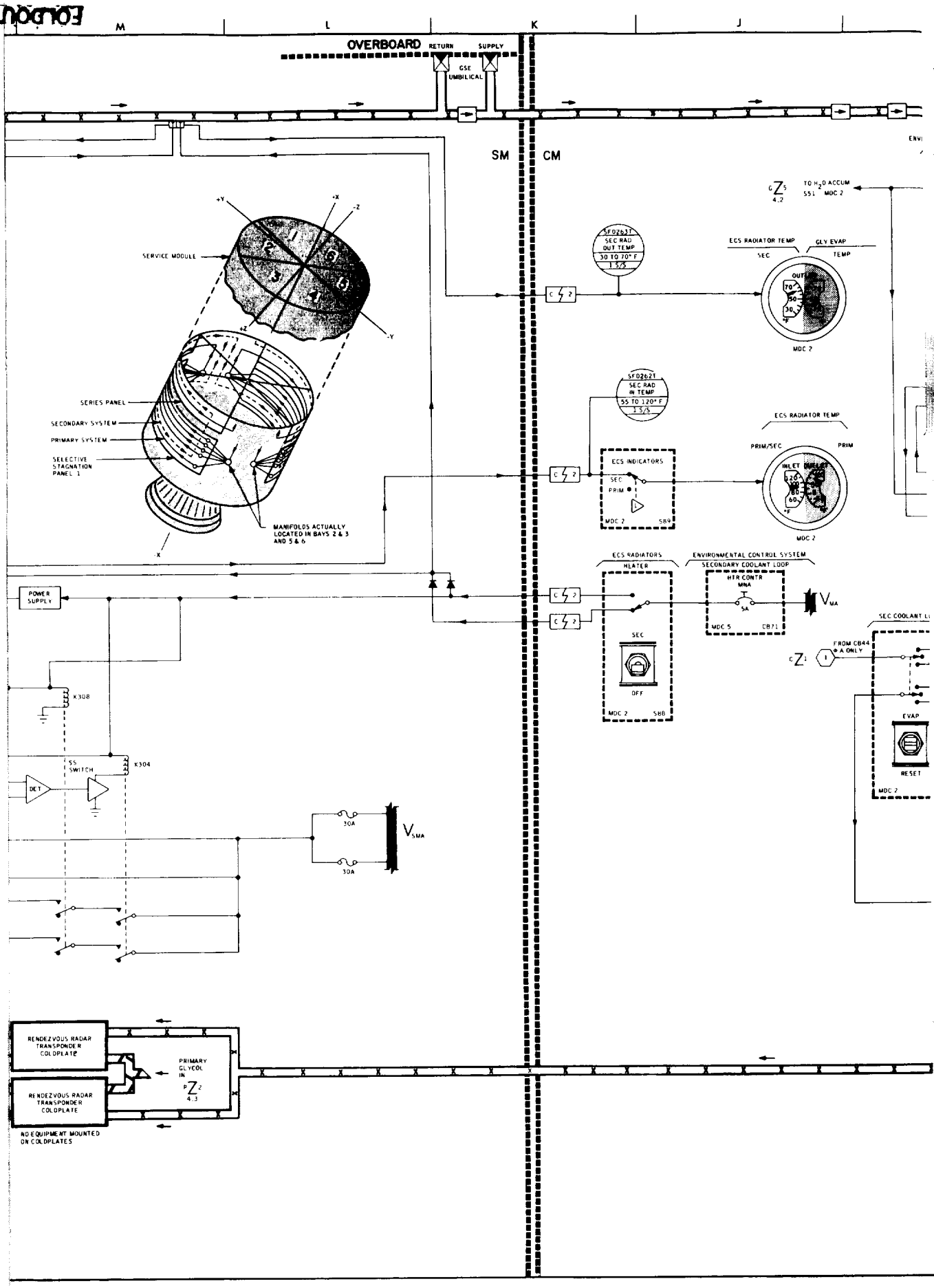

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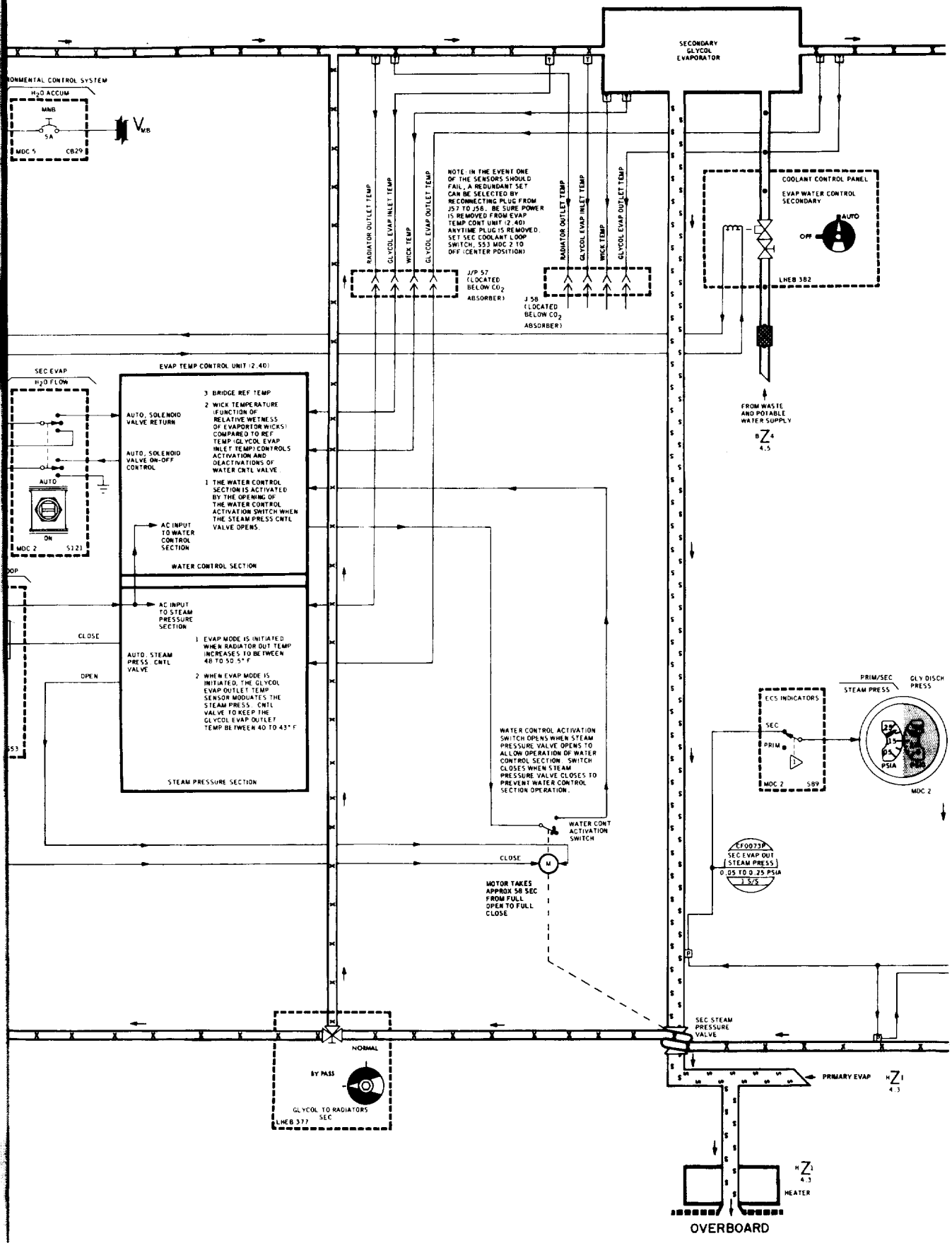

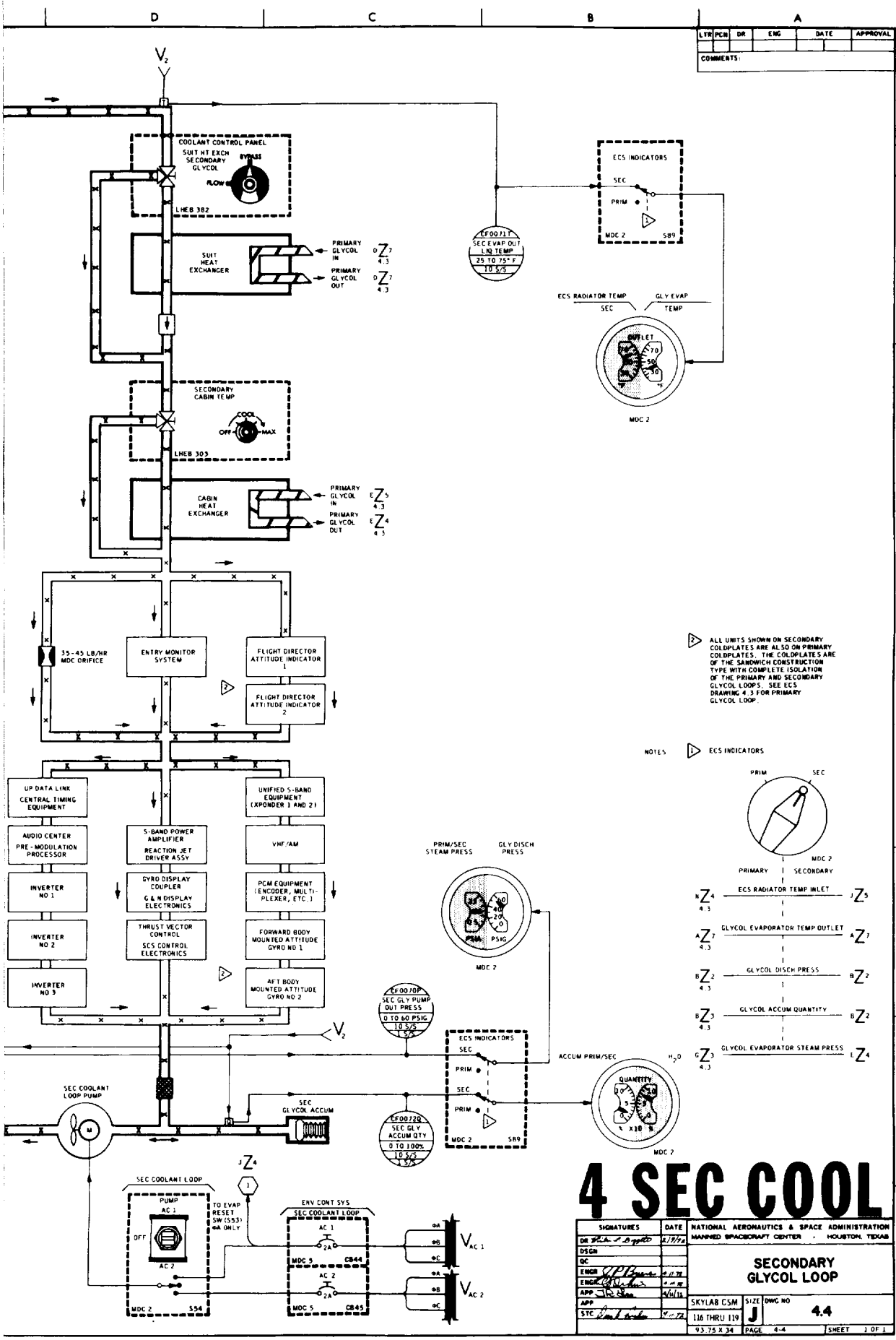

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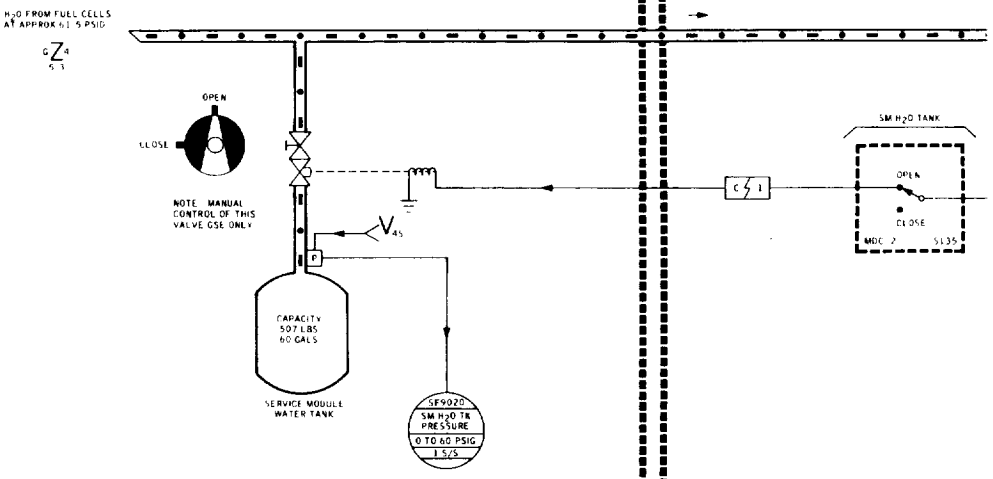

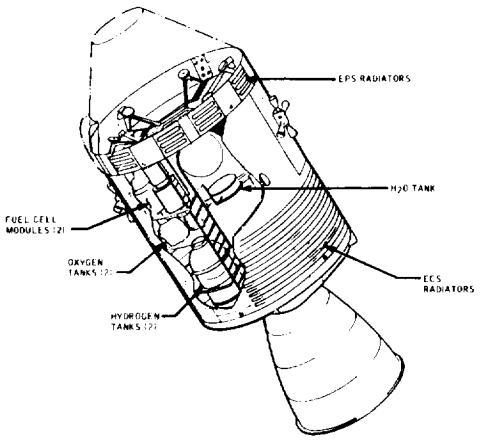

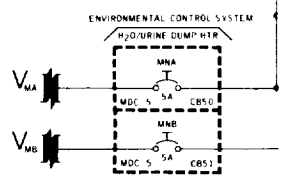

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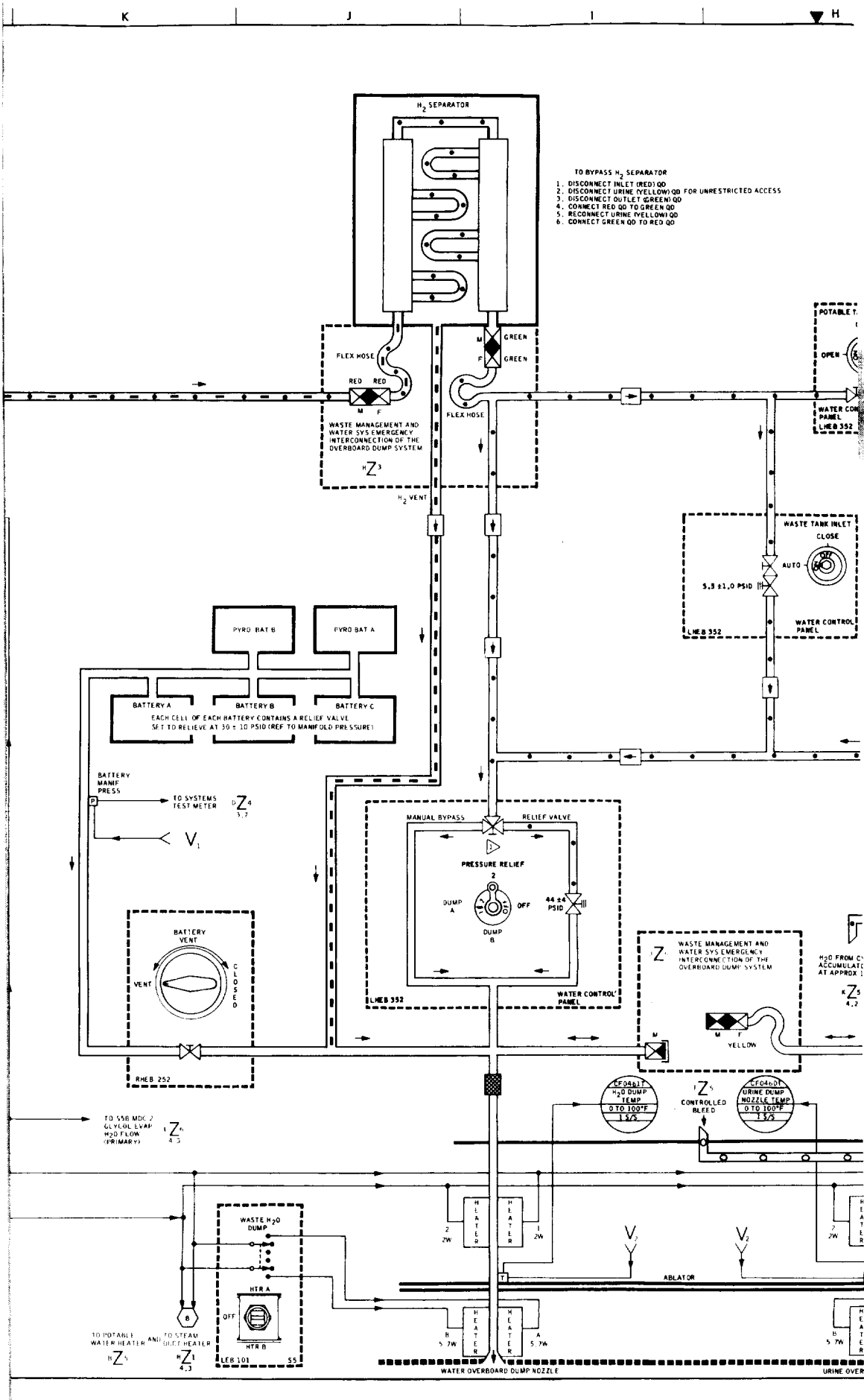

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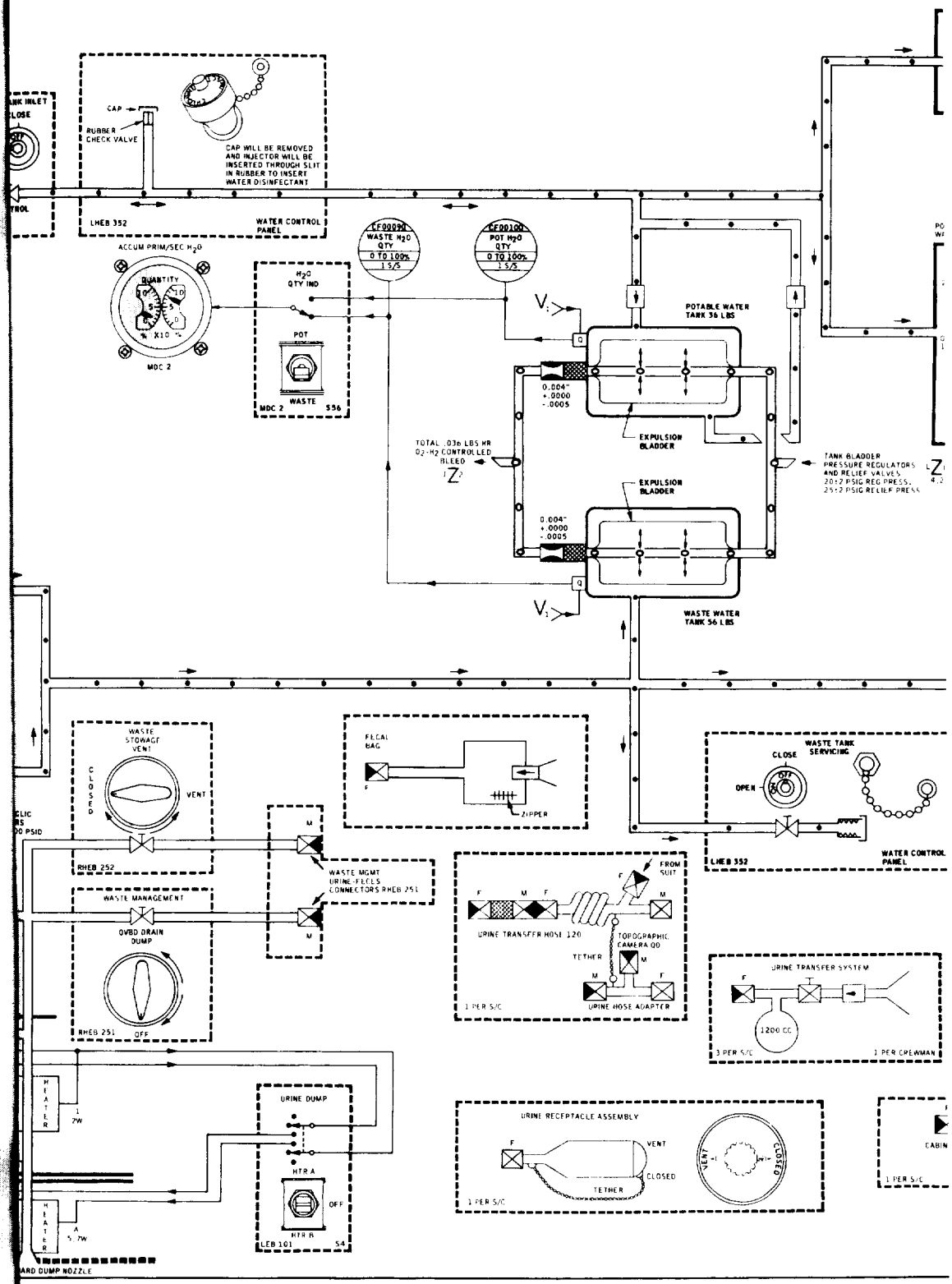

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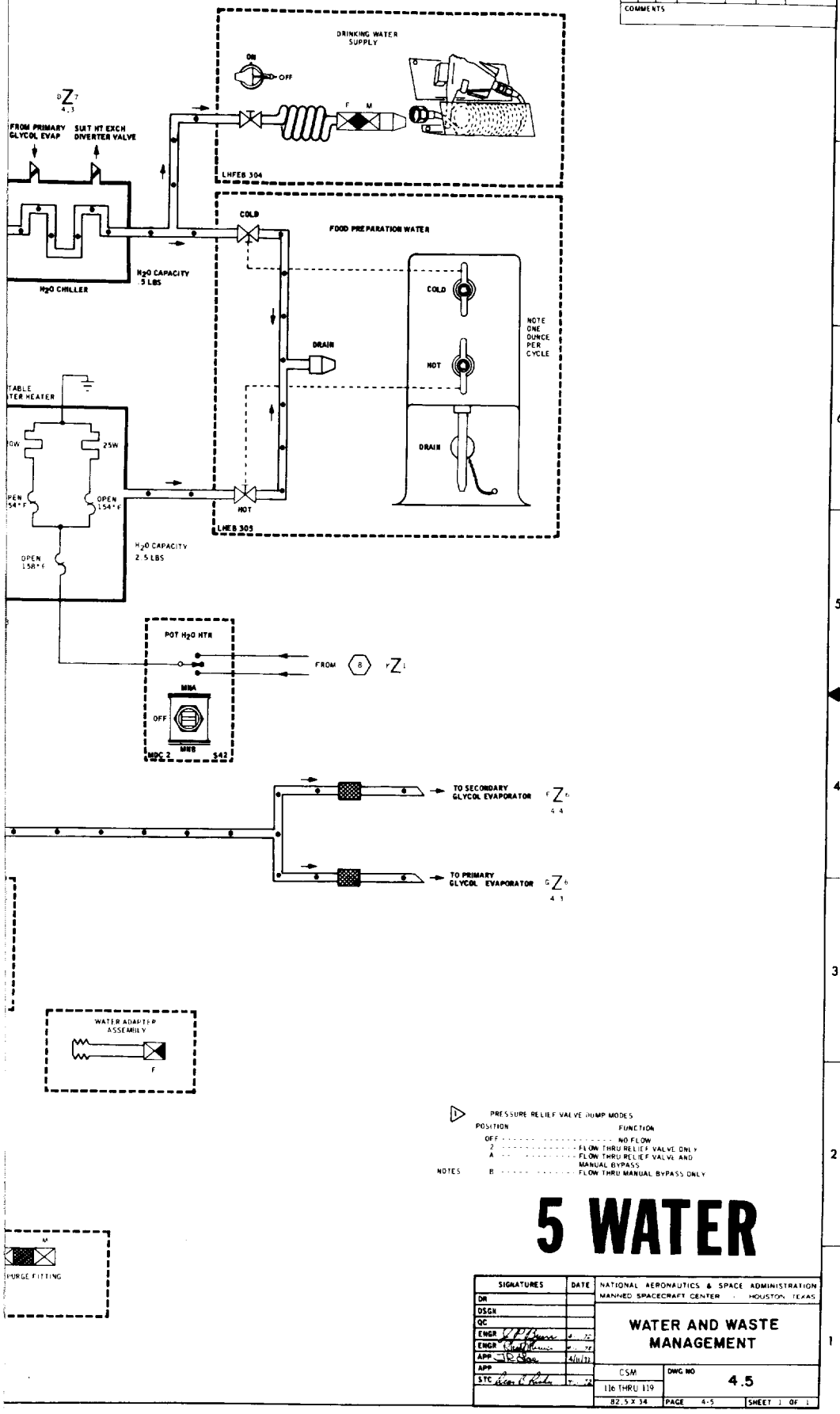

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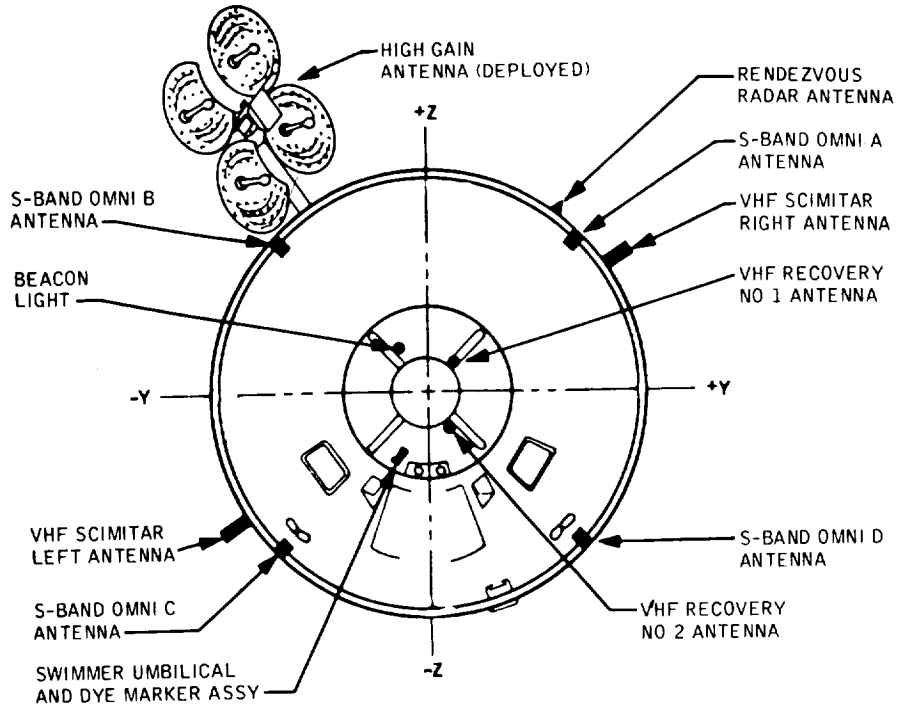
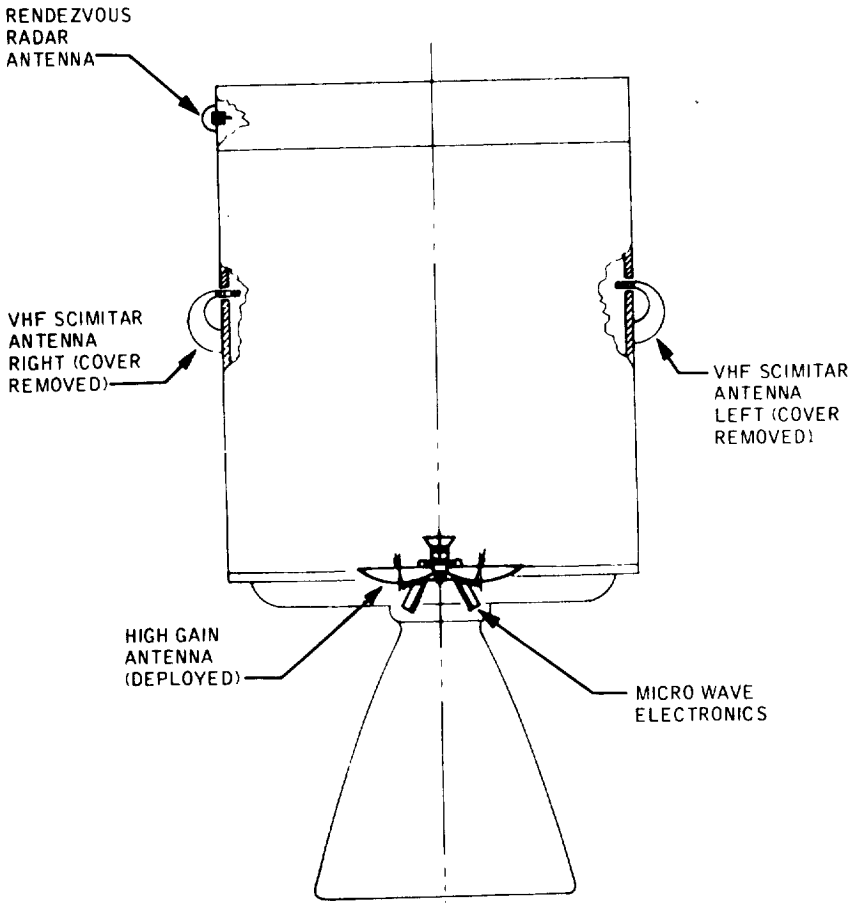
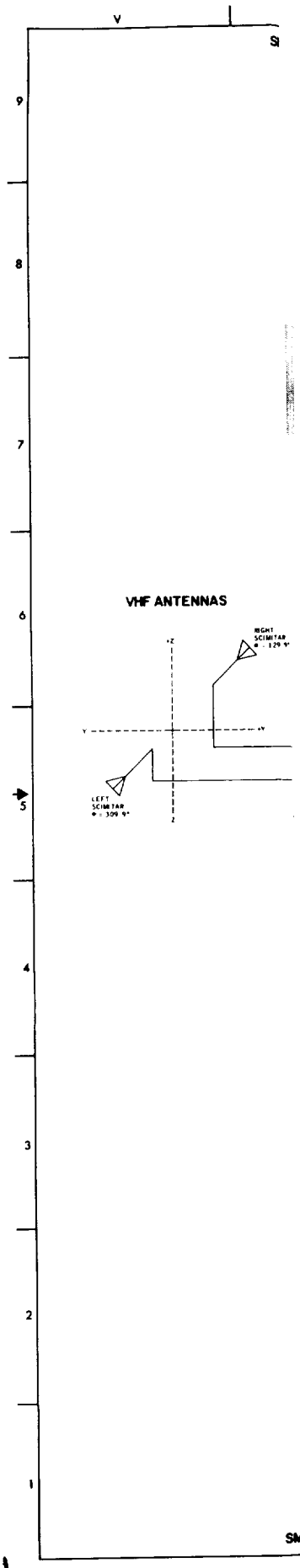
5 FUEL CELL/
CRYOGENICS
SYSTEM


6 COMMUNI-
CATIONS
SYSTEM





APRON ITEM 6.1



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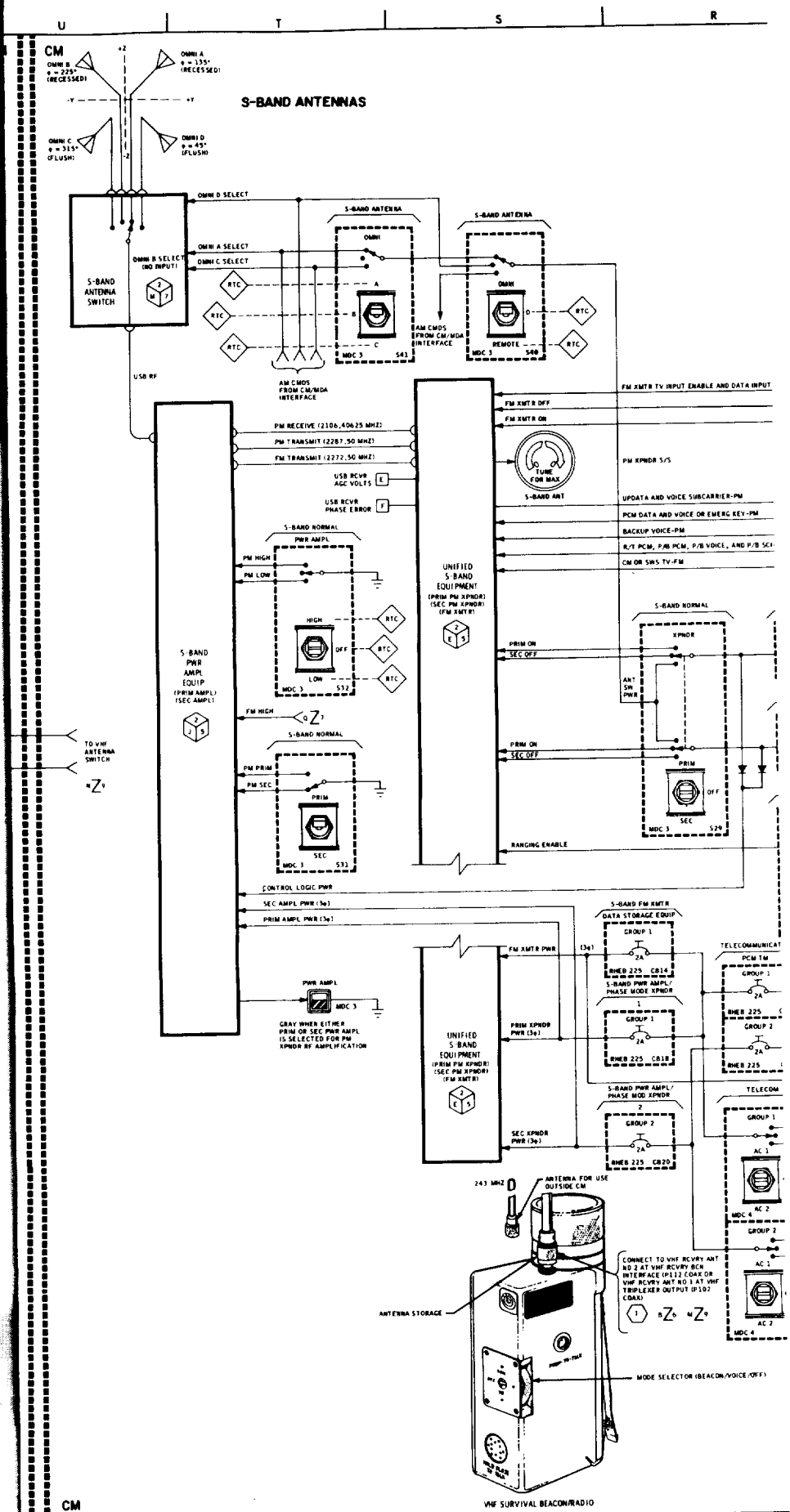

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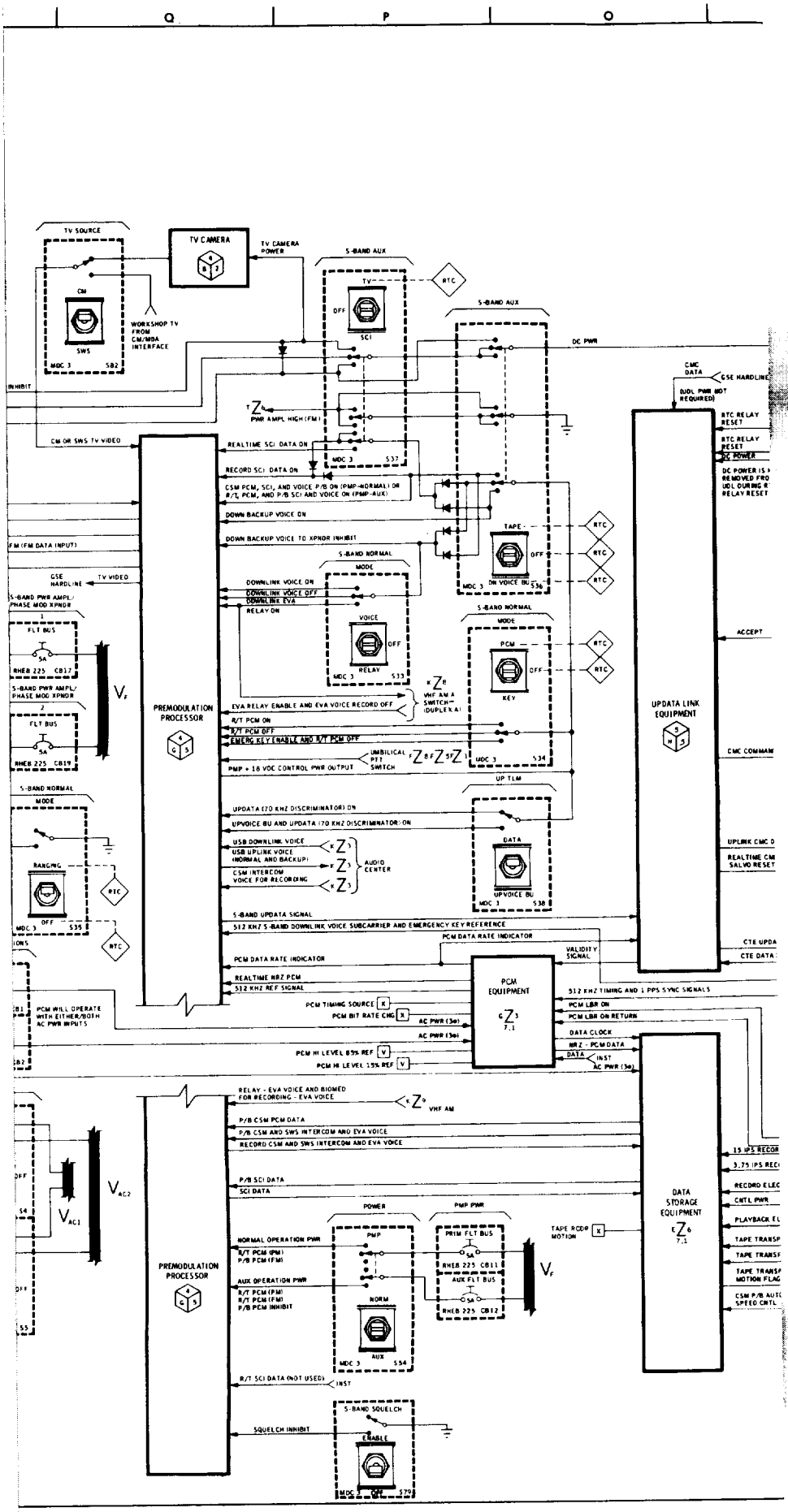

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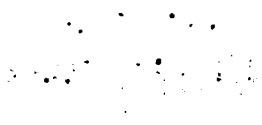

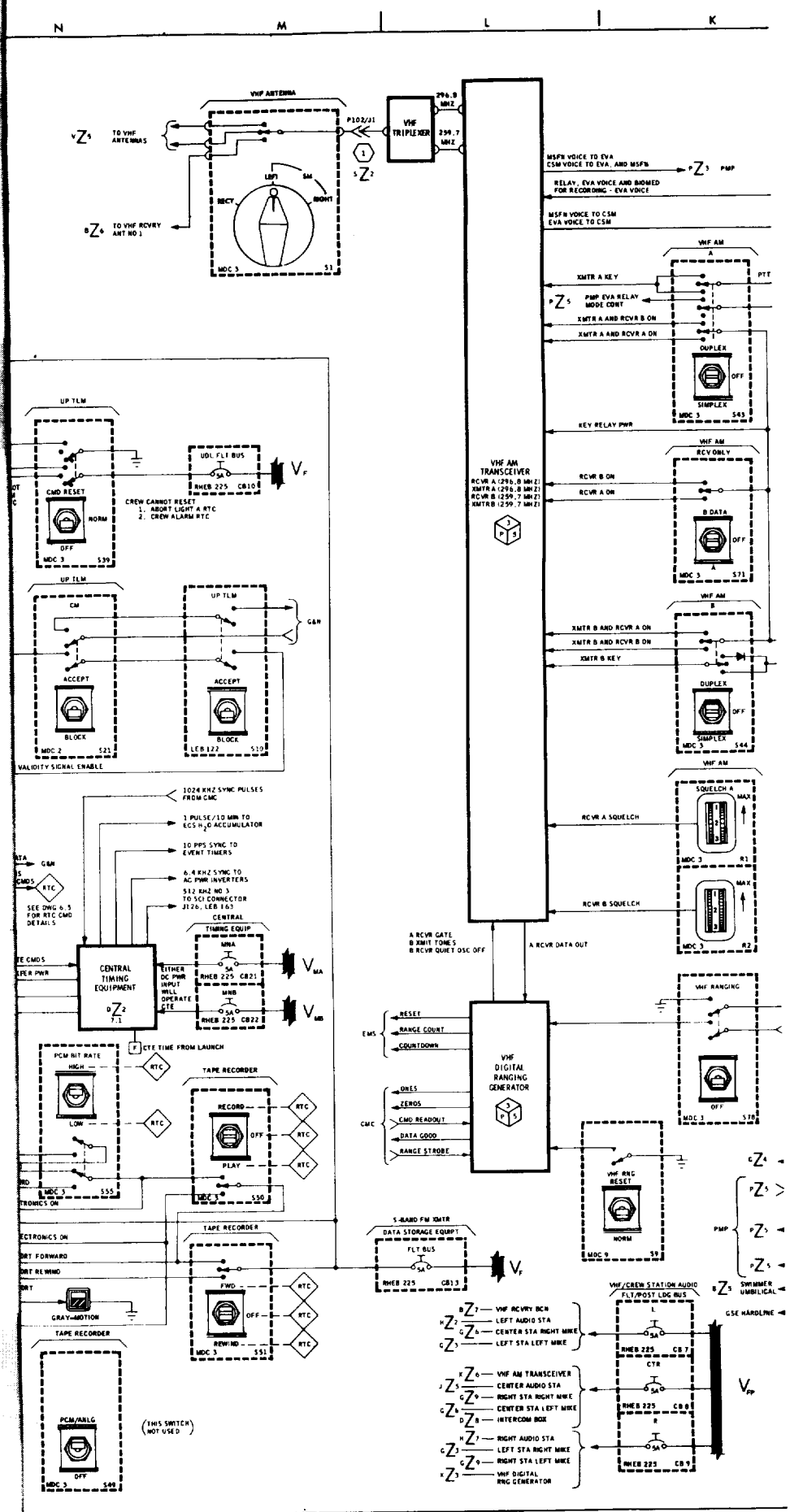

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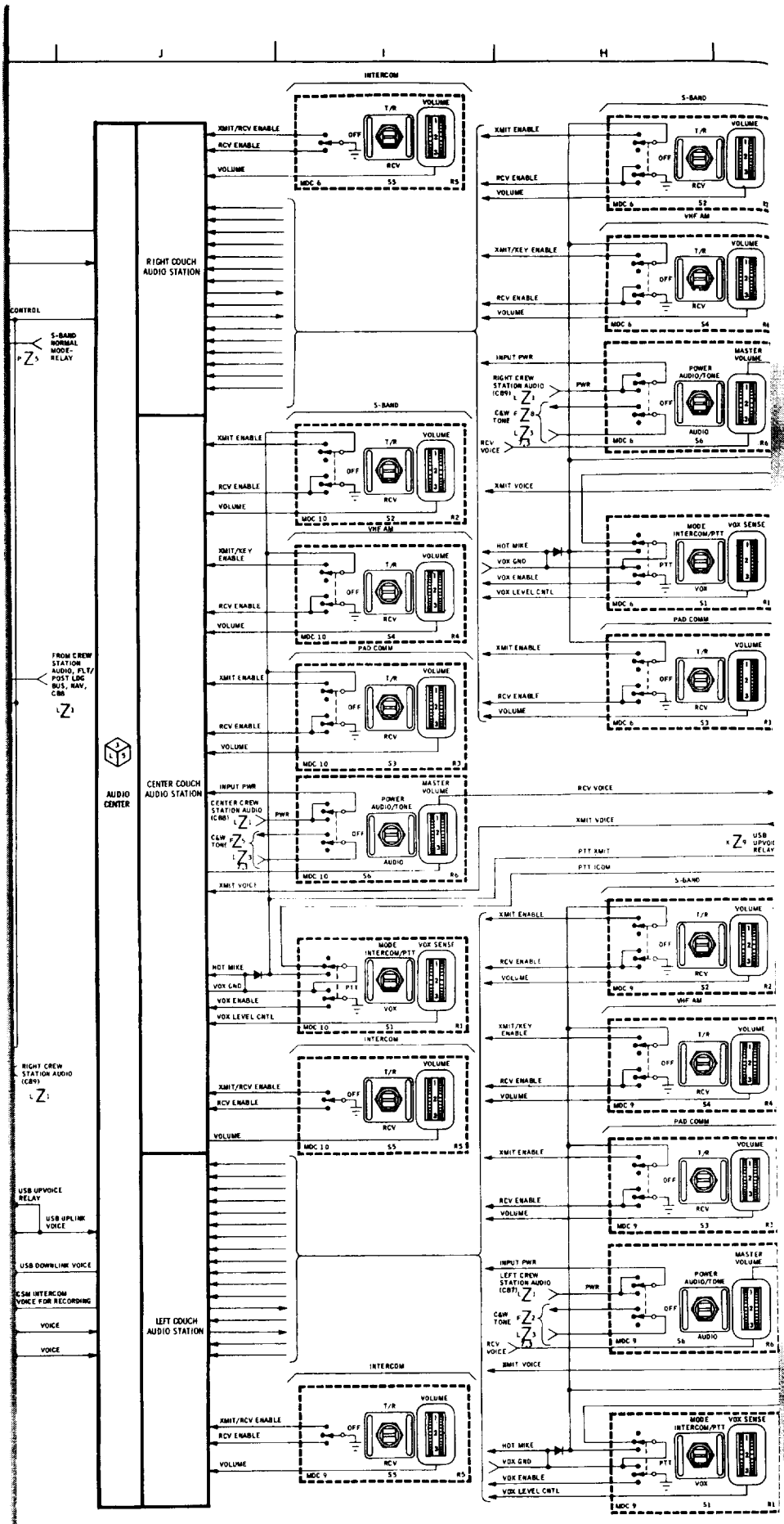

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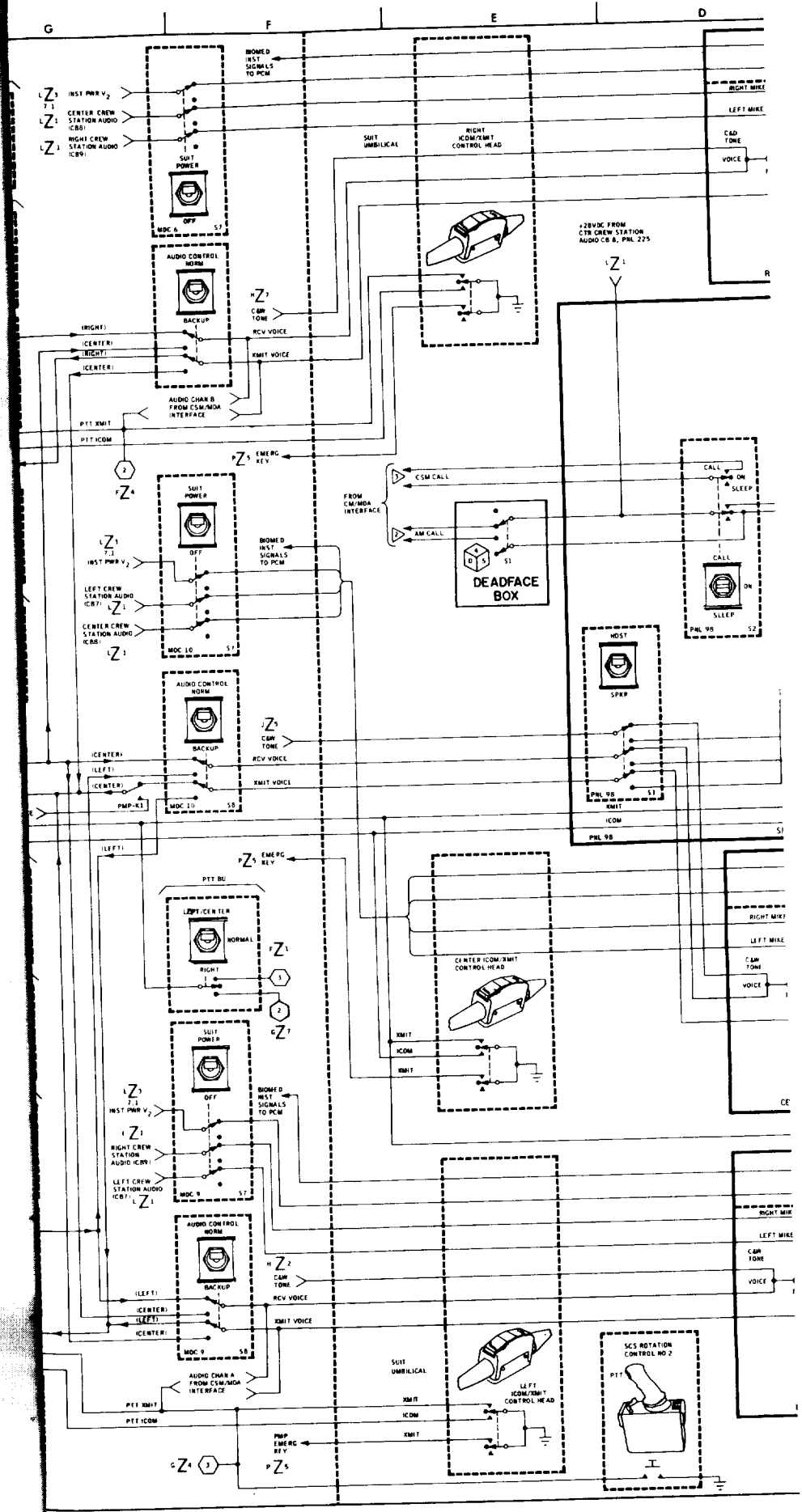

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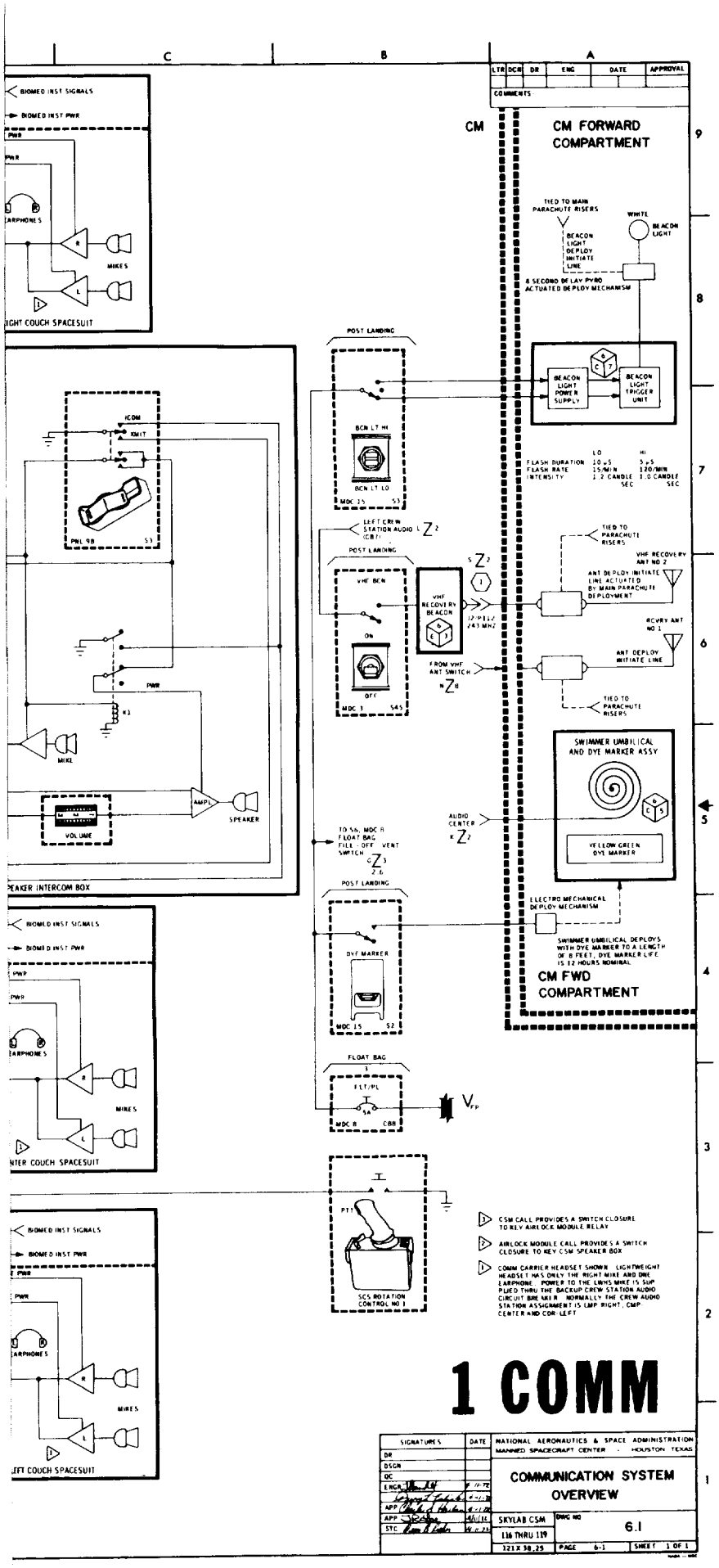

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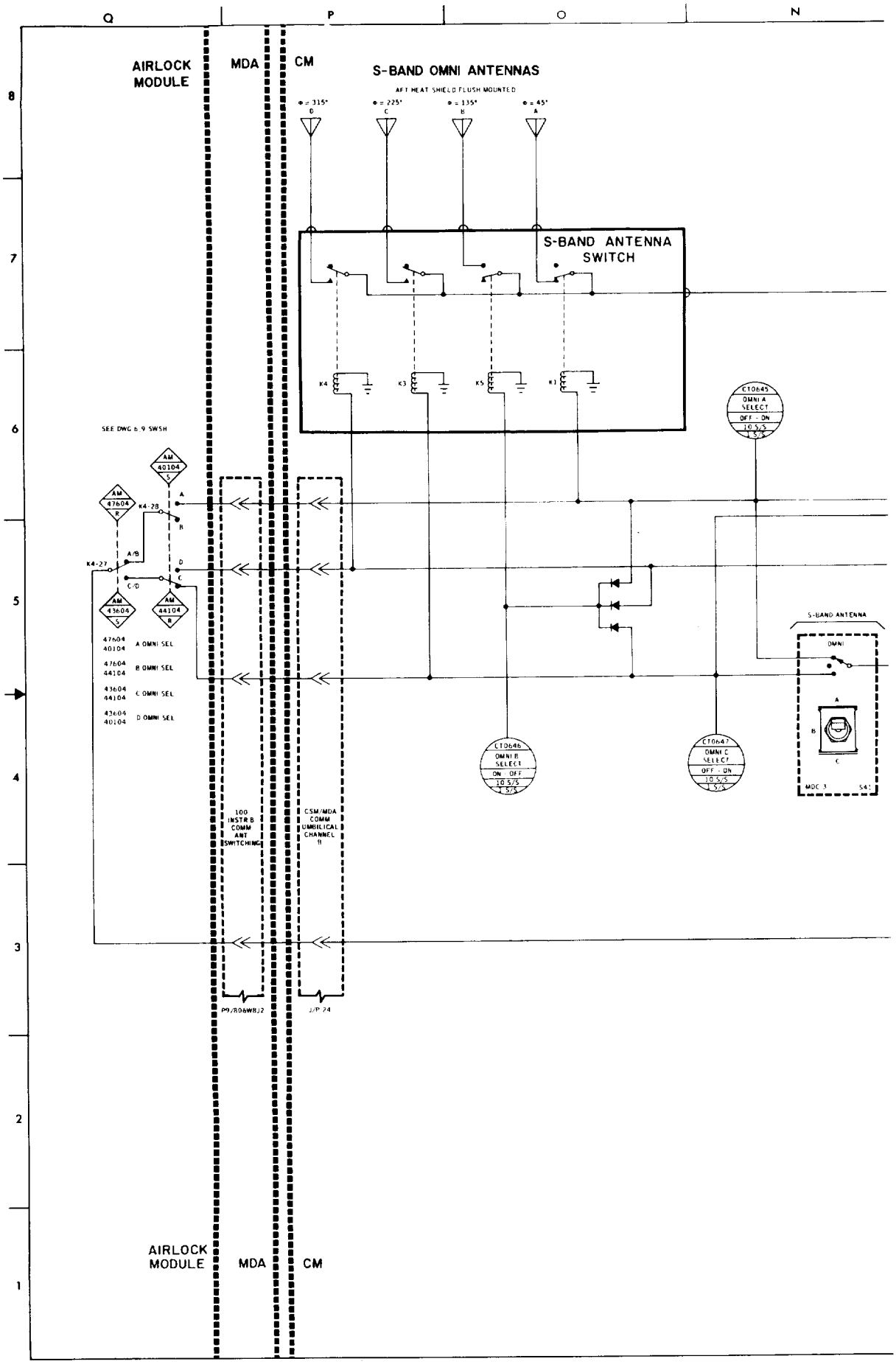

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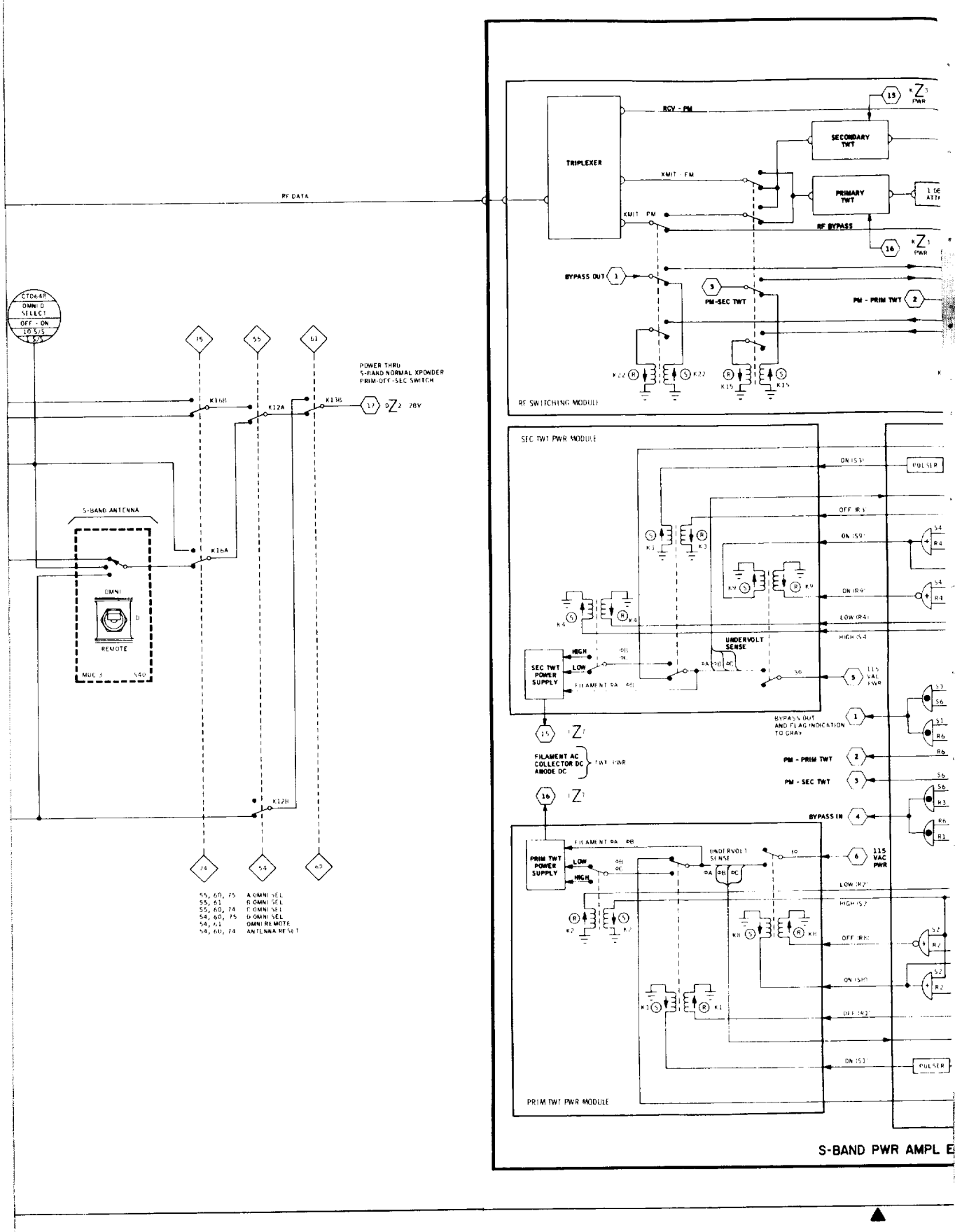

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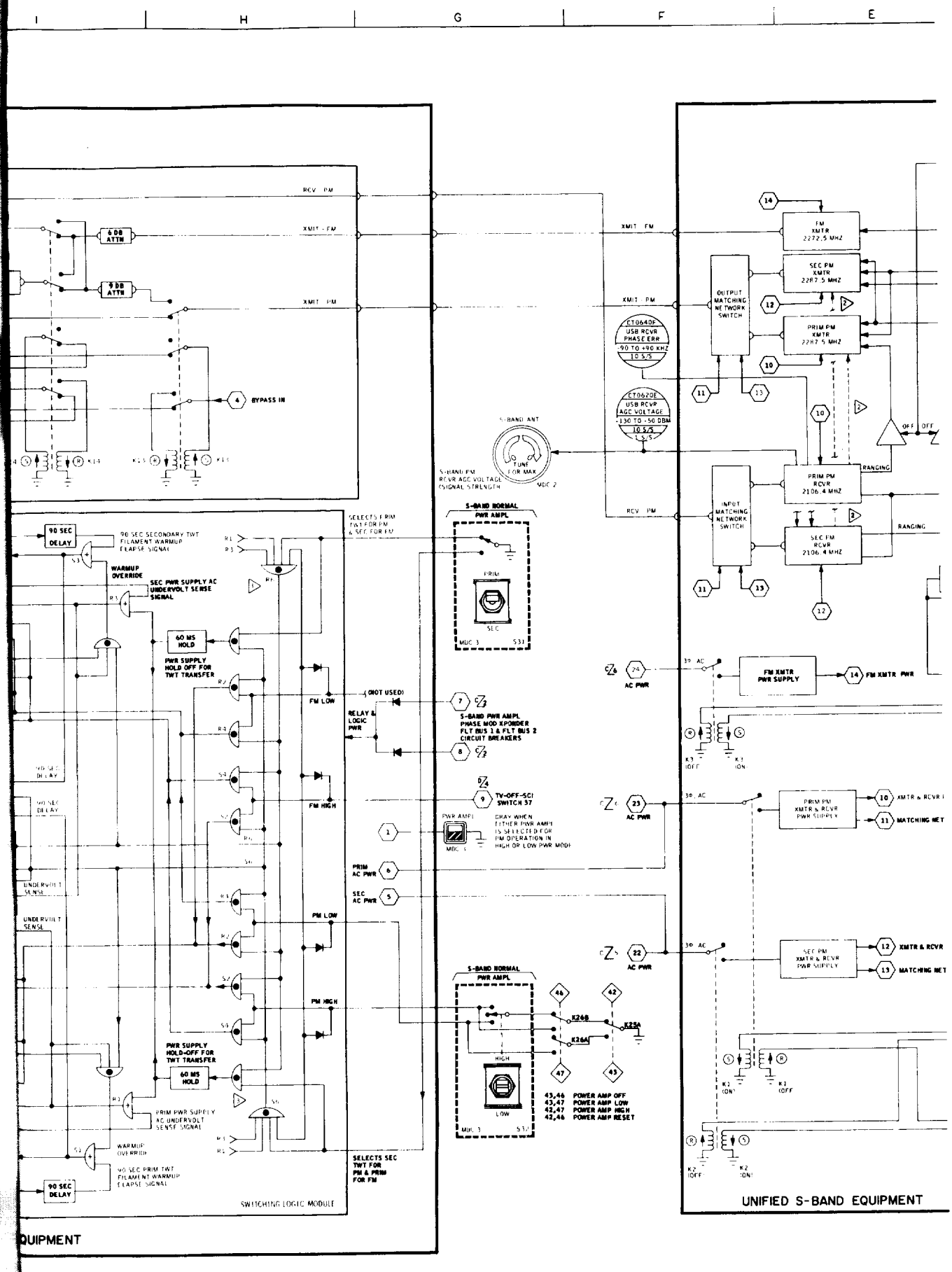

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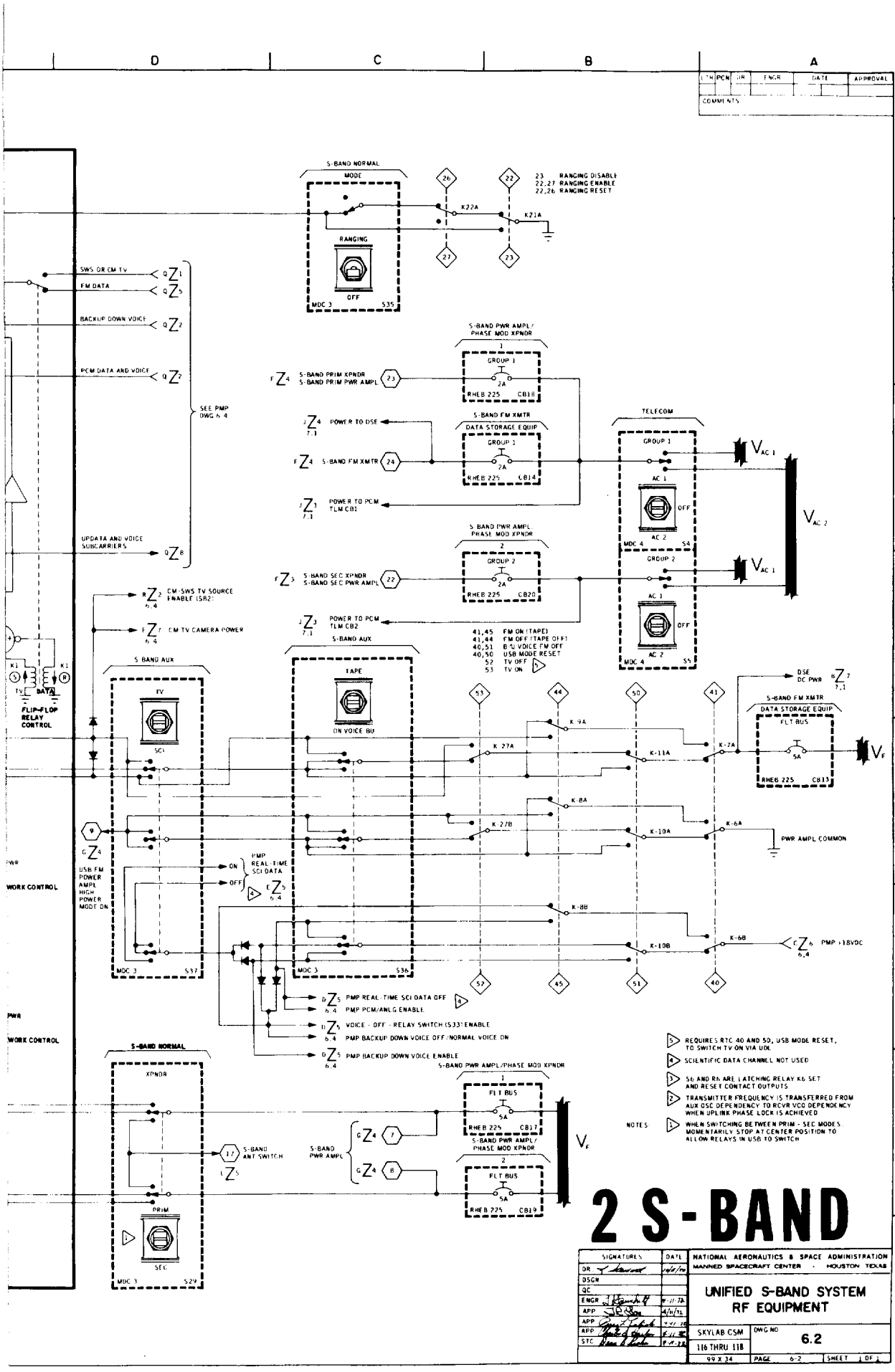

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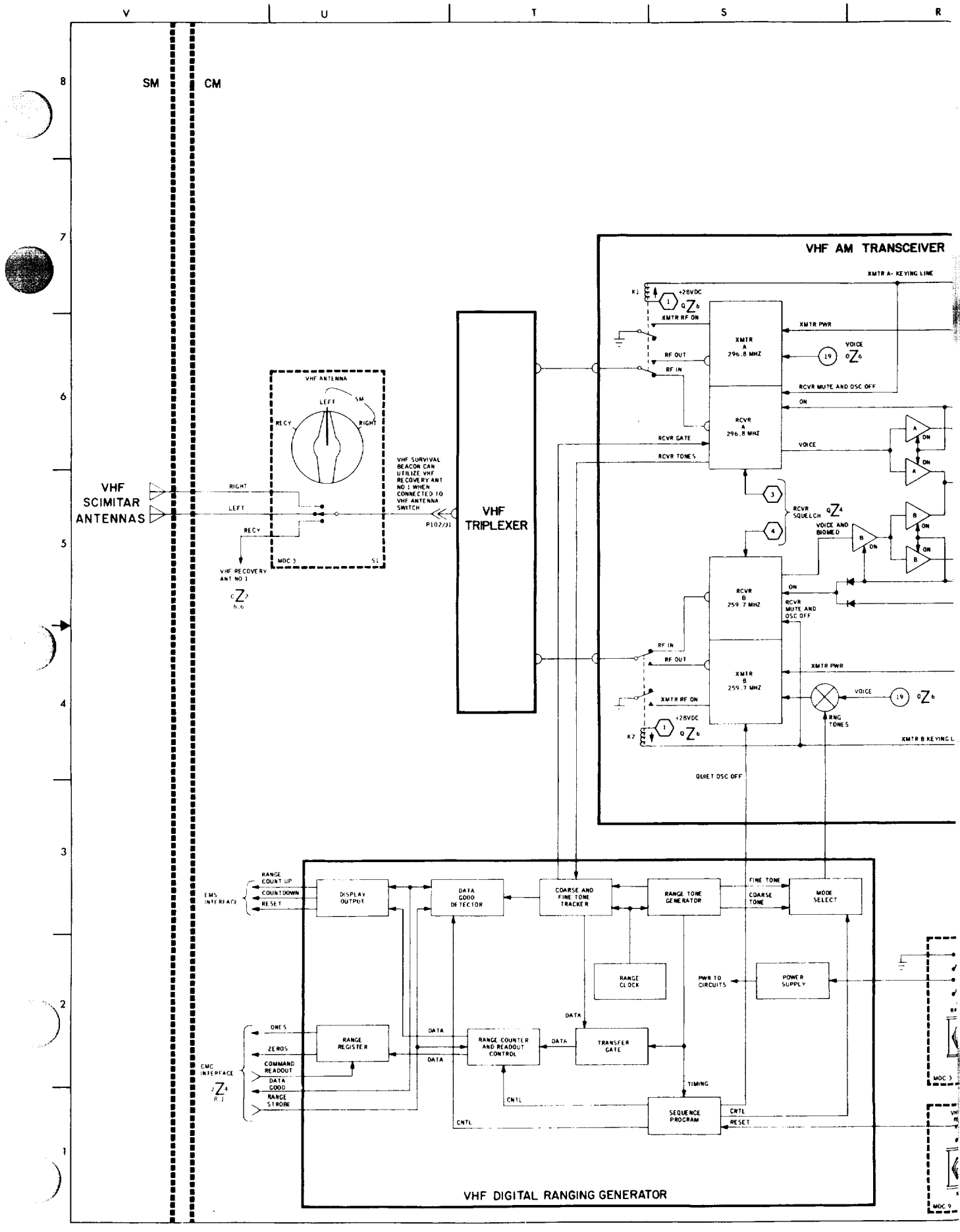

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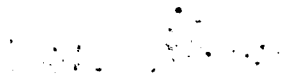

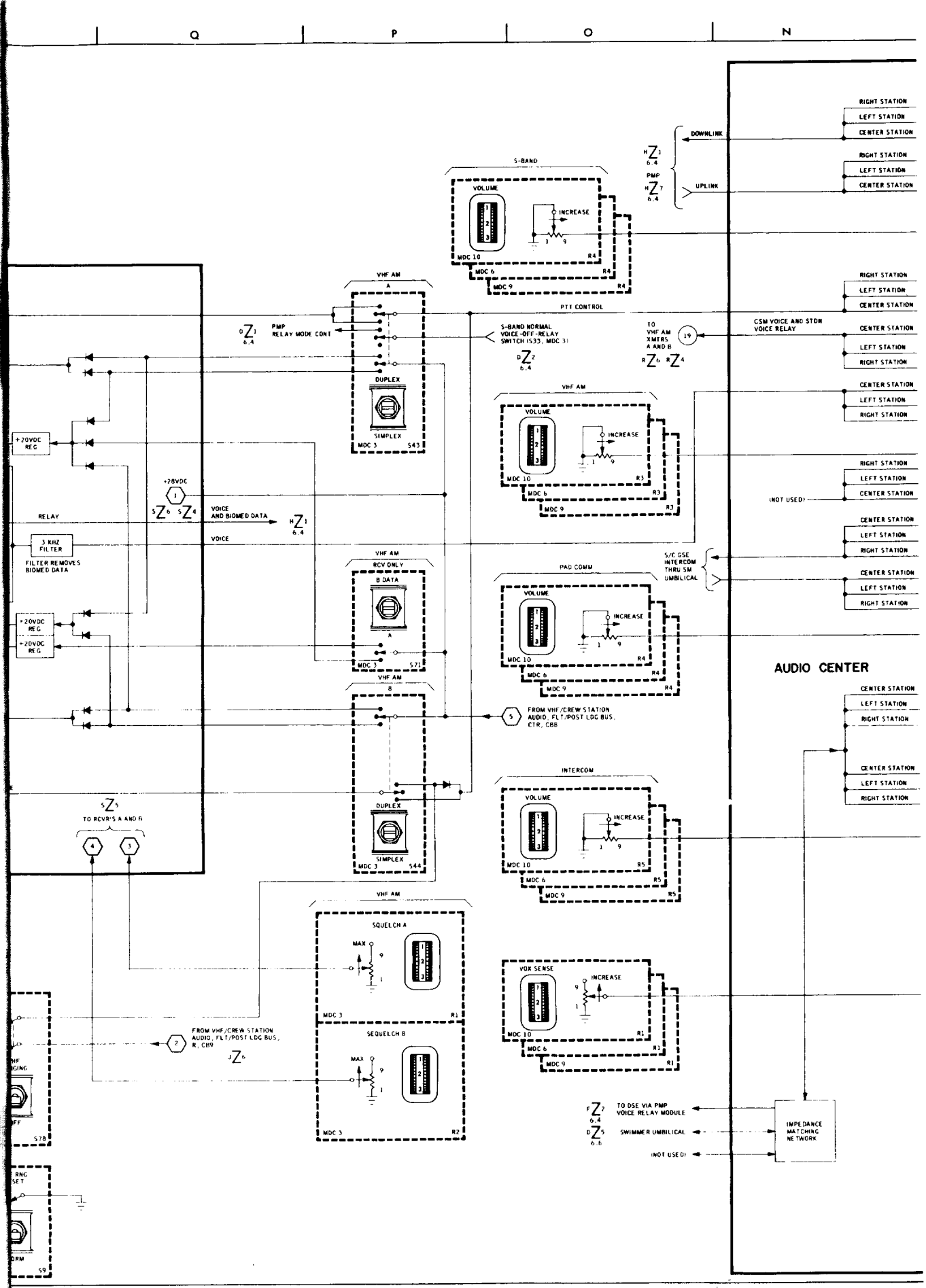

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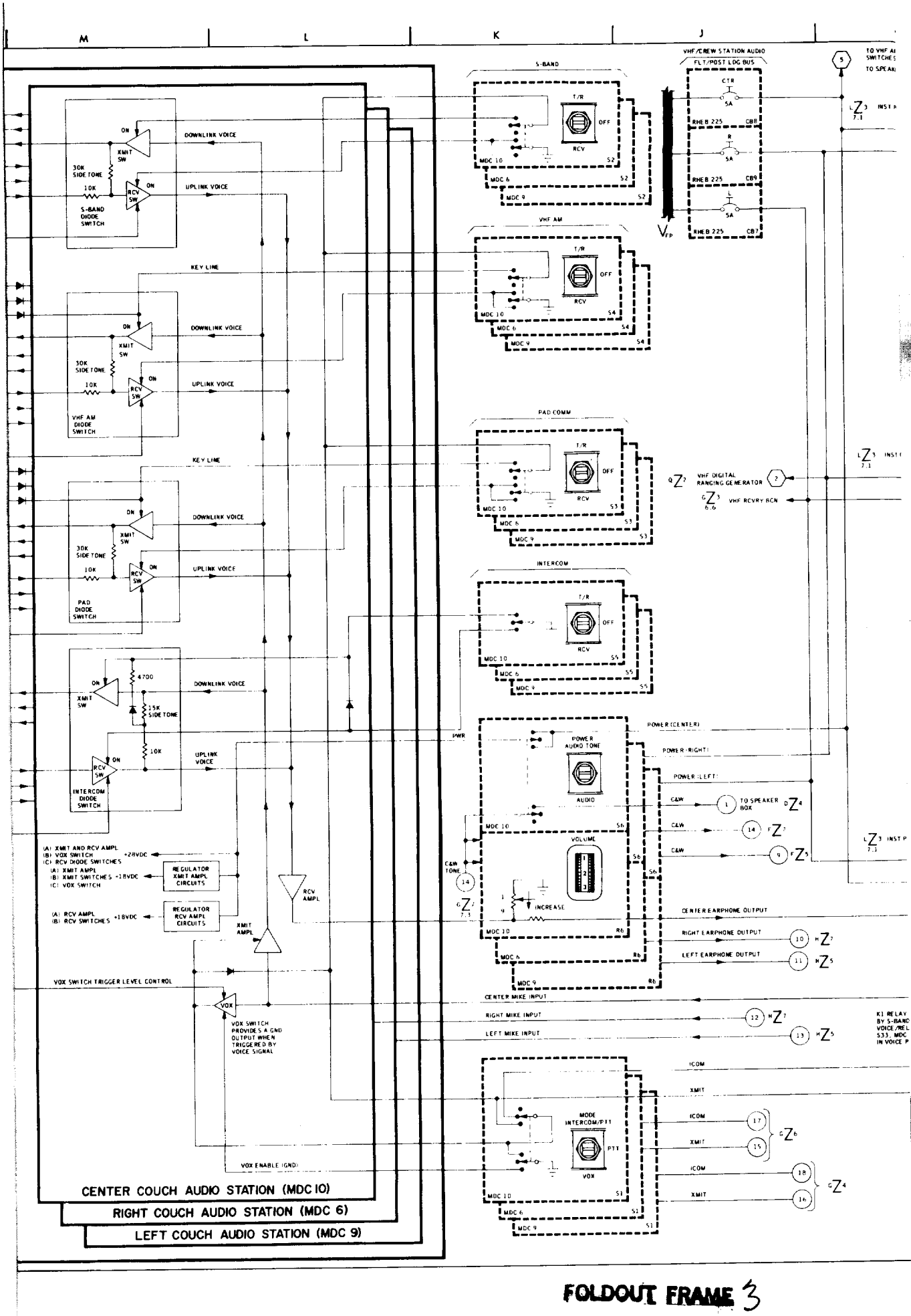

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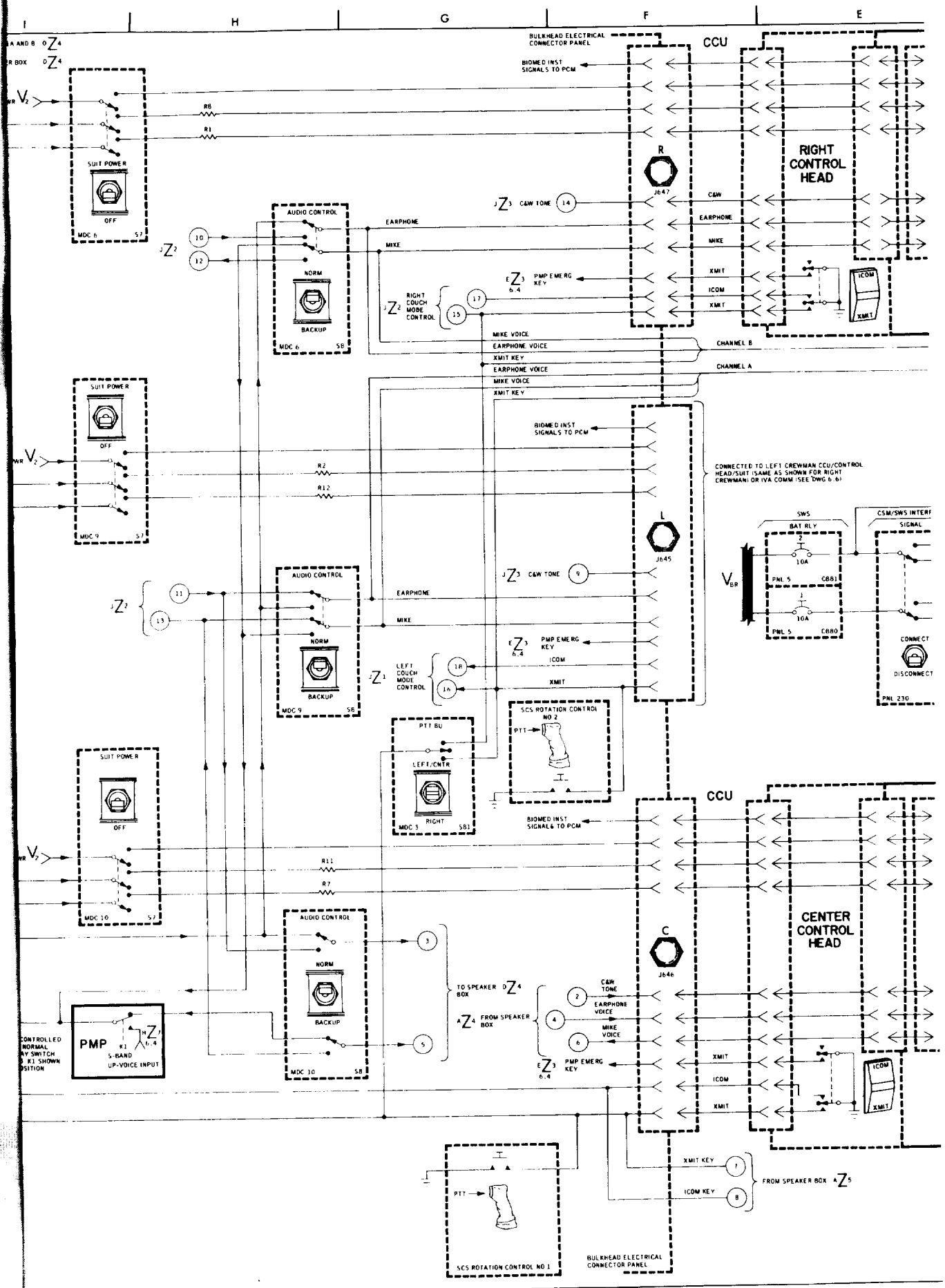

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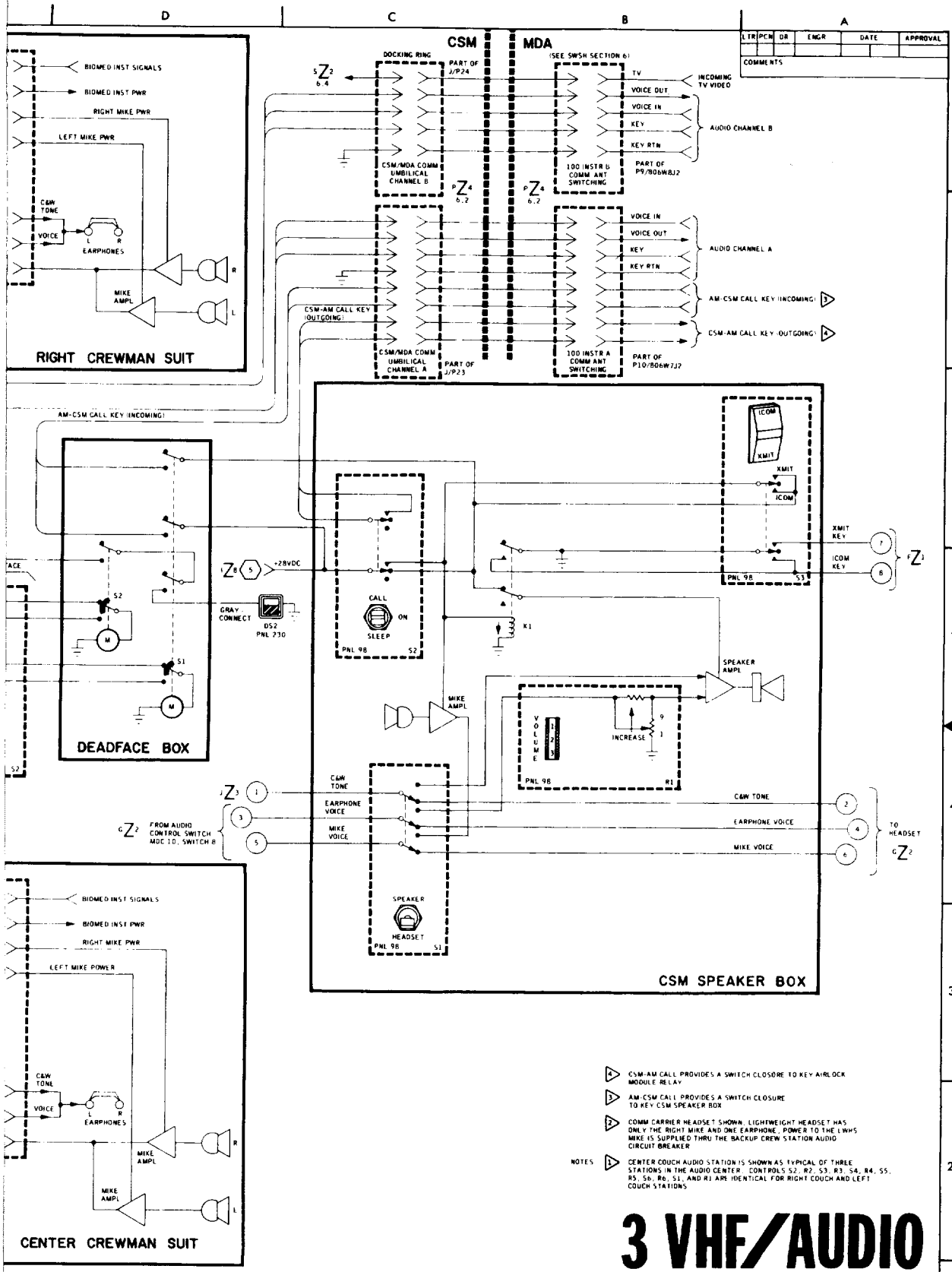


6 CSM-AM CALL PROVIDES A SWITCH CLOSORE TO KEY AIRLOCK MODULE RELAY

3 AM-CSM CALL PROVIDES A SWITCH CLOSURE TO KEY CSM SPEAKER BOX

2 COMM CARRIER HEADSET SHOWN. LIGHTWEIGHT HEADSET HAS ONLY THE RIGHT MIKE AND ONE EARPHONE. POWER TO THE LWHS MIKE IS SUPPLIED THRU THE BACKUP CREW STATION AUDIO CIRCUIT BREAKER

NOTES 1 CENTER COUCH AUDIO STATION IS SHOWN AS TYPICAL OF THREE STATIONS IN THE AUDIO CENTER. CONTROLS S2, R2, S3, R3, S4, R4, S5, R5, S6, R6, S1, AND R1 ARE IDENTICAL FOR RIGHT COUCH AND LEFT COUCH STATIONS

3 VHF/AUDIO

SIGNATURES	DATE
DR	5/19/72
DSGN	
QC	
ENGR	4-11-72
APP	4/11/72
APP	4-11-72
APP	4-11-72
STC	4-11-72

NATIONAL AERONAUTICS & SPACE ADMINISTRATION
MANNED SPACECRAFT CENTER — HOUSTON, TEXAS

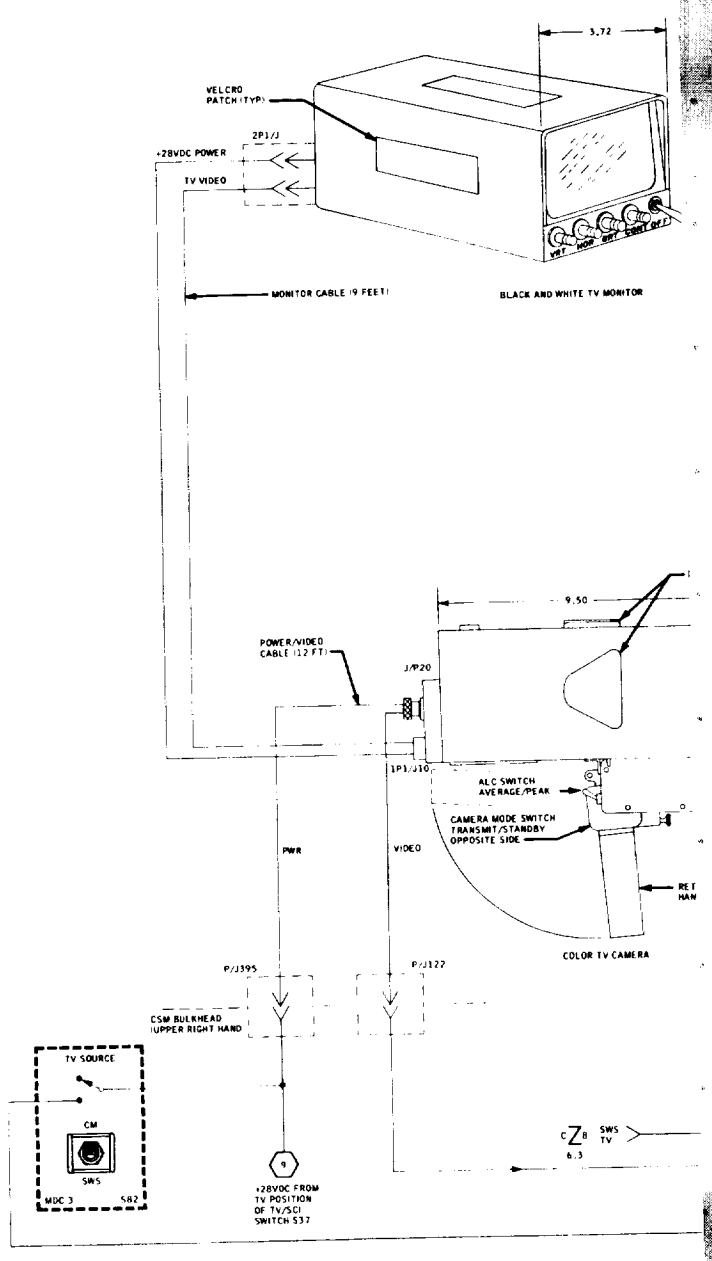
SKYLAB CSM VHF AM TRANSCEIVERS AND AUDIO EQUIPMENT

SKYLAB CSM | DWG NO 6.3
116 THRU 119
121 X 34 | PAGE 6-3 | SHEET 1 OF 1

FOLDOUT FRAME 5

V U T S

8 7 6 5 4 3 2 1



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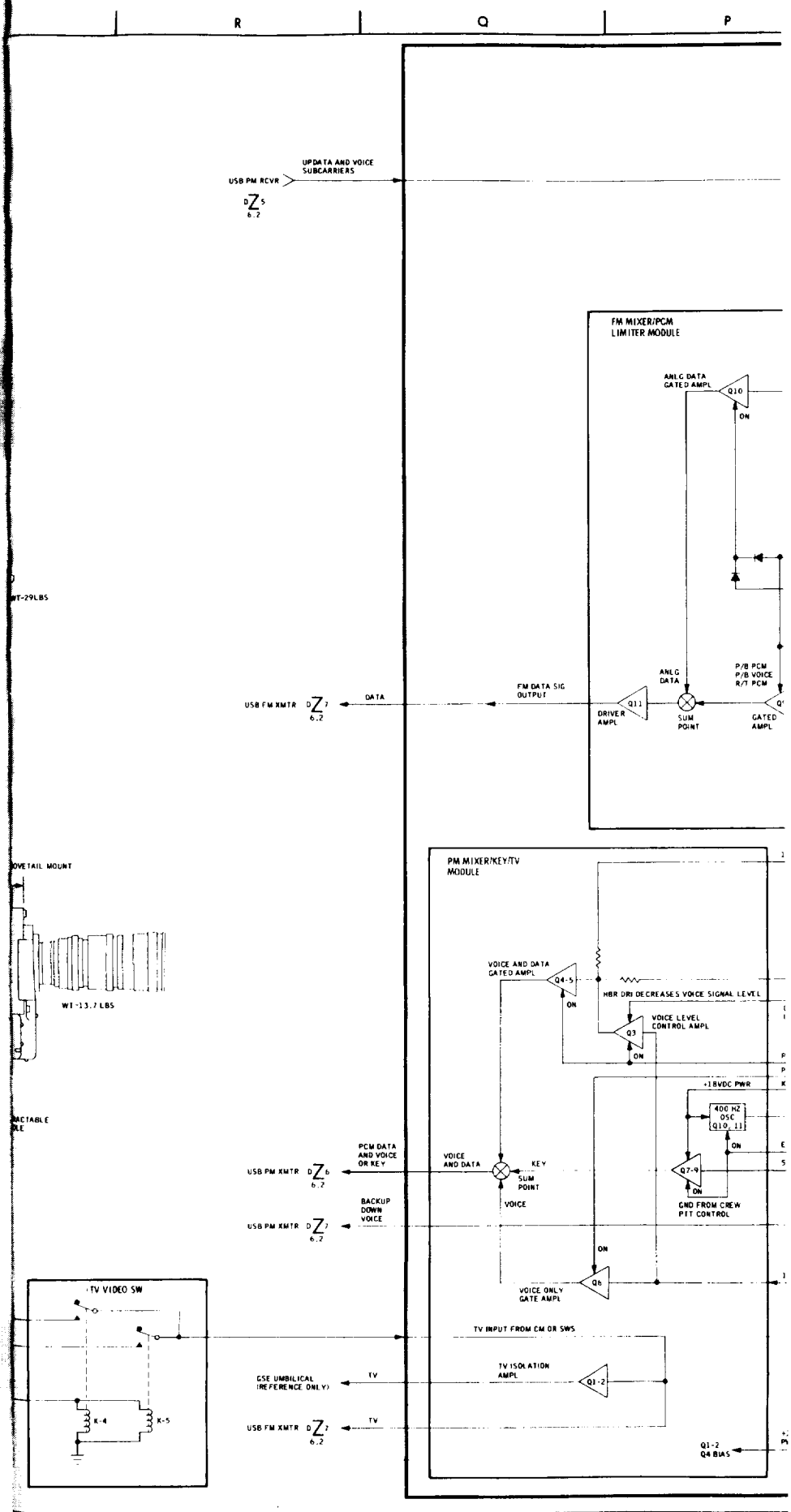

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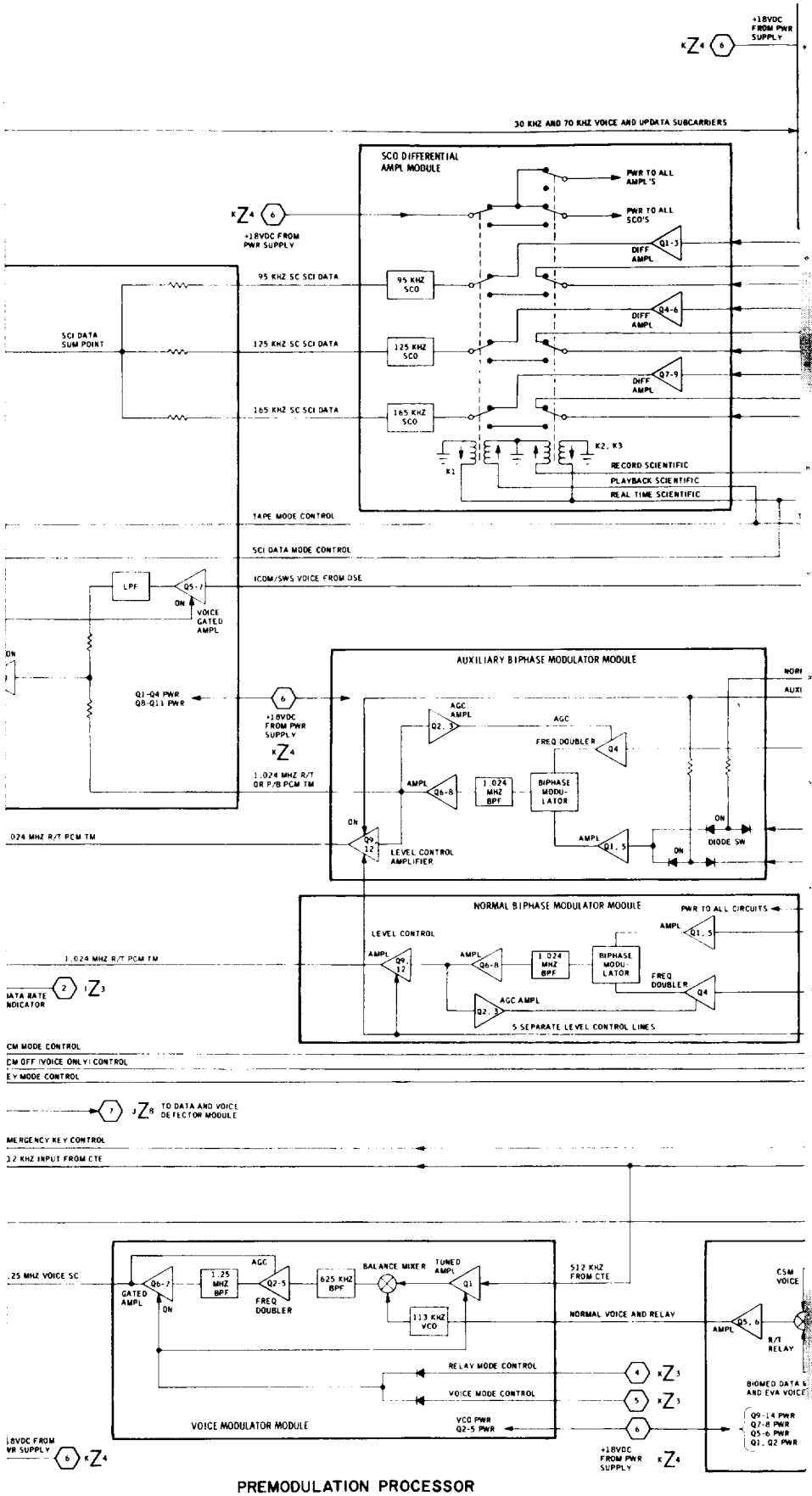
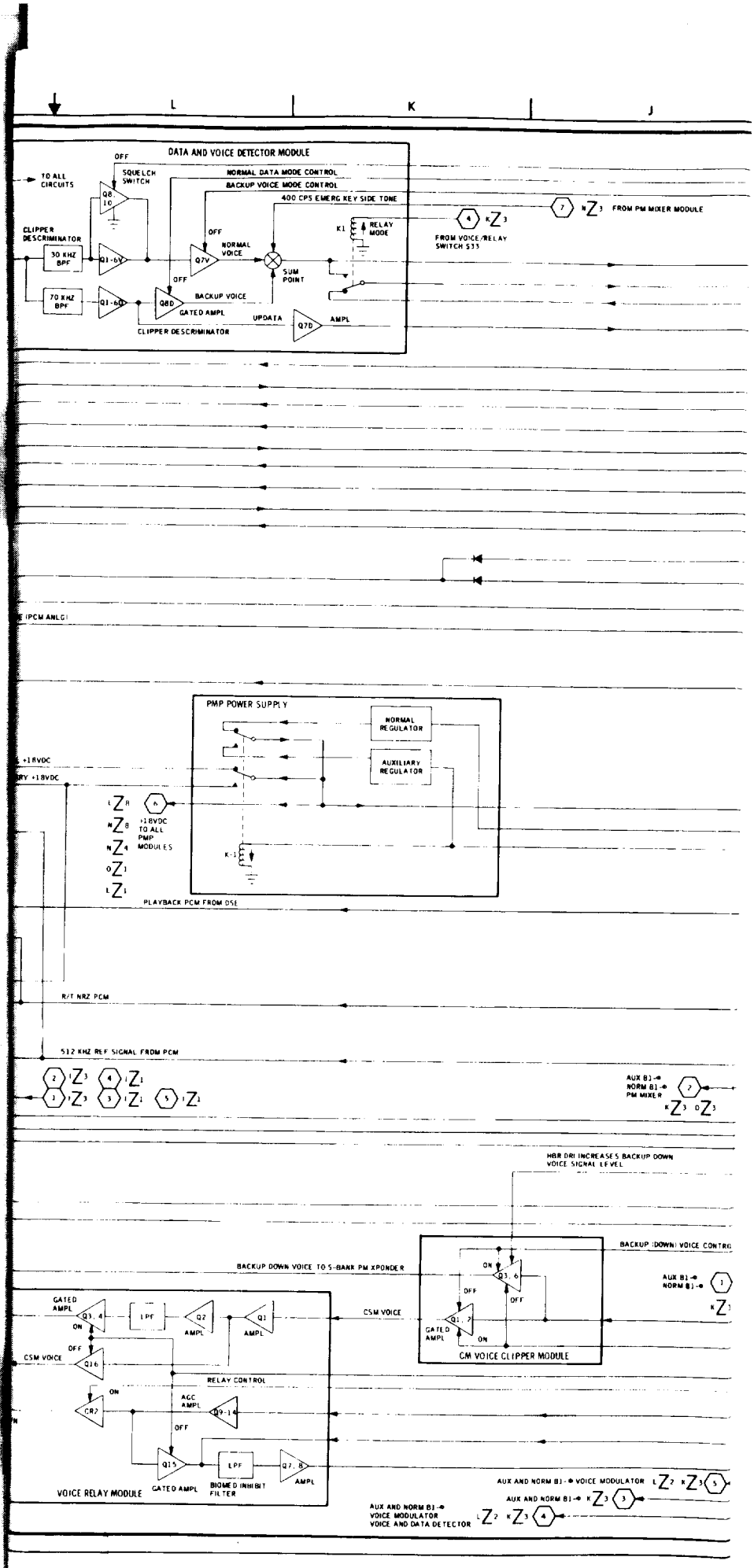
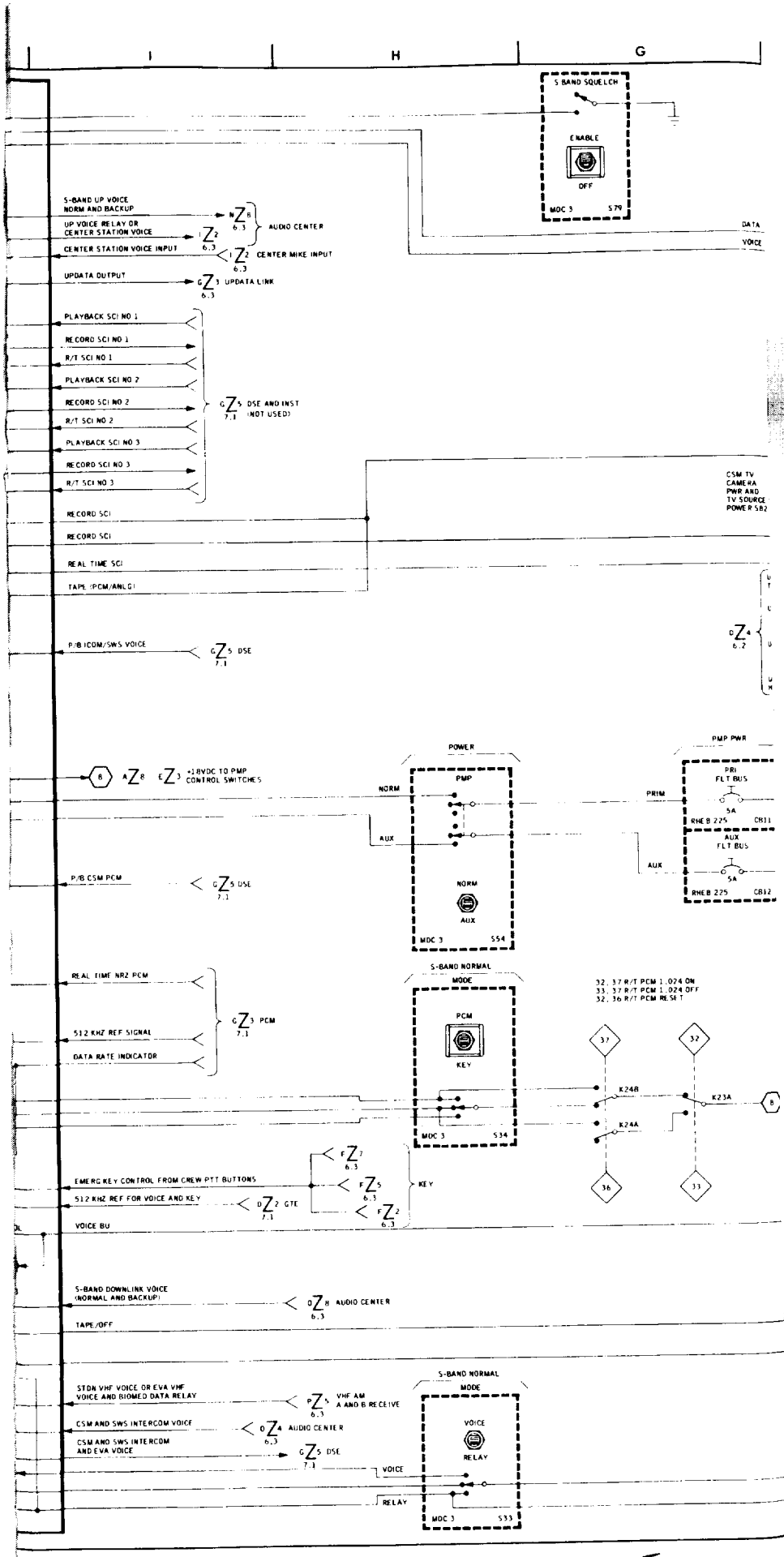


PREMODULATION PROCESSOR

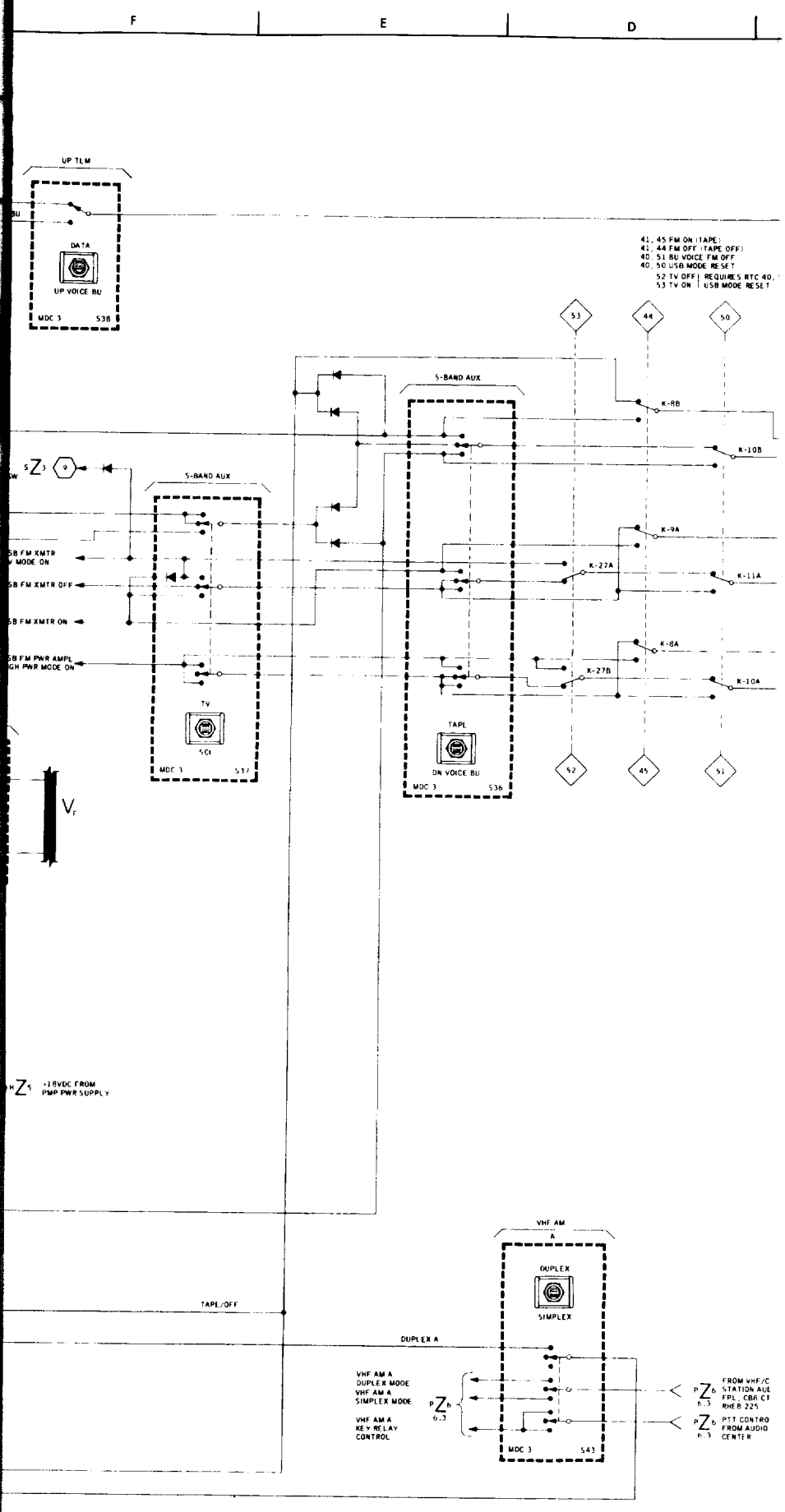
FOLDOUT FRAME 3



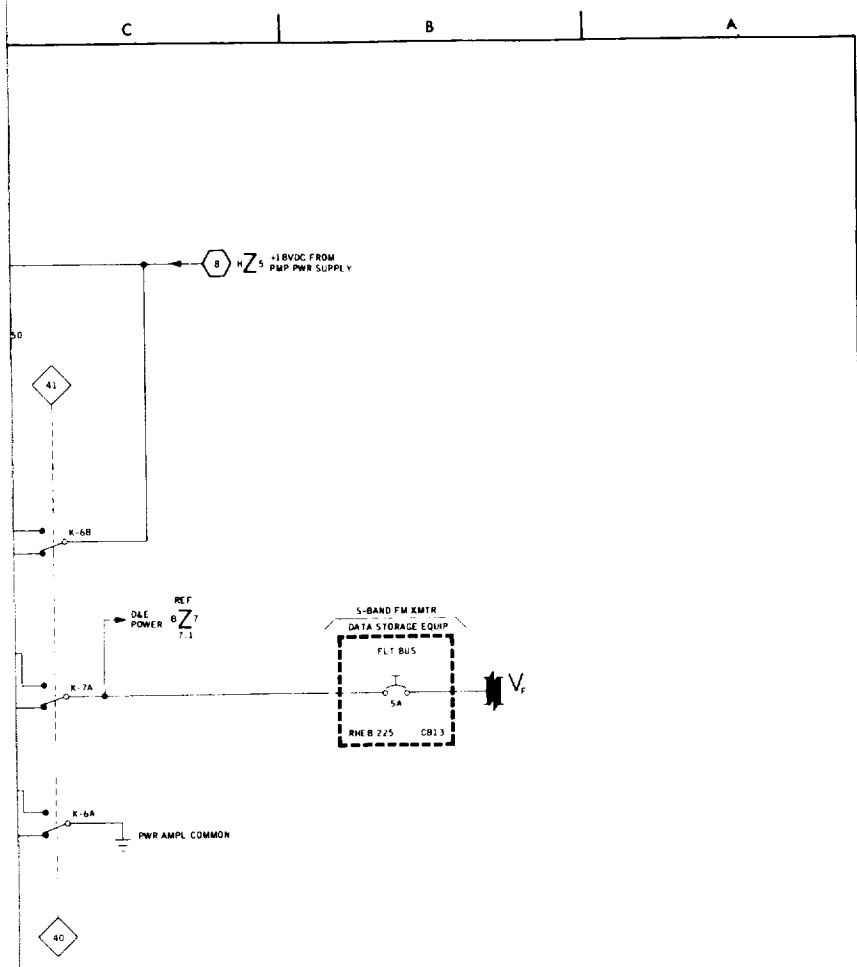
FOLDOUT FRAME 4



FOLDOUT FRAME 5



FOLDOUT FRAME 6



4 PREMOD

SIGNATURES	DATE
DR	3/9/72
DSGN	
DC	
ENGR	4-11-72
ENGR	4-11-72
APP	4/11/72
APP	4-11-72
STC	4-11-72

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PREMODULATION PROCESSOR

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REV NO. R

FOLDOUT FRAME 7

Q P O

8 7 6 5 4 3 2 1

SALVO REALTIME COMMAND LIST

SALVO RESET (OCTAL) (45XX)		SALVO FUNCTION
	SALVO RESET 1 (RESETS FOLLOWING RTC'S 46XX)	
30	00	ABORT LIGHT A OFF
	04	CREW ALARM OFF
	10	ACE CMC ZERO DISABLE
	14	ACE CMC ONE DISABLE
	20	CSM SPEC ELC PWR OFF
32	02	NORM MEM DUMP OFF ▷4
	06	ABORT LIGHT B OFF
	12	(SPARE)
	16	VG INIT-CLK U/D OFF ▷4
	22,26	RANGING RESET
	32,36	R/T PCM RESET
	SALVO RESET 2 (RESETS FOLLOWING RTC'S 46XX)	
70	40,50	USB MODE RESET
	44	NO EQUIPMENT AFFECTED
	54,60,74	ANTENNA SELECT RESET
	64,70	BIT RATE RESET
72	42,46	POWER AMP RESET
	52	TV OFF
	56	CSM SPEC DET PWR OFF
	62,66	DSE ELECT RESET
	72,76	TAPE CNTL RESET

SALVO COMMAND (OCTAL) (45XX)	RTC'S INITIATED
10*	00,04,10,14
11*	01,05,11,15
12*	02,06,12,16
13*	03,07,13,17
14*	04,14
15*	05,15
16*	06,16
17*	07,17
30*	00,04,10,14,20
31*	01,05,11,15,21
32*	02,06,12,16,22,26,32,36
33*	03,07,13,17,23,27,33,37
34*	04,14
35*	05,15
36*	06,16,26,36
37*	07,17,27,37
50*	40,44,50,54
51*	41,45,51,55
52*	42,46,52,56
53*	43,47,53,57
54*	44,54
55*	45,55
56*	46,56
57*	47,57
70*	40,44,50,54,60,64,70,74
71*	41,45,51,55,61,65,71,75
72*	42,46,52,56,62,66,72,76
73*	43,47,53,57,63,67,73,77
74*	44,54,64,74
75*	45,55,65,75
76*	46,56,66,76
77*	47,57,67,77

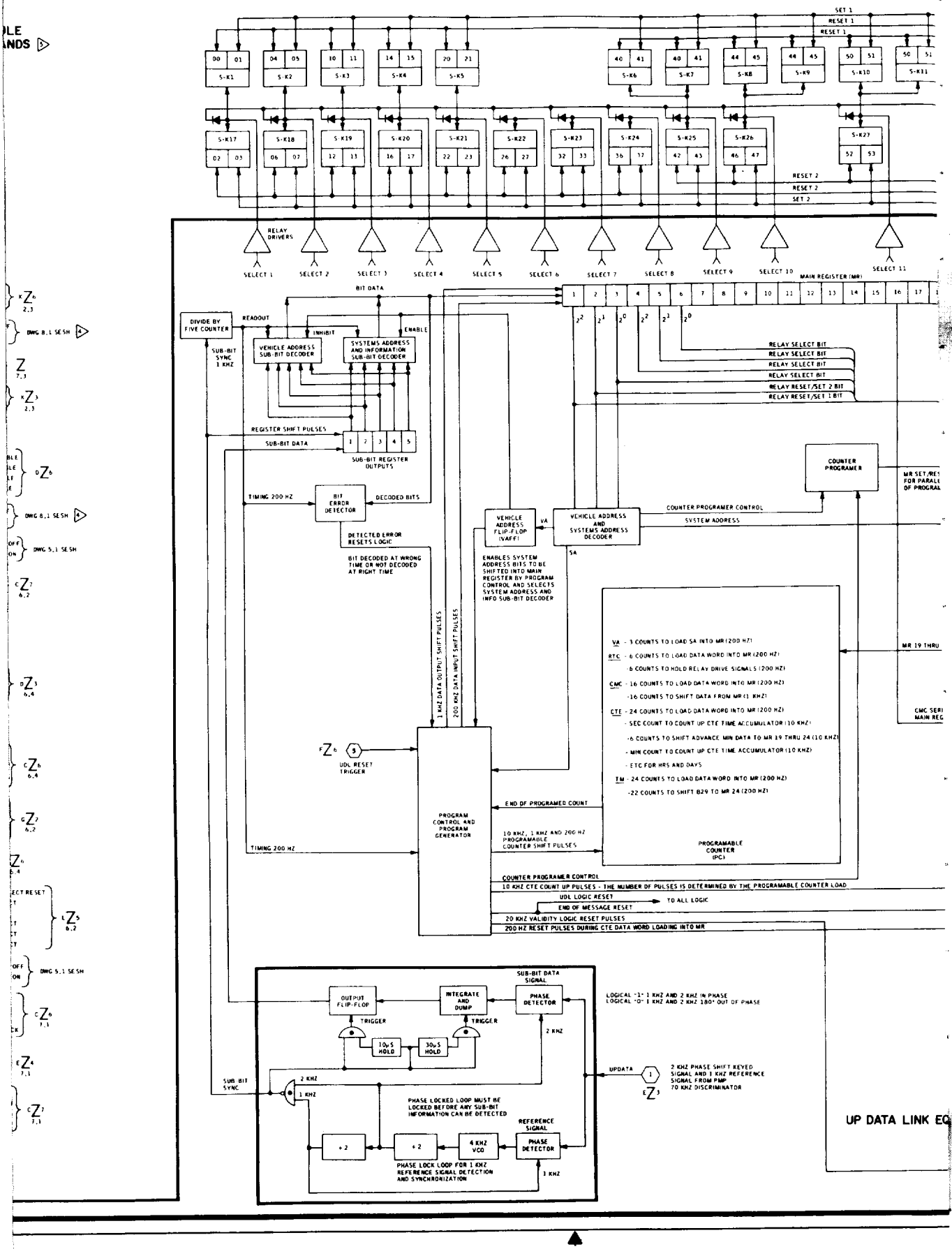
*THESE SALVO'S NOT USED

UDL RELAY MODU
REALTIME COMMA

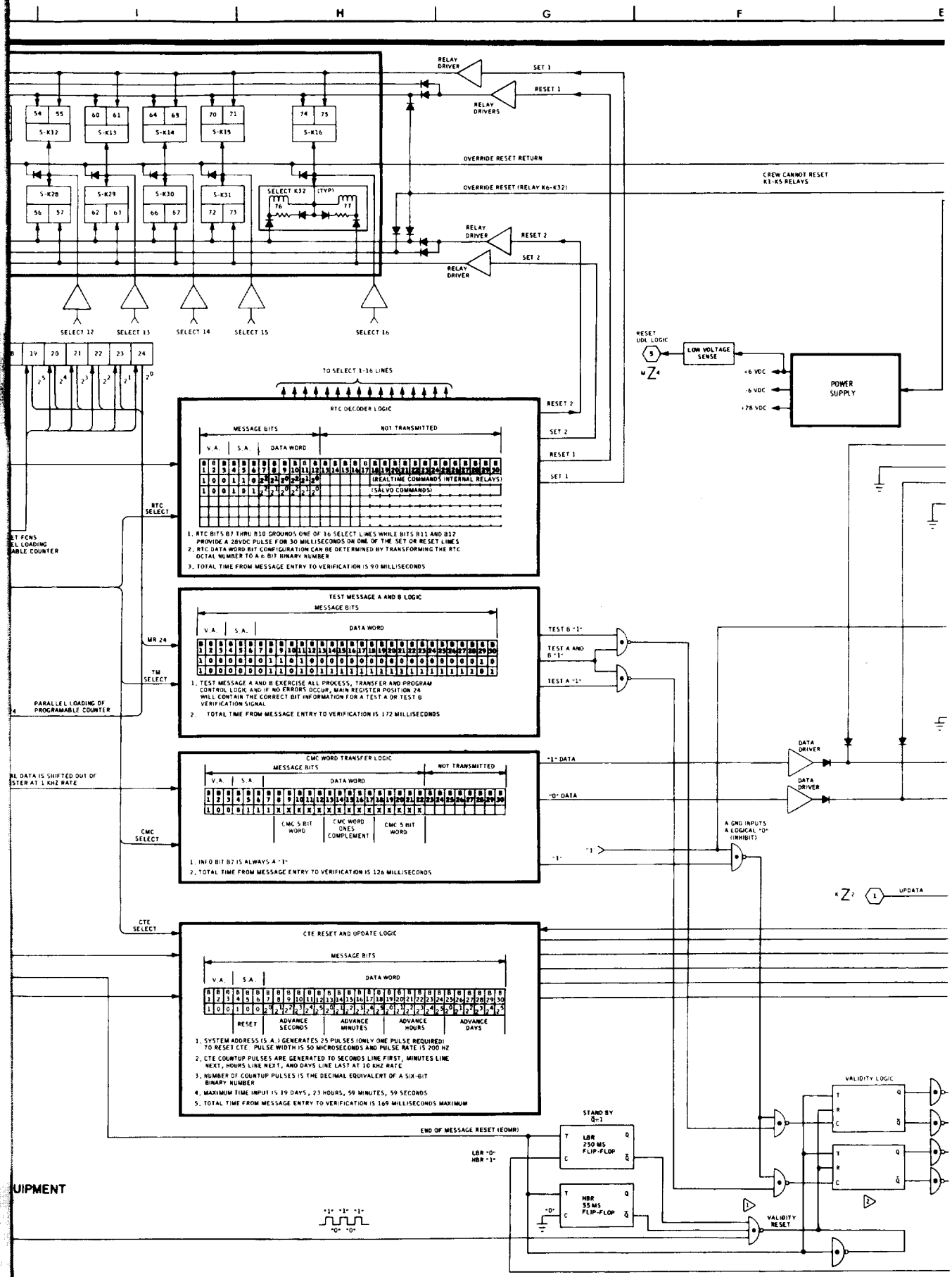
RTC (OCTAL) (46XX)	COMMAND NAME
00	ABORT LIGHT A OFF
01	ABORT LIGHT A ON
02	NORM MEM DUMP OF
03	NORM MEM DUMP ON
04	CREW ALARM OFF
05	CREW ALARM ON
06	ABORT LIGHT B OFF
07	ABORT LIGHT B ON
12	(SPARE)
13	(SPARE)
10	ACE CMC ZERO DISA
11	ACE CMC ZERO ENAL
14	ACE CMC ONE DISAB
15	ACE CMC ONE ENABL
16	VG INIT-CLK U/D OFF
17	VG INIT-CLK U/D ON
20	CSM SPEC ELC PWR
21	CSM SPEC ELC PWR
22,26	RANGING RESET
22,27	RANGING ENABLE
23	RANGING DISABLE
24	(NOT USABLE)
25	(NOT USABLE)
30	(NOT USABLE)
31	(NOT USABLE)
32,36	R/T PCM RESET
32,37	R/T PCM 1,024 ON
33,37	R/T PCM OFF
34	(NOT USABLE)
35	(NOT USABLE)
40,50	USB MODE RESET
40,51	B/U VOICE FM OFF
41,44	FM OFF (TAPE OFF)
41,45	FM ON (TAPE ON)
42,46	POWER AMP RESET
42,47	POWER AMP HIGH
43,46	POWER AMP OFF
43,47	POWER AMP LOW
52	TV OFF
53	TV ON
54,60,74	ANTENNA SEL
54,60,75	D OMNI SELE
54,61	REMOTE
55,60,74	C OMNI SELE
55,60,75	A OMNI SELE
55,61	B OMNI SELE
56	CSM SPEC DET PWR
57	CSM SPEC DET PWR
62,66	DSE ELECT RESET
62,67	DSE ELECT RECORD
63,66	DSE ELECT OFF
63,67	DSE ELECT PLAYBA
64,70	BIT RATE RESET
64,71	BIT RATE HIGH
65	BIT RATE LOW
72,76	TAPE CNTL RESET
72,77	DSE TAPE FORWARD
73,76	DSE TAPE STOP
73,77	DSE TAPE REWIND

B Z4 C 6.2

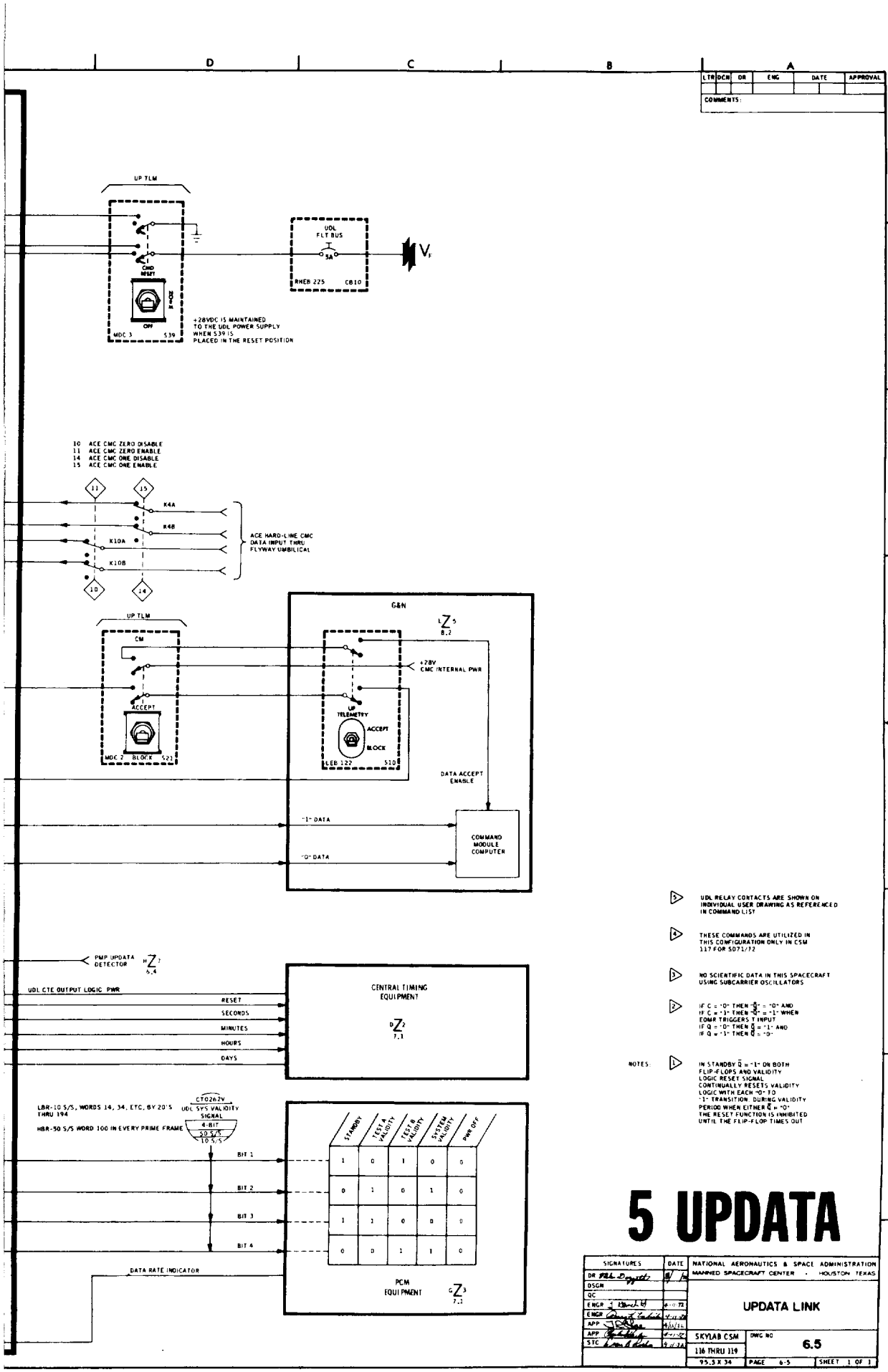
FOLDOUT FRAME 1



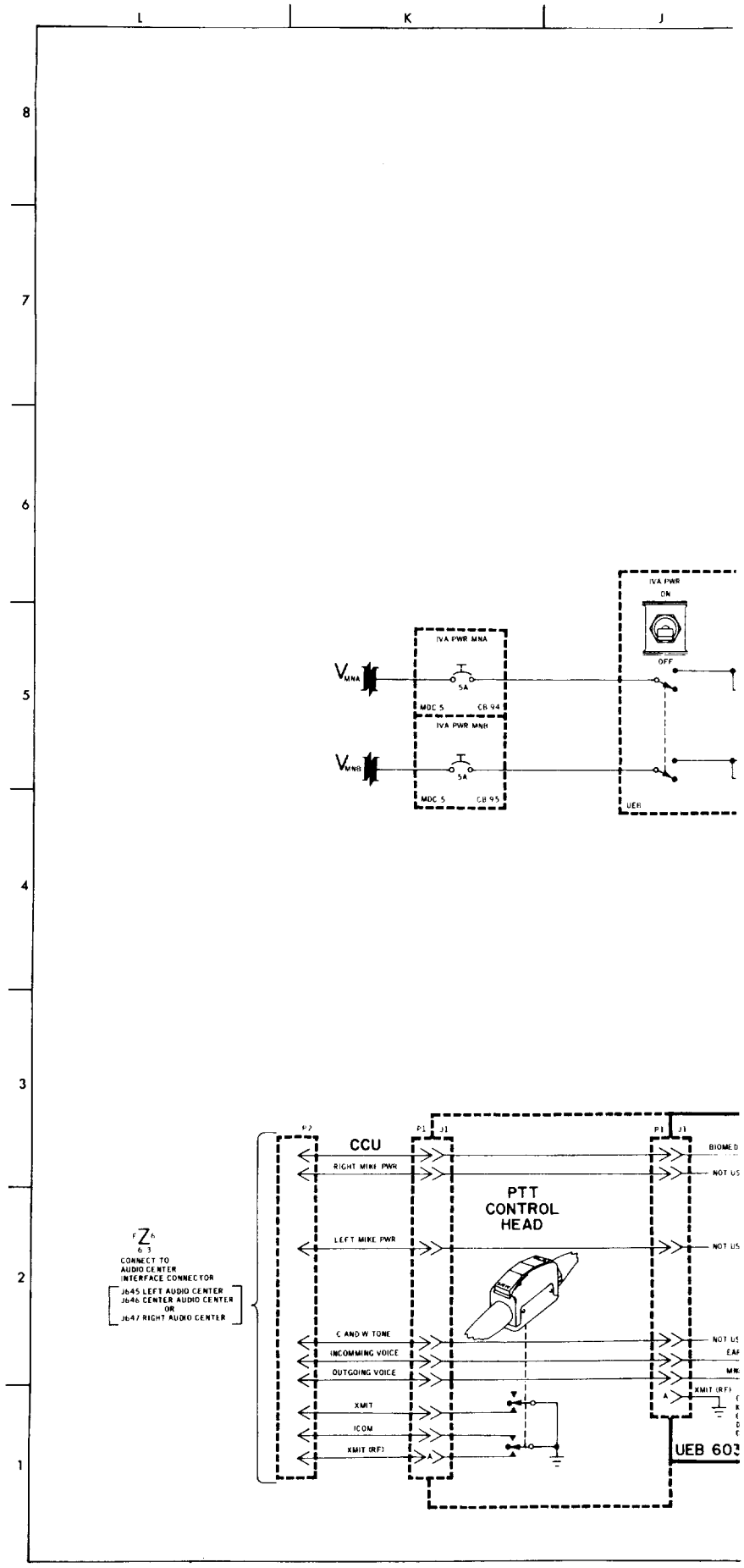
FOLDOUT FRAME 2



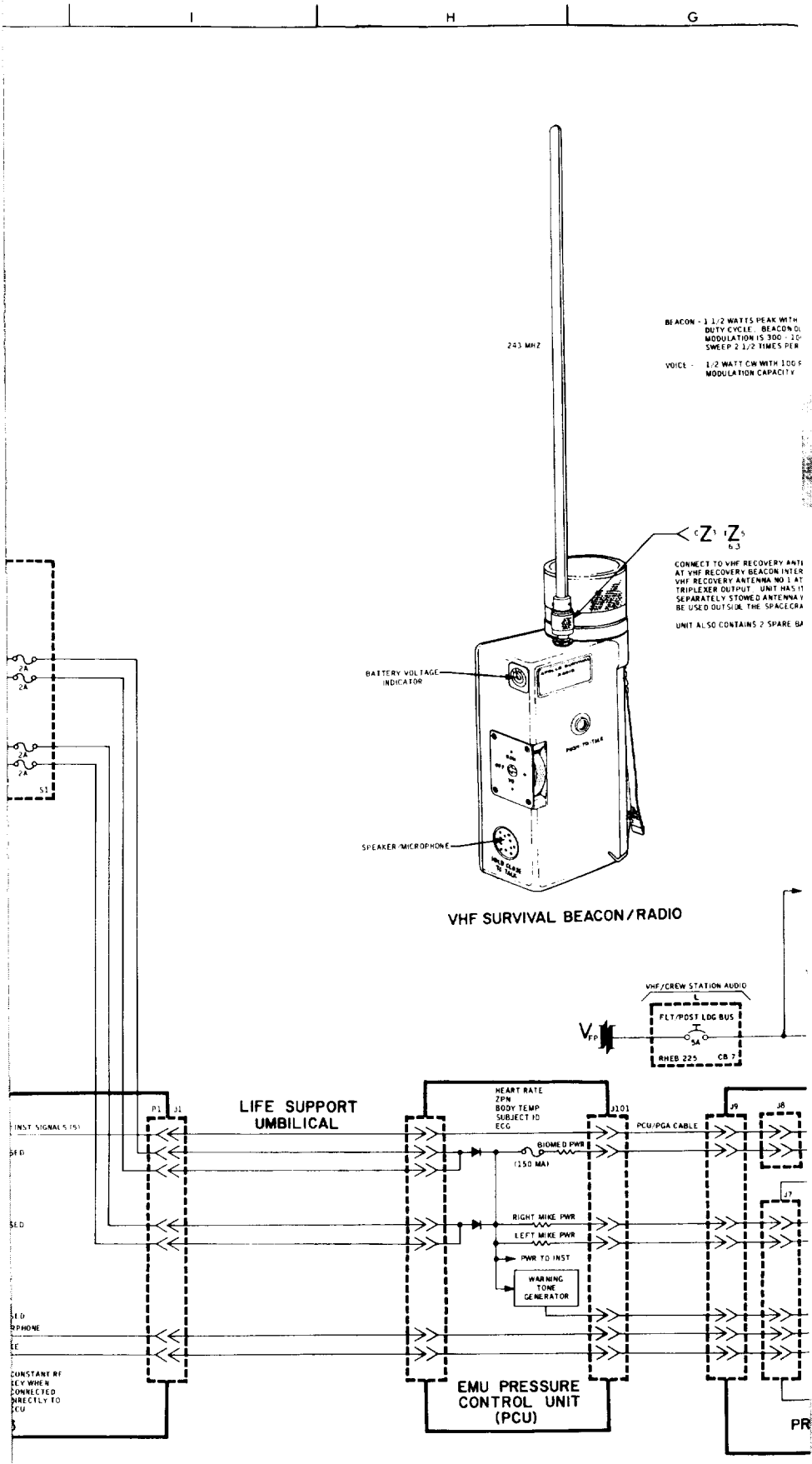
FOLDOUT FRAME 3



FOLDOUT FRAME 4



FOLDOUT FRAME 1



FOLDOUT FRAME 2

F E D

POST LANDING

BCN LT HI

BCN LT LO

MDC 15 S3

VHF TRIPLEXER

TO VHF ANT SW (P102 COAX)

J1

J2

VHF RCVRY BEACON

TO RCVRY ANT NO 2 (P112 COAX)

ACCESSABLE THRU PANEL DOOR

TO S6, MDC 8 FLOAT BAG FILL-OFF-VENT SWITCH

INTERCOM BUS

FLOAT BAG

3

FLT/PL

5A

MDC 8 CB 8

V_{FP}

POST LANDING

DYE MARKER

MDC 15 S2

CENTER COUCH AUDIO STATION
LEFT COUCH RIGHT MIKE
CENTER COUCH LEFT MIKE

VHG BCN

ON

OFF

MDC 3 S45

VHF RECOVERY BEACON

POWER SUPPLY

FLIP FLOP

XMTR CONTROL
2 SEC ON - 3 SEC OFF

XMTR 243 MHZ

1 KHZ OSC

SQUARE WAVE MODULATION

J2

FROM VHF ANT. SWITCH

BIOMED INST

RIGHT MIKE

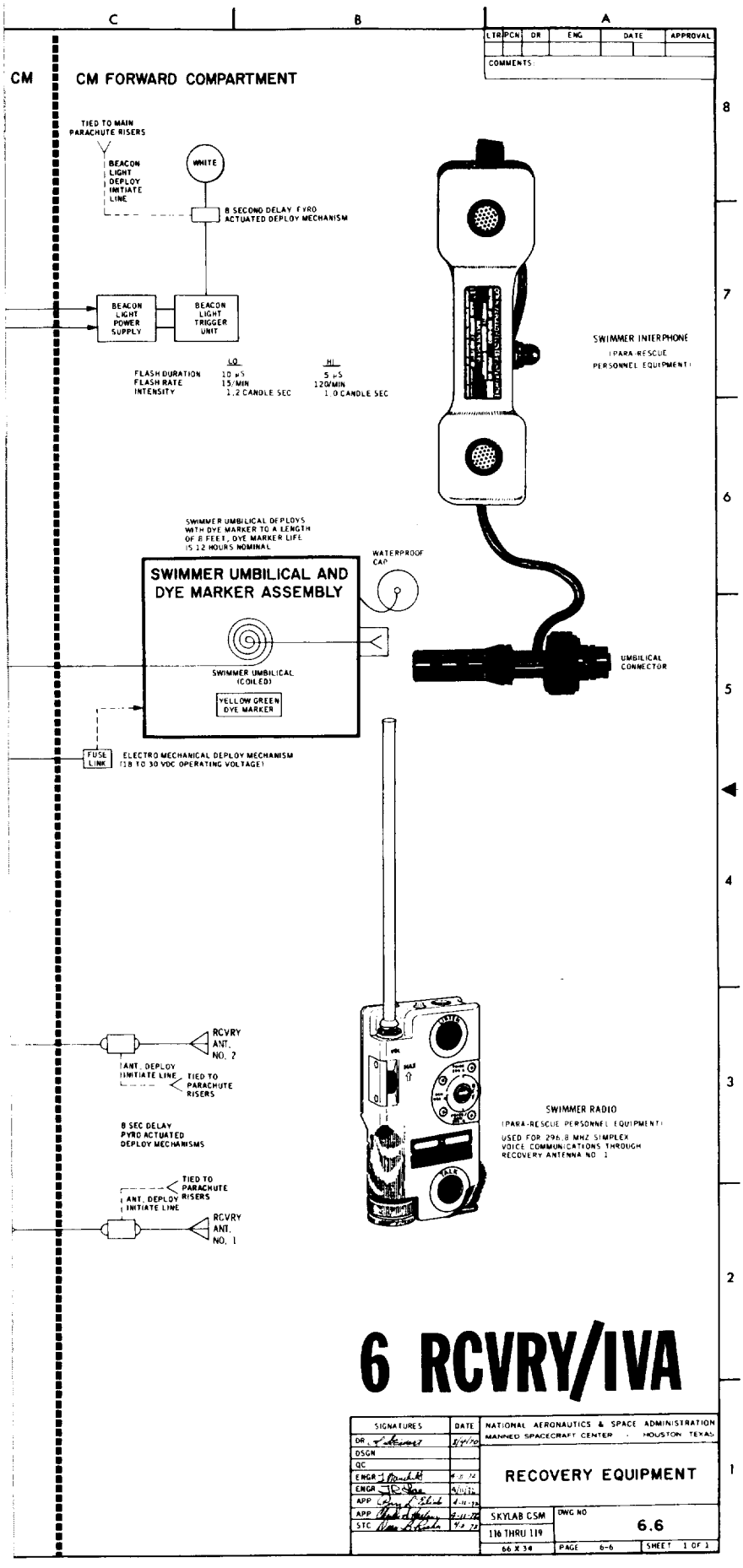
EARPHONES

LEFT MIKE

MIKE AMPL

ESSURE GARMENT ASSY (PGA)

FOLDOUT FRAME 3



6 RCVRY/IVA

SIGNATURES	DATE
DR	5/4/70
DSGN	
QC	
ENGR	4-8-72
ENGR	4/11/72
APP	4-11-72
APP	4-11-72
STC	4-9-72

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RECOVERY EQUIPMENT

SKYLAB CSM
116 THRU 119

DWG NO 6.6

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FOLDOUT FRAME 4

TABLE 6-I.- UNIFIED S-BAND TRANSPONDER AND FM TRANSMITTER

ITEM	FUNCTION and/or PARAMETERS
1. Weight	32 pounds
2. Cooling	ECS Primary and/or Secondary Glycol Loops
3. Electrical Power	
a. Dc Voltage	28 ± 4 Vdc (For control only)
b. Ac Voltage	115 Vac, 400 Hz, 3 phase
c. Power	
(1) PM Transponder	1.0 watts dc 16.5 watts dc (Prim or Sec)
(2) FM Transmitter	1.5 watts dc 6.7 watts ac
4. Activation Time	1 minute maximum - PM Receiver, PM Transmitter, and FM Transmitter
5. PM Receiver (Prim/Sec)	
a. Type	Double Conversion Superheterodyne, Phase Lock Loop
b. Frequency (Center)	2106.40625 MHz
c. Phase Lock Tracking Loop	
(1) In-Lock Range	±90 kHz for RF INPUT greater than -114 dBm and STATIC PHASE ERROR less than 15 degrees peak.
(2) In-Lock Rate	Linear rate of 35 kHz/second or less to ±90 kHz for RF INPUT greater than -114 dBm.
(3) Acquisition Probability	90 percent probability of acquisition on first sweep at above range and rates
(4) Predetection Noise Bandwidth	16 kHz
(5) Loop Noise Bandwidth (Optimizing Point)	800 Hz (0 dB S/N @ -134.5 dBm)
(6) Threshold	-125 dBm, defined as the level of unmodulated CW signal below which lock cannot be maintained for a period of at least one minute with 90 percent probability.

TABLE 6-I.- UNIFIED S-BAND TRANSPONDER AND FM TRANSMITTER - Continued

ITEM	FUNCTION and/or PARAMETERS
(7) Phase Error	24 degrees maximum (Offset + Rate Errors)
d. Dynamic Range	-51 dBm to -124 dBm (Normal) -35 dBm to -51 dBm (Must maintain lock and must not damage receiver).
e. Automatic Gain Control (AGC)	
(1) Attack Time	TBD
(2) Decay	3 seconds (-51 dBm to -127 dBm)
f. Ranging Channel	
(1) Modulation	PM on Carrier
(2) Bandwidth	10 kHz to 1.5 MHz (3 dB)
(3) PRN Bit Rate	992.834 kbs
(4) PRN Clock	992.834 kbs (496.417 kHz square wave)
(5) PRN Code Length	5,456,682 bits (lunar code)
g. High-Gain Antenna Track Channel	
(1) Pointing Error Signal	50 Hz amplitude modulated signal derived from the coherent AGC detector.
(2) Earth Presence Signal	DC signal superimpose on pointing error signal when RCVR is locked to incoming RF signal.
h. Outputs	(See Table 6-IV Modes)
6. PM Transmitter (Prim/Sec)	
a. Type	PM, S-band
b. Frequency	2287.5 MHz (Aux OSC Mode) or 240/221 times RCVR frequency when RCVR is phase locked to uplink RF signal. (See Auto OSC Control).
c. RF Output Power	301 to 374 milliwatts (Test Data)
d. Auto OSC Control	XMTR frequency is derived from XMTR Aux OSC prior to acquisition and RCVR VCO after acquisition. Switching is controlled using RCVR AGC signal.

TABLE 6-I.- UNIFIED S-BAND TRANSPONDER AND FM TRANSMITTER - Concluded

ITEM	FUNCTION and/or PARAMETERS
(1) Aux OSC to RCVR VCO Switching Time	Less than 0.25 seconds
(2) RCVR VCO to Aux OSC Switching Time	Less than 6 seconds (3 Seconds Nominal at -51 dBm)
(3) Switching Threshold	-127 dBm
e. Inputs	(See Table 6-III Modes)
7. FM Transmitter	
a. Type	FM, S-band
b. Frequency	2272.5 MHz ± 455 kHz
c. Frequency Deviation	±3 MHz maximum
d. RF Output	111 to 138 milliwatts (Test Data)
e. Inputs	(See Table 6-III Modes)
(1) TV (dc coupled)	f_o at +1.3 Vdc Input $\Delta f/V$ = 1 MHz/V Response dc to 500 kHz
(2) Wideband (ac coupled)	$\Delta f/V$ = MHz/V Response 200 Hz to 300 kHz
8. Special Operating Instructions	When switching between primary and secondary tranponders, momentarily stop at the OFF (Center) position to allow control relays to operate.

TABLE 6-II.- S-BAND POWER AMPLIFIER

ITEM	FUNCTION and/or PARAMETERS
1. Weight	32 pounds maximum
2. Cooling	ECS Primary and/or Secondary Glycol Loop
3. Electrical Power	
a. Input Voltage	28 ± 4 Vdc control 115 Vac, 400 Hz, 3Ø
b. Input Power	
(1) Control Power	5 watts maximum steady state and 350 watts during switching for 0.5 seconds maximum.
(2) Ac Power	High Pwr Ampl Mode 81 watts Low Pwr Ampl Mode 32 watts Off/Bypass 0 watts Sum ac power values to obtain simultaneous power level operation of Prim and Sec power amplifiers.
4. Power Amplification Activation Time	No RF amplification until 90 second nominal filament warm-up period complete. RF transfer (PM or FM) from one power amplifier to the other, with a 60 millisecond RF amplification dropout, is possible without an additional 90 second delay (filament warm-up) if the desired power amplifier is operating at the time of transfer.
5. RF Output	
a. PM Output - Prim or Sec Power Amplifier	High Pwr Mode: 11.2 watts min Low Pwr Mode: 2.8 watts min Bypass Mode: Less than 2.5 dB below input
b. FM Output - Prim or Sec Power Amplifier	High Pwr Mode: 11.2 watts min

TABLE 6-II.- S-BAND POWER AMPLIFIER - Concluded

ITEM	FUNCTION and/or PARAMETERS
6. RF Input	
a. PM	275 to 400 milliwatts
b. FM	100 to 145 milliwatts (For rated output)
7. Under Voltage Protection	Under-voltage protection circuit will remove ac pwr from power amplifier TWT if any phase of the ac input voltage falls below 95 Vac for 15 milliseconds or more. If this condition exists for 1 second or more, a 90 second filament warm-up delay will occur when ac voltage is restored.
8. Special Operating Instructions	Dc power should be applied before ac power and removed after ac power removal to prevent possible damage.

TABLE 6-III.- S-BAND DOWNLINK MODES AND MODULATIO

	MODE NUMBER	1	2	3	4	5	6	7	8	9
PM DOWNLINK MODES AVAILABLE	Channels Included	Carrier Voice (a) 51.2-kbps TM -- --	Carrier Voice (a) 51.2-kbps TM PRN ---	Carrier Voice (a) 1.6-kbps TM PRN --	Carrier Voice (a) 1.6-kbps TM -- --	Carrier -- 1.6-kbps TM -- --	Carrier -- -- -- KEY	Carrier -- -- PRN --	Carrier Backup Voice 1.6-kbps TM -- --	Carrie -- 1.6-kbp TM PRN --
PM DOWNLINK MODULATION PROCESS	Modulation Schemes; Subcarrier Characteristics	PRN : PM directly on carrier (2287.5 MHz) Backup Voice (a) : PM directly on carrier (2287.5 MHz) Normal Voice (a) : FM/PM; 1.25-MHz subcarrier deviated ±7.5 kHz peak (±9 kHz peak for voice and biomed) (b) TM : PCM/PSK/PM; 1.024 MHz subcarrier bi-phase modulated ±90° Key : AM/PM; 512 kHz, 100 percent AM								
	Peak Carrier Deviation-Radians ($\Delta\theta$)	PRN : (c) Normal Voice (a) : 0.7 for Modes 1,2 1.2 for Modes 3, 4, 11, 12 Backup Voice : 0.7 for Modes 8, 14 1.2 for Modes 10, 16 TM (c): 1.2 for Modes 1, 2, 16 (51.2-kbps) and Mode 8 (1.6-kbps) 0.7 for Modes 3, 4 (1.6-kbps) 1.6 for Modes 5, 9 (1.6-kbps) and Modes 13, 15 (51.2-kbps) Key : 1.0								

	MODE NUMBER	1	2	3	4	5	6	7	8
FM DOWNLINK MODES AVAILABLE	Channels Included	1:1 Playback of Recorded Voice, Recorded CSM 51.2-kbps TM and Scientific Data (d)	32:1 Playback of Recorded Voice, Recorded CSM 1.6-kbps TM and Scientific Data (d)	32:1 Playback of (CSM - Recorded) LM 1.6-kbps TM	TV	Real-time Scientific (d)	Real-time 51.2-kbps TM (e) Real-time Scientific (d)	Real-time 1.6-kbps TM (e) Real-time Scientific (d)	1:1/32:1 back of tific Da Real-tim 51.2-kbp
FM DOWNLINK MODULATION PROCESS	Modulation Schemes; Subcarrier Characteristics	TV : FM Directly on carrier (2272.5 MHz) Playback Voice : FM Directly on carrier (2272.5 MHz) Scientific Data (d): FM/FM (3 subcarriers) 95 kHz 125 kHz 165 kHz Playback LM TM : PCM/FM Playback CSM TM (e): PCM/PSK/FM; 1.024 MH bi-phase modulated ±							
	Peak Carrier Deviation (Δf)	Playback Voice : 100 kHz +20 percent -40 percent Playback CSM TM (e) : 600 kHz ±15 percent Playback LM TM : 200 kHz +25 percent -50 percent TV : 1 MHz ±10 percent, f_c at 1.3 Vdc within 0 to +455 kHz Scientific Data (d) (Real-time): FM/FM 75 kHz ±15 percent 108 kHz ±15 percent 168 kHz ±15 percent								

(a) Or voice and biomed

(b) In the event of an EVA, the EVA biomed data is relayed via the CSM S-band link on the voice subcarrier; otherwise the biomed data comes back as PCM telemetry.

(c) Varies with the received uplink.

(d) Scientific data not used.

(e) Auxiliary PMP mode will provide real time PCM with same USB-FM characteristics as playback PCM.

(f) For Mode 10 Backup Voice Mod Index, place TLM bit rate switch to HIGH. Use LOW for Mode 14 Mod Index.

(g) HBR Mod Index of 1.2 and 1.6 are actually 0.96 and 1.2 respectively due to HBR suppression of 1.024 MHz subcarrier.

FOLDOUT FRAME

	10	11	12	13	14	15	16	0
r	Carrier	Carrier	Carrier	Carrier	Carrier	Carrier	Carrier	
	Backup Voice (f)	Voice	Voice	--	Backup Voice (f)	--	Backup Voice	
s	--	--	--	51.2-kbps TM	--	51.2-kbps TM	51.2-kbps TM	No Carrier
	--	PRN	--	--	--	PRN	--	
	--	--	--	--	--	--	--	

	9	10	0
Play- Scien- ta and e s TM	1:1/32:1 Playback of Scientific Data and Real-time 1.6-kbps TM	8.1 Playback if (CSM-Recorded) LM 1.6-kbps TM	No Carrier

z subcarrier
90°

(95 kHz SC)
(125 kHz SC)
(165 kHz SC)

FOLDOUT FRAME 2

*

TABLE 6-IV.- S-BAND UPLINK MODES AND MODULATION PROCESS

PM UPLINK MODES AVAILABLE	MODE NUMBER	1	2	3	4	5	6	7	8	9	0
	Channels Included	Carrier PRN -- --	Carrier -- Voice --	Carrier -- -- Updata	Carrier PRN Voice --	Carrier PRN -- Updata	Carrier PRN Voice Updata	Carrier -- Voice Updata	Carrier PRN Backup Voice --	Carrier -- -- --	-- -- -- --
PM UPLINK MODULATION PROCESS	Modulation Schemes: Subcarrier Characteristics	PRN : PM directly on carrier Voice : FM/PM; 30-kHz subcarrier deviated ±7.5 kHz (peak) Updata : PSK/FM/PM; 70-kHz subcarrier deviated ±5.0 kHz (peak) Backup Voice: FM/PM; 70-kHz subcarrier deviated ±5.0 kHz (peak)									
	Carrier Phase Deviation (Radians-Peak)*	MODE NUMBER	1	2	3	4	5	6	7	8	9	0
		PRN	1.34	--	--	0.38	0.38	0.44	--	0.38	NA	NA
		Voice	--	1.85	--	1.20	--	1.00	1.10	--		
		Updata	--	--	1.85	--	1.20	1.00	1.10	--		
		Backup Voice	--	--	--	--	--	--	--	1.20		

*All phase deviations have ±10% tolerance

TABLE 6-V.- PREMODULATION PROCESSOR

ITEM	FUNCTION and/or PARAMETERS
1. Weight	14.5 pounds
2. Cooling	ECS Primary and/or Secondary Glycol Loops
3. Electrical Power	
a. Input Voltage	28 ± 4 Vdc
b. Input Power	8.5 watts
4. CM Down Voice Channel (Normal)	
a. Subcarrier	1.25 MHz derived from CTE 512 kHz.
b. Response	300 to 3000 Hz flat within 6 dB.
5. CM Down Voice Channel (Backup)	
a. Response	300 to 2300 Hz flat within 6 dB.
6. LM/EVA Voice and LM Biomed Relay Channel	
a. Subcarrier	1.25 MHz derived from CTE 512 kHz.
b. Subcarrier Deviation	LM Voice - 8 kHz EVA Voice and Biomed - 9 kHz
c. Response	300 to 13,000 Hz flat within 2 dB.
d. LM Input	Voice
e. EVA Input	Voice and/or 7 Biomed Subcarriers 4.0 kHz ± 5% f_o 5.4 kHz ± 5% f_o 6.8 kHz ± 5% f_o 8.2 kHz ± 5% f_o 9.6 kHz ± 4% f_o 11.0 kHz ± 3% f_o 12.4 kHz ± 3% f_o
7. Tape Recorder Output - LM & CSM Voice	LM and CSM intercom voice are mixed and output to DSE for recording.
a. Response	300 to 2300 Hz flat within 2 dB.
8. LM PCM Output Channel	LM PCM (1.6 kbs) is limited and output to DSE for recording.
a. Response	600 to 2800 Hz flat within 1 dB.

TABLE 6-V.- PREMODULATION PROCESSOR - Continued

ITEM	FUNCTION and/or PARAMETERS
9. CM PCM Data Channel (Real-time and Playback)	
a. Input	51.2 kbs or 1.6 kbs NRZ PCM data.
b. Subcarrier	1.024 MHZ derived from PCM 512 kHz ref signal.
c. Modulation	Bi-phase
10. Scientific Data Channel (Real-Time)	
a. Response	Flat within 2 dB Channel 1 0 to 2850 Hz 2 0 to 3750 Hz 3 0 to 4950 Hz
b. Frequency and Deviation	Channel 1 95 kHz +7.5% f_o 2 125 kHz +7.5% f_o 3 165 kHz +7.5% f_o
11. Scientific Data Channel (Playback)	
a. Response	Flat within 2 dB Channel 32:1 Playback 1:1 Playback 1 12.5 to 89 Hz 50 to 2850 Hz 2 12.5 to 117 Hz 50 to 3750 Hz 3 12.5 to 154 Hz 50 to 4950 Hz (Recorded data bandwidths)
12. Tape Recorder Input - LM PCM Channel	
a. Response	15 to 90 kHz flat within 1 dB.
13. Uplink Subcarrier Detectors	
a. Up Voice	30 kHz (normal) 70 kHz (backup)
b. Updata	70 kHz
c. Response	300 to 4,000 kHz flat within 3 dB.

TABLE 6-V.- PREMODULATION PROCESSOR - Concluded

ITEM	FUNCTION and/or PARAMETERS
14. Emergency Key Control	512 kHz signal derived from CTE 512 kHz timing signal baseband modulates S-band PM carrier when key is depressed. A 400 Hz sidetone output to the audio center is provided when key is depressed.
15. Data Rate Indicator Control	Dc signal from PCM to control modulation levels to PM and FM Modulator modules. HBR = 5.3 Vdc LBR = 0 Vdc
16. Television Channel	
a. Direct Output	To S-band FM transmitter
b. Response	Dc to 500 kHz flat within 0.5 dB.
c. Isolated Output	To GSE hardline
d. Response	10 to 500,000 Hz flat within 3 dB.
17. Uplink Voice Squelch (30 kHz Discriminator Output)	
a. Operation	Transistor switch actuated by voice subcarrier threshold detector. Switch grounds input to voice output amplifier.
b. Threshold	Mode — Received Carrier Power 2 — -119 dBm 4 — -111 dBm 6 — -108 dBm 7 — -109 dBm
c. Squelch Level	Greater than 35 dB squelch of audio output when threshold is reached.

TABLE 6-VI.- VHF AM TRANSCEIVER EQUIPMENT

ITEM	FUNCTION and/or PARAMETERS
1. Weight	13 pounds maximum
2. Cooling	ECS Primary and/or Secondary Glycol Loop
3. Electrical Power	
a. Input Voltage	28 ± 4 Vdc
b. Input Power	Duplex A (Key OFF) 4.2 watts Duplex A (Key ON) 28.8 watts Simplex A (Key OFF) 4.1 watts Simplex A (Key ON) 28.8 watts Duplex B (Key OFF) 3.8 watts Duplex B (Key ON) 27.6 watts Simplex B (Key OFF) 4.0 watts Simplex B (Key ON) 27.6 watts RCV A Only 1.2 watts RCV B Only 1.2 watts PTT (Key ON) 1.3 watts
4. Transmitter (A or B)	
a. Activation Time	250 milliseconds maximum to reach standby condition. 20 milliseconds maximum to reach full transmit power from PTT (Key ON)
b. RF Output	5 dBW (average) minimum
c. Transmitter Frequency	XMTR A 296.8 MHz ± 8.90 kHz XMTR B 259.7 MHz ± 7.79 kHz
d. Modulation	Modulated by clipped speech between 300 and 2000 Hz combined with a 30 kHz signal such that the ON-OFF duty cycle of the RF carrier (50 ± 5 percent) is speech signal dependent and the ON-OFF period is 30 kHz. When XMTR is keyed ON with no speech input the average RF Output is 5 dBW minimum.

TABLE 6-VI.- VHF AM TRANSCEIVER EQUIPMENT - Concluded

ITEM	FUNCTION and/or PARAMETERS
5. Receiver (A or B)	
a. Activation Time	500 milliseconds maximum to reach full receive operation from turn-on. 100 milliseconds maximum to reach full receive operation from PTT release (Key OFF)
b. RCVR RF Input	2 to 625,000 microvolts
c. A&B Output Response	
(1) Output to Audio Center (Voice)	300 to 3000 Hz, + 2 dB - 3 dB maximum variation, down 12 dB minimum at 5000 Hz.
(2) Output to PMP (Voice and Biomed Data)	300 to 13,000 (2 dB).
d. RCVR B LM PCM Output	300 to 13,000 Hz (2 dB).
e. RCVR Squelch	Adjustable by MDC 2 controls for between 0 and 10 to 25 microvolts. 9 on squelch control is maximum squelch (10 to 25 microvolt level)
6. VHF Digital Ranging Generator Interface	
a. RCVR A Gate Input	5.266 kHz early-late gate signal to gate fine tone error signal through RCVR IF AMPLS.
b. RCVR A Tone Output	RCVR A detected IF amplifier output to digital ranging generator.
c. XMTR B Tone Input	Coarse and module 2 sum of coarse and medium tone input during acquisition and fine tone input during range tracking.
d. XMTR B Quieting (SC Inhibit)	Inhibit to XMTR 30 kHz quieting OSC during fine tone transmissions.

TABLE 6-VII.- AUDIO CENTER EQUIPMENT

ITEM	FUNCTION and/or PARAMETERS
1. Weight	7.9 pounds
2. Cooling	ECS Primary and/or Secondary Glycol Loop
3. Electrical Power	
a. Input Voltage	28 ± 4 Vdc
b. Input Power	14.2 watts (3 Stations ON)
4. Stations	Left Couch Station Right Couch Station Center Couch Station
5. Microphone Amplifier (1 Each Station)	
a. Input	0 dBm sound pressure level (nominal)
b. Response	300 to 3000 Hz flat within 2 dB
c. Automatic Volume Control	
(1) Range	Less than 4 dB change for 20 dB input change
(2) Attack Time	50 milliseconds
(3) Release Time	1 to 6 seconds
(4) Threshold	13 ± 3 dB (referred to input)
d. Output	0 dBm ± 3 dB at threshold
e. Isolation	30 dB or greater between modulation output channels
6. Earphone Amplifier (1 Each Station)	
a. Input	Variable over 35 dB range of given input signal
b. Output	With 13 dB on input attenuator the output is 20 dBm ± 3 dBm
c. Response	300 to 3000 Hz flat within 2 dB
d. Isolation	40 dB or greater between input channels

TABLE 6-VII.- AUDIO CENTER EQUIPMENT - Concluded

ITEM	FUNCTION and/or PARAMETERS
7. Voice Operated Relay (VOX)	
a. VOX Sensitivity	Adjustable for input from -10 dBm to +10 dBm
b. VOX Attack	Less than 50 milliseconds
c. VOX Release	2 ± 0.7 seconds
8. Intercom Bus	
a. GSE Output	(Not Used)
b. Swimmer Output	For recovery voice to recovery swimmers
c. Tape Recorder	Output for voice recording on DSE
9. Spacecraft/GSE Facility Hardline Voice Interface	The Pad COMM Switch and Volume Control are used to operate each audio station's input/output voice links with the checkout and launch facilities.

TABLE 6-VIII.- UPDATA LINK EQUIPMENT

ITEM	FUNCTION and/or PARAMETERS
1. Weight	21 pounds maximum
2. Cooling	ECS Primary and/or Secondary Glycol Loops
3. Electrical Power	
a. Input Voltage	28 + 2, -4 Vdc
b. Input Power	8.9 watts maximum
4. Information Signal	
a. Modulation	Phase shift key FM modulation of 70 kHz S-band Uplink subcarrier. Modulation deviation is ±5 kHz.
b. Sub-bit "One"	Sub-bit "one" begins when the positive transition of the 1 kHz information signal cross each other in-phase.
c. Sub-bit "Zero"	Sub-bit "zero" begins when the positive transition of the 1 kHz sync signal crosses the 2 kHz information signal 180 degrees out-of-phase.
d. Sub-bit Period	One millisecond.
e. Sub-bit Rate	1,000 bits per second.
5. Message Structure	
a. Sub-bit Code	5 sub-bits per information bit. Vehicle address sub-bit code is different than system address and data word. Sub-bit coding (see Drawing 6.5).
b. Message Code	Each message contains up to 30 information bits which consist of a vehicle address, system address, and data word (see Drawing 6.5).
(1) Vehicle Address	Eight possible codes selectable by hard wire on an external connector.

TABLE 6-VIII.- UPDATA LINK EQUIPMENT - Continued

ITEM	FUNCTION and/or PARAMETERS
(2) System Address	1. Command Module Computer 2. Real-Time Command (Internal relays) 3. Real-Time Command (External relays) (not used) 4. Central Timing Equipment 5. Salvo RTC reset 6. Test message A & B 7. Auxiliary decoder (not used)
(3) Data Word	(See Drawing 6.5.)
6. Sub-bit Detector	The 1 kHz and 2 kHz PSK signals are separated to provide synchronization and sub-bit data.
a. Sub-bit Sync	Recovered by phase lock techniques. Three 5 sub-bit sequences must precede a command message to synchronize the UDL.
b. Sub-bit Data	Detected at a 1 kHz rate.
7. Decoder Operation	The vehicle address decoded as "access" bits are decoded asynchronously (without sync). Message timing in the decoder is not established until after vehicle address is decoded. Vehicle address recognition disables access bit decoding and enables the decoding of the remaining message. The system address determines information for receiving the correct number of info bits and processing a particular data word. After the proper number of bits have been received and temporarily stored in the main register, the program control modifies the operation to enable processing or transfer of the data word.

TABLE 6-VIII.- UPDATA LINK EQUIPMENT - Concluded

ITEM	FUNCTION and/or PARAMETERS
8. Verification Signal	When a complete message is received, processed or transferred without the detection of sub-bit or bit errors and without the occurrence of a logic power deviation, the parallel 4-bit verification code to the PCM TM will be as follows: PCM BIT — B1 B2 B3 B4 UDL OFF — 0 0 0 0 *TEST A — 0 1 1 0 *TEST B — 1 0 0 1 *SYS VAL — 0 1 0 1 UDL STANDBY (ON) — 1 0 1 0 *Verification signal is presented to the PCM as follows: PCM HBR 55 milliseconds PCM LBR 250 milliseconds
9. Internal Relays	
a. Type	32 double-pole double-throw relays, magnetic latching
b. Rating	2 ampere, minimum, contact rating
c. Actuation Time	Opening or closure less than 5 milliseconds.
d. Dc current	18.7 milliamperes per relay
e. Latch-in Current	7.1 milliamperes per relay

TABLE 6-IX.- VHF RECOVERY BEACON

ITEM	FUNCTION and/or PARAMETERS
1. Weight	2.7 pounds maximum
2. Cooling	Not required
3. Electrical Power	
a. Input Voltage	28 ± 4 Vdc
b. Input Power	6.9 watts maximum average over interruption cycle
4. RF Output Power	3 watts minimum during the ON time of the interruption cycle
5. XMT Frequency	243 ± 0.0126S MHz
6. Modulation	Carrier is amplitude - modulated by 1 kHz square wave, 20 to 40 percent.
7. Interruption Cycle	Modulated carrier is present at the output for 2 seconds and absent for 3 seconds.

TABLE 6-X.- VHF SURVIVAL BEACON - TRANSCEIVER

ITEM	FUNCTION and/or PARAMETERS
1. Weight	5 pounds maximum including battery pack
2. Cooling	Not required
3. Electrical	
a. Dc Voltage	16.2 Vdc from self-contained battery
b. Power	Battery pack life 24 hours in 100% beacon operation
4. Activation Time	No appreciable warm-up period
5. Receiver	
a. Type	Portable, VHF AM Beacon - transceiver with integral microphone, speaker, PTT pushbutton battery, antenna, and test meter
b. Frequency	243 MHz
Sensitivity ($\frac{S + N}{N}$ = 10 dB)	-97 dBm minimum
6. Transmitter	
a. Frequency	243 MHz
b. RF Output	
(1) Beacon	1.25 watts (peak)
(2) Voice	0.5 watts minimum (unmodulated)
c. Modulation	
(1) Beacon	ON-OFF key by a swept square wave, which varies in frequency from 1000 Hz to 300 Hz at a sweep rate of 2.5 Hz
(2) Voice	
7. Antenna	1/4 wavelength flexible whip

TABLE 6-XI.- ANTENNA SWITCH, S-BAND

ITEM	FUNCTION and/or PARAMETERS
1. Weight	2.5 pounds
2. Cooling	Not required
3. Electrical Power	
a. Input Voltage	23 to 30 Vdc
b. Input Power	12 watts (For omni position)
4. Actuation Time	150 milliseconds maximum
5. Mechanics	Non-latching, 5-position, break-before-make
6. Isolation	40 dB minimum between RF lines

TABLE 6-XII.- ANTENNA SWITCH, VHF

ITEM	FUNCTION and/or PARAMETERS
1. Weight	0.75 pounds maximum
2. Cooling	Not required
3. Electrical Power	
a. Input Voltage	None - manual switch
b. Input Power	None - manual switch
4. Actuation Time	Not applicable
5. Mechanics	Manual, 3-position, make-before-break
6. Isolation	40 dB minimum between RF lines

TABLE 6-XIII.- ANTENNA, S-BAND OMNI

ITEM	FUNCTION and/or PARAMETERS
1. Type	Helix in loaded cavity
2. Frequency	2100 MHz to 2300 MHz
3. Gain	Greater than -3 dB relative to isotropic source between $\theta > 45°$ and $\theta \geq 145°$ (See Item 5 below.)
4. Polarization	Right-hand circular
5. Coverage	The following coverage is applicable with sequential selection of the four antennas: *GAIN SOLID ANGLE $\geq$ -3 dB between $\theta = 45°$ and $145°$ $\geq$ -20 dB between $\theta = 15°$ and $165°$ $\geq$ -24 dB between $\theta = 10°$ and $170°$ GAIN WILL BE LESS THAN -24 dB for cones, with solid angles of 20 degrees at the spacecraft nose and SPS nozzel. *Applicable for $\emptyset = 0°$ to $360°$
6. Power Rating	15 watts of CW RF

TABLE 6-XIV.- ANTENNA, VHF SCIMTAR

ITEM	FUNCTION and/or PARAMETERS
1. Type	Scimitar blade - one inch thick cover for thermal protection
2. Frequency	225 MHz to 450 MHz
3. Gain	Greater than -3 dB (on axis) relative to isotropic source.
4. Polarization	Slant linear
5. Coverage	Each antenna covers a hemisphere, approximately full coverage obtainable with antenna selection.
6. Power Rating	50 watts average

TABLE 6-XV.- VHF RECOVERY

ITEM	FUNCTION and/or PARAMETERS
1. Type	10-inch erectible tape with ground-plane whiskers
2. Frequency	243 MHz tuned
3. Gain	+6 dB with respect to isotropic source, -18 dB null
4. Polarization	Vertical
5. Coverage	±70 degree elevation 360 degree azimuth
6. Power Rating	50 watts continuous

TABLE 6-XVI.- VHF DIGITAL RANGING GENERATOR

ITEM	FUNCTION and/or PARAMETERS
1. Weight	7 pounds maximum
2. Cooling	ECS Primary and/or Secondary Glycol Loop
3. Electrical Power	
a. Input Voltage	28 ± 4 Vdc
b. Input Power	10 watts maximum
4. Ranging Accuracy	±450 feet maximum error at 500 feet for ranging system: ±180 ft random ±270 ft bias
5. Range Tones	247 Hz (coarse), 3.9 kHz (medium), 31.6 kHz (fine)
6. EMS Interface	
a. Range Data Signal	Serial pulse train output to count up EMS range display to desired range in 0.01 n.mi. (60.761 feet) increments.
b. Maximum Unambiguous Range	327.68 n.mi. for intial range display.
c. Countdown Command Signal	When range is decreasing, a coundown command precedes each range data pulse.
d. Reset Pulse Signal	Resets EMS range display to zero when: a. Data good test fails b. Reacquisition sequence is initiated. c. Range rate is greater than 1,800 feet/second.
7. CMC Interface	
a. Range Data Signal	15-bit serial word with the "1" and "0" bits provided as pulse outputs on separate lines, most significant bit first.
b. Command Readout Input	3.2 kilobit/second Pulse train from CMC to clock out the range data signal
c. Range Strobe Input	3.2 kilobit/second pulse train from CMC to provide internal timing for loading range data into range data register.

TABLE 6-XVI.- VHF DIGITAL RANGING GENERATOR - Concluded

ITEM	FUNCTION and/or PARAMETERS
d. Data Good Signal	A data good test is initiated by the range strobe input just prior to loading the range data register and prior to permitting the output register to be clocked out to the CMC. Absence of the data good signal for two successive tests will result in a CMC alarm.
8. Data Good Test	Data good test is performed only during the following periods: a. Range reacquisition sequence (initiated by VHF ranging reset switch) b. CMC range strobe sequence Data good test will fail under the following conditions: a. Fine tracker loses lock during fine tone tracking. b. Range rate of greater than 1800 feet/second c. Coarse tone tracker is locked to an ambiguous null. This condition is corrected by the internal logic which forces the tracker to reacquire during acquisition.

TABLE 6-XVII.- COLOR TELEVISION CAMERA

ITEM	FUNCTION and/or PARAMETERS
1. Weight	Camera 11.0 pounds Lens 1.3 pounds
2. Cooling	Not required
3. Electrical Power	
a. Input Voltage	28 Vdc
b. Input Power	23 watts (camera) 2.5 watts (monitor)
4. Activation time	Instant on
5. Resolution	200 TV lines-per-picture height
6. Scanning rate	
a. Lines	525 scan lines per frame (2:1 interlace)
b. Frames	30 frames per second
7. Video Bandwidth	2 MHz
8. Illumination Levels	5 to 12,000 foot-candles by using f-stops. (20 watt flourescent lamp ≈ 4870 foot-candles.)
9. Aspect Ratio	4:3
10. Optics	Field of View — Near Object Distance
a. Zoom Lens (6:1)	7 degrees — Focused 24 in. to ∞ 43 degrees — Focused 20 in. to ∞
b. f-stops	4.4 to 44 continuously variable
c. Focal Length	25 to 150 mm
11. Video Output	3.5 volts peak-to-peak, dark negative, bandpass 4.5 MHz
12. Connectors	One video, one power
13. Automatic Light Control Switch	
a. Peak	(Bright object in scene)
b. Average	(Uniform scene lighting) 1000:1 light range with AGC
14. Monitor	The monitor provides crew viewing of actual camera picture transmitted so that f-stop, light level, zoom position and focus can be properly accomplished.
15. Video Control Switch	
a. Transmit	Normal video output
b. Standby	Picture content of video is inhibited

TABLE 6-XVIII.- DATA STORAGE EQUIPMENT (DSE)

ITEM	FUNCTION and/or PARAMETERS
1. Weight	42.5 pounds
2. Cooling	ECS primary glycol loop
3. Electrical	
a. DC Voltage	28 ± 4 Vdc
b. AC Voltage	115 Vac, 400 Hz, 3-phase
c. Total Power Consumption	50 watts
4. Operational Stability	
a. Record Speed	3 seconds (max) from activation
b. Playback Speed	5 seconds (max) from activation
c. Tape Speed	±0.5% of specification with a 400 Hz absolute power frequency
d. Wow and Flutter	
(1) 15 ips Record and Playback	3% peak-to-peak (max) with no vibration present; flutter bandwidth is from 0.1 to 5,000 Hz
(2) 3.75 ips Record and 120 ips Playback	1.5% peak-to-peak (max) with no vibration present; flutter bandwidth is from 0.1 to 5,000 Hz
5. Record/Playback Tracks	14 tracks (total)
a. CM PCM Data	4 tracks
b. CM PCM Data Timing	1 track
c. LM PCM Data	1 track (not used)
d. CM-VHF Received Voice	1 track
e. Analog Data	7 tracks (not used)
6. CM PCM Data Channel	
a. Data	1.6 or 51.2 kbps NRZ
b. Timing Signal	1.6 or 51.2 kHz symmetrical squarewave
c. Playback Speed	
(1) 1.6 kbps Data	120 ips (51.2 kbps)
(2) 51.2 kbps Data	15 ips (51.2 kbps)

TABLE 6-XVIII.- DATA STORAGE EQUIPMENT (DSE) - Continued

ITEM	FUNCTION and/or PARAMETERS
d. Record Speed	
(1) 1.6 kbps Data	3.75 ips
(2) 51.2 kbps Data	15 ips
7. LM PCM Data Channel	
a. Data	1.6 kbps Manchester Code
b. Record/Playback Speed	Determined automatically by CM PCM data record/playback speed
8. CM-VHF Received Voice Channel	
a. Signal	300 to 2,500 Hz
b. Record/Playback Speed	Determined automatically by CM PCM data record/playback speed
9. Analog Channels	
a. Frequency Response	
(1) 15 ips Record and 15 ips Playback	4 dB (50 Hz to 10,000 Hz) 6 dB (50 Hz to 25,000 Hz)
(2) 3.75 ips Record and 120 ips Playback	4 dB (12.5 Hz to 2,500 Hz) 6 dB (12.5 Hz to 6.250 Hz)
b. Harmonic Distortion	Less than 2 percent
c. Signal-to-Noise ratio (Input-to-Output)	35 dB (min) at 1,000 Hz 30 dB (min) at 32,000 Hz
d. Crosstalk	Down 32 dB (min) at 1,000 Hz for 15 ips playback Down 23 dB (min) at 32,000 Hz for 120 ips playback
10. Tape Motion Sensor	Indicates tape motion forward or backward
11. Tape Speed Sensor	Senses playback bit rate and automatically switches transport to prober speed. Playback speed is 120 ips if sensor fails. Sensor is overridden if in LM PCM playback mode or playback electronics is off. Speed will be 120 ips forward or backward.

TABLE 6-XVIII.- DATA STORAGE EQUIPMENT (DSE) - Concluded

ITEM	FUNCTION and/or PARAMETERS

12. Tape Recorder Mode:

Data Source	Record			Playback		
	Speed	Control	Data (2)	Speed	Control	Data (2)
CSM	3.75 ips --- 15 ips	Bit Rate Select Switch	Voice 1.6 kbps Analog data --- Voice 51.2 kbps Analog data	120 ips (32:1) --- 15 ips (1:1)	Auto Speed Select	Voice 51.2 kbps Analog data --- Voice 51.2 kbps Analog data
LM (1) (VHF)	3.75 ips --- 15 ips	Bit Rate Select Switch	1.6 kbps	120 ips	(Disconnected)	51.2 kbps --- 12.8 kbps

NOTES: (1) Not used on Skylab CSM

(2) Analog data channels not used

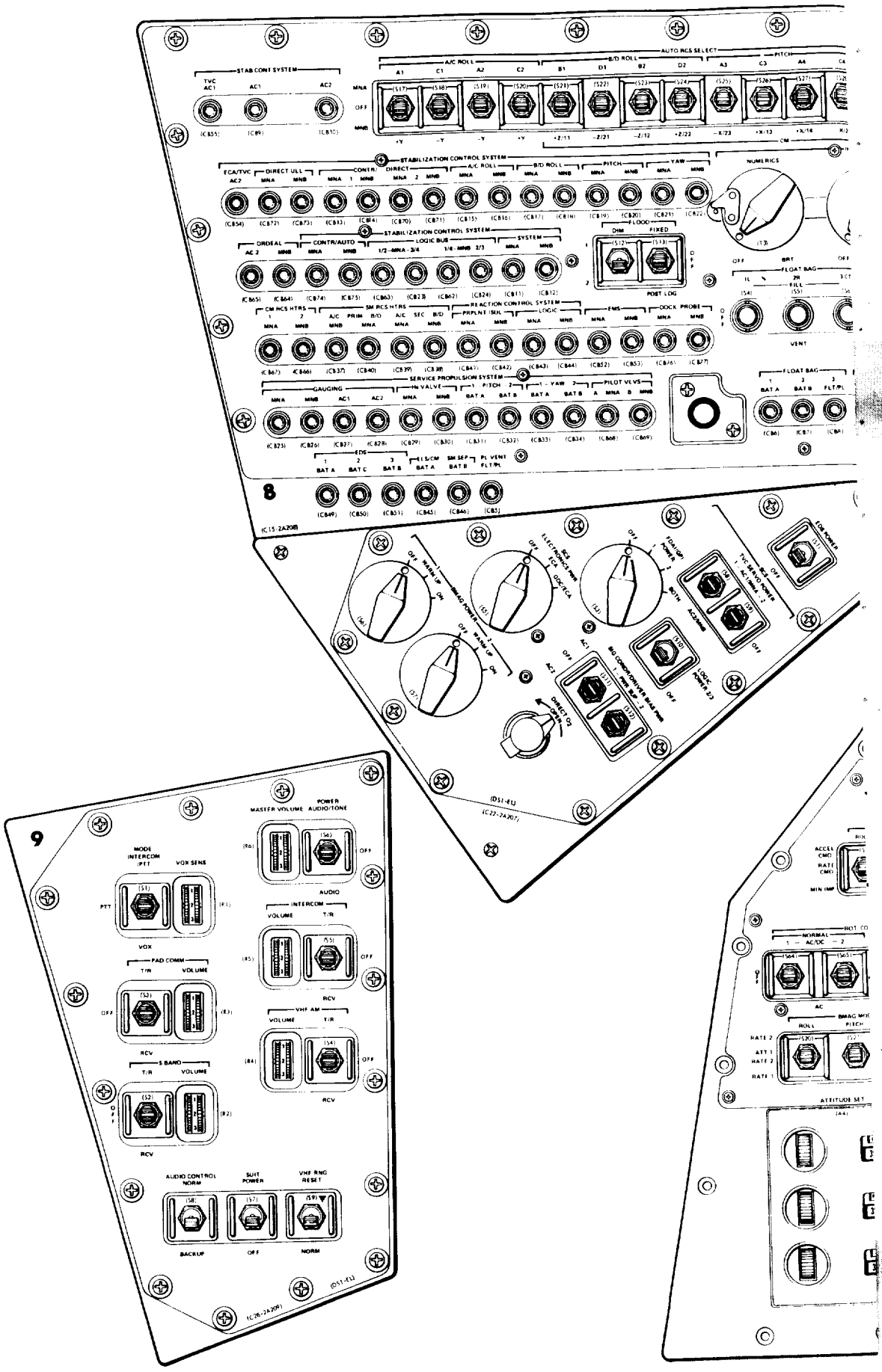
7 INSTRU-
MENTATION


8 GUIDANCE AND
CONTROL
SYSTEM

9 SERVICE
PROPULSION
SYSTEM


10 REACTION
CONTROL
SYSTEM

11 MISCELLANEOUS



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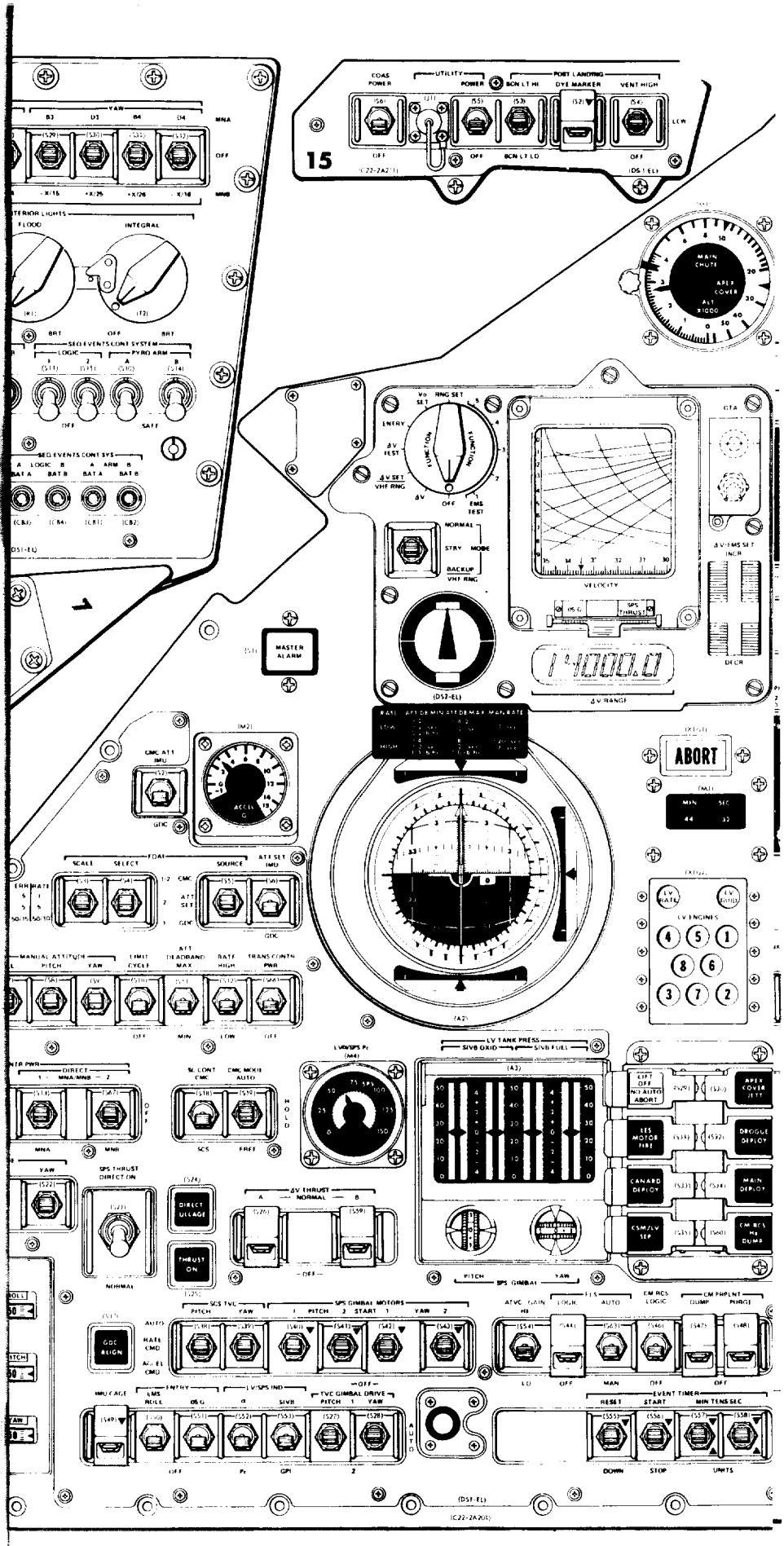

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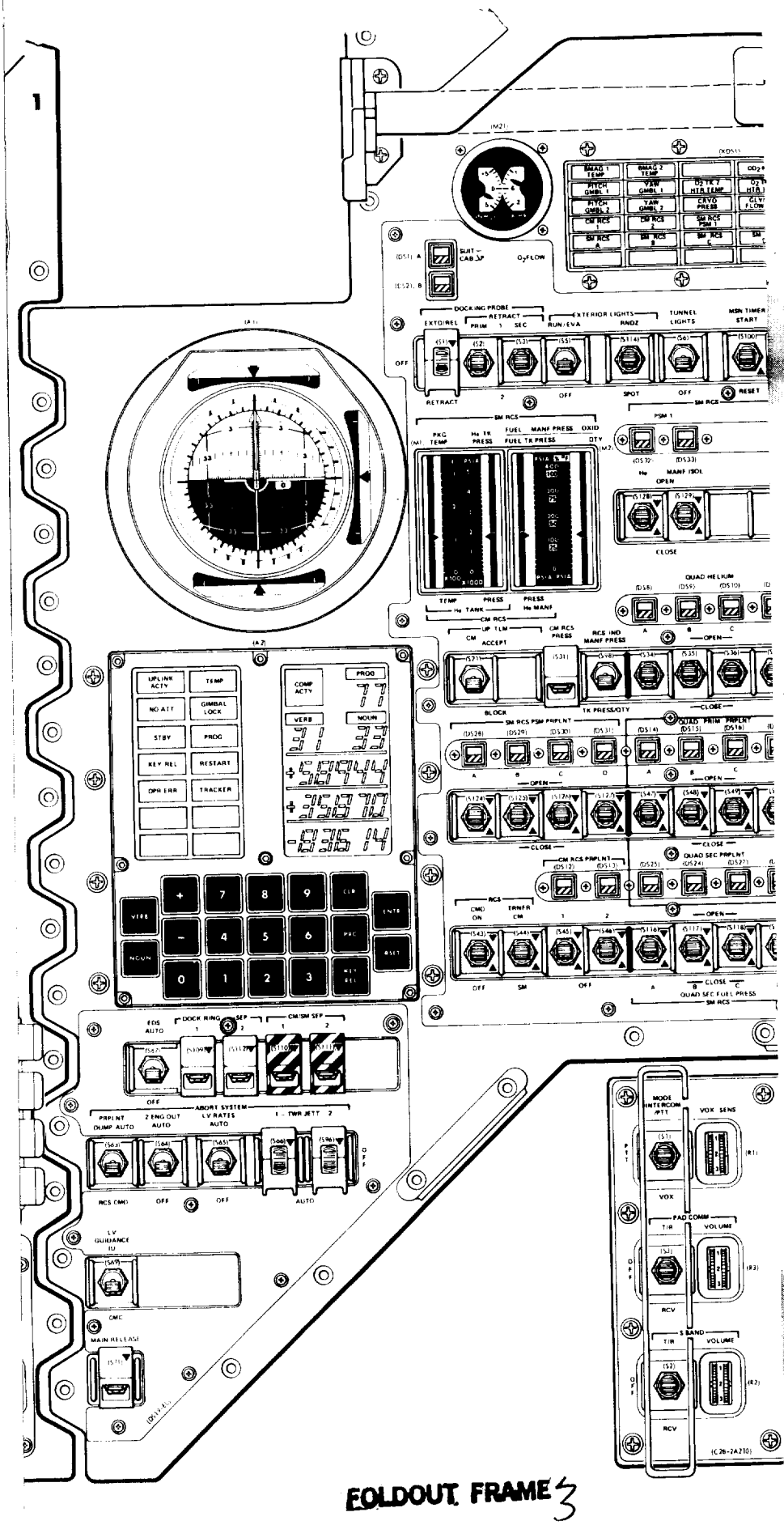

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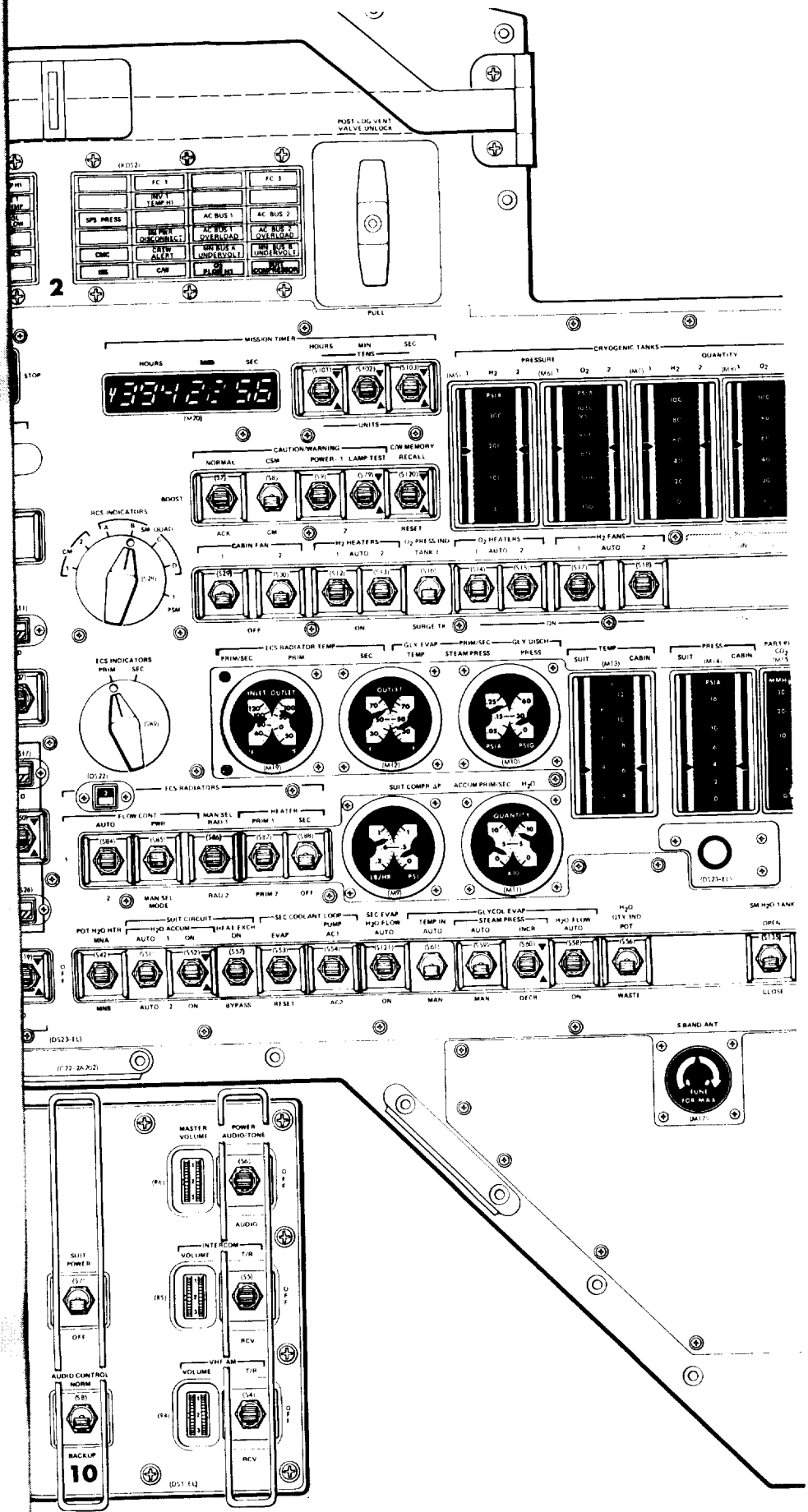

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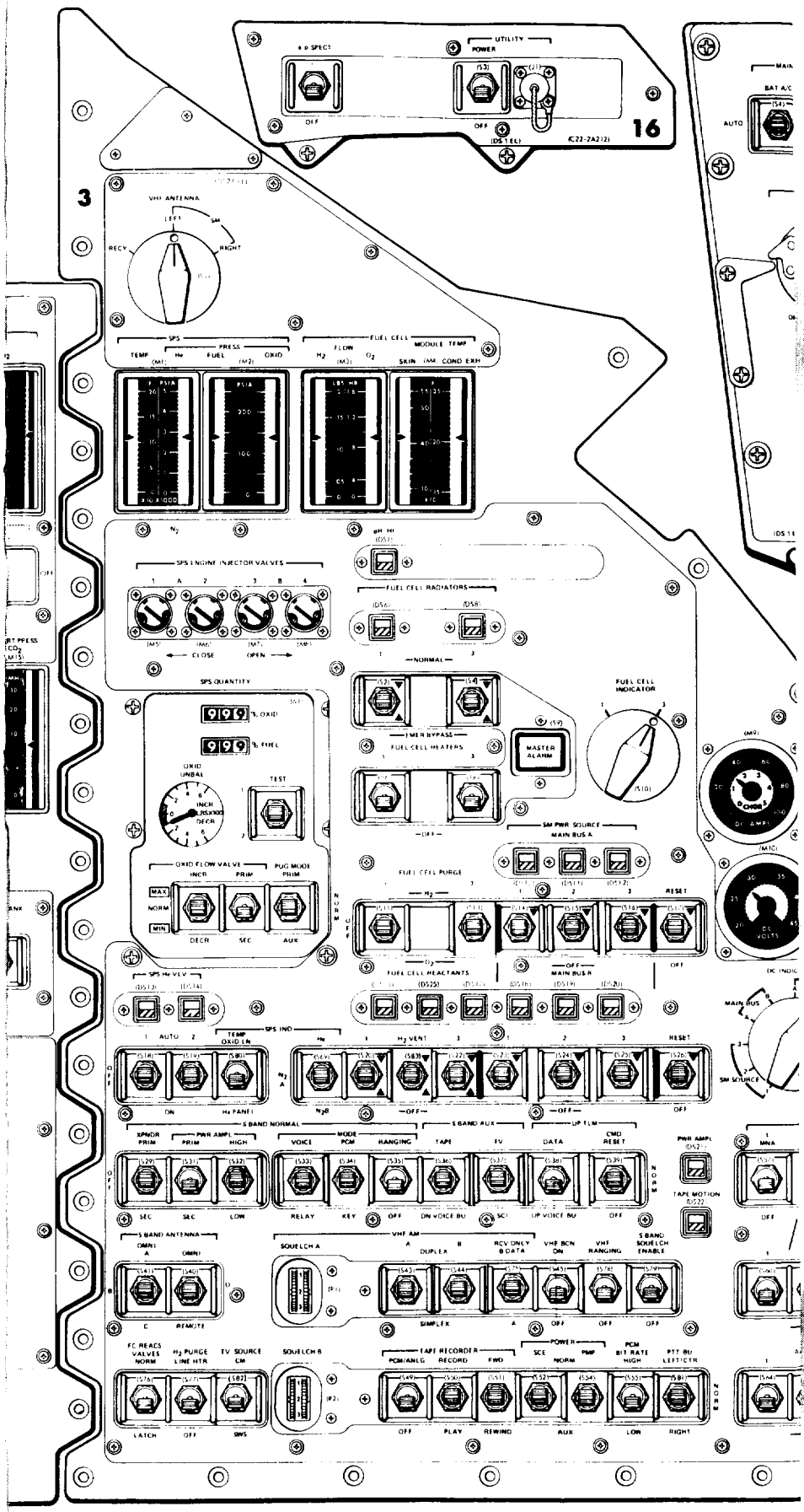

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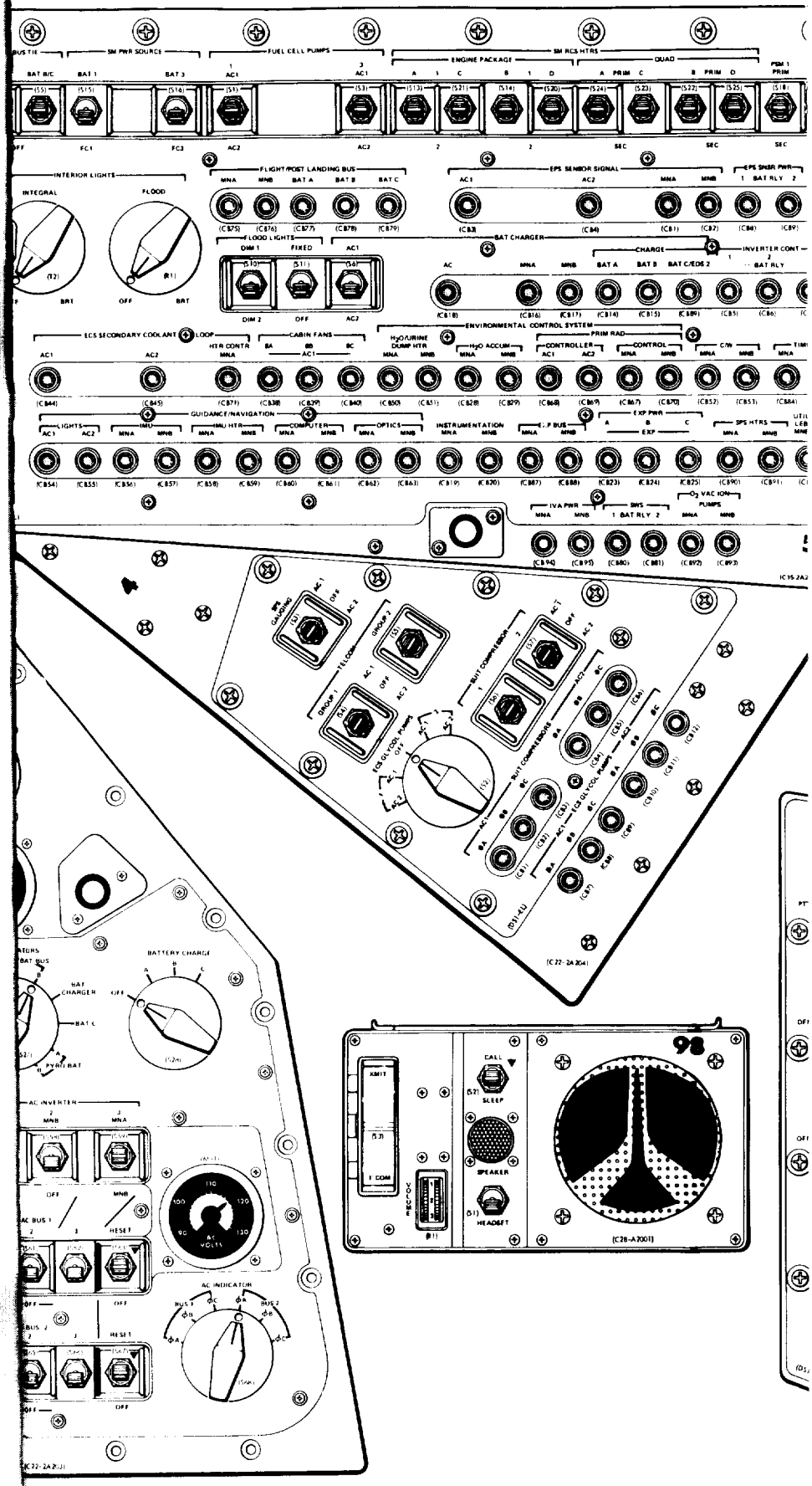

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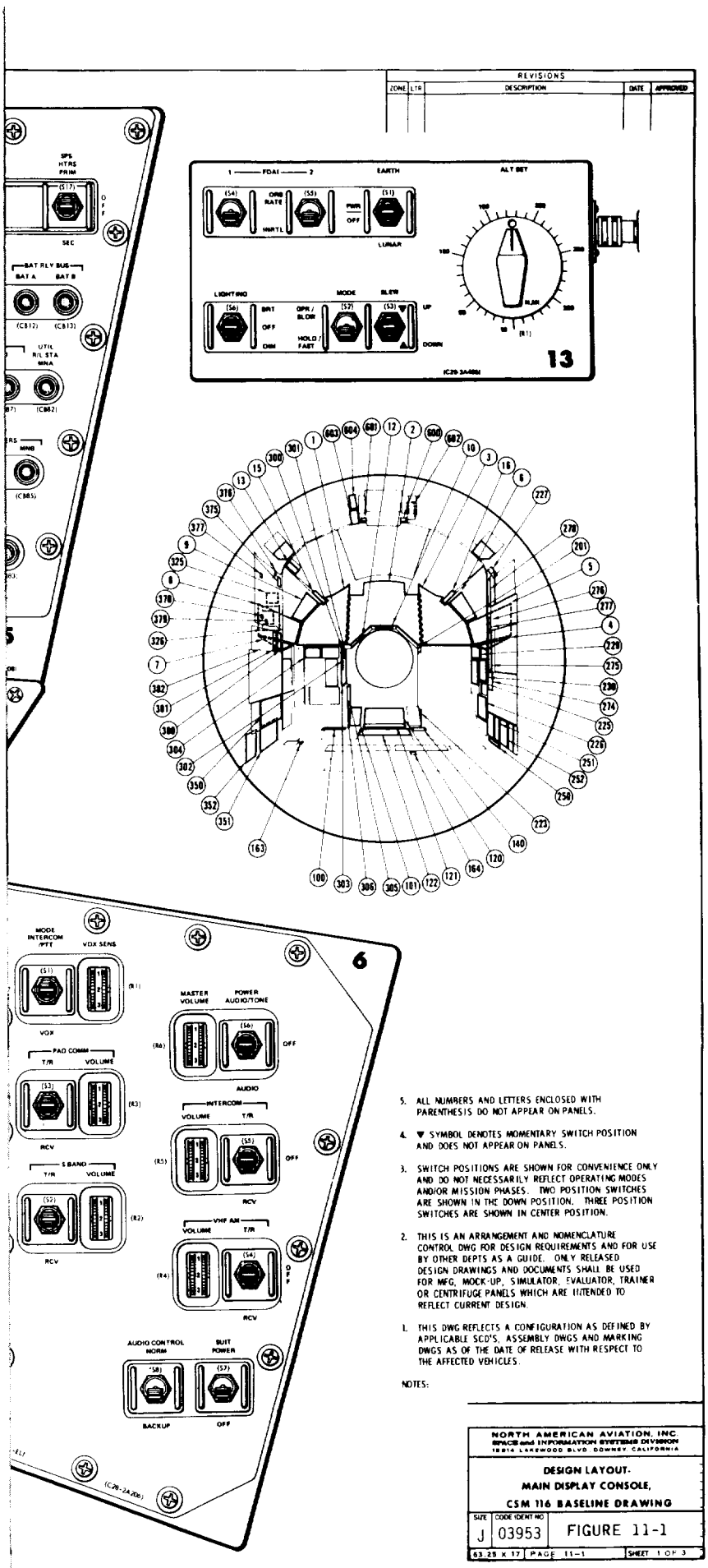
REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED



5. ALL NUMBERS AND LETTERS ENCLOSED WITH PARENTHESIS DO NOT APPEAR ON PANELS.

4. ▼ SYMBOL DENOTES MOMENTARY SWITCH POSITION AND DOES NOT APPEAR ON PANELS.

3. SWITCH POSITIONS ARE SHOWN FOR CONVENIENCE ONLY AND DO NOT NECESSARILY REFLECT OPERATING MODES AND/OR MISSION PHASES. TWO POSITION SWITCHES ARE SHOWN IN THE DOWN POSITION. THREE POSITION SWITCHES ARE SHOWN IN CENTER POSITION.

2. THIS IS AN ARRANGEMENT AND NOMENCLATURE CONTROL DWG FOR DESIGN REQUIREMENTS AND FOR USE BY OTHER DEPTS AS A GUIDE. ONLY RELEASED DESIGN DRAWINGS AND DOCUMENTS SHALL BE USED FOR MFG, MOCK-UP, SIMULATOR, EVALUATOR, TRAINER OR CENTRIFUGE PANELS WHICH ARE INTENDED TO REFLECT CURRENT DESIGN.

1. THIS DWG REFLECTS A CONFIGURATION AS DEFINED BY APPLICABLE SCD'S, ASSEMBLY DWGS AND MARKING DWGS AS OF THE DATE OF RELEASE WITH RESPECT TO THE AFFECTED VEHICLES.

NOTES:

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD. DOWNEY, CALIFORNIA

DESIGN LAYOUT-
MAIN DISPLAY CONSOLE,
CSM 116 BASELINE DRAWING

SIZE	CODE IDENT NO	
J	03953	FIGURE 11-1

63.25 X 17 | PAGE 11-1 | SHEET 1 OF 3

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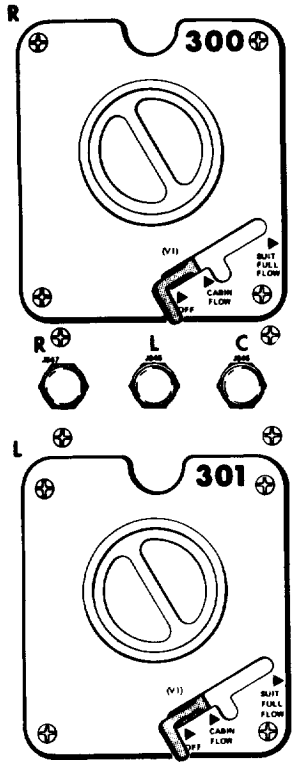

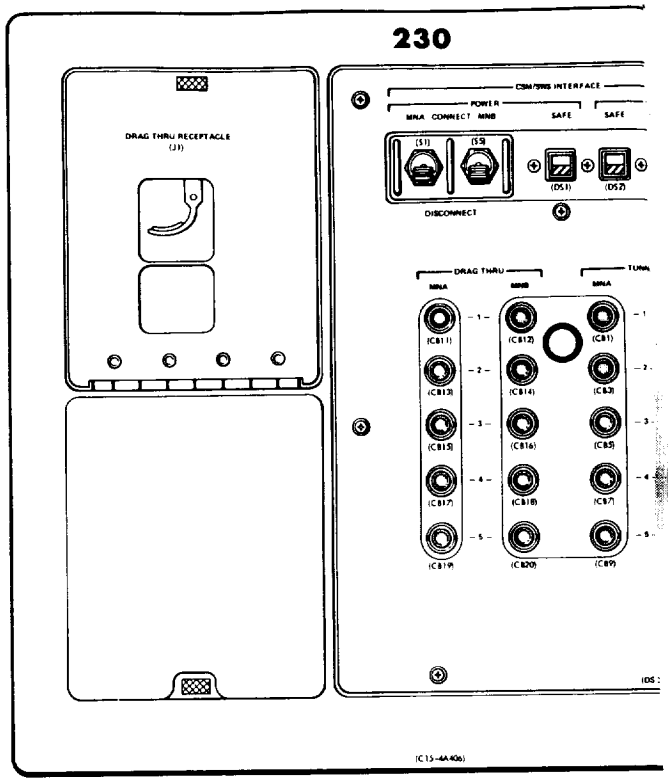

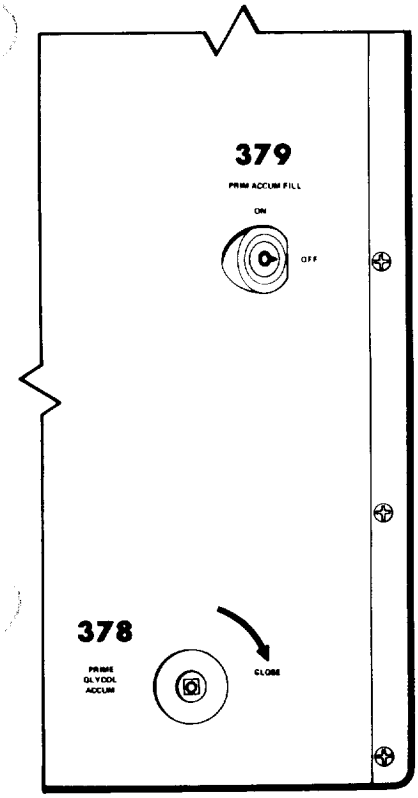

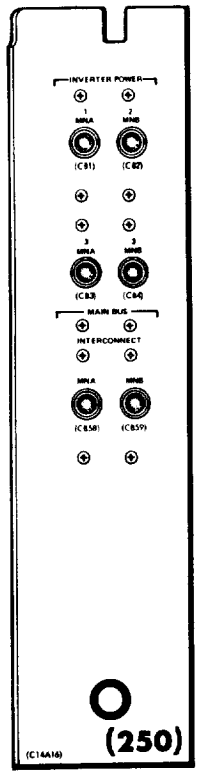

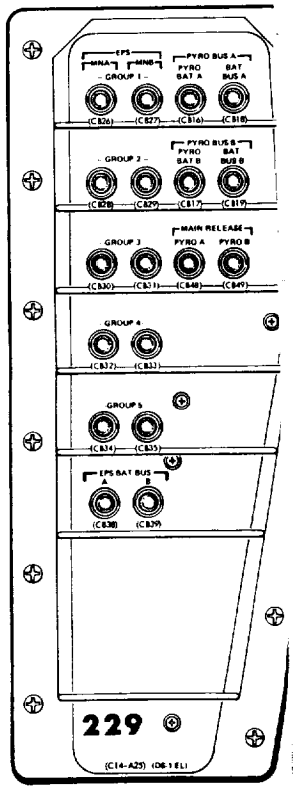

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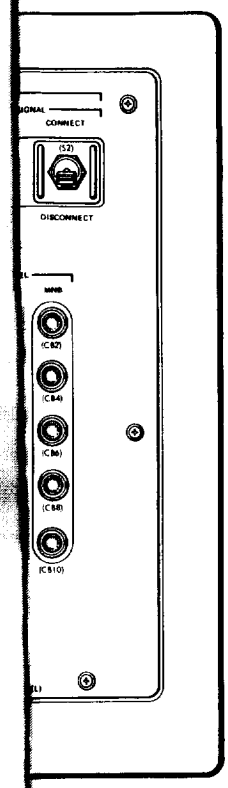

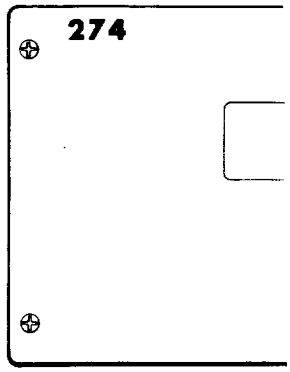

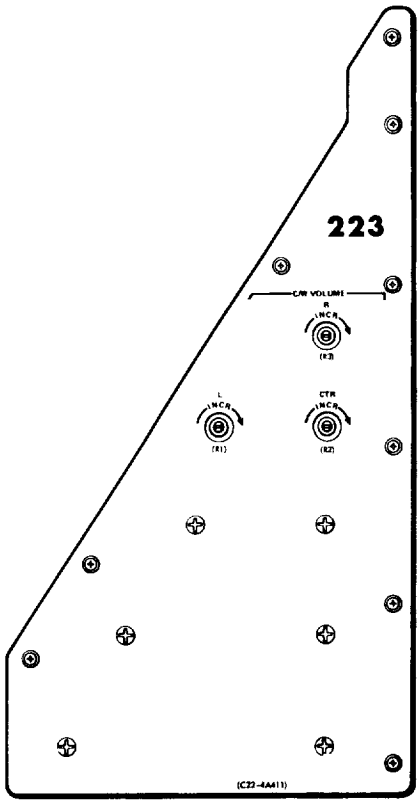

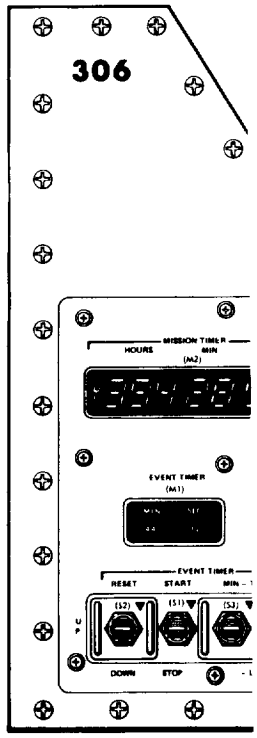

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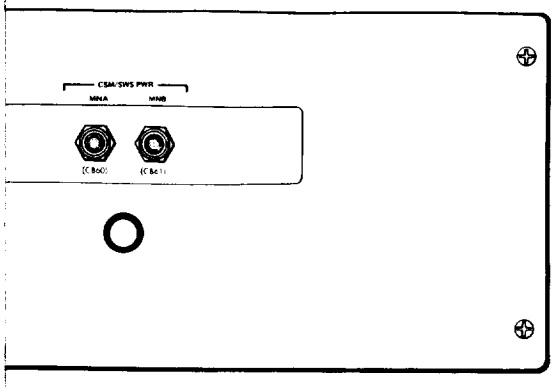

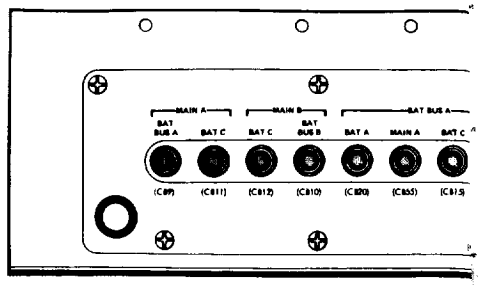

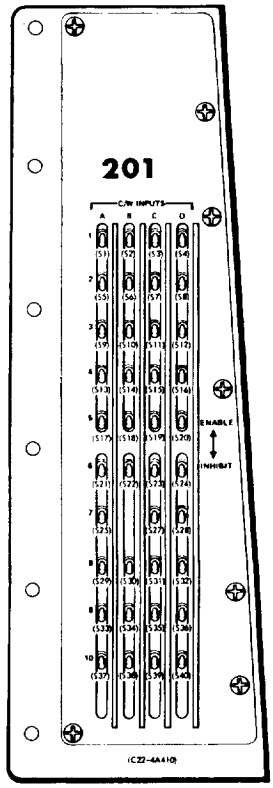

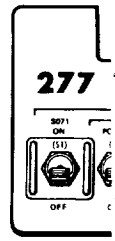

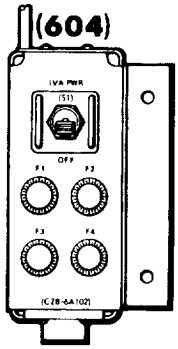

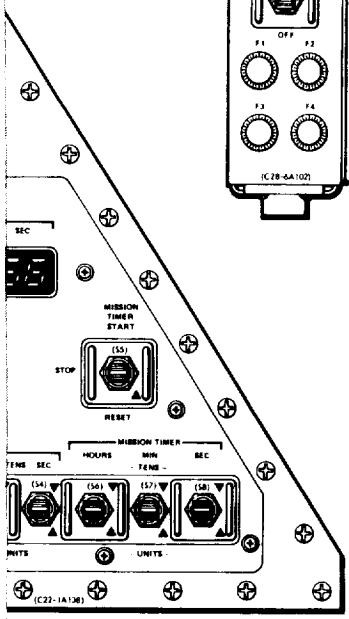

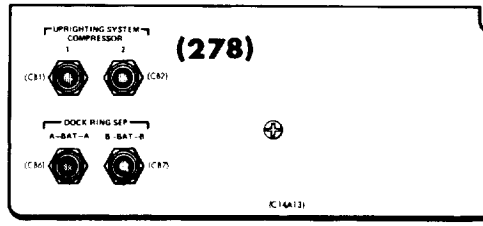

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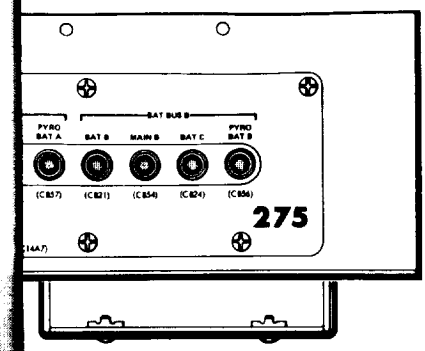
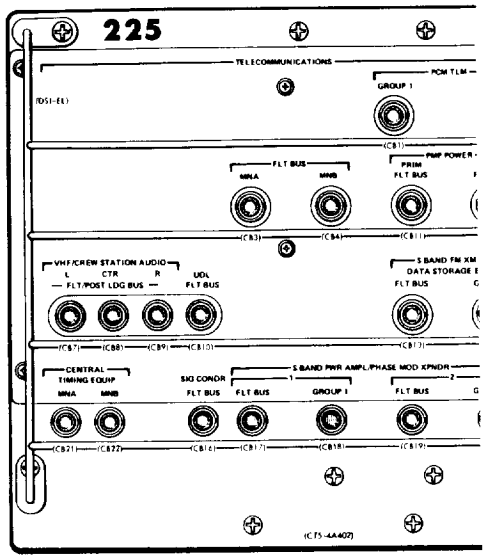
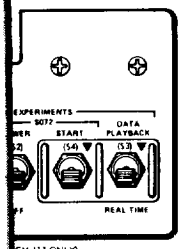




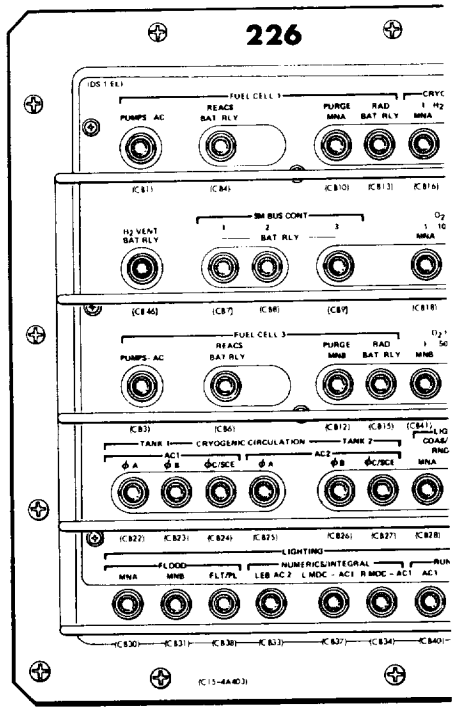
PLVC

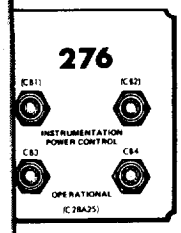
NORMAL

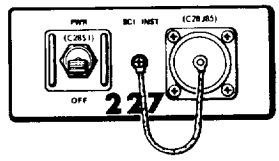
OPEN

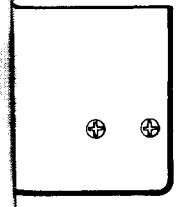


(CM 117 ONLY)



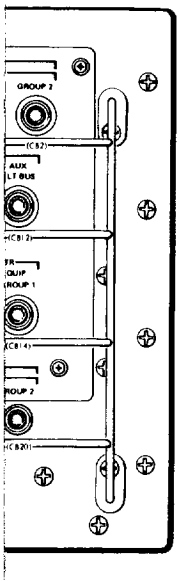


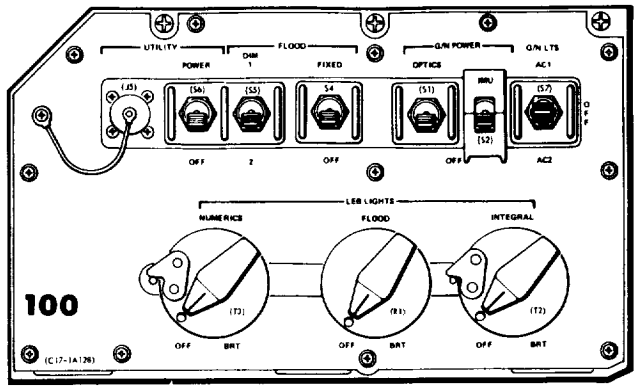


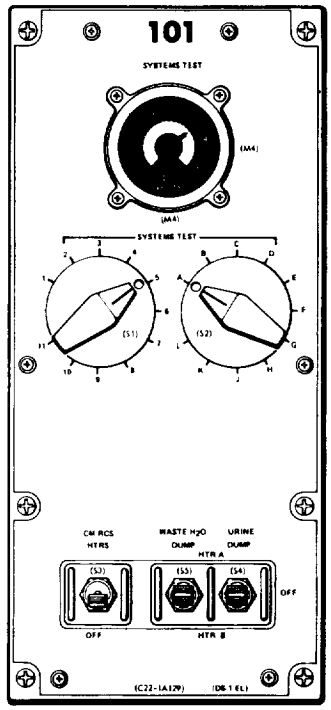


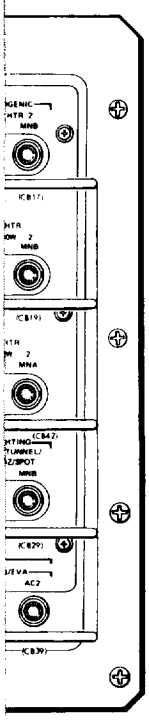
FOLDOUT FRAME 4

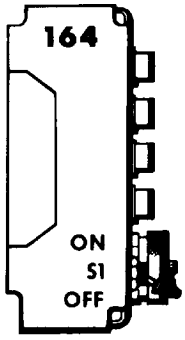
LTR	PCR	DR	ENGR	DATE	APPROVAL
COMMENTS:					

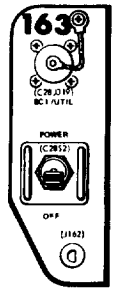






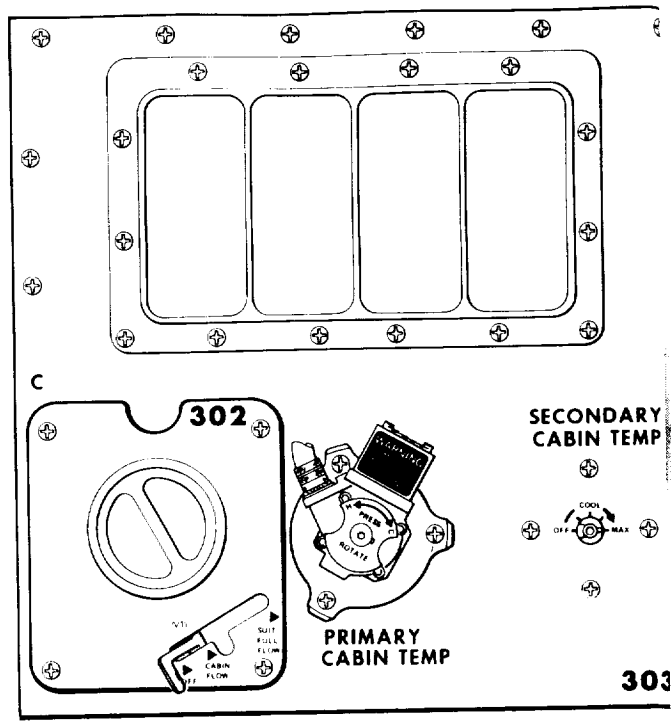


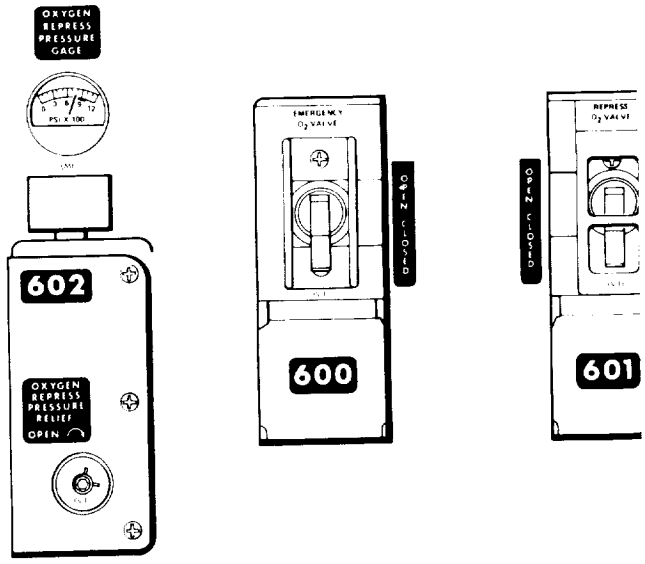




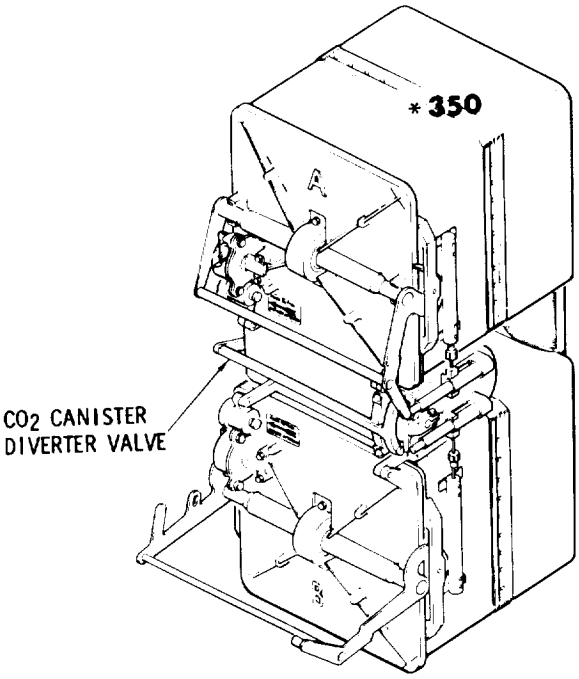
NATIONAL AERONAUTICS & SPACE ADMINISTRATION MANNED SPACECRAFT CENTER · HOUSTON TEXAS		
DESIGN LAYOUT- MAIN DISPLAY CONSOLE, CSM 116 BASELINE DRAWING		
	DWG NO FIGURE 11-1	
52 X 17	PAGE 11-2	SHEET 2 OF 3

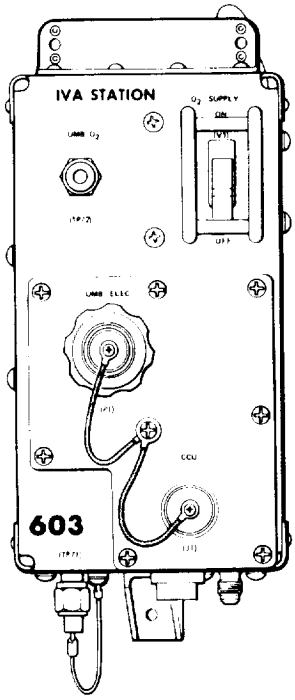
FOLDOUT FRAME 5

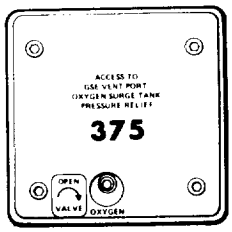


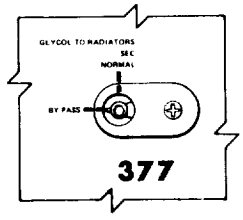


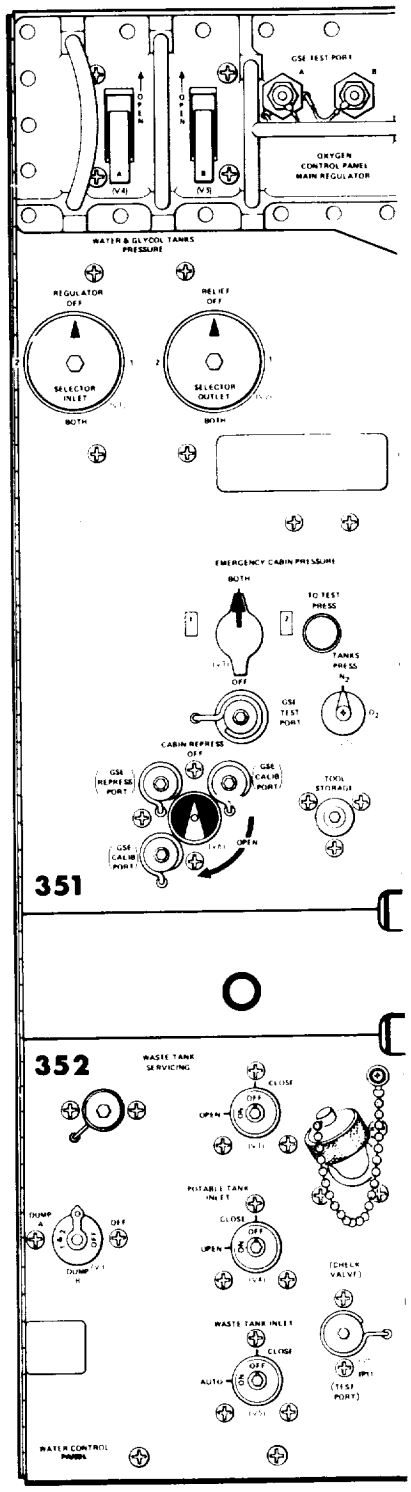
FOLDOUT FRAME 1











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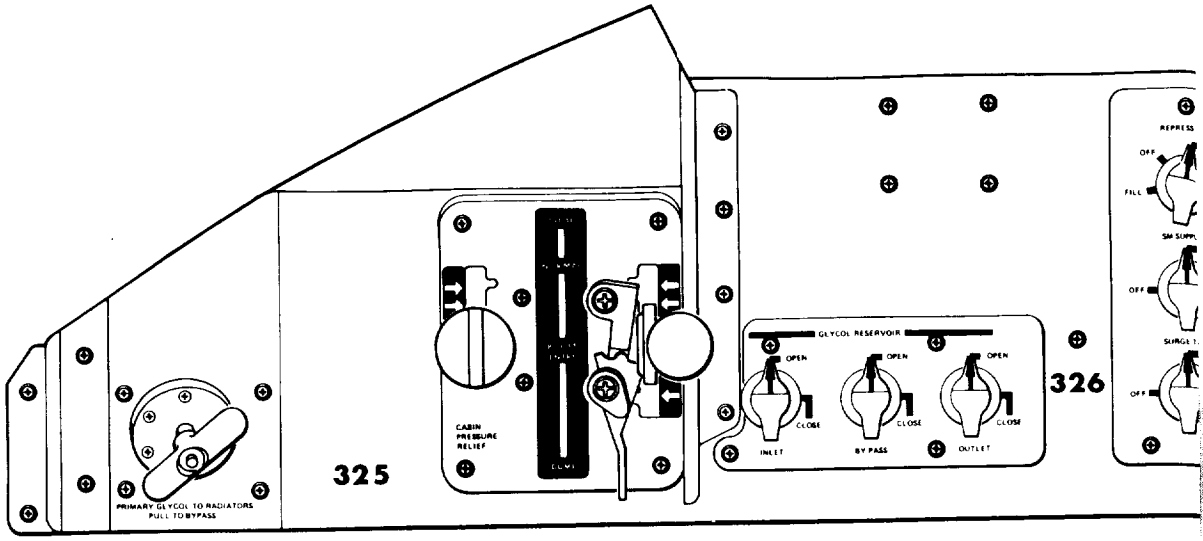

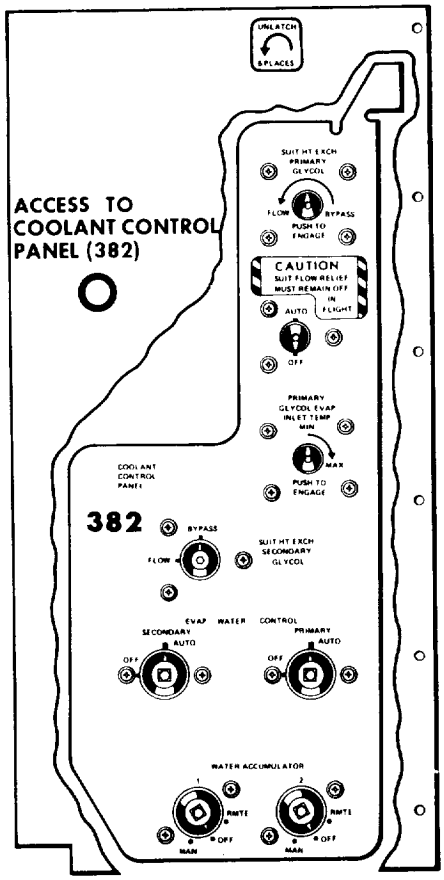

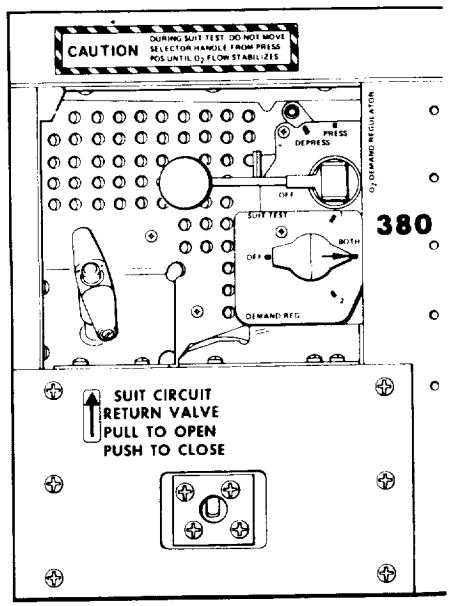

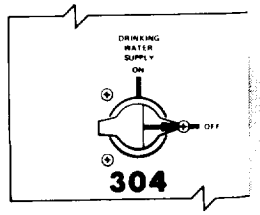

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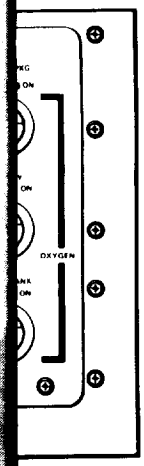

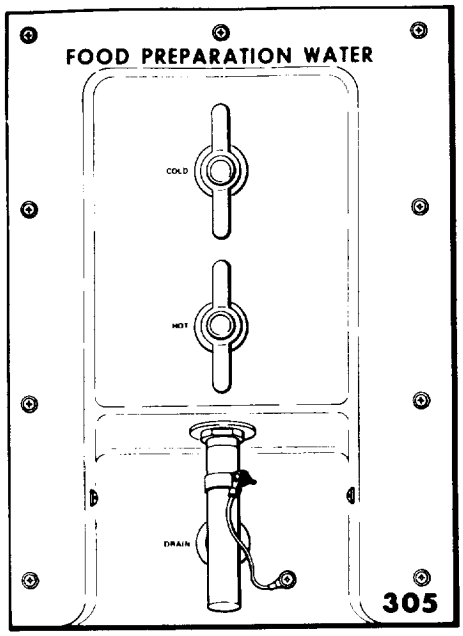

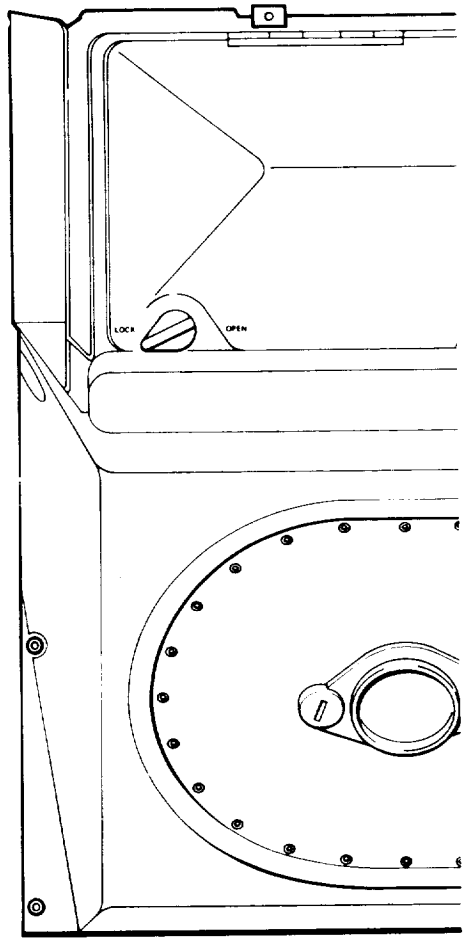

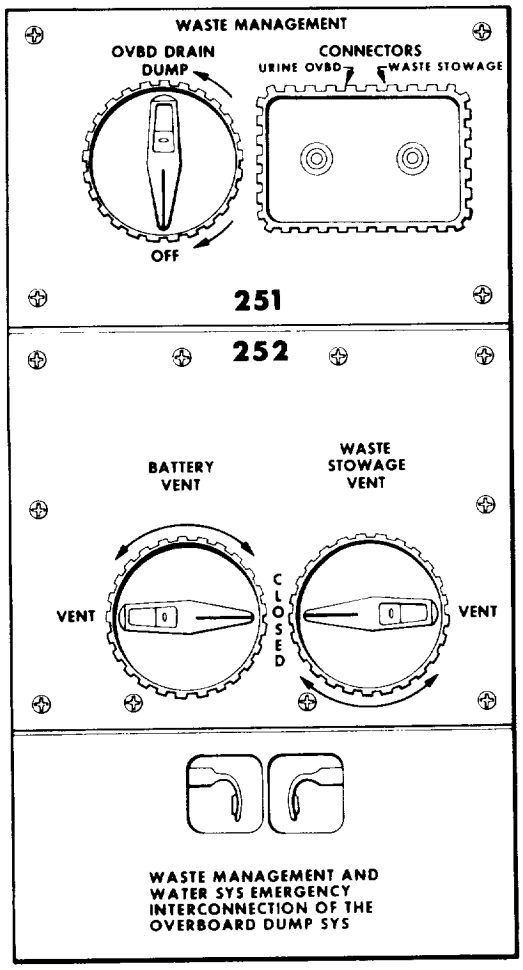

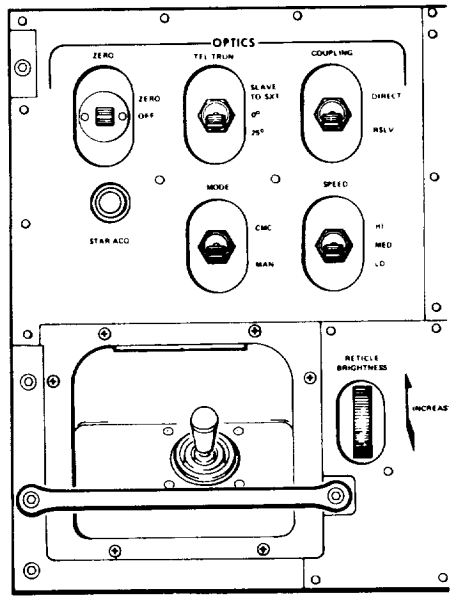

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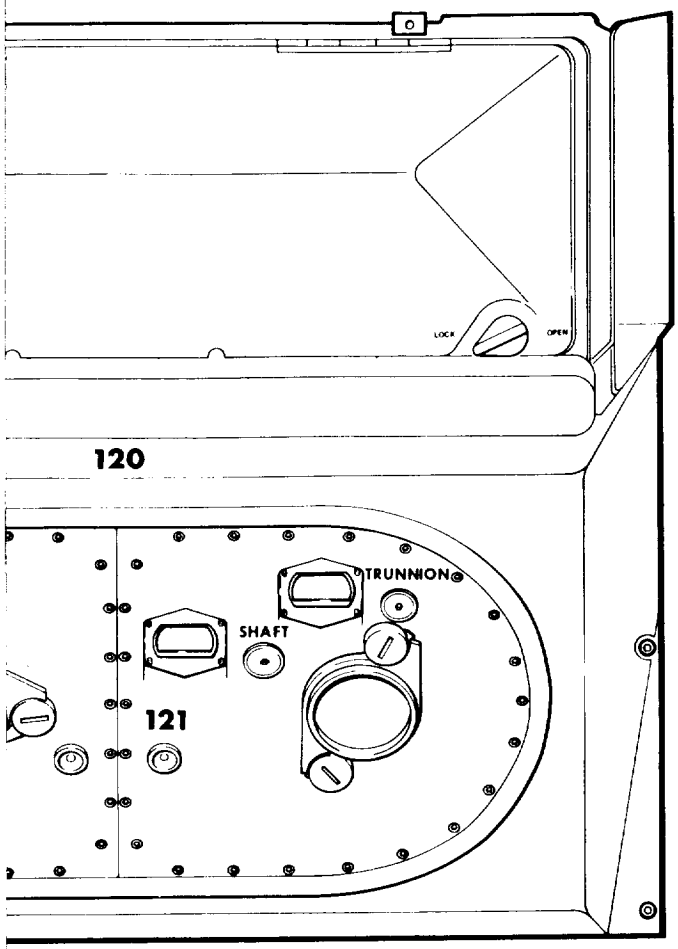
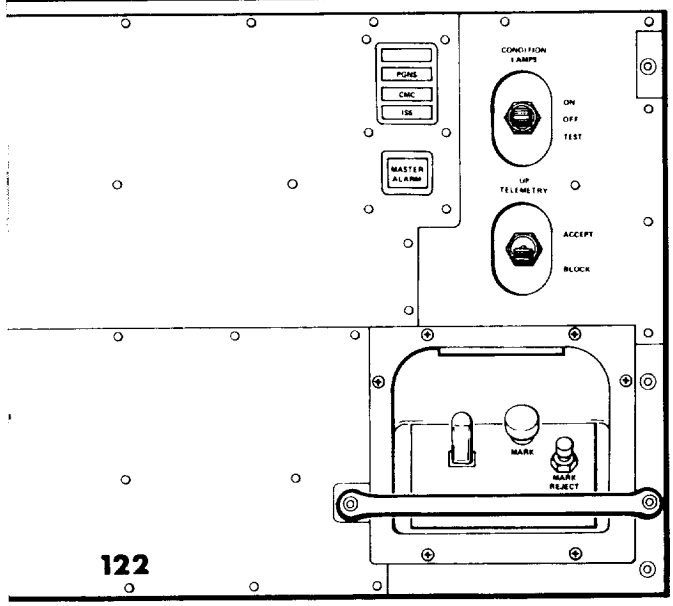
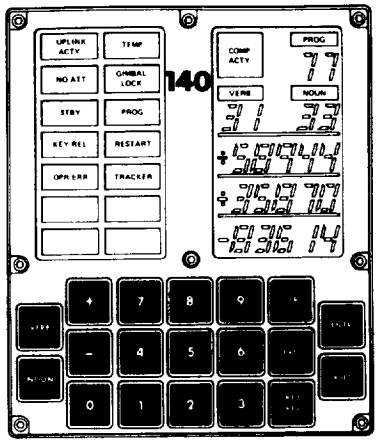
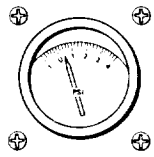


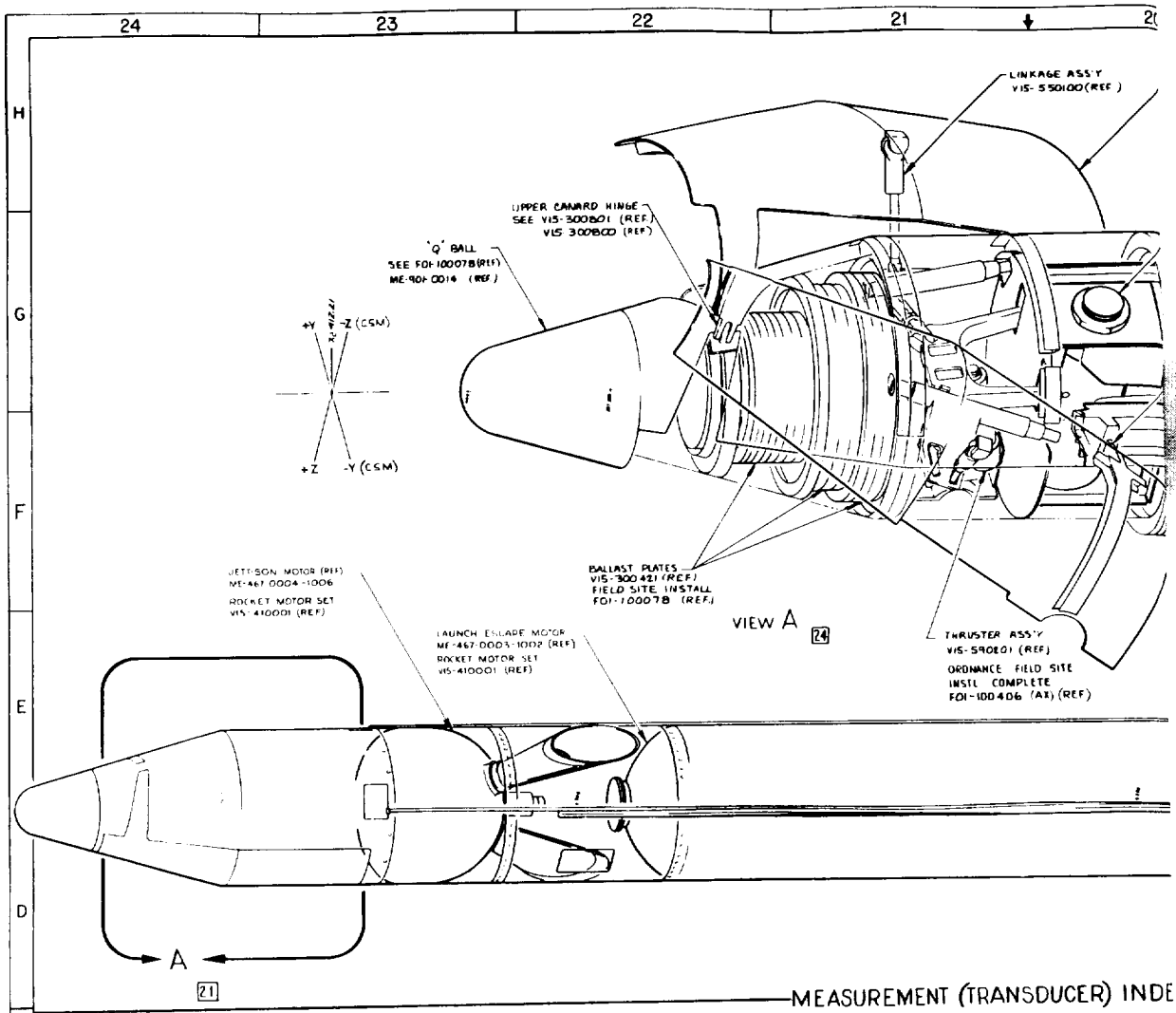






DR BY		NORTH AMERICAN AVIATION, INC. SPACE and INFORMATION SYSTEMS DIVISION 12214 LAKEWOOD BLVD. DOWNEY, CALIFORNIA	
CHK BY		DESIGN LAYOUT- MAIN DISPLAY CONSOLE, CSM 116 BASELINE DRAWING	
APPROVED BY		CODE IDENT NO 03953	SIZE J
			FIGURE 11-1
			SHEET 3 OF 3

FOLDOUT FRAME 5



MEASUREMENT (TRANSDUCER) INDE

COMMAND MODULE

	MEAS	SHT - ZONE
STRUCTURES	CA1820T	5 - 49
	CA1821T	4 - 86
	CA1822T	4 - 73
	CA1823T	3 - 61
ELECTRICAL	CC0188P	5 - 117
ENVIRONMENTAL	CF0001P	7 - 163
	CF0002T	7 - 161
	CF0003P	7 - 168
	CF0005P	8 - 177
	CF0006P	8 - 186
	CF0008T	7 - 165
	CF0017T	8 - 187
	CF0020T	8 - 187
	CF0120P	7 - 165
	CF0157R	6 - 121
	CF0181T	7 - 165
	CF0460T	3 - 65
	CF0461T	3 - 64
FLIGHT TECHNOLOGY	CK0026A	5 - 99
	CK0027A	5 - 100
	CK0028A	5 - 99

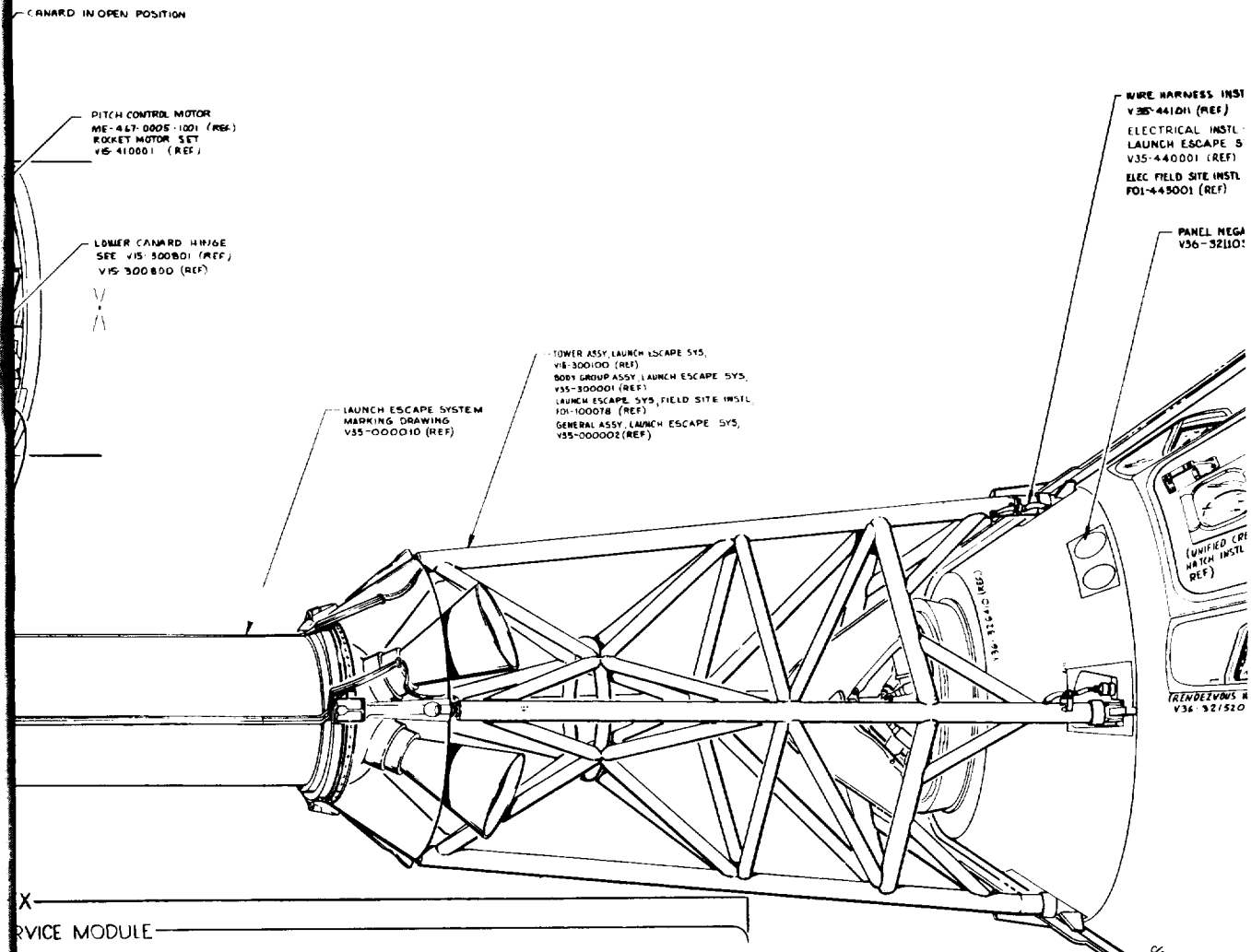
	MEAS	SHT - ZONE
REACTION CONTROL SYSTEM	CR0001P	4 - 96
	CR0002P	3 - 71
	CR0003T	4 - 90
	CR0004T	4 - 76
	CR0035P	4 - 96
	CR0036P	3 - 70
	CR0037P	4 - 94
	CR0038P	3 - 70
L/V EMERGENCY DETECTION	CS0220T	2 - 40

	MEAS	SHT - ZONE	SHT - ZONE
ELECTRICAL	SC0037P	12 -282	
	SC0038P	12 283	
	SC0039P	12 -286	
	SC0040P	12 -286	
	SC2087T	13 -299	
	SC2089T	13 -298	
	SC2090T	9 -214	
	SC2092T	9 -215	
	SC2139R	12 -285	
	SC2141R	12 -285	
	SC2142R	12 -282	
	SC2144R	12 -281	
ENVIRONMENTAL	SF0260T	11 -243	
	SF0262T	11 -241	
	SF0263T	13 -302	
SERVICE PROPULSION SYSTEM	SP0001P	9 -212	13 -300
	SP0003P	11 -255	13 -298
	SP0006P	11 -252	13 -299
	SP0048T	10 -227	
	SP0049T	10 -225	
	SP0055T	13 -299	
	SP0056T	13 -298	
	SP0061T	10 -219	
	SP0062T	10 -217	
	SP0600P	13 -300	

	MEAS	SHT - ZONE	SHT - ZONE
SERVICE PROPULSION SYSTEM (CONT'D)	SP0601P	13 -299	
	SP0661P	13 -300	
	SP0930P	11 -252	13 -299
	SP0931P	11 -253	13 -300
	SP9012T	11 -253	13 -299
	SP9014T	11 -255	13 -300
	SP9016T	11 -256	13 -299
	SP9018T	9 -209	
	SP9019T	9 -210	13 -300
	SP9020T	10 -227	
	SP9101T	10 -225	
	SP9102T	10 -225	
	SP9027T	10 -223	
REACTION CONTROL SYSTEM	SR5001P	12 -267	12 -268
	SR5002P	12 -275	
	SR5003P	12 -267	12 -268
	SR5004P	12 -274	
	SR5013T	12 -268	12 -271
	SR5014T	12 -275	12 -280
	SR5015T	12 -268	12 -271
	SR5016T	12 -275	12 -279
	SR5065T	9 -197	12 -271
	SR5066T	9 -197	12 -279
	SR5067T	9 -197	12 -270
	SR5068T	9 -197	12 -278
	SR5073T	12 -269	12 -270
	SR5074T	12 -277	12 -278

FOLDOUT FRAME 1

19	18	17	16	15



X

RVICE MODULE

REACTION CONTROL SYSTEM (CONT'D)	MEAS	SHT -ZONE	SHT -ZONE	SHT -ZONE
	SR5075T	12 -269	12 -270	
	SR5076T	12 -277	12 -277	
	SR5729P	12 -266	12 -266	
	SR5776P	12 -274		
	SR5817P	12 -265	12 -266	
	SR5830P	12 -274		
	SR5733P	12 -267	12 -270	
	SR5780P	12 -276	12 -278	12 -279
	SR5820P	12 -267	12 -270	
	SR5821P	12 -276	12 -277	
	SR5737P	12 -271		
	SR5784P	12 -280		
	SR5822P	12 -270		
	SR5823P	12 -279	12 -279	
	SR9215T	12 -269		
	SR9315T	12 -276		
	SR9415T	12 -269		
	SR9515T	12 -275		
	SR9740P		13 -291	13 -299
	SR9741P		13 -291	13 -299
	SR9802T	13 -290	13 -294	
	SR9902T	13 -291		
	SR9804P	13 -295	13 -295	
	SR9904P	13 -294		
	SR9806P	13 -294	13 -295	
	SR9906P	13 -294		
	SR9807P	13 -294	13 -296	
	SR9907P	13 -295		
	SR9808T	13 -291	13 -295	
	SR9908T	13 -290		

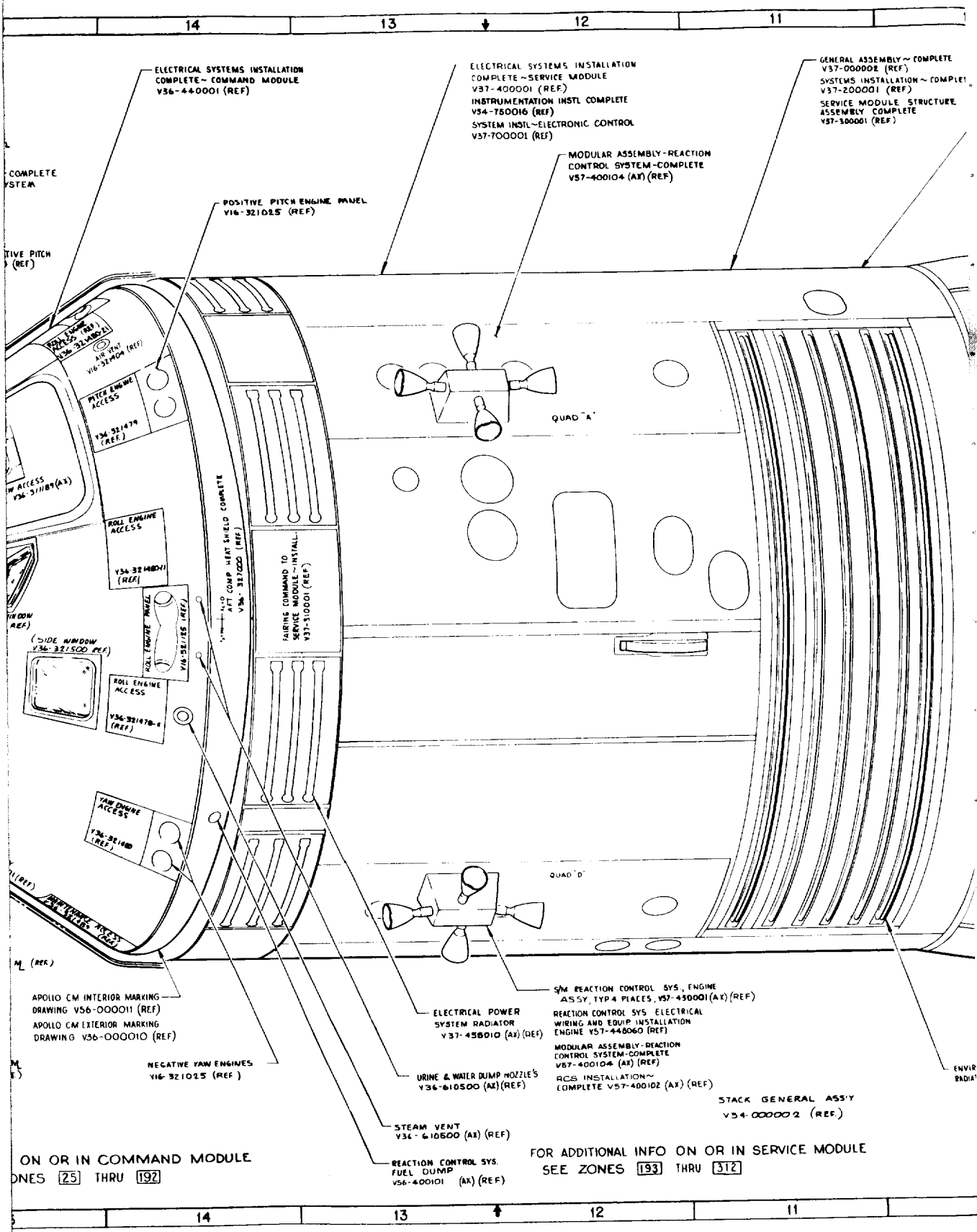
REACTION CONTROL SYSTEM (CONT'D)	MEAS	SHT -ZONE	SHT -ZONE
	SR9809T	13 -295	13 -296
	SR9909T	13 -294	

FOR ADDITIONAL INFO
SEE ZC

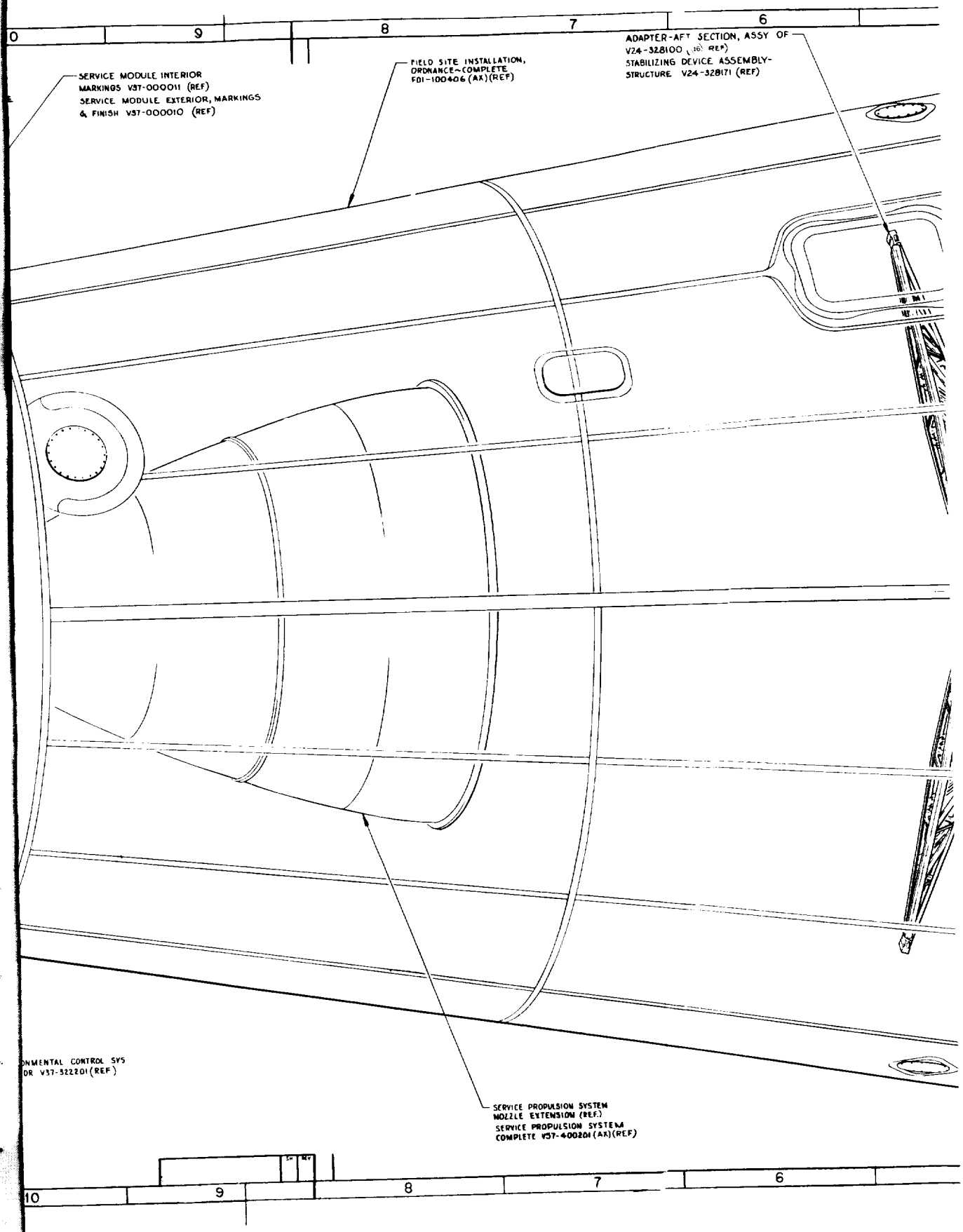
SHT	REV

19	18	17	16	15

FOLDOUT FRAME 2



FOLDOUT FRAME 3



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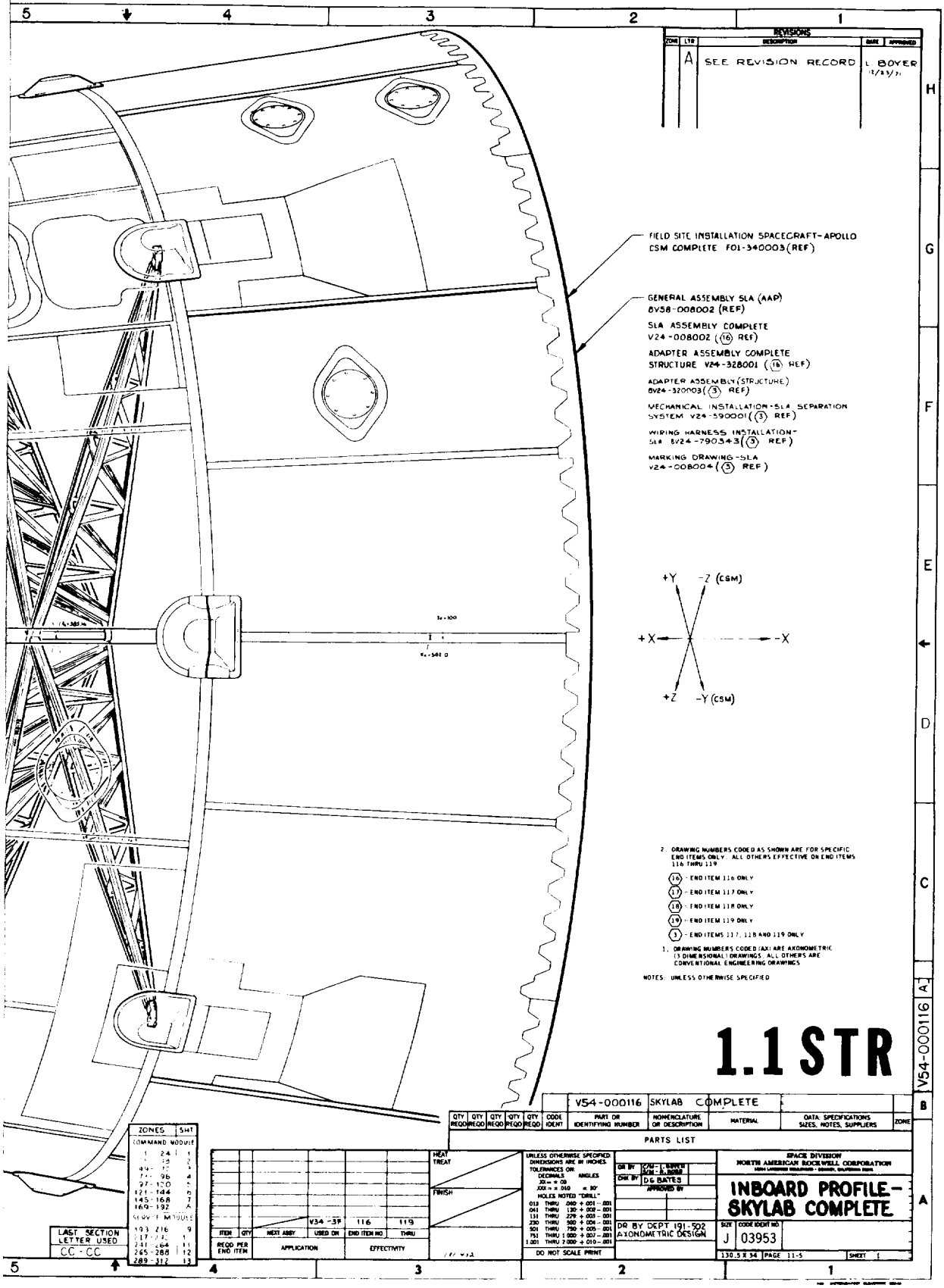


REVISIONS			
ZONE	LTR	DESCRIPTION	DATE / APPROVED
	A	SEE REVISION RECORD	L. BOYER 12/31/71

FIELD SITE INSTALLATION SPACECRAFT-APOLLO CSM COMPLETE F01-340003 (REF)

GENERAL ASSEMBLY SLA (AAP) 8V58-008002 (REF)

SLA ASSEMBLY COMPLETE V24-008002 (16) REF)

ADAPTER ASSEMBLY COMPLETE STRUCTURE V24-328001 (16) REF)

ADAPTER ASSEMBLY (STRUCTURE) 8V24-320003 (3) REF)

MECHANICAL INSTALLATION-SLA SEPARATION SYSTEM V24-590001 (3) REF)

WIRING HARNESS INSTALLATION-SLA 8V24-790343 (3) REF)

MARKING DRAWING-SLA V24-008004 (5) REF)

+Y −Z (CSM)
+X −X
+Z −Y (CSM)

2. DRAWING NUMBERS CODED AS SHOWN ARE FOR SPECIFIC END ITEMS ONLY. ALL OTHERS EFFECTIVE ON END ITEMS 116 THRU 119
(16) - END ITEM 116 ONLY
(17) - END ITEM 117 ONLY
(18) - END ITEM 118 ONLY
(19) - END ITEM 119 ONLY
(3) - END ITEMS 117, 118 AND 119 ONLY

1. DRAWING NUMBERS CODED (AX) ARE AXONOMETRIC (3 DIMENSIONAL) DRAWINGS. ALL OTHERS ARE CONVENTIONAL ENGINEERING DRAWINGS

NOTES: UNLESS OTHERWISE SPECIFIED

1.1 STR

V54-000116

ZONES	SHT
COMMAND MODULE	
1 - 24	1
25 - 48	2
49 - 72	3
73 - 96	4
97 - 120	5
121 - 144	6
145 - 168	7
169 - 192	8
SERVICE MODULE	
193 - 216	9
217 - 232	10
233 - 264	11
265 - 288	12
289 - 312	13

LAST SECTION LETTER USED: CC - CC

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
						V54-000116	SKYLAB COMPLETE			

PARTS LIST

ITEM	QTY	NEXT ASSY	USED ON	END ITEM NO	THRU
REQD PER END ITEM		APPLICATION	V34-3??	116	119
			EFFECTIVITY		

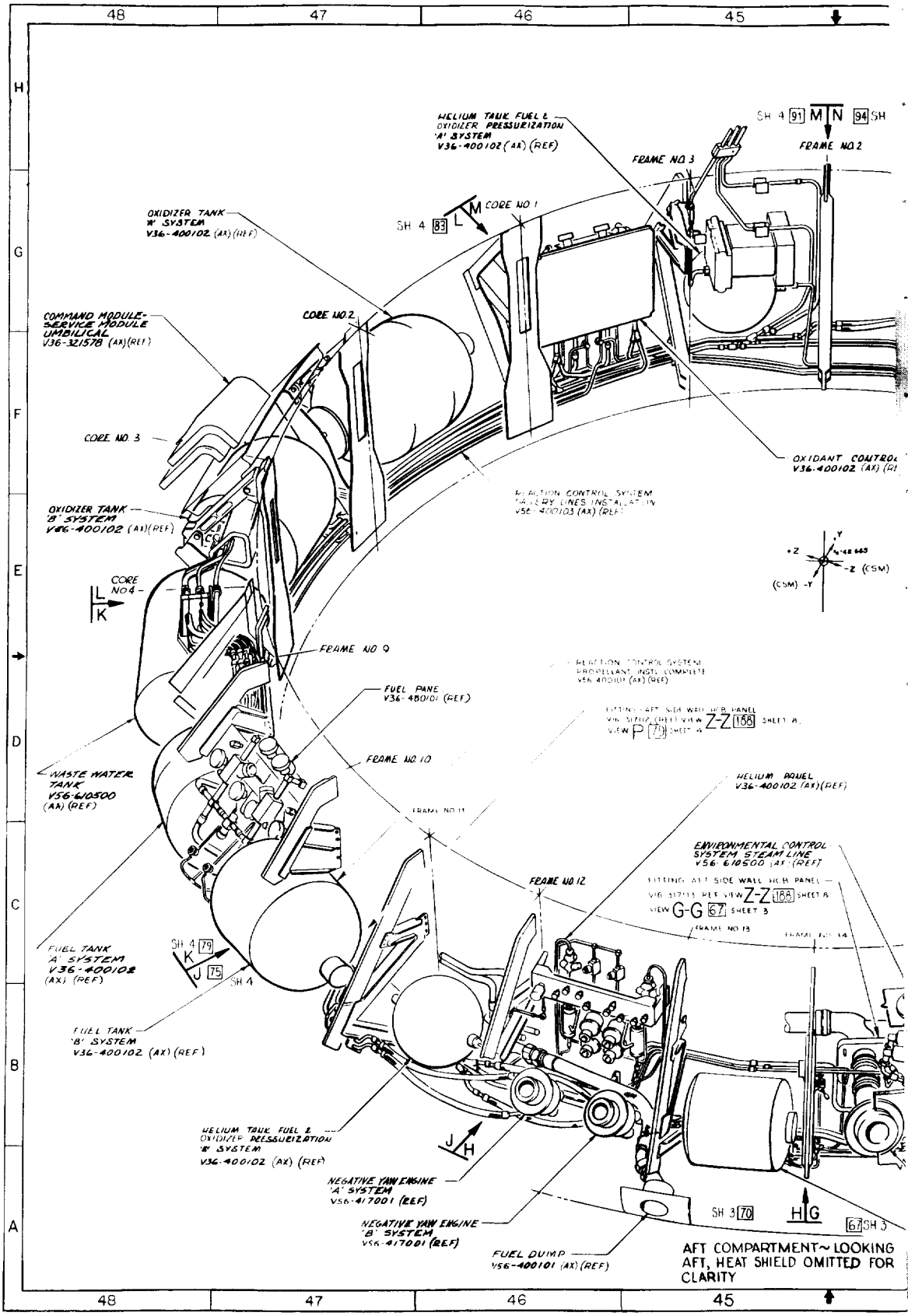
HEAT TREAT
FINISH

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES ON: DECIMALS ANGLES
XX = ± .03
XXX = ± .010 = 30'
HOLES NOTED "DRILL"
.013 THRU .060 + .001 − .001
.061 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
DO NOT SCALE PRINT

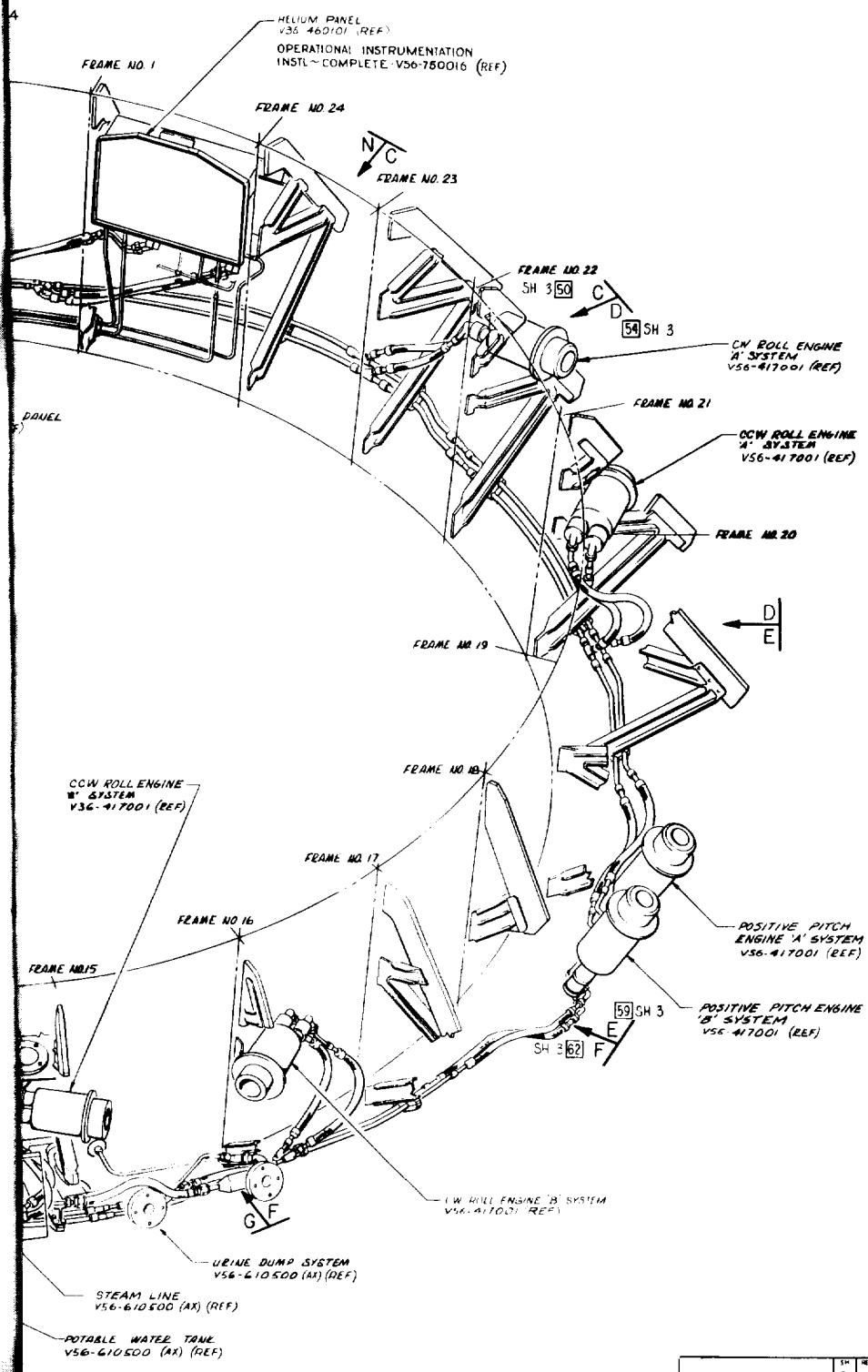
DR BY: KJM - 11-29-71
CHK BY: D.G. BATES
APPROVED BY:
DR BY DEPT 191-502
AXONOMETRIC DESIGN

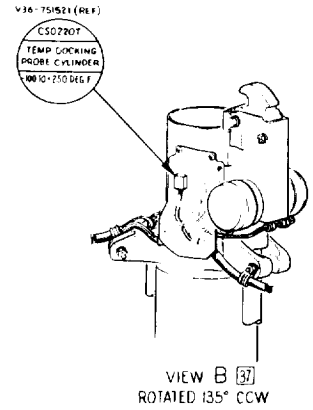
SPACE DIVISION
NORTH AMERICAN ROCKWELL CORPORATION
INBOARD PROFILE - SKYLAB COMPLETE
SIZE J | CODE IDENT NO 03953
130.5 X 34 | PAGE 11-5 | SHEET 1

FOLDOUT FRAME 5



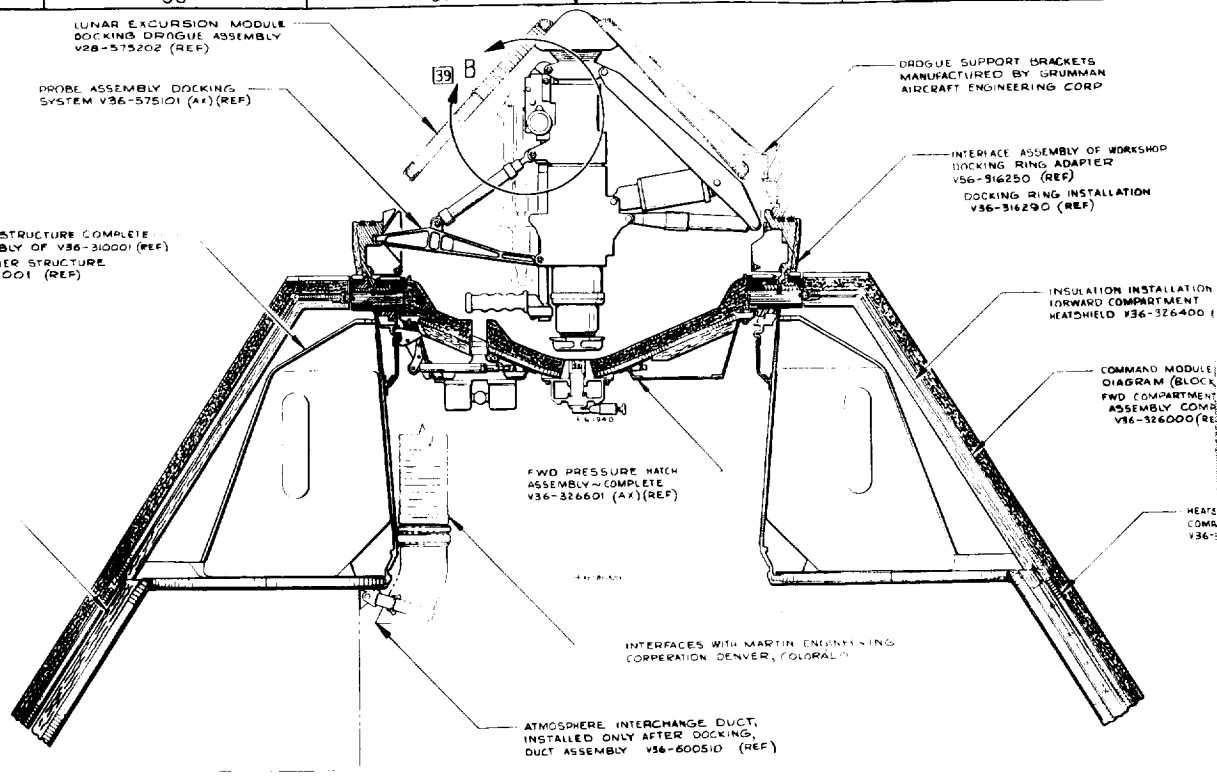
FOLDOUT FRAME 1



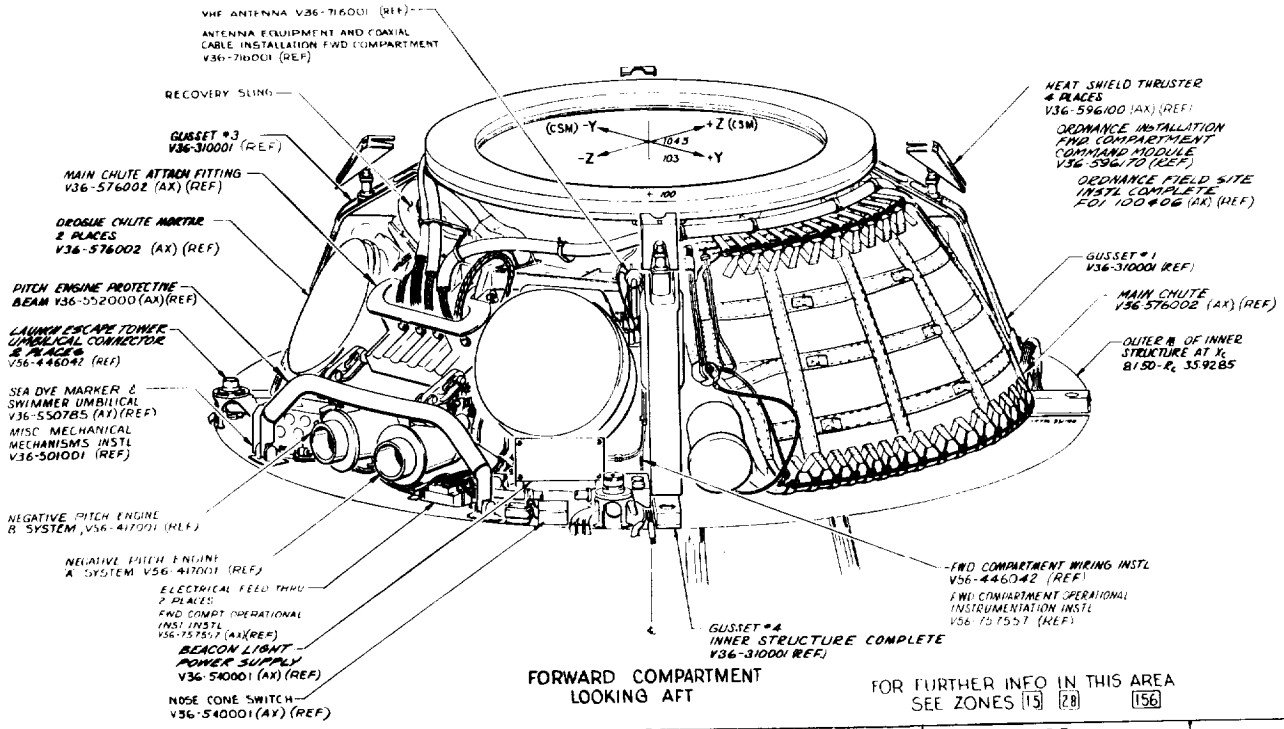


INSULATION II
CREW COMPART
V36-321400

FOLDOUT FRAME 2



SCHEMATIC CROSS SECTION OF TUNNEL AREA
COMMAND MODULE



FORWARD COMPARTMENT
LOOKING AFT

FOR FURTHER INFO IN THIS AREA
SEE ZONES 15 28 156

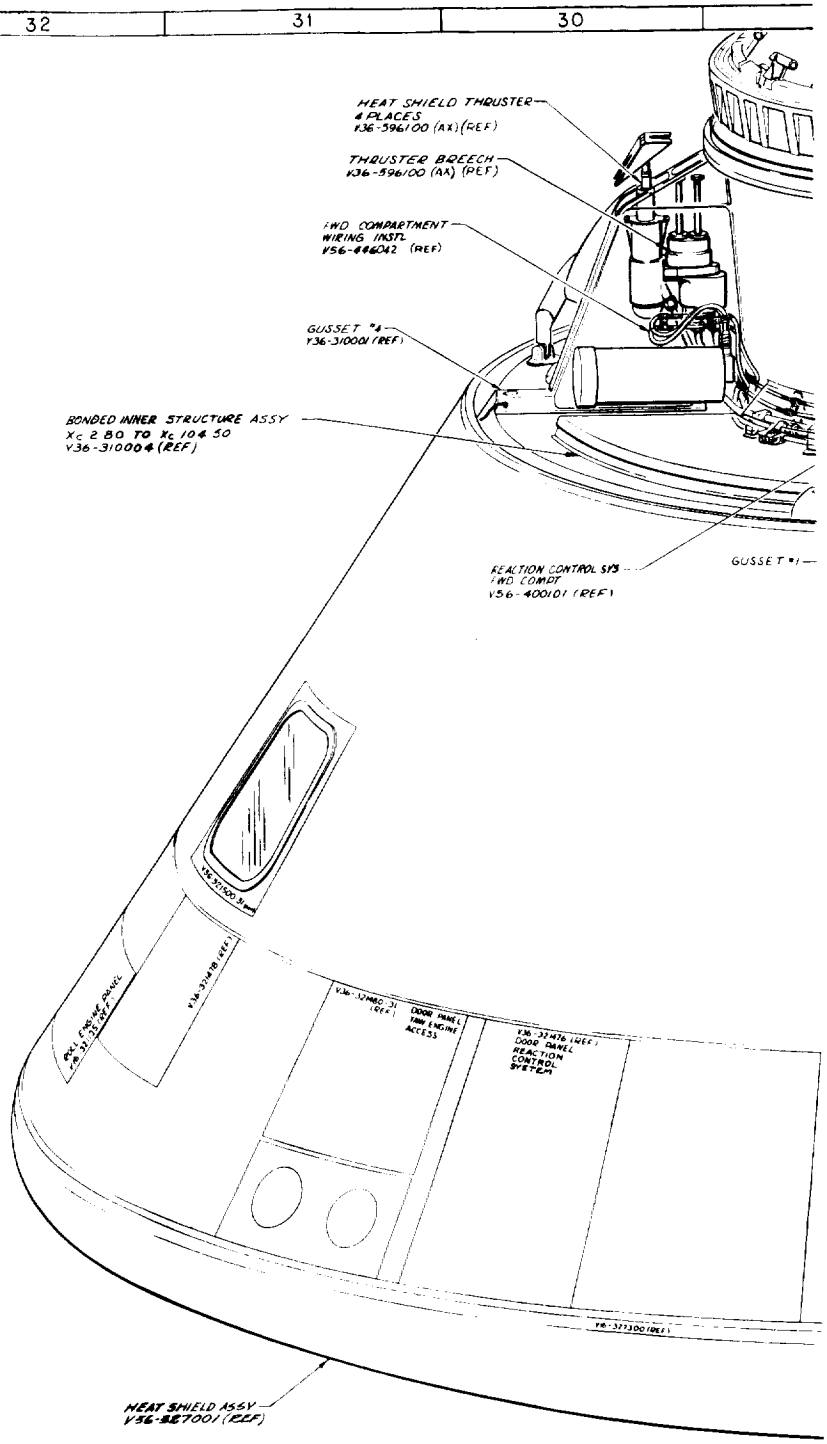
FOLDOUT FRAME 3

34 | 33 | 32 | 31 | 30

REF)

HEAT SHIELD STRUCTURE
II) V36-932003 (REF)
HEAT SHIELD
LETE
F)

HIELD ASSEMBLY CREW
RTMENT COMPLETE
321000 (REF)



-Z

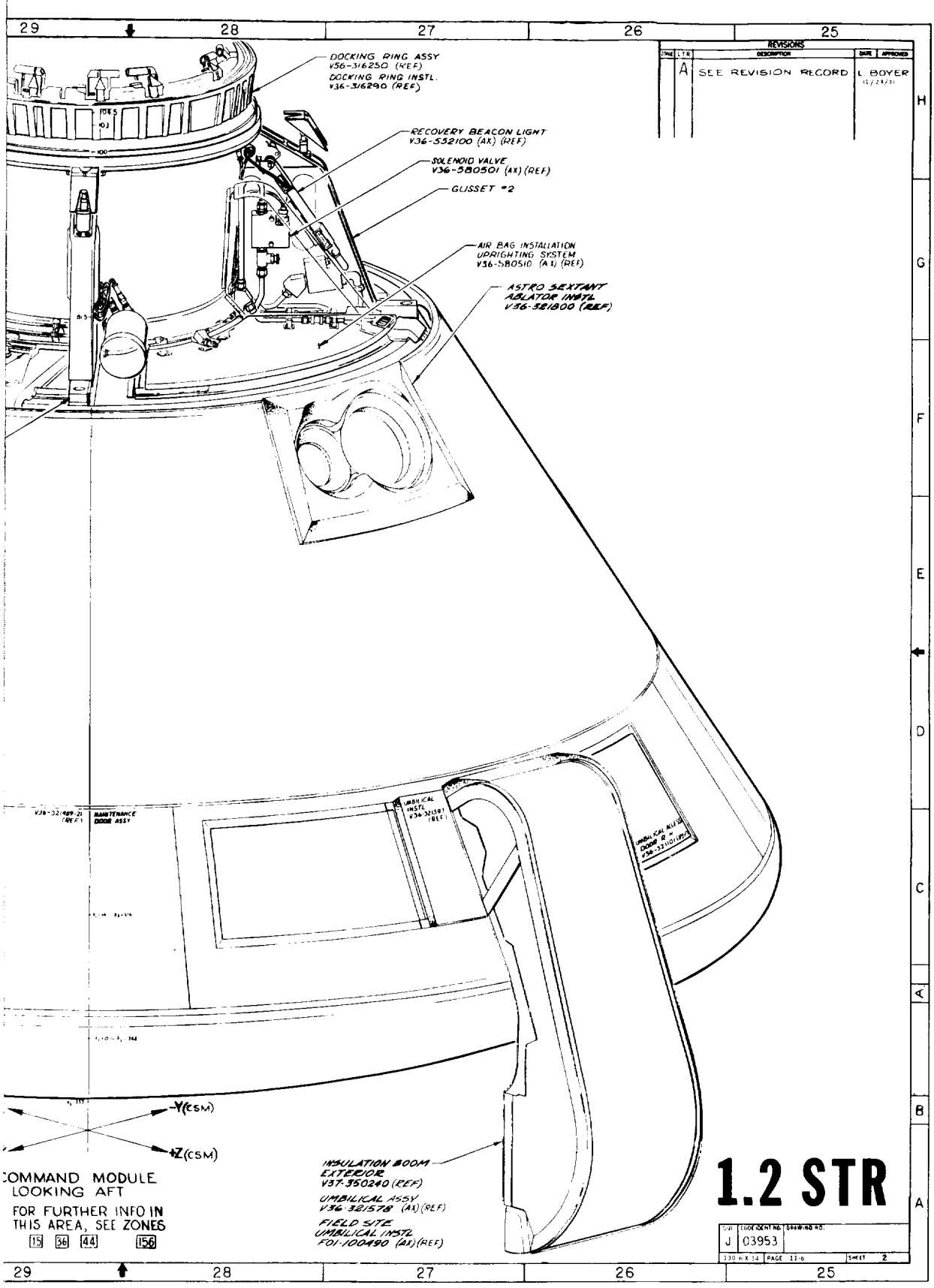
+Y

(

SH 2 | REV A

34 | 33 | 32 | 31 | 30

FOLDOUT FRAME 4



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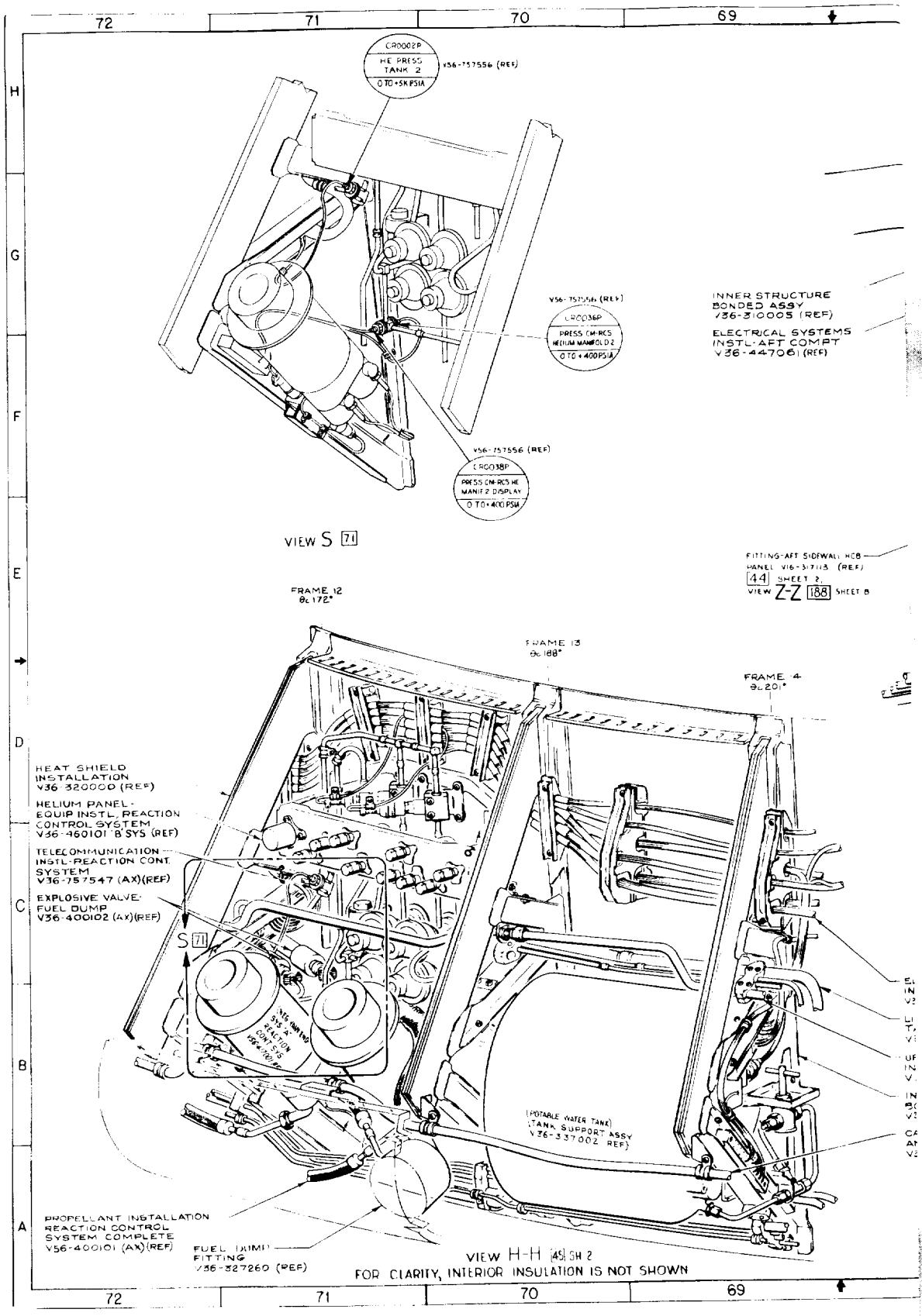

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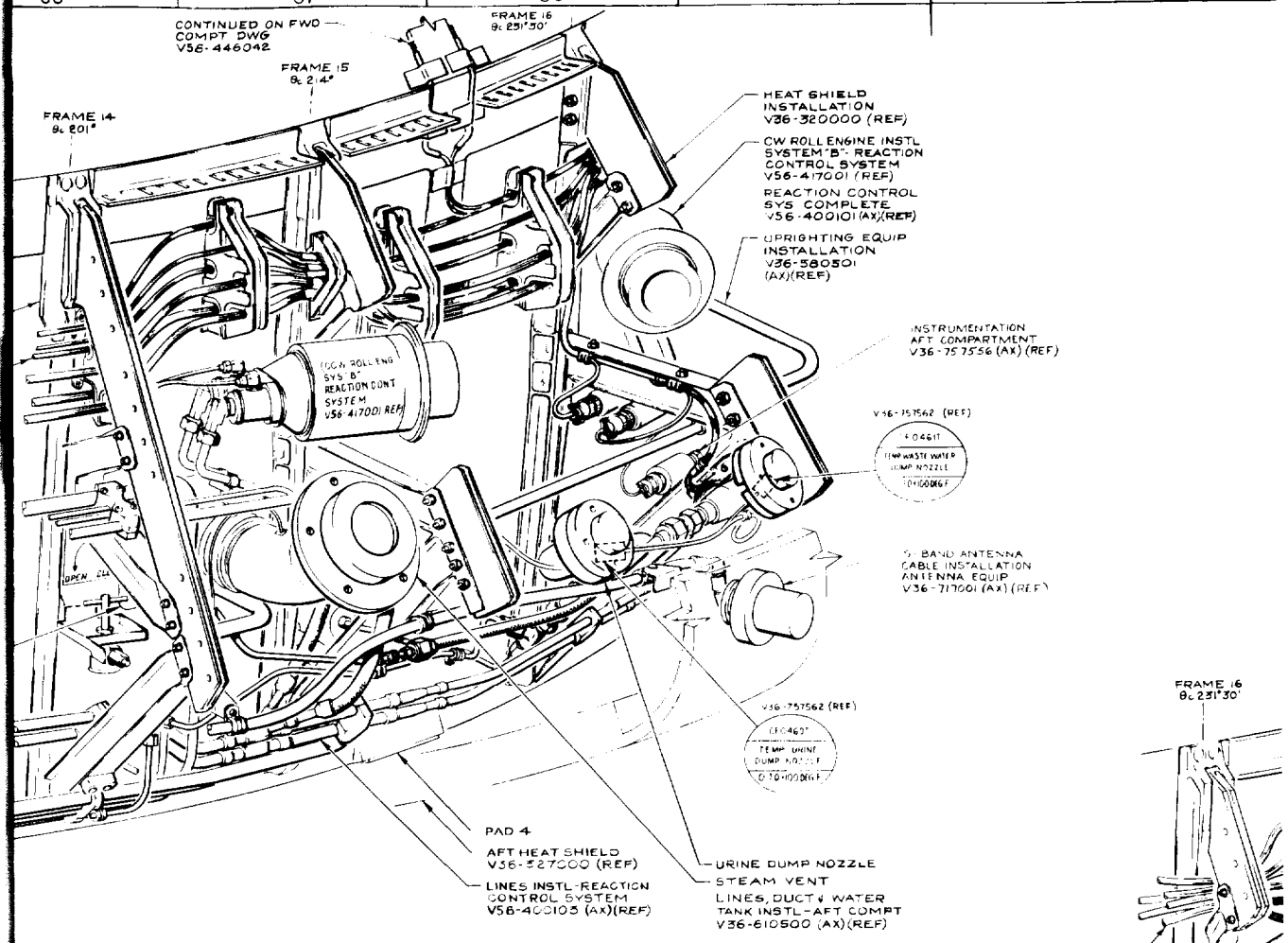
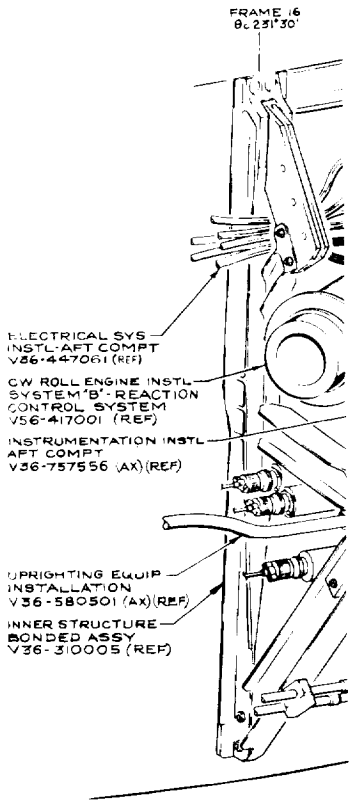


VIEW G-G [44] SH 2
FOR CLARITY, INTERIOR INSULATION IS NOT SHOWN



ECTRICAL SYSTEMS
STL-AFT COMPT
6-447061 (REF)

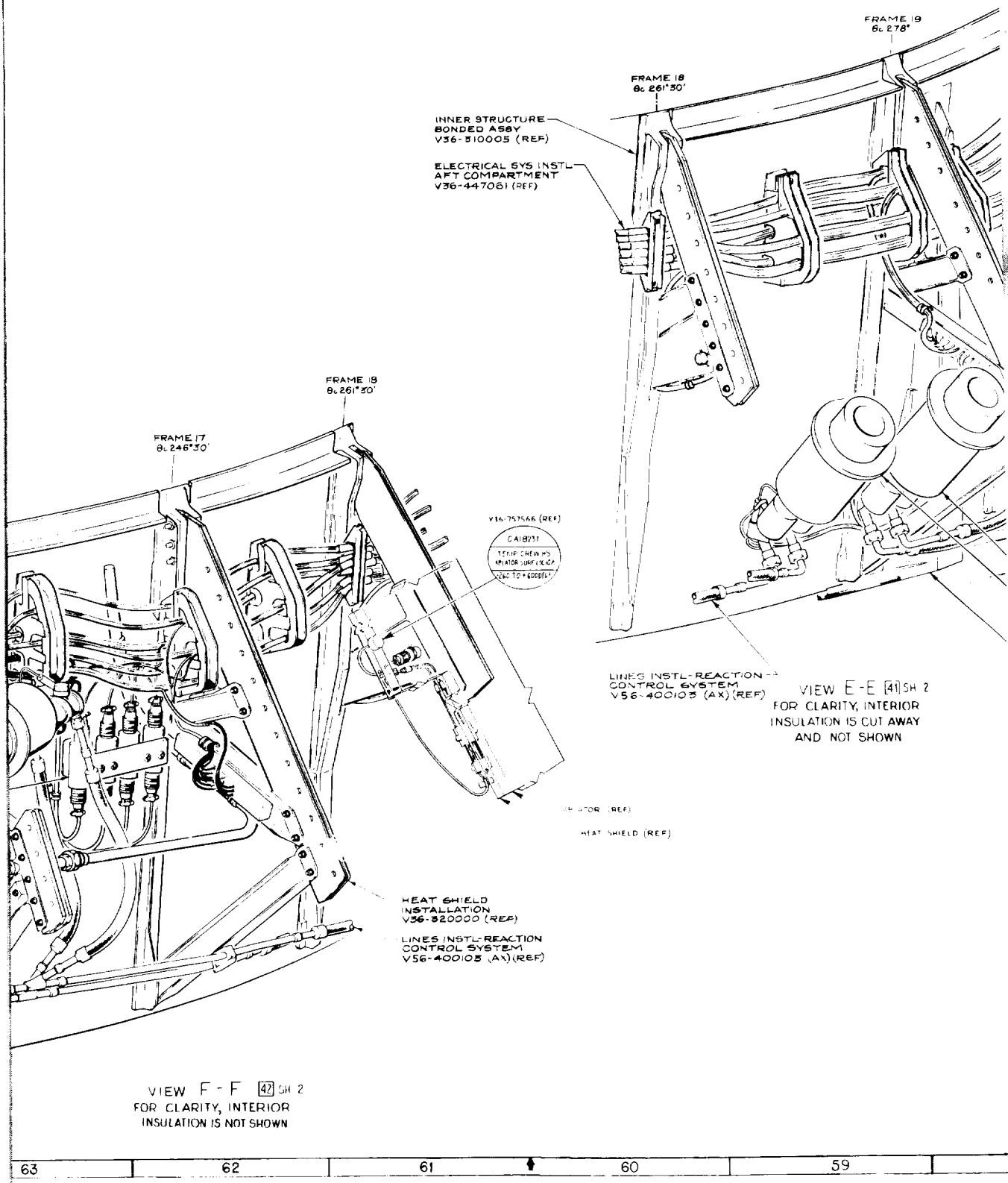
NES, DUCT & WATER
NK INSTL-AFT COMPT
56-610500 (AX)(REF)

RIGHTING EQUIPMENT
STALLATION
36-580501 (AX) (REF)

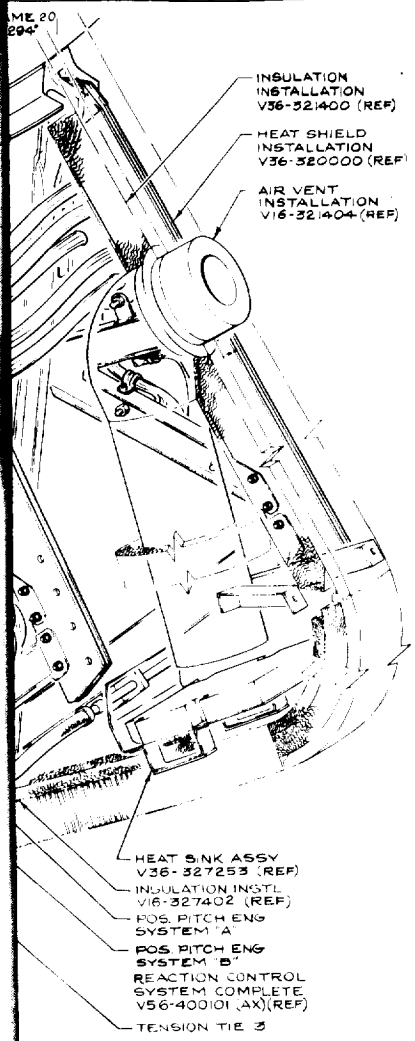
NER STRUCTURE
NDED ASSY
56-310005 (REF)

BLE INSTALLATION
TENNA EQUIP
6-717001 (AX)(REF)

FOLDOUT FRAME 2



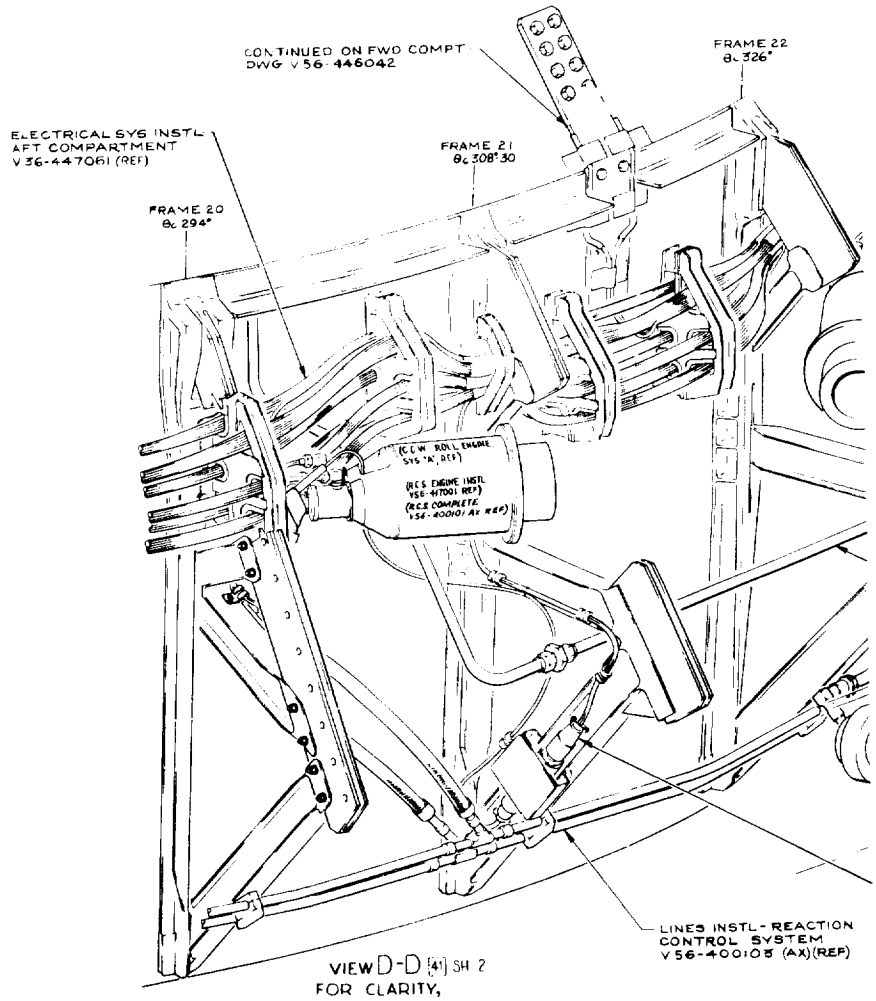
FOLDOUT FRAME 3



INNER STRUC
BONDED ASS
V36-310005

ELECTRICAL S
AFT COMPART
V36-447061 (

INSTRUMENT
AFT COMPAR
V36-757556

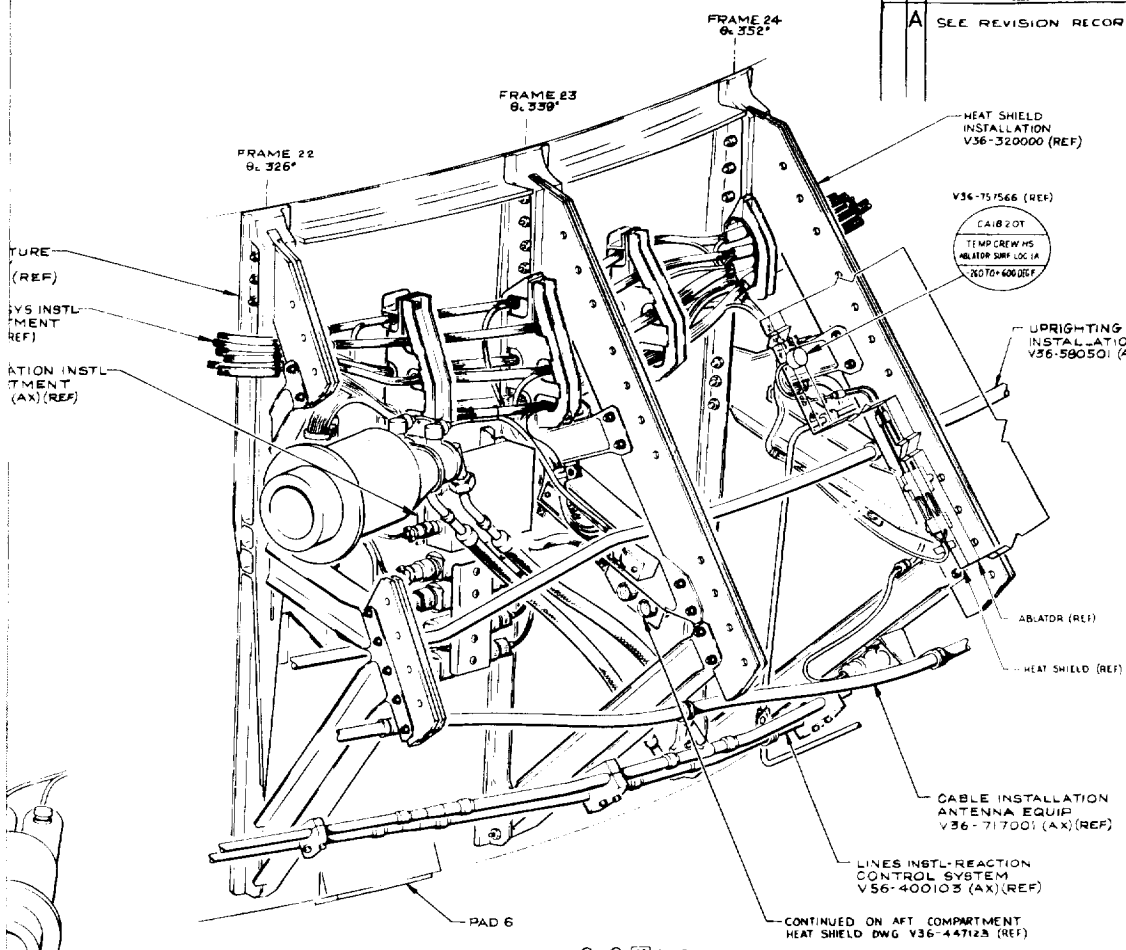


VIEW D-D [41] SH 2
FOR CLARITY,
INTERIOR INSULATION
IS NOT SHOWN

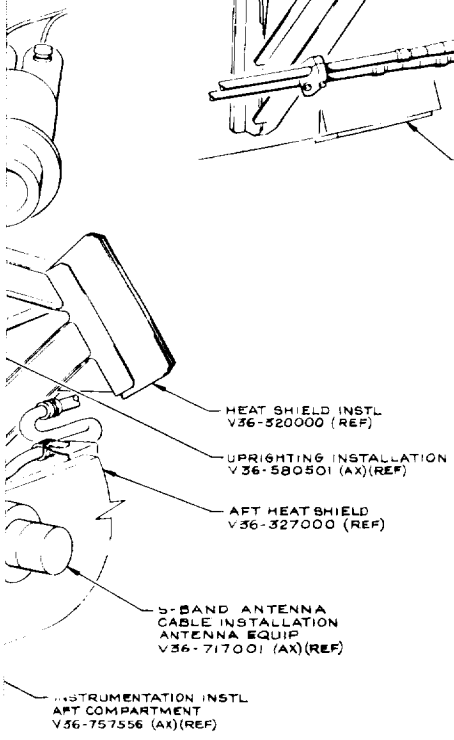
FOLDOUT FRAME 4

53	52	51	50	49

REVISIONS			
ZONE	LTR	DESCRIPTION	DATE / APPROVED
	A	SEE REVISION RECORD	L. BOYER 11/13/71



VIEW C-C [42] SH 2
FOR CLARITY,
INTERIOR INSULATION
IS NOT SHOWN

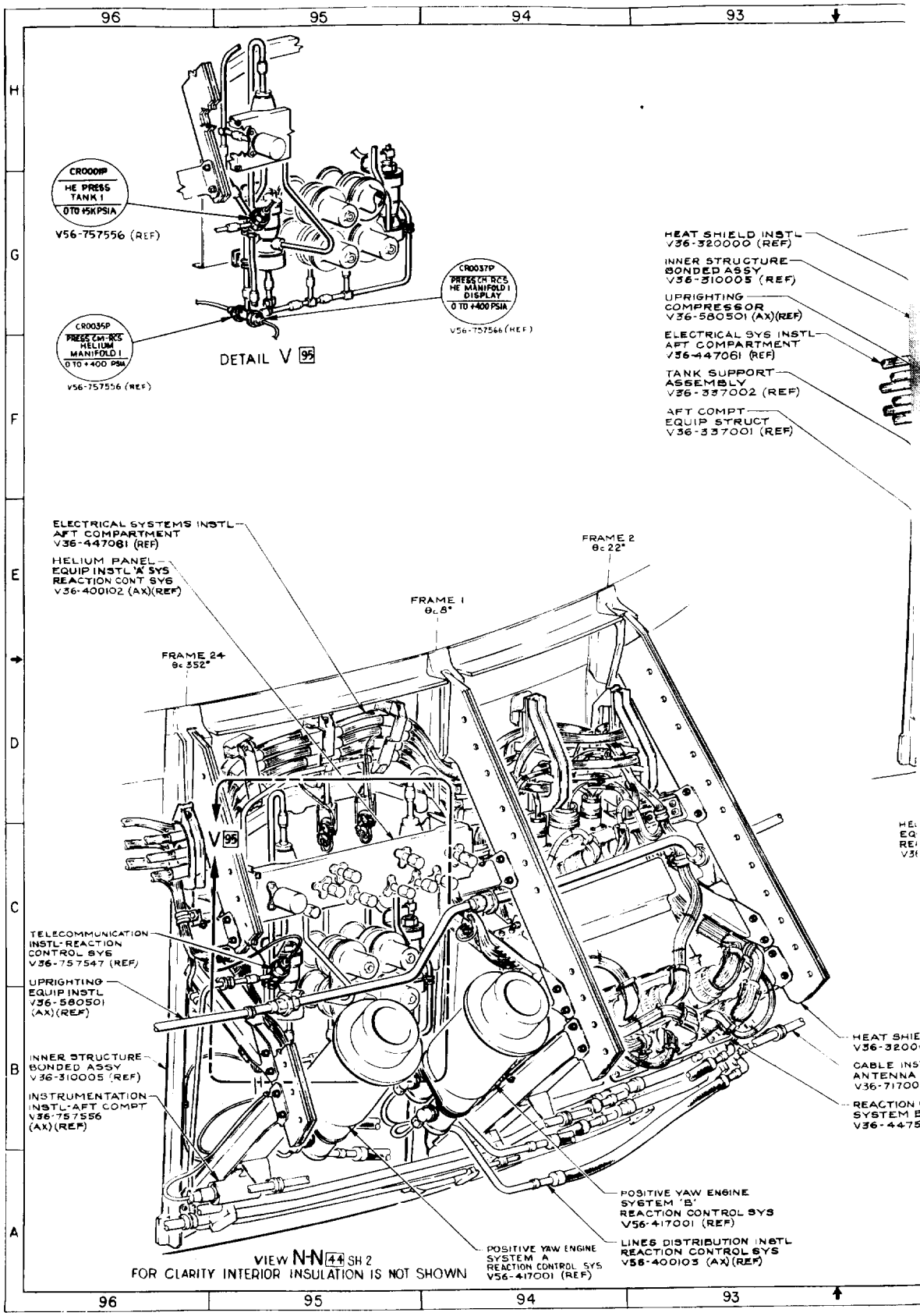


1.3 STR

SIZE	CODE IDENT NO	DRAWING NO
J	03953	V54-000116

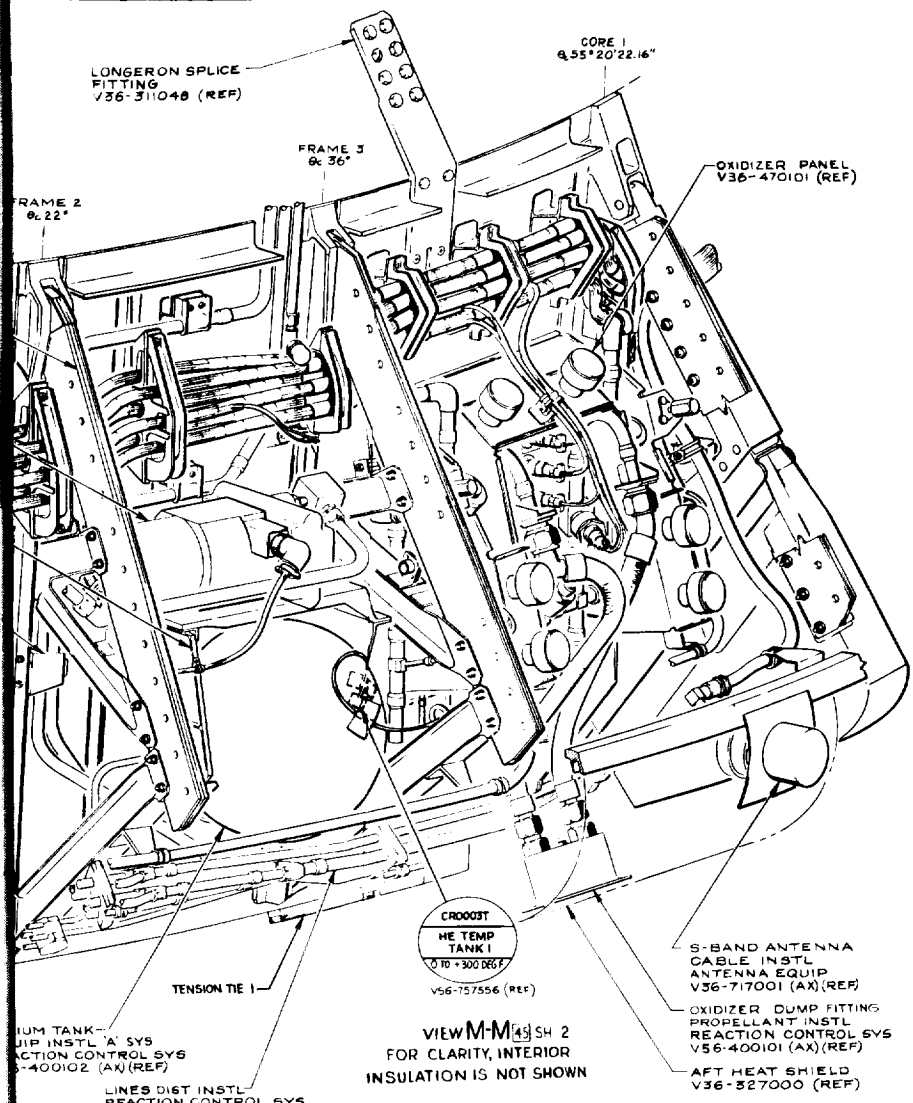
53	52	51	50	49

EOLDOUT FRAME 5

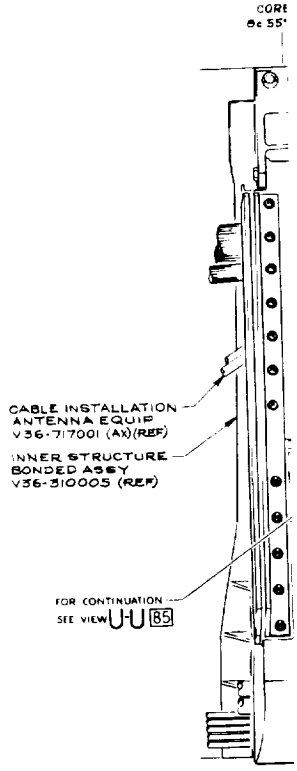


FOLDOUT FRAME 1

92 | 91 | 90 | 89 | | 88



VIEW M-M 45 SH 2
FOR CLARITY, INTERIOR INSULATION IS NOT SHOWN

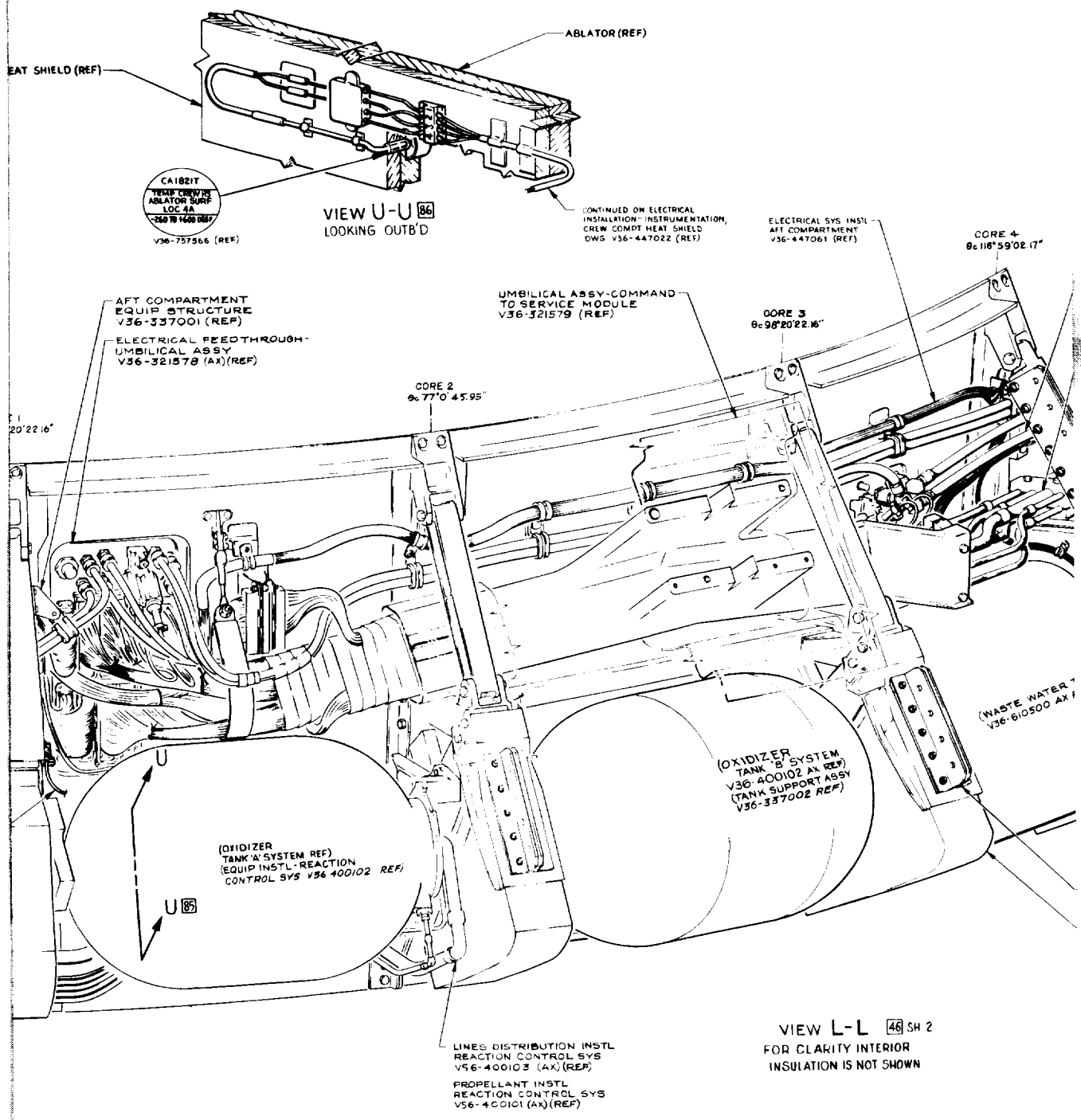


IUM TANK-
UIP INSTL 'A' SYS
CTION CONTROL SYS
-400102 (AX)(REF)

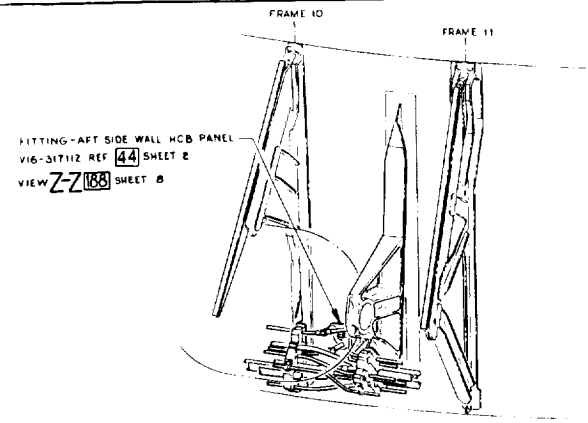
LD INSTL
00 (REF)
TALLATION
EQUIP
(AX)(REF)
CONTROL
OX
60 (REF)

92 | 91 | 90 | 89 | 3 of 3 | 88

FOLDOUT FRAME 2



FOLDOUT FRAME 3



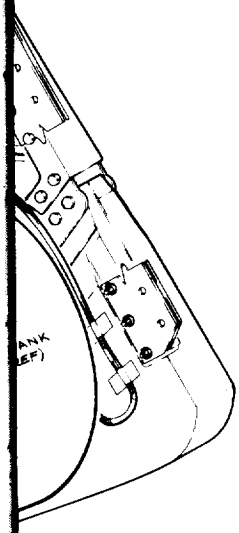
INNER STRL
BONDED AS
V36-310002

UPRIGHTING
INSTALLAT
V36-58050

CABLE INSTALLATION
ANTENNA EQUIP
V36-717001 (AX)(REF)

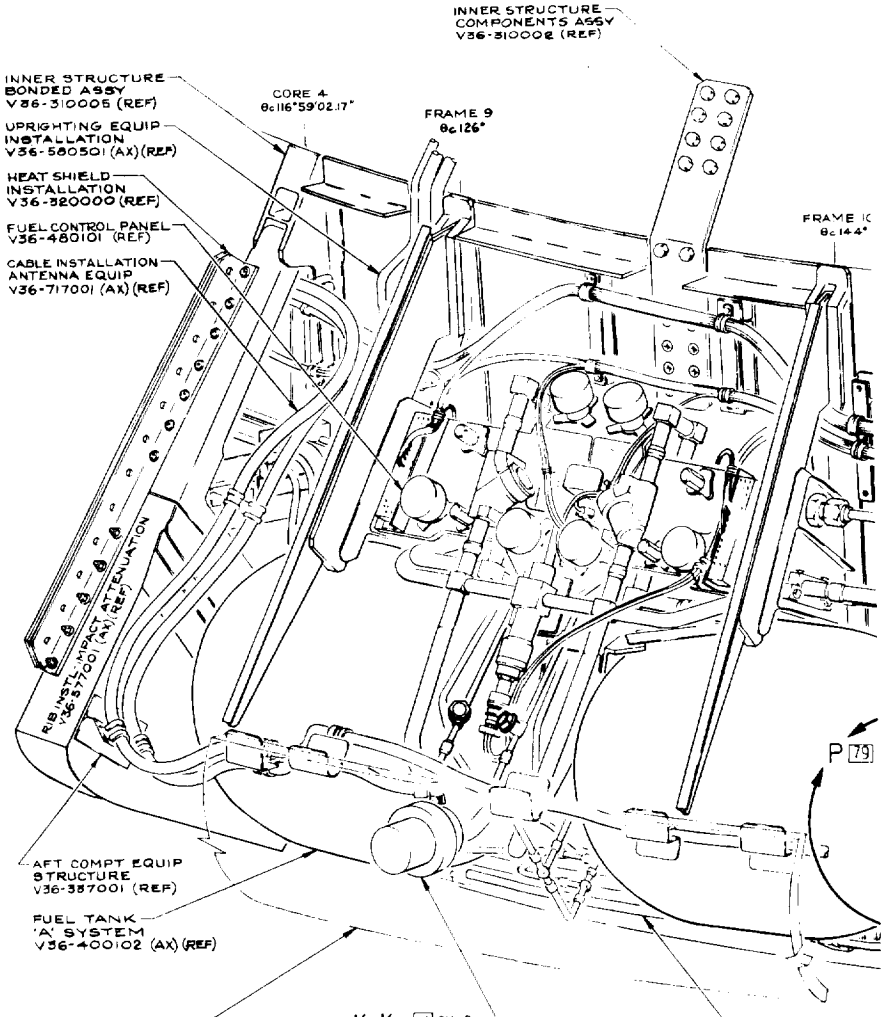
LINES, DUCT & WATER
TANK INSTL' AFT COMPT
V36-610500 (AX) (REF)

VIEW P 77
FOR CLARITY RCS LINES
ARE NOT SHOWN



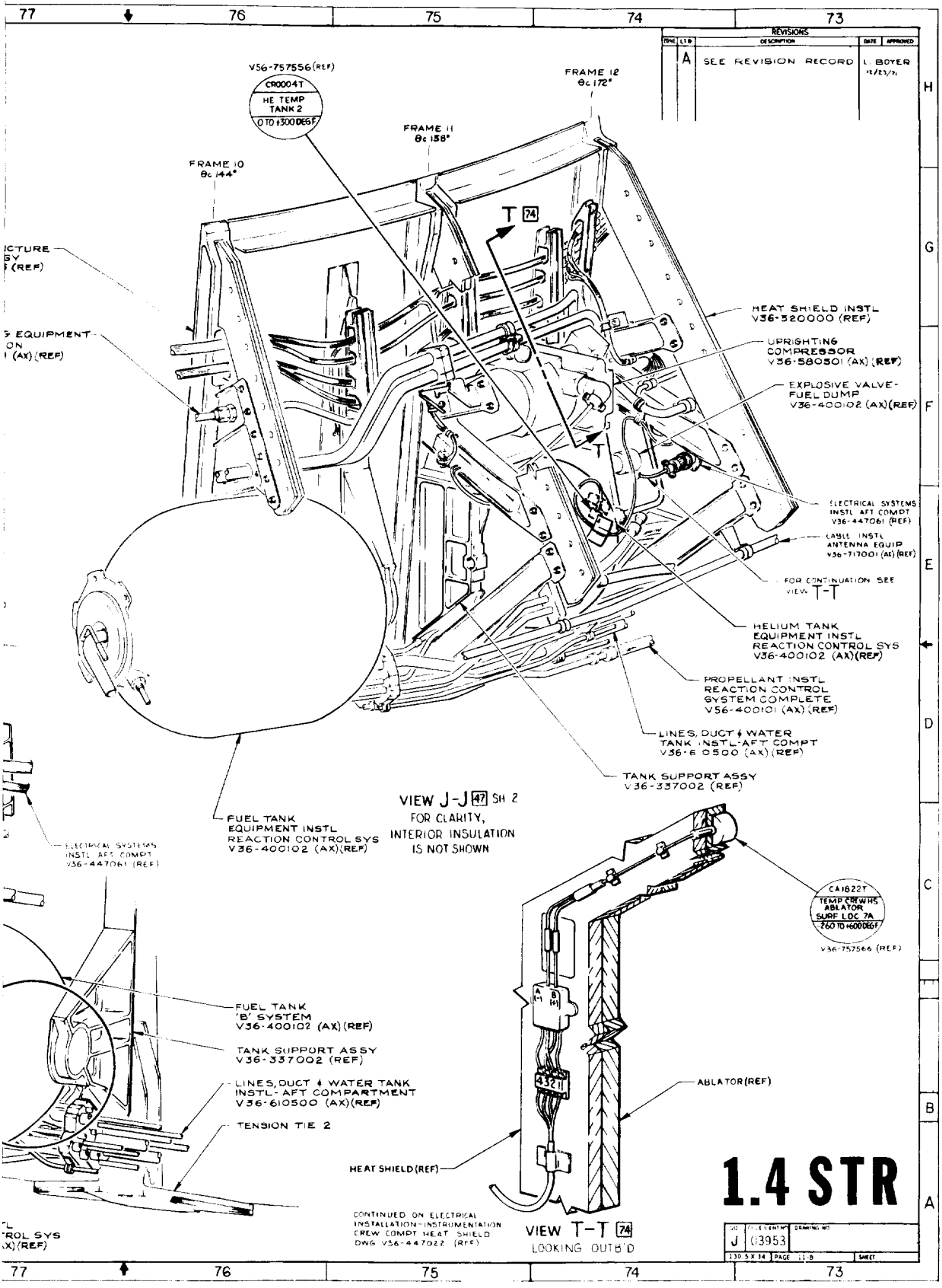
HEAT SHIELD
INSTALLATION
V36-320000 (REF)

RIB INSTALLATION
IMPACT ATTENUATION
V36-577001 (AX) (REF)

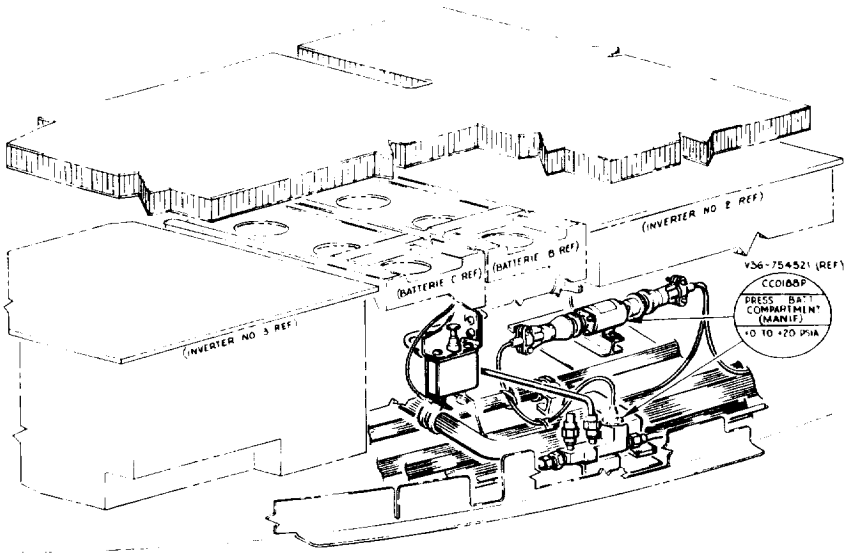


VIEW K-K 48 SH 2
FOR CLARITY, INTERIOR
INSULATION IS NOT SHOWN

FOLDOUT FRAME 4

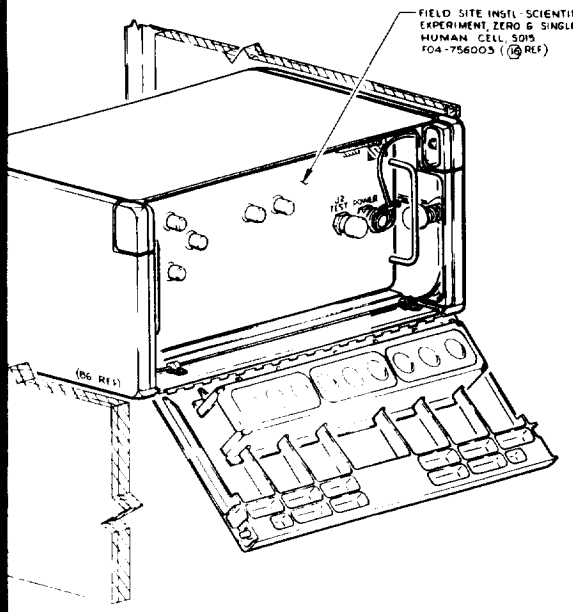


FOLDOUT FRAME 5



VIEW Z 102

FOLDOUT FRAME 1



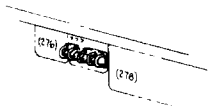
VIEW Y [101]

LOWER EQUIP BAY D+C INSTALLATION V56-764000 (REF)

GUIDANCE AND NAVIGATION EQUIP INSTL LOWER EQUIP BAY V36-724007 (REF)

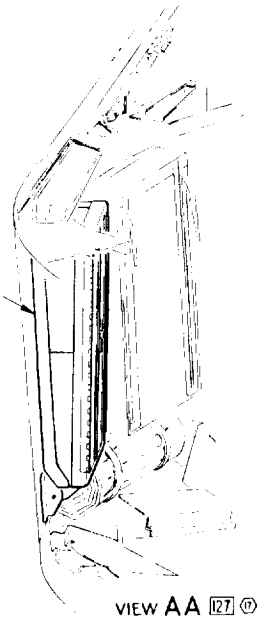
STRUCTURE-LOWER EQUIPMENT BAY X_c+42.665 to X_c+80.75 V36-334501 (REF)

RETAINERS-EQUIPMENT, CREW COMPARTMENT INTERIOR, INSTALLATION OF (SEE RETAINER DWG NO'S ZONE 97,G)



DETAIL W (⑰ REF)
THIS DETAIL TYPICAL FOR ALL R.H.E.B. VIEWS SEE ZONES [99] [107] [139]

STRUCTURE-LOWER EQUIPMENT BAY X_c+19.125 to X_c: 42.665, ASSY OF V36-334001 (REF)



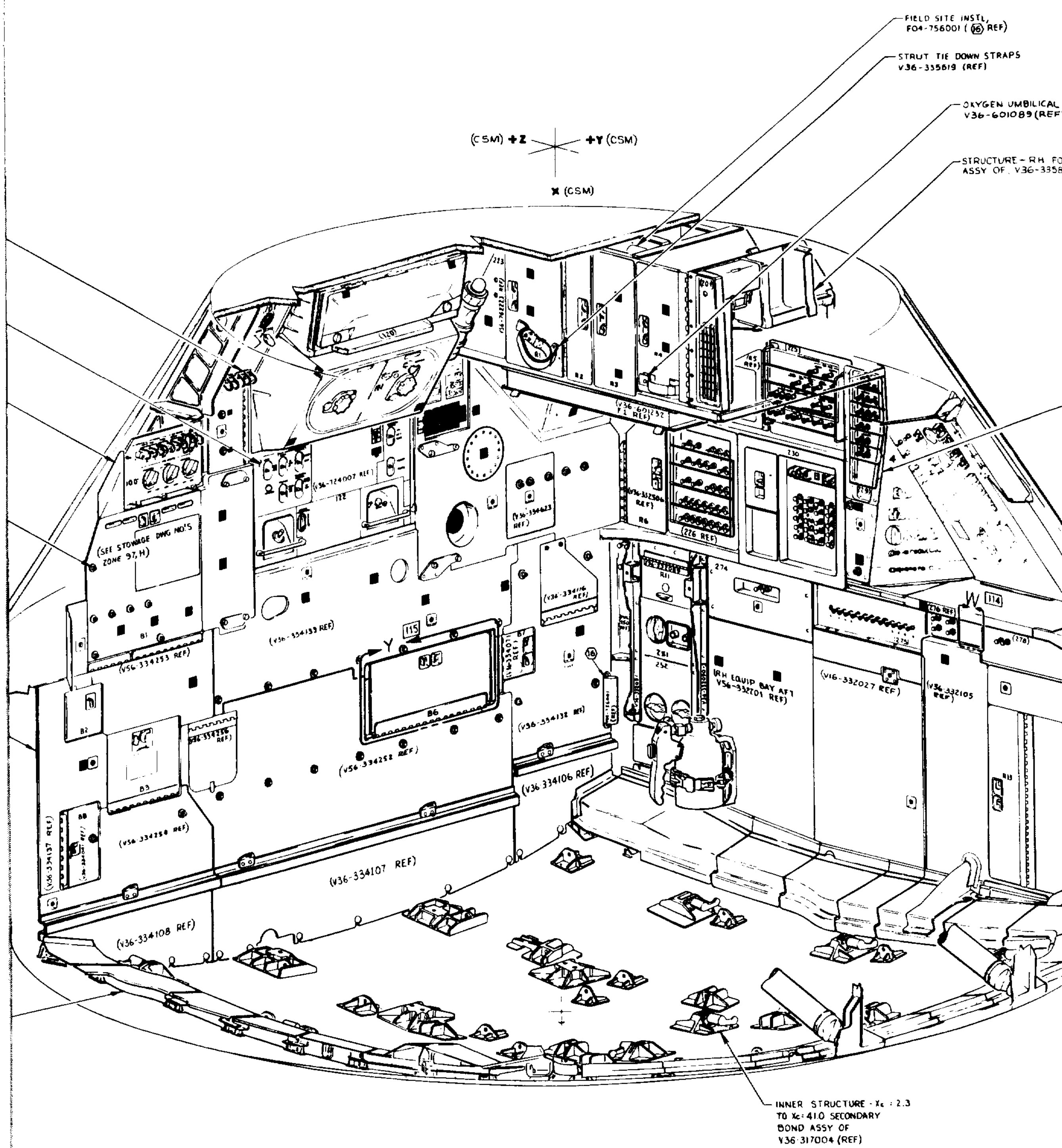
CONTAINER (LH2) R.H. STOWAGE V56-331540 (⑰ ⑱ ⑲ REF)
SEE STOWAGE DWG NO'S ZONE 92, H

VIEW AA [127] ⑰ ⑱ ⑲
SH 6

WIREWAY INSTL-AFT BULKHEAD-CENTRAL CREW COMPARTMENT, V56-441800 (REF)

FOLDOUT FRAME 2

111	110	109	108	107



CREW COMPARTMENT ~
LOWER EQUIPMENT BAY, AND
RIGHT HAND EQUIPMENT BAY,
CLOSE-OUT PANELS SHOWN
FOR FURTHER INFO IN THIS
AREA, SEE ZONES [15] [28] [100]
[124] [132] [140] [148] [156]

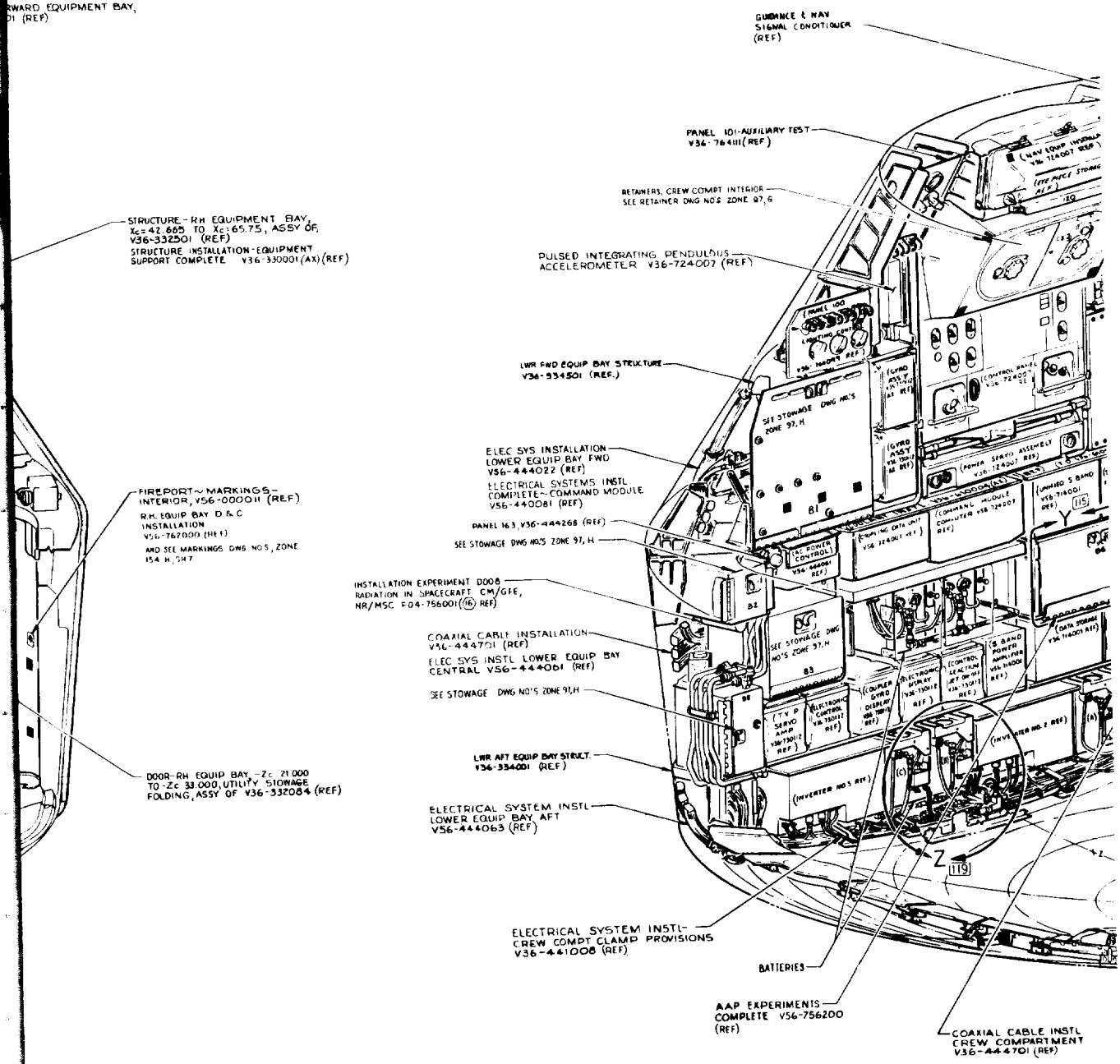
111	110	109	108	107

FOLDOUT FRAME 3

106	105	104	103	102

STRAP INSTL,

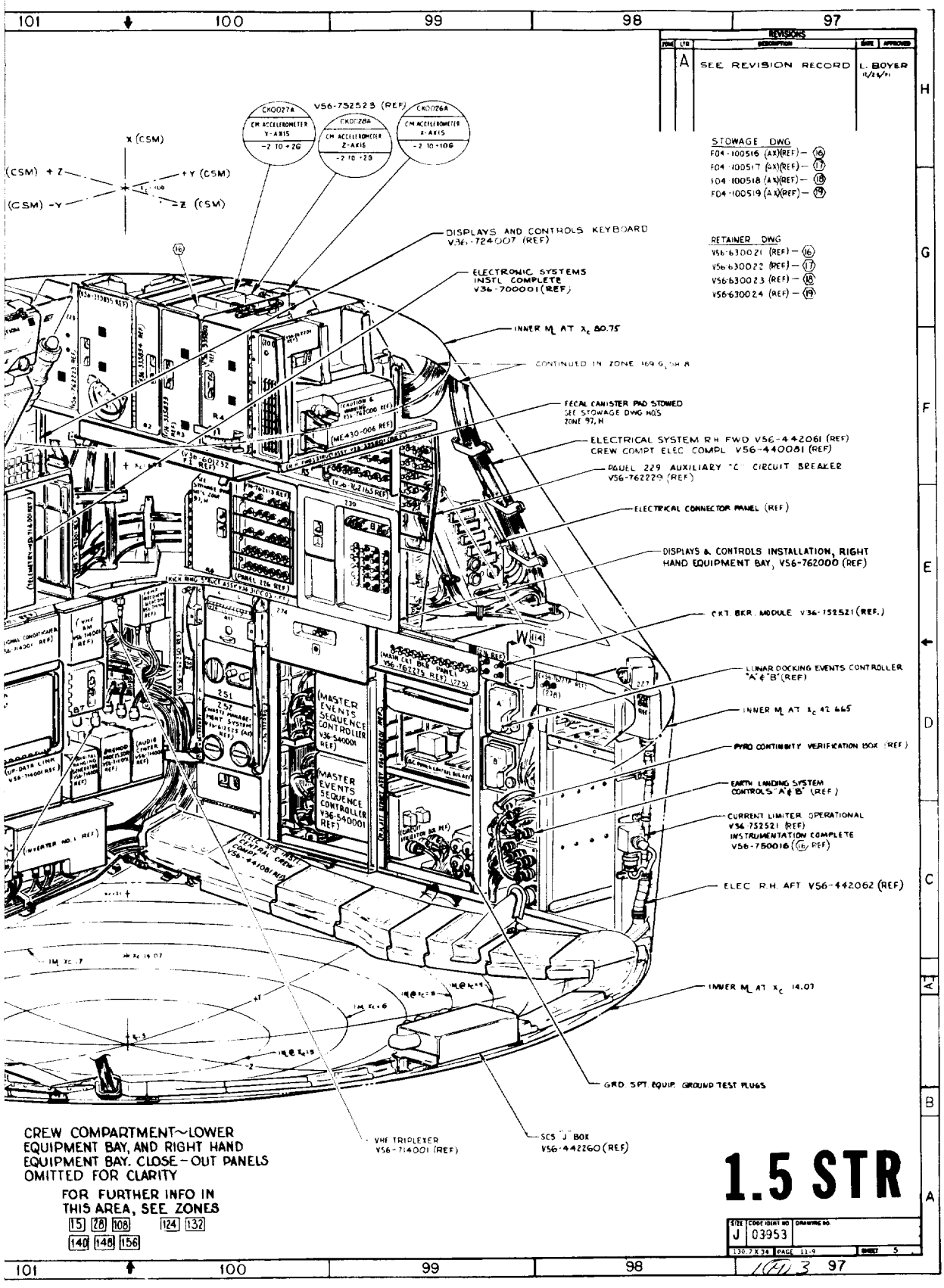
RWARD EQUIPMENT BAY,
01 (REF)



SH	REV
5	A

106	12(M)3 105	104	103	102

FOLDOUT FRAME 4



CREW COMPARTMENT~LOWER EQUIPMENT BAY, AND RIGHT HAND EQUIPMENT BAY. CLOSE-OUT PANELS OMITTED FOR CLARITY

FOR FURTHER INFO IN THIS AREA, SEE ZONES
15 28 108 124 132
140 148 156

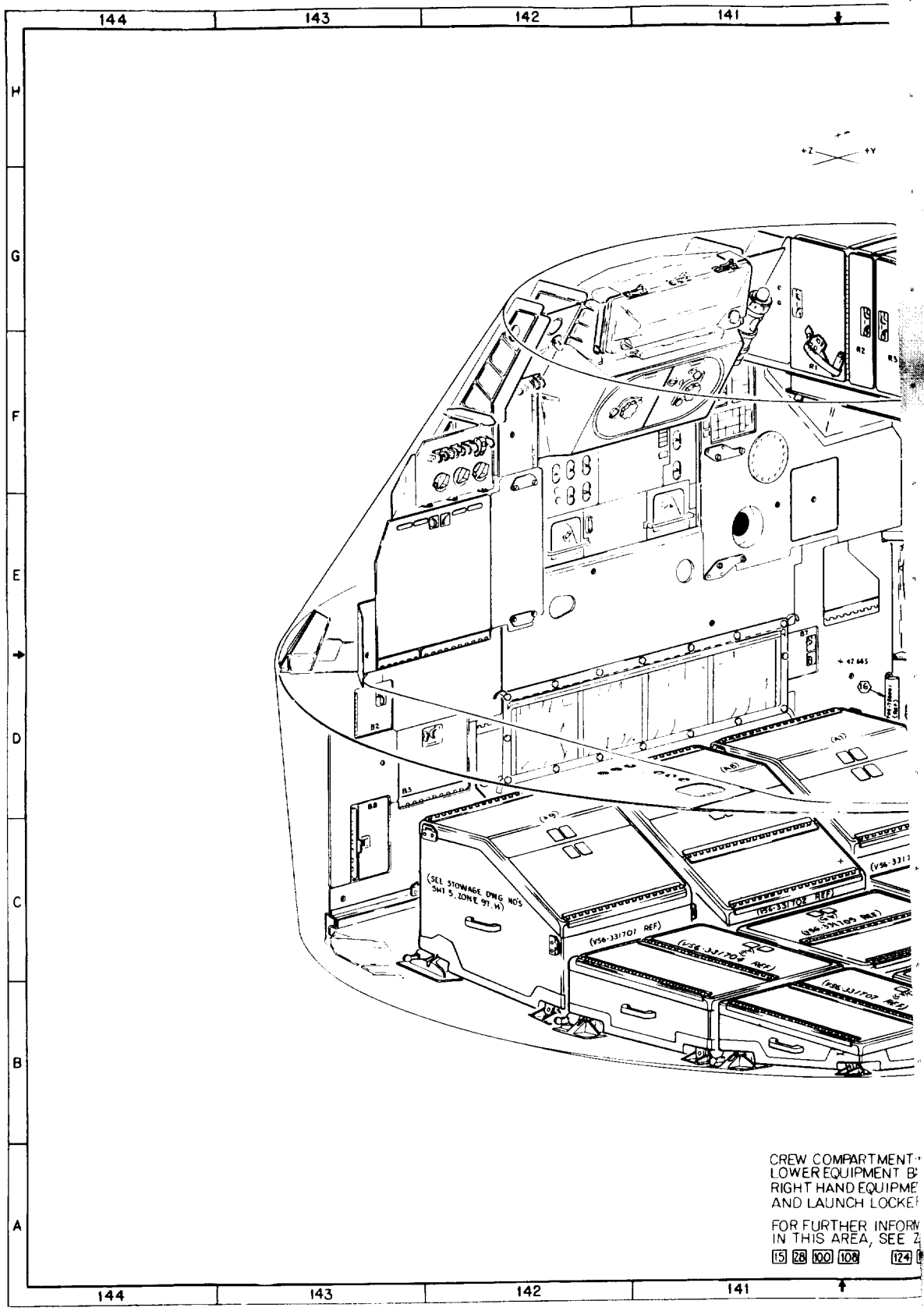
1.5 STR

SIZE	CODE IDENT NO	DRAWING NO.
J	03953	

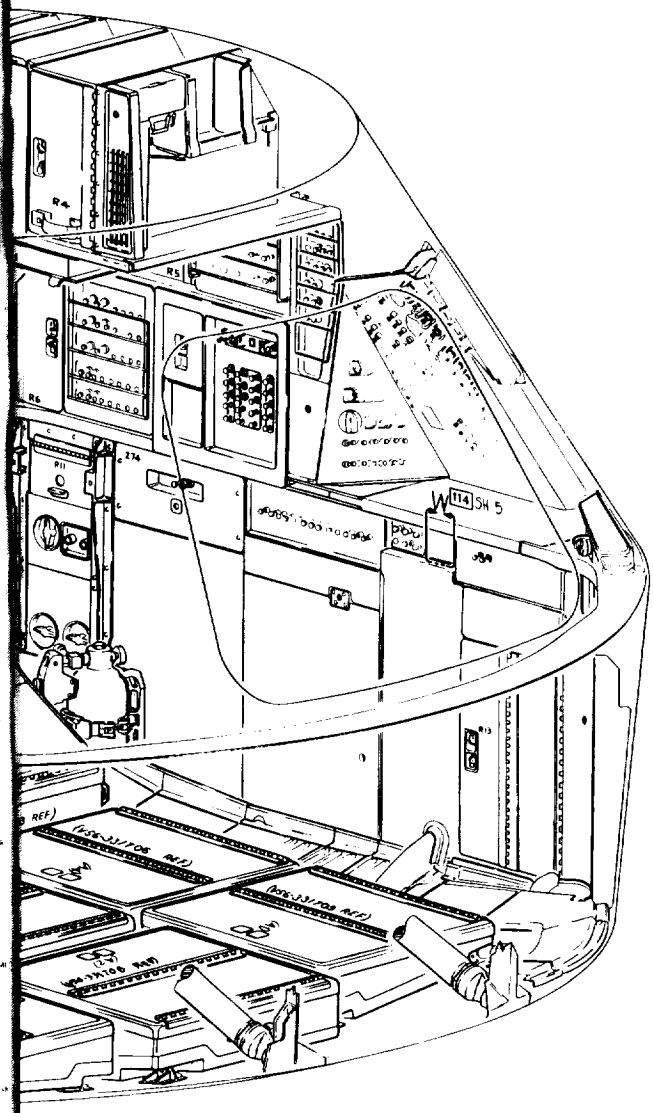
130.7 X 34 | PAGE 11-9 | SHEET 5

101 100 99 98 97

FOLDOUT FRAME 5



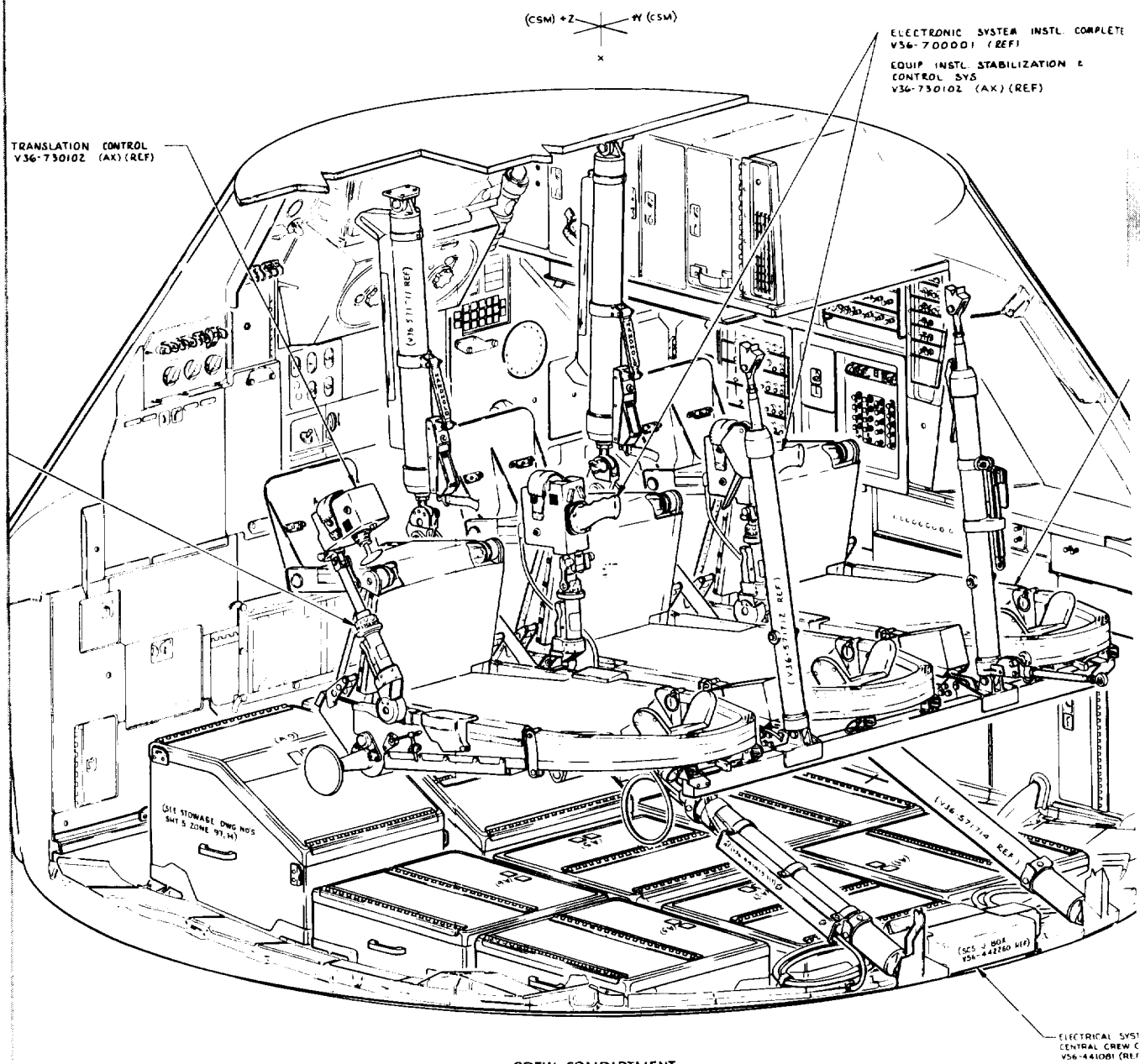
FOLDOUT FRAME 1



DESIGN LAYOUT INTERIOR CONFIGURATION AND MARKINGS, SEE MARKINGS DWG NO'S ZONE 154, H, SH 7

Y, AND
NT BAY
'S SHOWN
ATION
ONES
32

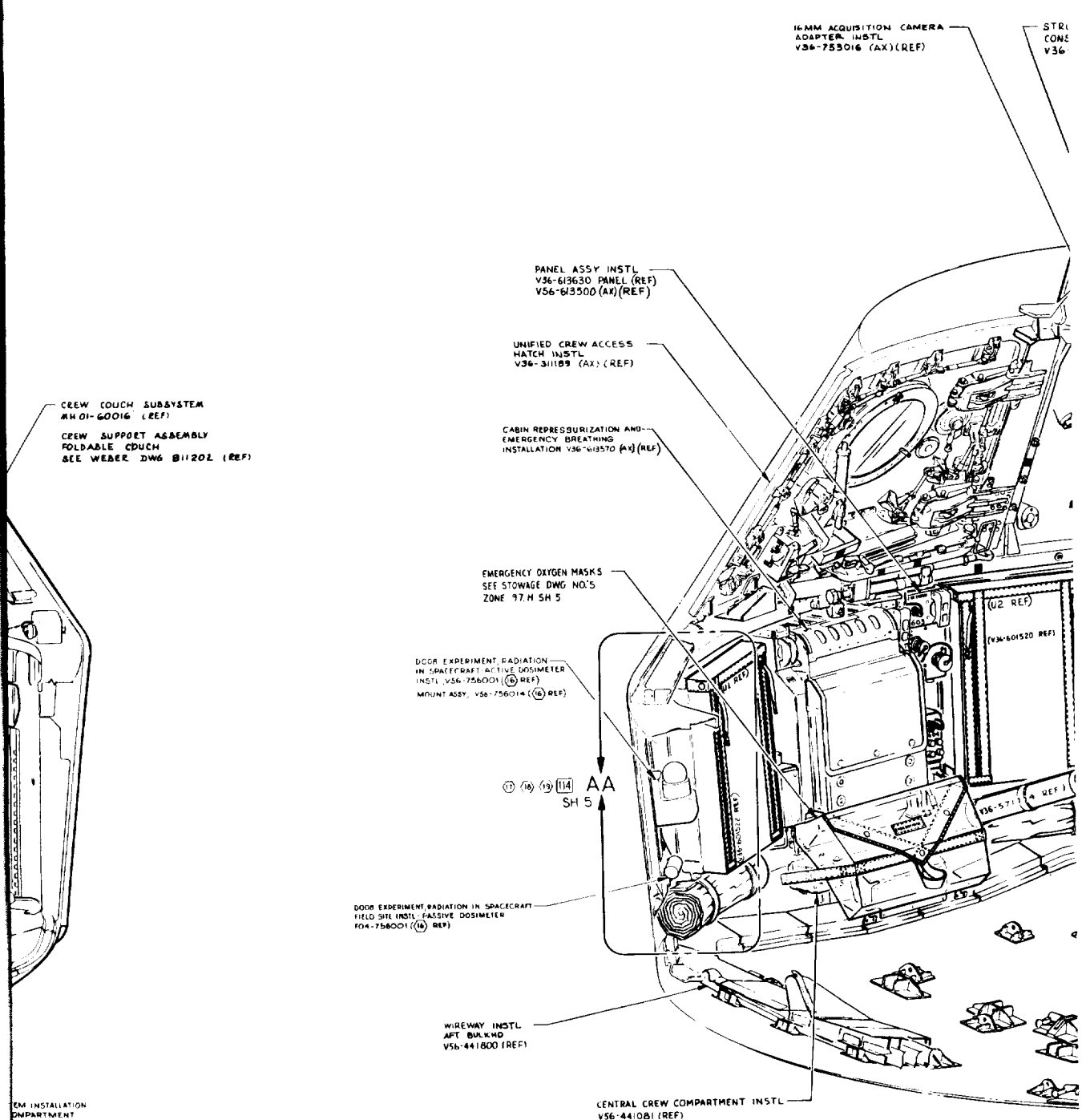
FOLDOUT FRAME 2



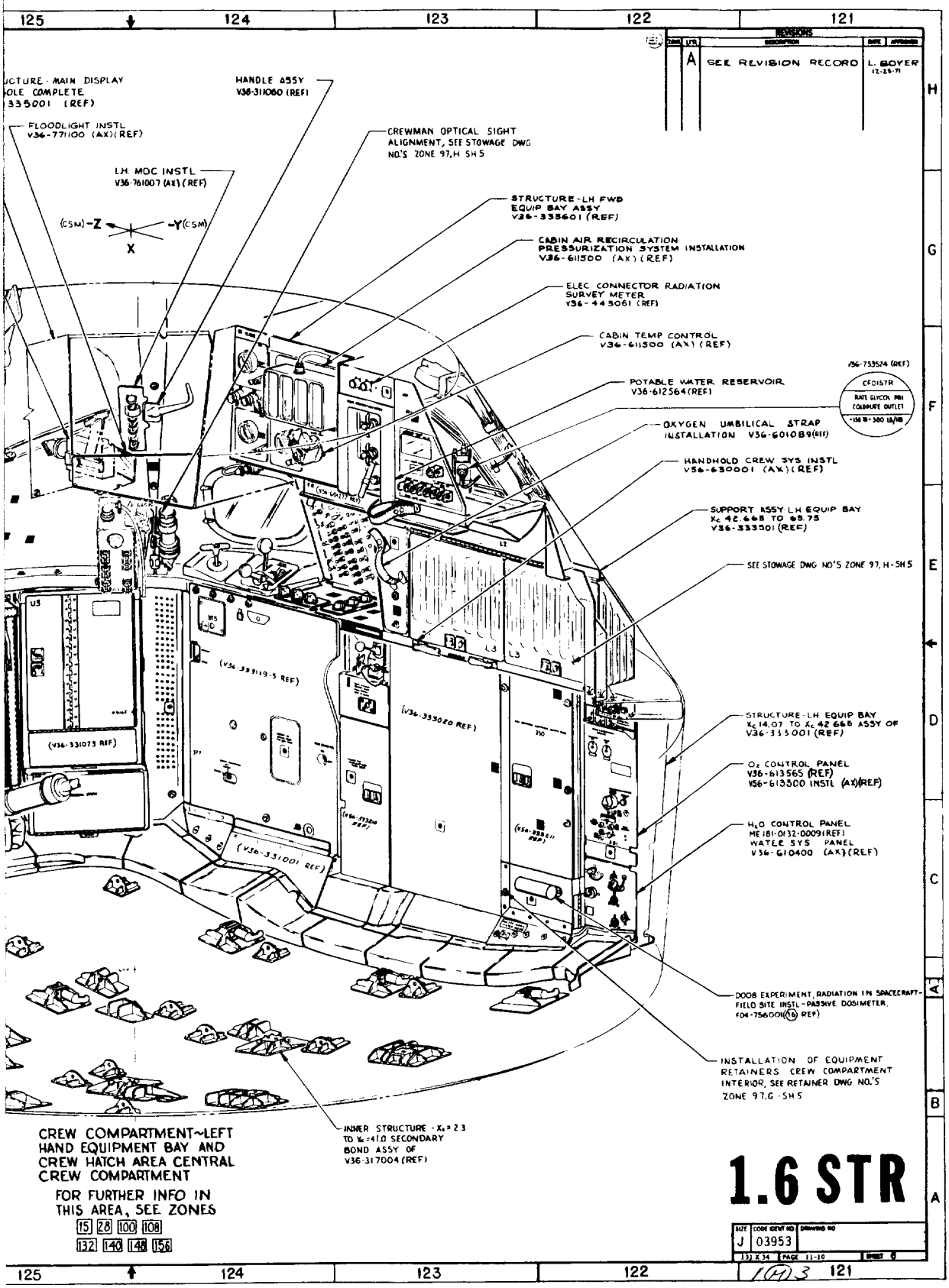
CREW COMPARTMENT~
VIEW LOOKING DOWN AND INBOARD
FOLDABLE CREW COUCHES

FOR FURTHUR INFO IN
THIS AREA, SEE ZONES
15 28 100 108
124 140

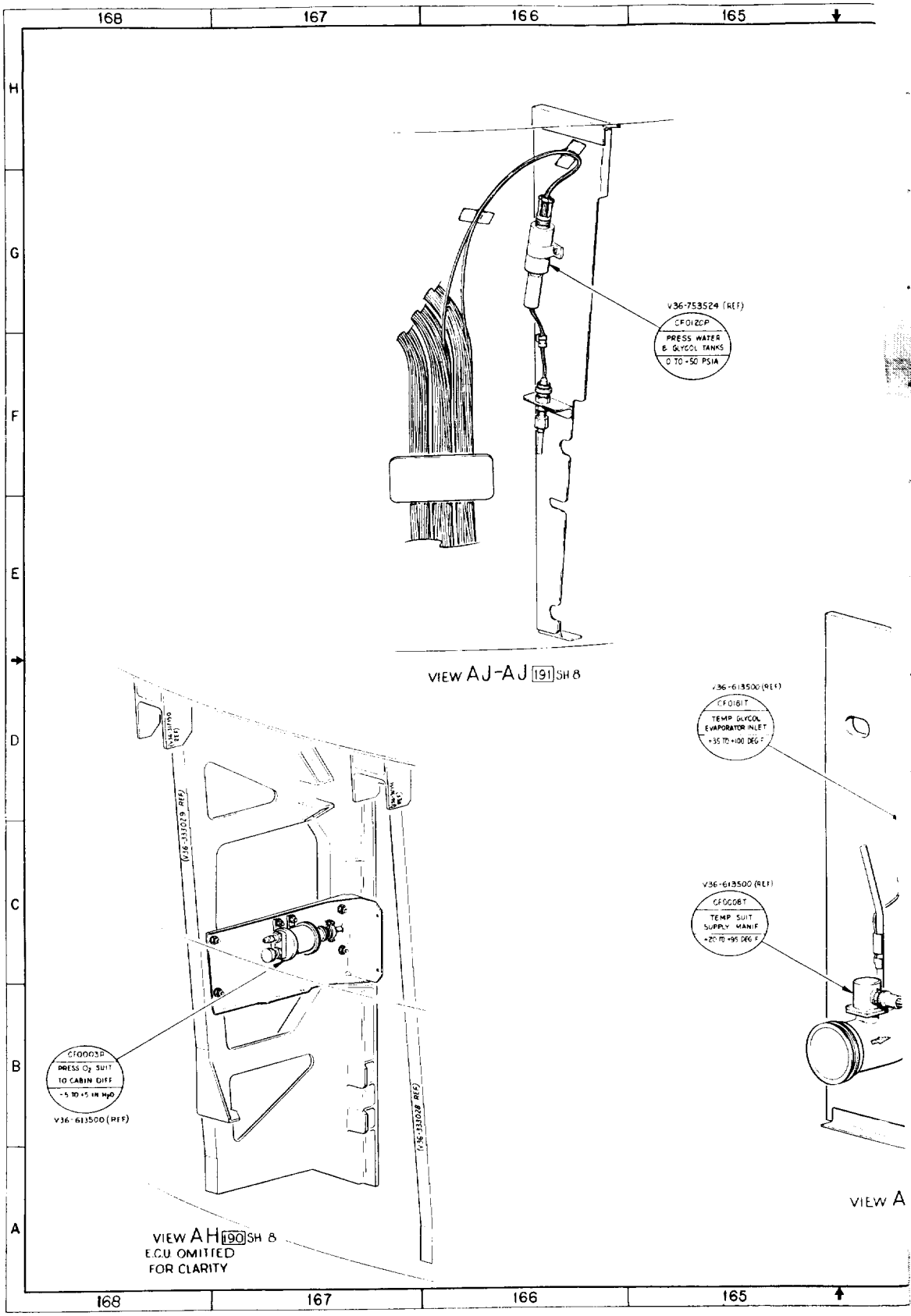
FOLDOUT FRAME 3



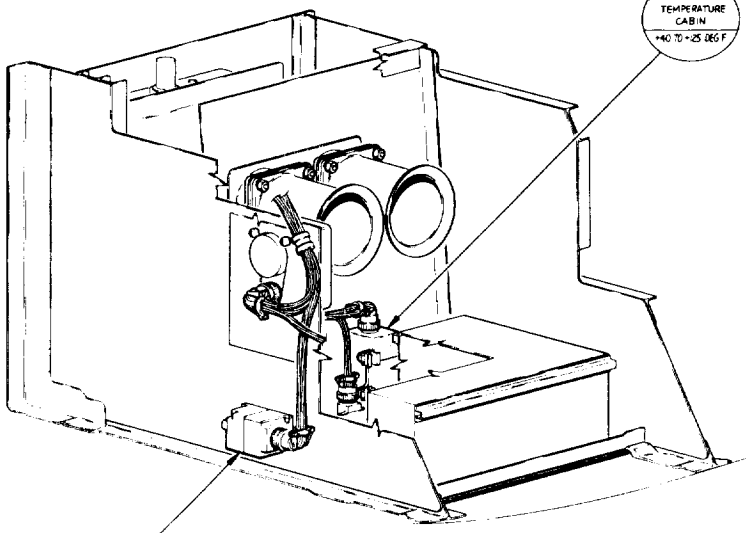
FOLDOUT FRAME 4



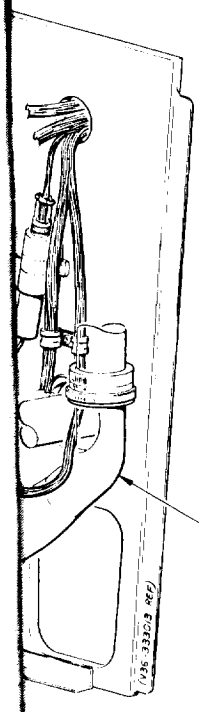
FOLDOUT FRAME 5



FOLDOUT FRAME 1



VIEW AF-AF 182 SH 8



DUCT - SUIT CIRCUIT TO ENVIRONMENTAL CONTROL UNIT SUPPLY V36-615814 (REF)

G-AG 189 SH 8

STOWAGE ASSY-FWD V36-601232 (REF)

AE

STRUCTURE, MAIN DISPLAY CONSOLE V36-335001 (REF)

COMPLETE DISPLAYS AND CONTROLS INSTL V56-761101 (AX) (R

MAIN DISPLAY CONSOLE INSTL V56-761000 (REF)

DESIGN LAYOUT, INSTRUMENT FACES, MAIN DISPLAY CONSOLE V56-976001 (REF)

ELECTRICAL SYS INSTL, MAIN DISPLAY CONSOLE V56-445061 (REF)

ENVIRONMENTAL CONTROL SYS INSTL COMPLETE V36-610001 (AK) (REF)

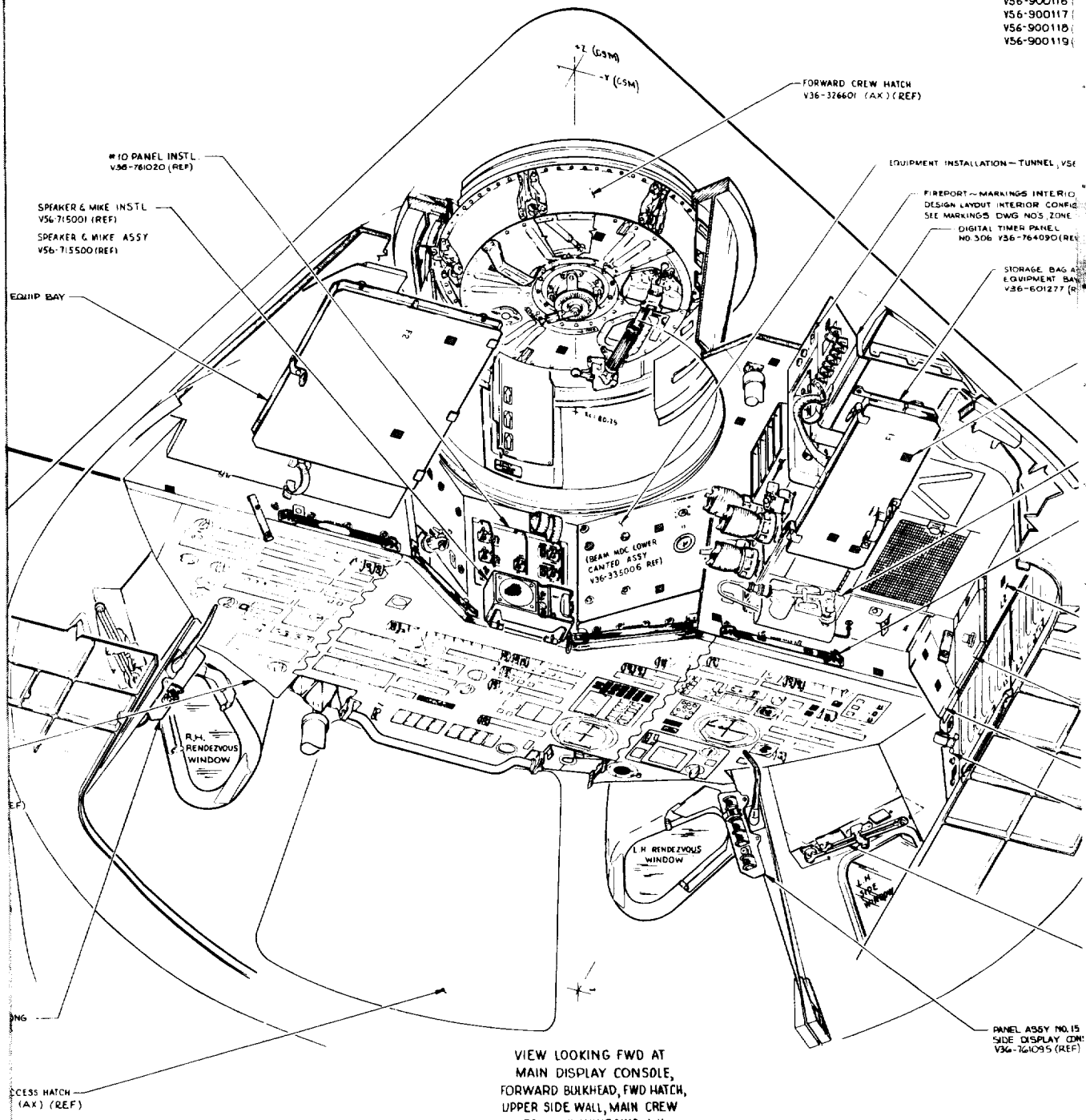
PANEL ASSY NO.16 R.H. LI SIDE DISPLAY CONSOLE V36-761096 (REF)

UNIFIED CREW AI INSTL V36-311189

SH 7 REV A

FOLDOUT FRAME 2

159	158	157	156	155

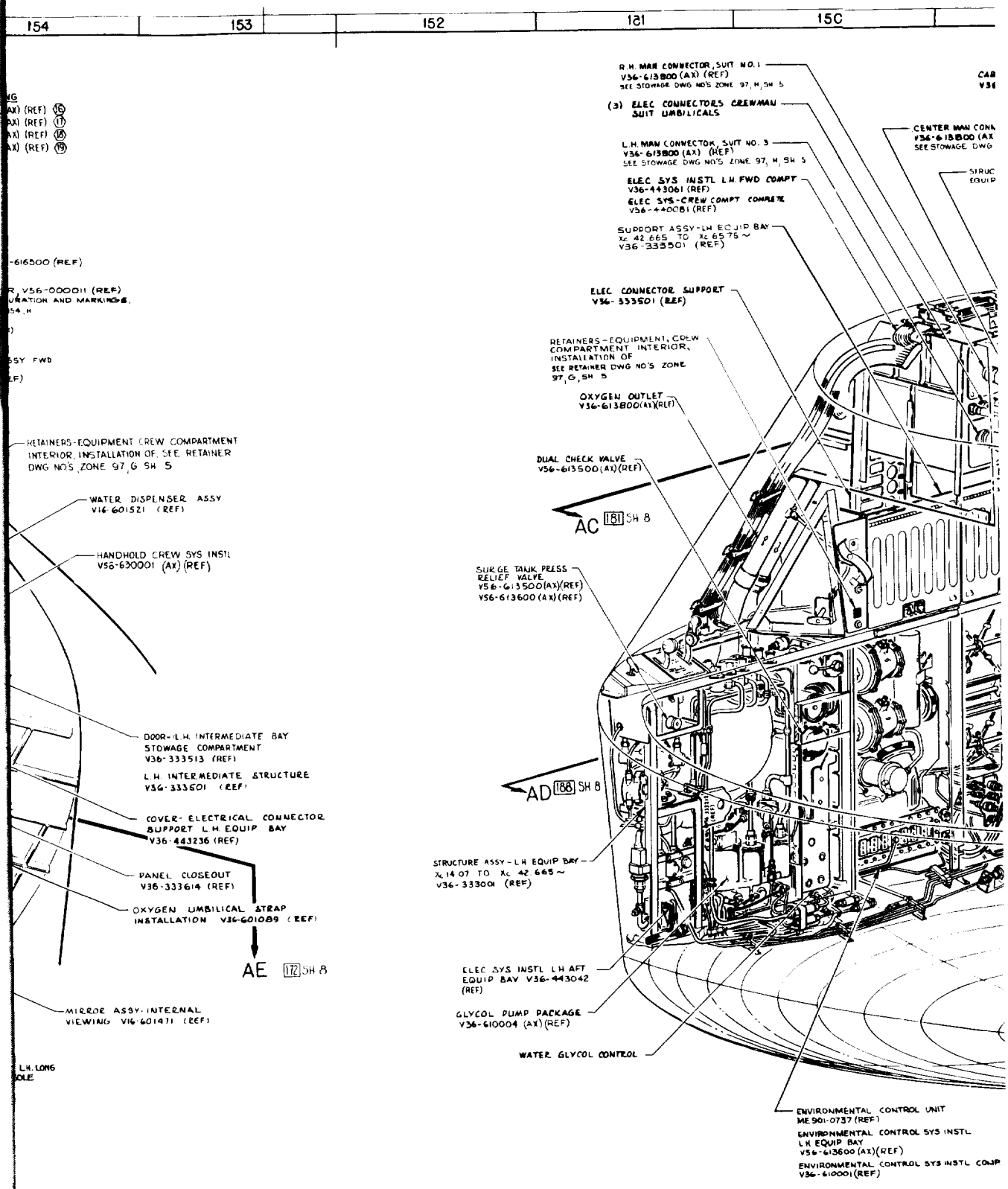


VIEW LOOKING FWD AT MAIN DISPLAY CONSOLE, FORWARD BULKHEAD, FWD HATCH, UPPER SIDE WALL, MAIN CREW HATCH, L.H. WINDOWS, L.H. FWD AND INTERMEDIATE EQUIP BAYS

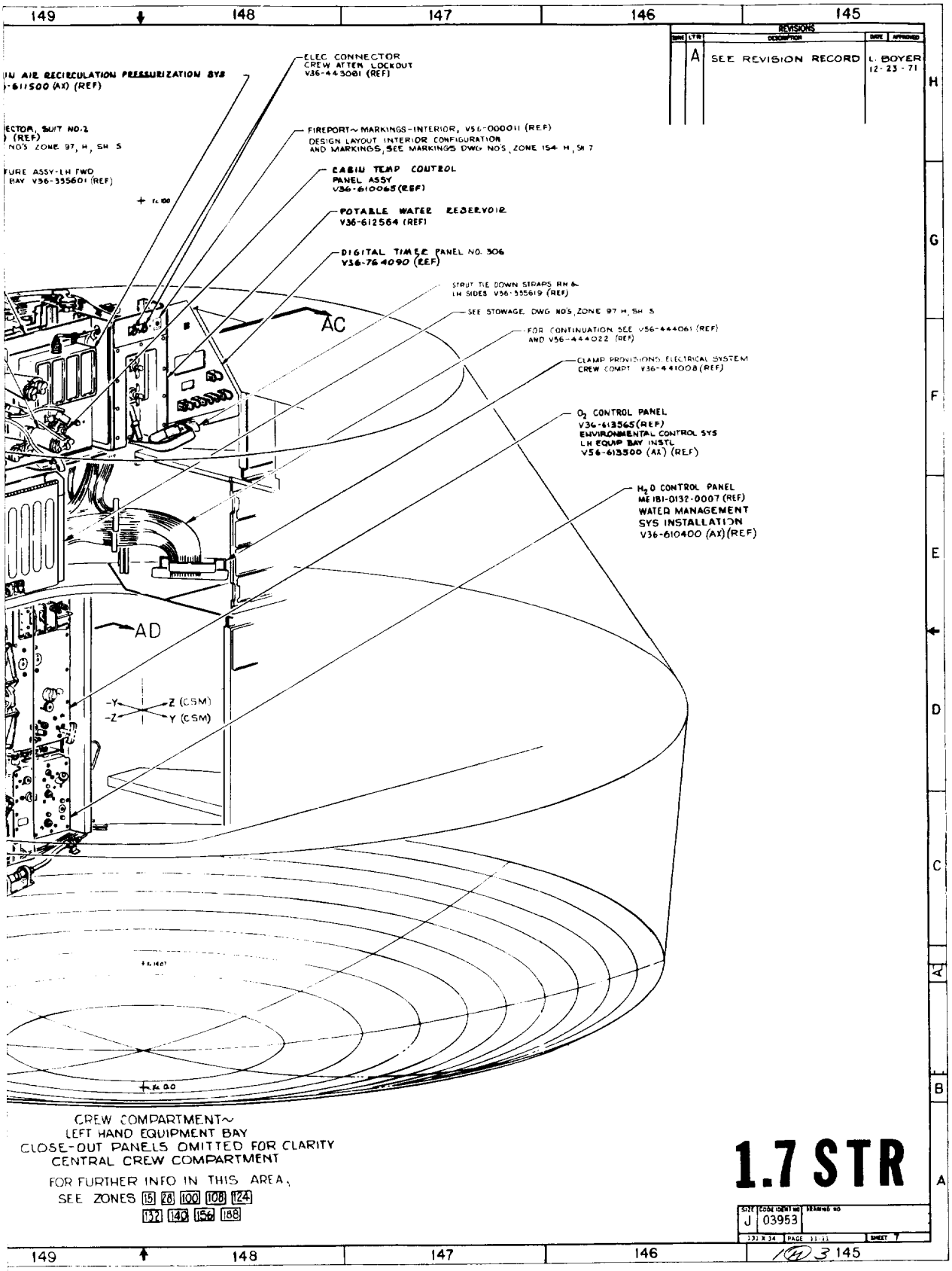
FOR FURTHER INFO IN THIS AREA
SEE ZONES 15 28 100 108
124 132 140 148

159	158	157	156	155

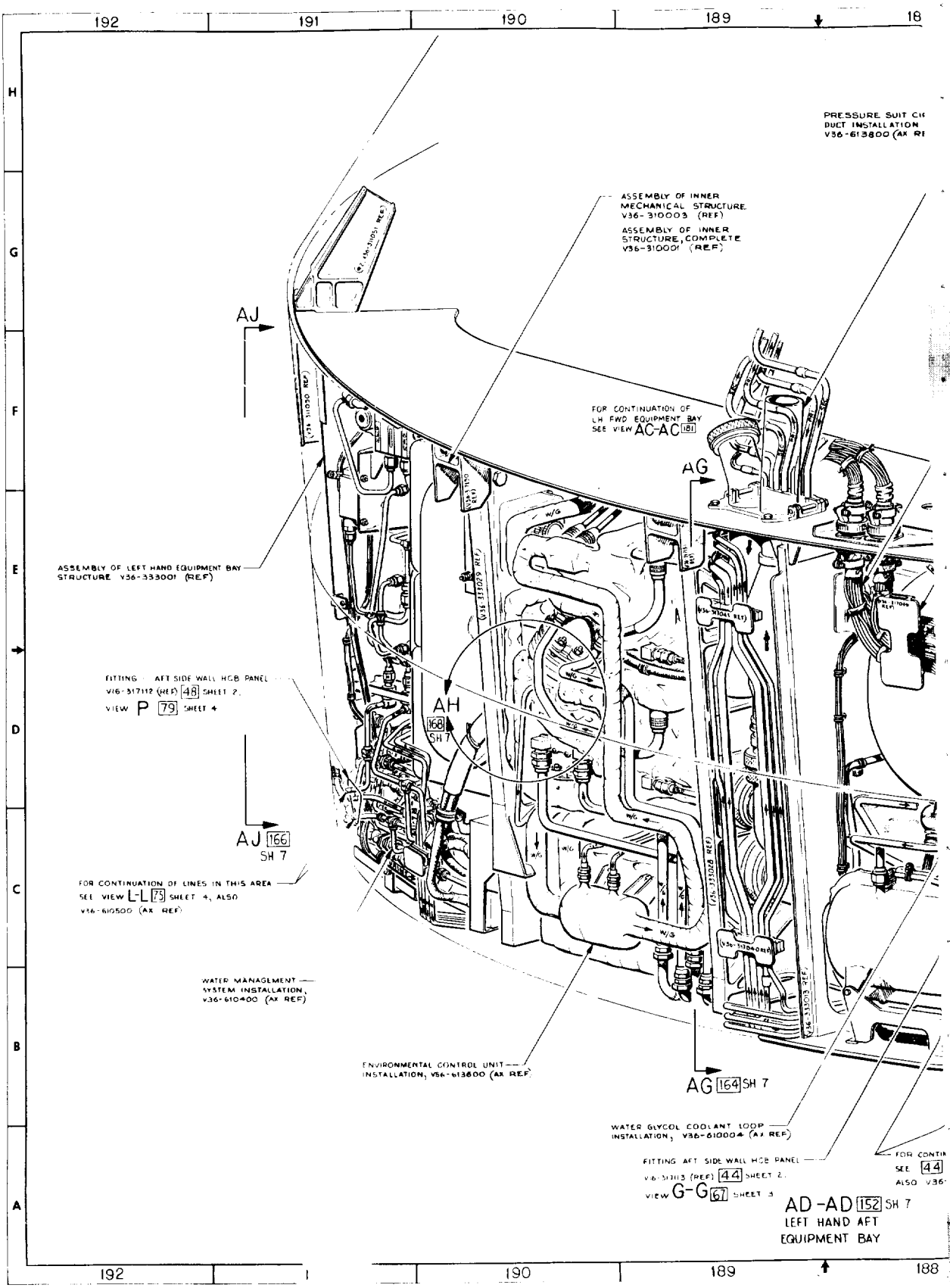
FOLDOUT FRAME 3



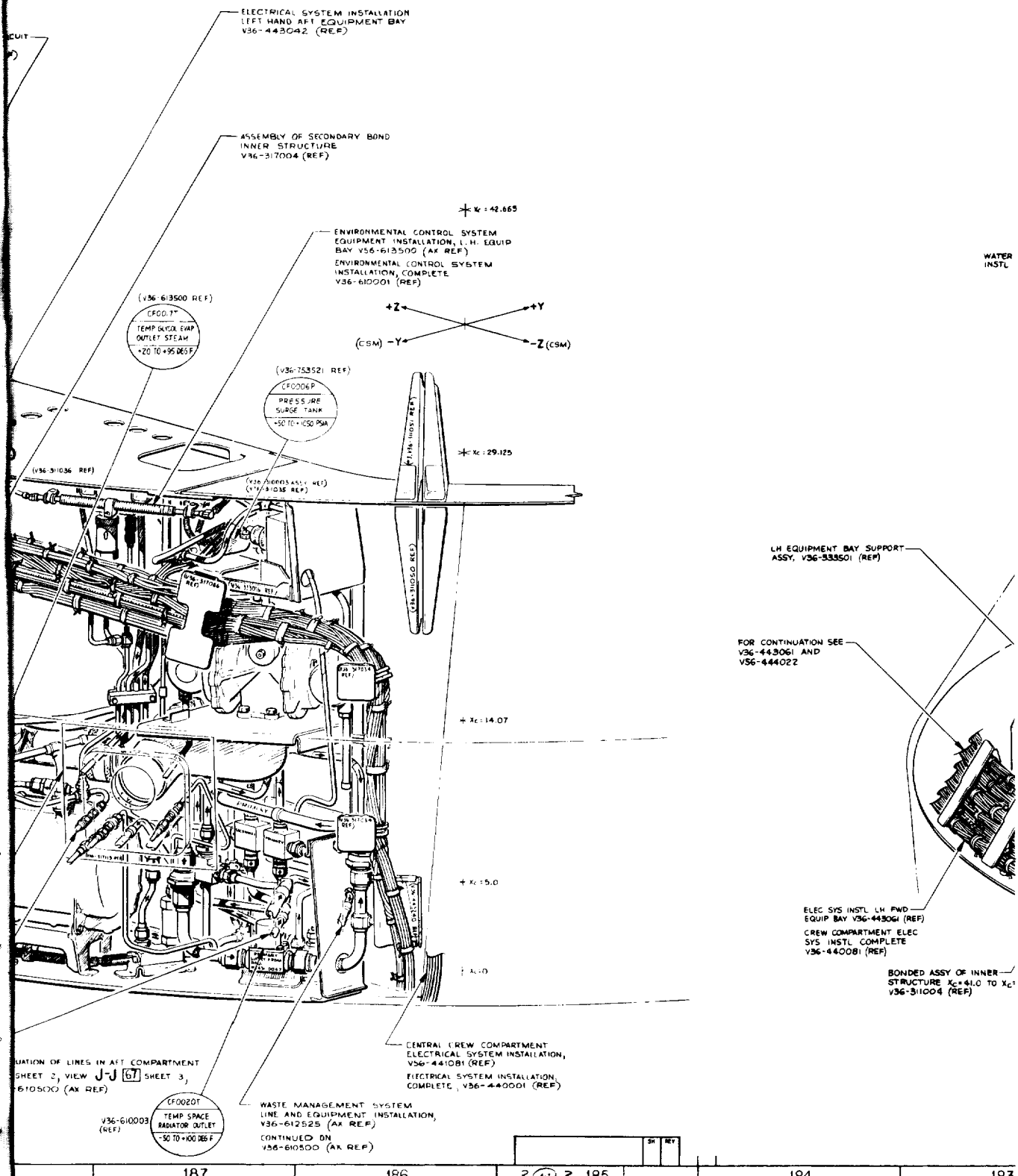
FOLDOUT FRAME 4



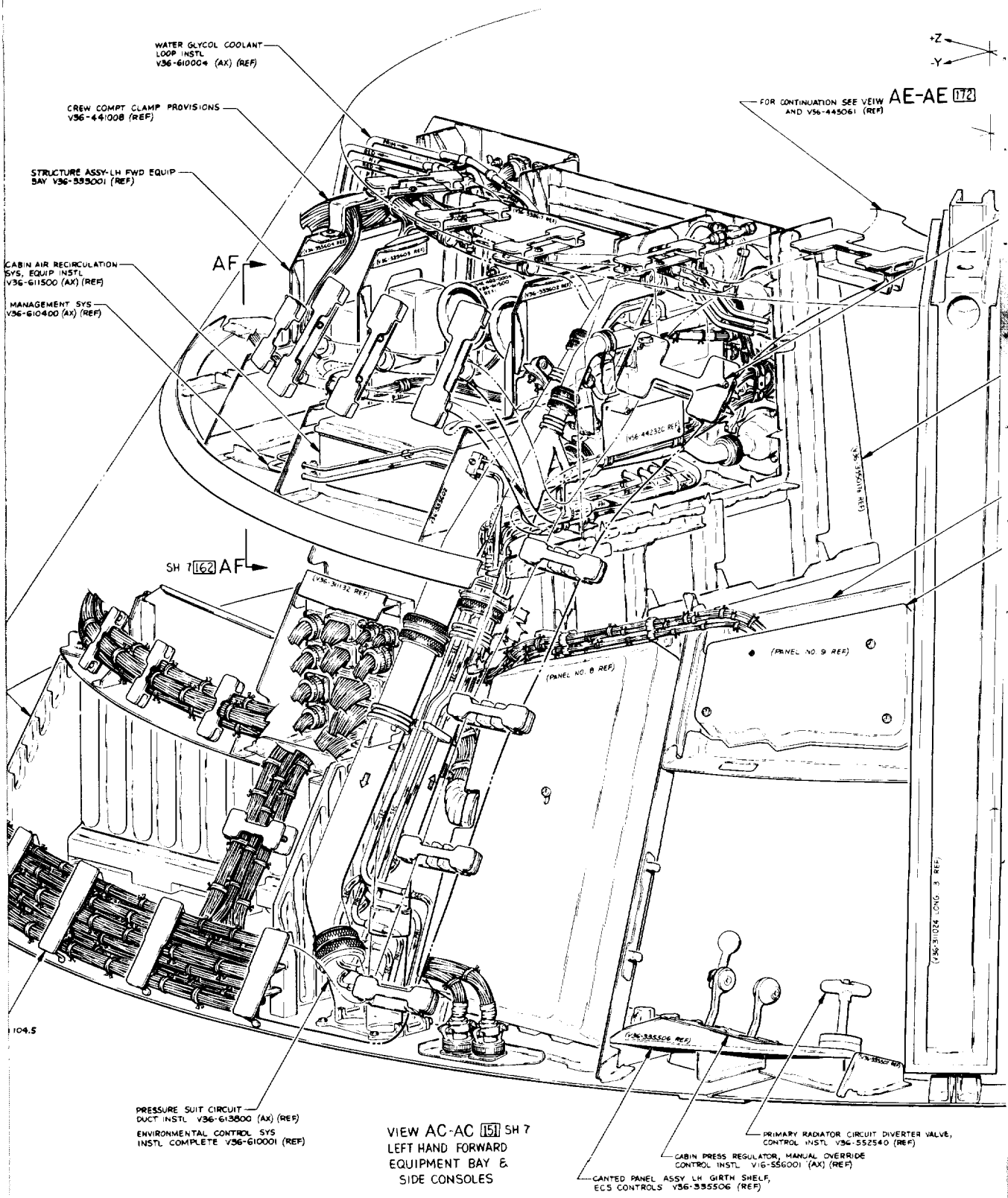
FOLDOUT FRAME 5



FOLDOUT FRAME 1

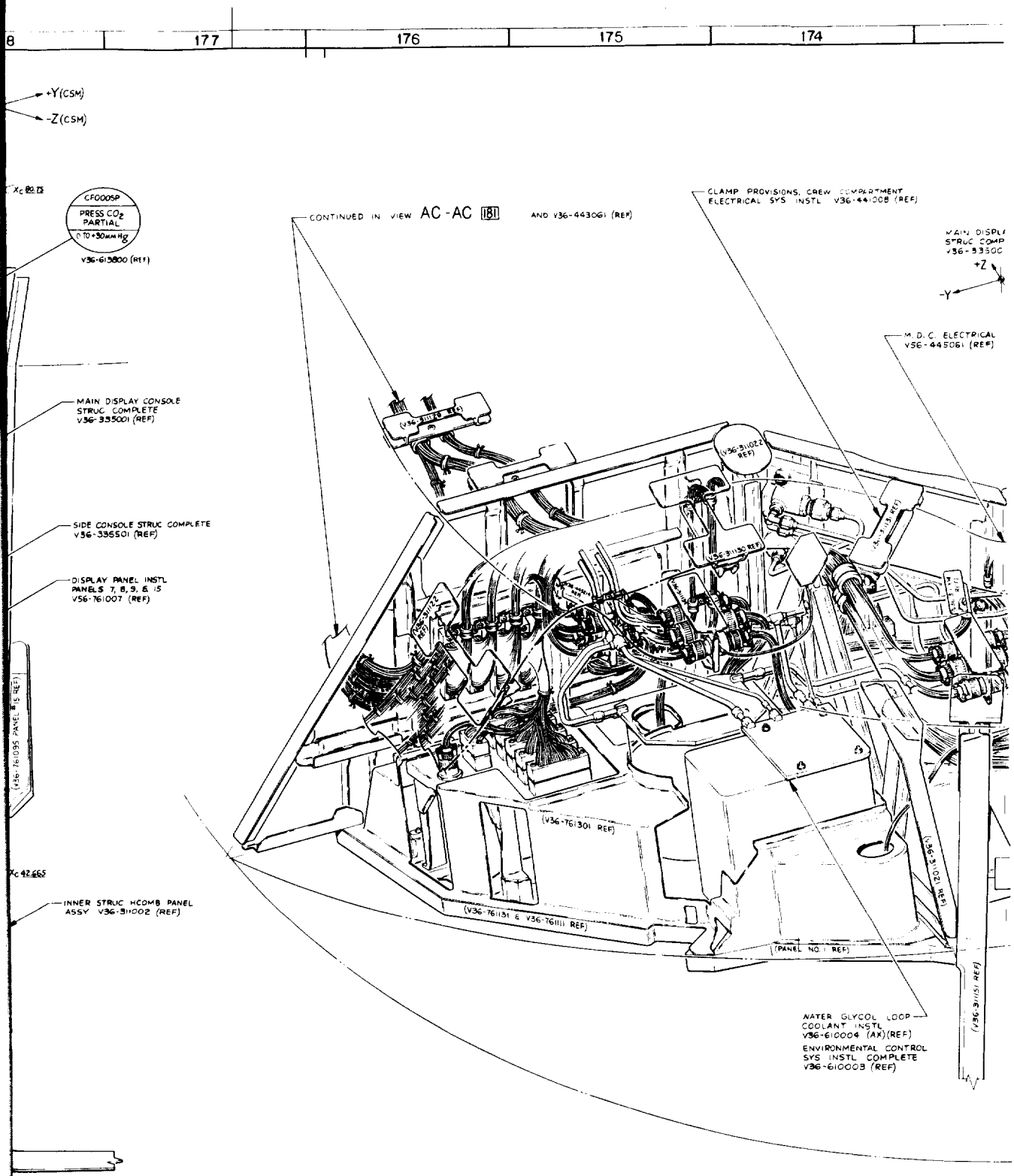


FOLDOUT FRAME 2

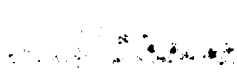


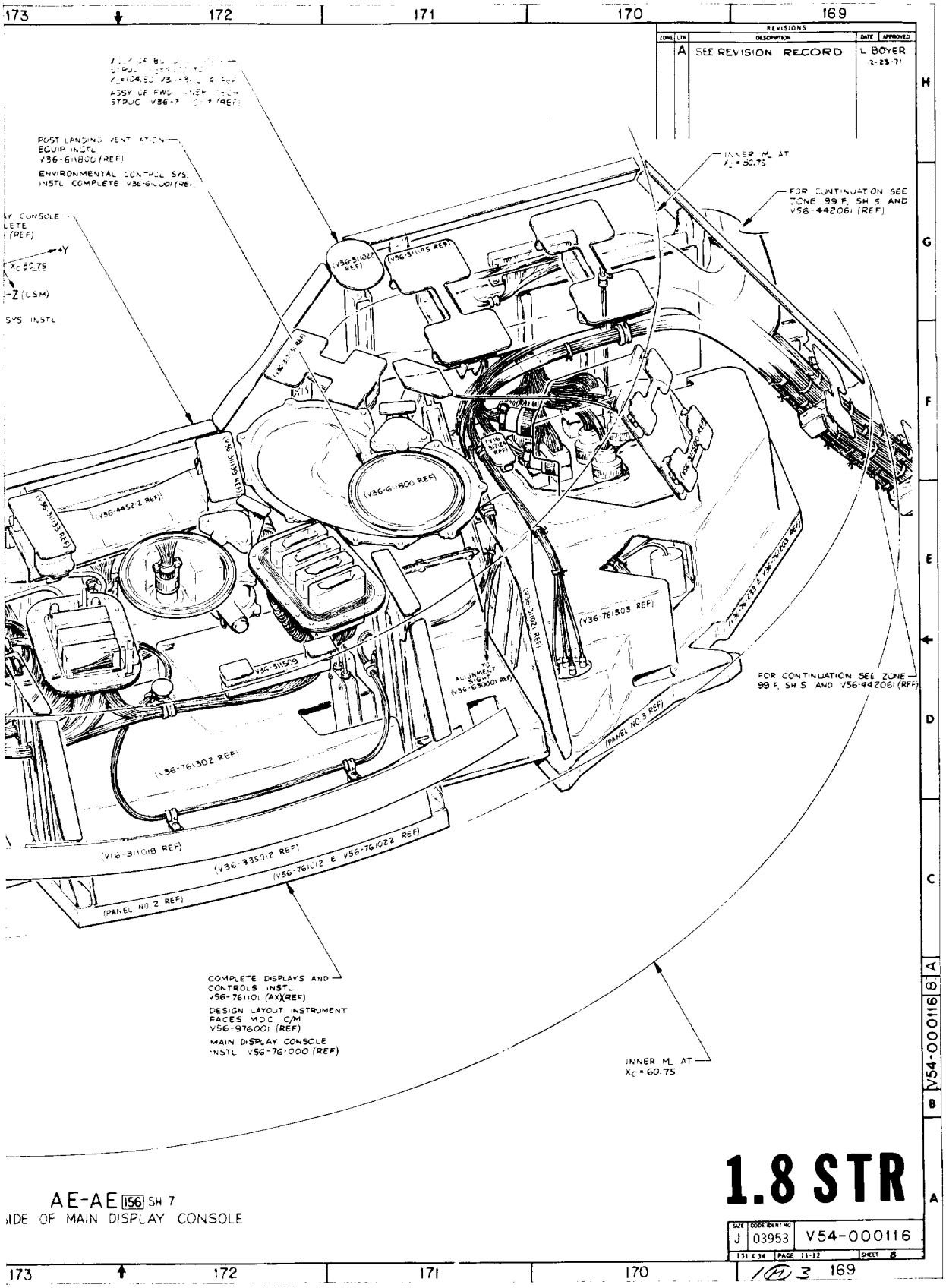
VIEW AC-AC 151 SH 7
LEFT HAND FORWARD
EQUIPMENT BAY &
SIDE CONSOLES

FOLDOUT FRAME 3



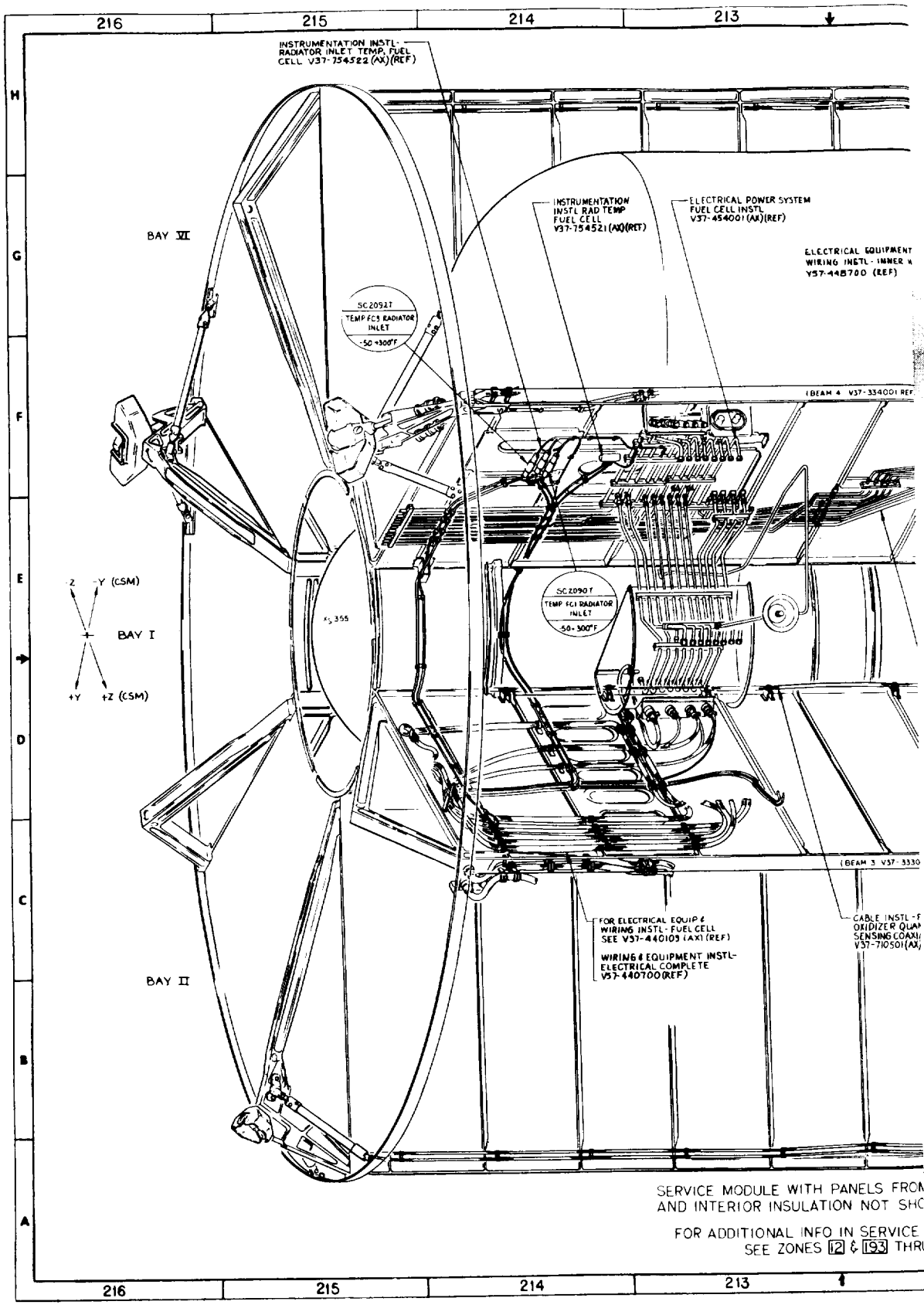
FOLDOUT FRAME 4



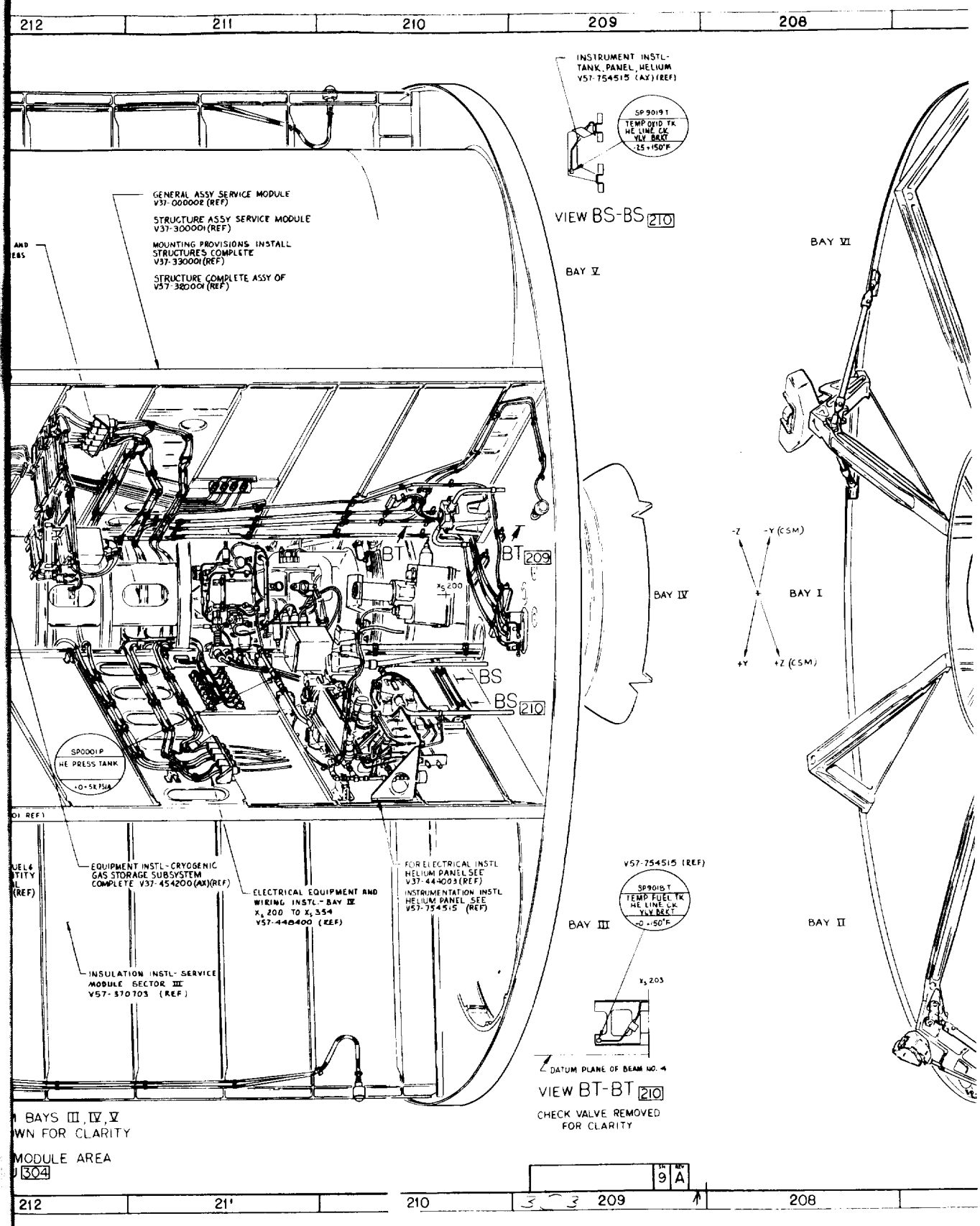


AE-AE 156 SH 7
IDE OF MAIN DISPLAY CONSOLE

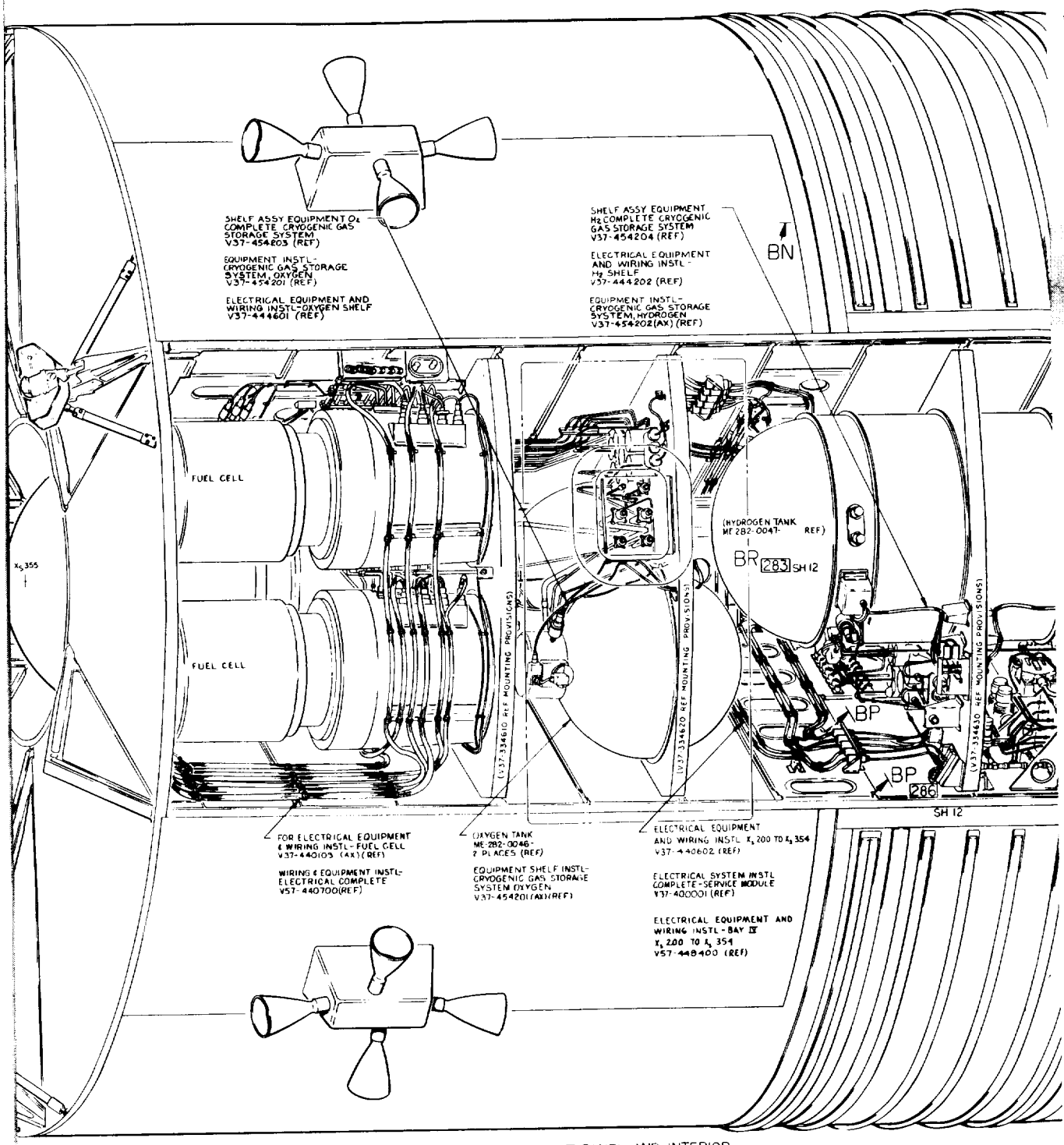
FOLDOUT FRAME 5



FOLDOUT FRAME 1



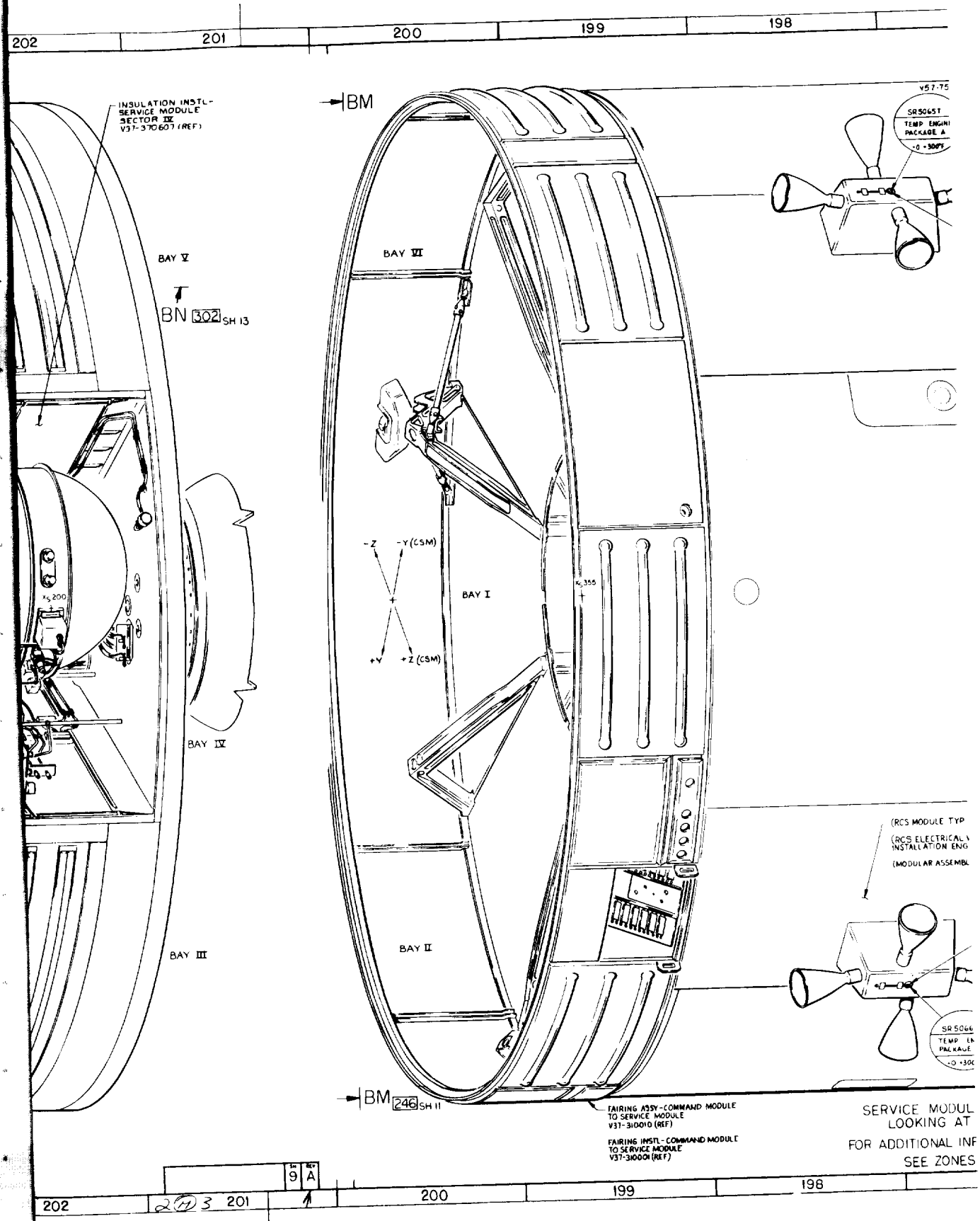
FOLDOUT FRAME 2



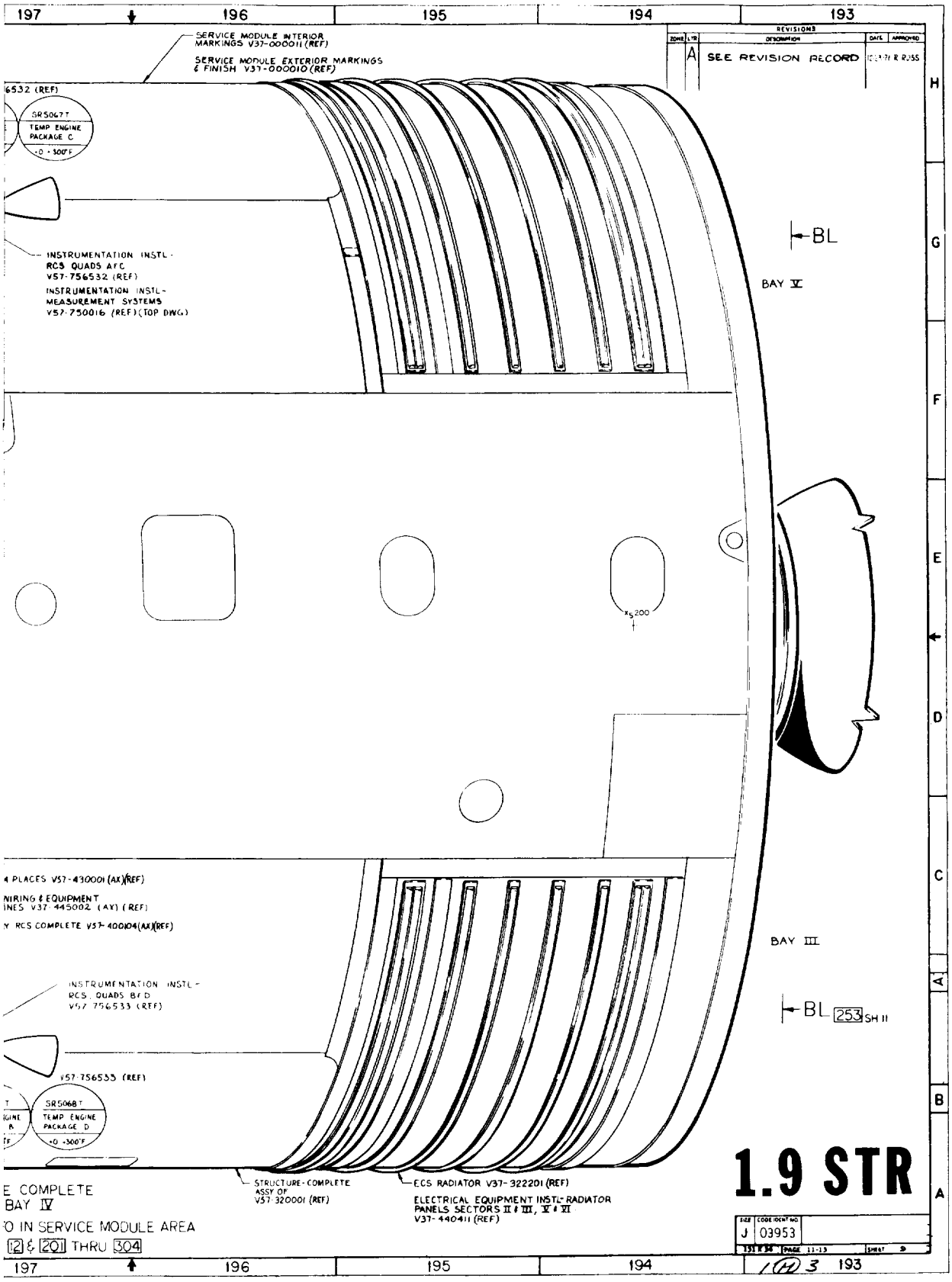
SERVICE MODULE WITH BAY IV PANEL AND INTERIOR INSULATION NOT SHOWN FOR CLARITY

FOR ADDITIONAL INFO IN SERVICE MODULE AREA SEE ZONES 12 & 193 THRU 304

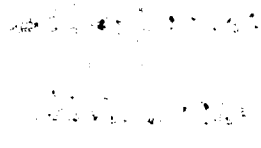
FOLDOUT FRAME 3



FOLDOUT FRAME 4



FOLDOUT FRAME 5



240 | 239 | 238 | 237

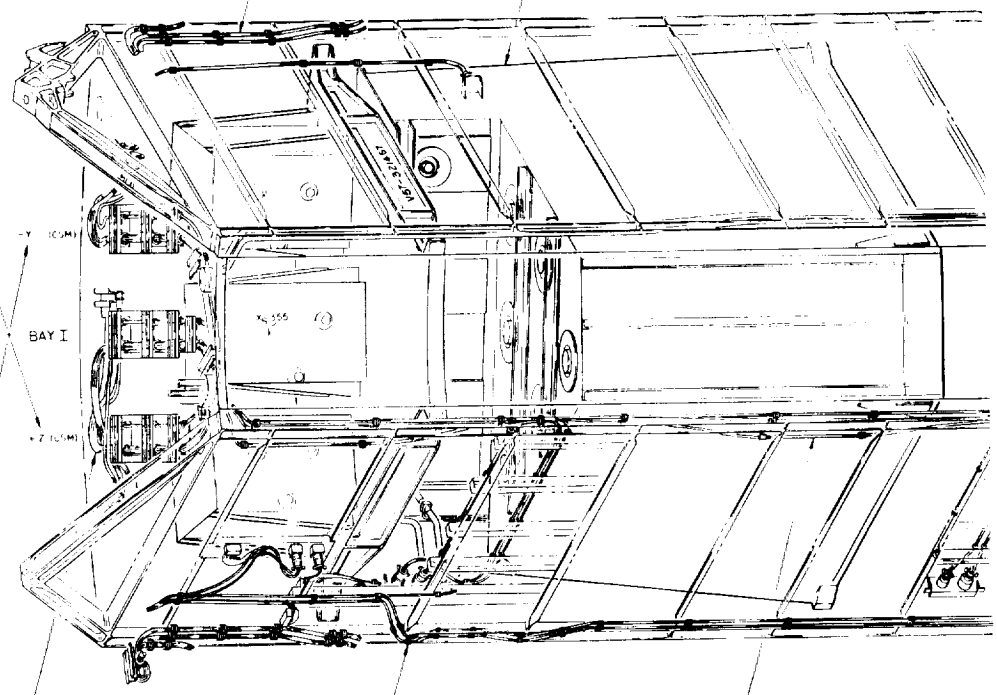
H
G
F
E
D
C
B
A

ELECTRICAL EQUIPMENT & WIRING INSTALLATION - BAYS III & VI V57-448500 (REF)

INSTL - RCS PROPULSION SYSTEM STORAGE MODULE V57-400106 (REF)

MODULE - RCS PSM STRUCTURE ASSY V57-32346S (REF)

ELECTRICAL INSTL REACTION CONTROL SYSTEM PROPELLANT STORAGE MODULE V57-448040 (REF)



BW 308 SH 13

ELECTRICAL EQUIPMENT & WIRING INSTL - BAYS II & V V57-448200 (REF)

ELECTRICAL EQUIPMENT & WIRING INSTL - RADIAL BEAM I, SECTOR I V57-448100 (REF)

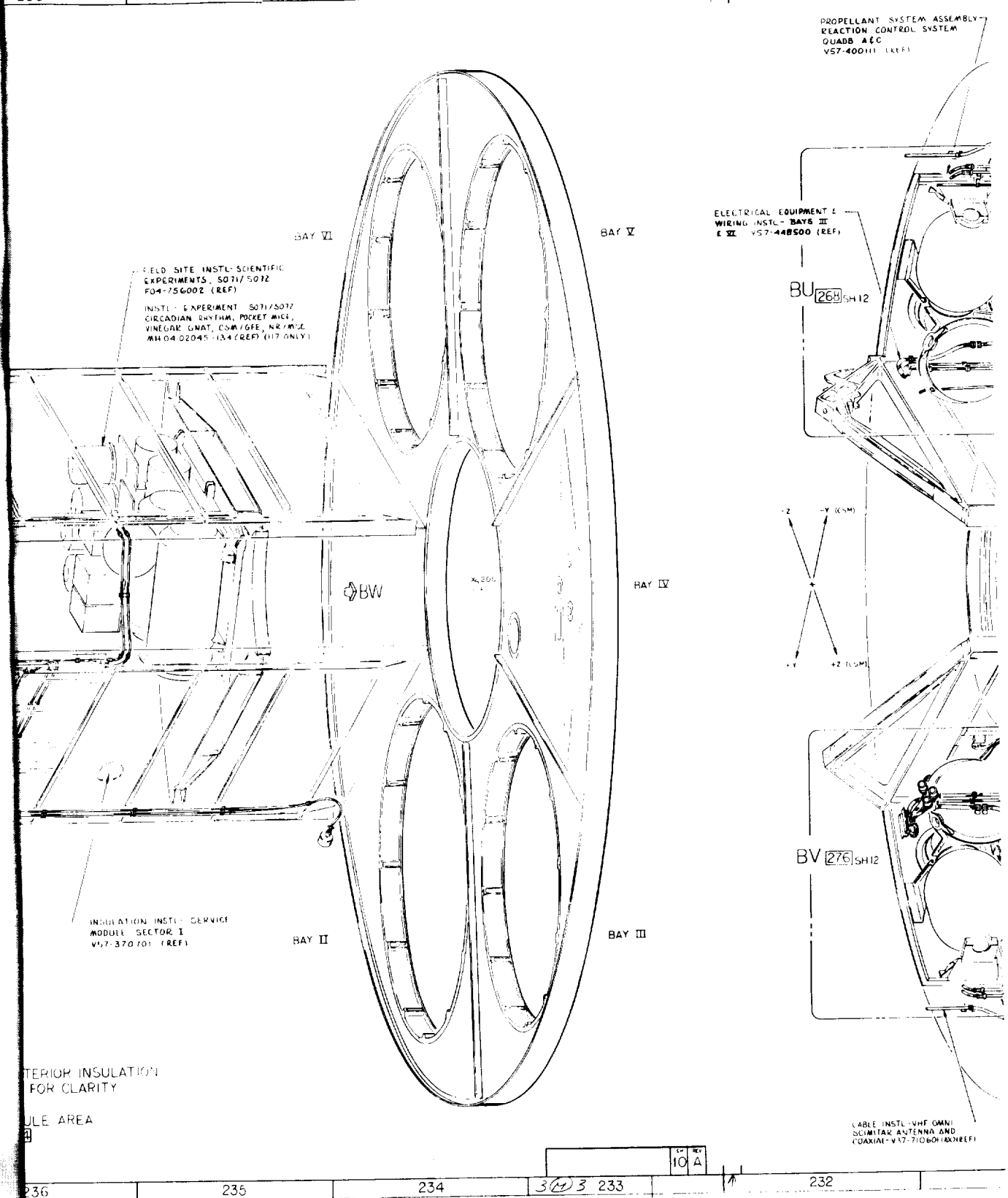
ELECTRICAL EQUIPMENT & WIRING INSTL - DESCENT BATTERY V57-448030 (REF)

SERVICE MODULE WITH EXTERIOR PANELS, IN
BEAMS II, III, IV, V, AND TANKS NOT SHOWN

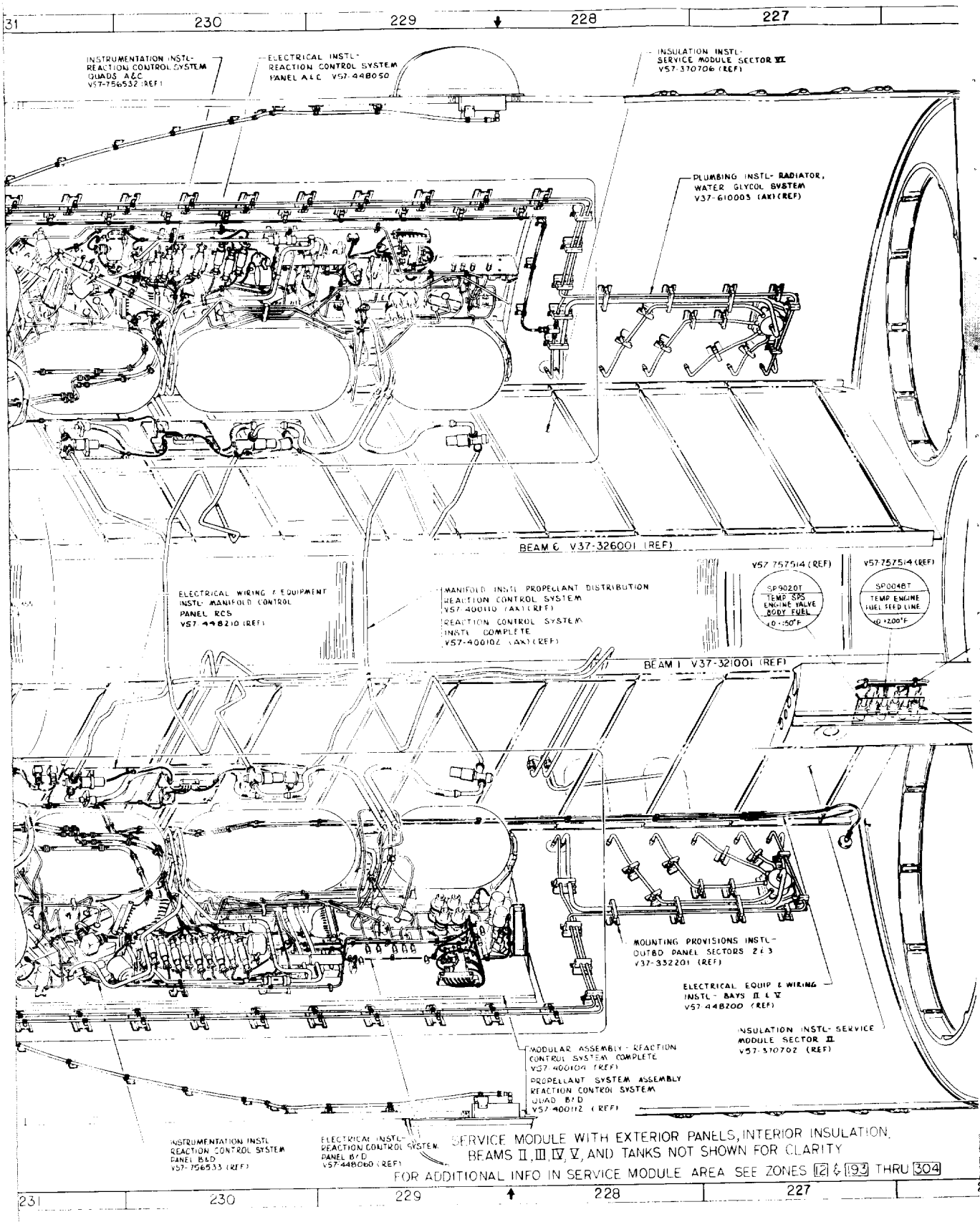
FOR ADDITIONAL INFO IN SERVICE MOD
SEE ZONES 12 & 193 THRU 30

240 | 239 | 238 | 237

FOLDOUT FRAME 1



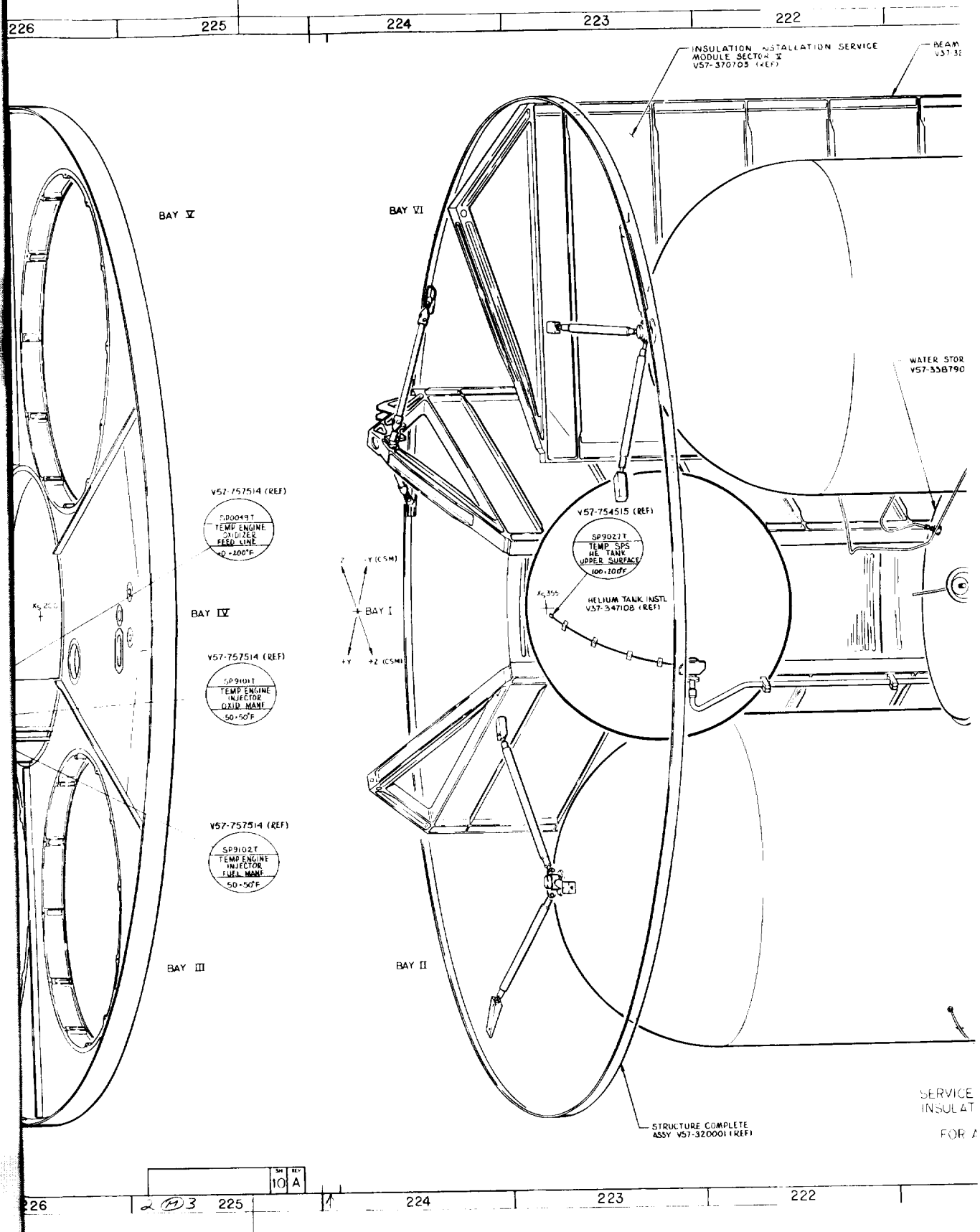
FOLDOUT FRAME 2



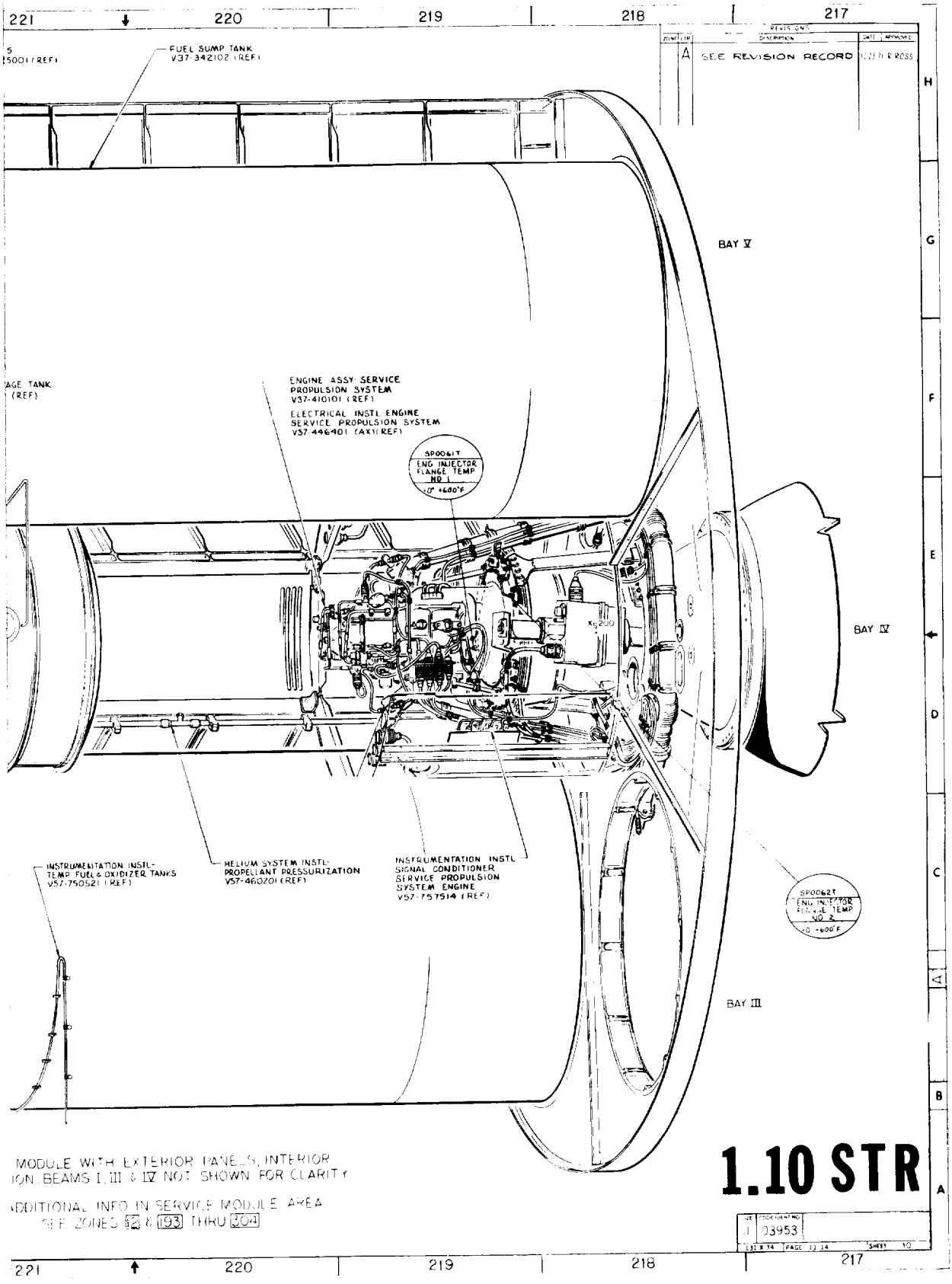
SERVICE MODULE WITH EXTERIOR PANELS, INTERIOR INSULATION, BEAMS II, III, IV, V, AND TANKS NOT SHOWN FOR CLARITY

FOR ADDITIONAL INFO IN SERVICE MODULE AREA SEE ZONES 12 & 193 THRU 304

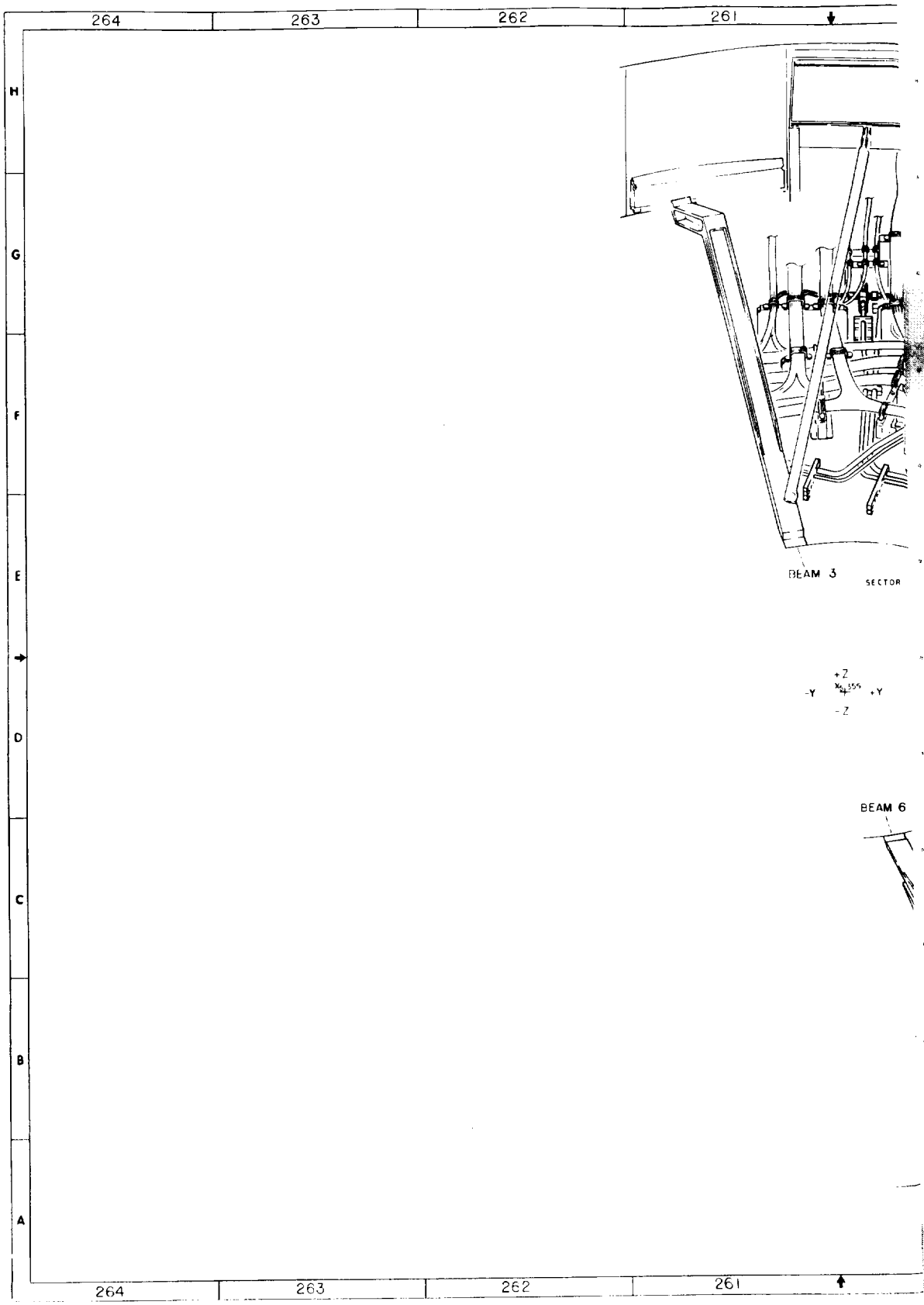
FOLDOUT FRAME 3



FOLDOUT FRAME 4

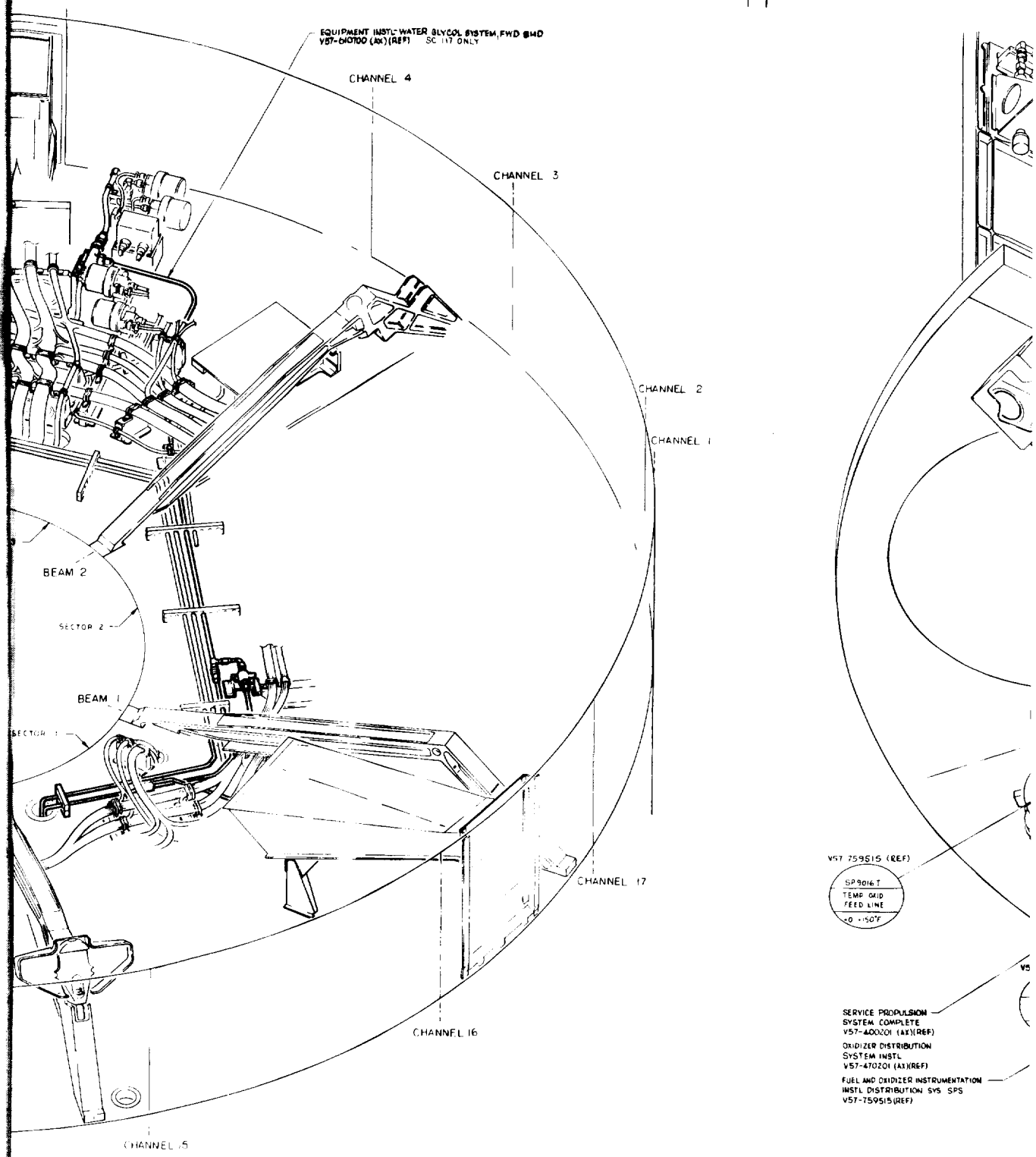


FOLDOUT FRAME 5



FOLDOUT FRAME 1

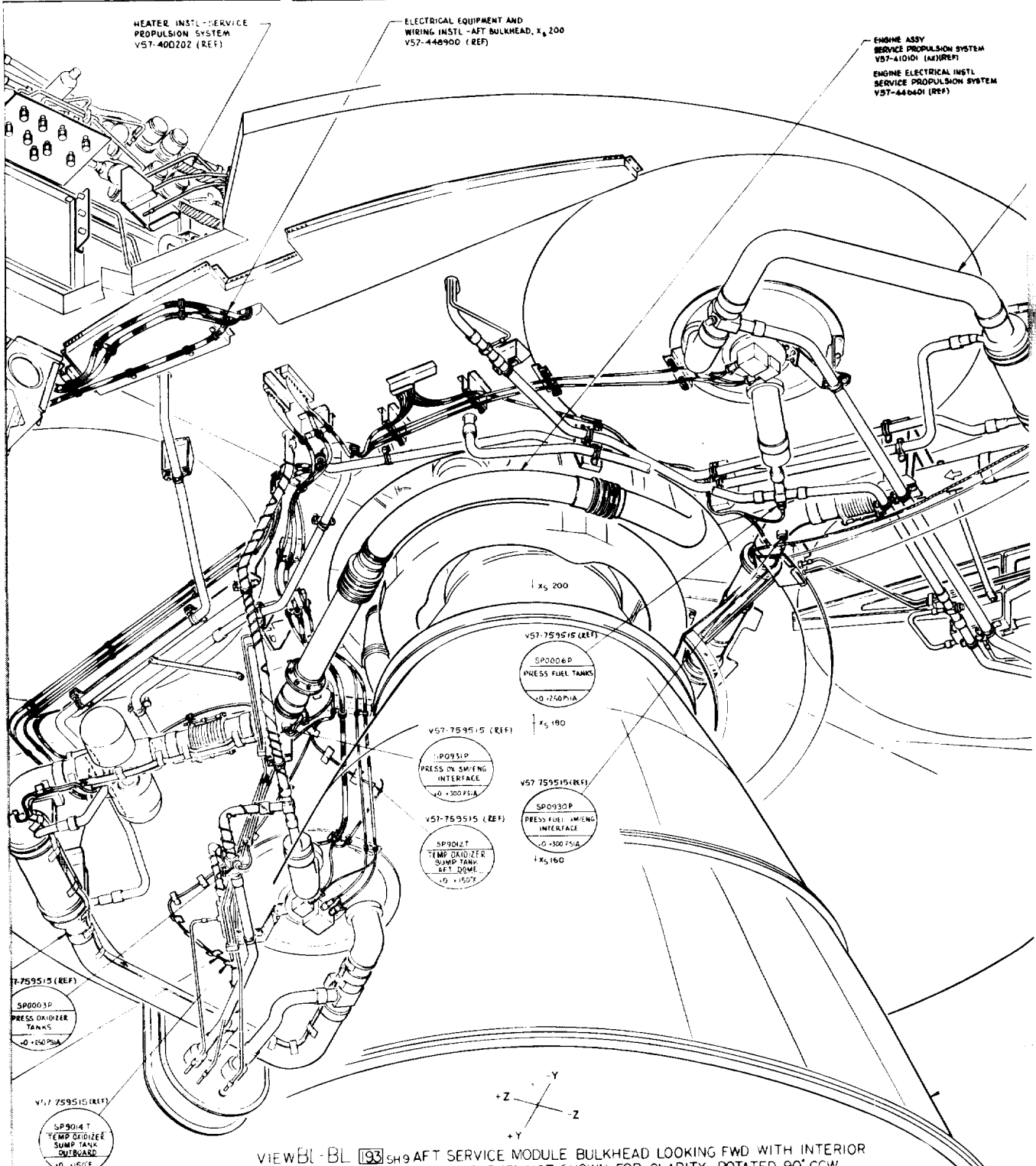
260 | 259 | 258 | 257 | 256



VIEW BY-BY 243 117 ONLY

260 | 259 | 258 | 257 | 256

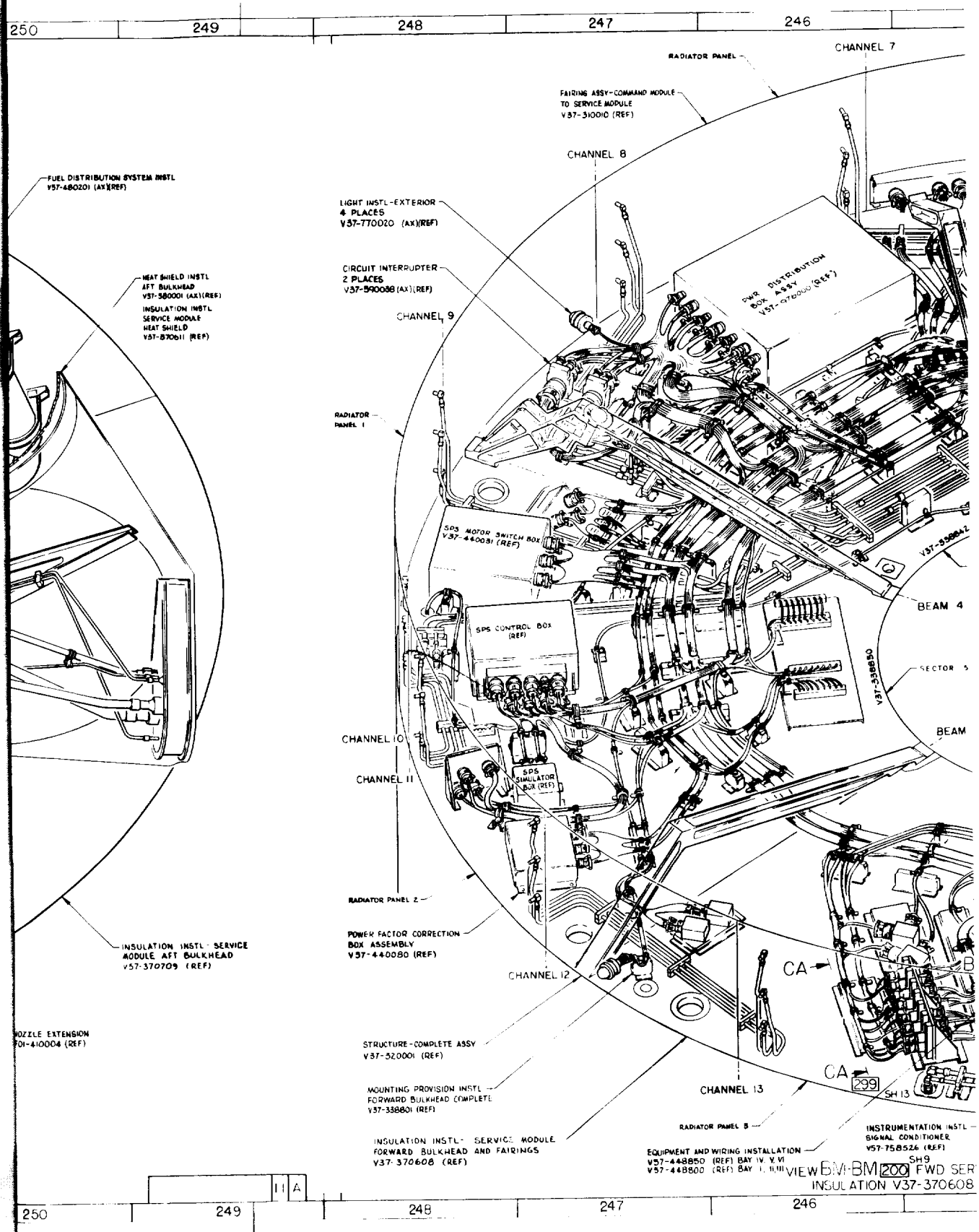
FOLDOUT FRAME 2



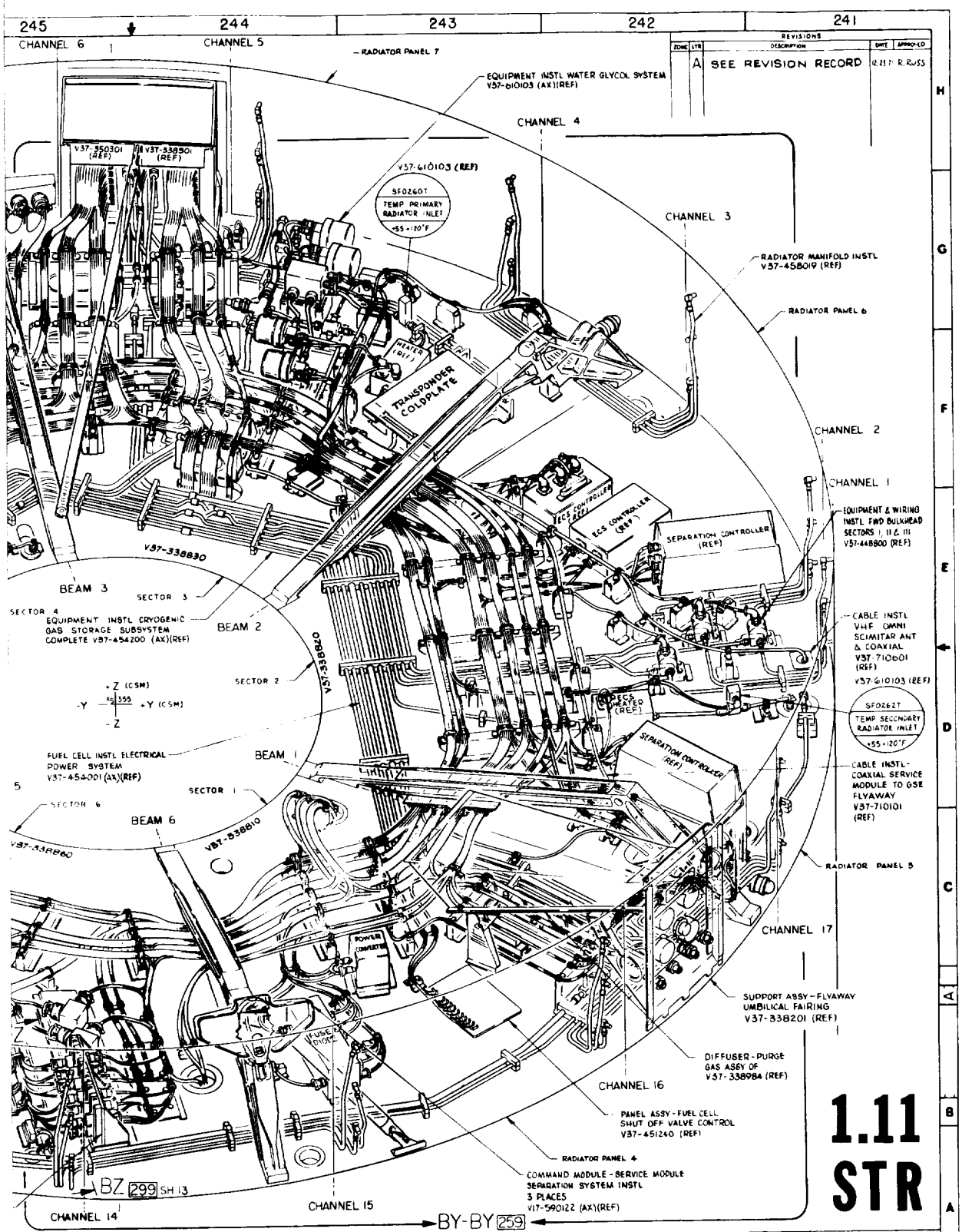
VIEW BL - BL 193 SH 9 AFT SERVICE MODULE BULKHEAD LOOKING FWD WITH INTERIOR INSULATION V57-370727 (REF) NOT SHOWN FOR CLARITY ROTATED 90° CCW

FOR ADDITIONAL INFO IN SERVICE MODULE AREA SEE ZONES 12 & 193 THRU 304

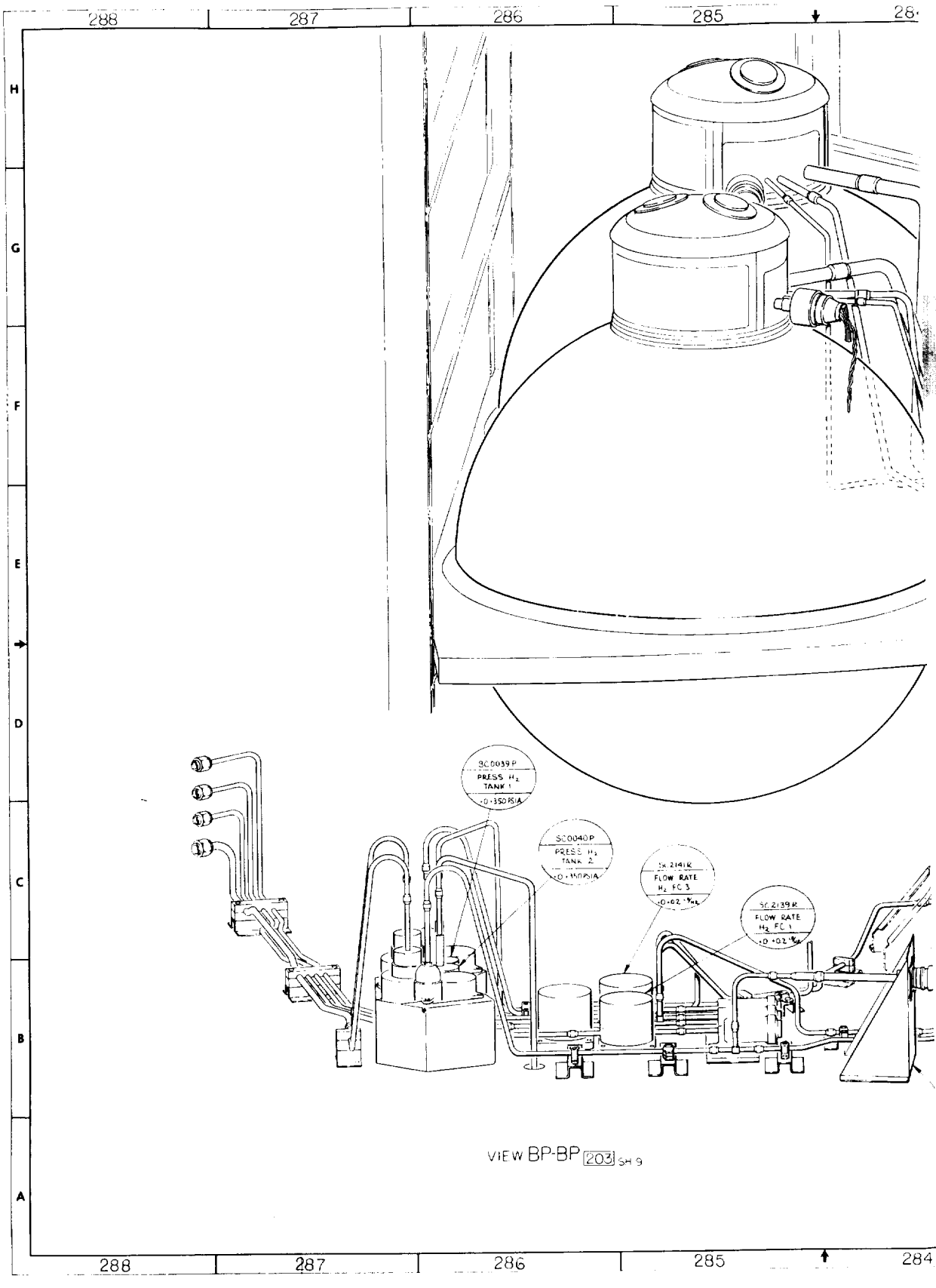
FOLDOUT FRAME 3



FOLDOUT FRAME 4



FOLDOUT FRAME 5



VIEW BP-BP 203 SH 9

FOLDOUT FRAME 1

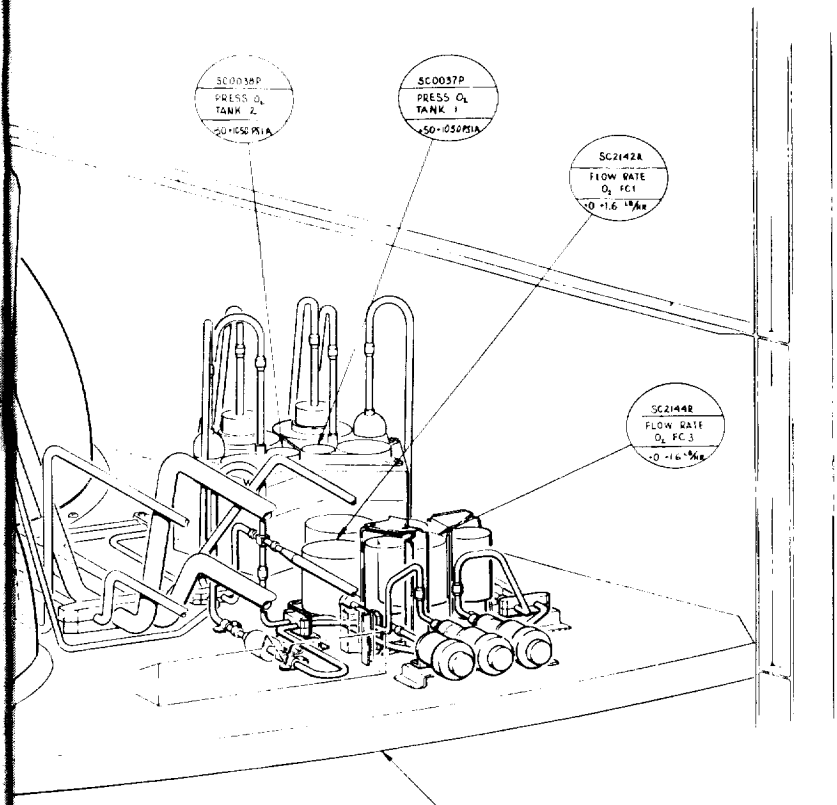
283 282 281 280 279

SC0038P
PRESS O_2 TANK 2
+50 +1050 PSIA

SC0037P
PRESS O_2 TANK 1
+50 +1050 PSIA

SC2142R
FLOW RATE O_2 FC1
+0 +1.6 LB/HR

SC2144R
FLOW RATE O_2 FC3
+0 +1.6 LB/HR



SR5014T
HE TEMP TANK B
+0 +150°F

SR5016T
HE TEMP TANK D
+0 +150°F

SR5784P
FUEL MANIFOLD PRESS SYS B
+0 +400 PSIA

SR5823P
FUEL MANIFOLD PRESS SYS D
+0 +400 PSIA

SR5780P
OXIDIZER MANIFOLD PRESS SYS B
+0 +300 PSIA

EQUIPMENT SHELF INSTL - CRYOGENIC GAS STORAGE SYS OXYGEN V37-454201 (AX) (REF)

VIEW BR-BR 204 SH 9

ROTATED 90° CLOCKWISE

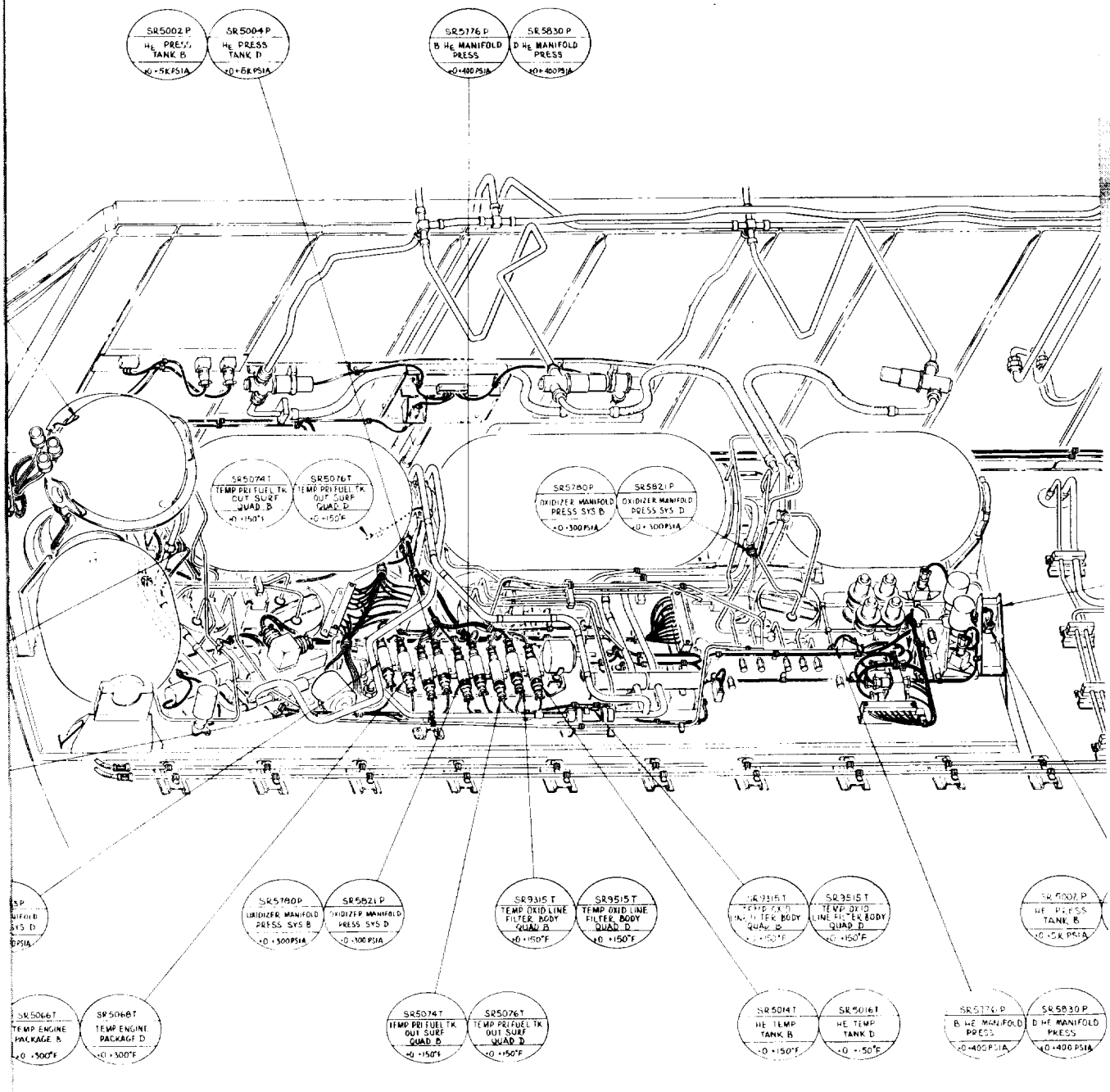
INSTRUMENTATION INSTL - REACTION CONTROL SYSTEM PANEL B&D V57-756533 (REF)

EQUIPMENT SHELF INSTL - CRYOGENIC GAS STORAGE SYSTEM HYDROGEN V37-454202

283 282 323 281 280 279

FOLDOUT FRAME 2

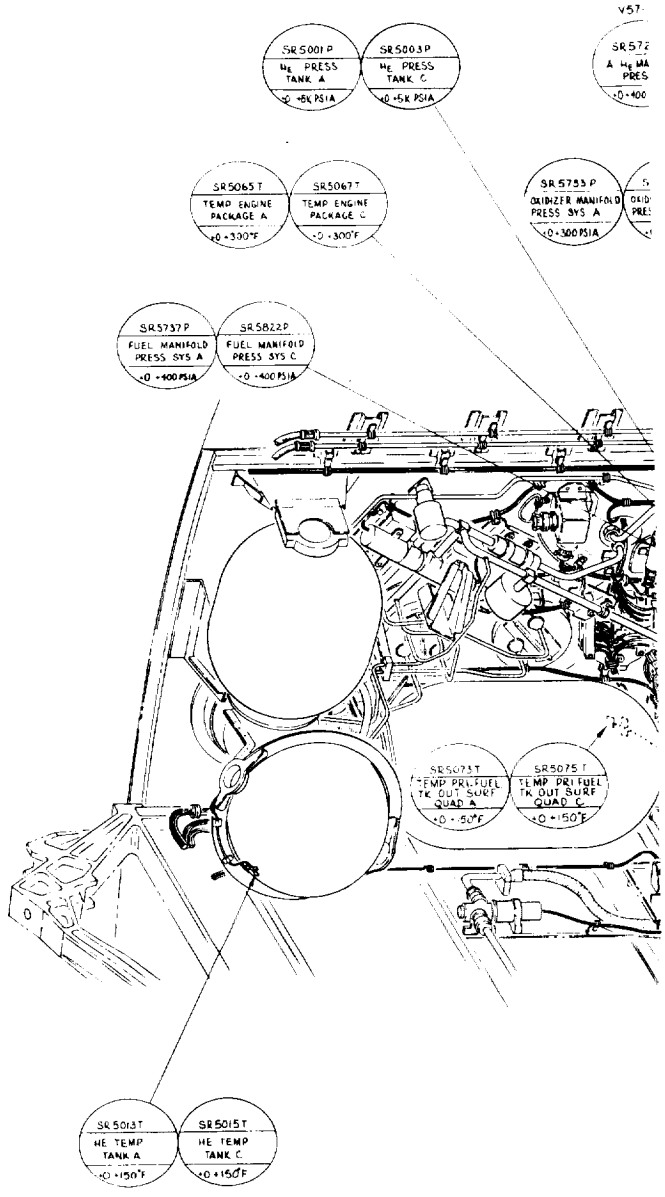
278 277 276 275



VIEW BV 232 SH 10

278 277 276 275

FOLDOUT FRAME 3



HEATER INSTL- REACTION CONTROL SYSTEM QUADS B&D V57-400171 (REF)
(HEATER NOT SHOWN FOR CLARITY)

SR5004P
HE PRESS TANK D
±0+5KPSIA

FOLDOUT FRAME 4

269 | 268 | 267 | 266 | 265

REVISIONS			
ZONE	LTR	DESCRIPTION	DATE / APPROVED
		SEE REVISION RECORD	

756532 (TYP) (REF)

SR5817P
C H_E MANIFOLD PRESS
+0 +400 PSIA

SR5073T
TEMP PRI FUEL TK OUT SURF QUAD A
+0 +150°F

SR5075T
TEMP PRI FUEL TK OUT SURF QUAD C
+0 +150°F

SR9215T
TEMP OXID LINE FILTER BODY QUAD A
+0 +150°F

SR9415T
TEMP OXID LINE FILTER BODY QUAD C
+0 +150°F

SR5729P
A H_E MANIFOLD PRESS
+0 +400 PSIA

SR5817P
C H_E MANIFOLD PRESS
+0 +400 PSIA

SR5001P
H_E PRESS TANK A
+0 +5KPSIA

SR5003T
H_E PRESS TANK C
+0 +5KPSIA

SR5013T
H_E TEMP TANK A
+0 +150°F

SR5015T
H_E TEMP TANK C
+0 +150°F

SR5733P
OXIDIZER MANIFOLD PRESS SYS A
+0 +300 PSIA

SR5820P
OXIDIZER MANIFOLD PRESS SYS C
+0 +300 PSIA

INSTRUMENTATION INSTL
REACTION CONTROL SYSTEM
QUADS A/C
V57 756532 (REF)

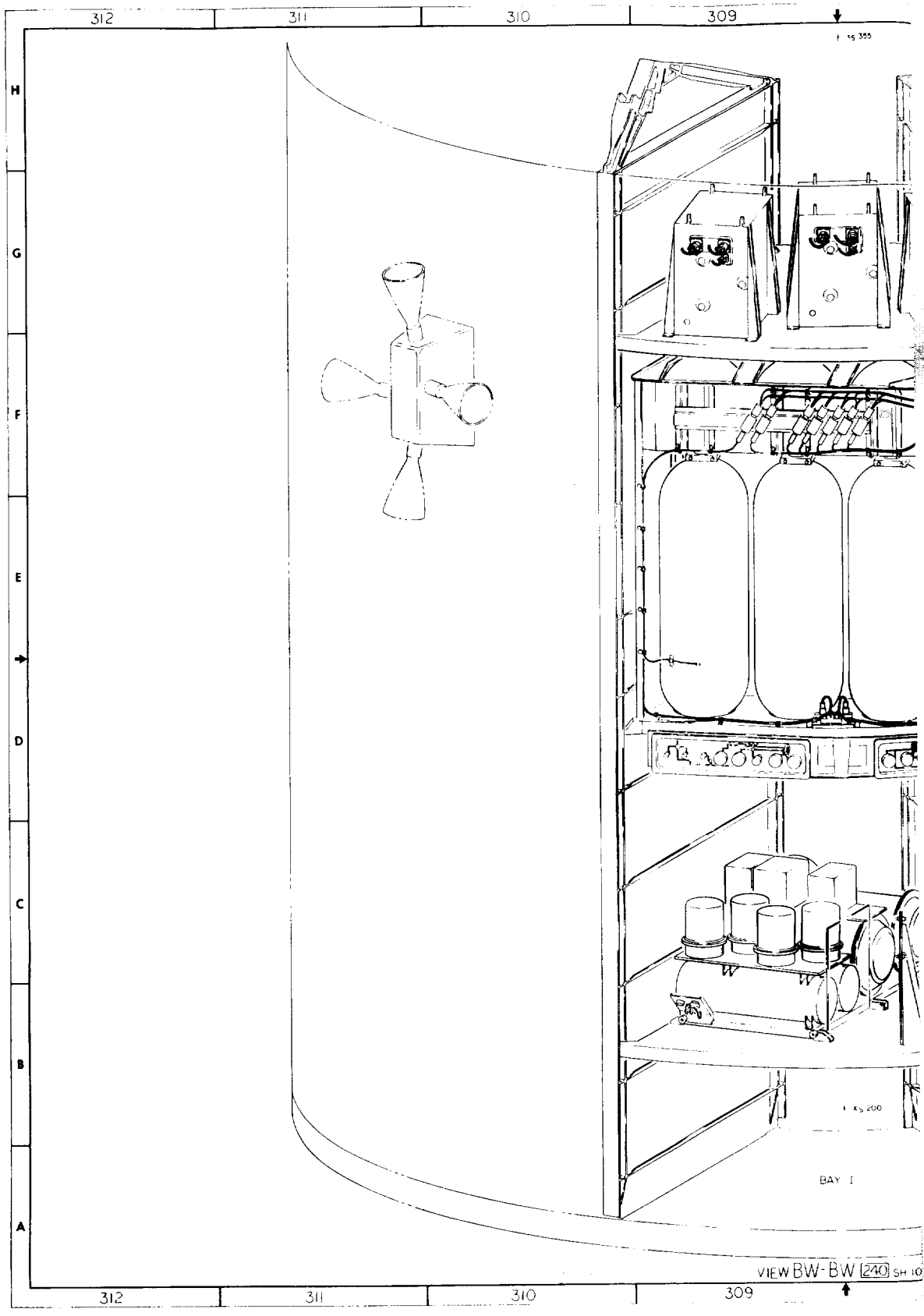
VIEW BU [232] SH 10

1.12 STR

SIZE	DOCM IDENT NO
J	03953
131 K 34	PAGE 11-16 SHEET 12

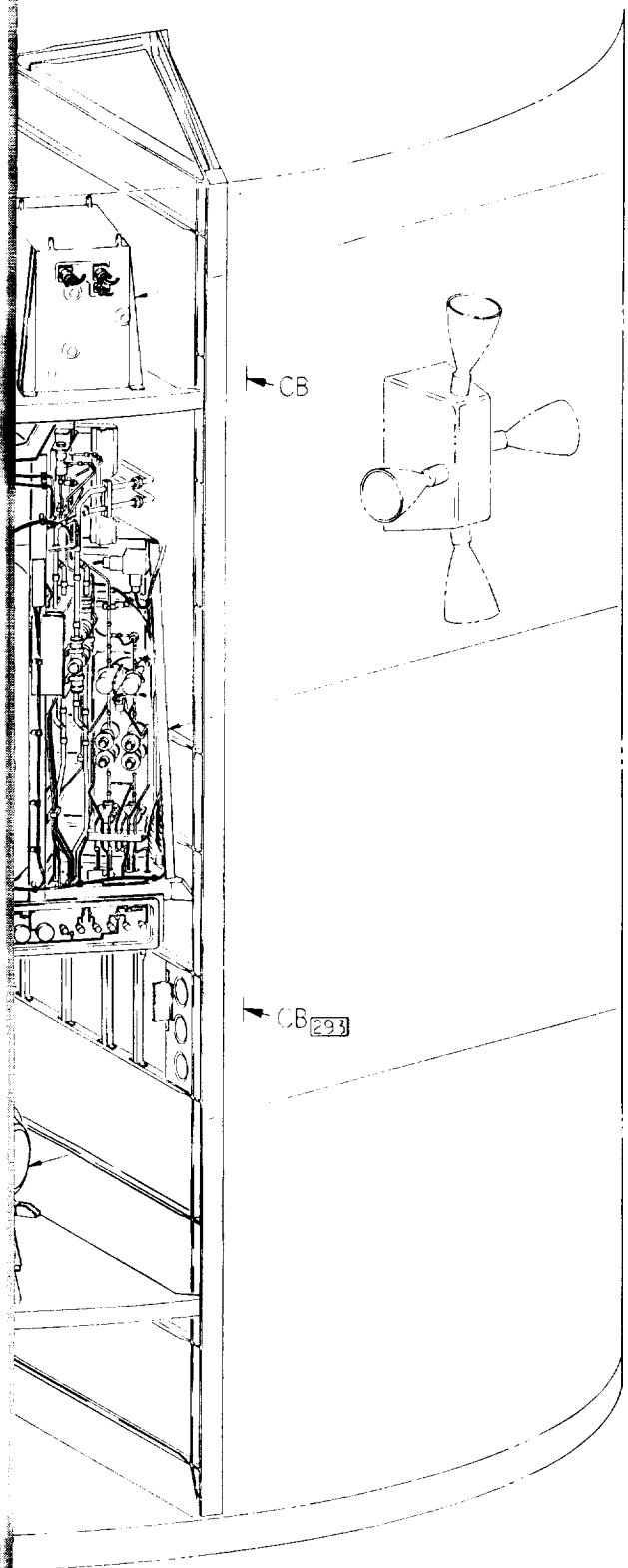
269 | 268 | 267 | 266 | 265

FOLDOUT FRAME 5



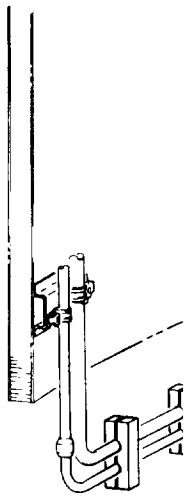
FOLDOUT FRAME 1

308 | 307 | 306 | 305 | 304



INSTALLATION PROVISIONS
BATTERY BAY 1
V57-331454 (REF)

BATTERY, STORAGE, SILVER OXIDE-ZINC, 29 VOLT
ST 4610009 ME



INSTL RCS PROPULSION SYSTEM STORAGE MODULE
V57-400106 (REF)

MODULE-RCS, PSM STRUCTURE ASSY
V57-323455 (REF)

ELECTRICAL INSTL-RCS PROPELLANT STORAGE MODULE
V57-448040 (REF)

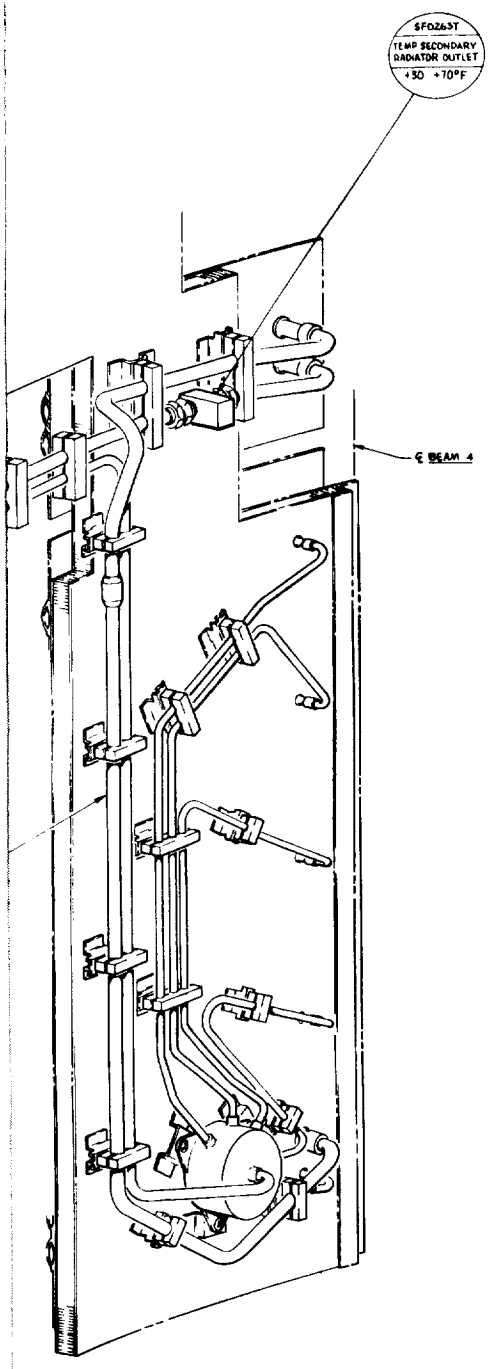
PLUMBING INSTL-RADIATOR WATER GLYCOL SYS
V57-610008 (REF)

FIELD SITE INSTL-SCIENTIFIC EXPERIMENTS, S071/S072
F04-756002 (REF)

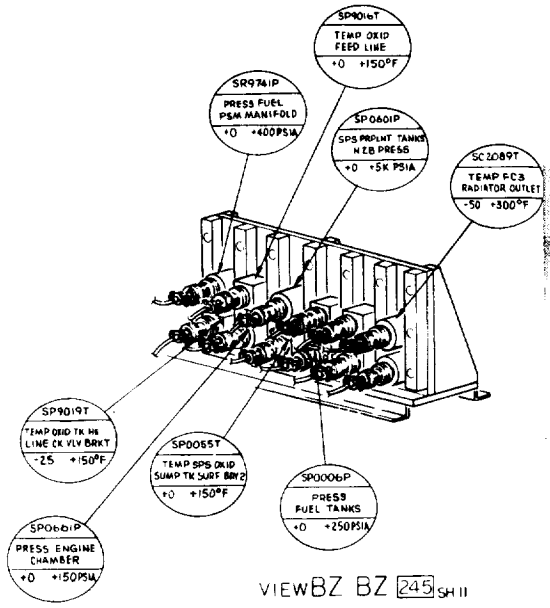
INSTL-EXPERIMENT S071/S072 CIRCADIAN RHYTHM, POCKET MICE, VINEGAR GNAT, CSM/GFE, NR/MSC
MH 04-02045-134 (REF) (117 ONLY)

308 | 307 | 306 | 303 | 305 | 304

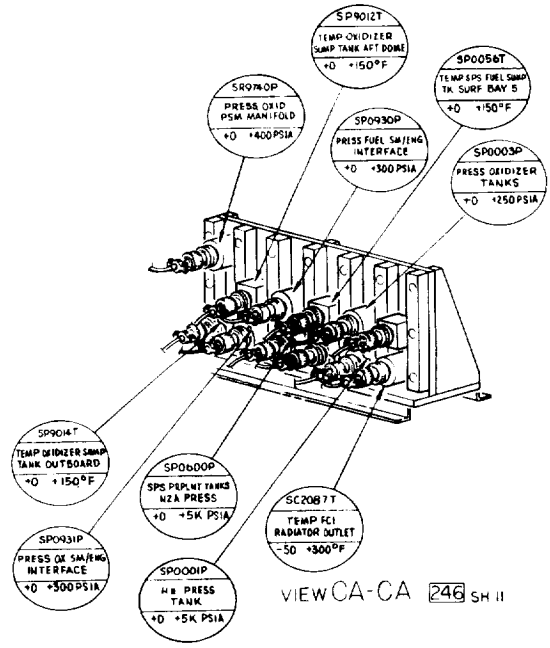
FOLDOUT FRAME 2



VIEW BN-BN 202 SH 9

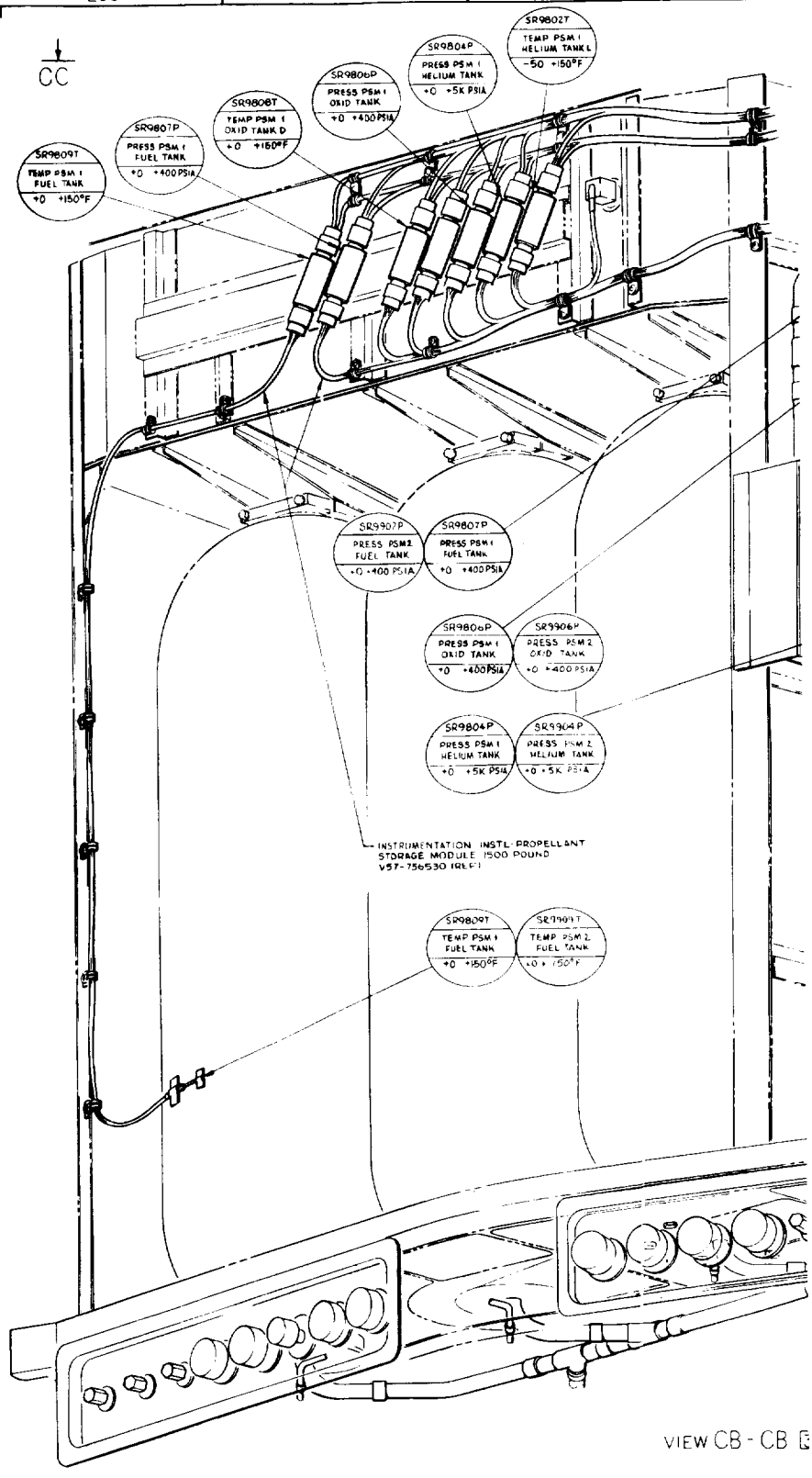


VIEW BZ BZ 245 SH 11



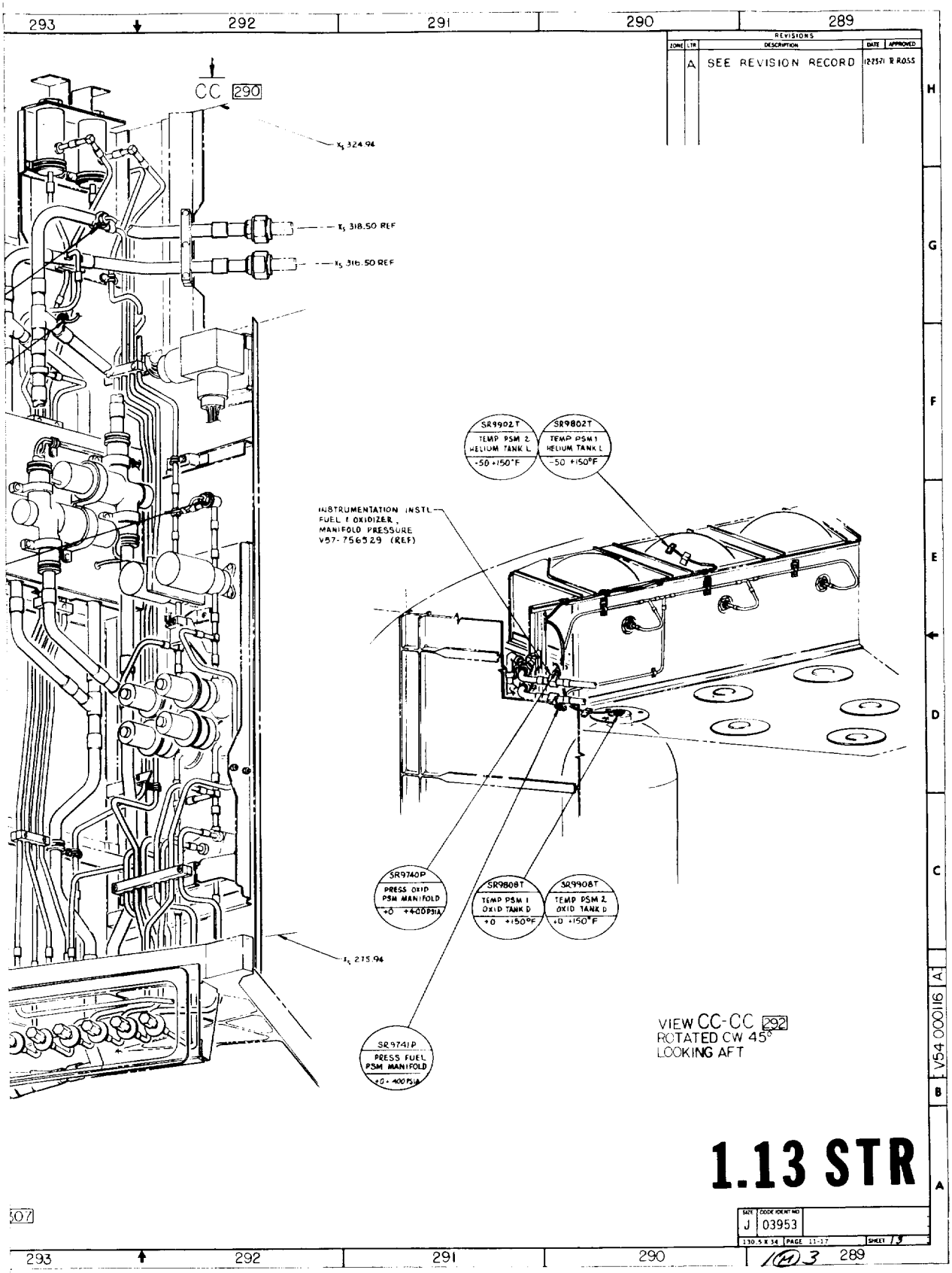
VIEW CA-CA 246 SH 11

FOLDOUT FRAME 3



VIEW CB - CB

FOLDOUT FRAME 4



FOLDOUT FRAME 5