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BOEING AEROSPACE CO HOUSTON TX

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ELECTRICAL ANALYSIS OF B-52/FB-111 AMAC AND RELEASE CIRCUITRY U--ETC(U)

OCT 75

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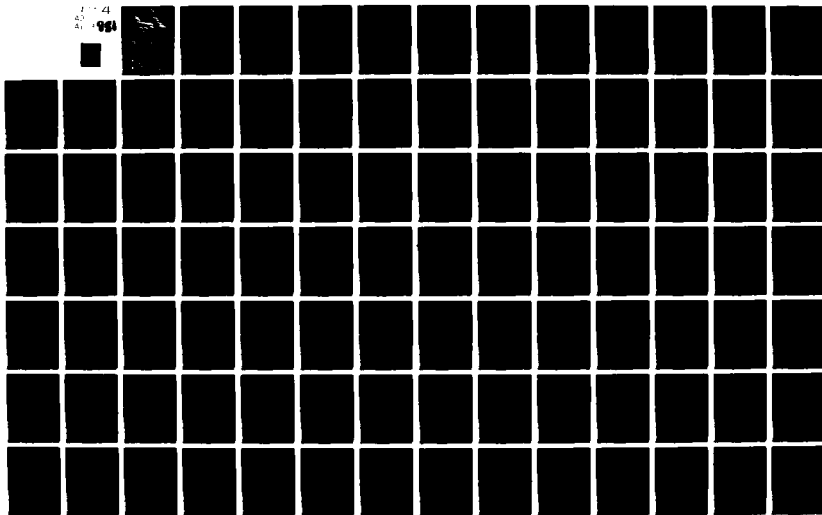
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ELECTRICAL ANALYSIS
OF B-52/FB-111 AMAC
AND
RELEASE CIRCUITRY
UTILIZING SNEAK CIRCUIT
ANALYSIS TECHNIQUE

— Final Report —

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THE **BOEING** AEROSPACE COMPANY
HOUSTON, TEXAS
OCTOBER 01, 1975

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REVISIONS

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ABSTRACT

This report summarizes the results of an electrical circuitry analysis of B-52G and FB-111A aircraft monitor and control (AMAC) interfaces with nuclear weapons. The B-52G interface with the AGM-69A missile was also analyzed. Sneak circuit analysis techniques were used to produce network trees. The network trees provided necessary circuit topology for power and load analysis to identify feasible power sources to nuclear weapon interfaces in normal and abnormal environments. Preliminary results were presented to Air Force Weapons Laboratory/SEC, Kirtland AFB, on 1 October 1975 for use in a nuclear safety evaluation study.

KEY WORDS

Air Force Weapons Laboratory/SEC
AGM-69A Missile
Aircraft Monitor and Control (AMAC)
B-52G Aircraft
Electrical Circuitry Analysis
FB-111A Aircraft
Network Trees
Nuclear Safety Evaluation
Power and Load Analysis
Sneak Circuit Analysis
Topology

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ARRANGEMENT

<u>Document Number</u>	<u>Title</u>	<u>Subject</u>
D2-1185761-1	Final Report	Electrical Analysis of B-52/FB-111 AMAC and Release Circuitry Utilizing Sneak Circuit Analysis Techniques
D2-1185761-2	B-52 Network Trees	B-52 AMAC and Release Circuitry
D2-1185761-3	FB-111 Network Trees	FB-111 AMAC and Release Circuitry

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1.0 SUMMARY

This report documents the electrical circuitry analysis performed by Boeing Aerospace Company - Houston on Air Force contract F29601-76-C-0017. The study contributed to the AFWL/SE nuclear safety evaluation of B-52 and FB-111 aircraft directed by a joint ERDA/DOD steering group. The effort primarily involved evaluation of aircraft monitor and control (AMAC) circuitry for possible sneak circuits, and for currents or voltages to weapon interface connectors in normal and abnormal environments. Necessary data and documentation tasks were also performed. This report summarizes the study approach and results. Analysis packages and network trees are provided for possible use in a combined evaluation of the aircraft and weapons.

1.1 OBJECTIVE

The primary objective of the analysis was to identify latent electrical circuit paths and conditions that can cause unwanted functions to occur or which could inhibit desired functions with or without component damage due to normal or abnormal environments.

1.2 SIGNIFICANT FINDINGS

The most significant sneak circuit found is a bus-to-bus tie on the FB-111A. This condition will exist when stores jettison relays are energized, causing loss of both MAU Fire 1 and 2 commands to all pivot pylons. The sneak circuit analysis provided baseline data for the power and load analysis. Network trees developed by this task are documented in Volumes 2 and 3 of the report. Section 3 contains thirteen reports of sneak circuits, design concerns and drawing errors.

The most significant finding of the power and load analysis is that most weapon interface pins can be exposed to either 24/28VDC or 118VAC power when electrical elements have been damaged under crash and fire environments. These are the maximum voltages found in adjacent circuitry. No unlimited power sources were found. Results are documented in Section 4 of this report. Table 1.2-1 summarizes normal and worst-case fault analysis results.

TABLE 1.2-1 Power and Load Analysis Results - B-52/Gravity Weapons Interface
(Sheet 1 of 4)

WEAPON INTERFACE		ENVIRONMENT ANALYSIS RESULTS									
		NORMAL					ABNORMAL - WORST CASE				
DESIGNATOR	FUNCTION	V	I	t	V	I	t	V	I	t	ANALYSIS PACKAGE
A114, J11, J12, J13 and J14	Forward Bomb Bay Clip-In Connectors	Note: Power is DC unless otherwise noted. AC current is 400 Hz unless otherwise noted.									Section 4.1.6
Pin A	IFC SAFING PWR	24V	75A	3.5s	24V	109A	1.4s	24V	109A	1.4s	4.1.6.7
B	TESTER SW GND	0	0	-	24V	152A	.8s	24V	152A	.8s	4.1.6.7
C	TESTER SW OFF/SAFE	0	0	-	24V	110A	1.1s	24V	110A	1.1s	4.1.6.4
D	TESTER SW AIR	0	0	-	24V	152A	.8s	24V	152A	.8s	4.1.6.7
E	IFC SAFING PWR	24V	131A	1.0s	24V	211A	.8s	24V	211A	.8s	4.1.6.7
F	TESTER SW SAFE	0	0	-	24V	109A	1.2s	24V	109A	1.2s	4.1.6.6
G	INFLIGHT TEST	0	0	-	24V	152A	.8s	24V	152A	.8s	4.1.6.7
H	TESTER SW, READY	0	0	-	24V	150A	.8s	24V	150A	.8s	4.1.6.6
J	TESTER SW, AIR	0	0	-	24V	109A	1.2s	24V	109A	1.2s	4.1.6.6
L	INFLIGHT TEST	0	0	-	24V	152A		24V	152A		4.1.6.7
O	WPN GROUND	GROUND									
P	IFC SAFING PWR	24V	152A	0.8s	24V	258A	.8s	24V	258A	.8s	4.1.6.7
R	INFLIGHT TEST	0	0	-	24V	152A	.8s	24V	152A	.8s	4.1.6.7
S	WPN GROUND	GROUND									
J11,12T	FWD IFI PWR, 25A	0	0	-	28V	1170A	.8s	28V	1170A	.8s	4.1.6.3 (LH WPNS)
J13,14T	AFT IFI PWR, 25A	0	0	-	28V	1000A	.8s	28V	1000A	.8s	4.1.6.2 (RH WPNS)
U	WPN GROUND	GROUND									
V	WPN GROUND	GROUND									
W	FWD IFI PWR, 15A	0	0	-	28V	800A	.8s	28V	800A	.8s	4.1.6.3
X	(OPEN)	0	0	-	24V	152A	.8s	24V	152A	.8s	4.1.6.8
Y	FWD IFI PWR, 15A	0	0	-	28V	800A	.8s	28V	800A	.8s	4.1.6.3
Z	TESTER SW, AIR	0	0	-	24V	110A	1.1s	24V	110A	1.1s	4.1.6.4
a	TESTER SW, GND	0	0	-	24V	110A	1.1s	24V	110A	1.1s	4.1.6.4
c	TESTER SW, GND	0	0	-	24V	109A	1.2s	24V	109A	1.2s	4.1.6.6
d	IFC RELAY (FWD)	0	0	-	24V	152A	.8s	24V	152A	.8s	4.1.6.1
f	TESTER SW, READY	0	0	-	24V	218A	.8s	24V	218A	.8s	4.1.6.4
h	FWD BOMB BAY SAFE	0	0	-	24V	152A	.8s	24V	152A	.8s	4.1.6.5

TABLE 1.2-1 Power and Load Analysis Results - B-52/AGM-69 Interfaces
(Sheet 2 of 4)

WEAPON INTERFACE		ENVIRONMENT ANALYSIS RESULTS									
		NORMAL				ABNORMAL - WORST CASE				ANALYSIS PACKAGE	
DESIGNATOR	FUNCTION	V	I	t		V	I	t		Section 4.1.7	
J1	Missile Connector										
P1n 2	BATTERY ACTIVATE PYLON LAUNCHER	OV OV	OA OA	- -		118VAC 118VAC	983A 900A	.125s .125s		4.1.7.4 4.1.7.4	
10	ACCUMULATOR ACT. PYLON LAUNCHER	OV OV	OA OA	- -		118VAC 118VAC	983A 900A	.125s .125s		4.1.7.4 4.1.7.4	
20	SAF CLASS III A CMD. PYLON LAUNCHER	OV OV	OA OA	- -		118VAC 118VAC	983A 900A	.125s .13s		4.1.7.8 4.1.7.8	
26	FIN UNLOCK PYLON LAUNCHER	OV OV	OA OA	- -		118VAC 118VAC	983A 900A	.125s .125s		4.1.7.4 4.1.7.4	
57	PROPULSION SAFE PYLON LAUNCHER	OV OV	OA OA	- -		28V 28V	1115A 411A	1.5s 2.0s		4.1.7.5 4.1.7.3	
60	SAF CLASS III B CMD. PYLON LAUNCHER	OV OV	OA OA	- -		118VAC 118VAC	983A 900A	.125s .13s		4.1.7.8 4.1.7.8	
82, 92, 96	MISSILE ELECTRONIC POWER PYLON SYS. ON SYS. OFF LAUNCHER SYS. ON SYS. OFF	28V OV 28V OV	254A OA 368A OA	.45s - .2s -		28V 28V 28V	1115A 1115A 1220A 1220A	1.5s 1.5s 1.5s 1.5s		4.1.7.6 4.1.7.6 4.1.7.2 4.1.7.2	
97	SAF PREARM CMD. PYLON LAUNCHER	OV OV	OA OA	- -		118VAC 118VAC	983A 900A	.125s .13s		4.1.7.1 4.1.7.1	
J1	Ejector Connector										
P1n r	ARM SOLENOID PYLON LAUNCHER	OV OV	OA OA	- -		27V 27V	37A 54A	1.1s 1.1s		4.1.7.7 4.1.7.7	

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TABLE 1.2-1 Power and Load Analysis Results - B-52/AGM-69 Interfaces
(Sheet 2 of 4)

WEAPON INTERFACE		ENVIRONMENT ANALYSIS RESULTS									
		NORMAL			ABNORMAL - WORST CASE			ANALYSIS PACKAGE			
		V	I	t	V	I	t	Section 4.1.7			
DESIGNATOR	FUNCTION										
J1	Missile Connector										
Pin 2	BATTERY ACTIVATE PYLON LAUNCHER	OV	OA	-	118VAC	983A	.125s	4.1.7.4			
		OV	OA	-	118VAC	900A	.125s	4.1.7.4			
10	ACCUMULATOR ACT. PYLON LAUNCHER	OV	OA	-	118VAC	983A	.125s	4.1.7.4			
		OV	OA	-	118VAC	900A	.125s	4.1.7.4			
20	SAF CLASS III A CMD. PYLON LAUNCHER	OV	OA	-	118VAC	983A	.125s	4.1.7.8			
		OV	OA	-	118VAC	900A	.13s	4.1.7.8			
26	FIN UNLOCK PYLON LAUNCHER	OV	OA	-	118VAC	983A	.125s	4.1.7.4			
		OV	OA	-	118VAC	900A	.125s	4.1.7.4			
57	PROPULSION SAFE PYLON LAUNCHER	OV	OA	-	28V	1115A	1.5s	4.1.7.5			
		OV	OA	-	28V	411A	2.0s	4.1.7.3			
60	SAF CLASS III B CMD. PYLON LAUNCHER	OV	OA	-	118VAC	983A	.125s	4.1.7.8			
		OV	OA	-	118VAC	900A	.13s	4.1.7.8			
82, 92, 96	MISSILE ELECTRONIC POWER PYLON SYS. ON	28V	254A	.45s	28V	1115A	1.5s	4.1.7.6			
		OV	OA	-	28V	1115A	1.5s	4.1.7.6			
	LAUNCHER SYS. ON	28V	368A	.2s	28V	1220A	1.5s	4.1.7.2			
		OV	OA	-	28V	1220A	1.5s	4.1.7.2			
97	SAF PREARM CMD. PYLON LAUNCHER	OV	OA	-	118VAC	983A	.125s	4.1.7.1			
		OV	OA	-	118VAC	900A	.13s	4.1.7.1			
J1	Ejector Connector										
Pin r	ARM SOLENOID PYLON LAUNCHER	OV	OA	-	27V	37A	1.1s	4.1.7.7			
		OV	OA	-	27V	54A	1.1s	4.1.7.7			

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TABLE 1.2-1 Power and Load Analysis Results - FB-111/Station 3
(Sheet 3 of 4)

WEAPON INTERFACE		ENVIRONMENT ANALYSIS RESULTS										ANALYSIS PACKAGE
		NORMAL					ABNORMAL - WORST CASE					
DESIGNATOR	FUNCTION	V	I	t	V	I	t	V	I	t	Section 4.2.6	
J479013-3 WPN STATION 3												
Pin A	SAFE INPUT	28V	608A	.6s	28V	608A	.6s	28V	608A	.6s	4.2.6.2	
B	(NONE)							115VAC	1983A	.6s		
C	SAFE INDICATION	28V	48mA		28V	48mA		28V	608A	.6s/-*	4.2.6.5	
D	(NONE)							115VAC	198mA			
E	GROUND	0	-			-						
F	GROUND	0	-			-						
G	WPN PRESENT (GROUND)	28V	48mA		28V	48mA		28V	608A	.6s/-*	4.2.6.5	
H	ARM INPUT	0	0		0	0		115VAC	198mA			
J	ARM INPUT	0	0		0	0		28V	608A	.6s	4.2.6.2	
K	(NONE)							28V	608A	.6s	4.2.6.2	
L	(UNUSED)	0	0		0	0		28V	608A	.6s/.6s	4.2.6.3	
M	(NONE)							115VAC	451A			
N	(UNUSED)	0	0		0	0		28V	608A	.6s/.6s	4.2.6.3	
P	PAL MONITOR	28V	48mA		28V	48mA		115VAC	451A	.6s/.6s	4.2.6.1	
R	ARM INDICATION	28V	48mA		28V	48mA		115VAC	608A	.6s/-*	4.2.6.5	
S	SWITCHED TO GROUND	0	0		0	0		115VAC	198mA			
T	(NONE)							28V	608A	.6s	4.2.6.6	
U	(NONE)											
V	PYLON CONTINUITY	0	0		0	0		28V	608A	.6s	4.2.6.6	
W	PYLON CONTINUITY	0	0		0	0		28V	608A	.6s	4.2.6.6	
X	WPN DROP CONFIG. RETARD	0	0		0	0		28V	608A	.6s	4.2.6.2	
Y	(FUTURE CAPABILITY)	0	0		0	0		28V	608A	.6s	4.2.6.2	
Z	BURST OPTION-AIR	0	0		0	0		28V	608A	.6s	4.2.6.2	
a	(SRAM ONLY)	28V	48mA		28V	48mA		28V	608A	.6s	4.2.6.3	
b	SAFE PROVISION	28V	48mA		28V	48mA		28V	608A	.6s/-*	4.2.6.4	
c	(SRAM ONLY)							115VAC	198mA			
d	WPN DROP CONFIG. FREE	0	0		0	0		28V	608A	.6s	4.2.6.3	
e	FALL	0	0		0	0		28V	608A	.6s	4.2.6.2	
f	(FUTURE CAPABILITY)	0	0		0	0		28V	608A	.6s	4.2.6.2	
	BURST OPTION-GND	0	0		0	0		28V	608A	.6s	4.2.6.2	

*Indefinite

TABLE 1.2-1 Power and Load Analysis Results - FB-111/Station -R
Weapon Interface (Sheet 4 of 4)

WEAPON INTERFACE		ENVIRONMENT ANALYSIS RESULTS										ANALYSIS PACKAGE		
		NORMAL				ABNORMAL - WORST CASE				Section 4.2.6				
		V	I	t	t	V	I	t	t					
DESIGNATOR	FUNCTION													
J479013-R	RH WPNS BAY													
Pin A	SAFE INPUT	28V	1333A	.6s		28V	1333A	.6s				4.2.6.2		
B	(NONE)					115VAC	3286A	.6s						
C	SAFE INDICATION	28V	48mA	--		28V	1333A	.6s				4.2.6.5		
D	(NONE)					115VAC	198mA	Indefinite						
E	GROUNDING													
F	GROUNDING													
G	WPN PRESENT (GND)	28V	48mA	--		28V	1333A	.6s				4.2.6.5		
H	ARM INPUT	0	0	--		115VAC	198mA	Indefinite				4.2.6.2		
J	ARM INPUT	0	0	--		28V	1333A	.6s				4.2.6.2		
K	(NONE)					28V	1333A	.6s						
L	(UNUSED)	0	0	--		28V	1333A	.6s				4.2.6.3		
M	(NONE)					115VAC	215A	.6s						
N	(UNUSED)	0	0	--		28V	1333A	.6s				4.2.6.3		
P	PAL MONITOR	28V	48mA	--		115VAC	215A	.6s				4.2.6.1		
R	ARM INDICATION	28V	48mA	--		28V	1333A	.6s				4.2.6.5		
S	SWITCHED TO GND	0	0	--		115VAC	198mA	Indefinite						
T	(NONE)					28V	1333A	.6s				4.2.6.6		
U	(NONE)													
V	(UNUSED IN WPN BAY)													
W	(UNUSED IN WPN BAY)													
X	WPN DROP CONFIG. RET	0	0	--		28V	1333A	.6s				4.2.6.2		
Y	(FUTURE CAPABILITY)	0	0	--		28V	1333A	.6s				4.2.6.2		
Z	BURST OPTION-AIR	0	0	--		28V	1333A	.6s				4.2.6.3		
a	(SRAM ONLY)	0	0	--		28V	1333A	.6s				4.2.6.4		
b	SAFE PROVISION	0	0	--		115VAC	198mA	Indefinite						
c	(SRAM ONLY)	0	0	--		28V	1333A	.6s				4.2.6.3		
d	WPN DROP CONFIG-FF	0	0	--		28V	1333A	.6s				4.2.6.2		
e	(FUTURE CAPABILITY)	0	0	--		28V	1333A	.6s				4.2.6.2		
f	BURST OPTION - GND	0	0	--		28V	1333A	.6s				4.2.6.2		

1.3 CONCLUSIONS

The following conclusions were reached:

- o The probability of abnormal voltage/currents being supplied to nuclear weapon interfaces, is considered to be very low, even in fire or crash environment, except as shown in this report.
- o The reported sneak circuits are the only ones to exist in the nuclear weapons monitor, control and release systems, based on available data.
- o Sneak circuit analysis provides an excellent baseline for fault analysis while defining all normal environment paths.
- o Wire-to-wire short circuits within common cables and crushed components can be expected in a crash causing abnormal continuities.
- o Limiting the scope of aircraft wiring harness fault analysis to wires within shared cables or connectors is considered practical and valid.
- o Techniques used in this study provide a number of fringe benefits:
 - Design concerns identified.
 - Input documentation accuracy cross checked.
 - Good visibility of interfacing circuits.
 - System configuration defined for all nuclear weapons monitor, control and release circuits.
 - Electrical safety of these circuits examined.

1.4 RECOMMENDATIONS

Boeing recommends that AFWL/SEC

- o Continue with methods used for this analysis on other systems to be analyzed.
- o Provide access to input data as early as possible through cognizant ALC's.
- o Review findings from analysis to assess impact on weapon circuits.

2.0 ANALYSIS DESCRIPTION

This section describes the scope of the analysis, defines the tasks performed, and discusses the methods used.

2.1 SCOPE

The sneak circuit analyses performed on the B-52G and FB-111A aircraft were confined to circuitry pertaining to monitor, control and release of onboard nuclear weapons. The power and load analysis was confined to circuits which interface with the nuclear weapons and adjacent circuitry. Primary power, switched secondary power and control circuits were included as required.

Generalized aircraft damage modes and conditions under which they occur were studied to postulate circuit faults that could cause abnormal voltages and currents in wiring that interfaces with the nuclear weapon systems. For this analysis two operational modes were assumed: 1) Ground alert posture with power on and engines running, 2) flight (including taxi, takeoff and landing).

Sources that could possibly supply high voltage and current to wiring adjacent to direct nuclear weapon circuits were located and identified. Calculations were performed to determine voltage and current for each aircraft nuclear weapon system circuit at its interface with the weapon under both normal and faulted conditions. For these calculations each circuit was assumed grounded at the interface connector.

2.1.1 Configuration

The airplane configurations analyzed are as follows:

2.1.1.1 B-52G, Serial Number 59-2602, configured as follows:

- Forward Bomb Bay - Multiple Weapon Clip-In Assembly, Type MHU-20A/C containing four bombs
- Aft Bomb Bay - AGM-69A Launcher containing only Missile no. 1
- Left Pylon - AGM-69A Ejector containing only Missile no. 1
- Right Pylon - Identical to Left Pylon

2.1.1.2 FB-111A, Serial Number 69-6514, configured as follows:

Weapons Bay - Right-hand (Station -R) MAU-12B/A, Aircraft Bomb Ejector Rack Assemblies, each containing a bomb. (Left-hand station identical)

Left Pivot Pylon - Station -3, One MAU-12B/A, Aircraft Bomb Ejector Rack Assembly, containing a bomb.

Right Pivot Pylon - Identical to Left Pivot Pylon Station.

2.1.1.3 Analysis Assumptions and Exclusions

- o Interfaces with gravity bombs are the connectors shown in the aircraft wiring diagrams.
- o Interfaces with SRAMs are the connectors to the SRAM missile Internal SRAM missile circuits were excluded.
- o Aircraft circuits for SRAM guidance were excluded.
- o One SRAM weapons bay installation and one SRAM pylon station was analyzed in depth for the B-52G. The other similar SRAM installations were analyzed for impacts of detail differences.
- o Analyses of abnormal environments considered only one fault at a time.
- o Wiring faults within aircraft wiring harnesses were limited to those within shared cables and connectors. Cable-to-cable and bundle-to-bundle wiring faults were excluded.
- o Release circuits were not included as nuclear weapon interface circuits during load analysis for abnormal environments.
- o Short circuits in terminals and faults internal to components were not considered except in the worst-case abnormal environment analysis for each model.
- o The abnormal environments analysis of the FB-111A escape capsule disconnects were limited to circuits related to nuclear weapons.
- o Circuits to the "Hound Dog" AGM were excluded.
- o FB-111A SRAM interfaces were excluded.

2.1.2 Definitions

Some terms used in this study require specific definitions for clarity. The following definitions apply throughout this report:

Normal environments

These are the conditions present on an aircraft during ground alert operations with no faults postulated due to component damage, or abnormal temperature, forces, radiation or other out-of-tolerance influences from the aircraft surroundings.

Abnormal environments

For the purposes of the analysis, the abnormal environments that were considered were damaging temperatures and mechanical forces due to fuel-fed fire for aircraft on ground alert status and fuel-fed fire or crash for aircraft in flight.

Power and load analysis

This consisted of determining open circuit voltage and short circuit current on each weapon system interface wire under normal and faulted conditions.

Fire on ground alert

A fire fed by aircraft fuel such that damaging temperatures and forces reach the circuits of concern while power is still applied to them.

Fire and crash in flight

An intense fire in flight fed by fuel and slipstream. Inflight crash involves collision or structural breakup resulting in mechanical forces that cause damage and introduce abnormal current paths such as conductive structural debris in contact with circuits of concern.

2.1.2 (Continued)

High voltage and current

Any AC or DC voltage or current exceeding normal operating values, allowing for tolerances.

Electrical faults

These are the logical results from the damage modes. They are of the following types:

1. Open weapon system circuits in components and wiring.
2. Shorted wires in junction boxes, components, cables and connectors containing circuits that lead to nuclear weapon interfaces.

Damage

The physical result of fire or crash as defined above. Damage modes are generalized categories such as shear, rupture, collapse, melting, and perforation.

Worst-case conditions

Worst-case conditions assumed power on all systems, all engines running and fire on ground alert, or fire/crash in flight, as defined above.

Power profile

Plots of short circuit current versus time on each weapon system interface wire.

Interfacing circuits

Any circuit that can directly affect nuclear circuits.

Adjacent wiring

Wires that physically share the same cable or connector but do not electrically interface with the nuclear weapon system circuits.

2.1.2 (Continued)

Transient suppression

Components/circuits that will reduce voltages from inductive loads such as relays, motors or solenoids.

Direct nuclear circuit

Any circuit that has a current path into the nuclear weapon interface without an interrupting device. Resistors and relay coils are assumed to continue the current path. Switches, circuit breakers and relay contacts stop the current path.

2.2 TASK DESCRIPTIONS

The following tasks were performed:

2.2.1 Data Requirements and Handling - Task 1

Boeing received, catalogued and filed documents such as wiring diagrams, schematics, wire lists and other input data that defined electrical continuity, operation, and subsystem functions to be analyzed by aircraft model. Appendix A lists technical data utilized for the analysis.

2.2.2 Electrical Paths and Network Trees - Task 2

Boeing processed the input data to identify all continuity paths. Network trees were prepared for the sneak circuit analysis and power/load analysis efforts described below.

2.2.3 Sneak Circuit Analysis - Task 3

Boeing performed a sneak circuit analysis of each aircraft model in the ground alert and flight modes assuming a normal environment. The analysis used the network trees developed in Task 2. Boeing identified potential sneak circuit conditions such as:

- o Sneak paths which may allow current or voltage to flow along an unexpected route to a nuclear weapon or SRAM interface.
- o Sneak timing which may actuate or inhibit a function at an unexpected time.

2.2.3 (Continued)

- o Sneak indications which may cause an ambiguous or false display of system operating conditions to the flight crew.
- o Sneak labels which may cause incorrect stimuli to be initiated by the flight crew.

2.2.4 Power and Load Analysis - Task 4

Boeing performed a power and load analysis under worst-case environment conditions with the aircraft on ground alert. This assumed that power is on all circuits of concern and that all engines are running. Boeing calculated maximum power duration and profile in direct and interfacing circuits and in wiring adjacent to exposed nuclear weapon system circuits. Maximum currents were calculated for each circuit path assuming zero impedance to ground at the weapon interface. Sources were identified that could possibly supply high voltage or current on wiring that interface with nuclear weapon circuits. Expected failure modes resulting from abnormal environments (fire) were considered in this task to the extent that they could affect the voltage and current available to the weapons. Abnormal environment was limited to fire for ground alert and fire or crash for flight mode.

2.2.5 Documentation - Task 5

Boeing documented the analyses as described below.

2.2.5.1 Potential Sneak Circuit Conditions

Sneak circuit conditions found were described and documented. Sketches of the circuits are included when appropriate. Recommendations for appropriate corrective action are given along with references to supporting documentation.

2.2.5.2 Undesirable Circuit Conditions

Undesirable circuit conditions found during the analysis are described on design concern reports. Circuit paths that could deliver high power to nuclear weapon interfaces as a result of fire and crash environments are identified in Circuit Analysis Packages. During the performance of the analysis,

2.2.5.2 (Continued)

when the following conditions were apparent, they were also described and reported on Design Concern Reports:

- o Single failure points
- o Unnecessary circuitry or components
- o Improper implementation of redundancy
- o Lack of transient suppression or improper suppression for inductive loads
- o Improper application of components

2.2.5.3 Drawing Errors

Drawing errors and other discrepancies found in the input data for the analysis were identified and documented.

2.2.5.4 Analysis Effort Summary

The analysis effort was summarized to include: the Scope, Method, Conclusions and Recommendations at the completion of the analysis tasks.

2.3 METHODS

The chart in Figure 2.3-1 shows graphically how the total analysis was performed and the interaction between the sneak circuit portion and the power and loads analysis. The following paragraphs describe in detail how each analysis was performed.

2.3.1 Sneak Circuit Analysis Methods

The Sneak Circuit Analysis (SCA) techniques and associated computer programs developed by The Boeing Aerospace Company were designed to be applied to a broad range of electrical/electronic systems including the B-52G and FB-111A special weapons monitor, control and release systems. The methods described were applied directly.

Specifically, the methods used to conduct the analysis of these systems included an input phase, a processing phase and an analysis phase. Figure 2.3-2

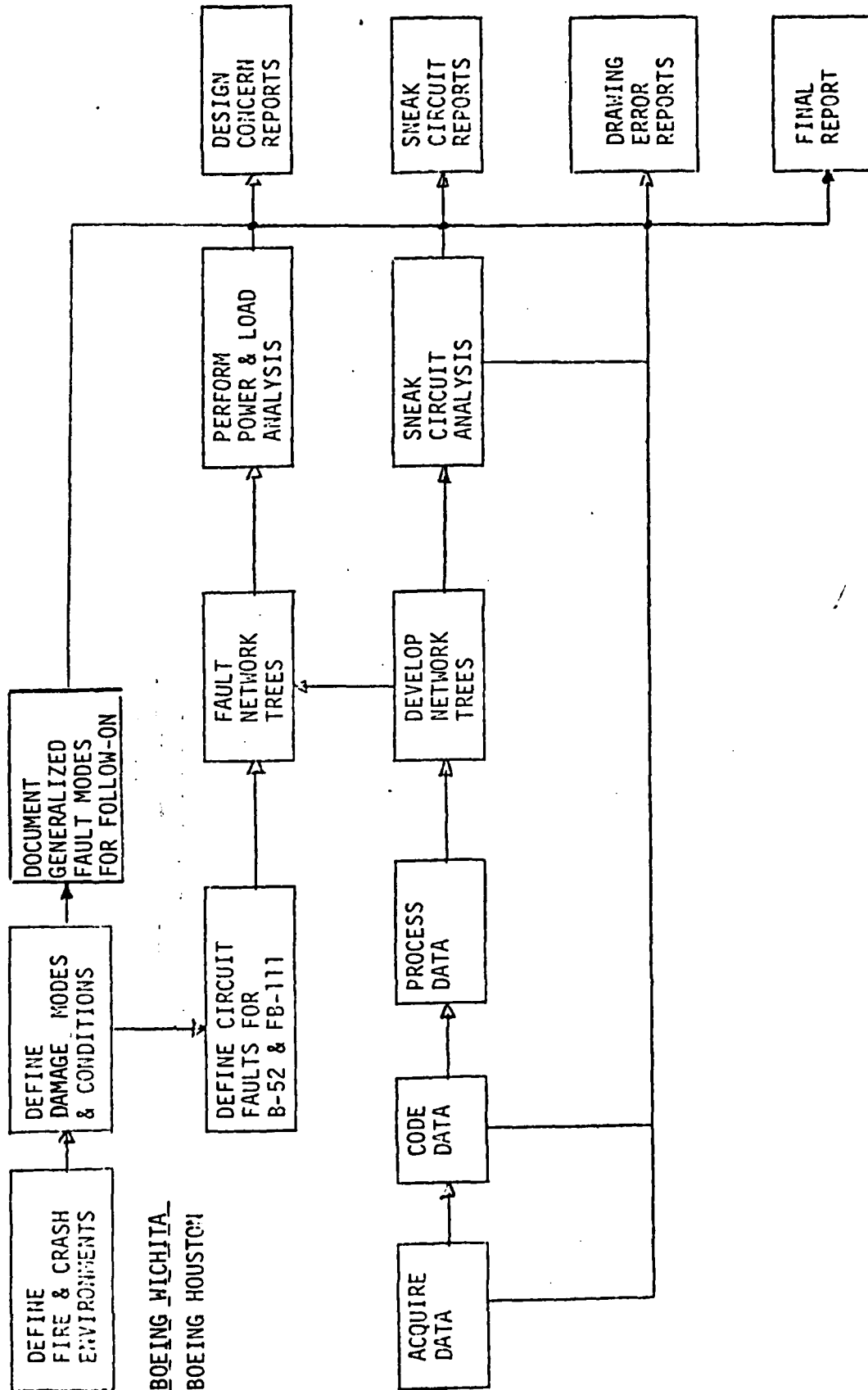


Figure 2.3-1 "B-52/FB-111 ANALYSIS WORK FLOW"

2.3.1 (Continued)

shows the steps involved in these phases and their relationship.

2.3.1.1 Input Phase

Data supplied by the Air Force Weapons Laboratory were converted into the proper format for use by the computer. Input data was manually encoded from the detail schematics and wiring diagrams. The computer generated a masterfile from this data. Several automatic audit and edit functions were performed while generating the masterfiles. The masterfiles were then verified by a second analyst. The masterfile was updated as necessary to correct any discrepancies noted. By using manufacturing level data and performing necessary audit and edit functions, an accurate data base was insured. Drawing errors discovered have been reported.

2.3.1.2 Computer Processing Phase

The masterfiles generated in the input phase formed the data base for the path search program. One of the outputs of the run was the Open End (O.E.) Report. This report identified all the path segments that are not connected to another segment, power or ground. All unintentional open ends were resolved and the masterfiles updated. The O.E. Report is one method of discovering drawing errors, i.e., mismatched connector numbers, connector pin numbers, etc.

The next major step was the path search which established all possible paths by stringing together all records with point to point continuity. All data input to the search program was accounted for in the Used and Unused Data Record indices. Matrix reports were generated identifying all paths, intersect nodes and path types. Several other reports (terminal branch, switch branch, special node cross reference, etc.) were produced at this time to present supplementary information used during the analysis phase.

2.3.1.3 Analysis Phase

The outputs of the computer processing phase were collated into nodal set

COMPUTER-AIDED SNEAK CIRCUIT ANALYSIS

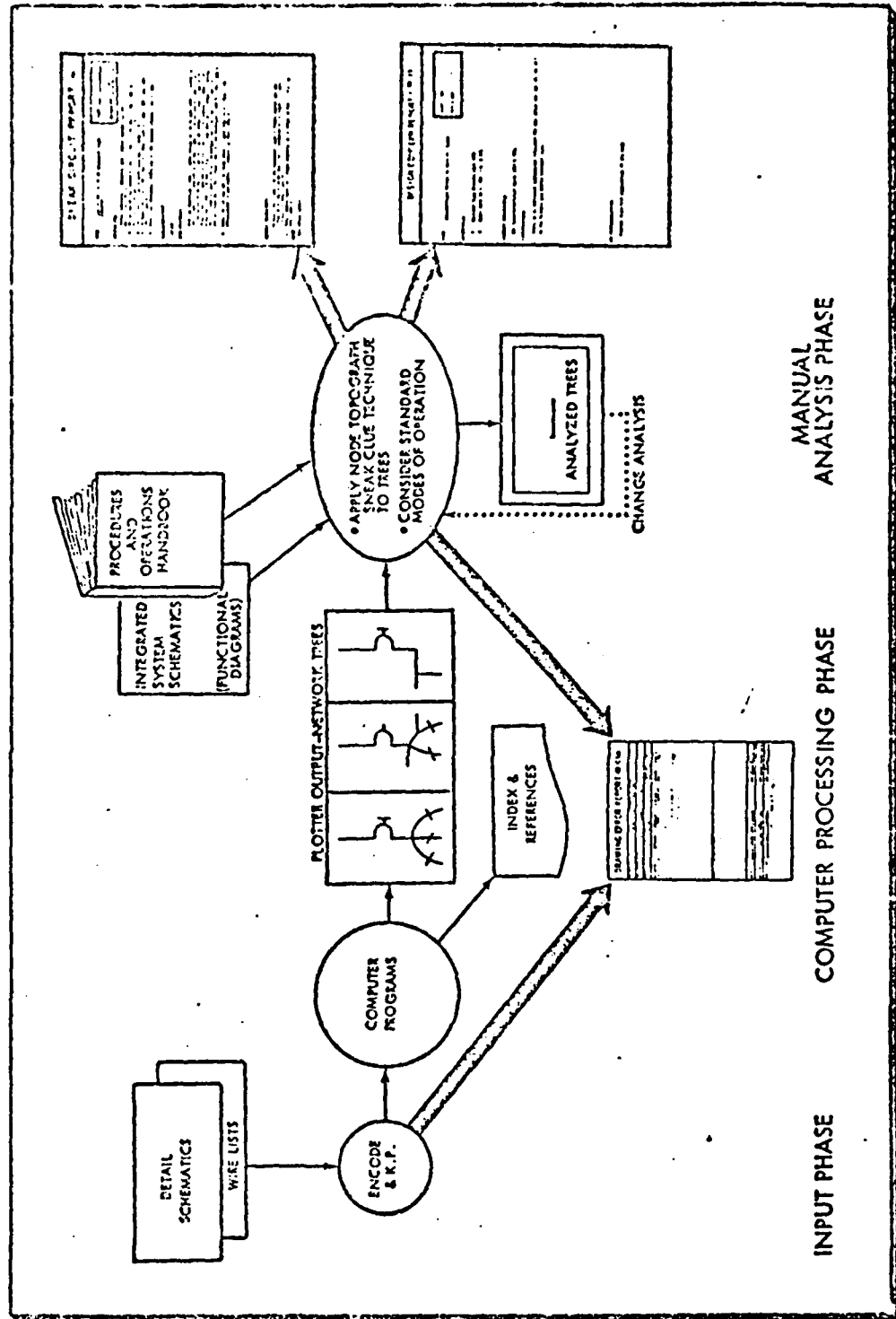


Figure 2.3-2. Sneak Circuit Analysis Work Flow



2.3.1.3 (Continued)

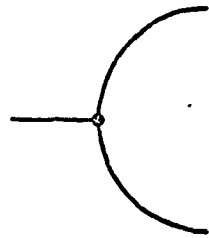
packages. These packages contained the network trees, matrix reports and the various reference reports peculiar to each nodal set. The analyst then prepared "node topographs" for the network trees. Topological network trees show the electrical power source (voltage input) at the top and the electrical return (ground) at the bottom of the figure. The only exception to this was a network tree with digital logic in which case the tree was drawn in a left to right manner. All nodes (intersection of three or more branches) were structured into levels between power and ground, and they were separated into levels or from one another by branches containing a switching device, a load (impedance), or a diode.

The use of topological network trees is a feature which greatly facilitates the analysis by clearly showing all connections at each electrical node. It also eliminates extraneous circuit routing detail and drafting line layout problems which can handicap an analysis to the extent of hiding sneak circuits. Therefore, topological network trees were essential to successful electrical Sneak Circuit Analysis.

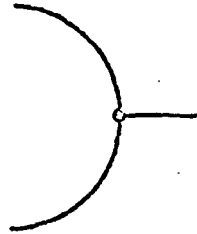
Another key element in electrical Sneak Circuit Analysis development came with realization that the clues can be divided into groups with each group applying to an individual node topograph. Node topographs are the patterns which geometrically describe node connections in topological network trees. The node topographs recognized to exist in electrical network topology are presented in Figure 2.3-3. All electrical nodes in a topological network tree will fit one of these patterns. More complex patterns encountered can be broken into component parts represented by these basic patterns. The actual analysis was then performed by identifying all possible modes of operation, eliminating those that are not possible by switching or other restrictions and then determining if the remaining circuits perform as intended by the designer. The analyst applied a list of approximately forty "sneak circuit clues" to each nodal set. Potential "sneak" conditions and design concerns were reported along with the recommended corrective action.

NODE TOPOGRAPHS

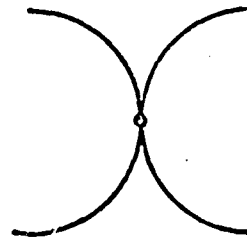
SNEAK CIRCUIT CLUE APPLICATION KEYS TO OVERCOME PERSPECTIVE LIMITATIONS



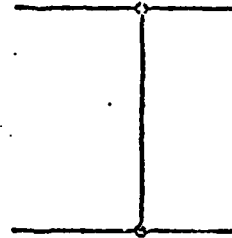
GROUND DOME
(SWITCHED GROUND-TO-GROUND PATH)



POWER DOME
(SWITCH POWER-TO-POWER PATH)



COMBINATION DOME
(COMBINATION PATHS THRU NODE)



REVERSE CURRENT DOME
(CURRENT REVERSES THRU CROSS BRANCH)



Figure 2.3-3. Electrical Network Node Topographs

2.3.2 Power and Load Analysis Method

The power and load analysis was performed for both normal and abnormal environment conditions.

2.3.2.1 Definition of Environments and Fault Modes

The power and load analysis involved normal and abnormal environments for nuclear-loaded ground alert and operational flight postures. Boeing defined the environments as shown in Table 2.3-1. There is very little difference in electrical effects between flight and ground alert. Perhaps the basic difference is ambient temperature which has a significant effect upon circuit breaker trip times.

TABLE 2.3-1 ENVIRONMENTS AND FAULT MODES

OPERATIONAL POSTURE	ENVIRONMENT DEFINITION		FEASIBLE FAULT MODES
	ENVIRONMENT	CONDITIONS	
GROUND ALERT	NORMAL	- o AIRCRAFT PARKED - o ALL ENGINES RUNNING - o POWER ON ALL BUSES - o AMBIENT T = 25°C	NONE
	ABNORMAL	- o AIRCRAFT PARKED - o ALL ENGINES RUNNING - o POWER ON ALL BUSES - o POWER ON ALL CIRCUITS OF CONCERN - o FIRE LOCATED IN AREA OF CONCERN - o AMBIENT T = 25°C	- o ADJACENT WIRES/ADJACENT PINS SHORTED TOGETHER - o WIRES IN COMMON CABLE FAULTED OPEN/ OR SHORTED TO GROUND - o COMPONENTS/EQUIPMENT SHORTED TOGETHER OR TO GROUND - o POWER LOSS FROM FAULTED COMPONENT
FLIGHT	NORMAL	- o AIRCRAFT FLYING NORMAL MISSION PROFILE - o ALL ENGINES, GENERATORS, TR'S, BATTERIES OPERATING - o POWER ON ALL BUSES - o AMBIENT T = -54°C - o CREW COMPARTMENT T = 25°C	NONE
	ABNORMAL	- o ALL ENGINES RUNNING - o POWER ON ALL BUSES AND CIRCUITS OF CONCERN - o CRASH DAMAGE IN AREA OF CONCERN - o FIRE IN AREA OF CONCERN - o AMBIENT T = -54°C	- o ADJACENT WIRES/ADJACENT PINS SHORTED TOGETHER - o WIRES IN COMMON CABLE FAULTED OPEN/ OR SHORTED TO GROUND - o COMPONENTS/EQUIPMENT SHORTED TOGETHER OR TO GROUND - o POWER LOSS FROM FAULTED COMPONENT

2.3.2.2 Normal Condition Calculations

The network trees that show the weapon interfaces and interfacing circuitry were analyzed as to voltage sources and current paths to the weapon interface. Path resistance was determined from the voltage source to the weapon interface where current paths were determined to be possible under ground alert or normal inflight checkout. This resistance was obtained from cable assembly drawings, wiring specifications, aircraft dimensions and cable routing. It was assumed for this analysis that arming functions and code switching were not normal conditions, but monitor, station select and safing functions might be performed. The current profile was then determined from the voltage source and path resistance assuming a ground at the weapon interface. Open circuit voltage was determined to be the source voltage assuming an open circuit at the weapon interface.

2.3.2.3 Fault Condition Calculations

The network trees that show the weapon interfaces and interfacing circuitry were analyzed as to possible voltage sources under fault conditions. The computer generated path reports were used to determine each connection and wire segment in the direct and interfacing circuitry. These were used with the computer generated output data index, technical orders, wiring diagrams, schematics and cable assembly drawings to determine powered circuitry in common cables, connectors or component assemblies. Under fault conditions it was assumed that any powered circuits could short into the direct or connected interfacing circuits where they exist in common cables, connectors or component assemblies. A sketch was prepared for each weapon interface pin to show the direct circuitry and adjacent circuitry. Potential points where faults could occur were identified on the sketches and on the network trees. The worst case path for each weapon interface was determined from examination of the above data considering the power source voltage, wire lengths and wire sizes. Resistance of the faulted path was determined from the cable assembly drawings, wiring specifications, aircraft dimensions and cable routing. The worst case path for each weapon interface was shown on a sketch that identifies

2.3.2.3 (Continued)

the fault area, resistance of the path and the voltage source. Maximum current was calculated assuming a ground at the weapon interface. Open circuit voltage was determined assuming an open circuit at the weapon interface. Time duration of the current was determined using manufacturer's data and governing specifications of the circuit breakers that supplied the circuits.

3.0 SNEAK CIRCUIT ANALYSIS OF B-52G & FB-111A

A Sneak Circuit Analysis of the Monitor & Control and Weapons Release systems of the B-52G and FB-111A aircraft was performed with the aid of a digital computer.

3.1 SUMMARY

The analyses of the systems of each aircraft were based on electrical wiring data from technical manuals. Circuit evaluation was limited to pertinent portions of the subsystems, and excluded circuitry internal to the weapons. The results of the B-52G analysis were three sneak-circuit reports describing erroneous indicator lights, two design concern reports describing unnecessary components and a single failure point, and one drawing error report. The FB-111A analysis resulted in two sneak circuit reports describing a sneak inhibit and a bus-to-bus tie, and five drawing error reports. Copies of all reports are included in Sections 3.4, 3.5 and 3.6 respectively.

3.2 CONDITIONS AND ASSUMPTIONS

The B-52G and FB-111A sneak circuit analyses were based on electrical wiring diagrams contained in technical manuals. The information shown on these drawings was of sufficient detail for component interconnections and generally sufficient for circuits internal to component "Boxes". Supplementary information was obtained from functional/integrated drawings and system descriptions from additional technical manuals.

Specifically, the circuitry of each aircraft that was analyzed was limited to the portions of the Weapons Release and Monitor and Control Systems for which electrical wiring data was available. Circuitry in other systems which interfaced with the aforementioned systems was considered out of scope. No circuitry internal to the gravity weapons or the AGM-69A was included in the analysis. Assumptions were made for components on which detail electrical data were not available, based on the supplementary information.

3.3 NETWORK TREES

The network trees derived from computer processed B-52G and FB-111A data were analyzed for sneak circuit conditions. The trees were uniquely identified according to aircraft, numbered, and titled for reference and cross-reference between trees. Copies of all network trees for B-52G and FB-111A aircraft are included as Volumes 2 and 3.

3.4 SNEAK CIRCUIT REPORTS

Five sneak circuit conditions were discovered during the analysis of aircraft systems. Three sneak circuit reports (SCR's) resulted from B-52G analysis, and two SCR's from FB-111A analysis. Copies of these SCR's are presented in the Figures listed below.

<u>SCR Number</u>	<u>Subject</u>	<u>Figure</u>
B-52G-1	DCU-9/A Warning Light	3.4-1
-2	Master Bomb Control Power Indicator	3.4-2
-3	AGM-69A Power Distribution Indicator	3.4-3
FB-111A-1	Tail Arming Solenoid	3.4-4
-2	Essential Bus to Main Bus Tie	3.4-5

SNEAK CIRCUIT REPORT B-52G-1

TITLE DCU-9/A Warning Light Provides
False Indication.

DATE 8-27-75

ENGINEER M. Garnett
gk

REFERENCES

- 1) USAF T.O. 11N-T5009-2 change 6, para. 4-1.2 Warning Indicator
- 2) USAF T.O. 1B-52B-2-31 change 32, page 3-83, figure 3-20
- 3) USAF T.O. 1B-52B-2-23, A8F.00 Rev JH
- 4) USAF T.O. 1B-52B-2-23, A8.14 Rev KM

MODULE/EQUIPMENT

DCU-9/A/B52-G

EXPLANATION

Per reference 1, the DCU-9/A Warning Indicator is used to indicate undesirable external conditions or to test certain external circuits for continuity. When the forward readiness switch S619 is in the SAFE position and the DCU-9/A rotary switch is in the GND or AIR position, relay K502 in the readiness panel will energize removing J11, J12, J13, and J14 pins G and L from the warning indicator circuit by opening the normally closed K502 contacts. Closure of the normally open K502 contacts will illuminate the warning indicator falsely implying an undesirable external circuit condition even though the indicator is not connected to an external circuit. Power is still present on J11/A through J14/A to "safe" the weapon. See figure 1.

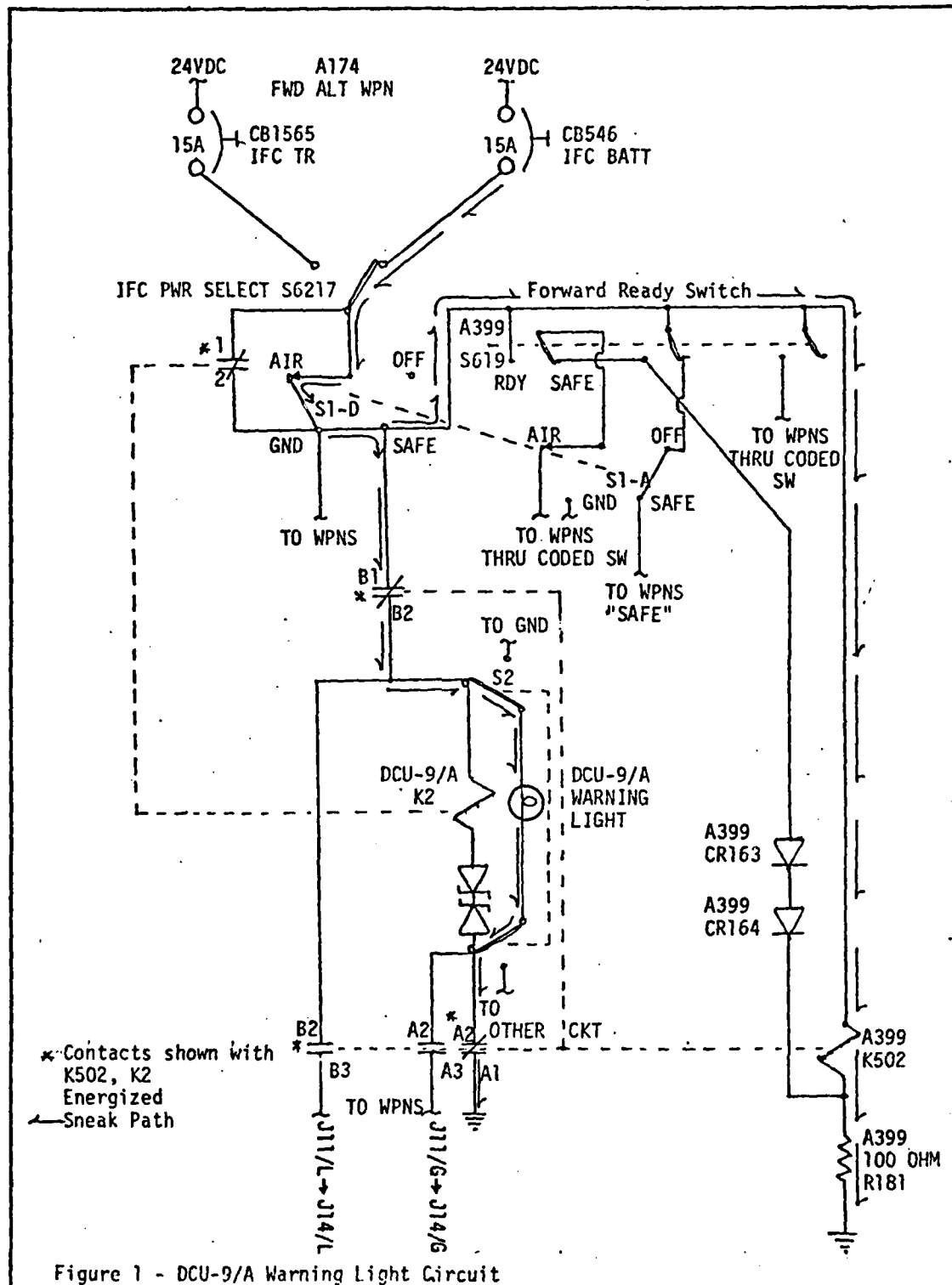
POTENTIAL IMPACT

False indication of an undesirable external condition when an undesirable internal condition exists.

RECOMMENDATION

Change reference 1 and other documentation as necessary to show that the DCU-9/A warning light may also indicate an undesired switch configuration in addition to undesired external circuit conditions.

Figure 3.4.1, Page 1



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Figure 3.4.1, Page 2

SNEAK CIRCUIT REPORT B-52G-2

TITLE Erroneous Master Bomb Control Power
On Indicator

DATE 8-27-75

ENGINEER L. Bose

jk *L. Bose*

REFERENCES

- 1) T.O. 1B-52G-2-23, change 16, Electronic Wiring Diagrams and Data, Diagrams A6.02, A4.38, A3.32.
- 2) T.O. 1B-52G-2-31, change 38, Bomb Release Systems, pages 2-1, 2-3 & 3-1.

MODULE/EQUIPMENT

B-52G/A234

EXPLANATION

Figure 1 shows DS155, the "Power On" indicator in A234, Master Bomb Control Panel. This indicator is supplied power through CB411 (A174), S302 (A234) and S151 (A234), the Master Bomb Control Power On/Off switch. This indication shows only that power from CB411 and S302 has been switched through S151. It does not accurately indicate that the Master Bomb Control Power On function has been accomplished through S151 switching. Three other wafers of S151 switch control power from CB284 and CB409. The present configuration of DS155 cannot monitor that control power from CB284 and CB409 has been switched through S151.

POTENTIAL IMPACT

DS155 could provide indication that power is on when it may be partially or totally interrupted by CB284 or CB409.

RECOMMENDATION

Change all applicable documentation to show that DS155 may not indicate power on function.

Figure 3.4.2, Page 1

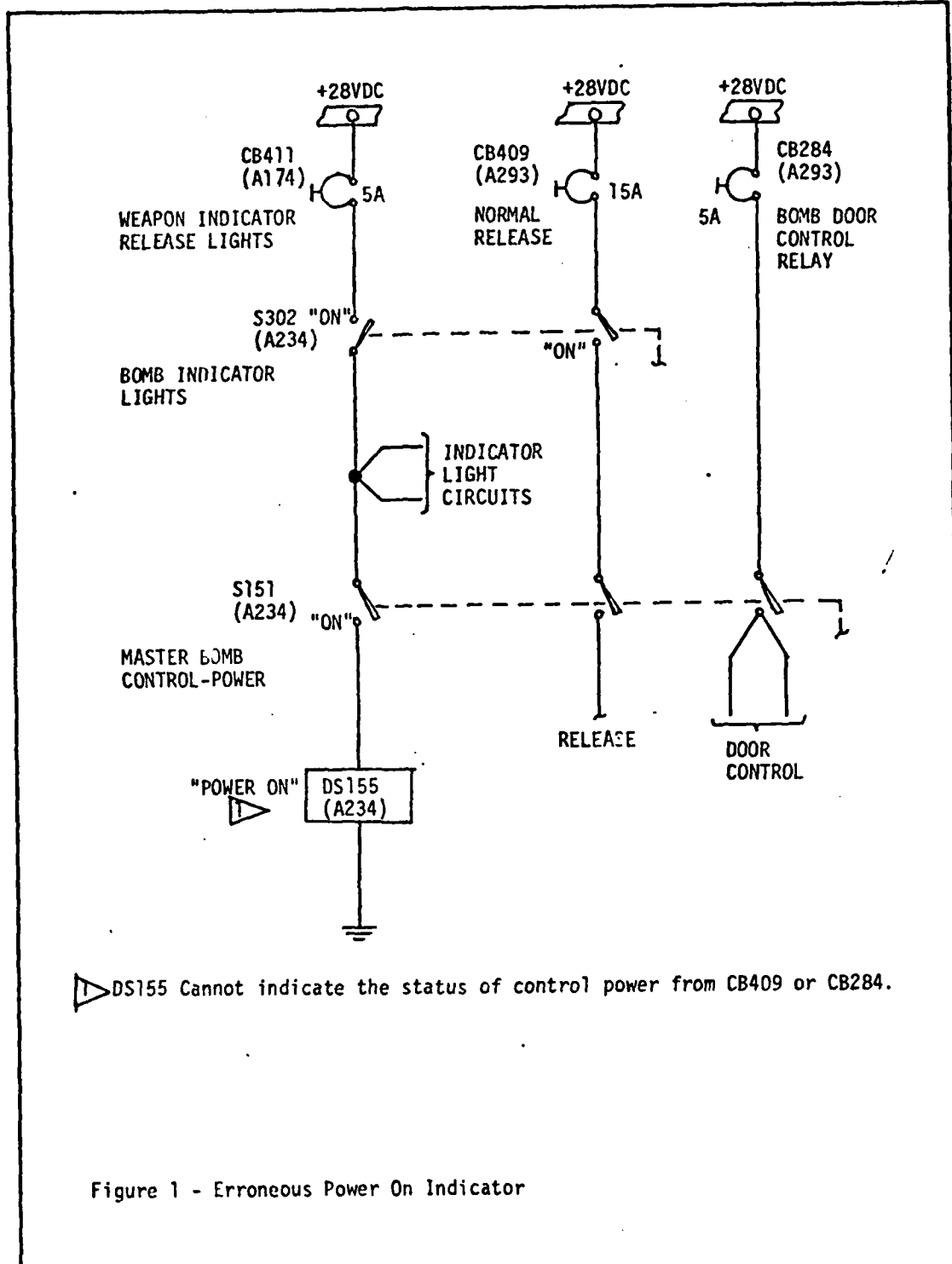


Figure 3.4.2, Page 2

SNEAK CIRCUIT REPORT B-52G-3

TITLE Erroneous Indicator In AGM-69A
Power Distribution

DATE 9-4-75

ENGINEER L. Bose

He. L. Bose

REFERENCES

- 1) T.O. 1B-52G-2-23, change 16, Electronic Wiring Diagrams and Data, pages Y6B1M.03 & Y6B1U.04.
- 2) T.O. 1B-52G-2-12, change 55, Electrical Systems, pages 3-51, 3-52, 3-53, & 3-54.

MODULE/EQUIPMENT

B52-G/AGM-69A PWR DIST. BOX

EXPLANATION

Indicator DS439 in A482, AGM-69A Power Distribution Box, does not indicate "Hydraulic Pump T. R. On" as its label suggests. DS439 shows only that K659 the Hydraulic Pump T. R. Ground Check Relay has been energized. A true "T.R. On" can be taken only at the output of the transformer-rectifier (T.R.). DS439 and the transformer-rectifier input circuits are shown in Figure 1.

POTENTIAL IMPACT:

The present configuration of DS439 cannot monitor loss of input or output of the transformer-rectifier.

RECOMMENDATION

1. Incorporate into applicable documentation that DS439 may not indicate the true "on-off" status of the hydraulic pump T.K., or
2. If a true "on" indication is desired, place DS439 or control of DS439 in the transformer-rectifier output circuit.

Figure 3.4.3, Page 1

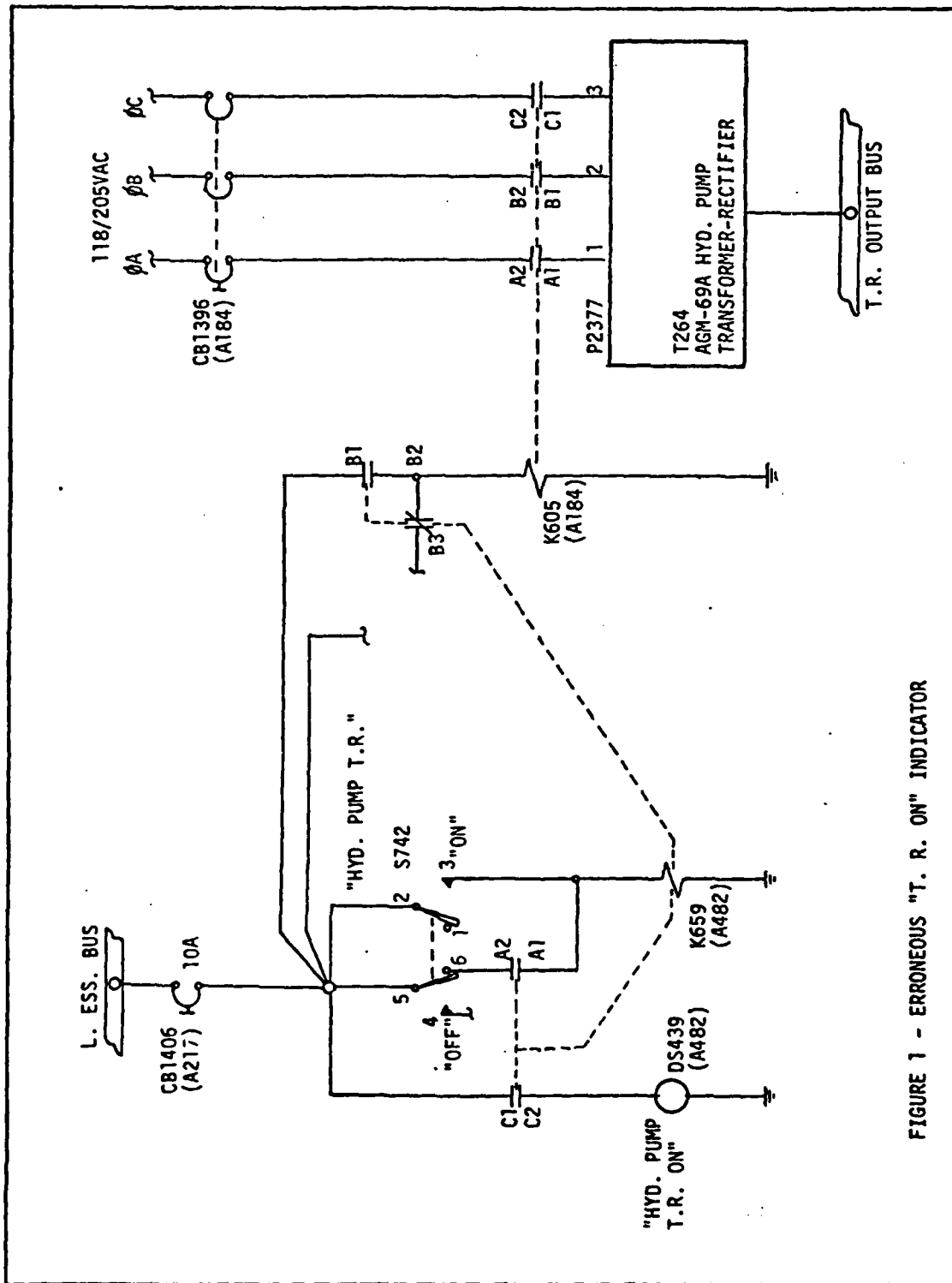


FIGURE 1 - ERRONEOUS "T. R. ON" INDICATOR

Figure 3.4.3, Page 2

SNEAK CIRCUIT REPORT FB-111A-1

TITLE Tail Arming Solenoid Cannot be Energized

DATE 9-17-75

ENGINEER M. Garnett

REFERENCES

1. T.O. 11N-T5055-2, Change 6, Station Program Unit, Figure 3-4.
2. T.O. 1F-111(B)A-2-11-1, Change 2, Figure 1-8, pg. 1-22

MODULE/EQUIPMENT

Pivot Pylon Conventional Station Program Unit/FB-111A

EXPLANATION

Reference 1 is excerpted in Figure 1. Note that no connection is made to pin 13 of relay K9. Normally open contact 3 of K9 connects to the "TAIL ARMING SOLENOID". Because of no connection to K9 pin 13, no means exists to energize the solenoid.

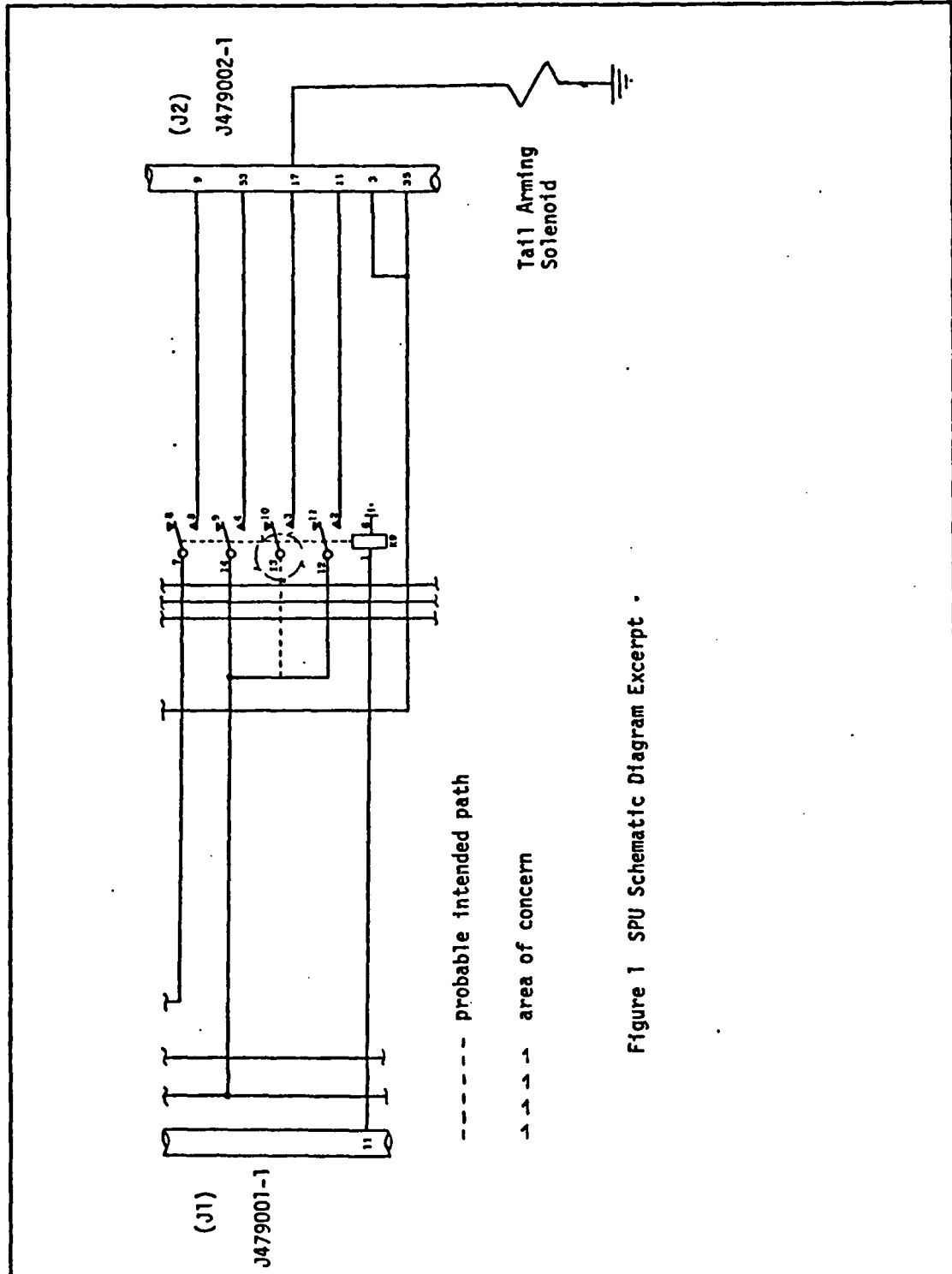
POTENTIAL IMPACT

Impossibility of tail arming a conventional weapon in this configuration.

RECOMMENDATION

Reference 2 implies that the dotted line connection shown in Figure 1 would resolve the problem.

Figure 3.4.4, Page 1



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Figure 3.4.4, Page 2

SNEAK CIRCUIT REPORT FB-111A-2 PAGE 1 OF 2

TITLE ESSENTIAL BUS TO MAIN BUS TIE

DATE 10-6-75

ENGINEER *H. Holt*
H. Holt

REFERENCES

1. T.O. 11F9-2-3 Technical Manual, Overhaul Instructions, Programmer Electronic Command Signals, Figure 12-1.
2. T.O. 1F-111(B)A-2-14 Technical Manual, Organizational Maintenance, Wiring Diagrams, Figure 3-28A & 3-41A.
3. T.O. 11N-T5055-2 Technical Manual Intermediate Maintenance, Station Program Unit Figure 3-4.

MODULE/EQUIPMENT

Weapon Release Circuitry/FB-111A

EXPLANATION

Figure 1 shows that when the Release Program Unit (RPU) issues a MAU Fire 2 command and K3 (Stores Jett) in the conventional SPU is energized a bus to bus tie exists between the 28VDC Ess bus in the DC Power Panel and the 28VDC Main bus in Weapons Bay DC Power Panel. This is typical for all four pylon weapons stations.

POTENTIAL IMPACT

When the bus to bus tie is made the 28VDC Ess bus can supply power to the 28VDC Main bus loads if the 28VDC Main bus is not powered for any reason. If the 28VDC Ess bus is at a higher potential than the 28VDC Main bus, CB5 in the DC Power Panel could trip causing loss of 28VDC power to the RPU MAU Fire circuits. Any fault that trips CB5 in the DC Power Panel will cause loss of both MAU Fire and 2 commands to all pivot pylons.

RECOMMENDATION

Revise the aircraft wiring such that RPU connector J230004 pin 2 is supplied power from the 28VDC Main bus and remove the internal connection in the RPU that ties the wiring from J230004 pins 1 and 2 together, and reverse MAU Fire 1 and 2 outputs for weapon station 3 at the RPU.

Figure 3.4-5, Page 1

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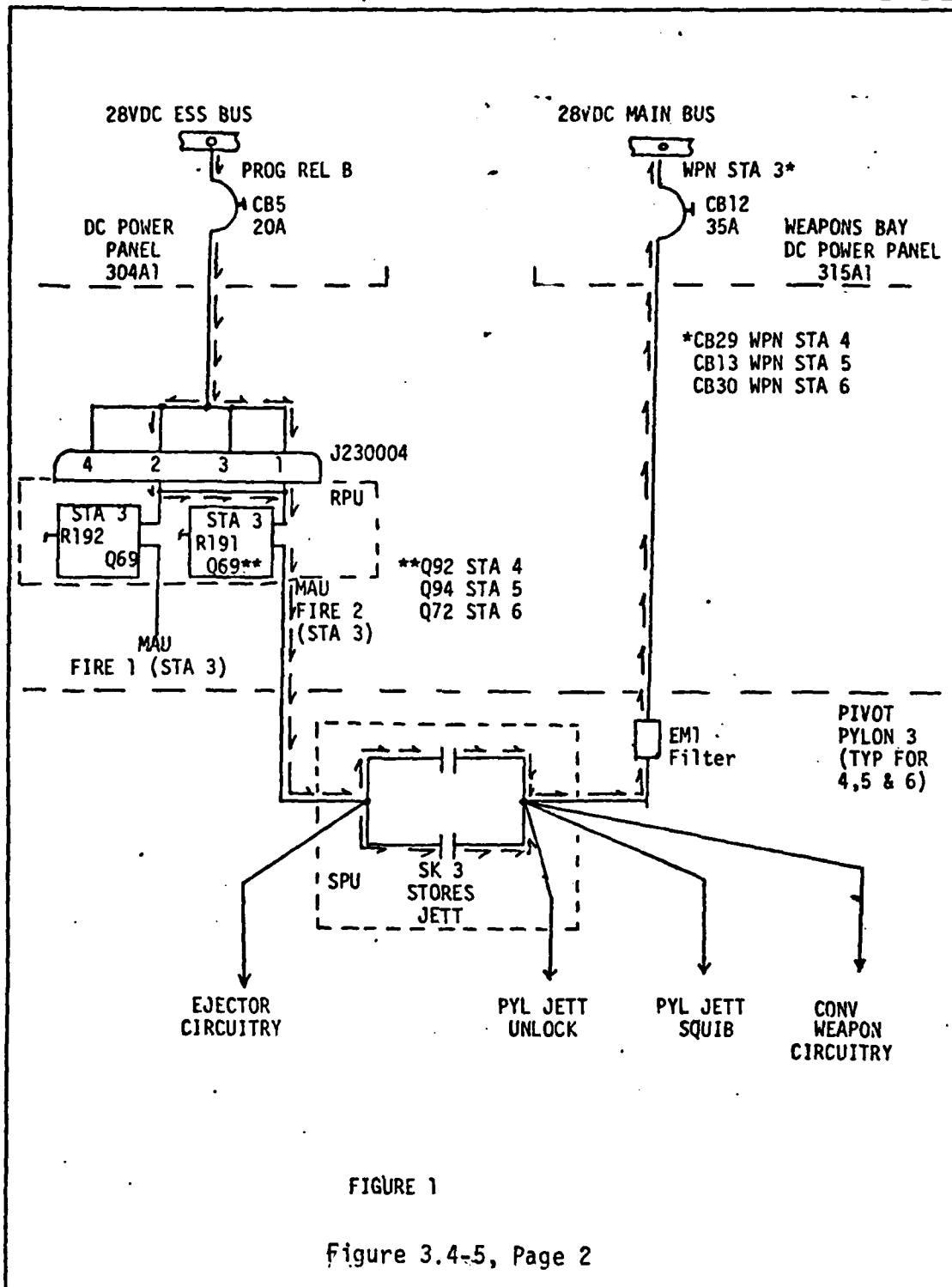


FIGURE 1

Figure 3.4-5, Page 2

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3.5 DESIGN CONCERN REPORTS

Two design concern reports (DCR's) were written describing areas of concern in B-52G circuitry. No DCR's resulted from the FB-111A analysis. Copies of the two DCR's are presented in Figures listed below.

<u>DCR Number</u>	<u>Subject</u>	<u>Figure</u>
B-52G-1	Unnecessary Components	3.5-1
-2	Single Failure Point	3.5-2

DESIGN CONCERN REPORT B-52G-1

TITLE Unnecessary Components in Clip-In
Subassembly and MB 3A Bomb Racks

DATE 9-2-75
ENGINEER ^{mb} M. Garnett
ile

REFERENCES

- 1) USAF T.O. 11N-H5035-2, change 4, page 5-2, figure 5-1.

MODULE/EQUIPMENT

Clip-In Subassembly/B52-G

EXPLANATION

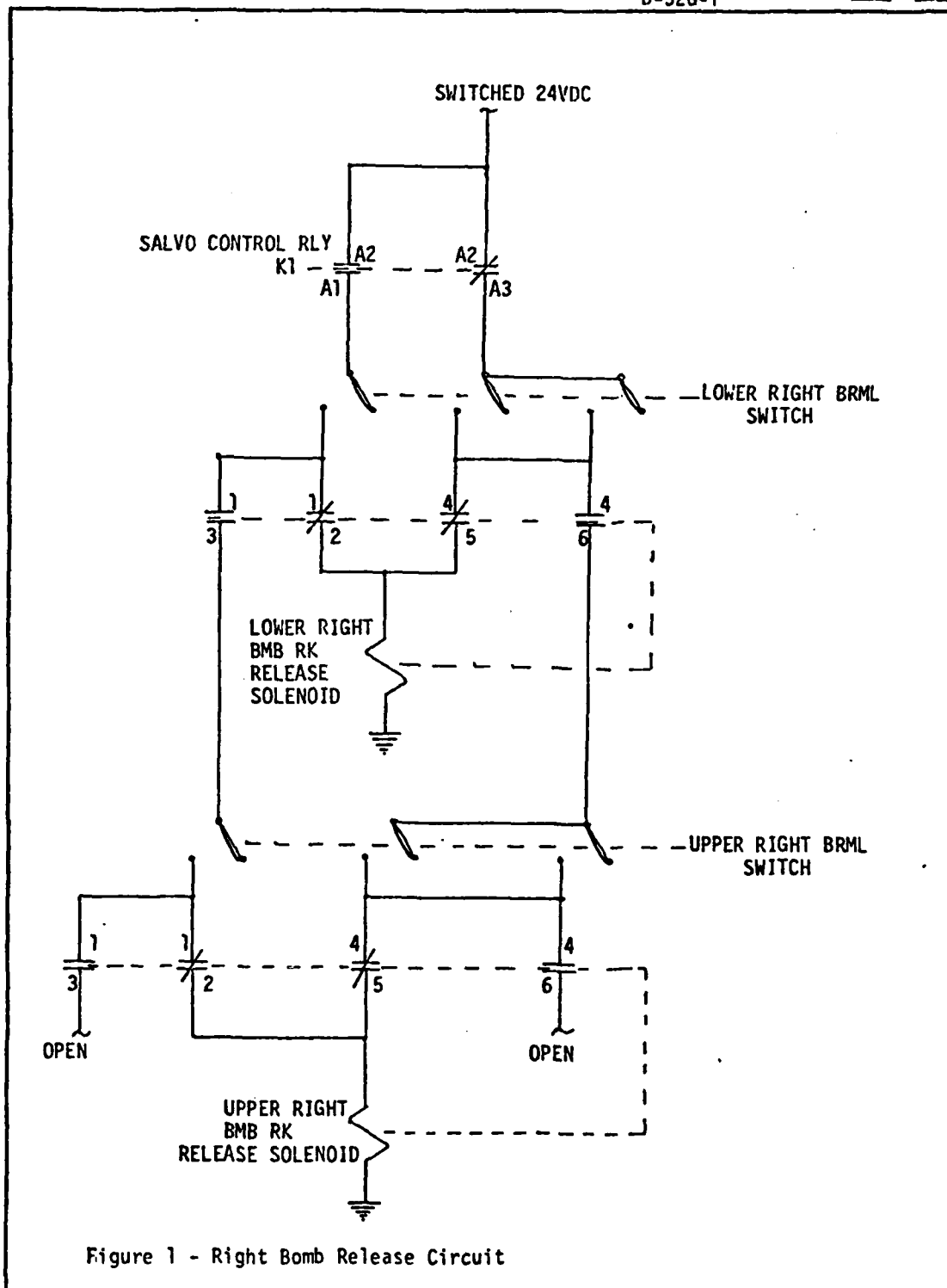
Figure 1 shows the forward right release schematic as it presently exists. Note that regardless of the state of salvo control relay K1, the lower and upper right release solenoids will energize with the BRML switches closed. A less complex circuit shown in figure 2 deletes K1, uses a single set of lower right BRML switch contacts, a single pair of lower right BOMB RACK RELEASE solenoid contacts, a single set of upper right BRML switch contacts, and a single pair of upper right BOMB RACK RELEASE solenoid contacts. A similar situation exists for the forward left release schematic.

RECOMMENDATION

The configuration shown in figure 2 requires fewer and less complex components. Removal of the salvo control relay K1 saves parts and improves reliability. It may be desired however, to leave the BRML switches and RELEASE solenoid contacts as is for redundancy.

Figure 3.5.1, Page 1

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Figure 3.5.1, Page 2

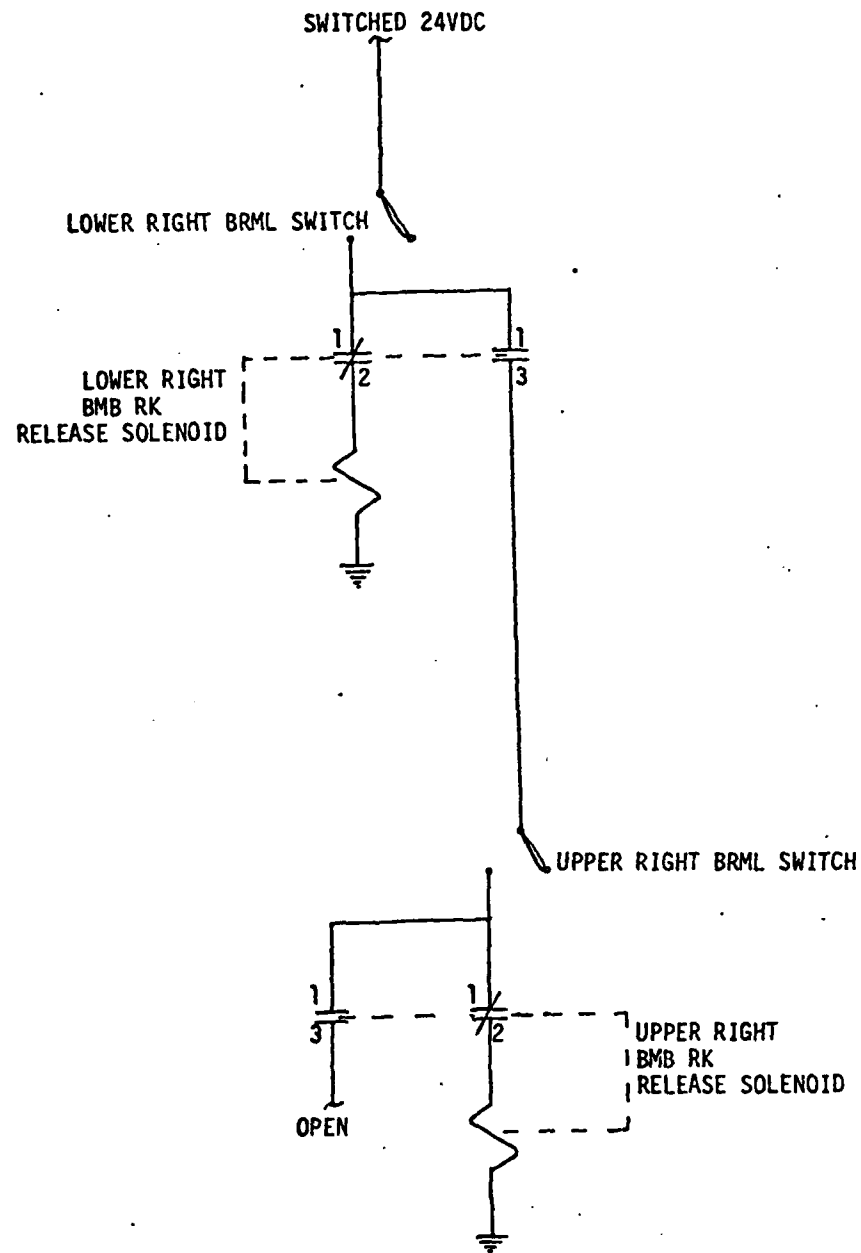


Figure 2 - Suggested Right Bomb Release Circuit

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DESIGN CONCERN REPORT B-52G-2

TITLE Single Failure Point Ties Missile Critical
& Non-Critical Electronic Power

DATE 9-3-75

ENGINEER M. Garnett
jl

REFERENCES

- 1) USAF T.O. 11LA12-2-3, page 5-40, figure 5-9, Schematic Diagram Relay Assembly
- 2) USAF T.O. 16W6-19-2, change 3, page 5-15, figure 5-7, Pylon Electrical Schematic

MODULE/EQUIPMENT

B-52G/AGM-69A

EXPLANATION

As shown in figure 1, pins Y and M on the missile connector (J9 for MSL 1, etc) are connected together in the relay assembly, reference 1. This connection ties the "ELECTRONIC POWER (NON-CRITICAL)" and the "ELECTRONIC POWER (CRITICAL)" supplied to the missiles per reference 2. A failure on the "NON-CRITICAL" bus will result in the loss of both "CRITICAL" and "NON-CRITICAL" ELECTRONIC POWER.

RECOMMENDATION

Supply separate paths including circuit breakers and relay switching for "CRITICAL" and "NON-CRITICAL" ELECTRONIC POWER or delete the distinction.

Figure 3.5.2, Page 1

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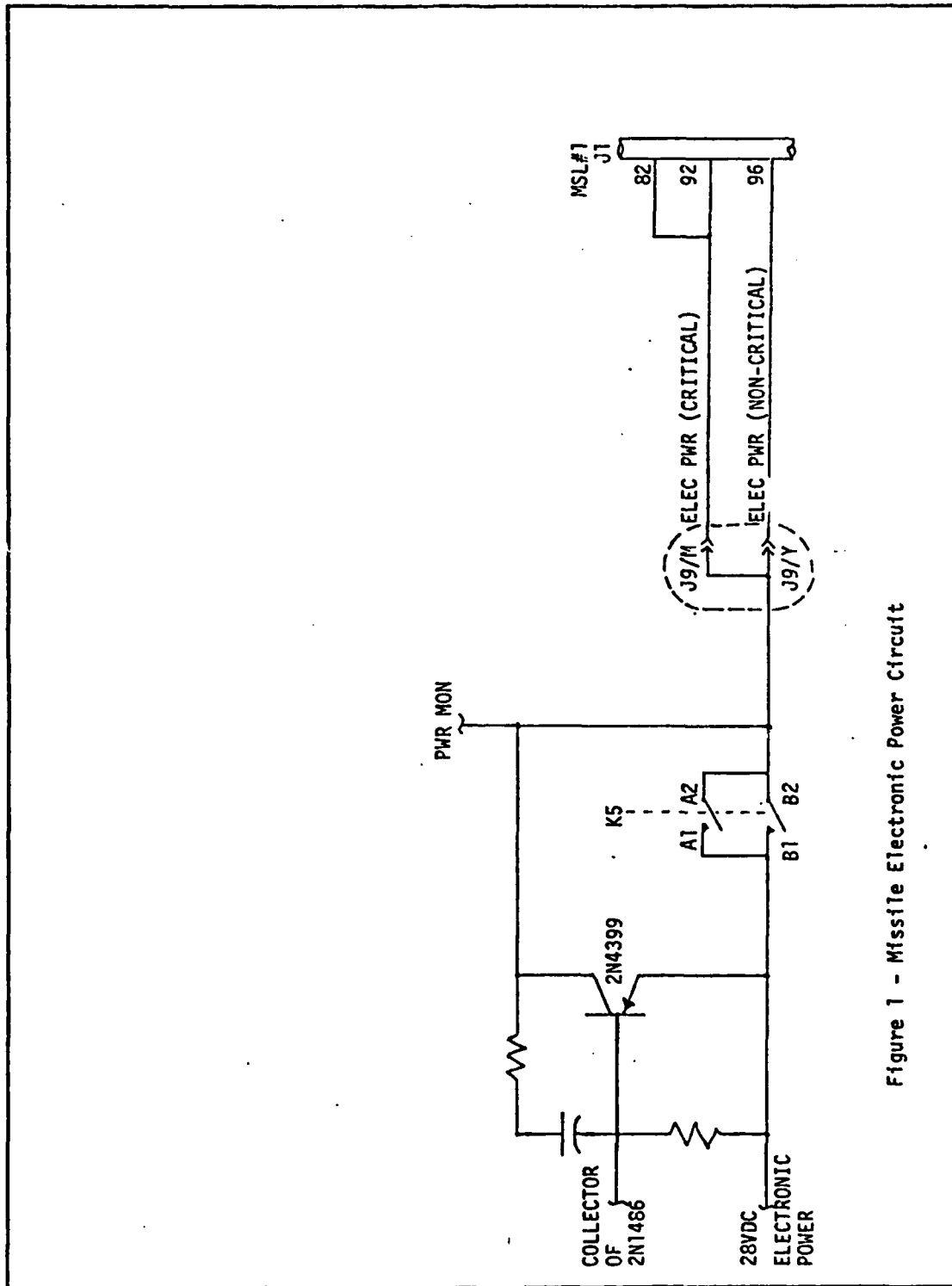


Figure 1 - Missile Electronic Power Circuit

Figure 3.5.2, Page 2

3.6 DRAWING ERROR REPORTS

A total of six drawing error reports (DER's) were written during the analysis. One DER resulted from the B-52G analysis, and five resulted from the FB-111A analysis. Copies of the DER's are presented in Figures listed below.

<u>DER Number</u>	<u>Subject</u>	<u>Figure</u>
B-52G-1	T.O. 1B-52G-2-23, p. A8.14, Change 10	3.6-1
FB-111A-1	T.O. 1F-111(B)A-2-14, p. 3-246H, Change 5	3.6-2
-2	T.O. 1F-111(B)A-2-145-1, p. 3-244, Change 5	3.6-3
-3	T.O. 1F-111(B) A-214, p. 3-246 E, Change 5-S10	3.6-4
-4	T.O. 16W6-23-2, p. 2-69, Change 9	3.6-5
-5	T.O. 1F-111(B)A-2-14, p. 3-762A, Change 10	3.6-6

DRAWING ERROR REPORT B-52G-1

TO:		PROJECT:
DOCUMENT NO.	REFERENCE DESIGNATOR	SUBSYSTEM
T.O. 1B-52G-2-23, A8.14 Change 10	A217	POWER
UNIT NOMENCLATURE		
LH FWD DC LOAD BOX		
DISCREPANCY:		
CB550 has a rating of 5A shown on page A8.14 of T.O. 1B-52G-2-23. The part number shown in the index is BAC-C18J-15 which is a 15A rating.		
ASSUMED CORRECTION:		
Change the rating shown on page A8.14 to 15A.		
REPORTED BY J. B. Campbell		DATE 8-19-75
SNEAK CIRCUIT GROUP ACTION BY J. B. Campbell <i>gbc</i>		DATE 8-19-75
CONTACT NAME		DATE
CONTRACTOR CONCURRENCE BY		DATE
Figure 3.6.1		

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DRAWING ERROR REPORT FB-111A-1

TO:		PROJECT: FB-111A	
DOCUMENT NO.	REFERENCE DESIGNATOR	SUBSYSTEM	
T.O. 1F-111(B)A-2-14	RPU (A2)		
UNIT NOMENCLATURE			
RELEASE PROGRAM UNIT			
DISCREPANCY:			
Figure 3-28A, Sheet 9; Page 3-246H, Change 5 The following discrepancies exist in that portion of the circuit shown on the attached sheet: 1. Plug P13 is labeled incorrectly 2. Receptacle J23004 is labeled incorrectly 3. The function of P13-2,3,4 are shown incorrectly 4. Wire number A2403B12 is used twice			
ASSUMED CORRECTION:			
1. P13 will be labeled P230004. 2. The RPU receptacle will be labeled J230004. 3. All inputs to the RPU will be labeled ESS BUS. 4. One wire will be renumbered.			
REPORTED BY <u>P. Stokes <i>P. Stokes</i></u>		DATE <u>9-22-75</u>	
SNEAK CIRCUIT GROUP ACTION BY <u>Julius B. Campbell</u>		DATE <u>9-23-75</u>	
CONTACT NAME _____		DATE _____	
CONTRACTOR CONCURRENCE BY _____		DATE _____	
Figure 3.6.2, Page 1			

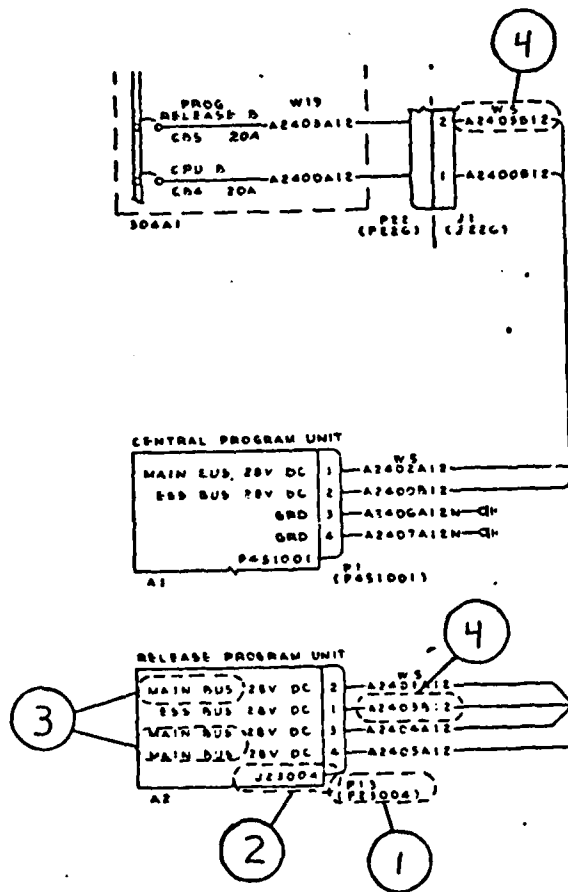


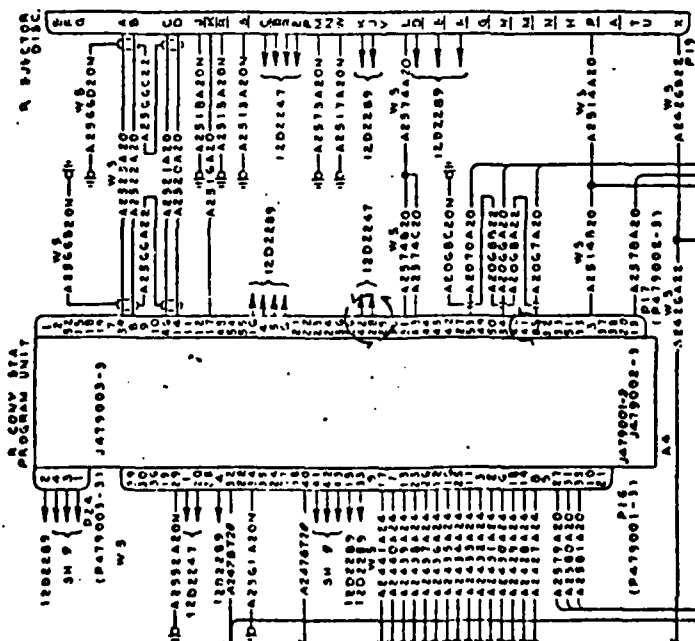
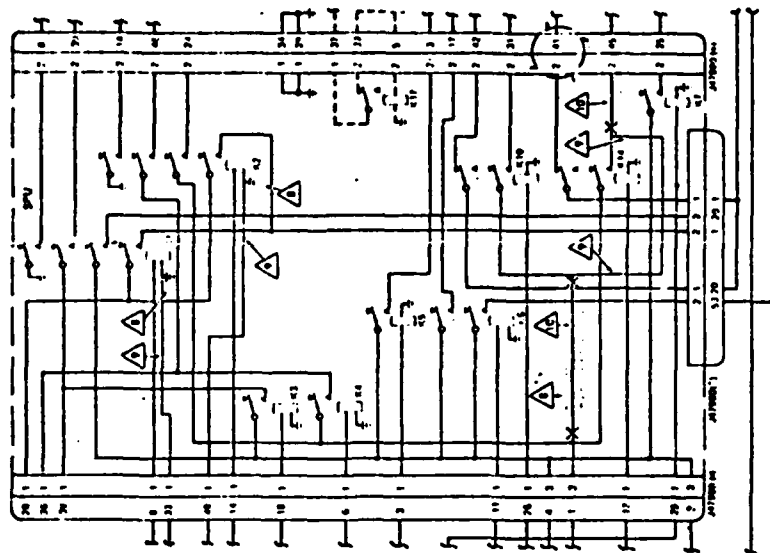
Figure 1 Release Program Unit

DRAWING ERROR REPORT FB-111A-2

TO:		PROJECT: FB-111A	
DOCUMENT NO.		REFERENCE DESIGNATOR	SUBSYSTEM
USAF T.O. 1F-111(B)A-2-145-1, Change 5		SPU L and R	
UNIT NOMENCLATURE			
Station Program Unit, part number 9346-8479-1			
DISCREPANCY:			
On Sheet 3-244, Figure 3-28 shows modules A3 and A4 which are the left and right SPU's. Note that J479002/28 is referenced to 12D2247. At this reference no J479002/28 can be located but J479002/41 (unwired on the document in question) is present. See Figure 1. It appears that J479002 pins 28 and 41 have been reversed.			
ASSUMED CORRECTION:			
Using USAF T.O. 1F-111(B)A-2-11-1, sheet 1-26, change 2 as supporting documentation, J479002/28 should be unwired and J479002/41 should be shown connected and referenced to 12D2247 in pin 28's place. Figure 2 excerpts the SPU on the aforementioned T.O.			
REPORTED BY <u>M. Garnett</u>		DATE <u>9-23-75</u>	
SNEAK CIRCUIT GROUP ACTION BY <u>Julius B. Campbell</u>		DATE <u>9-24-75</u>	
CONTACT NAME _____		DATE _____	
CONTRACTOR CONCURRENCE BY _____		DATE _____	
Figure 3.6.3, Page 1			

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area of concern

Figure 3.6.3, Page 2

DRAWING ERROR REPORT FB-111A-3

TO:		PROJECT: FB-111A	
DOCUMENT NO.	REFERENCE DESIGNATOR	SUBSYSTEM	
T.O. 1F-111(B)A-2-14	003S10		
UNIT NOMENCLATURE			
EXT STORES JETTISON			
DISCREPANCY:			
Figure 3-28A, Sheet 6, Page 3-246E, Change 5-S10 is labeled "EMER JETTISON SW". On the jettison panel, S10 is labeled "EXT STORES JETTISON" (Ref. T.O. 1F-111(B)A-2-11-1, Change 4, page 1-3 and 1-23)			
ASSUMED CORRECTION:			
Change figure 3-28A, Sheet 6 of T.O. 1F-111(B)A-2-14 to read "EXT STORES JETTISON" so that panel nomenclature and schematic nomenclature will agree.			
REPORTED BY <u>Jim Verges</u>		DATE <u>9-24-75</u>	
SNEAK CIRCUIT GROUP ACTION BY <u>J. Burt Campbell</u>		DATE <u>10-7-75</u>	
CONTACT NAME _____		DATE _____	
CONTRACTOR CONCURRENCE BY _____		DATE _____	
Figure 3.6-4			

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SNEAK CIRCUIT DRAWING ERROR REPORT FB-111A-4

TO:		PROJECT:
DOCUMENT NO. T.O. 16W6-23-2, 2-69, Change 9	REFERENCE DESIGNATOR Pivot Pylon	SUBSYSTEM Monitor & Control
UNIT NOMENCLATURE Conventional Weapon Station Program Unit		
DISCREPANCY: T.O. 16W6-23-2 shows an electrical connection between Pins 1, 20, 21 of connector P47900-1. T.O. 1F-111(B)A-2-14 and T.O. 1F-111(B)A-2-11-1 show an electrical connection between Pins 1, 20, 22 of connector P479001-1.		
ASSUMED CORRECTION: T.O. 16W6-23-2 should be changed to show electrical connection between Pins 1, 20, 22 of connector P479001-1.		
REPORTED BY <u>H. Holt 2/1 H.H.</u>		DATE <u>10-3-75</u>
SNEAK CIRCUIT GROUP ACTION BY <u>H. Holt 2/1 H.H.</u>		DATE <u>10-3-75</u>
CONTACT NAME _____		DATE _____
CONTRACTOR CONCURRENCE BY _____		DATE _____

Figure 3.6-5

SNEAK CIRCUIT DRAWING ERROR REPORT FB-111A-5

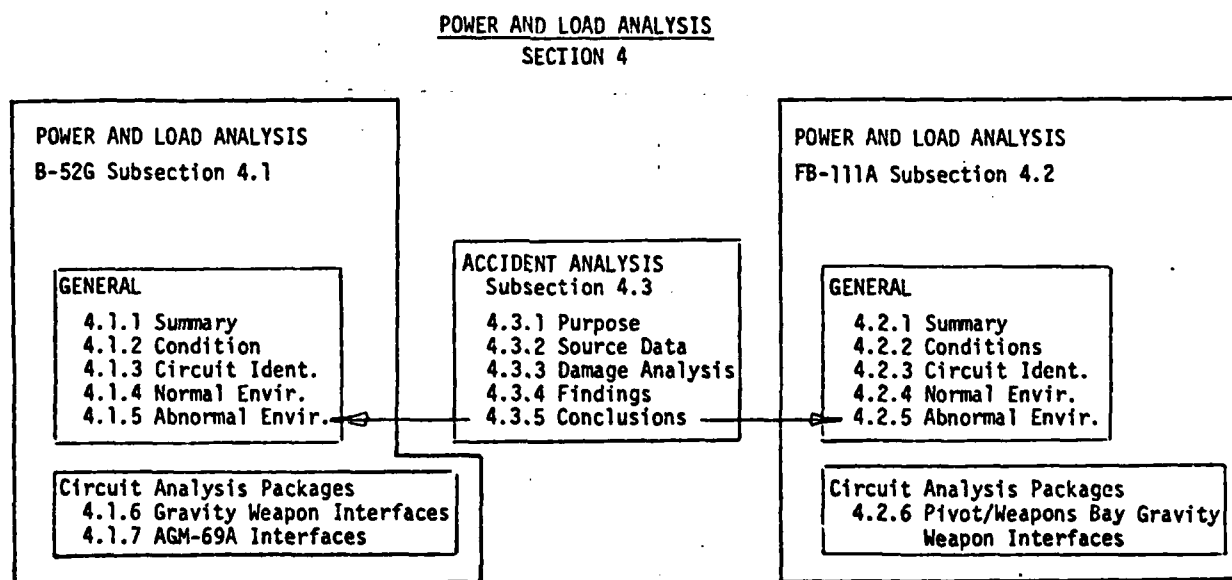
TO:		PROJECT:
DOCUMENT NO. T.O. 1F-111(B)A-2-14, Change 10	REFERENCE DESIGNATOR 304A1	SUBSYSTEM Weapon Release
UNIT NOMENCLATURE Program Release B Circuit Breaker		
DISCREPANCY: T.O. 1F-111(B)A-2-14, Page 3-762A, Change 10 shows the Program Release B circuit breaker between wire A2403A12 and the essential bus rated at 5 amps. T.O. 1F-111(B)A-2-14, Page 3-246H, Change 5, shows the Program Release B circuit breaker between wire A2403A12 and the essential bus rated at 20 amps.		
ASSUMED CORRECTION: T.O. 1F-111(B)A-2-14, Page 3-762A should be changed to show the Program Release B circuit breaker (between wire A2403A12 and essential bus) rated at 20 amps.		
REPORTED BY <u>H. Holt <i>H. Holt</i></u>		DATE <u>10-3-75</u>
SNEAK CIRCUIT GROUP ACTION BY <u>H. Holt <i>H. Holt</i></u>		DATE <u>10-3-75</u>
CONTACT NAME _____		DATE _____
CONTRACTOR CONCURRENCE BY _____		DATE _____
Figure 3.6-6		

HOU-777-1

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4.0 POWER AND LOAD ANALYSIS

Boeing performed a power and load analysis of B-52 and FB-111 aircraft monitor and control (AMAC) circuitry to the nuclear weapon interfaces. Normal power and load analysis included direct and indirect interface circuits. Circuits adjacent to exposed nuclear weapon system circuitry sharing common cables, connectors and components were included in the fault analysis. The B-52 and FB-111 subsections are designed to stand alone in the event that they are separated from the rest of the report. The following diagram shows how the power and load analysis subsections are organized.



4.1 POWER AND LOAD ANALYSIS - B-52G

This section describes the power and load analysis of the B-52G monitor and control (AMAC) circuits leading to gravity weapons loaded on the forward bomb bay multiple carriage clip-in assembly and to AGM-69A missiles on the left pylon and the launcher in the aft bomb bay. Figures 4.1-A and 4.1-B are simplified schematic diagrams of gravity weapon circuits and AGM-69A arming circuits. Numbers opposite the AMAC connector pins refer to analysis packages in Sections 4.1.6 and 4.1.7 of this report.

4.1.1 Summary

The power and load analysis was performed on groups of interface circuits identified by sneak circuit network trees. Results are summarized in Table 4.1-A.

4.1.2 Conditions

The study was made according to the following ground-ruled conditions:

- o Interfaces with gravity bombs are the connectors shown in the aircraft wiring diagrams.
- o Interfaces with SRAM are the aircraft connectors to the SRAM missile. Internal SRAM missile circuits were excluded.
- o Aircraft circuits for SRAM guidance were excluded.
- o One SRAM weapons bay installation and one SRAM pylon station was analyzed in depth for the B-52G. The other similar SRAM installations were analyzed for impacts of detail differences.
- o Analyses of abnormal environments considered only one fault at a time.
- o Wiring faults within aircraft wiring harnesses were limited to those within shared cables and connectors. Cable-to-cable and bundle-to-bundle wiring faults were excluded.
- o Release circuits were not included as nuclear weapon interface circuits during load analysis for abnormal environments.
- o Short circuits in terminals and faults internal to components were considered only in the worst-case abnormal environment analysis for each model.

TABLE 4.1-A Power and Load Analysis Results - B-52/Gravity Weapons Interface
(Sheet 1 of 2)

WEAPON INTERFACE		ENVIRONMENT ANALYSIS RESULTS									
		NORMAL			ABNORMAL - WORST CASE			ANALYSIS PACKAGE			
		V	I	t	V	I	t	Section 4.1.6			
A114, J11, Forward Bomb Bay Clip- J12, J13 In Connectors and J14		Note: Power is DC unless otherwise noted. AC current is 400 Hz unless otherwise noted.									
Pin A	IFC SAFING PWR	24V	75A	3.5s	24V	109A	1.4s	24V	109A	1.4s	4.1.6.7
B	TESTER SW GND	0	0	-	0	152A	.8s	24V	152A	.8s	4.1.6.7
C	TESTER SW OFF/SAFE	0	0	-	0	110A	1.1s	24V	110A	1.1s	4.1.6.4
D	TESTER SW AIR	0	0	-	0	152A	.8s	24V	152A	.8s	4.1.6.7
E	IFC SAFING PWR	24V	131A	1.0s	24V	211A	.8s	24V	211A	.8s	4.1.6.7
F	TESTER SW SAFE	0	0	-	0	109A	1.2s	24V	109A	1.2s	4.1.6.6
G	INFLIGHT TEST	0	0	-	0	152A	.8s	24V	152A	.8s	4.1.6.7
H	TESTER SW, READY	0	0	-	0	150A	.8s	24V	150A	.8s	4.1.6.6
J	TESTER SW, AIR	0	0	-	0	109A	1.2s	24V	109A	1.2s	4.1.6.6
L	INFLIGHT TEST	0	0	-	0	152A	-	24V	152A	-	4.1.6.7
O	WPN GROUND	GROUND			GROUND			24V			
P	IFC SAFING PWR	24V	152A	0.8s	24V	258A	.8s	24V	258A	.8s	4.1.6.7
R	INFLIGHT TEST	0	0	-	0	152A	.8s	24V	152A	.8s	4.1.6.7
S	WPN GROUND	GROUND			GROUND			28V			
J11,12T	FWD IFI PWR, 25A	0	0	-	0	1170A	.8s	28V	1170A	.8s	4.1.6.3 (LH WPNS)
J13,14T	AFT IFI PWR, 25A	0	0	-	0	1000A	.8s	28V	1000A	.8s	4.1.6.2 (RH WPNS)
U	WPN GROUND	GROUND			GROUND						
V	WPN GROUND	GROUND			GROUND			28V			
W	FWD IFI PWR, 15A	0	0	-	0	800A	.8s	24V	800A	.8s	4.1.6.3
X	(OPEN)	0	0	-	0	152A	.8s	28V	152A	.8s	4.1.6.7
Y	FWD IFI PWR, 15A	0	0	-	0	800A	.8s	24V	800A	.8s	4.1.6.3
Z	TESTER SW, AIR	0	0	-	0	110A	1.1s	24V	110A	1.1s	4.1.6.4
a	TESTER SW, GND	0	0	-	0	110A	1.1s	24V	110A	1.1s	4.1.6.4
c	TESTER SW, GND	0	0	-	0	109A	1.2s	24V	109A	1.2s	4.1.6.6
d	IFC RELAY (FWD)	0	0	-	0	152A	.8s	24V	152A	.8s	4.1.6.1
f	TESTER SW, READY	0	0	-	0	218A	.8s	24V	218A	.8s	4.1.6.4
h	FWD BOMB BAY SAFE	0	0	-	0	152A	.8s	24V	152A	.8s	4.1.6.5

TABLE 4.1A Power and Load Analysis Results - B-52/AGM-69 Interfaces
(Sheet 2 of 2)

WEAPON INTERFACE		ENVIRONMENT ANALYSIS RESULTS									
		NORMAL			ABNORMAL - WORST CASE			ANALYSIS PACKAGE			
		V	I	t	V	I	t	Section 4.1.7			
DESIGNATOR	FUNCTION										
J1	Missile Connector										
Pin 2	BATTERY ACTIVATE PYLON LAUNCHER	OV OV	OA OA	- -	118VAC 118VAC	983A 900A	.125s .125s	4.1.7.4 4.1.7.4			
10	ACCUMULATOR ACT. PYLON LAUNCHER	OV OV	OA OA	- -	118VAC 118VAC	983A 900A	.125s .125s	4.1.7.4 4.1.7.4			
20	SAF CLASS III A CMD. PYLON LAUNCHER	OV OV	OA OA	- -	118VAC 118VAC	983A 900A	.125s .13s	4.1.7.8 4.1.7.8			
26	FIN UNLOCK PYLON LAUNCHER	OV OV	OA OA	- -	118VAC 118VAC	983A 900A	.125s .125s	4.1.7.4 4.1.7.4			
57	PROPULSION SAFE PYLON LAUNCHER	OV OV	OA OA	- -	28V 28V	1115A 411A	1.5s 2.0s	4.1.7.5 4.1.7.3			
60	SAF CLASS III B CMD. PYLON LAUNCHER	OV OV	OA OA	- -	118VAC 118VAC	983A 900A	.125s .13s	4.1.7.8 4.1.7.8			
82, 92, 96	MISSILE ELECTRONIC POWER PYLON SYS. ON SYS. OFF LAUNCHER SYS. ON SYS. OFF	28V OV 28V OV	254A OA 368A OA	.45s - .2s -	28V 28V 28V 28V	1115A 1115A 1220A 1220A	1.5s 1.5s 1.5s 1.5s	4.1.7.6 4.1.7.6 4.1.7.2 4.1.7.2			
97	SAF PREARM CMD. PYLON LAUNCHER	OV OV	OA OA	- -	118VAC 118VAC	983A 900A	.125s .13s	4.1.7.1 4.1.7.1			
J1	Ejector Connector										
Pin r	ARM SOLENOID PYLON LAUNCHER	OV OV	OA OA	- -	27V 27V	37A 54A	1.1s 1.1s	4.1.7.7 4.1.7.7			

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4.1.3 Identification of Circuits

The analysis used Air Force technical manuals and other source documents to identify the interface circuits. The gravity bomb interfaces are shown in T.O. 11N-H5035-2, Figure 5-2, Change 4. (Reproduced in Figure 4.1-A of this report). The AMAC circuitry to the gravity weapons is shown in Figure 4.1-B, which is a reproduction of T.O. 1B-52B-2-31, Figure 3-10, Change 33. Analysis package numbers are shown opposite to the corresponding AMAC connector pins. AGM-69A missile interface is shown in Figure 4.1-C. Pertinent arming circuits are shown in Figure 4.1-D. The analysis used sneak circuit network trees and other source documents to identify adjacent and interrelated circuits for fault analysis. The applicable network trees are reproduced in the analysis packages.

4.1.4 Normal Environment

Power capability of the interfacing circuits was calculated by determining open circuit voltage and short circuit current at the weapon interfaces with the circuits grounded at that point.

4.1.5 Abnormal Environments

Each network tree was analyzed for postulated faults. Postulated faults were identified by numbered circles. The worst case for each interfacing circuit was identified and open circuit voltage, short circuit current and the duration of current flow was determined.

Several of the faults postulated receive power through the DCU-9/A Tester or SWK Box. Power from these sources can occur only twice during a mission according to T.O. 1B-52G-1, Radar Navigators Checklist (Nuclear), once during the Interior Inspection Checklist, before takeoff, and during the Before Descent Checklist. Power paths other than those through DCU-9/A Tester or SWK Box were used to determine worst case conditions whenever they existed. The reasons are that exposure to damage time during testing is minimal, and testing does not occur during landing, takeoff and air refueling when risk to damage is highest.

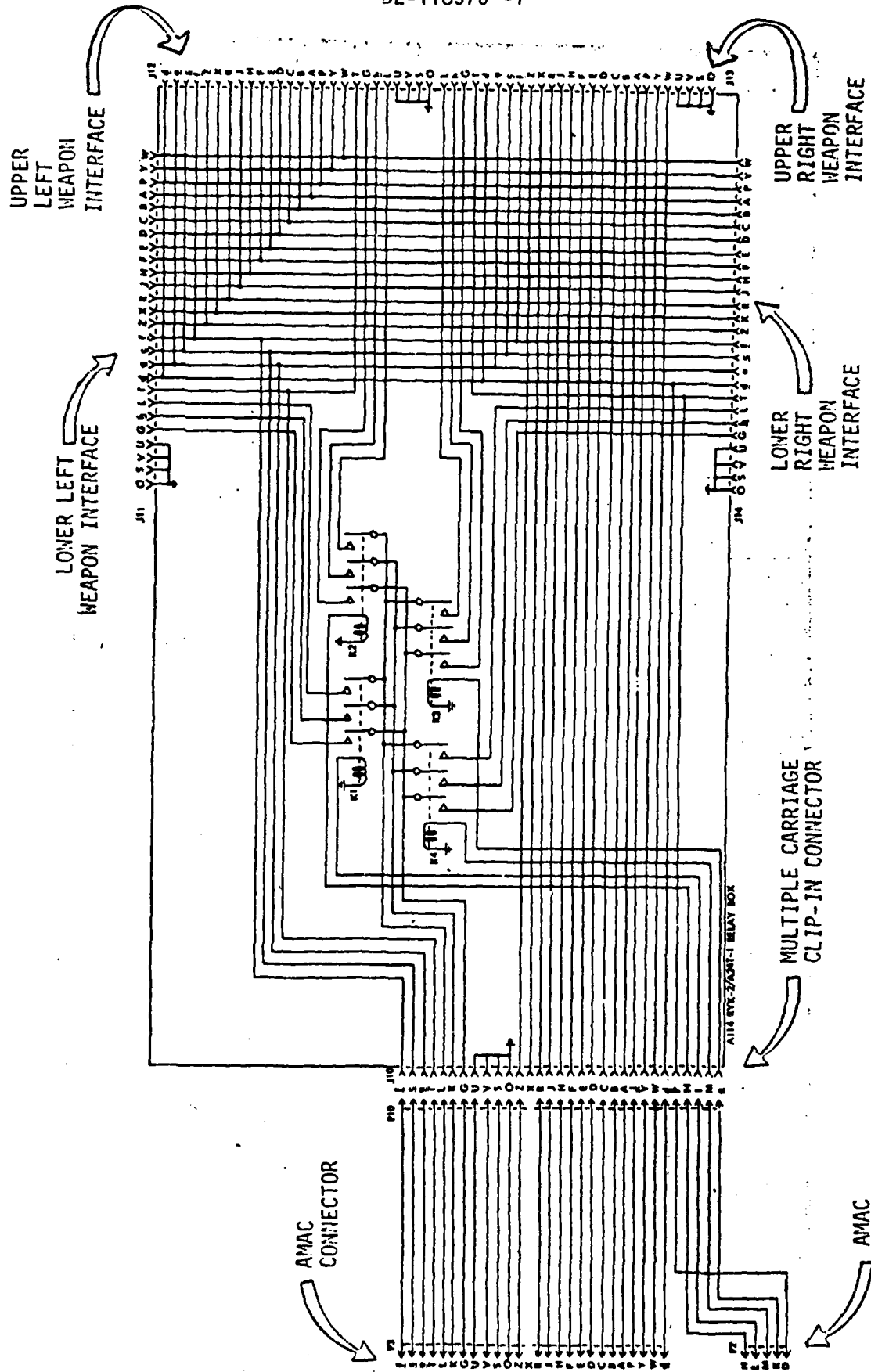


Figure 4.1-A Gravity Bomb Weapon Interfaces

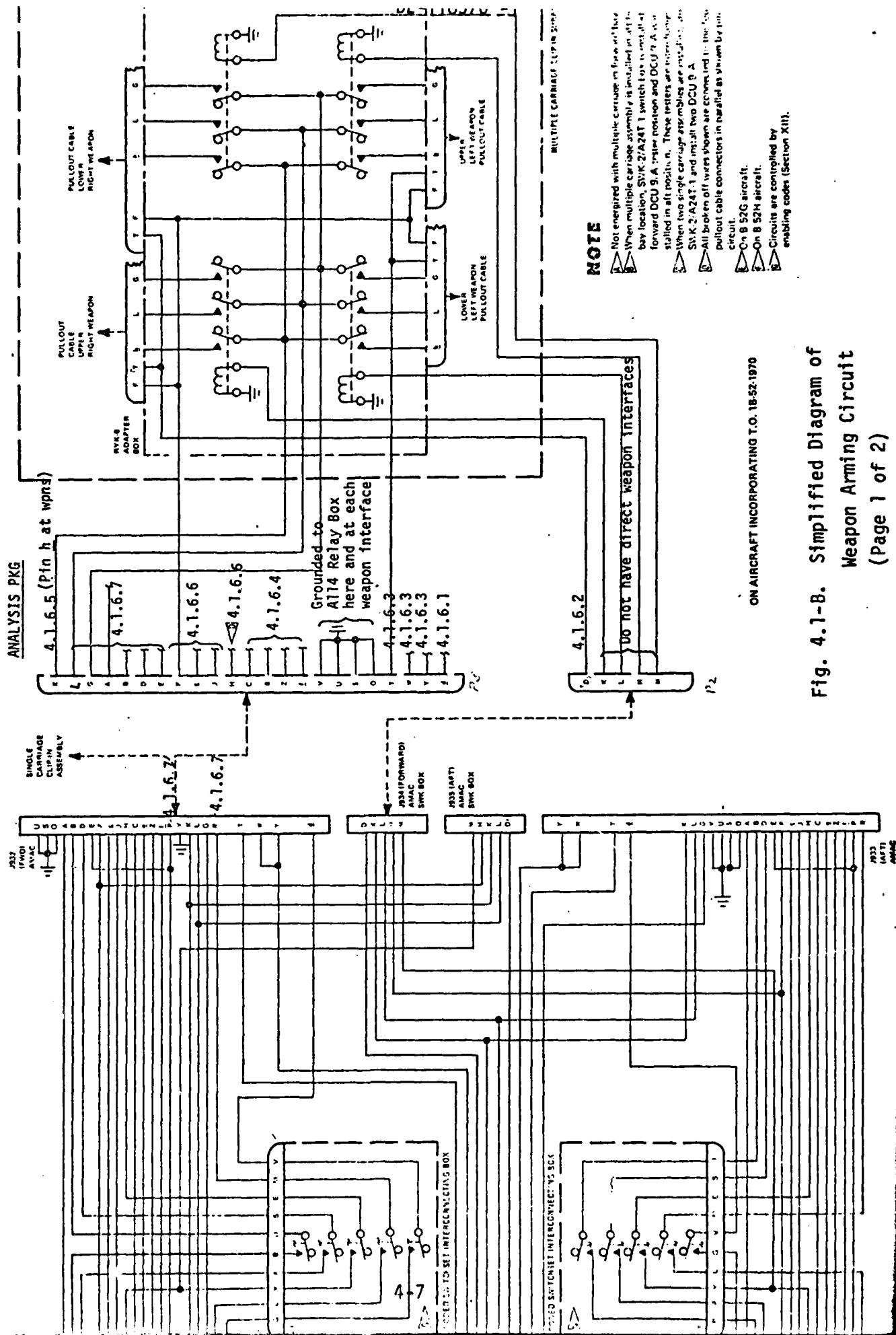


Fig. 4.1-B. Simplified Diagram of
Weapon Arming Circuit
(Page 1 of 2)

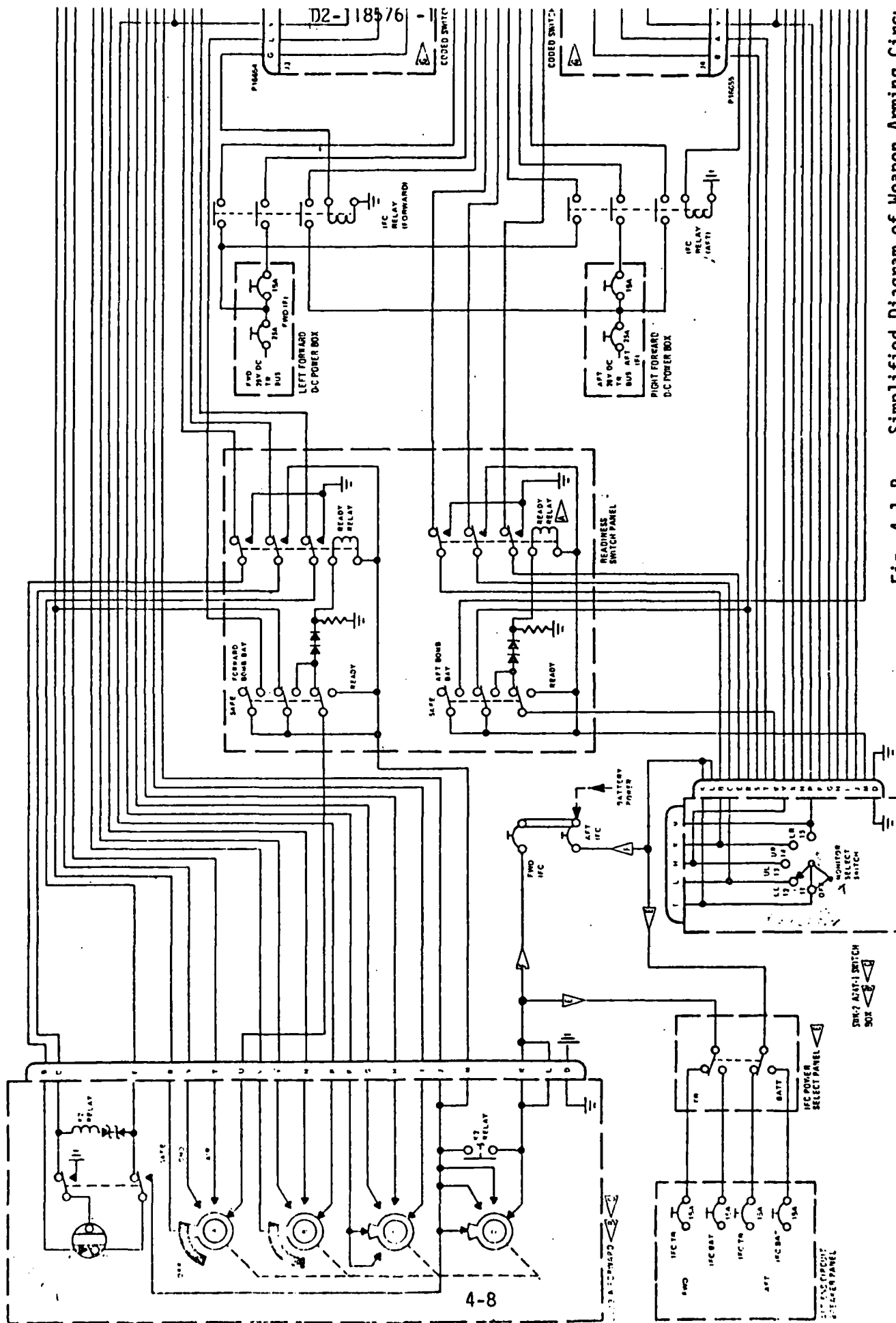


Fig. 4.1-8. Simplified Diagram of Weapon Arming Circuit (Page 2 of 2)

Figure 3-10. Weapon Arming Simplified Circuit (B-52G and H Aircraft) (Sheet 2 of 2)

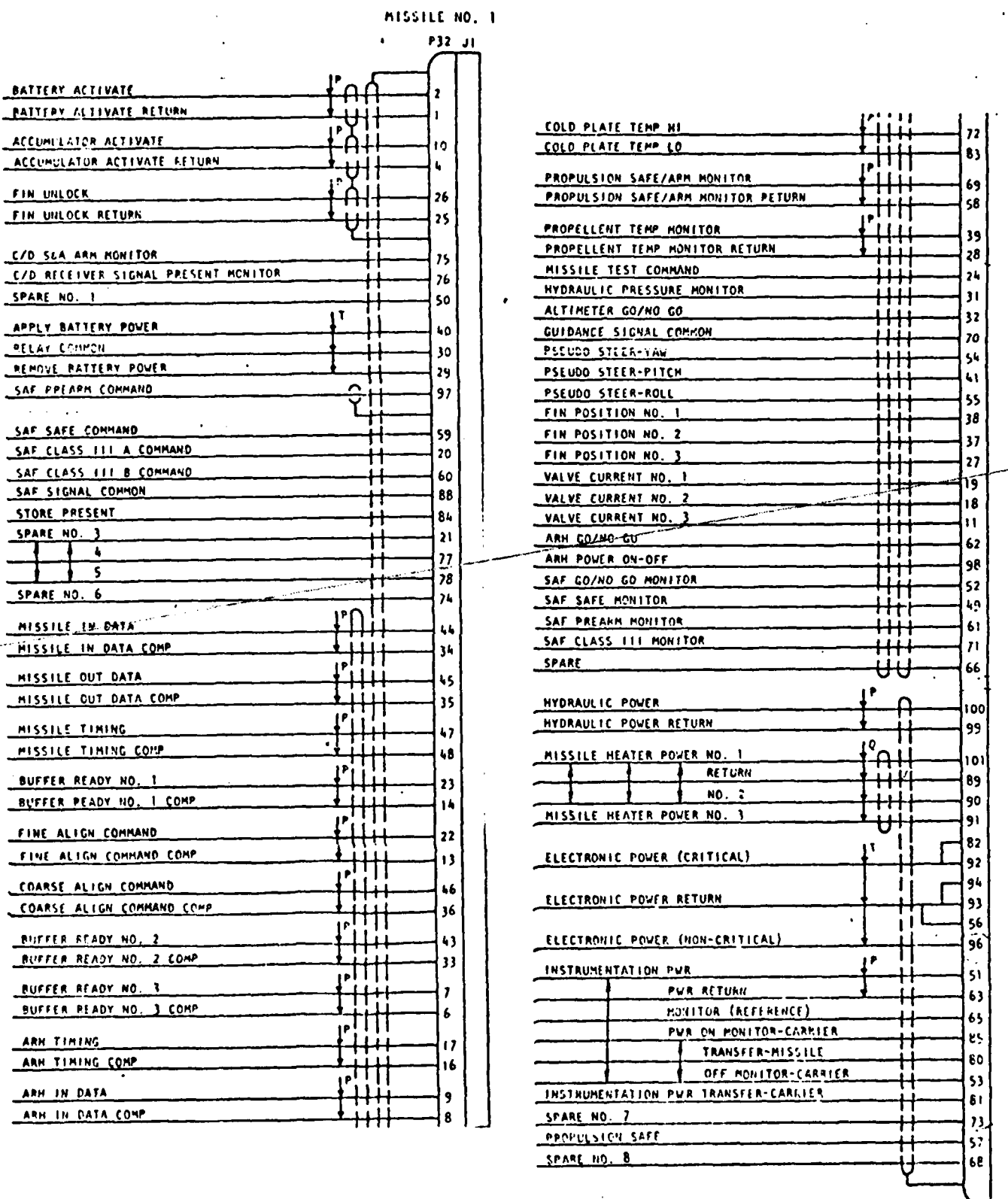
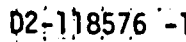


Figure 4.1-C AGM-69A Missile Interface



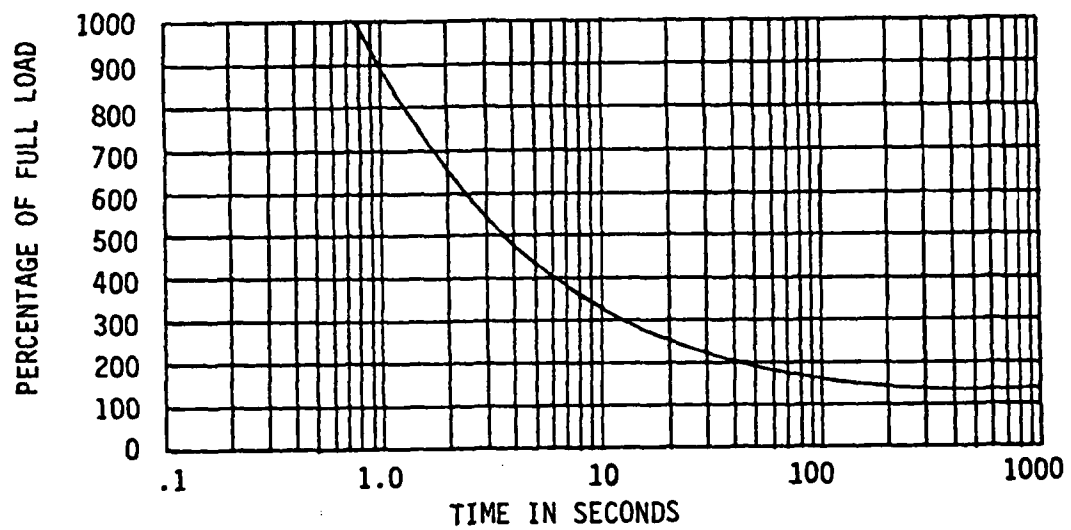
4-10

Figure 4.1-D AGM-69A Simplified Schematic - Arming Circuits

4.1.5.1 Ground Rules & Assumptions

Wire resistances and resistances across switches and relays were selected from parts specifications. Zero ohms resistance was assumed for cable connections and splices. Circuit breaker trip-times were determined from Figure 4.1-E, B-52 Gravity Bomb Circuit Breaker Trip Time V- Current Profile, and Figures 4.1-F, -G and -H, AGM-69A Circuit Breaker Trip Time Vs Current Profile. These curves were obtained from parts specifications. When applicable, standard temperature was used in determining characteristics.

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CB TRIP TIME VS CURRENT PROFILE

Figure 4.1-E Gravity Bomb Circuit Breaker
Trip Time Vs Maximum Current

Rev. E 50

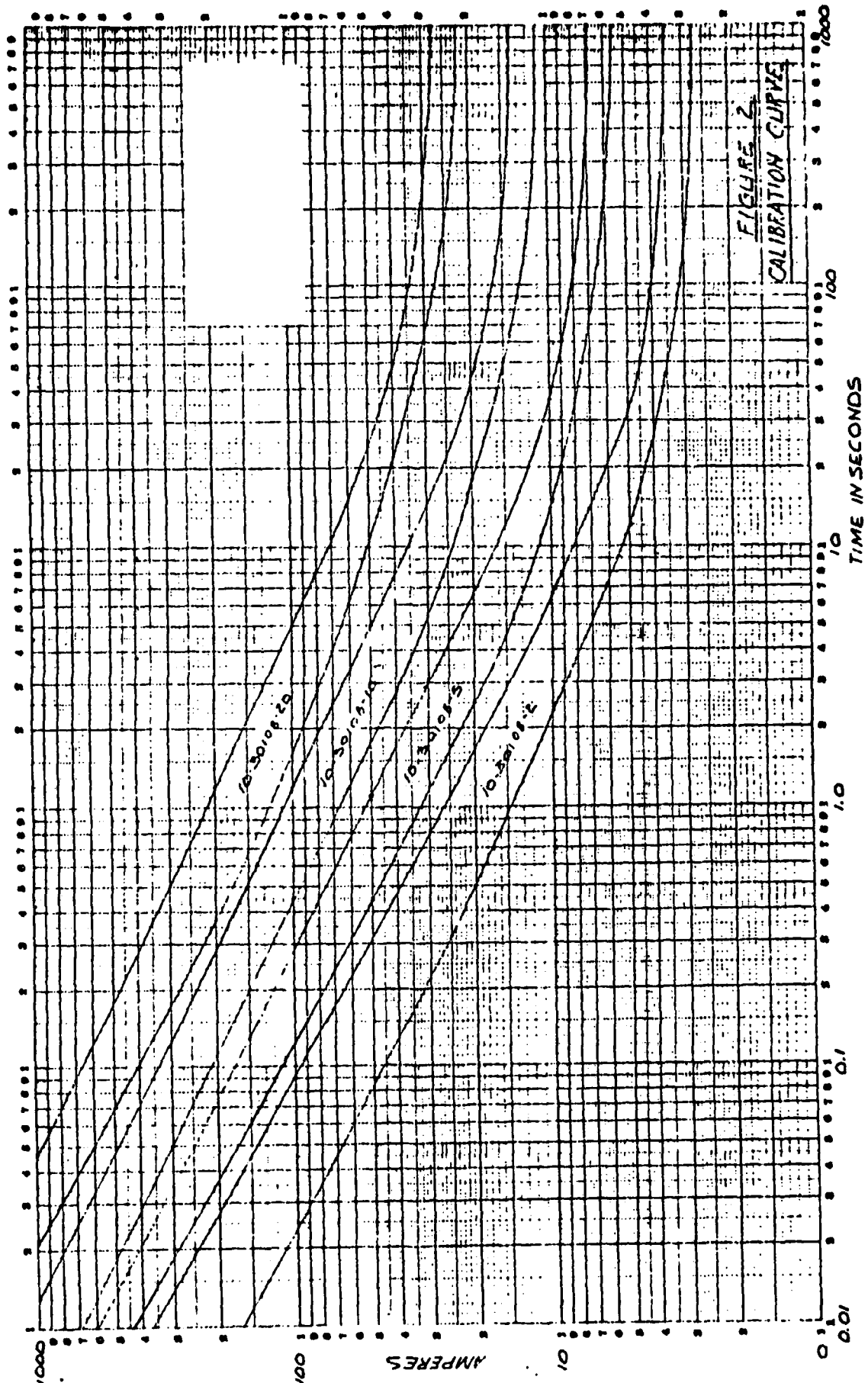


Fig. 4.1-F AGM-69A Circuit Breaker
Trip Time Vs Current -
2, 5, 10 & 20 A Breakers

REV. E 51

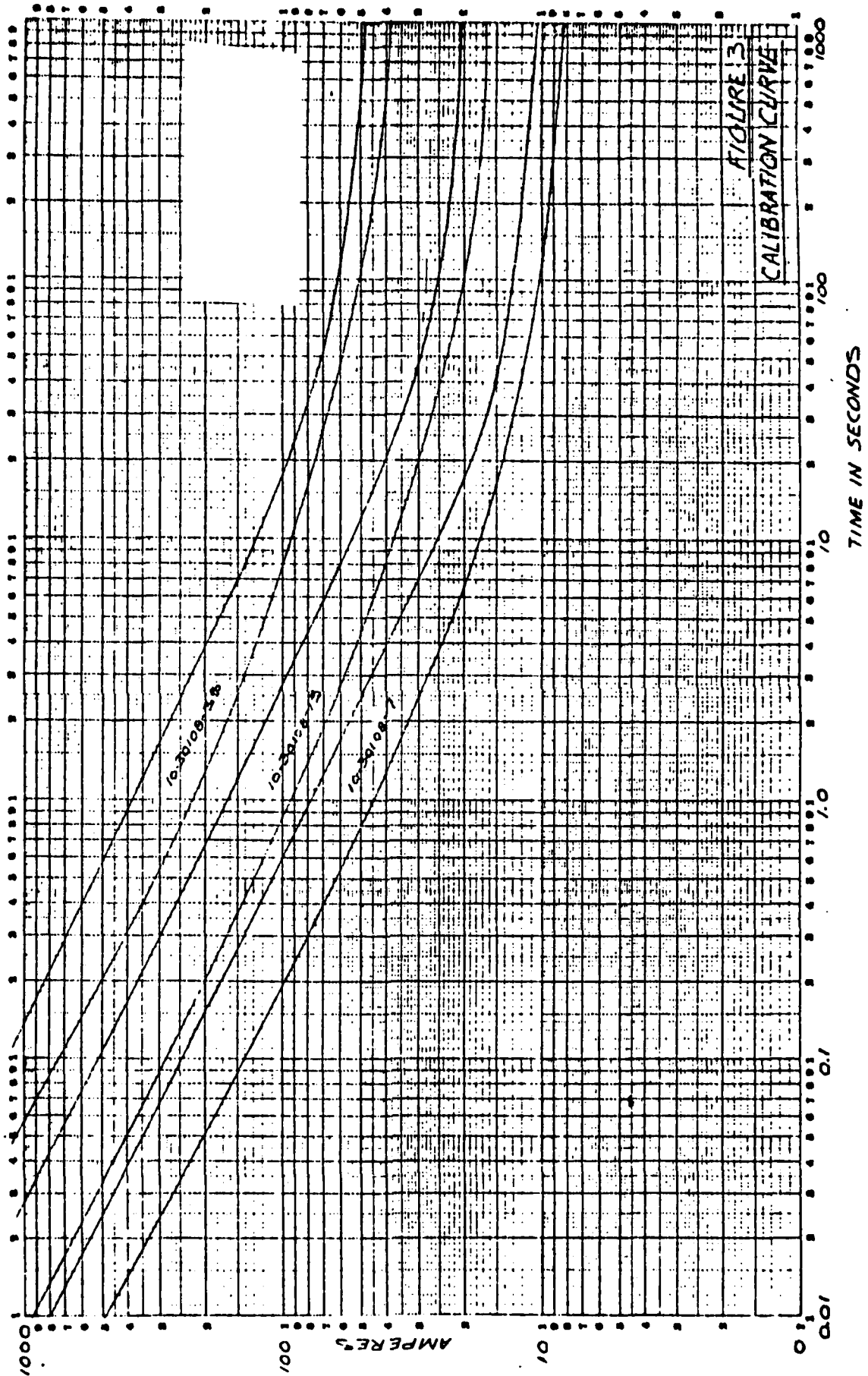
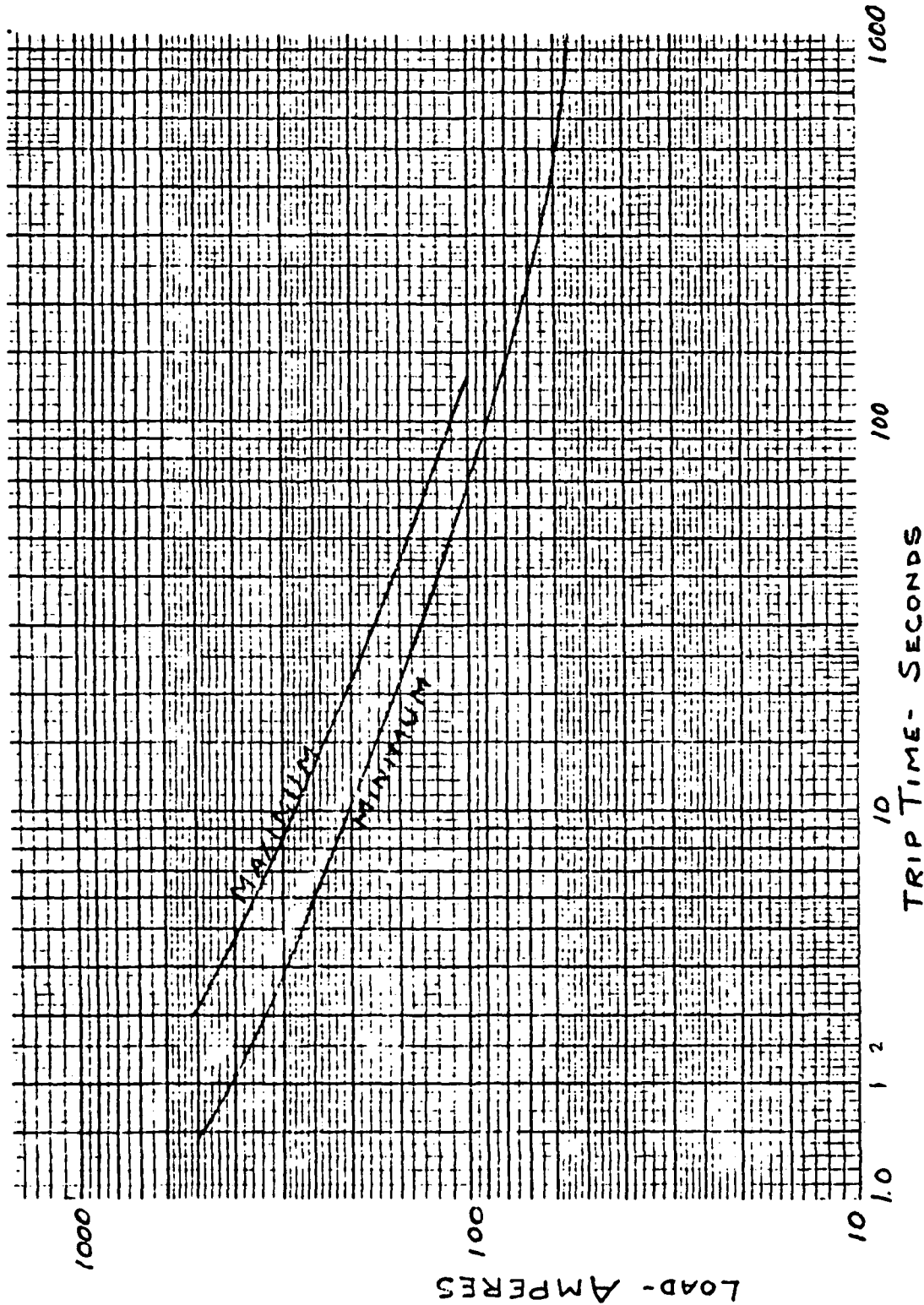


Fig. 4.1-G AGM-69A Circuit Breaker
Trip Time Vs Current -
7, 15, & 35 A Breakers



CALIBRATION CURVE - 501
 Fig. 4.1-H AGM-69A Circuit Breaker
 Trip Time Vs Current -
 60 A Breaker

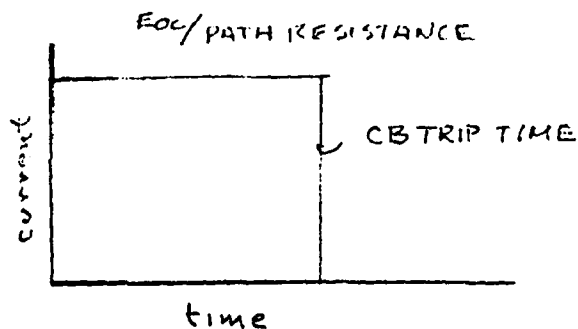
4.1.6 CIRCUIT ANALYSIS PACKAGES

Normal and fault analyses of each network tree are documented in individual packages. The following analysis packages cover all of the interface circuits to weapons carried in the forward bomb bay on the multiple carriage clip-in assembly:

4.1.6.1	Pin d	AMAC FWD SYS SECT III & IFC RELAY (Network Tree 0200)
4.1.6.2	Pin T	POWER FROM TR 4 (Network Tree 80)
4.1.6.3	Pins T, W & Y	POWER FROM TR 8 (Network Tree 83)
4.1.6.4	Pins C, f, Z & a	INFLIGHT CONTROL TESTER, DCU-9A (Network Tree 0198)
4.1.6.5	Pin h	FWD BOMB BAY SAFING (Network Tree 201, 248)
4.1.6.6	Pins c, J, H & F	INFLIGHT CONTROL TESTER, DCU-9A (Network Tree 0199)
4.1.6.7	Pins G, L, R, E, D, B, A & P	DCU-9A, INFLIGHT TEST (Network Tree 43B)
4.1.6.8	Pin X	UNUSED CIRCUITRY (Network Tree 202)

NOTE

Power Profiles - In all cases, short circuit current, caused by faults was found to be constant because of the absence of inductors and capacitors in the circuits investigated. Voltage source impedance was assumed to be zero ohms. A typical fault current Vs time profile is shown here:

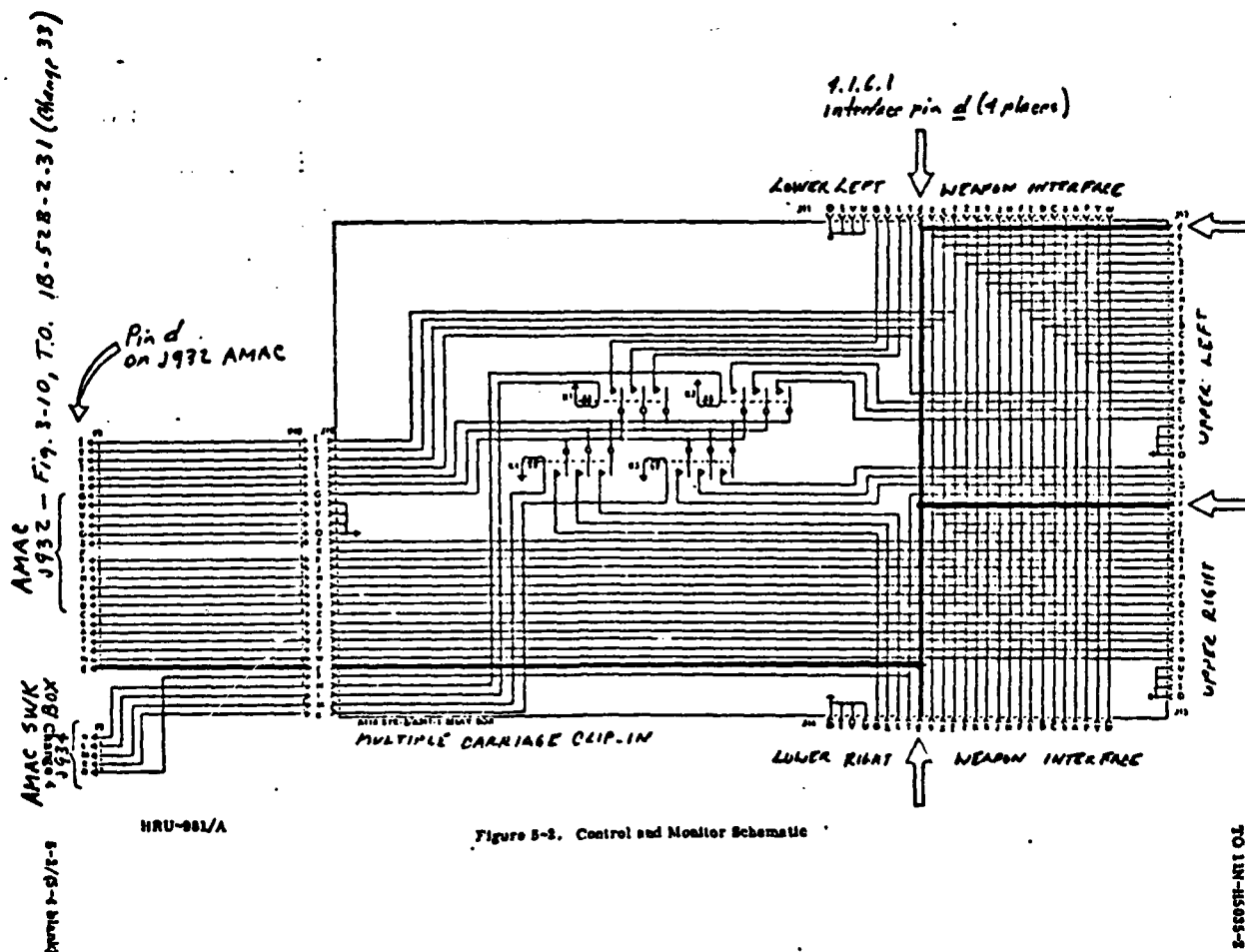


FAULT CURRENT PROFILE

CLIP-IN ASSEMBLY PIN d CIRCUIT ANALYSIS PACKAGE

4.1.6.1 Circuit Analysis Package, Weapon Interface Pin d of Connectors J11, J12, J13 and J14 on the A114 Clip-In Assembly and Cable In Forward Bomb Bay

These interfaces are shown in Figure 5-2, T.O. 11N-H5035-2 (Change 4) - copy attached below. Maximum current available to pin d in a normal environment is 0 amps. Worst case current at 24VDC in an abnormal (faulted) environment would be 152 amps assuming the pin d wires grounded at the weapon and shorted to power at J932 (AMAC).



4.1.6.1 (Continued)

a. Normal Power and Load Analysis

From examination of Figure 4.1-1, Network Tree 0200, normal power environment is without voltage sources.

Open circuit voltage = 0V; Short circuit current = 0A.

b. Fault Analysis

The following postulated faults were analyzed using Network Tree 0200 and Figure 4.1-2, Cable Drawing:

① Clip-In Assembly or Connector Damaged

Wires to subject pins shorted to 24VDC from CB1565 or CB1566 during Radar Navigator testing using DCU-9/A and the SWK Box.

② Connector J932/P3 or Cable 31-3516-27 Damaged (Worst Case)

Wires to subject pins shorted to 24VDC from CB1565 during testing. See Figure 4.1-3 for source of voltage.

③ Cable 31-3516-1 Damaged

No voltages present. Cable runs between CSS interconnect box and weapons interface. The interconnect box opens all circuits.

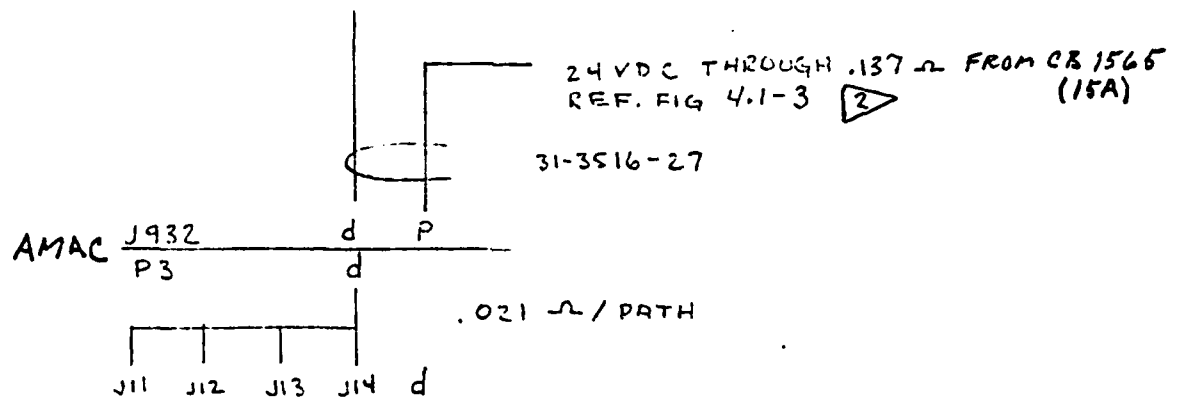
④ Interconnect Box or Connector Damaged

Wires to subject pins shorted to 24VDC from CB1566 during testing. See Figure 4.1-4 for source of voltage.

4.1.6.1 (Continued)

c. Worst Case Path and Calculations

REFERENCE PATH ② in paragraph b.



Total resistance of path = .187 Ω

$V_{OC} = 24\text{VDC}$

$I_{SC} = \frac{24}{.158} = 152 \text{ amps}$

Time = Less than 0.8 seconds. Current is greater than 1000% circuit breaker rating.

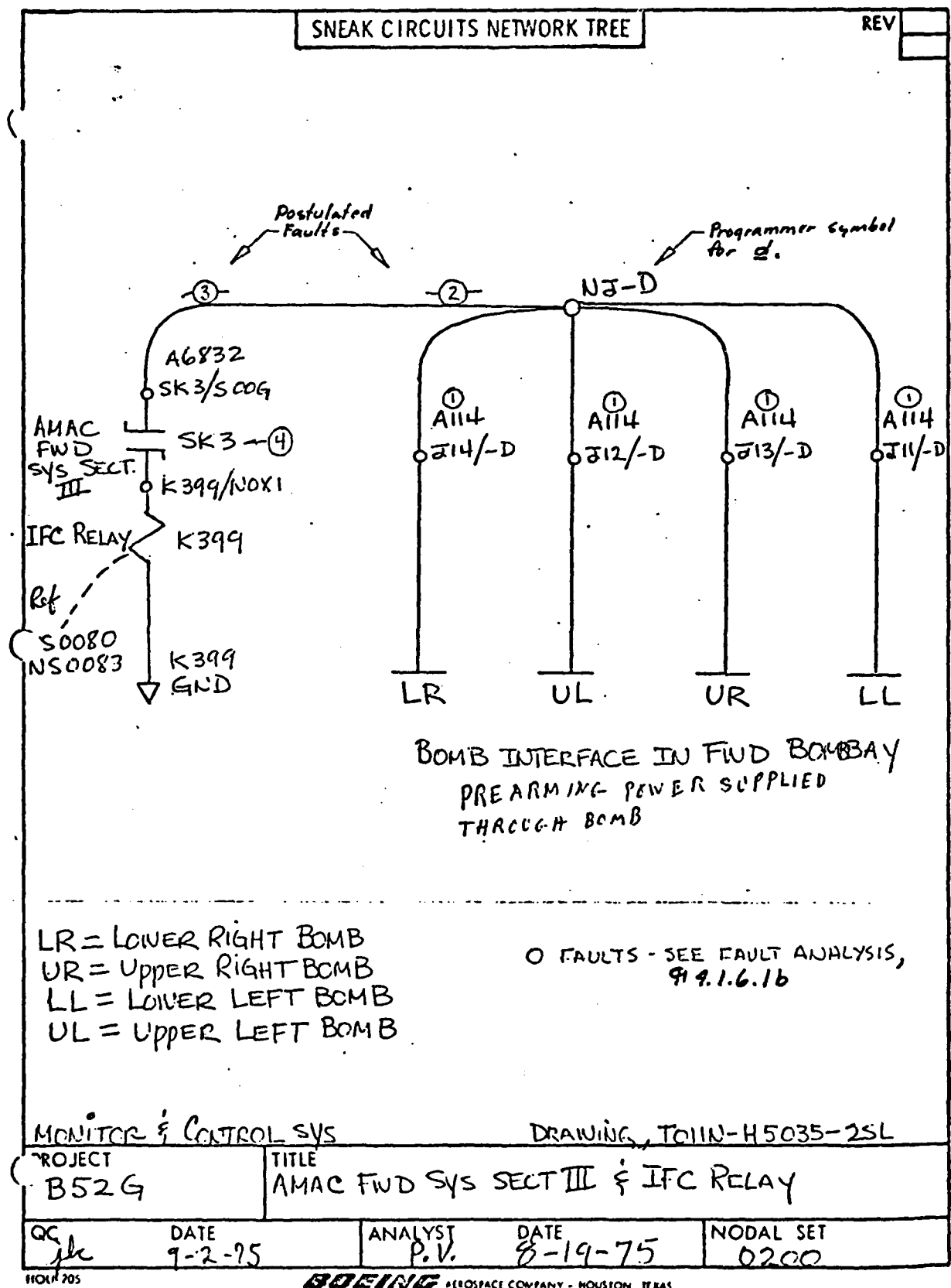


Figure 4.1.1 Network Tree No. 0200

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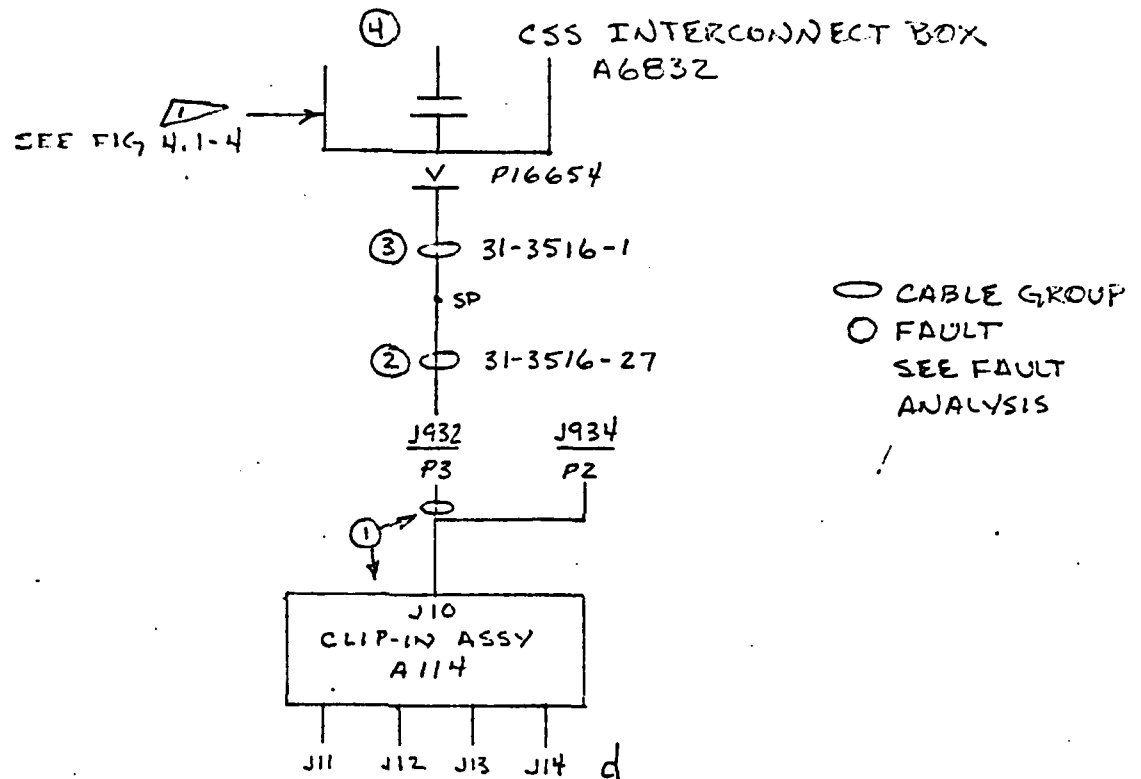
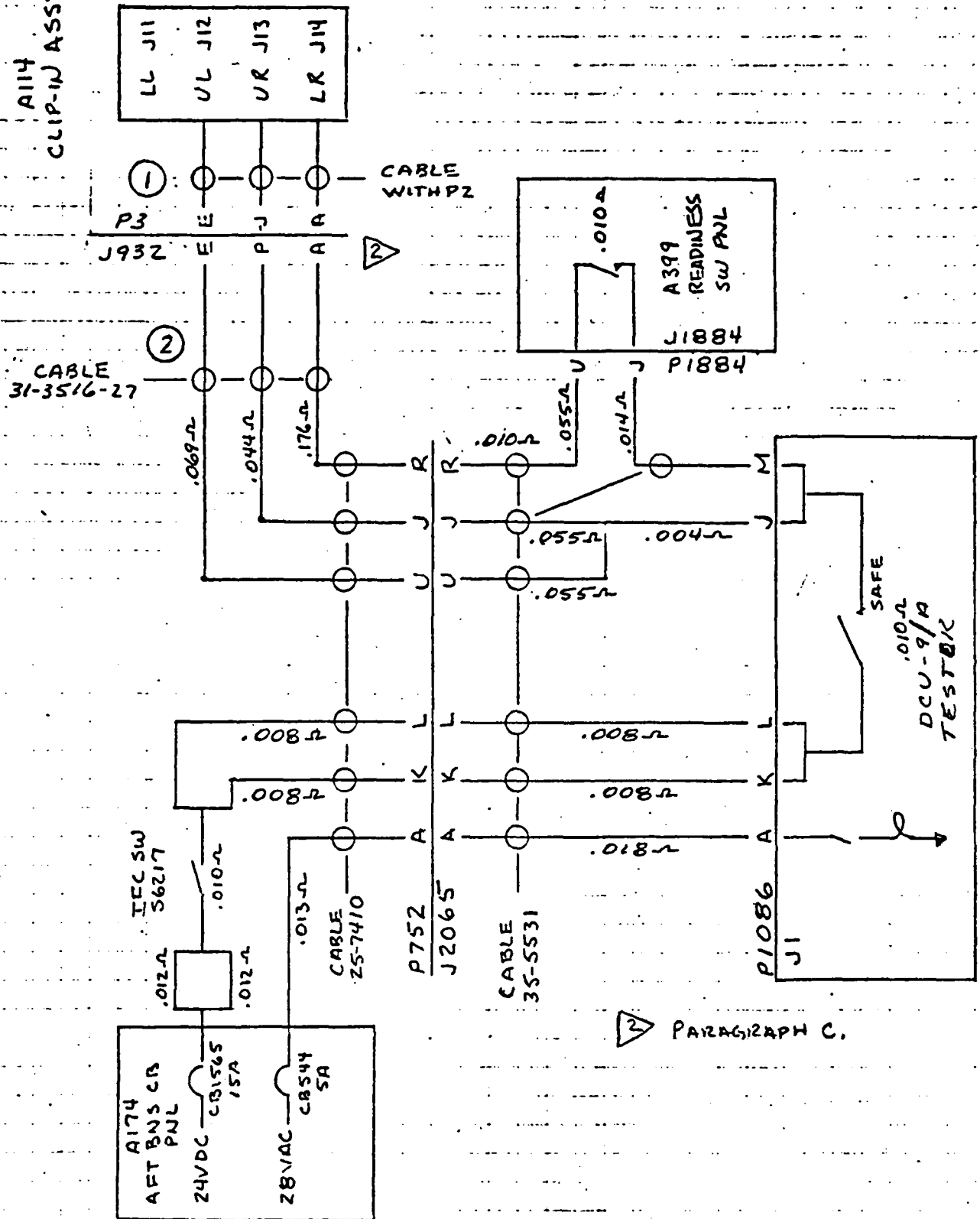


FIGURE 4.1-2

CABLE DRAWING

A114
CLIP-IN ASSY



PARAGRAPH C.

Figure 4.1-3 Power Paths Through DCU-9/A Tester

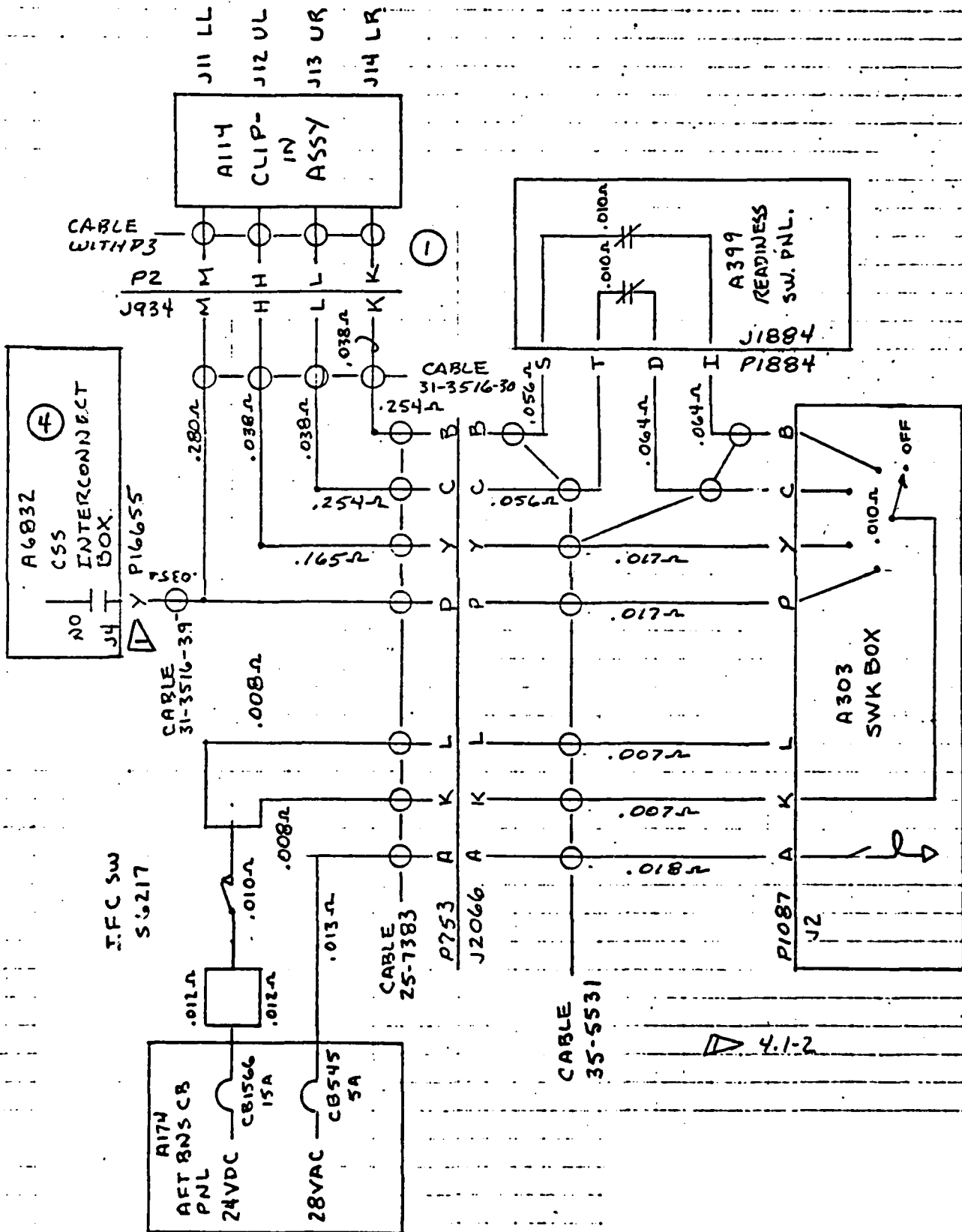


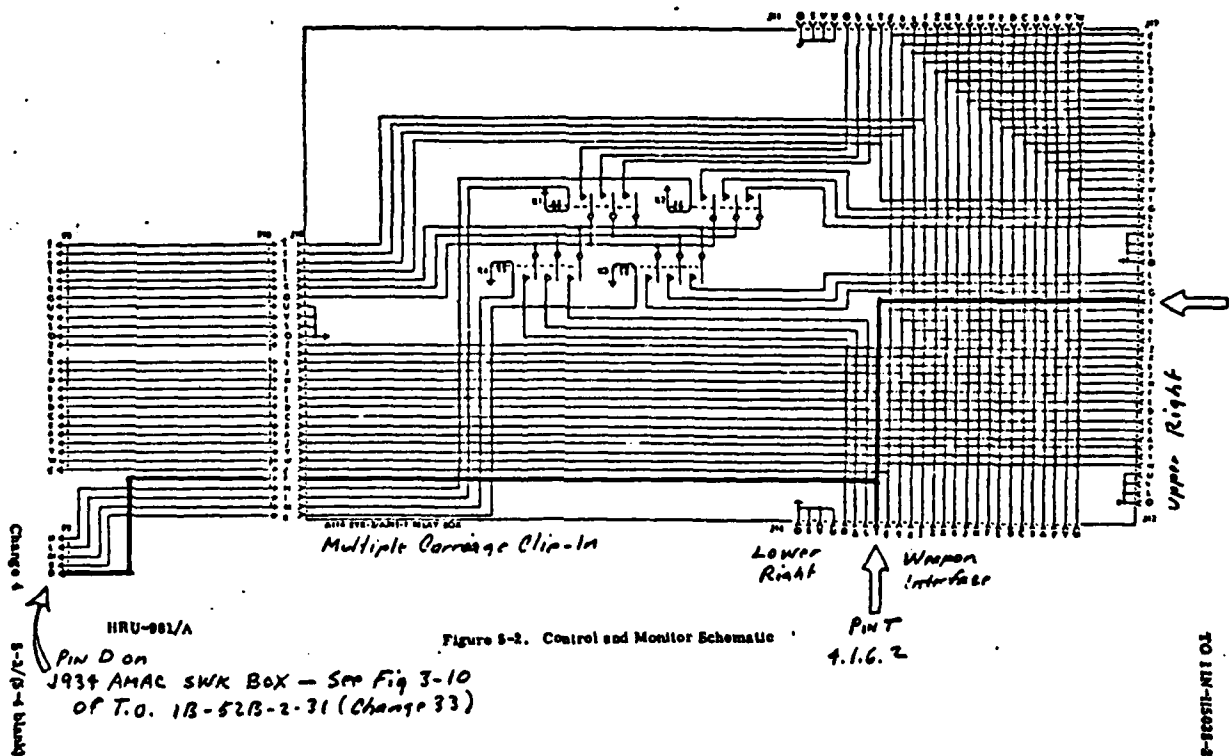
Figure 4.1-4 Power Paths Through SWK Box

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CLIP-IN ASSEMBLY UPPER
AND LOWER RIGHT WEAPON
INTERFACE PINS T
CIRCUIT ANALYSIS PACKAGE

4.1.6.2 Circuit Analysis Package, Weapon Interface Pins T of Connectors
J13 and J14 on A114 Clip-In Assembly and Cable in Forward Bomb Bay

These interfaces are shown in Figure 5-2, T.O. 11N-H5035-2 (Change 4) - copy attached below. Maximum current available to pin T in a normal environment is 0 amps. Worst case current at 28VDC in an abnormal (faulted) environment would be 1000 amps, assuming the pins grounded at the weapon and shorted to power at IFC relay.



4.1.6.2 (Continued)

a. Normal Power and Load Analysis

From examination of Figure 4.1-5, Network Tree 80, normal power environment is with K399 open.

Open circuit voltage = 0V; Short circuit current = 0A.

b. Fault Analysis

The following postulated faults were analyzed using Network Tree 80 and Figure 4.1-6, Cable Drawing.

① Clip-In Assembly or Connector Damaged

Wires to subject pins shorted to 24VDC from CB1565 or CB1566 during Radar Navigator Testing with the DCU-9/A and SWK Box. See Figures 4.1-7 and 4.1-8 for voltage source.

② Cable 31-3516-30 or Connector J934/P2

Wires to subject pins shorted to 24VDC from CB1566 during testing. See Figure 4.1-8 for voltage source.

③ IFC Relay K399 Damaged (Worst Case)

Pin L3 to T3 28VDC from CB549

L1 to T3 28VDC from CB548

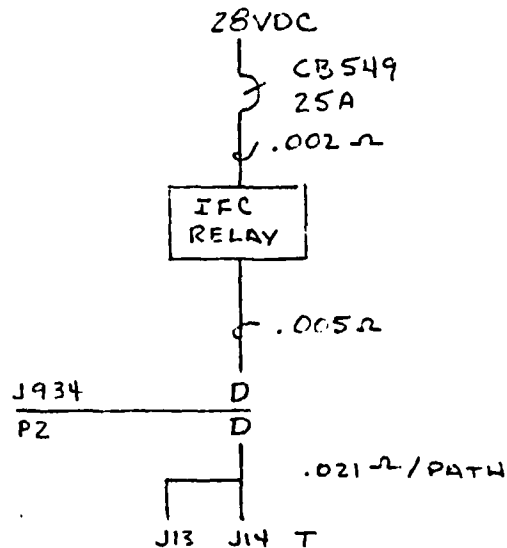
L2 to T3 28VDC from CB550

See Figure 4.1.6 for voltage sources

4.1.6.2 (Continued)

c. Worst Case Path

Reference path ③ IFC Relay K399 Damaged (from paragraph b).

Total resistance of path .028 Ω

$$V_{OC} = 28\text{VDC}$$

$$I_{SC} = \frac{28}{.028} = 1000 \text{ Amps}$$

Time = Less then 0.8 seconds for circuit breaker to open.

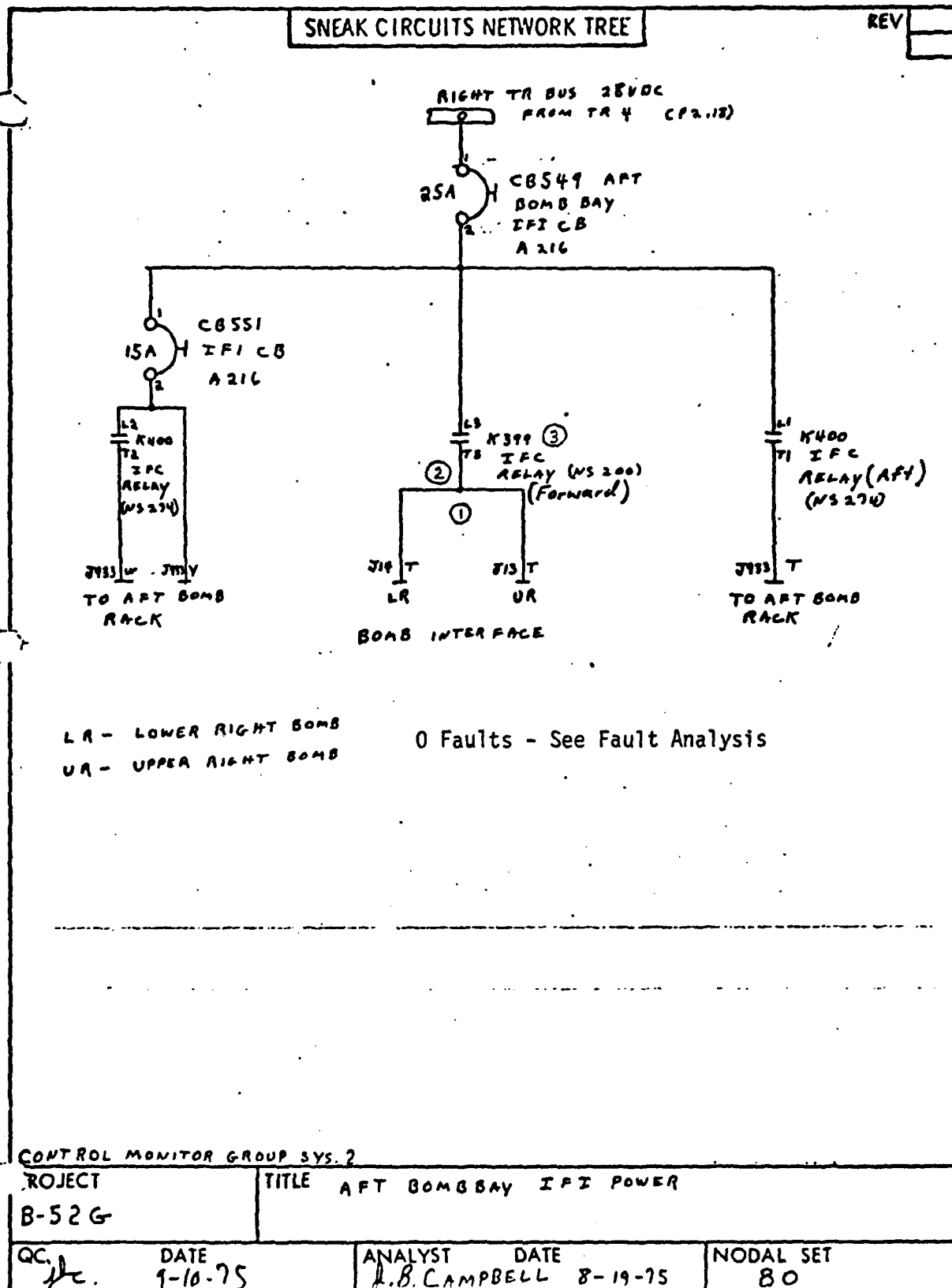
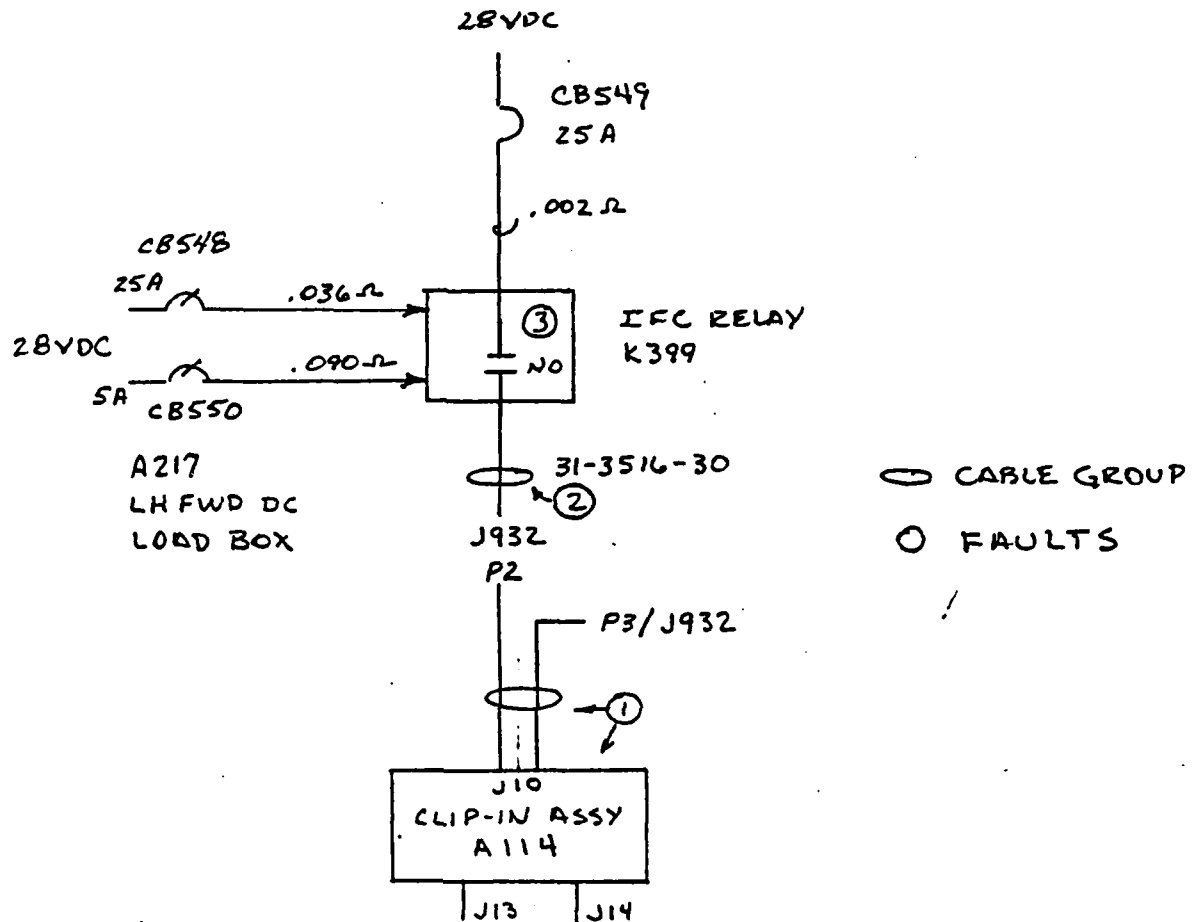


Figure 4.1-5 Network Tree No. 80



CABLE DRAWING

FIGURE 4.1-6

A114
CLIP-W ASSY

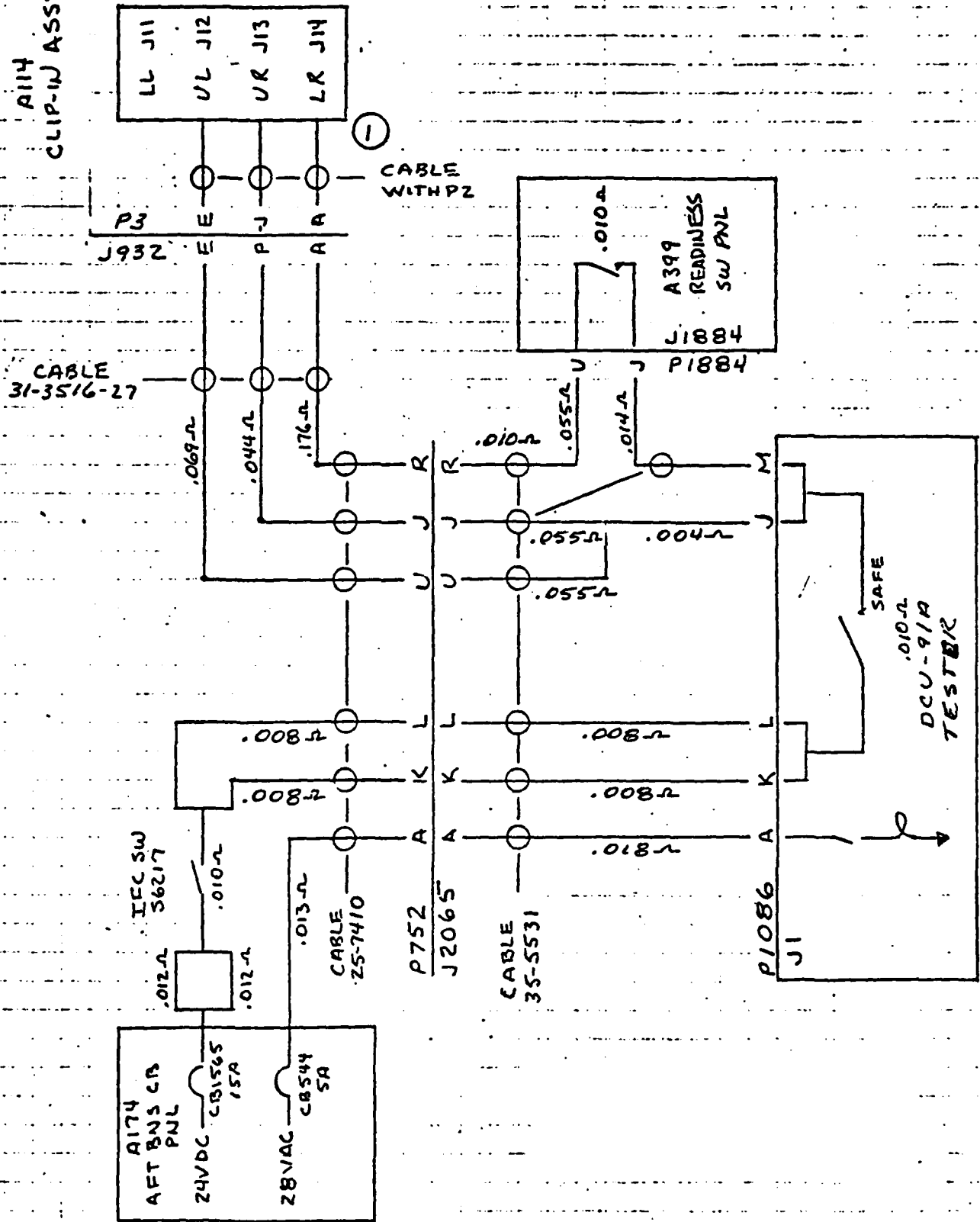
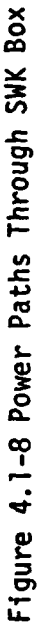


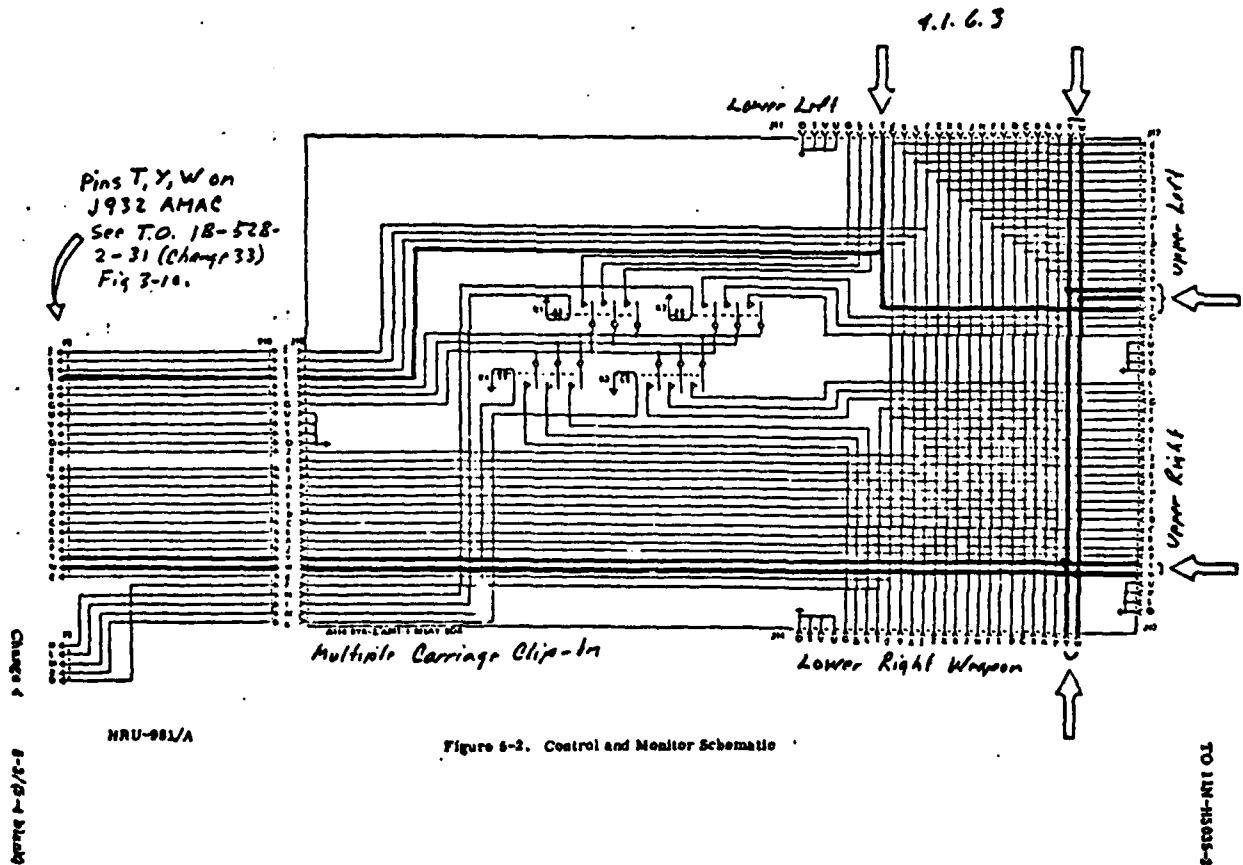
Figure 4.1-7 Power Paths Through DCU-9/A Tester



CLIP-IN ASSEMBLY PINS T, W & Y CIRCUIT ANALYSIS PACKAGE

4.1.6.3 Circuit Analysis Package, Weapon Interface Pins W & Y of Connectors J11, J12, J13 and J14; and Pin T of Connectors J11 and J12 on A114 Clip-In Assembly and Cable in Forward Bomb Bay

These interfaces are shown in Figure 5-2, T. O. 11N-H5035-2 (Change 4) - Copy attached below. Maximum current available to pins T, W and Y in a normal environment is 0 amps. Worst case current at 28VDC is an abnormal environment (faulted) would be 1170 amps for pins T and 800 amps for pins W and Y assuming the pins are grounded at the weapon and shorted to power through IFC relay.



4.1.6.3 (Continued)

a. Normal Power and Load Analysis

From examination of Figure 4.1-9, Network Tree No. 83, normal power environment or all pins: Open circuit voltage = 0V; short circuit current = 0A, because K399 is normally open.

b. Fault Analysis

The following postulated faults were analyzed using Network Tree No. 83 and Figure 4.1-10, Cable Drawing:

① Clip-In Assembly or Connector Damaged

Wires to subject pins shorted to 24VDC from CB1565 or CB1566 during Radar Navigator testing. See Figures 4.1-11 and 4.1-12 for source of voltage.

② Cable 31-3516-27 or Connector J932/P3 Damaged

Wires to subject pins shorted to 24VDC from CB1565 during Radar Navigator testing. See Figure 4.1-12 for source of voltage.

③ IFC Relay K399 Damaged (Worst Case)

Reference Figure 4.1-10.

L2 to T2 28VDC from CB550

L1 to T1 28VDC from CB548

L1 to T2 28VDC from CB548

L2 to T1 28VDC from CB550

L3 to T1 or T2 28VDC from CB549

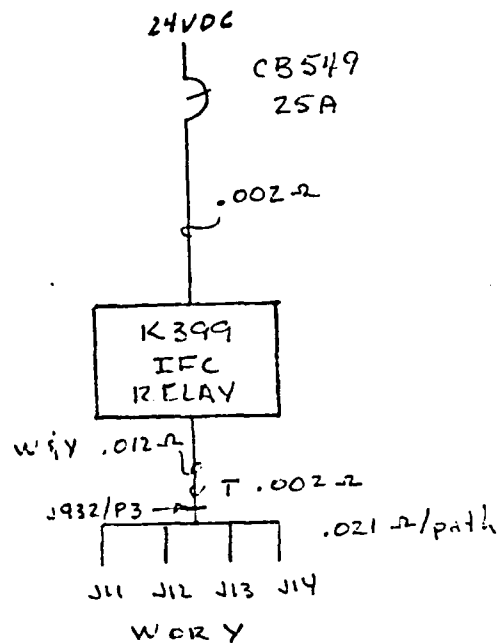
4.1.6.3 (Continued)

c. Worst Case Path

Reference Path ③ IFC Relay K399 Damaged.

J11, J12, J13 and J14 Y or W

J11 and J12T



Pin T

Total resistance = .024 Ω $V_{OC} = 28VDC$

$$I_{SC} = \frac{28}{.024} = 1170 \text{ amps}$$

Pins W & Y

Total resistance = .035 Ω $V_{OC} = 28VDC$

$$I_{SC} = \frac{28}{.035} = 800 \text{ amps}$$

Time - less than 0.8 seconds for
circuit breaker to open.

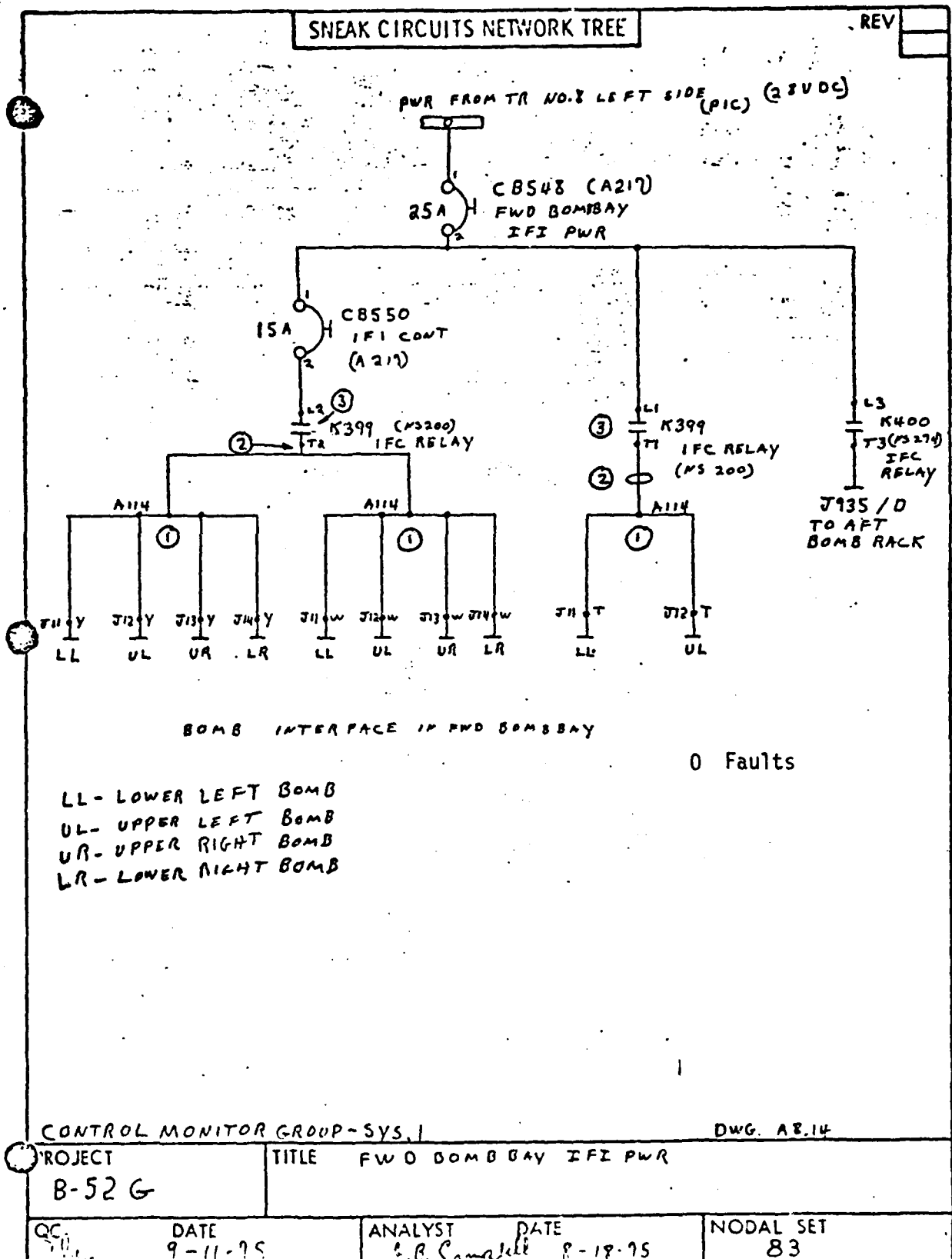


Figure 4.1-9 Network Tree No. 83

AD-A103 951

BOEING AEROSPACE CO HOUSTON TX

F/S 15/6

ELECTRICAL ANALYSIS OF B-52/FB-111 AMAC AND RELEASE CIRCUITRY U--ETC(U)

OCT 75

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UNCLASSIFIED

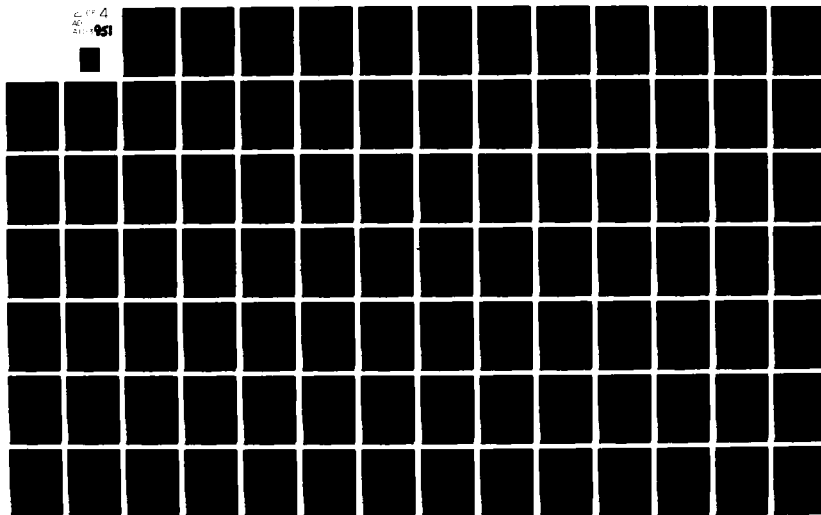
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NL

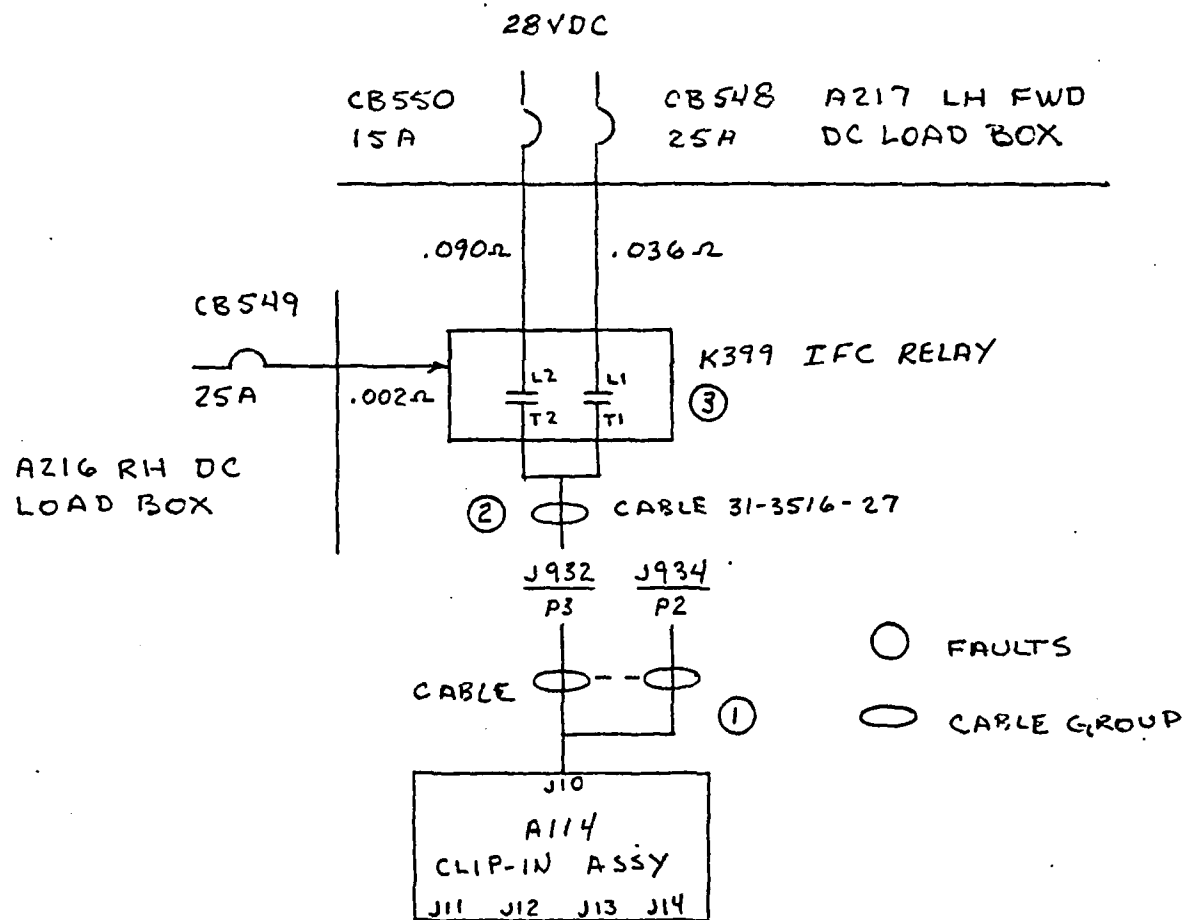
CLASS 4

AD-A103 951

501



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CABLE DRAWING

FIGURE 4.1-10

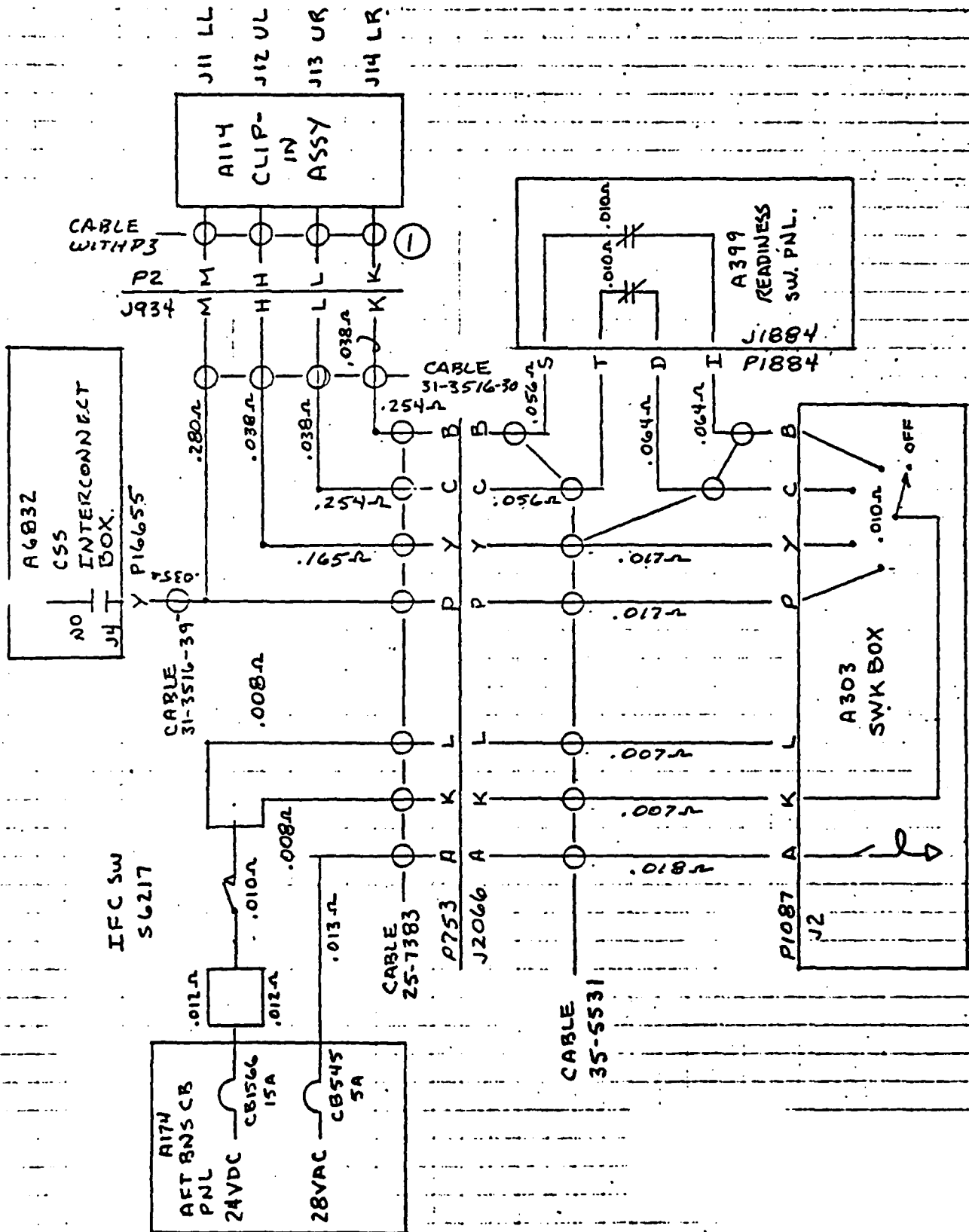
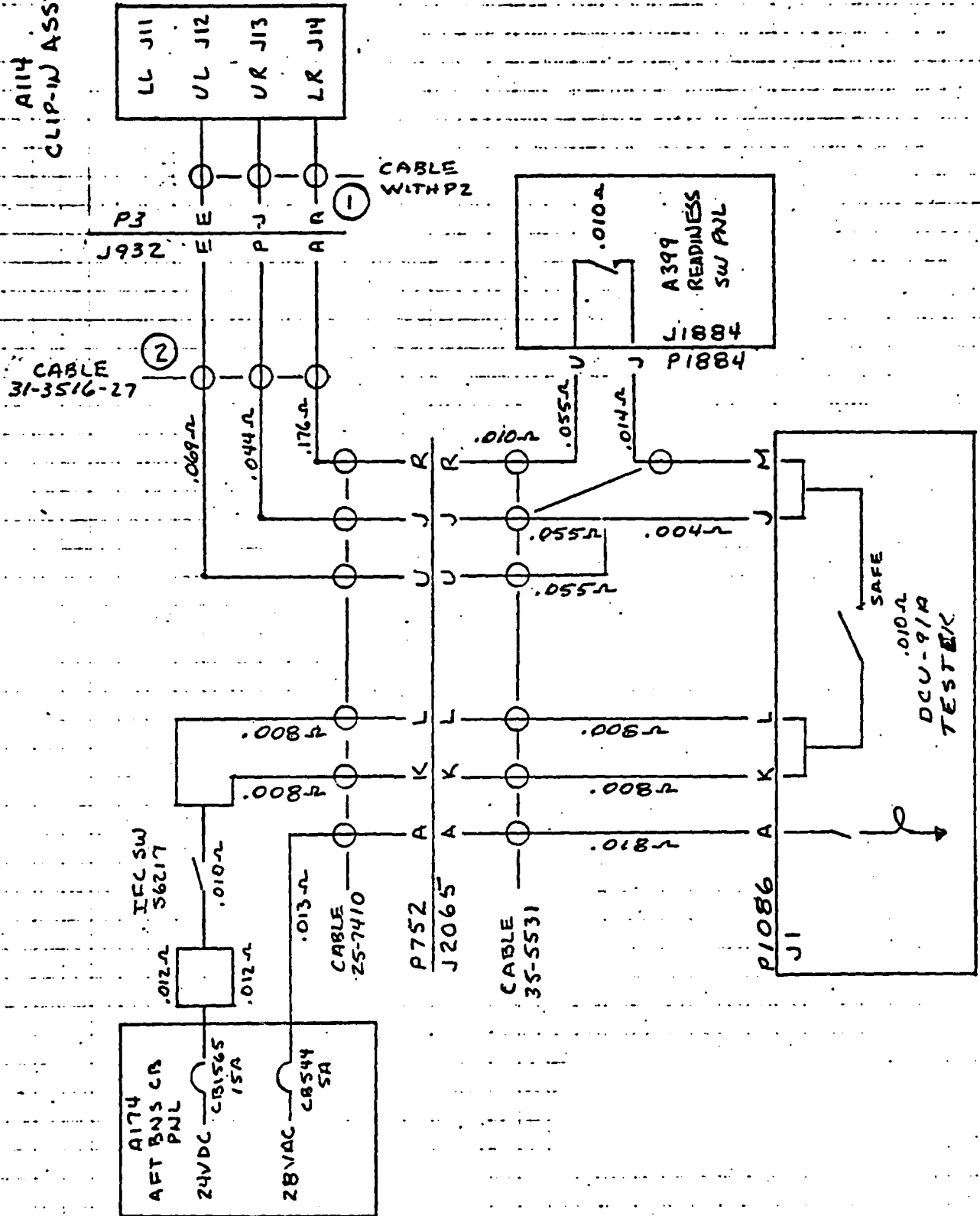


Figure 4.1-11 Power Paths Through SWK Box

A114
CLIP-IN ASSY



4.1.6.4 (Continued)

a. Normal Power and Load Analysis

From examination of Figure 4.1-13, Network Tree No. 0198, normal open circuit voltage = 0V; short circuit current = 0A.

b. Fault Analysis

The following postulated faults were analyzed using Network Tree No. 0198 and Figure 4.1-14, Cable Drawing.

① Clip-In Assembly or Connector Damaged

Wires to subject pins shorted to 24VDC during testing using DCU-9/A and the SWK box from CB1565 or CB1566. See Figure 4.1-15 and 4.1-16 for power paths.

② Cable 31-3516-27 or Connectors Damaged

Wires to subject pins shorted to 24VDC during testing from CB1565. See Figure 4.1-15 for power paths.

③ Cable 25-7410 or Connectors Damaged (Worst Case)

Wires to subject pins shorted to 24VDC from CB1565 or 28VAC from CB544. See Figure 4.1-15 for power paths.

④ Cable 35-5531 or Connectors Damaged

Wires to subject pins shorted to 24VDC from CB1565 or CB1566 on 28VDC from CB544 or CB585. See Figure 4.1-15 or 4.1-16 for power paths.

⑤ DCU/9A Testor or Connector Damaged

Wires to subject pins shorted to 24VDC from CB1565 or 28VAC from CB544. See Figure 4.1-15 for power paths.

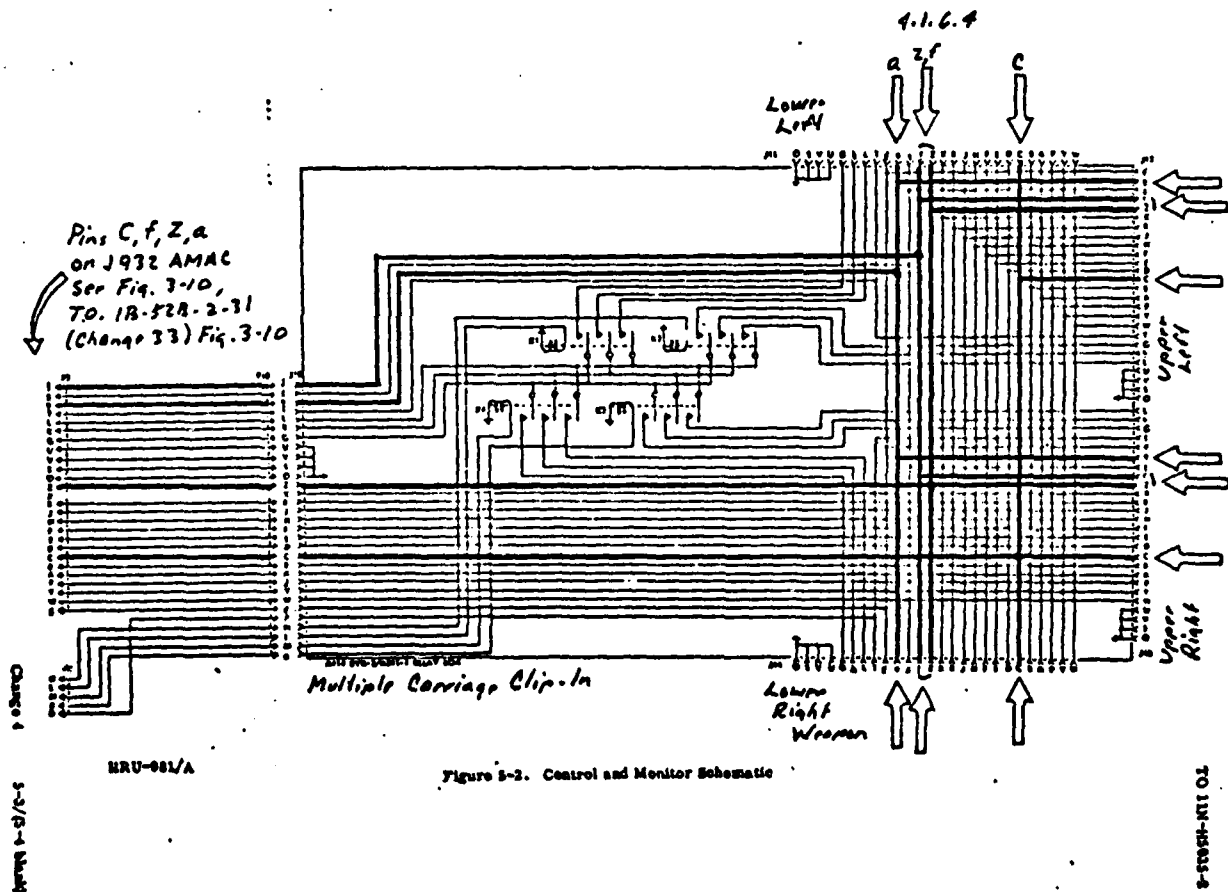
CLIP-IN ASSEMBLY PINS

C, f, Z & a

CIRCUIT ANALYSIS PACKAGE

4.1.6.4 Circuit Analysis Package, Weapons Interface Pins C, f, Z, a of Connectors J11, J12, J13 and J14 on A114 Clip-In Assembly and Cable in Forward Bomb Bay

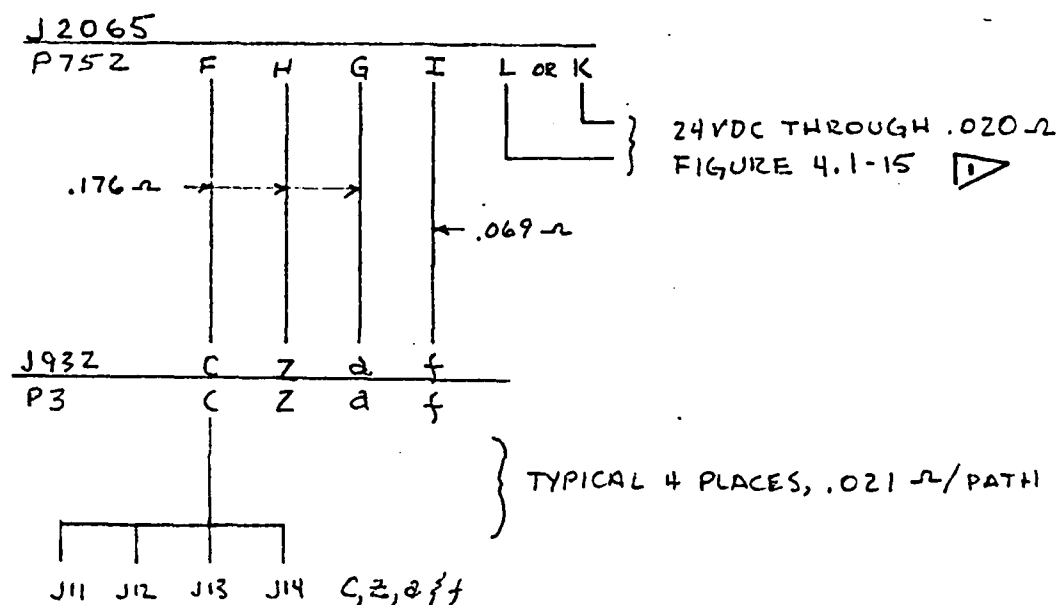
These interfaces are shown in Figure 5-2, T.O. 11N-H5035-2 (change 4) Copy attached below. Maximum current available to pins C, f, Z and a in a normal environment is 0 amps. Worst case current at 24VDC in an abnormal (faulted) environment would be 218 amps for pin f and 110 amps for pin C, Z and a, assuming the pins grounded at the weapon and shorted to power at J2065/P752 connector.



4.1.6.4 (Continued)

c. Worst Case Path and Calculations

Reference Path ③ Cable 25-7410 or Connectors Damaged.

Pin fTotal resistance = .110 Ω $V_{OC} = 24\text{VDC}$

$$I_{SC} = \frac{24}{.110} = 218 \text{ Amps}$$

Time = less than 0.8 seconds.

Pins C, Z, & a Total resistance = .217 Ω $V_{OC} = 24\text{VDC}$

$$I_{SC} = \frac{24}{.217} = 110 \text{ amps}$$

Time = 1.1 seconds maximum.

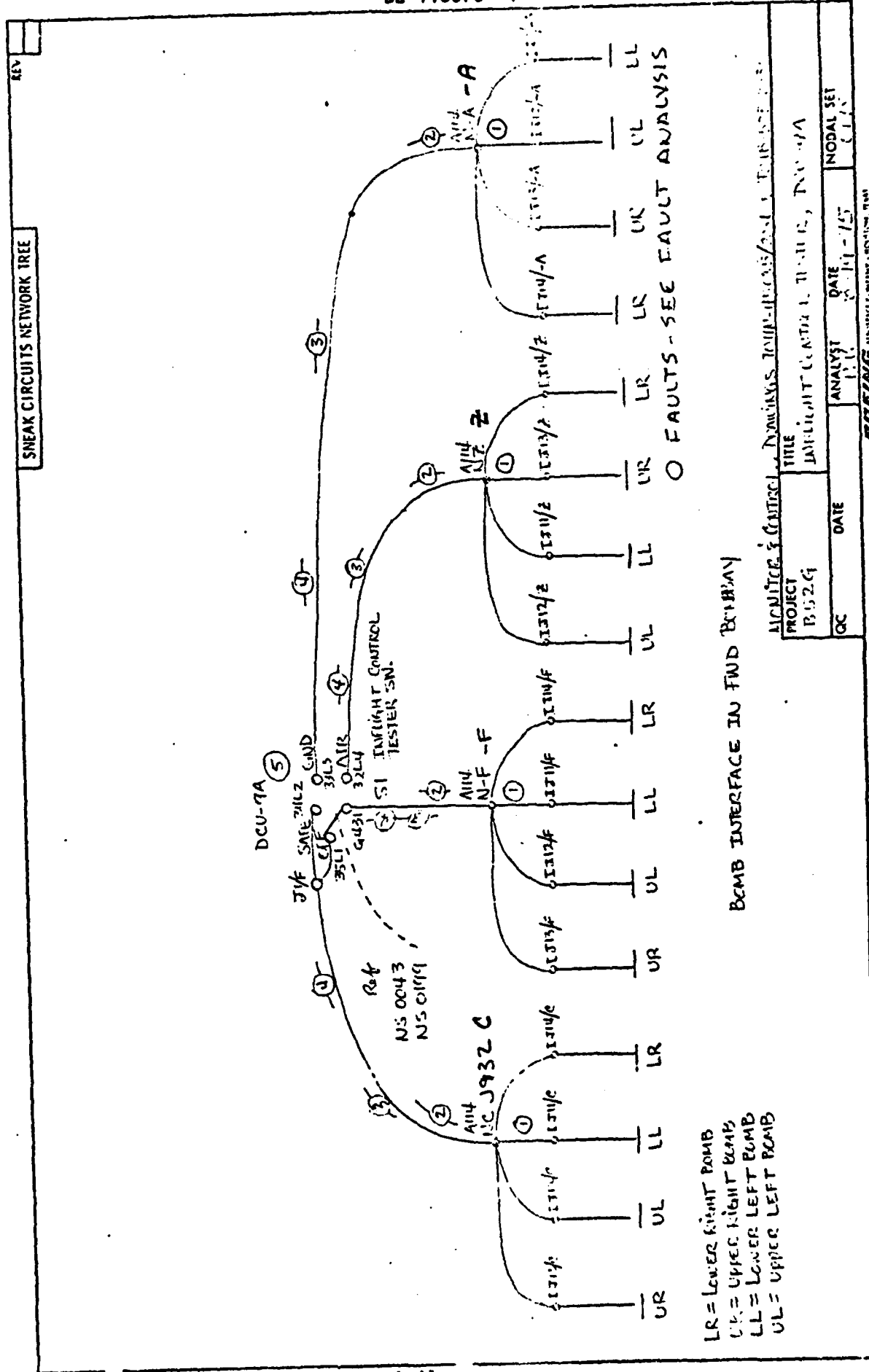
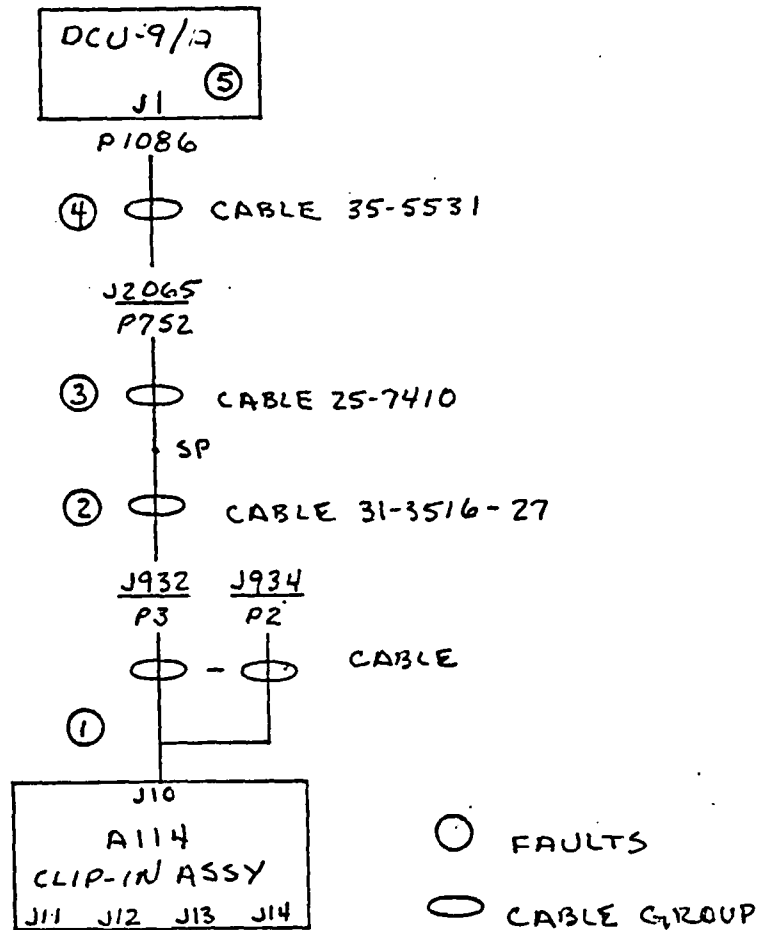


Figure 4.1-13 Network Tree No. 0198

D2-118576 -1



CABLE DRAWING

FIGURE 4.1-14

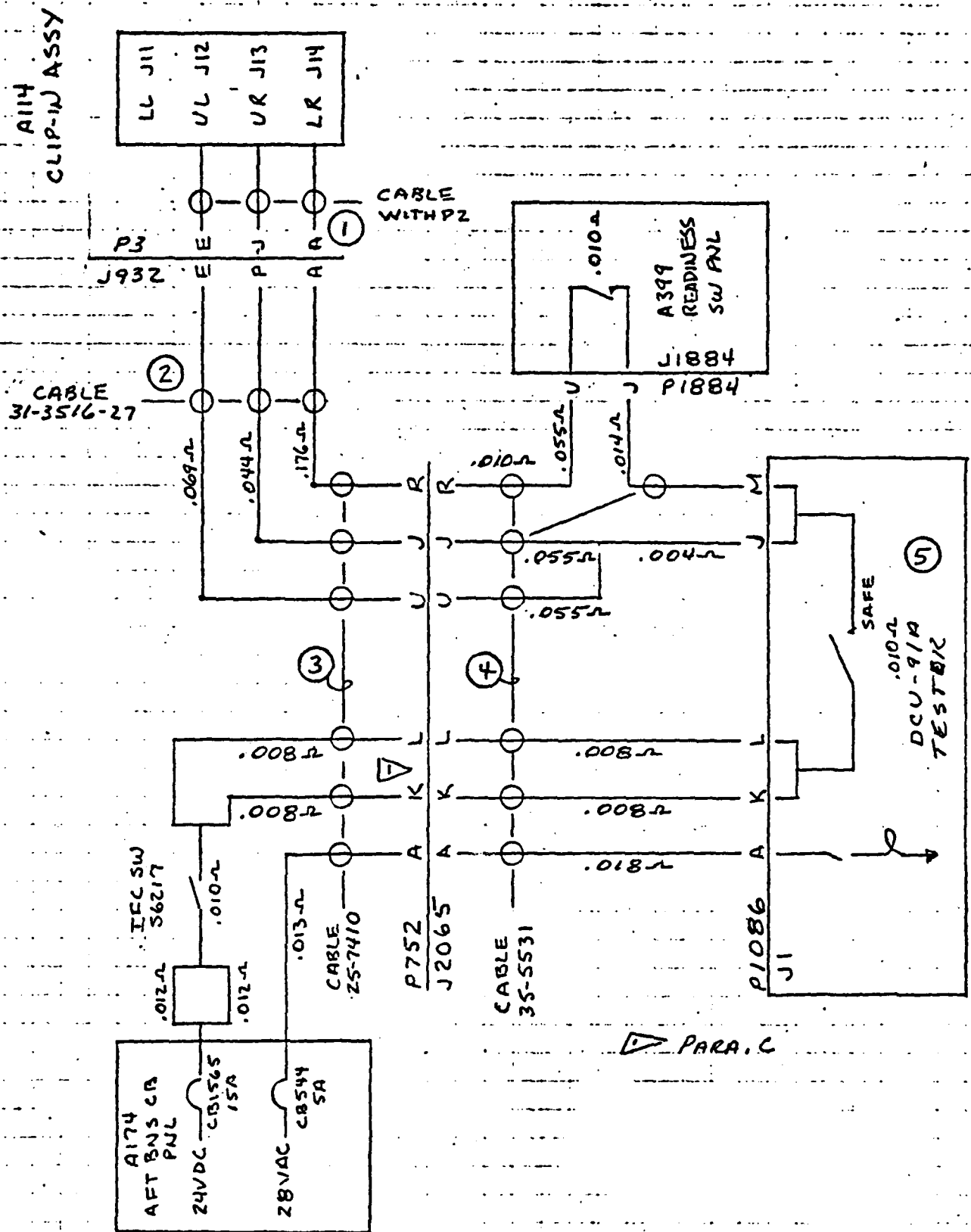
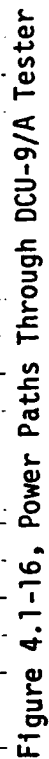


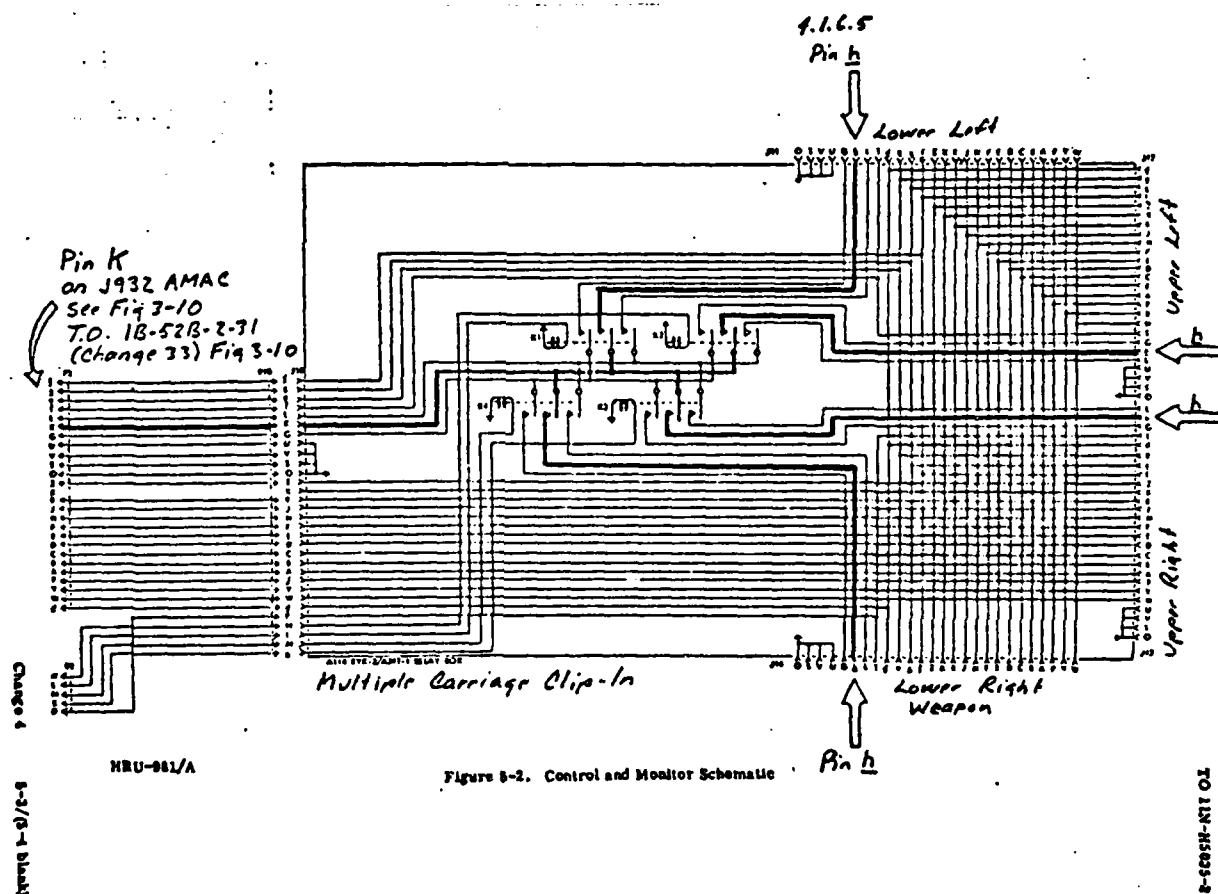
Figure 4.1-15, Power Paths Through DCU-9/A Tester



CLIP-IN ASSEMBLY PIN h CIRCUIT ANALYSIS PACKAGE

4.1.6.5 Circuit Analysis Package, Weapon Interface Pin h of Connectors J11, J12, J13 and J14 on A114 Clip-In Assembly and Cable in Forward Bomb Bay

These interfaces are shown in Figure 5-2, T.O. 11N-H5035-2 (Change 4) - copy attached below. Note that Pin h connects to cable Pin K through relay contacts. Maximum current available to pin h in a normal environment is 0 amps. Worst case current at 24VDC in an abnormal (faulted) environment would be 152 amps assuming the pin grounded at the weapon and the SWK Box not switched "Off". With the SWK "off", the relay contacts in A114 would be open.



4.1.6.5 (Continued)

a. Normal Power and Load Analysis

From examination of Figure 4.1-17, Network Tree 201/248, normal open circuit voltage = 0V; short circuit current = 0A.

b. Fault Analysis

The following postulated faults were analyzed using Network Tree 201/248 and Figure 4.1-18, Cable Drawing.

① Clip-In Assembly or Connector Damaged

Wires to subject pins shorted to 24VDC from CB1565 or CB1566 during Radar Navigator testing using DCU-9/A and the SWK Box. Relay contacts (K1, K2, K3 and K4) in A114 are only closed during this period. Voltage sources are shown in Figures 4.1-19 or 4.1-20.

② Connector J932/P3 or Cable 31-3516-27 Damaged

Wires to subject pins shorted to 24VDC from CB1565 during testing. Voltage source is shown on Figure 4.1-19.

③ Connector J935 or Cable 31-3516-28 Damaged

Connector is located in Aft Bomb Bay and is not connected and unpowered.

④ Cable 31-3516-37 Damaged

Wires to subject pins shorted to 24VDC from CB1566 during testing. Voltage source is shown on Figure 4.1-20.

⑤ Cable 25-7410 or Connector P 752/J2065

Wires to subject pins shorted to 24VDC from CB1565 or 28VAC from CB544 during testing. Voltage sources are shown on Figure 4.1-19.

⑥ Cable 35-5531 Damaged

Wires to subject pins shorted to 24VDC from CB1565 or CB1566, or 28VAC from CB545. Voltage sources are shown on Figures 4.1-19 and 4.1-20.

4.1.6.5b (Continued)

⑦ Readiness Switch Panel(A399) or Connector Damaged

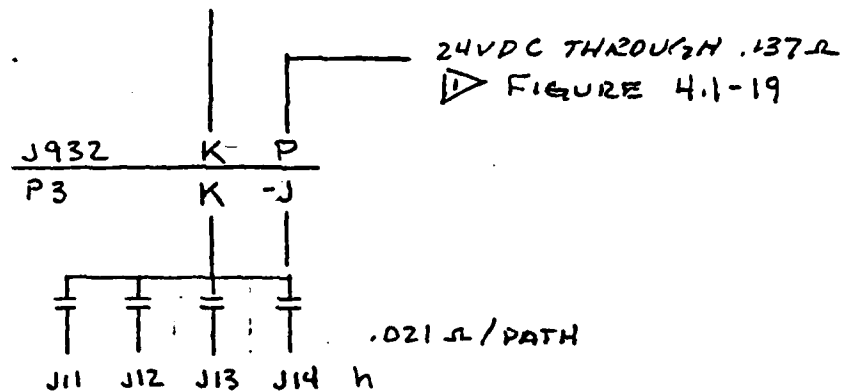
Wires to subject pins shorted to 24VDC from CB1565 or CB1566 during testing. Voltage sources are shown on Figures 4.1-19 and 4.1-20.

⑧ DCU/9A Tester or Connector Damaged

Wires to subject pins shorted to 24VDC from CB1565 or 28VAC from CB544. Voltage sources are shown on Figure 4.1-19.

c. Worst Case Path and Calculations

Reference path ①, Clip-In Assy Damaged

Total Resistance of Path = .158 Ω V_{OC} = 24VDC $I_{SC} = \frac{24}{.158}$ = 152 Amps

Time = Less than 0.8 seconds. Current is greater than 1000% circuit breaker rating.

D2-118576 -1

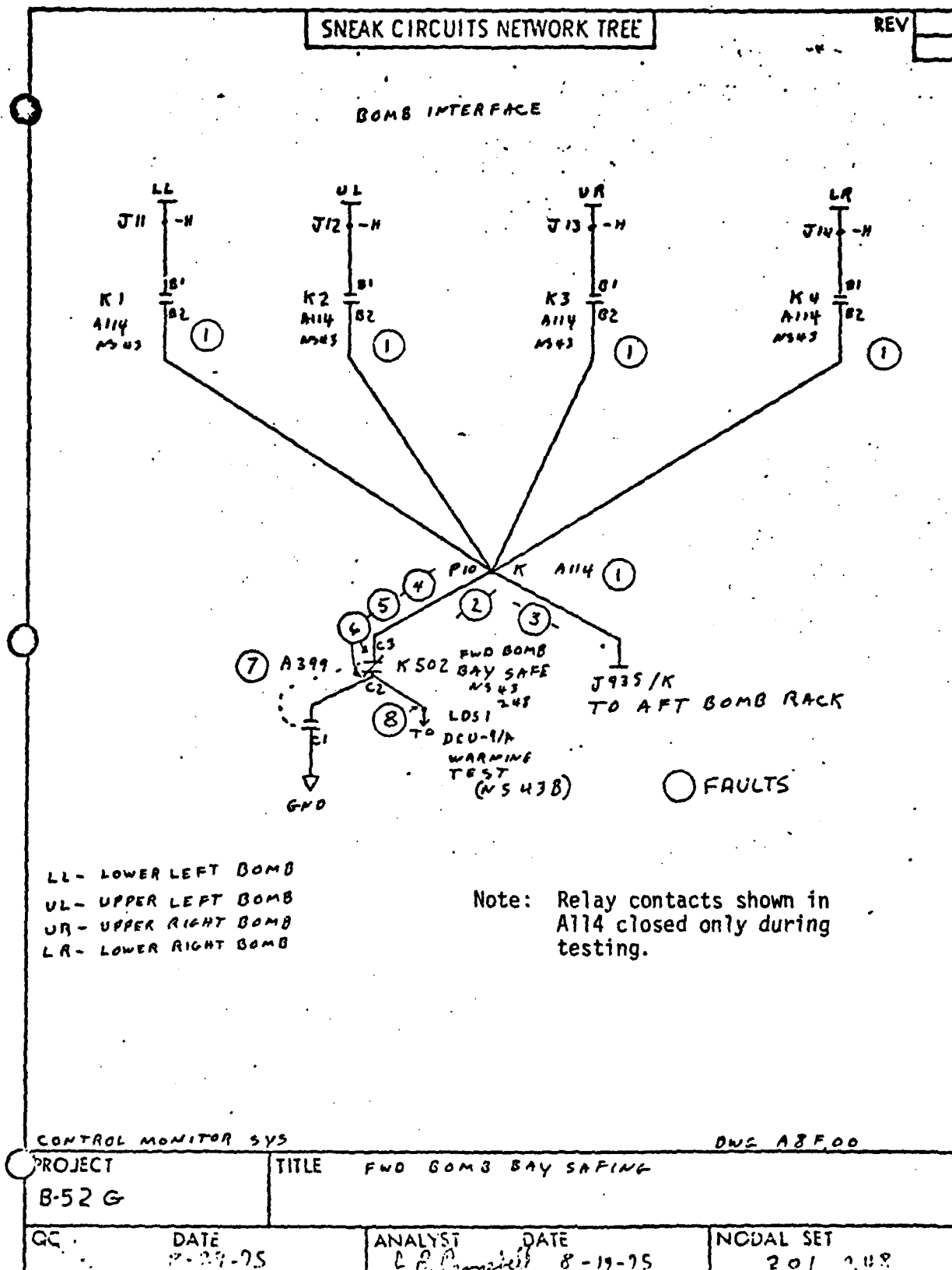
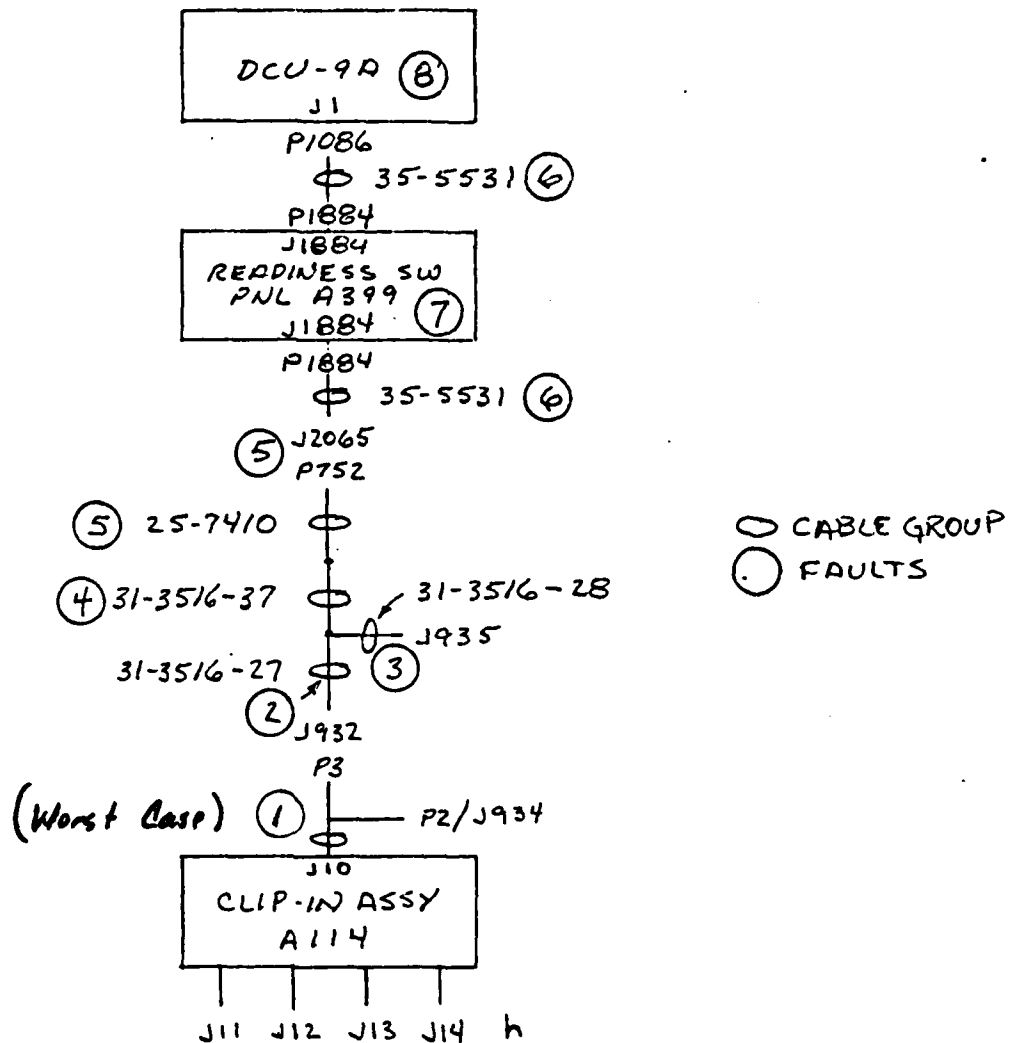


Figure 4.1-17 Network Tree No. 201/248

D2-118576 -1



CABLE DRAWING

FIGURE 4.1-18

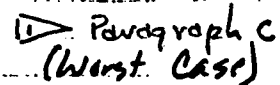


Figure 4.1-19 Power Paths Through DCU-9/A Tester

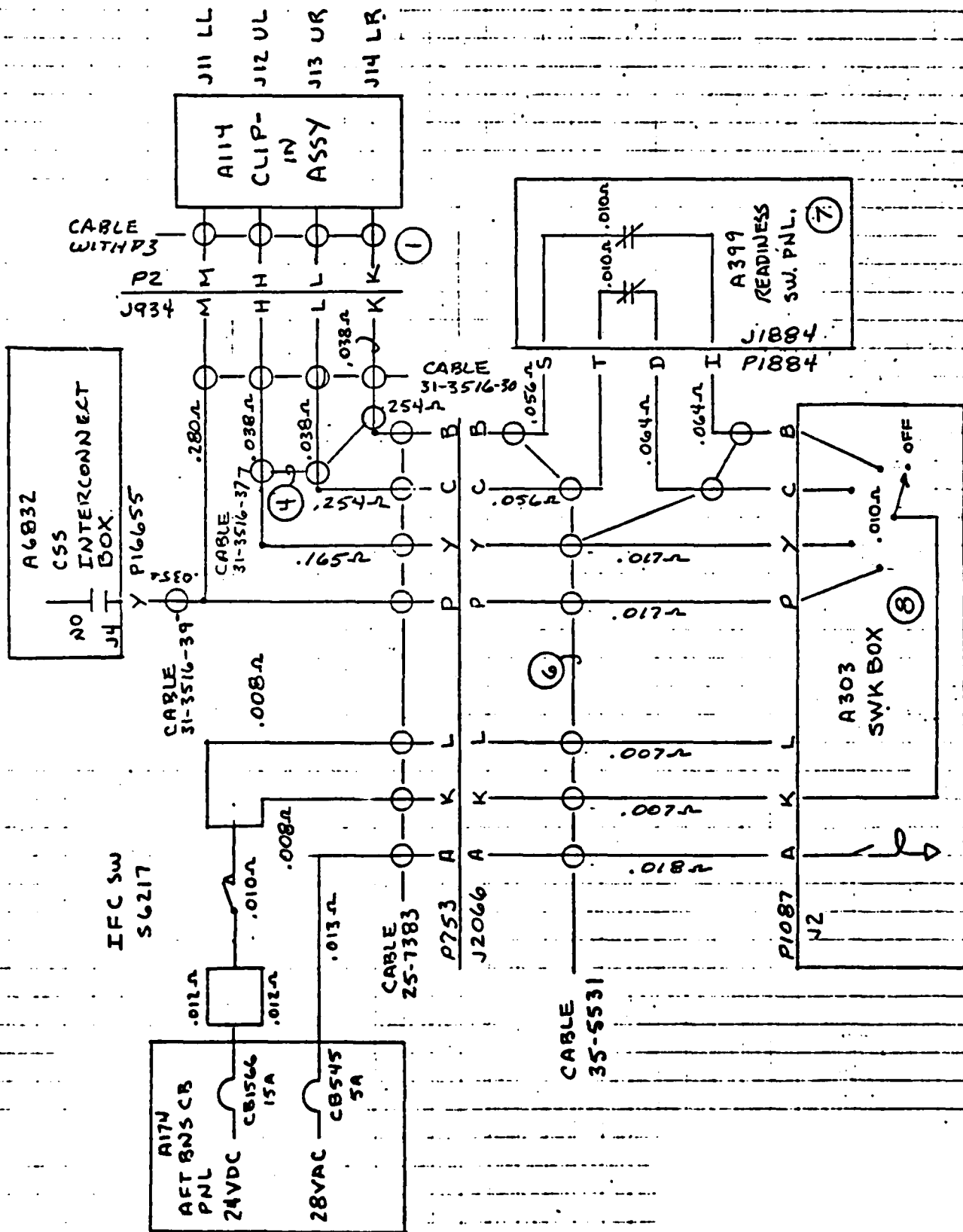
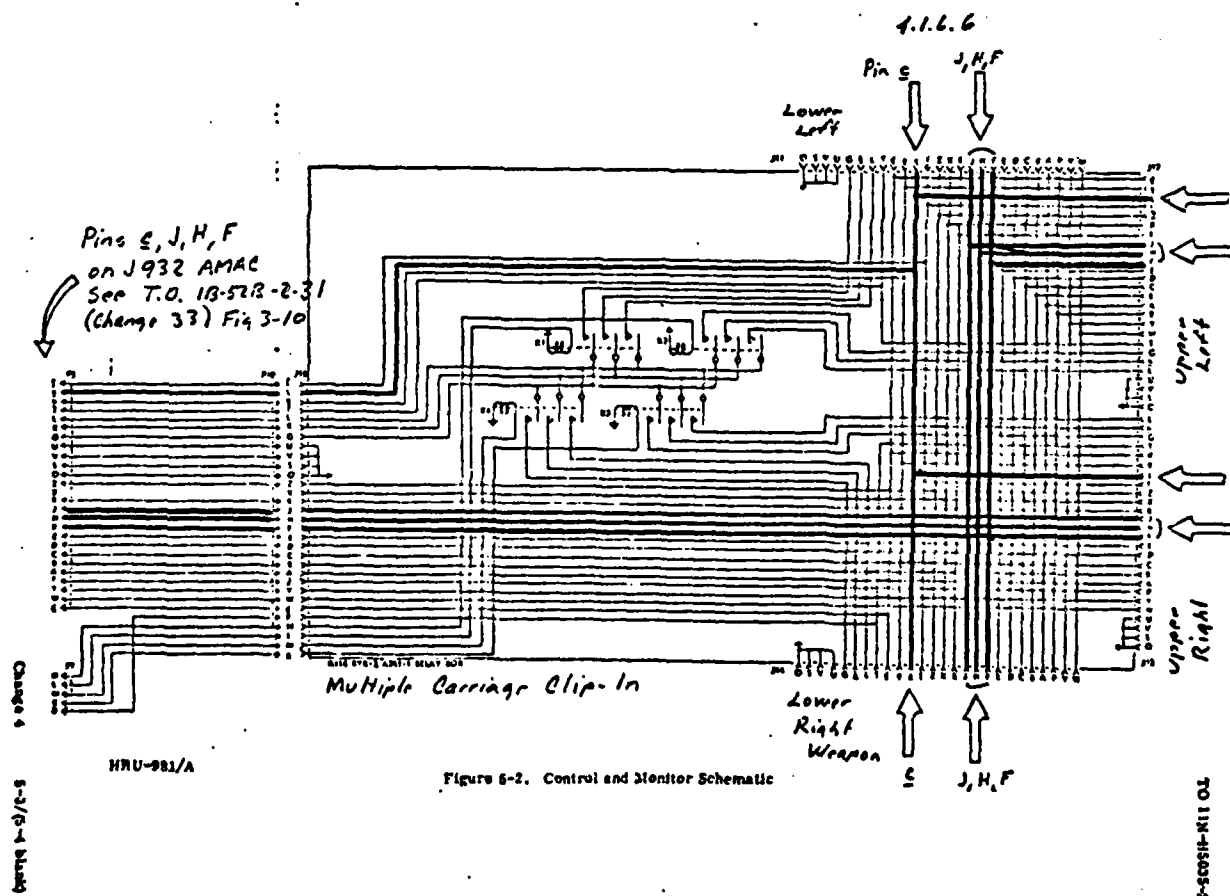


Figure 4.1-20 Power Paths Through SWK Box

CLIP-IN ASSEMBLY PINS
F, H, J & c
CIRCUIT ANALYSIS PACKAGE

4.1.6.6 Circuit Analysis Package, Weapon Interface Pins F, H, J & c of Connectors J11, J12, J13 and J14 on A114 Clip-In Assembly and Cable in Forward Bomb Bay

These interfaces are shown in Figure 5-2, T.O. 11N-H5035-2 (Change 4) - copy attached below. Maximum current available to these pins in a normal environment is 0 amps. Worst case current at 24VDC in an abnormal (faulted) environment assuming the pins grounded at the weapon interface would be 109 amps for pins F, J & c and 0 amps on pin H. The only fault that can supply current to pin H occurs during Radar Navigator Testing using the DCU-9/A. In this case 150 amps could be supplied but only for a brief period. This may result when the Clip-In Assembly is damaged.



4.1.6.6 (Continued)

a. Normal Power and Load Analysis

From examination of Figure 4.1-21, Network Tree 0199, normal open circuit voltage = 0V; Short circuit current = 0A.

b. Fault Analysis

The following postulated faults were analyzed using Network Tree 0199 and Figure 4.1-22, Cable Drawing.

① Clip-In Assembly or Connector Damaged

Wires to subject pins shorted to 24VDC from CB1565 or CB1566 during testing using DCU-9/A and SWK Box. Voltage sources are shown on Figures 4.1-23 and 4.1-24.

② Connector J932/P3 or Cable 31-3516-27 Damaged

Wires to subject pins shorted to 24VDC from CB1565 during testing. Voltage source is shown on Figure 4.1-23.

③ Cable 25-7410 or Connector P752/J2065 Damaged

Wires to subject pins shorted to 24VDC from CB1565 or 28VAC from CB544. Voltage sources are shown on Figure 4.1-23.

④ Cable 35-5531 Damaged

Wires to pins F, J & c shorted to 24VDC from CB1565 or CB1566 or 28VAC from CB544 and CB545. Voltage sources are shown on Figures 4.1-23 and 4.1-24.

⑤ DCU-9/A Testor or Connector Damaged

Wires to pins F, J & c shorted to 24VDC from CB1565 or 28VAC from CB544. Voltage sources are shown on Figure 4.1-23.

⑥ Cable 31-3516-28 or Connector J935 Damaged

Cable to Aft Bomb Bay is not connected and unpowered, (common with wire to Pin F).

4.1.6.6 (Continued)

⑦ Cable 31-3516-37 Damaged

Wire to pin F shorted to 24VDC from CB1566 during testing. Voltage source is shown in Figure 4.1-24.

⑧ Cable 31-3516-35 Damaged

Cable to CSS Interconnect Box does not normally contain voltage sources (common with wires to pins F & H).

⑨ Cable 31-3516-1

Cable from CSS Interconnect Box to Bomb Bay connectors does not normally contain voltage sources. (Common with wires to Pins F&H)

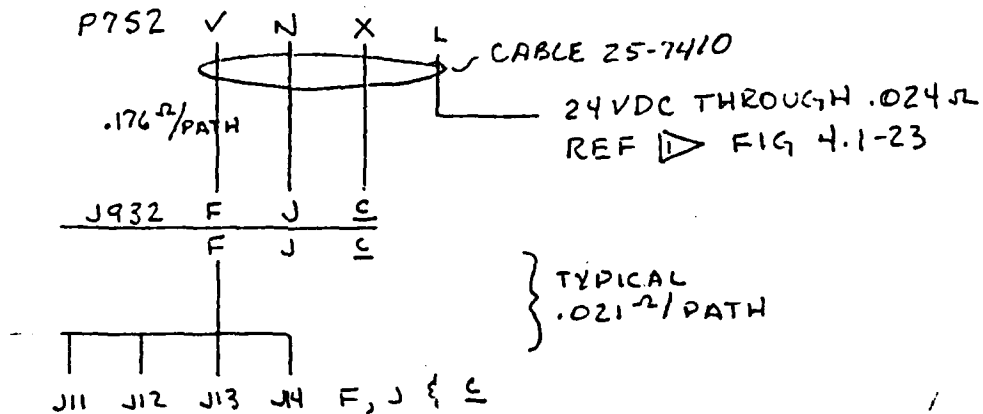
⑩ CSS Interconnect Box Damaged

Wire to pins F & H shorted to 24VDC from CB1566. Voltage source is shown in Figure 4.1-24. /

4.1.6.6 (Continued)

c. Worst Case PathsPins F, J & C

Reference Path ③, Cable 25-7410 or Connector P752/J2065 Damaged.

Total resistance of path = .221 Ω $V_{OC} = 24VDC$

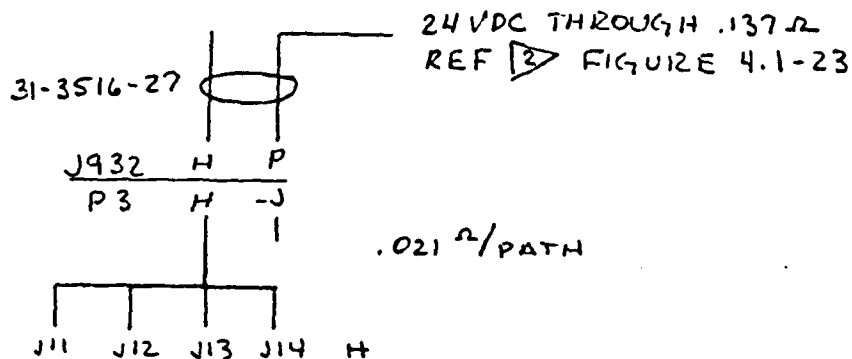
$$I_{SC} = \frac{24}{.221} = 109 \text{ A}$$

Time = 1.2 seconds maximum for CB to open.

4.1.6.6c (Continued)

Pin H

Reference Path ①, Clip-In Assembly or Connectors Damaged.



Total Resistance of Path .158 Ω

 $V_{OC} = 24VDC^*$

$$I_{SC}^* = \frac{24}{.158} = 150 \text{ A}$$

Time = 0.8 seconds maximum for CB to open.

* Voltage present when DCU-9/A in "SAFE"



Figure 4.1-21 Network Tree No. 0199

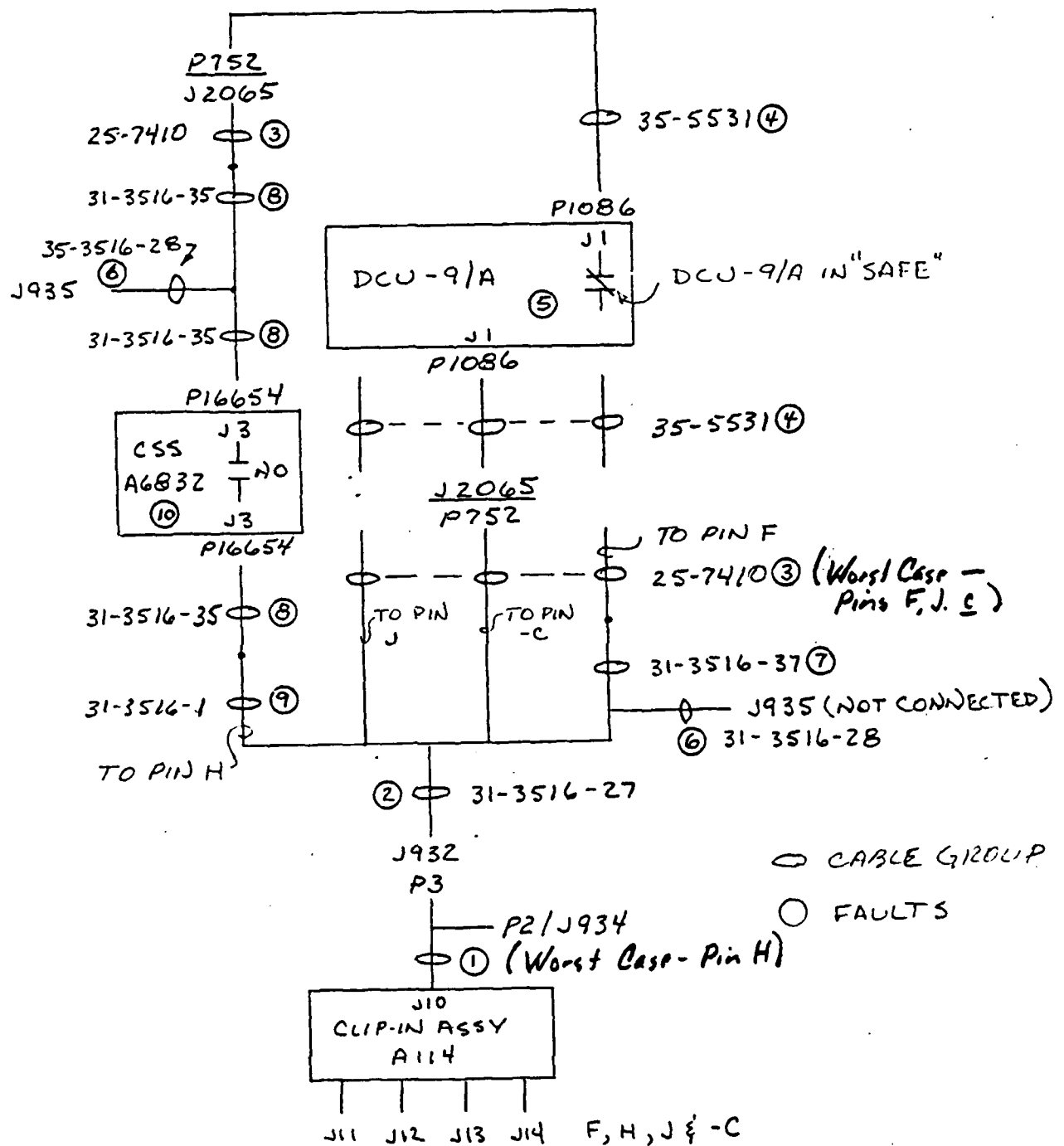


FIGURE 4.1-22
CABLE DRAWING

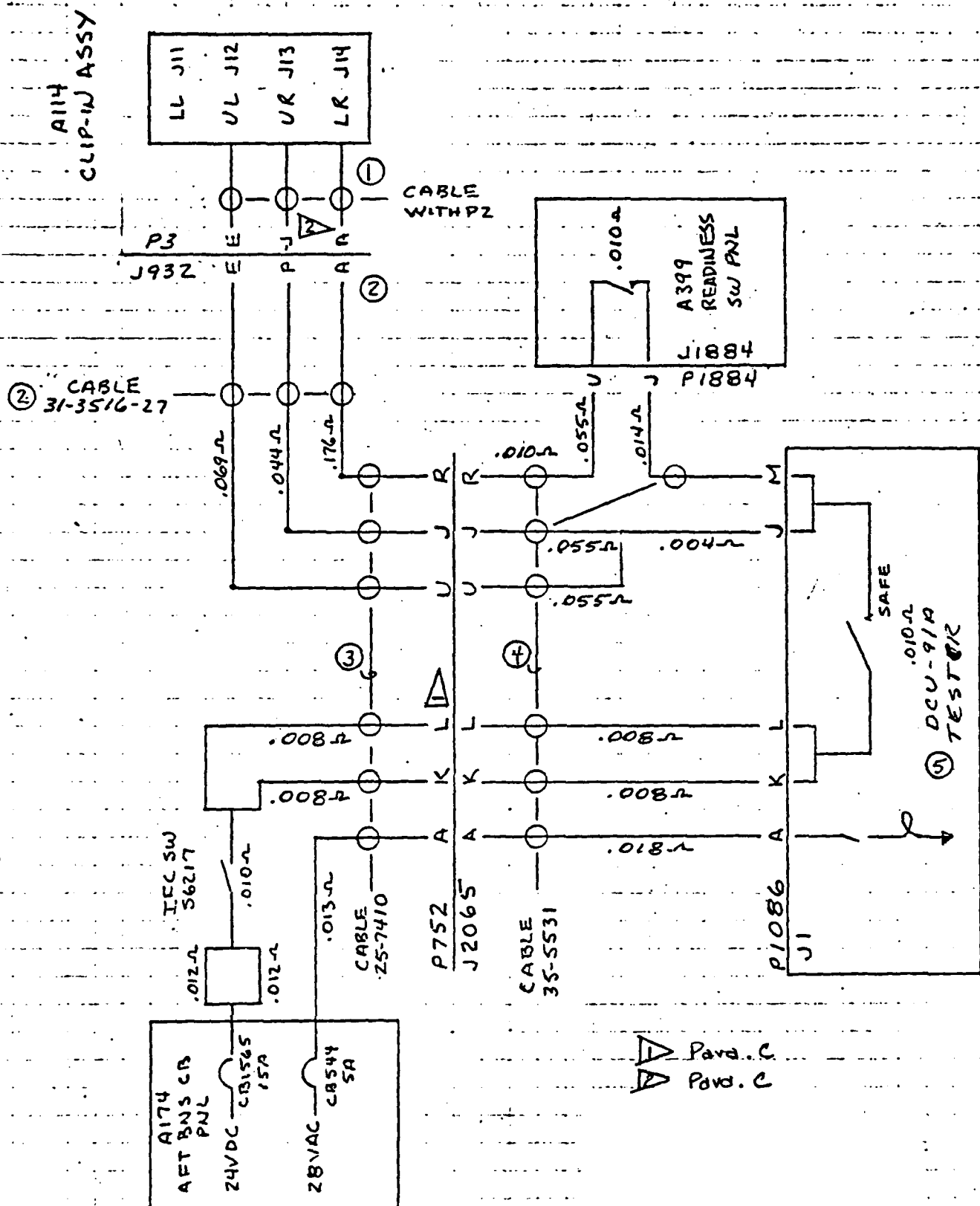


Figure 4.1-23 Power Paths Through DCU-9/A Tester

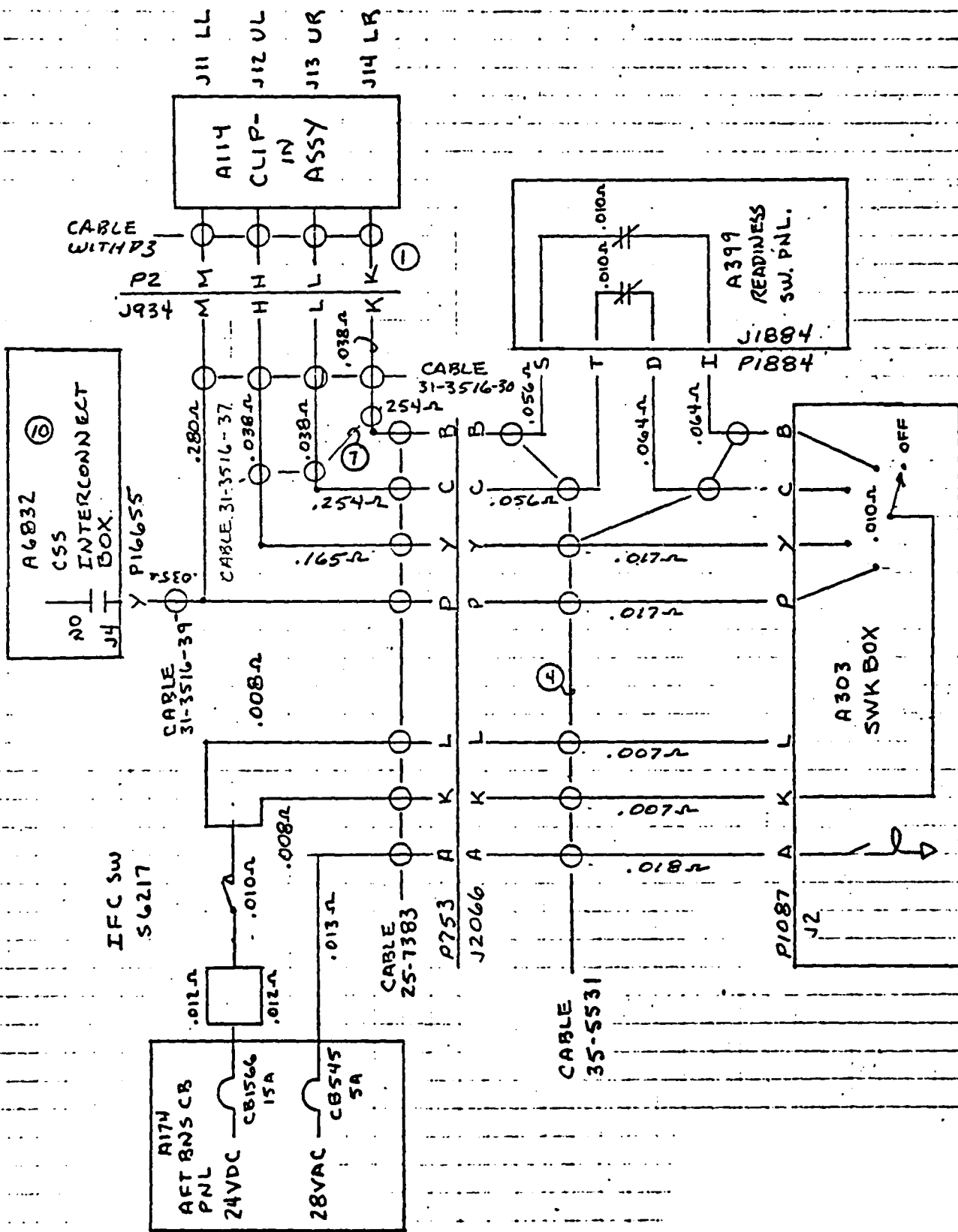
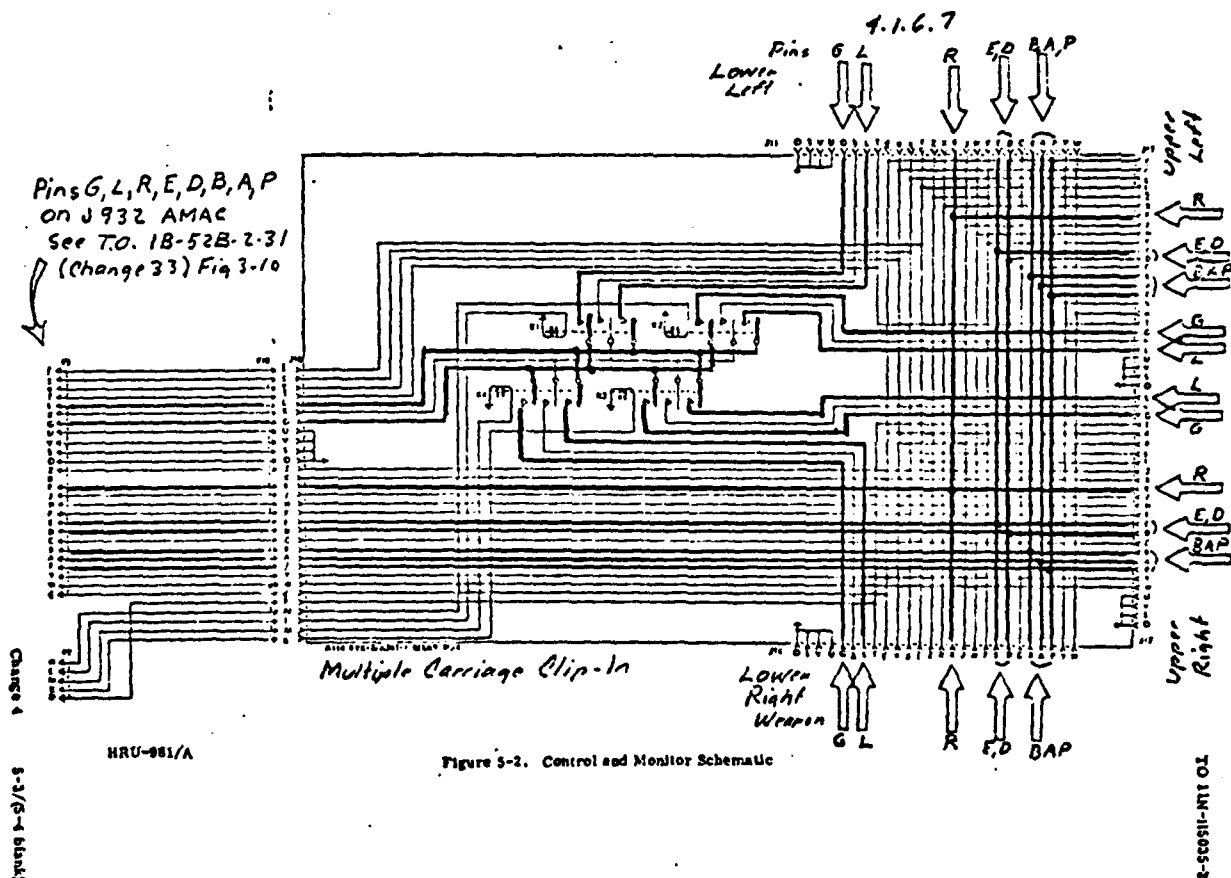


Figure 4.1-24 Power Paths Through SWK Box

These interfaces are shown in Figure 5-2, T.O. 11N-H5035-2 (Change 4) - copy attached below. Maximum short circuit current available to these pins in a normal environment is 0 amps. When the DCU-9/A is switched to "SAFE", a test mode, short circuit current to Pin P is 152 amps, Pin E is 131 amps and Pin A is 75 amps at 24VDC. Worst case current at 24V in an abnormal environment to Pin P would be 258 amps, Pin E would be 211 amps, and Pin A would be 109 amps. Worst case fault current for Pins G, L, D, B & R would be 152 amps at 24V.



4.1.6.7 (Continued)

Worst case current at 24VDC in an abnormal (faulted) environment assuming the pins grounded would be:

Pin P - 258 Amps
 E - 211 Amps
 A - 109 Amps
 G - 152 Amps - current available only when DCU-9/A is in "SAFE"
 L - 152 Amps - current available only when DCU-9/A is in "SAFE"
 D - 152 Amps - current available only when DCU-9/A is in "SAFE"
 B - 152 Amps - current available only when DCU-9/A is in "SAFE"
 R - 152 Amps - current available only when DCU-9/A is in "SAFE"

a. Normal Power and Load Analysis

From examination of Figure 4.1-25, Network Tree 43B, open circuit voltage for all subject pins would be = 0 amps. Short circuit current = 0A. With DCU-9/A switched to "SAFE", a test mode, a power path is established as shown in Figure 4.1-27, open circuit voltage and short circuit current for pins P, E and A in this mode would be:

Pin P

Total Resistance of path = .158 Ω
 $V_{OC} = 24VDC$
 $I_{SC} = \frac{24}{.158} = 152 \text{ A}$

Pin E

Total Resistance of path = .183 Ω
 $V_{OC} = 24VDC$
 $I_{SC} = \frac{24}{.183} = 131 \text{ A}$

Pin A

Total Resistance of path = .320 Ω
 $V_{OC} = 24VDC$
 $I_{SC} = \frac{24}{.320} = 75 \text{ A}$

b. Fault Analysis

The following postulated faults were analyzed using Network Tree 43B and Figure 4.1-26, Cable Drawing.

4.1.6.7b (Continued)

① Clip-In Assembly or Cable Damaged (Worst Case - Pins G & L)

Wires to subject pins shorted to 24VDC from CB1565 or CB1566 during testing with DCU-9/A tester and SWK Box. Voltage sources are shown on Figures 4.1-27 and 4.1-28.

② Cable 31-3516-27 or Connector J932/P3 (Worst Case - Pins D, B & R) Damaged

Wires to subject pins shorted to 24VDC from CB1565 during testing. Voltage source is shown on Figure 4.1-27.

③ Cable 31-3516-1 Damaged

Cable runs between CSS and weapons interface. The CSS is normally open therefore no voltage potentials are present. This cable is common with wires to pins B, D & R.

④ CSS Interconnect Box (A6832) or Connectors Damaged

Wires to pins B, D & R shorted to 24VDC from CB1566 during testing. Voltage source is shown on Figure 4.1-28.

⑤ Cable 31-3516-35 Damaged

Cable to CSS Interconnect Box (A6832) does not normally contain voltage sources (common with wire to pin R).

⑥ Cable 31-3516-28 Damaged

Cable to Aft Bomb Bay is open and does not contain voltage sources (common with wire to pin L).

⑦ Cable 31-3516-37 Damaged

Wire to pin L shorted to 24VDC from CB1566 during testing. Voltage source is shown on Figure 4.1-28.

⑧ Cable 25-7410-or Connector P752/J2065 Damaged (Worst Case-pins P,E & A)

Wires to pins A, E, G, L & P shorted to 24VDC from CB1565 or 28VAC from Voltage sources are shown on Figure 4.1-27.

⑨ Cable 35-5531 Damaged

Wires to pins A, E, G, L & P shorted to 24VDC from CB1565 or CB1566, or 28VAC from CB544 or CB545. Voltage sources are shown on Figures 4.1-27 or 4.1-28.

⑩ DCU-9/A Tester or Connector Damaged

Wires to pins A, E, G, L & P shorted to 24VDC from CB1565 or 28VAC from CB544. Voltage sources are shown on Figure 4.1-27.

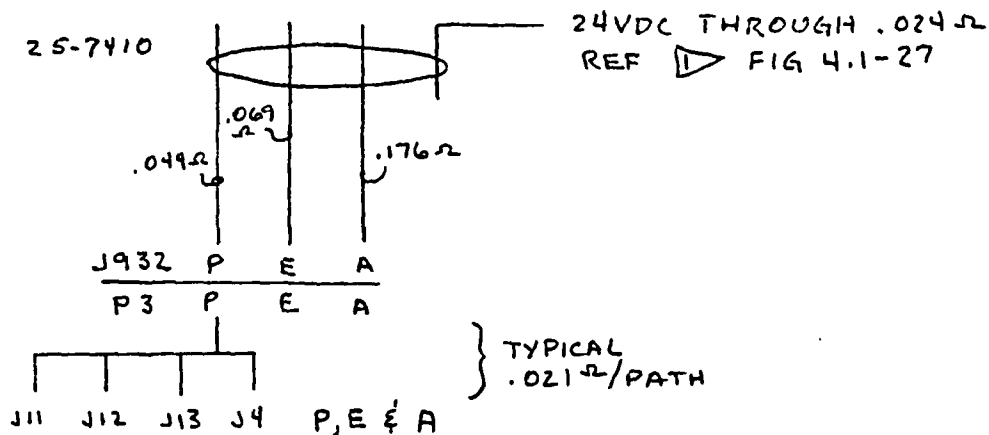
⑪ Readiness Switch Panel (A399) or Connector Damaged

Wires to pins G, L & A shorted to 24VDC from CB1565 or CB1566 during testing. Voltage sources are shown on Figures 4.1-27 and 4.1-28.

4.1.6.7 (Continued)

c. Worst Case Paths

Pins P, E & A Reference Path ⑧ Cable 25-7410 Damaged.

Pin P Total resistance of path = .089 Ω $V_{OC} = 24\text{VDC}$

$$I_{SC} = \frac{24}{.089} = \underline{258} \text{ A}$$

Time = Less than 0.8 seconds. Current exceeds 1000% rating of CB.

Pin E Total resistance of path = .114 Ω $V_{OC} = 24\text{VDC}$

$$I_{SC} = \frac{24}{.114} = \underline{211} \text{ A}$$

Time = Less than 0.8 seconds. Current exceeds 1000% rating of CB.

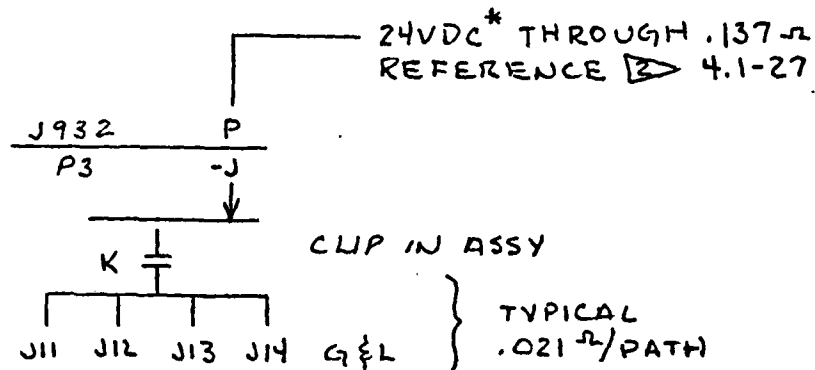
Pin A Total resistance of path = .221 Ω $V_{OC} = 24\text{VDC}$

$$I_{SC} = \frac{24}{.221} = \underline{109} \text{ A}$$

Time = Less than 1.4 seconds.

4.1.6.7c (Continued)

Pins G & L Reference Path ① Clip-In Assembly Damaged

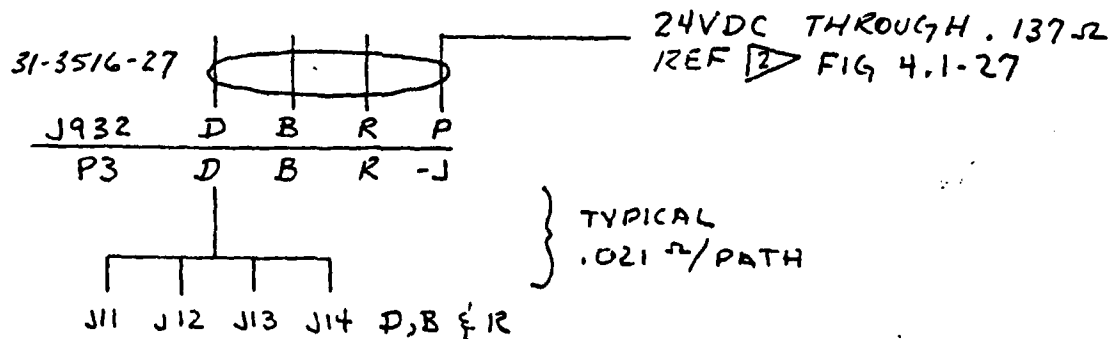
Total Resistance of Path = .158 Ω $V_{OC} = 24VDC$

$$I_{SC} = \frac{24}{.158} = 152 \text{ A}$$

Time = Less than 0.8 seconds. Current exceeds 1000% rating of CB.

Note: Relay K closed only when SWK Box is in "UL", "LL", "UR" or "LR".

Pins D, B & R Reference Path ② Cable 31-3516-27 or Connector J932/P3 Damaged.



4.1.6.7c (Continued)

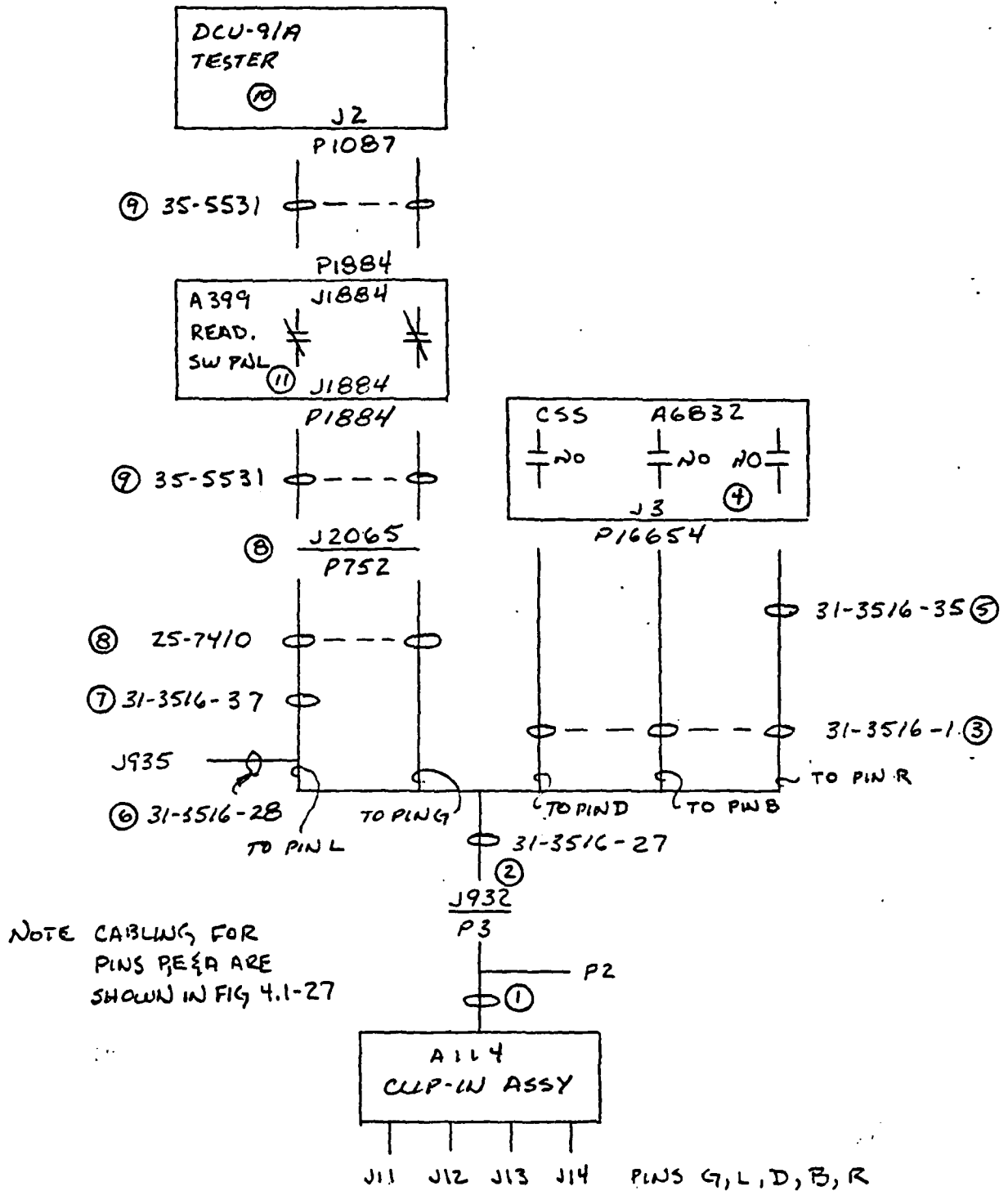
Total Resistance of Path = .158 Ω

V_{OC} = 24VDC

I_{SC} = 152 A

Time = Less than 0.8 seconds. Current exceeds 1000% rating of CB.

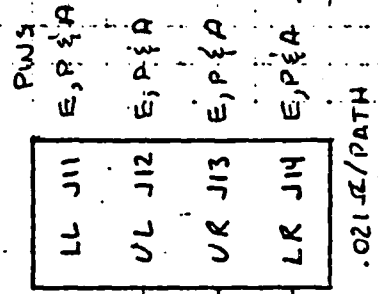
* Voltage source is present only when DCU-9/A is in "SAFE" during Radar Navigator Testing.



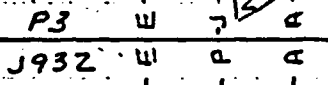
CABLE DRAWING

FIGURE 4.1-26

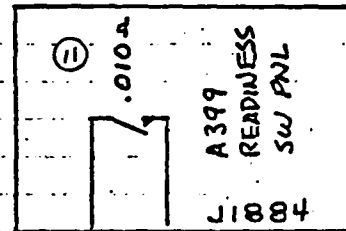
A114
CLIP-IN ASSY



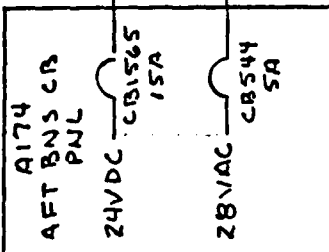
CABLE
31-3516-27



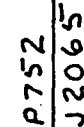
CABLE
WITH PZ



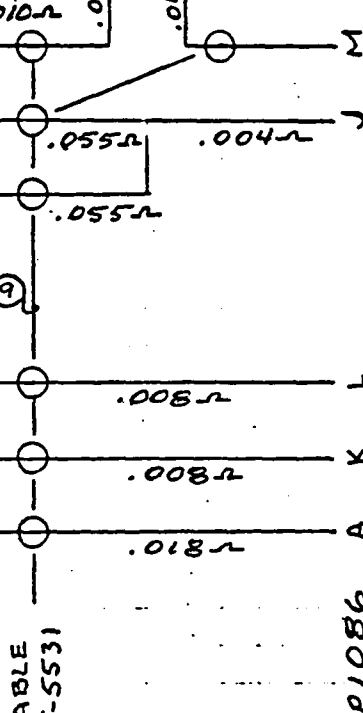
IEC SW
S6217



CABLE
25-7410



CABLE
35-5531



Reference Pwd. C
SAME

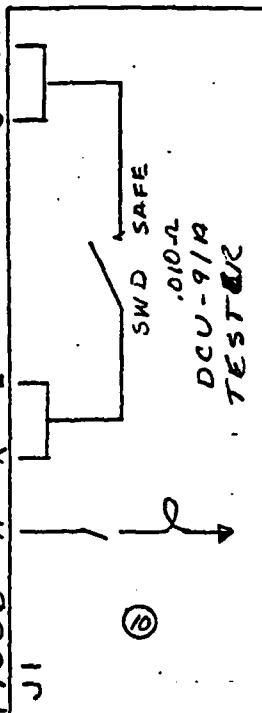


Figure 4.1-27 Power Paths Through DCU-9/A Tester

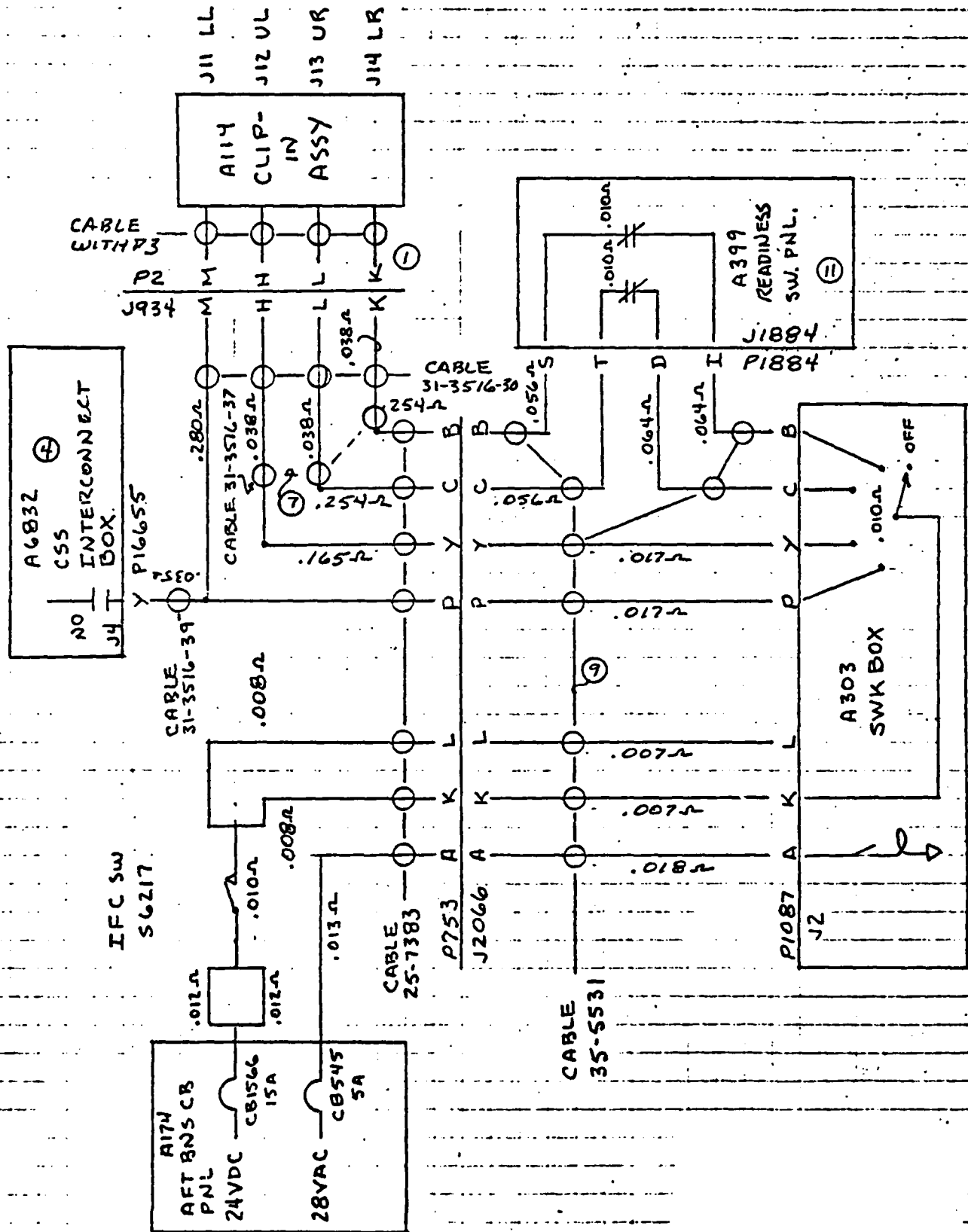


Figure 4.1-28 Power Path Through SWK Box

CLIP-IN ASSEMBLY PIN X CIRCUIT ANALYSIS PACKAGE

4.1.6.8 Circuit Analysis Package, Weapon Interface Pin X on Connectors J11, J12, J13 and J14 of the Clip-In Assembly and Cable in the Forward Bomb Bay

These interfaces are shown in Figure 5-2, T.O. 11N-H5035-2, (Change 4) - copy attached below. Maximum current available to pin X in a normal environment is 0 amps. Worst case current in an abnormal (faulted) environment would be 152 amps assuming the pins grounded at the weapon interfaces when current is available through the DCU-9/A tester (a test mode).

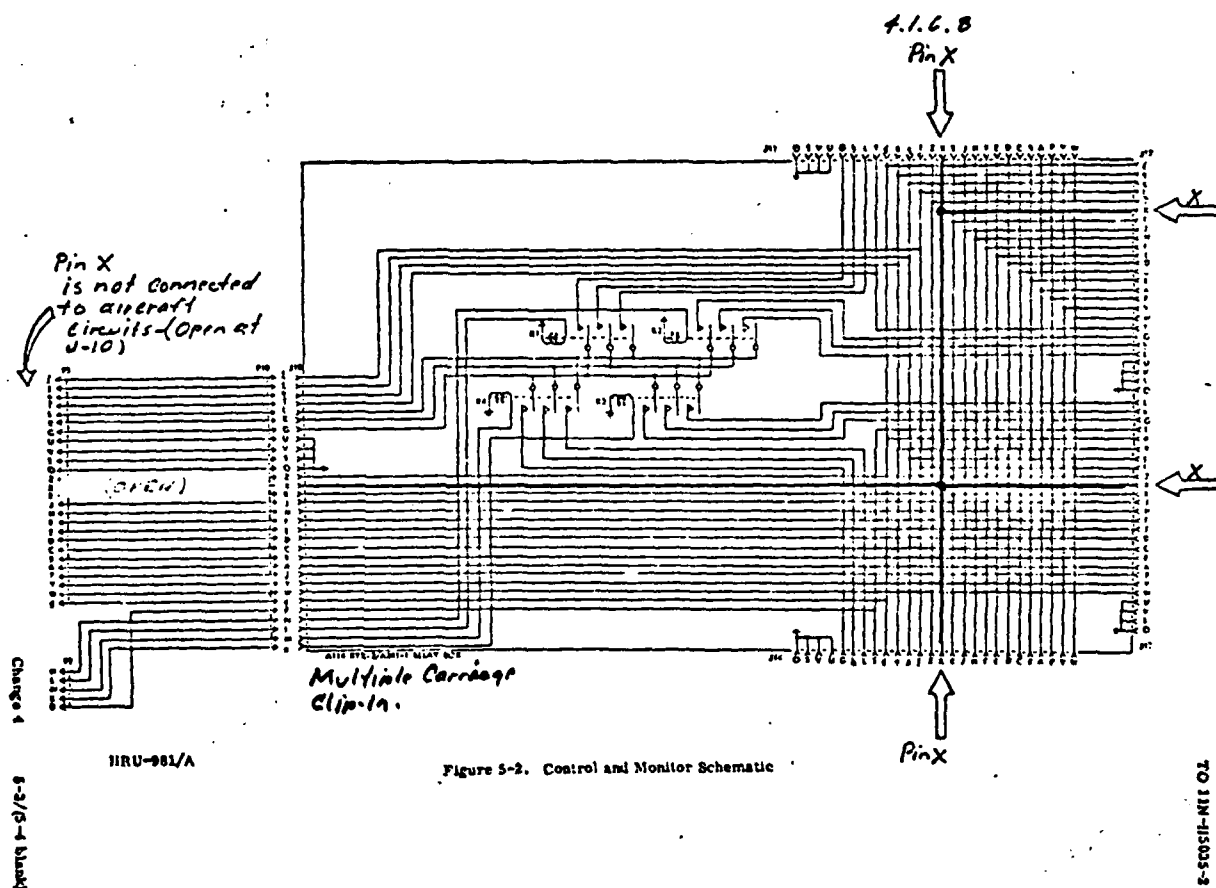


Figure 5-2. Control and Monitor Schematic

4.1.6.8 (Continued)

a. Normal Power and Load Analysis

From examination of Figure 4.1-29, Network Tree 202, open circuit voltage for pin X is = 0V. Short circuit current = 0A. This circuit is not connected to the aircraft. The cable between A114 Clip-In Relay Box and J932 AMAC has no wire to pin X.

b. Fault Analysis

The following postulated fault was analyzed using Network Tree 202.

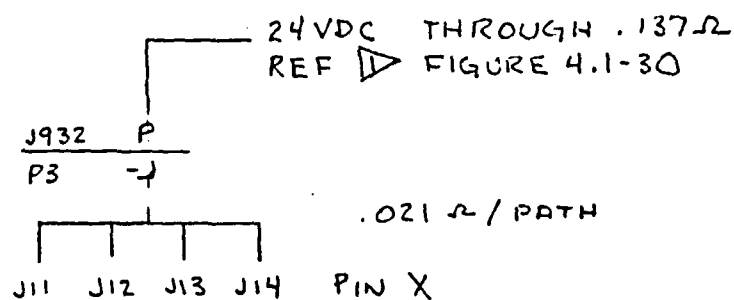
① Clip-In Assembly Damaged (Worst Case)

Wires to pin X shorted to 24VDC from CB1565 or CB1566 during testing using the DCU-9/A and the SWK Box. Voltage sources as shown in Figures 4.1-30 and 4.1-31.

4.1.6.8 (Continued)

c. Worst Case Fault

① Clip-In Assembly Damaged



Total Resistance of Path = .158 Ω

V_{OC} = 24VDC

I_{SC} = 152 A

Time = Less than 0.8 seconds. Current exceeds 1000% CB rating.

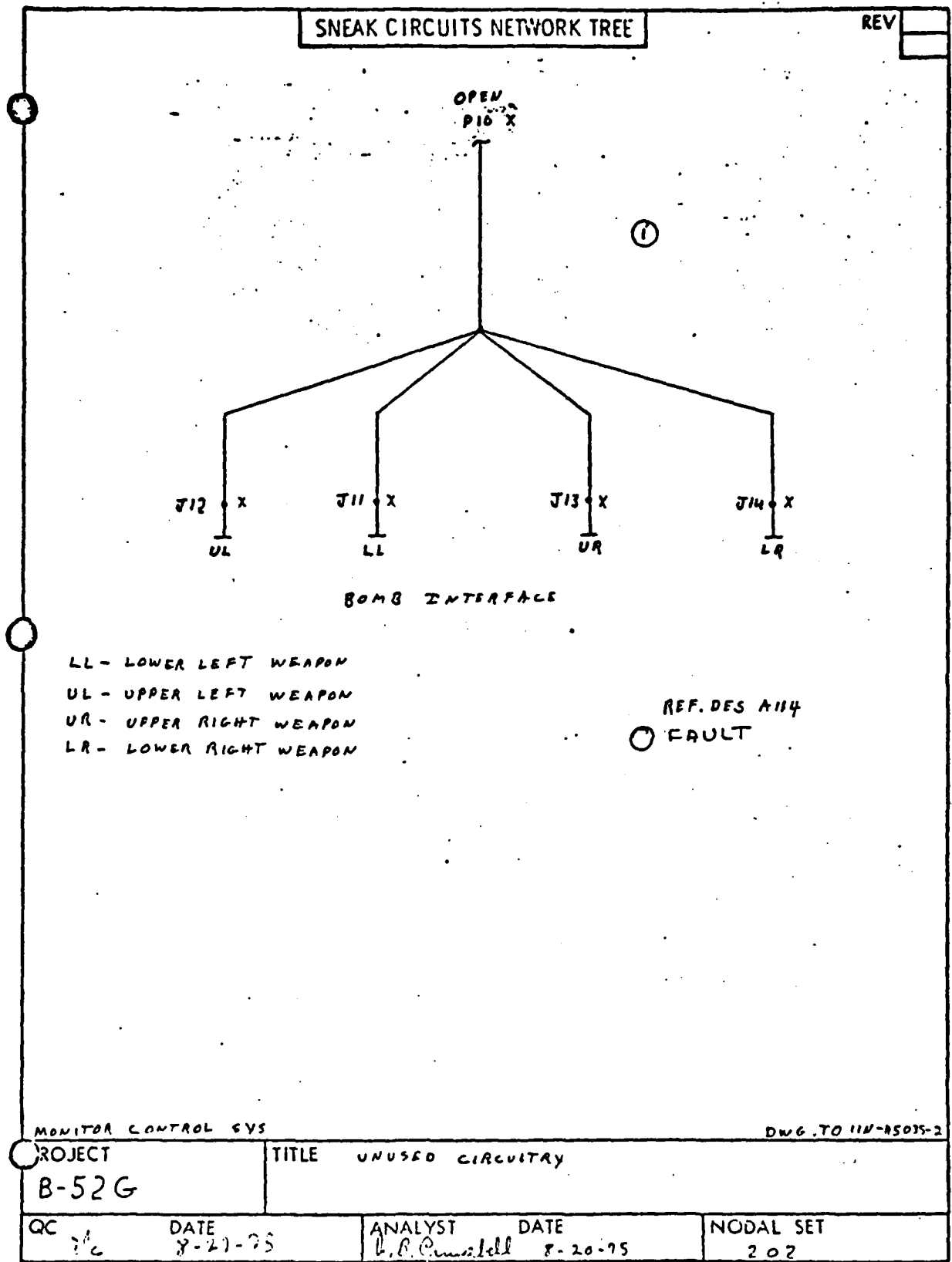


Figure 4.1-29 Network Tree 202

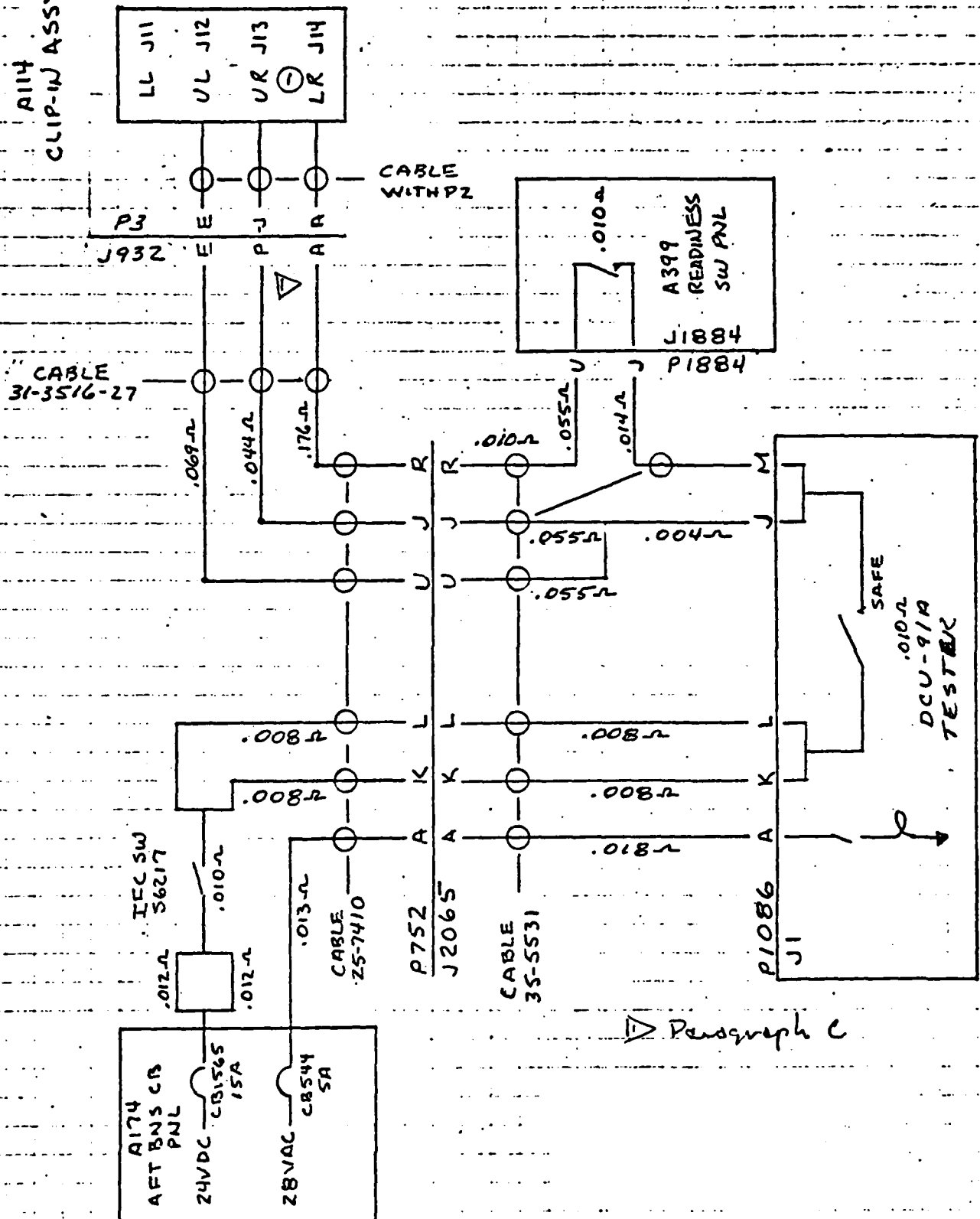
A114
CLIP-W ASSY

Figure 4.1-30 Power Paths Through DCU-9/A Tester

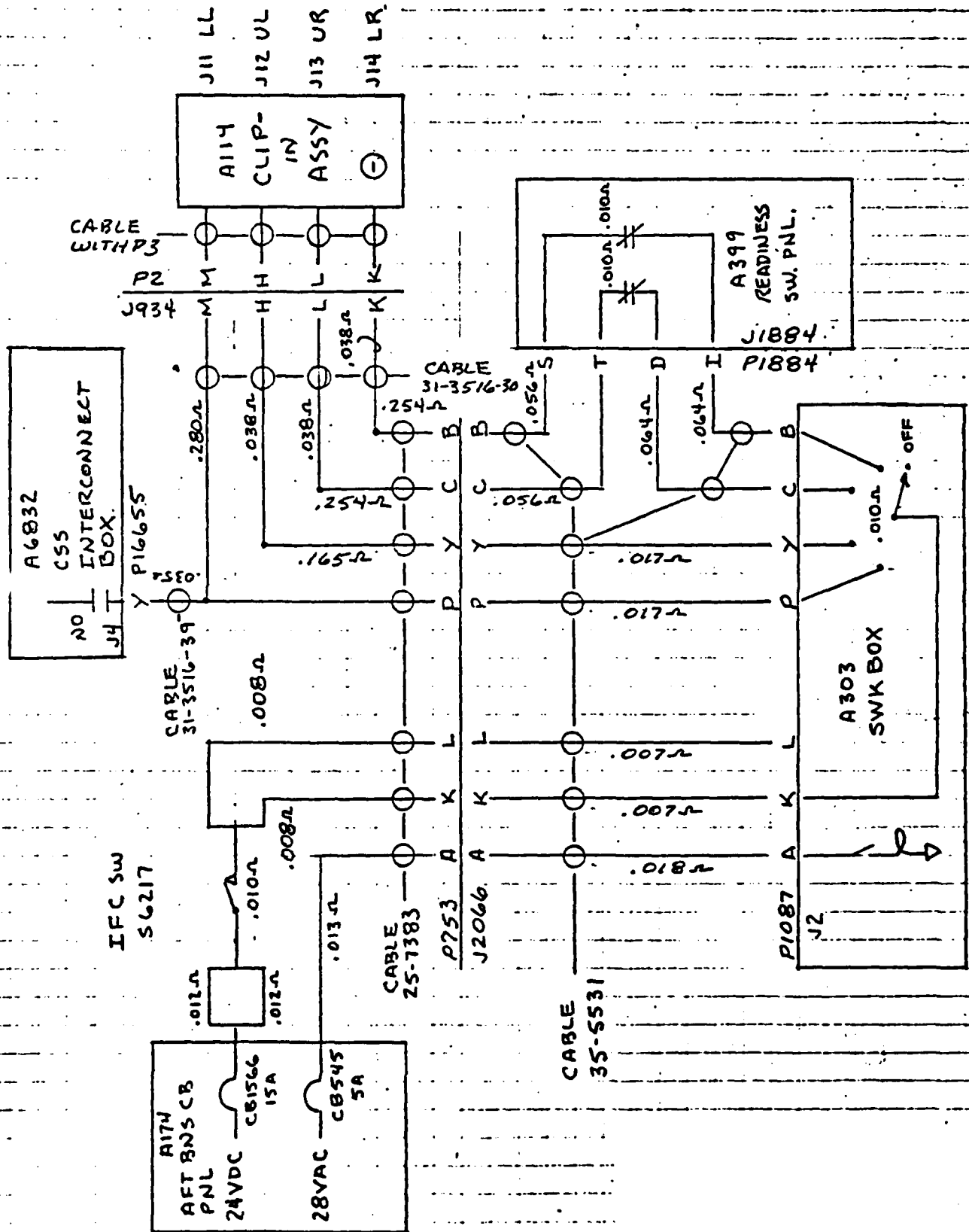


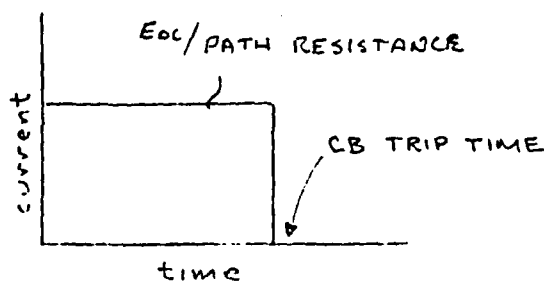
Figure 4.1-31 Power Paths Through SWK Box

4.1.7 Circuit Analysis Packages - B52/AGM-69A

The following packages present the power and load analyses of AGM-69A arming circuits on the launcher or pylon. Some packages describe the circuit for both the launcher and pylon while other packages describe separate circuits.

<u>Analysis</u>	<u>Interface</u>	<u>Function</u>
4.1.7.1	J1 Pin 97	SAF Prearm Command
4.1.7.2	J1 Pin 82	Missile Electronic Power
	Pin 92	Missile Electronic Power
	Pin 96	Missile Electronic Power
4.1.7.3	J1 Pin 57	Propulsion Safe (Launcher)
4.1.7.4	J1 Pin 2	Battery Activate
	Pin 10	Accumulator Activate
	Pin 26	Fin Unlock
4.1.7.5	J1 Pin 57	Propulsion Safe (Pylon)
4.1.7.6	J1 Pin 82	Missile Electronic Power (Pylon)
	Pin 92	Missile Electronic Power (Pylon)
	Pin 96	Missile Electronic Power (Pylon)
4.1.7.7	J1 Pin	(Ejector) Arm Solenoid
4.1.7.8	J1 Pin 20	SAF Class III A Command
	J Pin 60	SAF Class III B Command

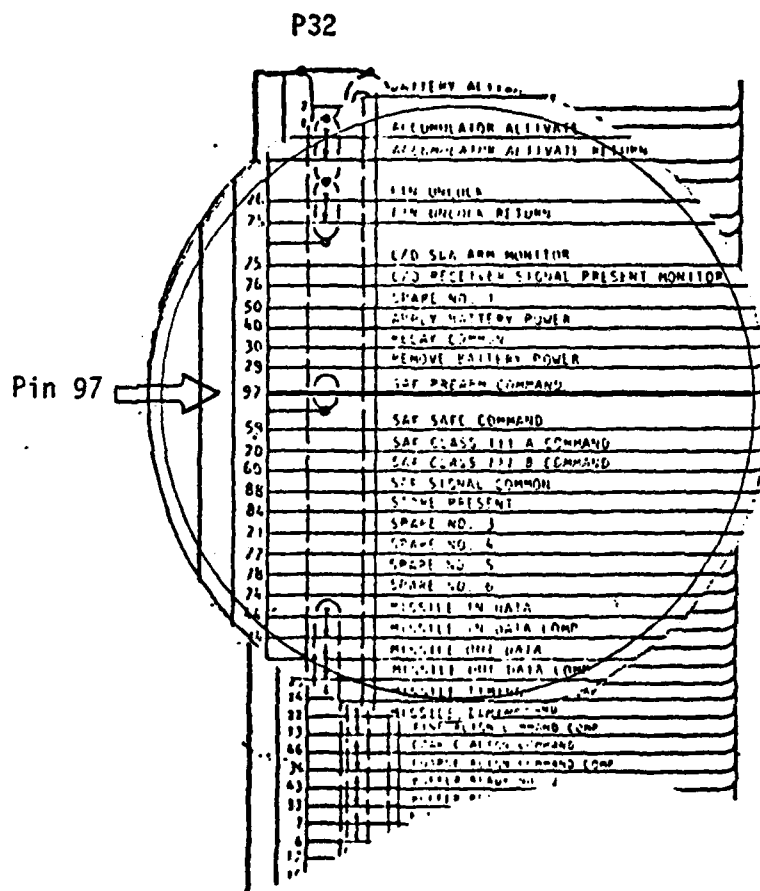
NOTE: Power Profiles - In all cases, short circuit current, caused by faults was found to be constant because of the absence of inductors and capacitors in the circuits investigated. Voltage source impedance was assumed to be zero ohms. A typical fault current versus time profile is shown here.



FAULT CURRENT PROFILE

4.1.7.1 Circuit Analysis Package, AGM 69A Interface Pin 97, Connector J1, Missile #1 on the Launcher & Left Pylon

This interface is shown in Figure 5-7, T.O. 11L1-2-8-2, (Change 12) and T.O. 16W6-19-2 (Change 3). Maximum current available to pin 97 in a normal environment is 0 amps. Worst case current at 118VAC in an abnormal (faulted) environment would be 900 amps for the missile on the launcher and 983 amps for the missile on the pylon assuming the pins grounded.



Refer to Figure 2-38
of T.O. 1B-52G-2-39GA-1
For Circuit Details

4.1.7.1 (Continued)

a. Normal Power & Load Analysis

From an examination of Figure 4.1-52, Cable Drawing - showing applicable circuits in the MCU, open circuit voltage for pin 97 is 0 VDC (the electronic switch is off) and short circuit current is 0A.

b. Fault Analysis

The following postulated faults were analyzed using Network Tree 99B and 99C, and Figure 4.1-52, Cable Drawing.

Pin 97, J1 Missile #1 Launcher

① Cable W1 Damaged

Wire to pin 97 shorted to 28VDC from CB1411, 118VAC from CB1395 if heater power is on, or to guidance and logic signals.

CB1411 (15A) 28VDC Missile Electronic Power

Resistance of wire from CB to missile interface

55 ft of #10 wire = .06 Ω

switch = .01 Ω

Maximum current available = 400 A

CB1395 (15A) 118VAC Missile Heater Power

Resistance of wire from CB to missile interface

47 ft of #12 wire = .095 Ω

6 ft of #16 wire = .027 Ω

switch = .01 Ω

Maximum current available = 900 A

Guidance and Logic Signals

Current output from these sources is device limited to less than other sources listed.

4.1.7.1 (Continued)

② Launcher MCU Damaged

Wire to pin 97 shorted to 27VDC from CB1484, +22VDC from power supply in the switch unit, or guidance/logic signals.

CB1484 (5A) 27VDC Essential Power

Resistance of wire from CB to MCU

44 ft of #20 wire = .405 Ω

Maximum current available = 66 A

Power Supply in Switch Unit

Current output is less than other source listed. The magnitude is unknown. The specification is not available.

Guidance and Logic Signals

Current output from these sources is device limited to less than other sources listed.

③ Cable W13, W22 or W19 Damaged

Wire to electronic switch shorted to 27VDC from CB1484 (Essential Bus) or to guidance and logic signals in the same cable. This may cause the electronic switch to turn on supplying 300 mA at 27VDC to pin 97.

④ Connector J16462/P1 or Cable 31-3564-119 Damaged

Wire to electronic switch shorted to 27VDC from CB1484 (Essential Bus) or to guidance and logic signals in the same cable. This may cause the electronic switch to turn on supplying 300 mA at 27VDC to pin 97.

Pin 97, J1 Missile #1 Left Pylon

⑤ Cable W6 Damaged

Wire to pin 97 shorted to 28VDC from CB1444 (ELEX Bus), 118VAC from CB1394 if heater power is on, or to guidance and logic signals.

4.1.7.1b (Continued)

⑤ (Continued)

CB1444 (15A) 28VDC Missile Electronic Power

Resistance of wire from CB to missile interface

58 ft of #20 wire = $.11 \Omega$ switch = $.01 \Omega$ Maximum current available = 233 A

CB1394 (10A) 118VAC Heater Power

Resistance of wire from CB to missile interface

58 ft of #12 wire = $.11 \Omega$ switch = $.01 \Omega$ Maximum current available = 938 A

Guidance and Logic Signals

The current output of these sources is device limited to less than other sources listed.

⑥ Left Pylon MCU Damaged

Wire to pin 97 shorted to 27VDC from CB1483 (Essential Bus), $\pm$ 22VDC from power supply in the switch unit, or to guidance and logic signals.

CB1483 (5A) 27VDC Essential Power

Resistance of wire from CB to MCU

50 ft of #20 wire = $.619 \Omega$ Maximum current available = 43.5 A

Power Supply in Switch Unit

Current output is less than other listed source. The magnitude is unknown. The specification is not available.

Guidance and Logic Signals

Current output from these sources is device limited to less than other sources listed.

4.1.7.1b (Continued)

- ⑦ Cable W1 Left Pylon, Connector J16460/P1, Cable 31-3564-114, Connector P16539/J16539 or Cable 31-3564-117 Damaged

Wire to electronic switch shorted to 28VDC from CB1411, 27VDC from CB1483 or guidance and logic signals in the same cable. This may cause the switch to turn on supplying 300 mA at 27VDC to pin 97.

Pin 97, J1 Missile #1 Launcher or Left Pylon

- ⑧ PDU Damaged

Wire to electronic switch of both MCU's shorted to 118VAC from CB1487 (AC Bus), 118VAC-30 (AC Bus) from CB1422, 27VDC from CB1486, or guidance and logic signals. This may cause the switches to turn on supplying 300 mA at 27VDC to pin 97 of both missiles.

- ⑨ Cabling from PDU to Right Pylon MCU Damaged

Wire to electronic switch of both MCU's shorted to 27VDC from CB1485 (Essential Bus) or guidance and logic signals. This may cause the switches to turn on supplying 300 mA at 27VDC to pin 97 of both missiles.

- ⑩ Right Pylon MCU Damaged

Wire to electronic switch of both MCU's shorted to 27VDC from CB1485 (Essential Bus), +22VDC from Power Supply in the Switch Unit, or guidance and logic signals. This may cause the switches to turn on supplying 300 mA at 27VDC to pin 97 of both missiles.

- ⑪ Cable 31-3564-52 Damaged

Wire to electronic switches in both MCU's are cabled with wires running between the PDU and MDU/BCU. These wires primarily carry guidance, digital information and other low level signals. A short to them may cause the switches to turn on supplying 300 mA at 27VDC to pin 97 of both missiles.

4.1.7.1b (Continued)

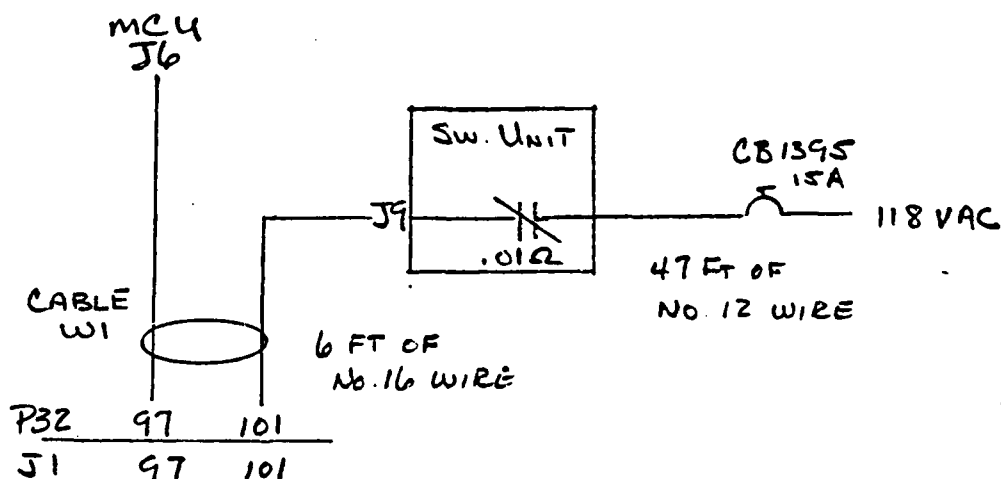
(12) CSS Interconnect Box Damaged

Wires to electronic switch of both MCU's shorted to 24VDC from CB1566. This may cause the electronic switches to turn on supplying 27VDC at 300 mA to both missiles. The 24 VDC is available only when the SWK Box is switched to "LL".

Note: All circuit breakers are located in the AGM-69A Power Distribution Box, A482 except CB1566 which is located in the Aft BNS CB PNL, A174.

c. Worst Case Paths

Launcher Missile pin 97: Reference path (1) Cable W1 Damaged.



Total resistance of path = $.122 \Omega$

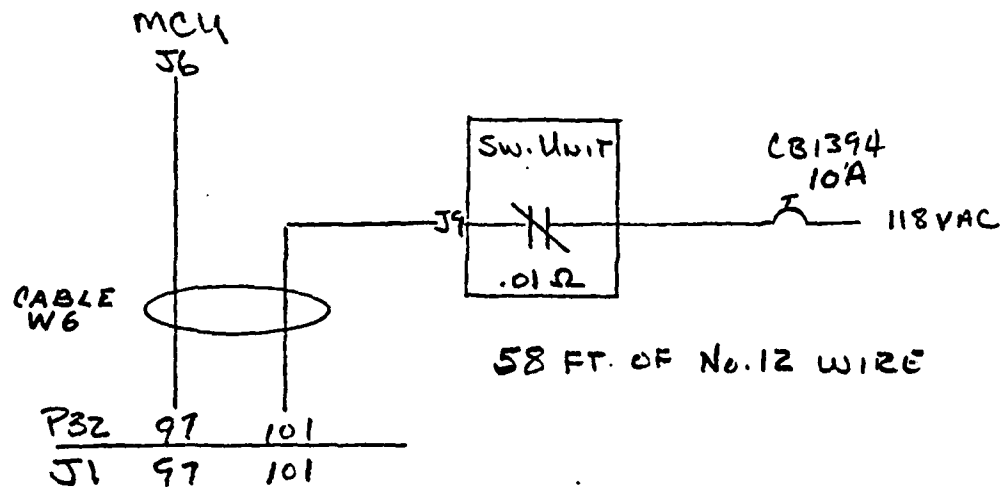
$V_{OC} = 118VAC$

$$I_{SC} = \frac{.118}{.122} = \underline{.900 \text{ A}}$$

Time = current exceeds 6000% rating of CB. The time will be less than .13 sec (3000% rating).

4.1.7.1c (Continued)

Left Pylon Missile pin 97: Reference path ⑤ Cable W6 Damaged.

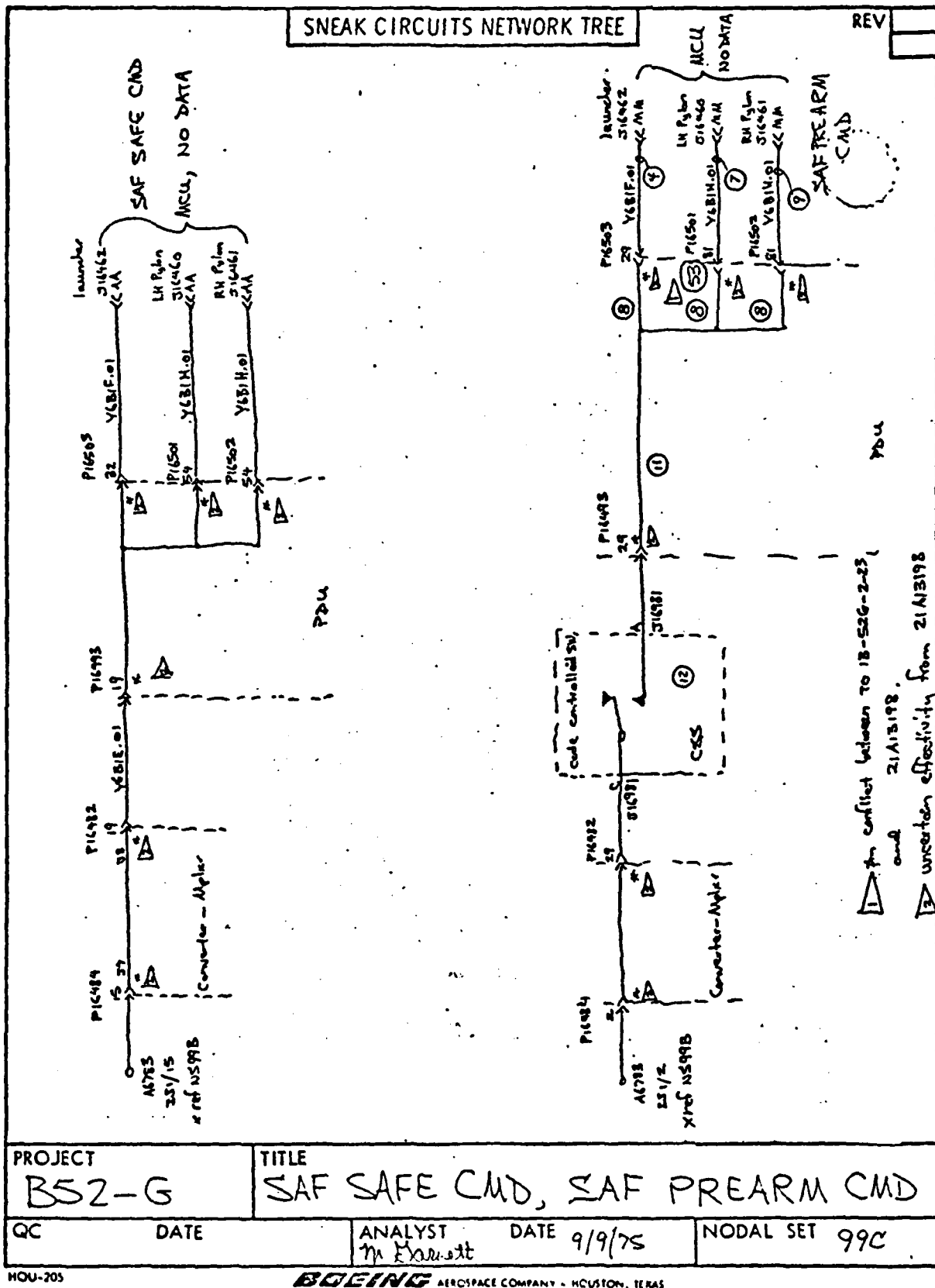


Total resistance of path = $.12 \Omega$

$V_{OC} = 118VAC$

$$I_{SC} = \frac{118}{.12} = \underline{983} \text{ A}$$

Time = current exceeds 9000% rating of CB. The time will be less than .125 Sec (3000% rating). Reference CB Spec D10-30108.



Notes:

Shorts to wires above MCU will cause switch in MCU to turn on applying normal power to missiles.

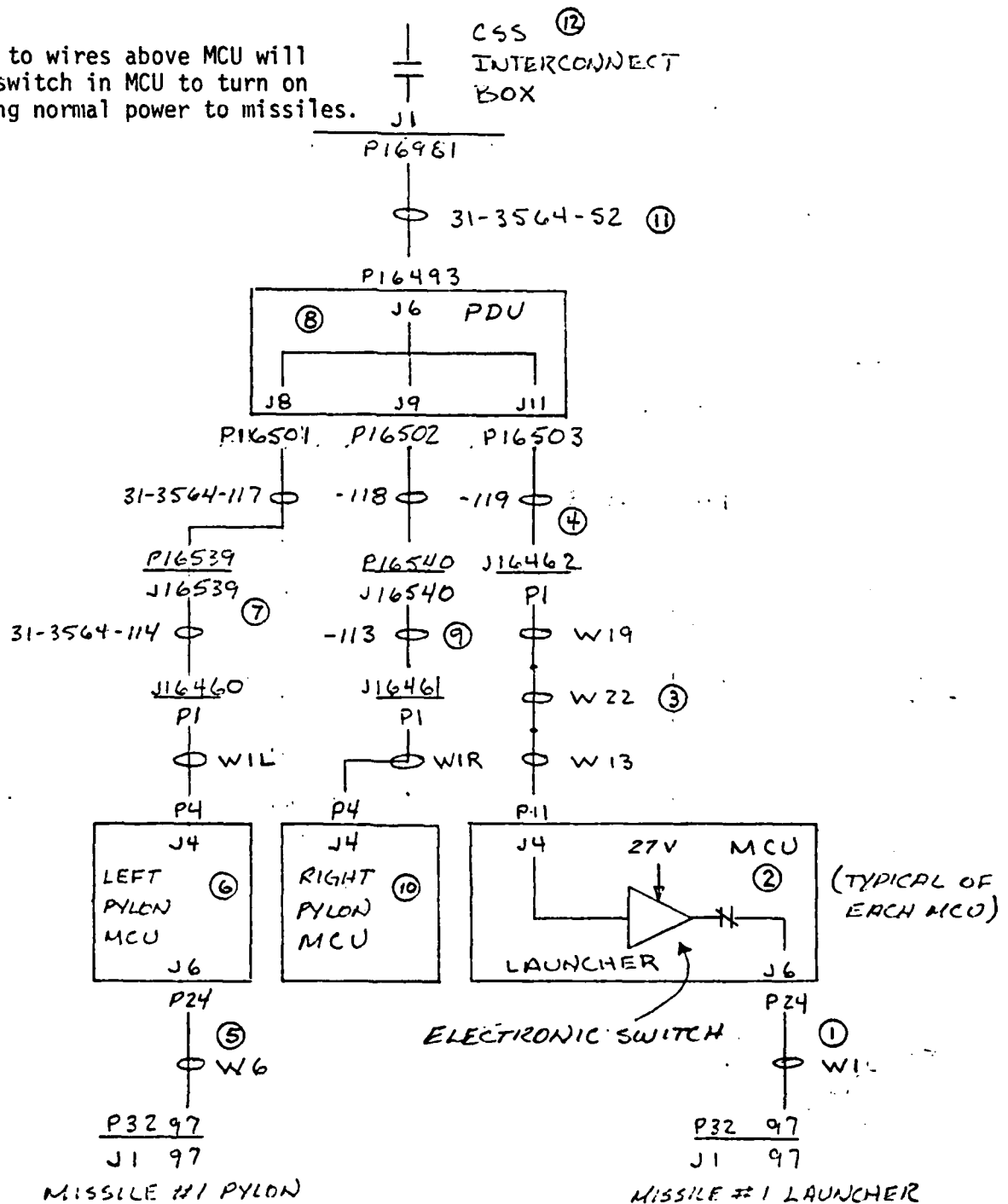


FIGURE 4.1-52. CABLE DRAWING

4.1.7.2 Circuit Analysis Package, AGM-69A Interface Pins 82, 92, and 96, Connector J1, Missile #1 on the Launcher

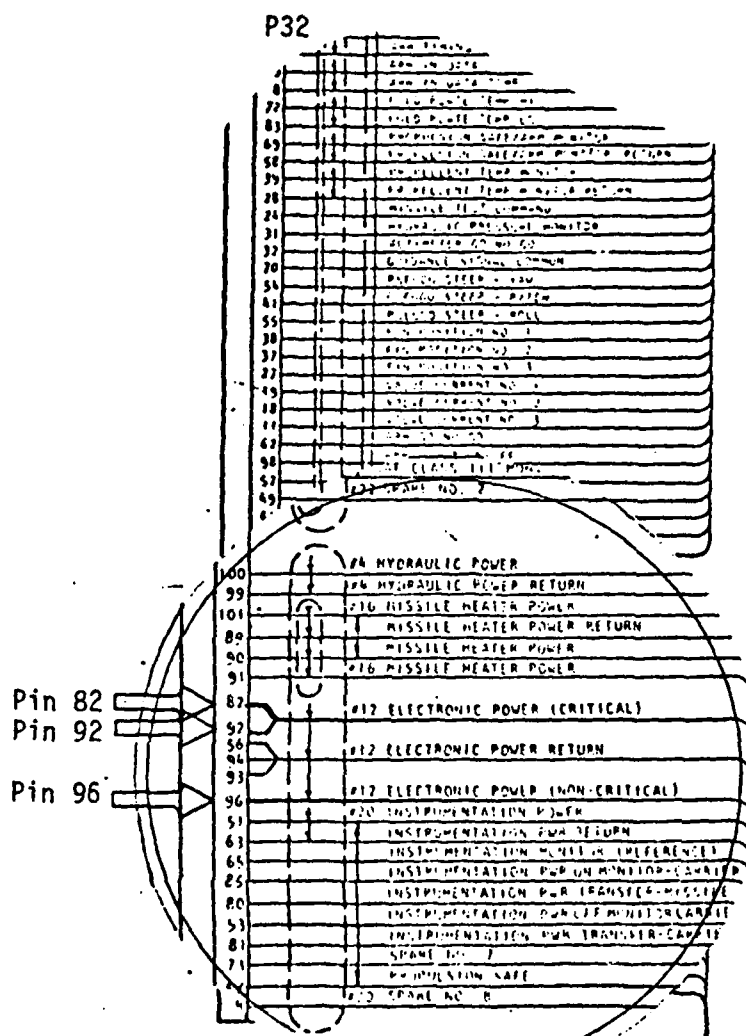
This interface is shown in Figure 5-7 of T.O. 11L1-2-8-2, Change 12.

Maximum current available to the pins in a normal environment with the pins grounded would be:

System Off: $V_{oc} = 0V$; $I_{sc} = 0 A$

System On: $V_{oc} = 28 VDC$; $I_{sc} = 368 A$

Worst case current at 28VDC in an abnormal environment would be 1220 A with the pins grounded.



Refer to Figure 2-40 of T.O. 1B-52G-2-39GA-1 For Circuit Details

4.1.7.2 (Continued)

a. Normal Power and Load Analysis

From examination of Figure 4.1-53, Network Tree 118 and Figure 4.1-54, Cable Drawing, open circuit voltage and short circuit voltage is as follows:

Ground, System Off: $V_{oc} = 0V$; $I_{sc} = 0A$

Airborn, System On: Current to pins is supplied by CB1411, 28VDC ELEX Bus, through 37 ft. of #10 wire (.044 Ω) and 17 ft. of #12 wire (.0323 Ω). Total resistance of path = .076 Ω .

Therefore:

$V_{oc} = 28 \text{ VDC}$

$I_{sc} = \frac{28}{.026} = 368 \text{ A}$

b. Fault Analysis

The following postulated faults were analyzed using Figures 4.1.53 and 4.1.54:

① Cable WI Damaged

Wires subject pins shorted to 118 VAC from CB 1395 if heater power is on.

CB1395 (15A) 118 VAC Missile Heater Power

Resistance of wire from CB to missile interface

47 ft. of #12 wire = .095 Ω

6 ft. of #16 wire = .027 Ω

Maximum current available at 118 VAC = 967 A

② Switch Unit Damaged

Wires to subject pins shorted to:

118 VAC from CB 1395, Heater Power

28 VDC from CB 1433, Hydraulic Power

28 VDC from CB 1412 through CB 1418, Missile 2-8 ELEX Power

118 VAC from CB 1427, Launcher AC

28 VDC from CB 1435, Missile Valve

4.1.7.2b (Fault 2 Continued)

CB 1395 (15A) 118 VAC Missile Heater Power

Resistance of wire from CB to switch unit

47 ft. of #12 wire = .095 Ω

Maximum current available at 118 VAC = 1242 A

CB 1433 (60A) 28 VDC Hydraulic Power

Resistance of wire from CB to Switch Unit

48 ft. of #4 wire = .013 Ω

Maximum current available at 28 VDC = 2154 A

CB 1412 - CB 1418 (15A) 28 VDC Missile ELEX Power

Resistance of wire from CB's to Switch Unit

37 ft. of #10 wire = .044 Ω

10 ft. of #12 wire = .019 Ω

Maximum current available at 28 VDC = 444 A

CB 1427 (5A) 118 VAC Launcher AC

Resistance of wire from CB to Switch Unit

37 ft. of #20 wire = .34 Ω

10 ft. of #16 wire = .045 Ω

Maximum current available at 118 VAC = 306 A

CB 1435 (7.5A) 28 VDC Missile Valve

Resistance of wire from CB to Switch Unit

47 ft. of #16 wire = .21 Ω

Maximum current available at 28 VDC = 133 A

③ Cable W10 Damaged

Same faults as given in ② above omitting power from CB 1395, CB 1417, CB 1418, and CB 1433.

④ Cable W23 or W17

Same faults as given in ② above.

4.1.7.2b (Fault 5 Continued)

⑤ Cable 31-3564-124 or Connector P2/J2371 Damaged

Wires to subject pins shorted to:

118 VAC from CB 1395, Heater Power

28 VDC from CB's 1412 through CB 1417, Missile 2-7, ELEX Power

118 VAC from CB 1427, Launcher AC

28 VDC from CB 1435, Missile valve

CB 1395 (15A) 118 VAC Missile Heater Power

Resistance of wire from CB to connector

37 ft. #12 wire = $.07\Omega$

Maximum current available at 118 VAC = 1685 A

CB 1412 - CB 1417, (15A) 28 VDC, Missile 2-7 ELEX Power

Resistance of wire from CB to connector

37 ft. #10 wire = $.044\Omega$

Maximum current available at 28 VDC = 636 A

CB 1427 (5A) 118 VAC Launcher AC

Resistance of wire from CB to connector

37 ft. #20 wire = $.34\Omega$

Maximum current available at 118 VAC = 347 A

CB 1435 (7.5A) 28 VDC Missile Valve

Resistance of wire from CB to Switch Unit

37 ft. of #16 wire = $.166\Omega$

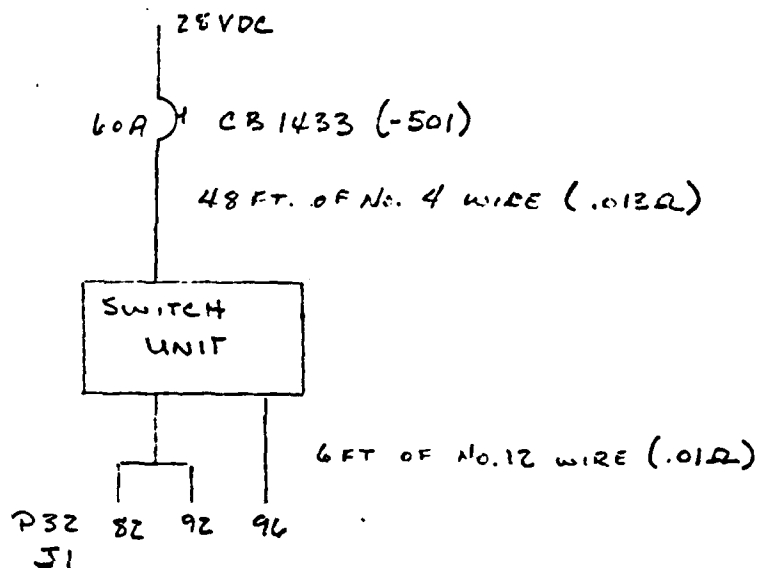
Maximum current available at 28 VDC = 168 A

Note: All circuit breakers are located in the AGM-69A Power Distribution Box.

4.1.7.2b (Fault 5 Continued)

c. Worst Case Path

Reference Path ② Switch Unit Damaged

Total Resistance of path = $.023\Omega$

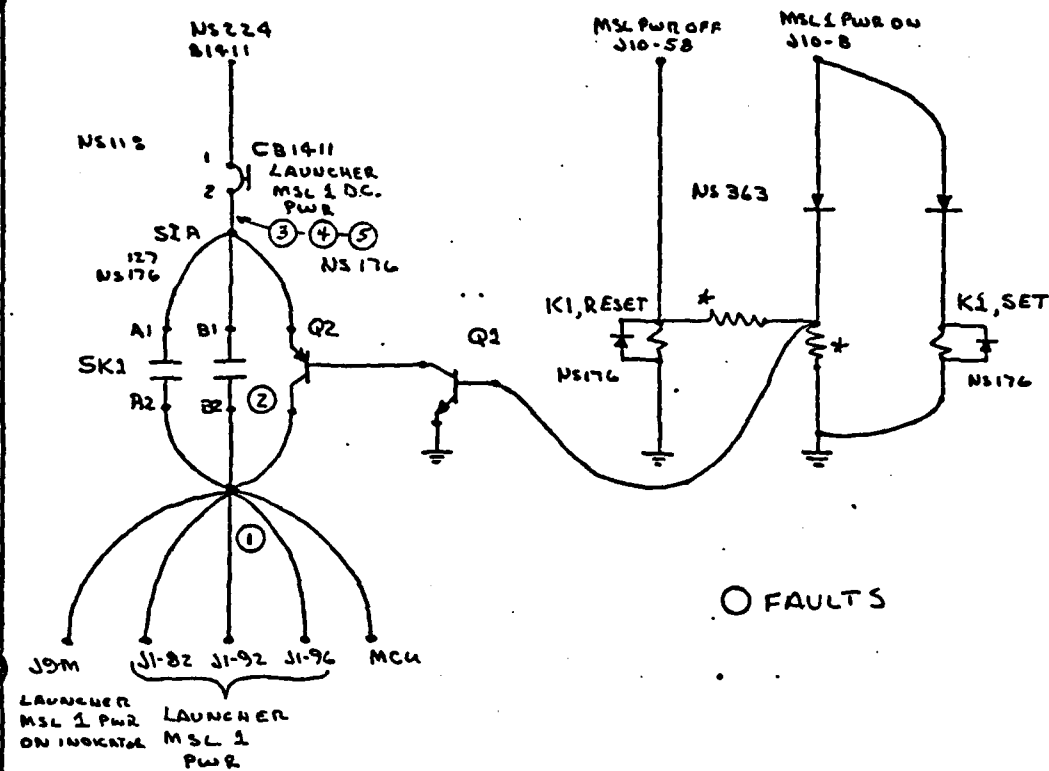
Voc = 28 VDC

$$I_{sc} = \frac{28}{.023} = \underline{1220 \text{ A}}$$

Time = Minimum trip time shown on calibration curve is 1.5 seconds for 500 amps. Therefore the time for 1220 would be less than 1.5 seconds.

SNEAK CIRCUITS NETWORK TREE

REV



PROJECT

BS2-G

TITLE

MISSILE #1 DC. POWER - LAUNCHER

QC

DATE

ANALYST

J.D.E.

DATE

9 SEPT 1975

NODAL SET

118, 176, 363

PCDU-705

BOEING AEROSPACE COMPANY - HOUSTON, TEXAS

Figure 4.1-53 Network Tree No. 118

D2-118576, -1

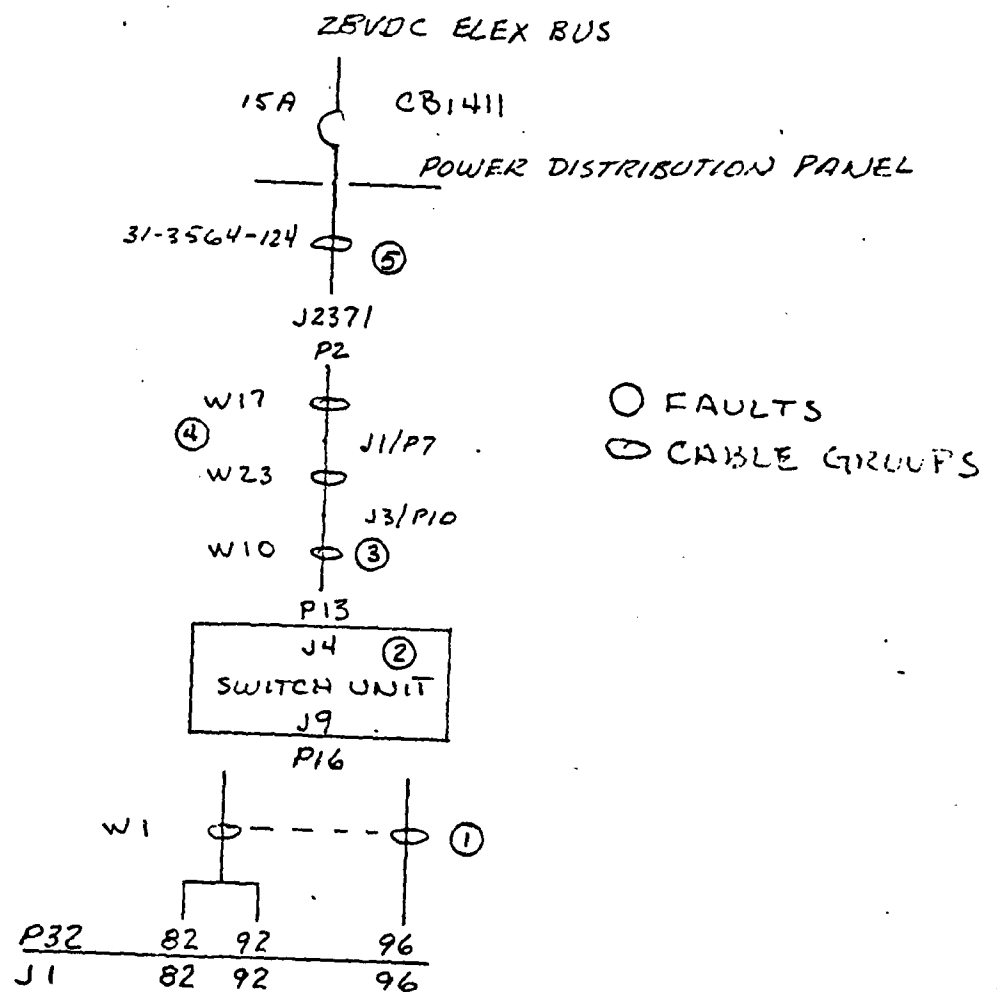
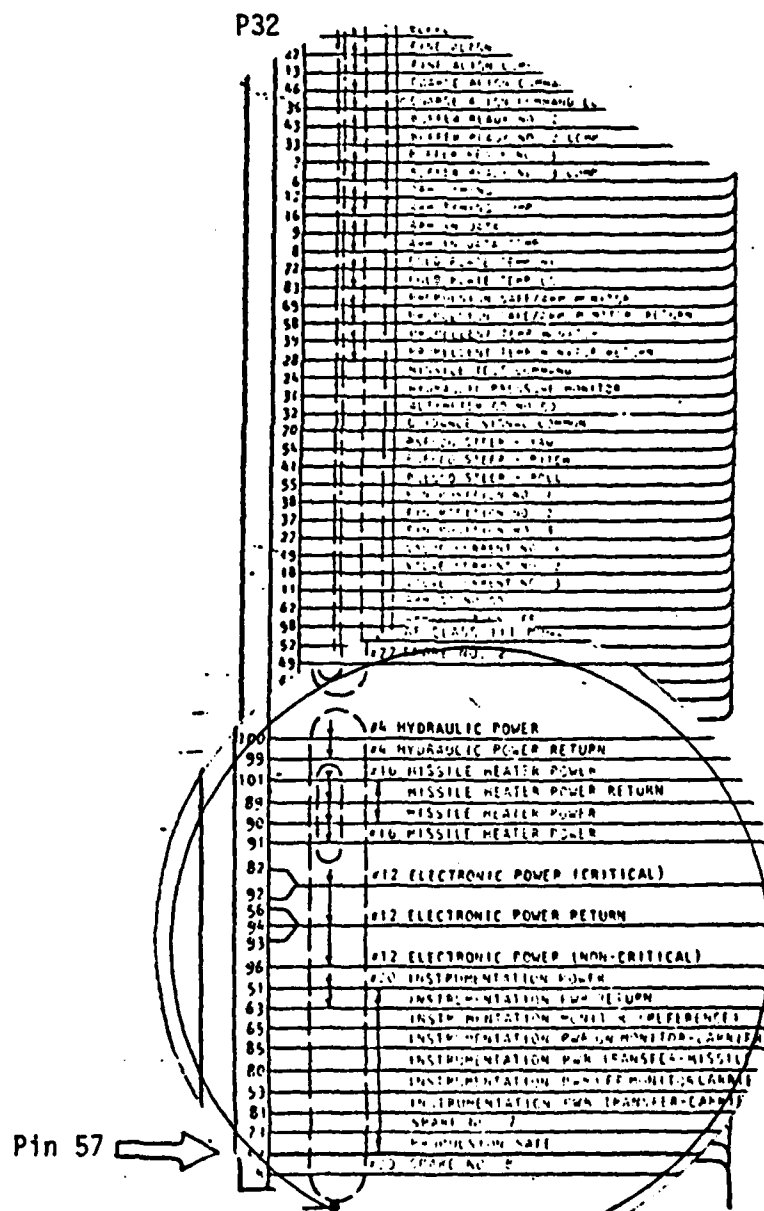


FIGURE 4.1-54. CABLE DRAWING

4.1.7.3 Circuit Analysis Package, SRAM, Interface Pin 57 of Connector J1, Missile 1 on the Launcher

This interface is shown in Figure 5-7, of T.O. 11L1-2-8-2, change 12. The current available to this pin in a normal environment is 0 amps. The worst-case current in an abnormal environment (faulted) is 411.76 A (assuming the pin is grounded).



Refer to Figure 2-38 of T.O. 1B-52G-2-39GA-1 For Circuit Details.

4.1.7.3 (Continued)

a. Normal Power and Load Analysis

From an examination of the Figure 4.1-55, Network Tree 151, the open circuit voltage is 0V and the short circuit current is 0A. The circuit passes through normally open relay contacts in the Power Distribution Panel.

b. Fault Analysis

The following postulated faults were analyzed using Network Tree 151 and the Cable Diagram, Figures 4.1-55 and 4.1-56.

① Damage to Connector J1 or Cable W1

Pin 57 may be shorted to 118 VAC through CB 1395, if heater power is on, or to 28 VDC through CB 1411.

CB 1395 (15A) 118 VAC Missile Heater Power

Resistance of wire from CB to missile

47 ft. of #12 wire = $.095\Omega$

6 ft. of #16 wire = $.027\Omega$

Maximum current available at 118 VAC = 967 A

CB 1411 (15A) 28 VDC Missile Electronic Power

Resistance of wire from CB to missile

37 ft. of #10 wire = $.044\Omega$

17 ft. of #12 wire = $.0323\Omega$

Maximum current available at 28 VDC = 3680 A

② Damage to Relay Assembly

The wires to the subject pins may be shorted to 28 VDC through CB 1433, CB 1435, CB 1411-CB 1418 or shorted to 118 VAC through CB 1395 or CB 1427.

CB 1433 (60A) 28 VDC Hydraulic Power

Resistance of wire from CB to Relay Assembly

48 ft. of #4 wire = $.013\Omega$

Maximum current available at 28 VDC = 2154 A

4.1.7.3b (Fault 2 Continued)

CB 1435 (7.5A) 28 VDC Missile Bypass Valve

Resistance of wire from CB to Relay Assembly

47 ft. of #16 wire = $.21\Omega$

Maximum current available at 28 VDC = 133 A

CB 1411 -CB 1418 (15A) 28 VDC Missile Electronic Power

Resistance of wire from CB's to Relay Assembly

37 ft. of #10 wire = $.044\Omega$

10 ft. of #12 wire = $.019\Omega$

Maximum current available at 28 VDC = 444 A

CB 1395 (15A) 118 VAC Missile Heater Power

Resistance of wire from CB to Relay Assembly

47 ft. of #12 wire = $.095\Omega$

Maximum current available at 118 VAC = 1242 A

CB 1427 (5A) 118 VAC Launcher AC

Resistance of wire from CB to Relay Assembly

37 ft. of #20 wire = $.34\Omega$

10 ft. of #16 wire = $.045\Omega$

Maximum current available at 118 VAC = 306 A

③ Cable W10 Damaged

Faults are the same as ② except power from CB 1395, CB 1417, CB 1418, and CB 1433 is not available.

④ Cable W23 or Cable W17 Damaged

Faults same as ③ above.

4.1.7.3b (Fault 5 Continued)

⑤ Cable 31-3564-124 or Connector J2371 Damaged

Wires to subject pins may be shorted to 28 VDC through CB 1411-
CB 1418 or through CB 1435. Wires may be shorted to 118 VAC
through CB 1395 or CB 1427.

CB 1411 - CB 1418 (15A) 28 VDC Missile Electronic Power

Resistance of wire from CB to Connector

37 ft. of #12 wire = $.07\Omega$

Maximum current available at 28 VDC = 1685 A

CB 1435 (7.5A) 28 VDC Missile Bypass Valve

Resistance of wire from CB to Connector

37 ft. of #16 wire = $.166\Omega$

Maximum current available at 28 VDC = 168 A

CB 1395 (15A) 118 VAC Missile Heater Power

Resistance of wire from CB to Connector

37 ft. of #12 wire = $.07\Omega$

Maximum current available at 118 VAC = 1685 A

CB 1427 (5A) 118 VAC Launcher AC Power

Resistance of wire from CB to Connector

37 ft. of #20 wire = $.34\Omega$

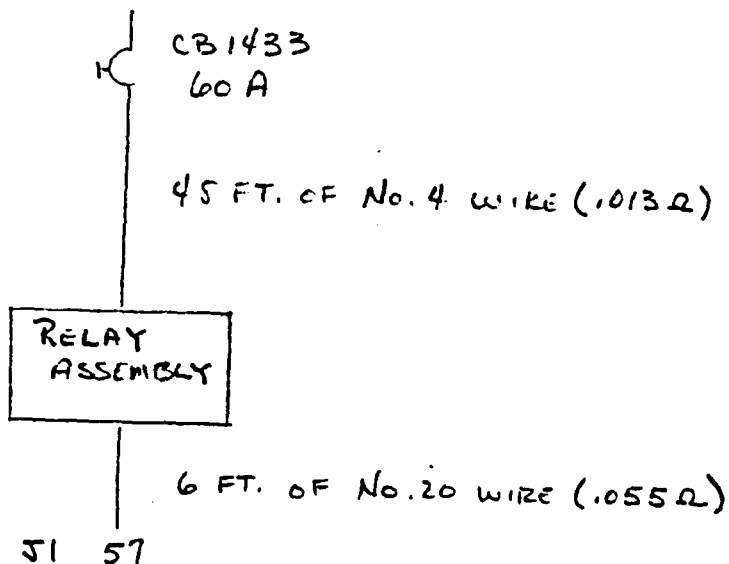
Maximum current available at 118 VAC = 347 A

Note: All circuit breakers are located in the AGM-69A
Power Distribution Box.

4.1.7.3 (Continued)

c. Worst Case Path

Refer to Fault (2), Relay Assembly Damaged



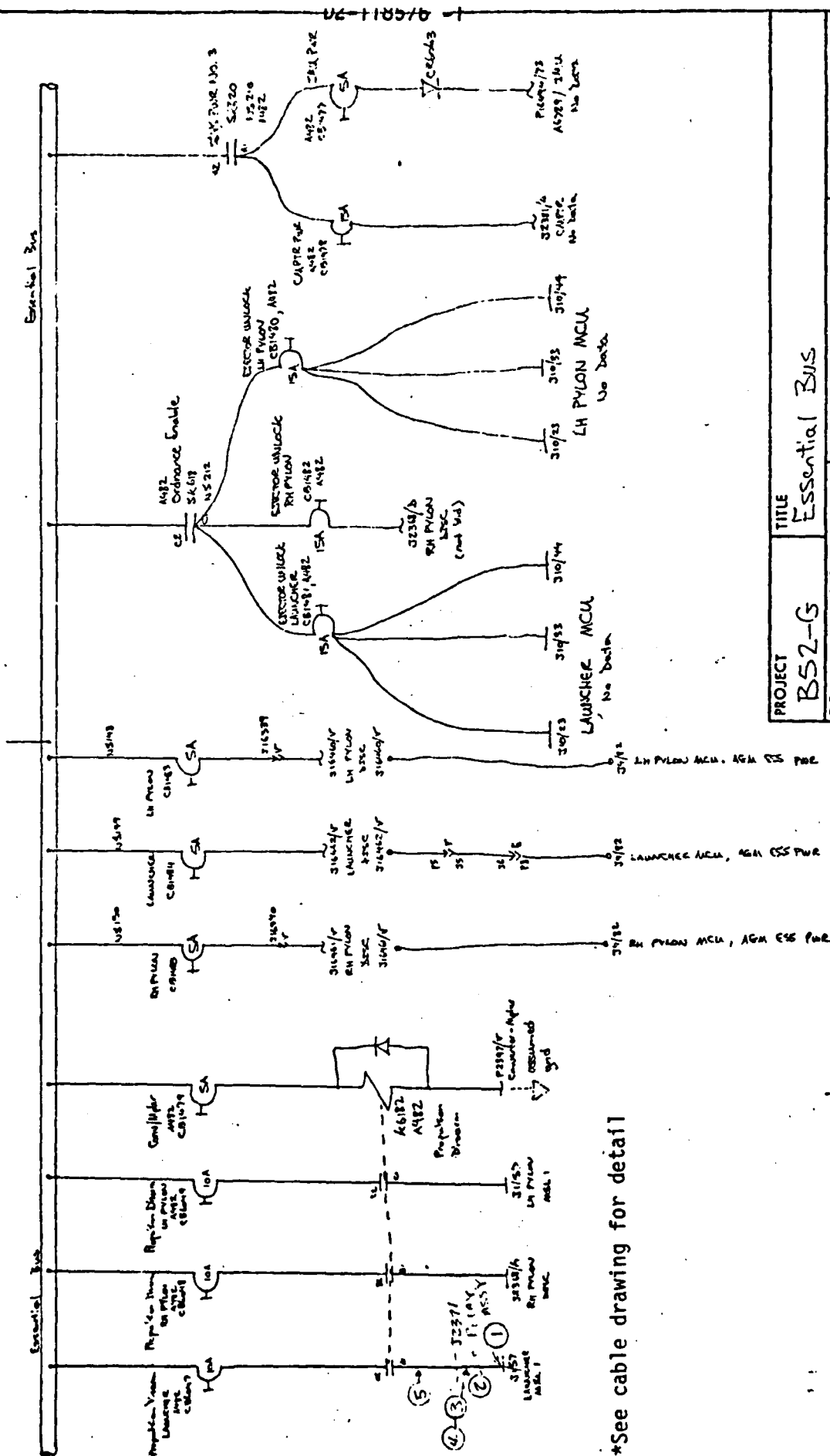
Total Resistance of path = $.068\Omega$

Voc = 28 VDC

$$I_{sc} = \frac{28}{.068} = \underline{411.76 \text{ A}}$$

Time = 2.0 seconds

PWR FROM Voltage Regulator
AF 411/A



PROJECT	TITLE	ANALYST	DATE	NODAL SET
B52-G	Essential Bus	FM	9/8/75	149, 153, 222, 223
OC				

THE GOING AIRCRAFT COMPANY - PORTLAND, OREGON

FIGURE 4.1-55. NETWORK TREE 151

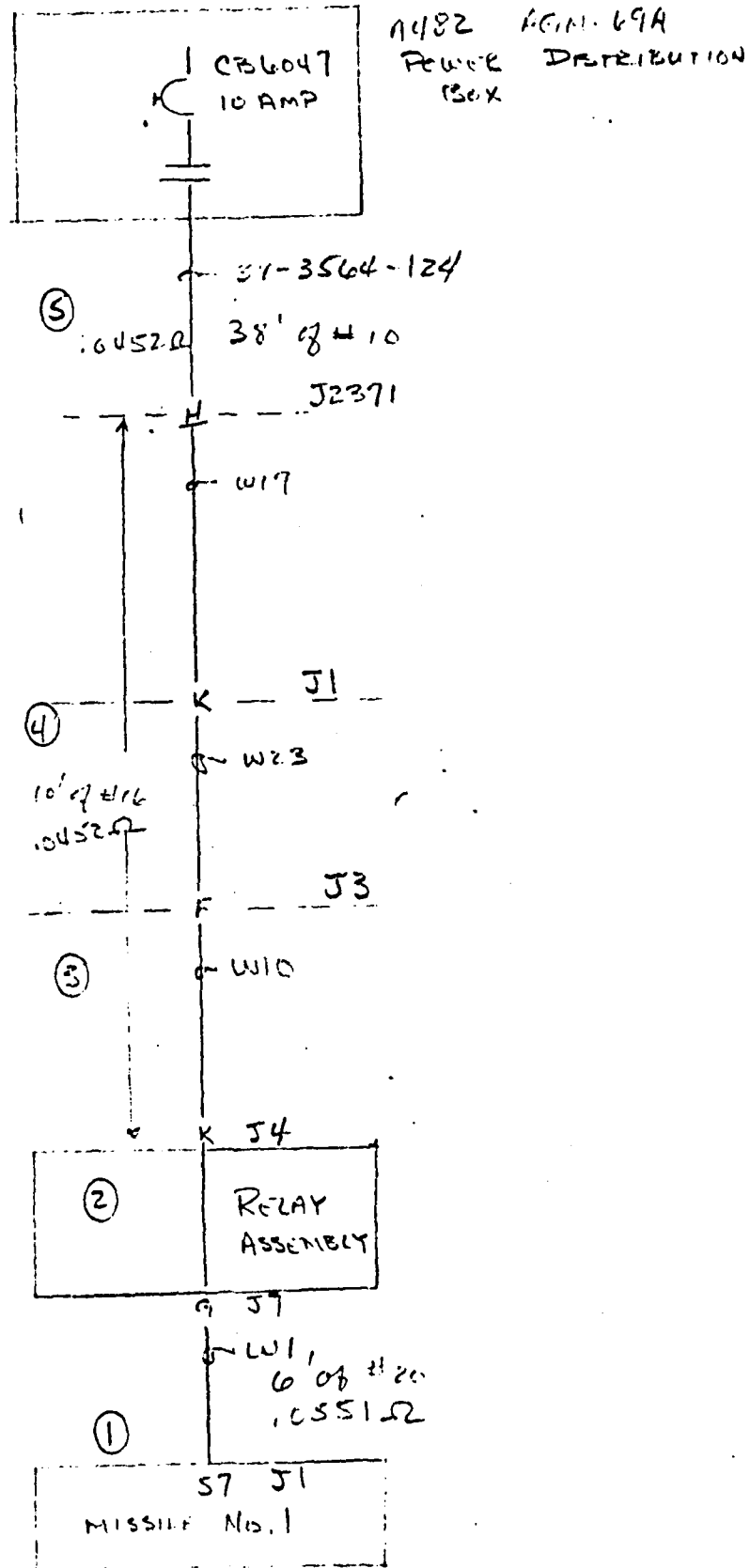


FIGURE 4.1-56. CABLE DRAWING

4.1.7.4 Circuit Analysis Package, AGM 69A Interface Pins 10, 26, and 2, Connector J1, Missile #1 on the Launcher and Left Pylon

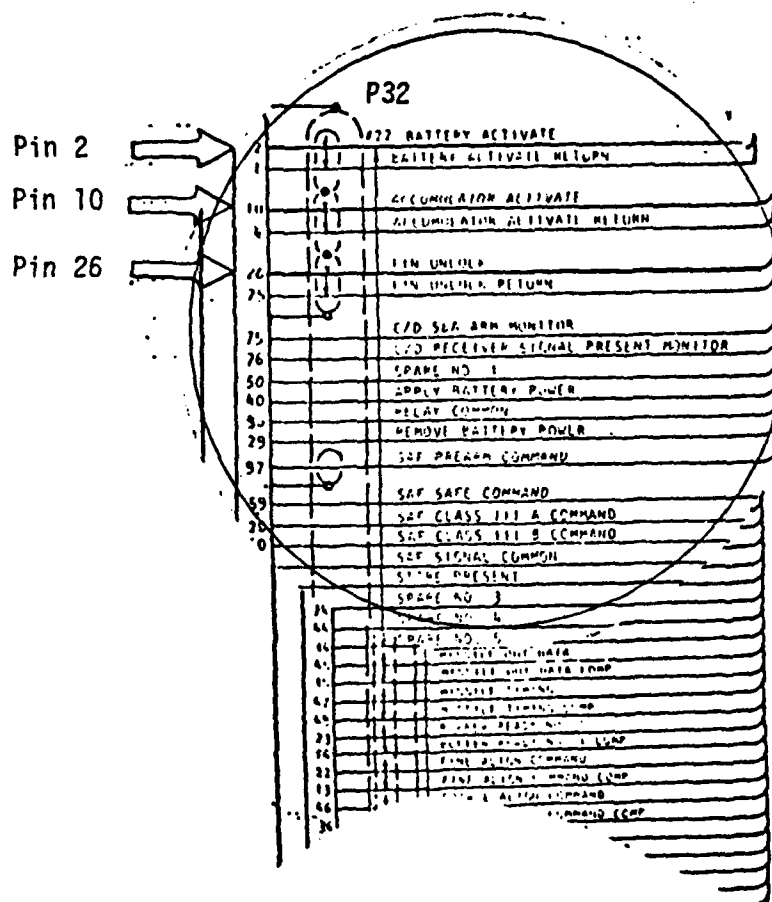
This interface is shown in Figure 5-7 of T.O. 11L1-2-8-2, Change 12.

Maximum current available to these pins in a normal environment is 0 amps.

Worst case current at 118 VAC in an abnormal (faulted) environment with the pins grounded would be:

Launcher Missile 900 A

Pylon Missile 983 A



Refer to Figure 2-39 of T.O. 1B-52G-2-39GA-1 For Circuit Details.

4.1.7.4 (Continued)

a. Normal Power and Load Analysis

From an examination of Figure 4.1-58, Cable Drawing, open circuit voltage is 0V and the short circuit current is 0A. The electronic switches and EED power are normally off prior to launch.

b. Fault Analysis

The following postulated faults were analyzed using Network Tree 144-145 for Launcher Mounted Missile and Figure 4.1-58.

① Cable W1 Damaged

Wires to pins 10, 2 and 26 shorted to 28 VDC from CB 1411, to 118VAC from CB1395 (if heater power is on) or to guidance and logic signals.

CB 1411 (15A) 28 VDC Missile Electronic Power

Resistance of wire from CB to missile interface

55 ft. of #10 wire = $.06\Omega$

Switch = $.01\Omega$

Maximum current available = 400 A

CB 1395 (15A) 118 VAC Missile Heater Power

Resistance of wire from CB to missile interface

47 ft. of #12 wire = $.095\Omega$

6 ft. of #16 wire = $.027\Omega$

Maximum current available = 940 A

Guidance and Logic Signals

Current from these sources is device limited and is less than other sources listed.

4.1.7.4b (Continued)

② Launcher MCU Damaged

Wire to pins 10, 2 and 26 shorted to 27 VDC from CB 1484, $\pm$ 22VDC from Power Supply in the Switch Unit, or to guidance and logic signals.

CB 1484 (5A) 27 VDC Essential Power

Resistance of wire from CB to MCU

44 ft. of #20 wire = $.405\Omega$

Maximum current available = 66 A

Power Supply in Switch Unit

Current output less than other source listed. The magnitude of the current is unknown since the part specification is not available.

Guidance and Logic Signals

Current output is device limited and is less than other sources listed.

For Pylon Mounted Missile

① Cable W6 Damaged

Wires to pins 10, 2 and 26 shorted to 28 VDC from CB 1444, 118VAC from CB1394, if heater power is on, or to guidance and logic signals.

CB 1444 (15A) 28 VDC Missile Electronic Power

Resistance of wire from CB to missile interface

58 ft of #20 wire = $.11\Omega$

Switch = $.01\Omega$

Maximum current available = 233 A

CB 1394 (10A) 118 VAC Heater Power

Resistance of wire from CB to missile interface

58 ft. of #12 wire = $.11\Omega$

Switch = $.01\Omega$

Maximum current available = 983 A

Guidance and Logic Signals

Current output from these sources is device limited and is less than other sources listed.

4.1.7.4b (Continued)

(2) Left Pylon MCU Damaged

Wires to pins 10, 2 and 26 shorted to 27 VDC from CB 1483, ± 22 VDC from power supply in Switch Unit or guidance and logic signals.

CB 1483 (5A) 27 VDC Essential Power

Resistance of wire from CB to MCU

50 ft. of #20 wire = $.619\Omega$

Maximum current available = 43.5 A

Power Supply in Switch Unit

Current output is less than other listed source. The magnitude is unknown since the specification is unavailable.

Guidance and Logic Signals

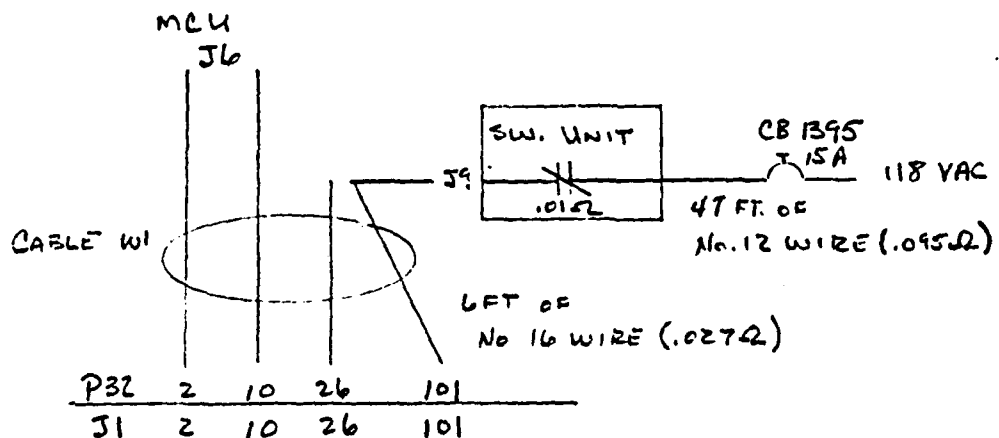
Current output from these sources is device limited and is less than other sources listed.

Note: Circuit Breakers are located in the AGM-69A Power Distribution Panel.

c. Worst Case Paths

For Launcher Mounted Missile

Reference Path (1) Cable W1 Damaged



Total Resistance of Path = $.122\Omega$

Voc = 118 VAC

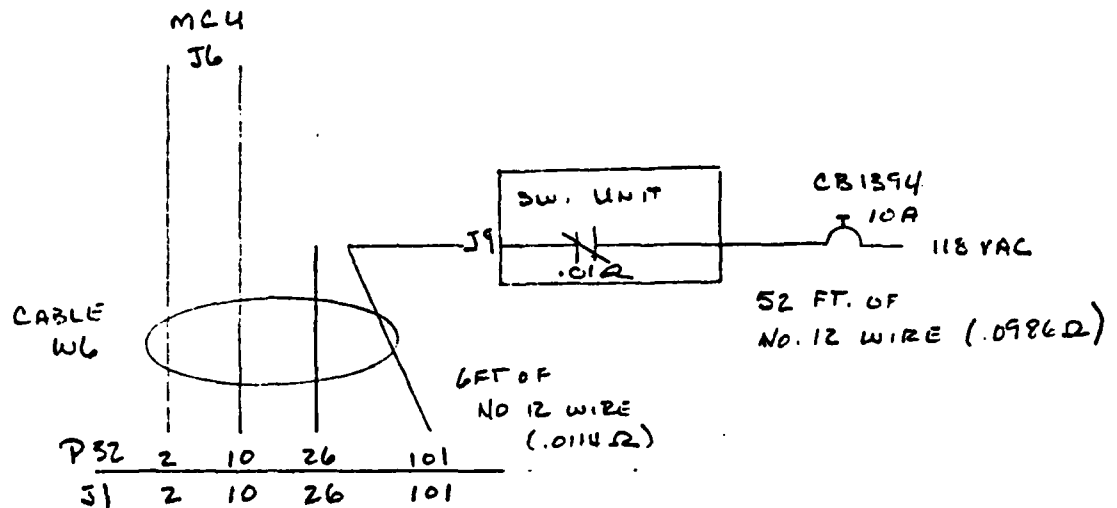
$$I_{sc} = \frac{118}{.122} = 900 \text{ A}$$

Time - Current rating exceeds 6000% rating of CB. The time will be less than .13 sec. (3000% rated).

4.1.7.4c (Continued)

For Pylon Mounted Missile

Reference Path ① Cable W6 Damaged



58 ft. of #12 wire total

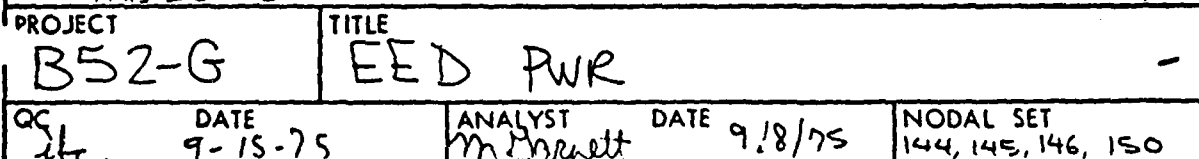
Total resistance .12Ω

Voc = 118 VAC

$$I_{sc} = \frac{118}{.12} = \underline{983} \text{ A}$$

Time - Current exceeds 9000% rating of CB. The time will be less than .125 sec. (3000% rated), Reference CB Spec. D10-30108.

REV



4-109.

NOTE: CABLING AND CONNECTORS ARE SHOWN FOR MISSILE MOUNTED IN THE LAUNCHER. FOR MISSILE MOUNTED ON THE LEFT PYLON:

W1 IS W6
P24 IS P15
P32 IS P32
J1 IS J1

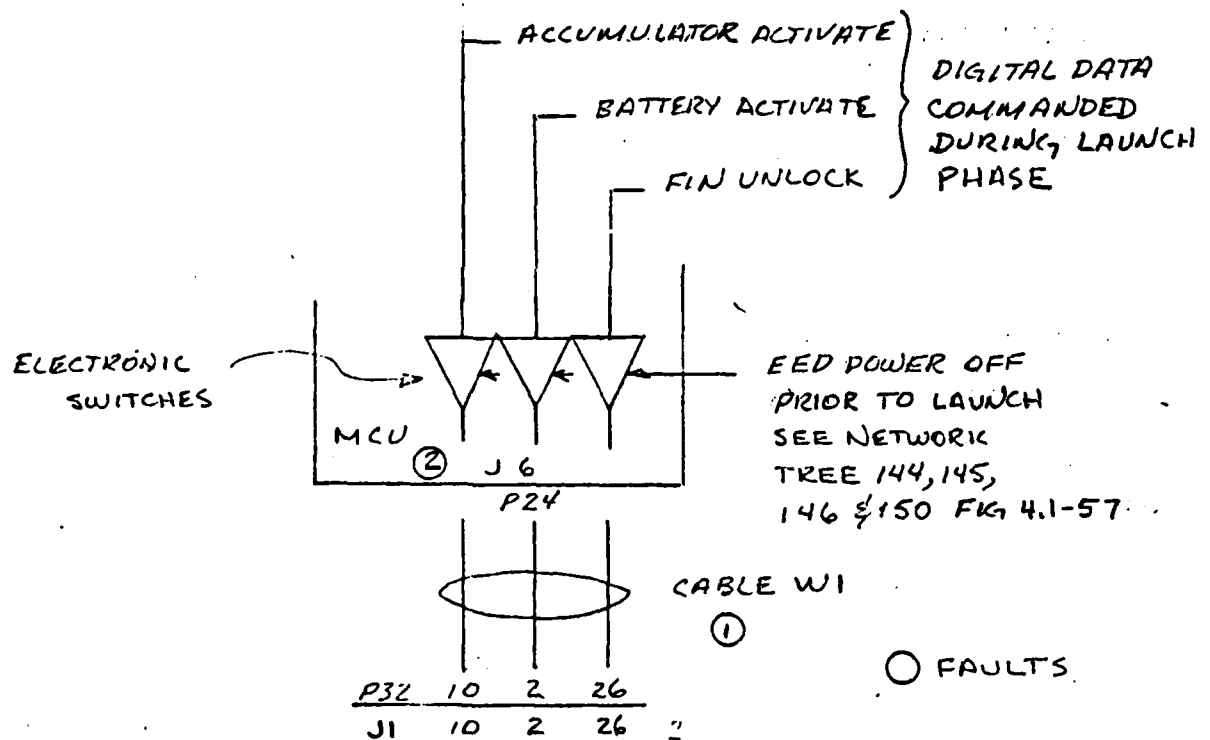
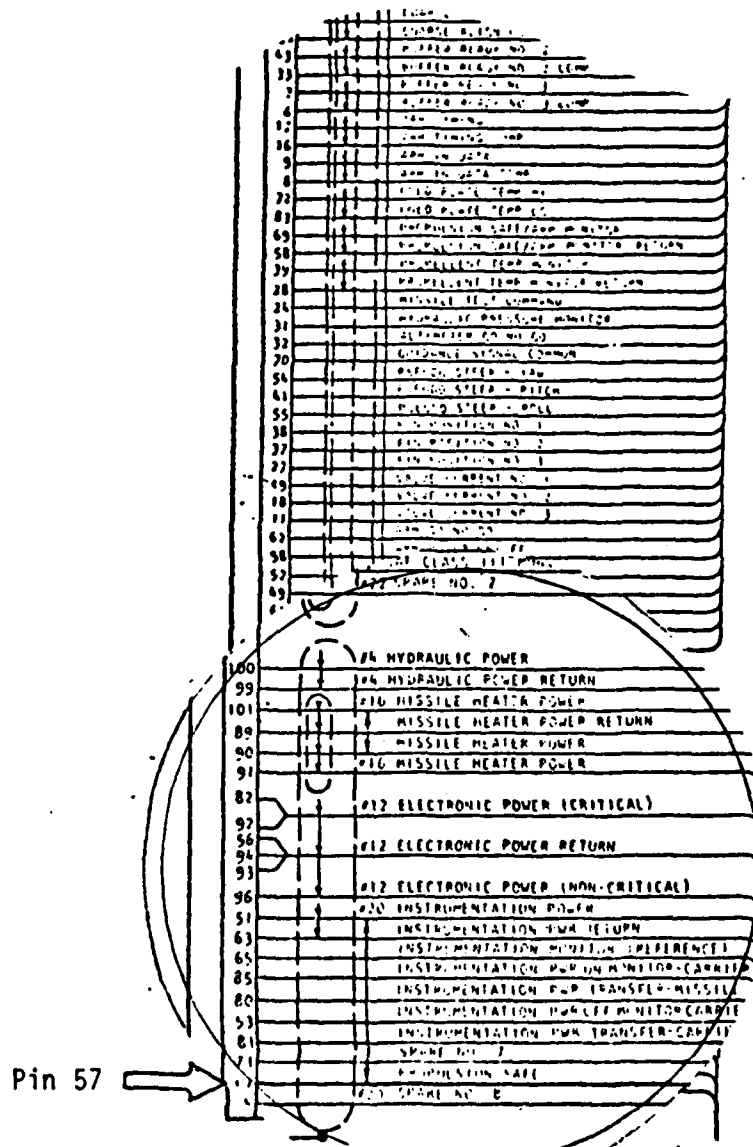


FIGURE 4.1-58. CABLE DRAWING

4.1.7.5 Circuit Analysis Package, SRAM, Interface Pin 57 of Connector J1, Missile 1 on the Left Pylon

This interface is shown in Figure 5-7 in T.O. 16W6-19-2, Change 3. The current available to this pin in a normal environment is 0 A. The worst case current in an abnormal environment (faulted) is 1115.5 A, assuming the pin is grounded.



Refer to Figure 2-38 of T.O. 1B-52G-2-39GA-1 For Circuit Details

4.1.7.5 (Continued)

a. Normal Power and Load Analysis

From an examination of Figure 4.1-59, Sneak Circuit Network Tree 153, the normal open circuit voltage is 0V and the short circuit current is 0A. The circuit passes through normally open relay contacts in the Power Distribution Panel.

b. Fault Analysis

The following postulated faults were analyzed using Figure 4.1-59, Network Tree 153 and Figure 4.1-60, Cable Drawing.

① Damage to Connector J1 or Cable W6

Pin 57 may be shorted to 28 VDC through CB 1444 or to 118 VAC through CB 1394.

CB 1444 (15A) 28 VDC Missile Electronic Power

Resistance of wire from CB to missile interface

58 ft. of #12 wire = $.1102\Omega$

Relay Contact Resistance = $.01\Omega$

Maximum current available at 28 VDC = 232 A

CB 1394 (10A) 118 VAC Missile Heater Power

Resistance of wire from CB to missile

58 ft. of #12 wire = $.1102\Omega$

Relay contact resistance = $.01\Omega$

Maximum current available at 118 VAC = 981.7 A

4.1.7.5b (Continued)

② Damage to the Relay Assembly or Cable W2

Wires to the subject pin may be shorted to 28 VDC through CB 1450, CB 1444, CB 1434, or shorted to 118 VAC through CB 1401 or CB 1394.

CB 1450 (7.5A) 28 VDC Bypass Valve Power

Resistance of wire from CB to Relay Assembly

52 ft. of #12 wire = .0988 Ω

Maximum current available at 28 VDC = 283.4 A

CB 1444 (15A) 28 VDC Missile Electronic Power

Resistance of wire from CB to Relay Assembly

52 ft. of #12 wire = .0988 Ω

Maximum current available at 28 VDC = 283.4 A

CB 1434 (60A) 28 VDC Missile Hydraulic Power

Resistance of wire from CB to Relay Assembly

52 ft. of #4 wire = .0137 Ω

Maximum current available at 28 VDC = 2043.8 A

CB 1401 (5A) 118 VAC AC Power

Resistance of wire from CB to Relay Assembly

52 ft. of #12 wire = .0988 Ω

Maximum current available at 118 VAC = 1194.33A

CB 1394 (10A) 118 VAC Missile Heater Power

Resistance of wire from CB to Relay Assembly

52 ft. of #12 wire = .0988 Ω

Maximum current available at 118 VAC = 1194.33A

③ Damage to Connector J2367 or Cable 31-3564-121

The wire to pin 57 may be shorted to 28 VDC through CB 1450, CB 1444 or to 118 VAC through CB 1401 or CB 1394.

CB 1444 (15A) 28 VDC Missile Electronic Power

Resistance of wire from CB to Connector

44 ft. of #12 wire = .0836 Ω

Maximum current available at 28 VDC = 334.9 A

4.1.7.5b (Continued)

③ (Continued)

CB 1450 (7.5A) 28 VDC Bypass Valve Power

Resistance of wire from CB to Connector

44 ft. of #12 wire = .0836 Ω

Maximum current available at 28 VDC = 334.9 A

CB 1401 (5A) 118 VAC AC Power

Resistance of wire from CB to Connector

44 ft. of #12 wire = .0836 Ω

Maximum current available at 118 VAC = 1141.5A

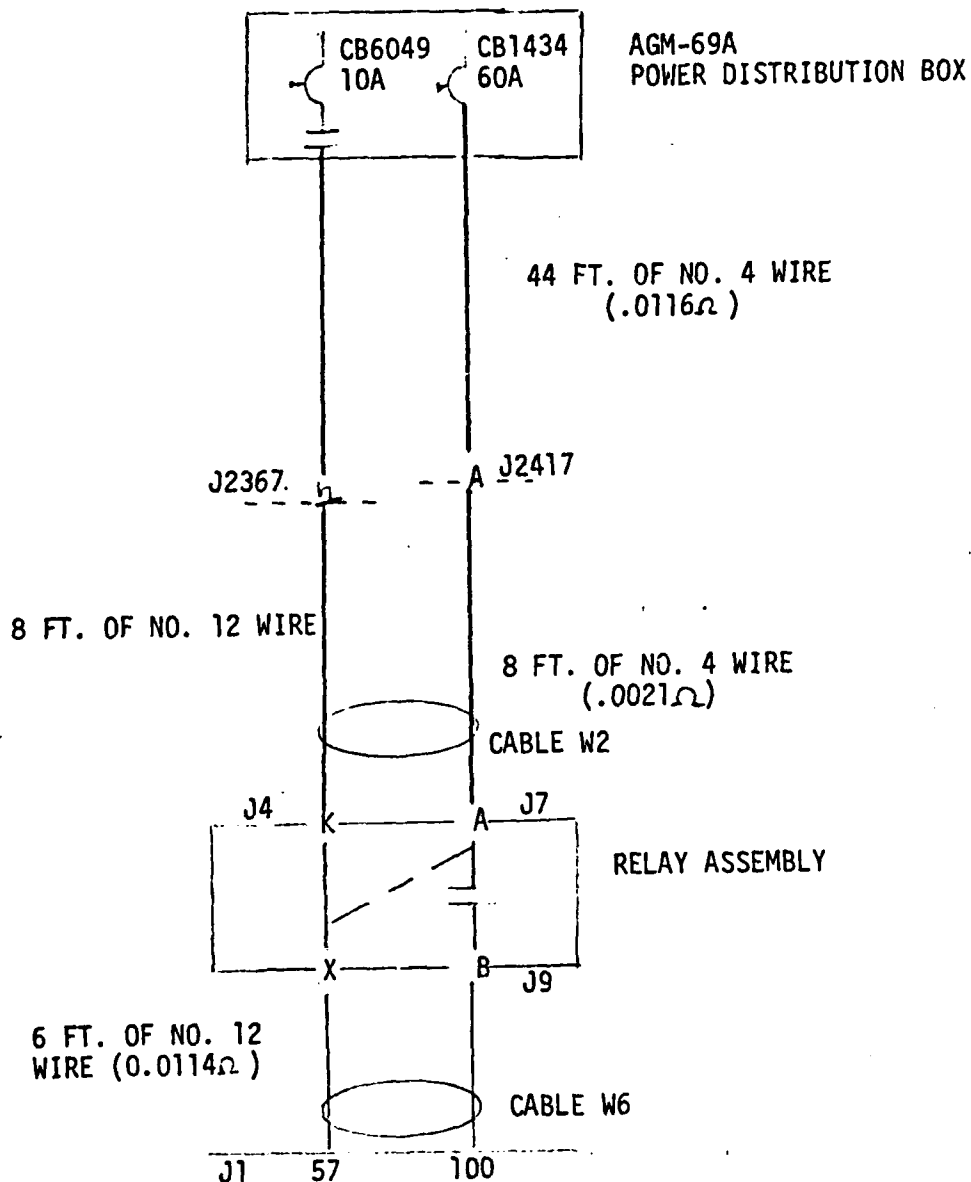
CB 1394 (10A) 118 VAC Missile Heater Power

Resistance of wire from CB to Connector

44 ft. of #12 wire = .0836 Ω

Maximum current available at 118 VAC = 1141.5A

4.1.7.5 (Continued)

c. Worst Case Path(2) Damage to Relay Assembly

Interface Pin 57

Total wire Resistance = 0.0251Ω

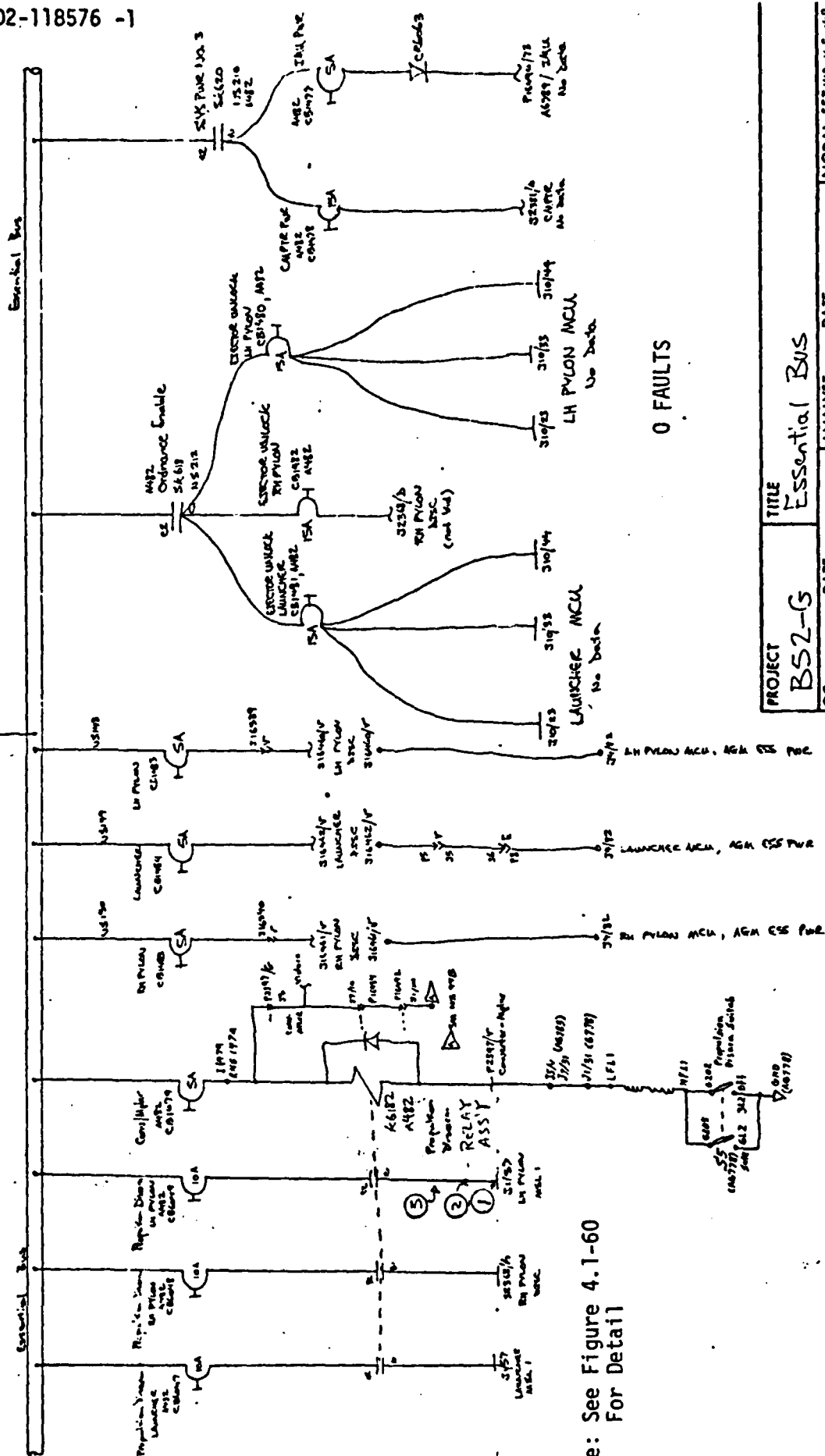
Voc = 118 VAC

$$I_{sc} = \frac{118}{.0251} = 1115.5A$$

Time - Minimum trip time shown on calibration curve is 1.5 seconds for 500 amps.
Therefore the time for 1115.5 amps would be less than 1.5 sec.

SNEAK CIRCUITS NETWORK TREE

POW FROM Voltage Regulator
A408/P2411/A



Note: See Figure 4.1-60
For Detail

0 FAULTS

PROJECT	TITLE	ANALYST	DATE	NODAL SET
B52-G	Essential Bus	TA 2000	9/9/75	147, 148, 149
OC JLC			9-11-75	150, 151, 152, 153, 222, 223

FIGURE 4.1-59. NETWORK TREE 153

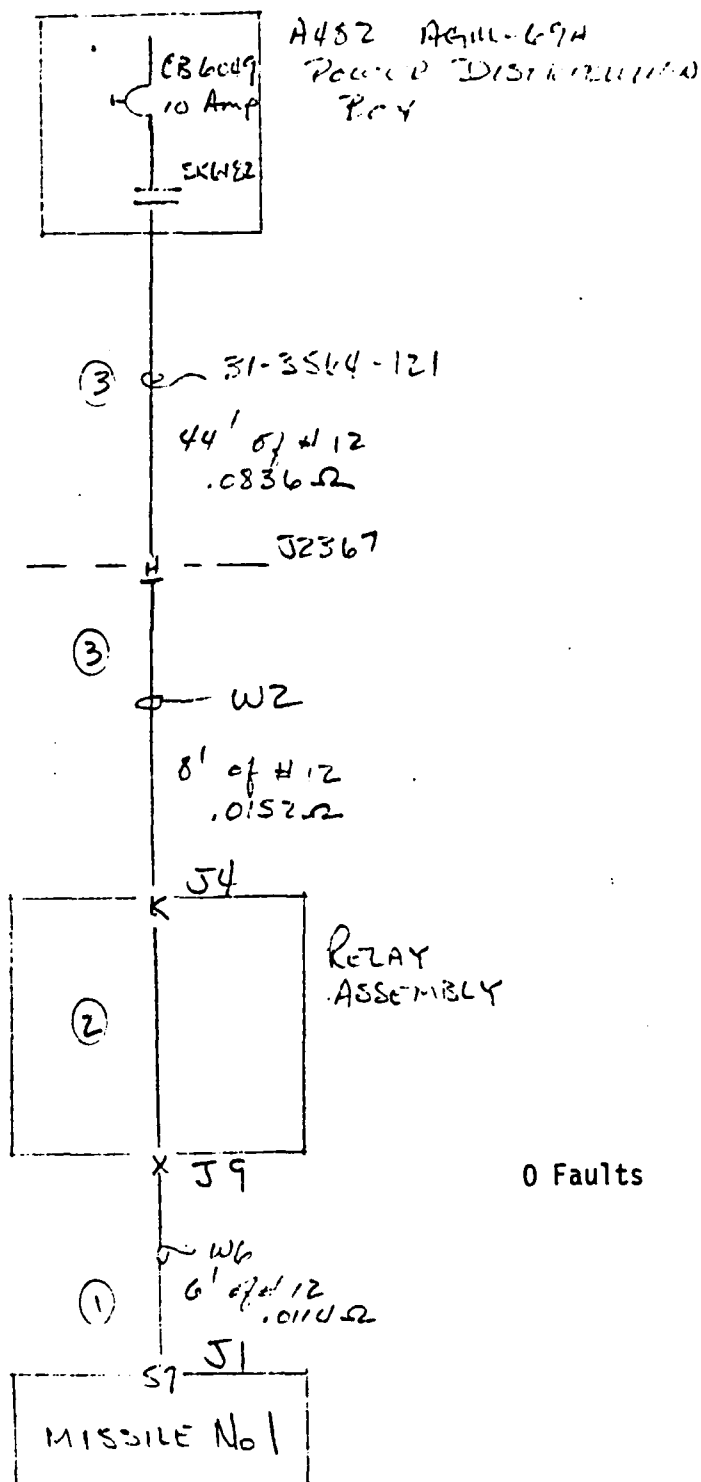
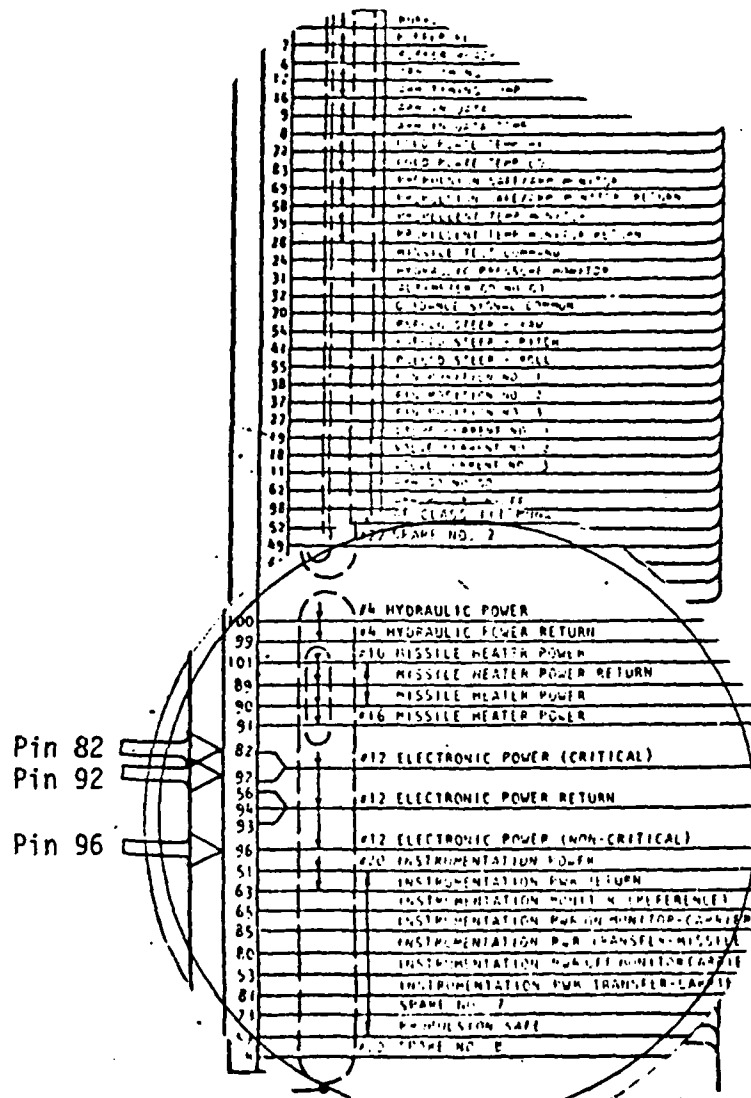


FIGURE 4.1-60. CABLE DRAWING

4.1.7.6 Circuit Analysis Package, AGM-69A Interface Pins 82, 92 & 96 of Connector J1, Missile 1 on the Left Pylon

These interfaces are shown in Figure 5-7 and T.O. 16W6-19-2, Change 3. The maximum current available to these pins in a normal environment is 0A for ground alert and 254A for airborne conditions. The worst case current at 28VDC in an abnormal (faulted) environment would be 1115.5A with the pins grounded.



Refer to Figure 2-40
of T.O. 1B-52G-2-39GA-1
For Circuit Details

4.1.7.6 (Continued)

a. Normal Power and Load Analysis

From examination of Figure 4.1-61, Network Tree 175, and Figure 4.1-62, open circuit voltage and short circuit current are:

Ground alert: $V_{OC} = 0 \text{ VDC}$
 (Missile OFF) $I_{SC} = 0 \text{ A}$

Airborne: $V_{OC} = 28 \text{ VDC}$
 (Missile ON) $I_{SC} = 232 \text{ A}$

b. Fault Analysis

The following postulated faults have been analyzed using Network Tree 175 and Cable Diagram, 4.1-61 and 4.1-62.

① Damage to Connector J1 or Cable W6

Pins 82, 92 and 96 may be shorted to 118VAC through CB1394 if missile heater power is on.

CB1394 (10A) 118VAC Missile Heater Power

Resistance of wire from CB to missile

58 ft of #12 wire = .1102

Resistance of relay contacts = .01

Maximum current available at 118VAC = 981.7A

② Damage to Relay Assembly or Cable W2

The wires to the subject pins may be shorted to 28VDC through CB1450, CB1444 and CB1434. The wires may also be shorted to 118VAC through CB1401 and CB1394.

4.1.7.6b (Continued)

CB1450 (7.5A) 28VDC Bypass Valve Power

Resistance of wire from CB to Relay Assembly

52 ft of #12 wire = .0988

Maximum current available at 28VDC = 283A

CB1444 (15A) 28VDC Missile Electronic Power

Resistance of wire from CB to Relay Assembly

52 ft of #12 wire = .0988

Maximum current available at 28VDC = 283A

CB1434 (60A) 28VDC Missile Hydraulic Power

Resistance of wire from CB to Relay Assembly

52 ft of #4 wire = .0137

Maximum current available at 28VDC = 2043A

CB1401(5A) 118VAC AC Power

Resistance of wire from CB to Relay Assembly

52 ft of #12 wire = .0988

Maximum current available at 118VAC = 1194A

CB1394 (10A) 118VAC Missile Heater Power

Resistance of wire from CB to Relay Assembly

52 ft of #12 wire = .0988

Maximum current available at 118VAC = 1194A

③ Damage to Connector J2367 or Cable 31-3564-121

The wires to pins 82, 92, 96 may be shorted to 28VDC through CB1450 or to 118VAC through CB1401 or CB1394.

CB1450 (7.5A) 28VDC Bypass Valve Power

Resistance of wire from CB to Connector

44ft of #12 wire = .0836

Maximum current available at 28VDC = 334A

4.1.7.6b (Continued)

③ (Continued)

CB1401 (5A) 118VAC AC Power

Resistance of wire from CB to Connector

44 ft of #12 wire = .0836

Maximum current available at 118VAC = 114A .

CB1394 (10A) 118VAC Missile Heater Power

Resistance of wire from CB to Connector

44 ft of #12 wire = .0836

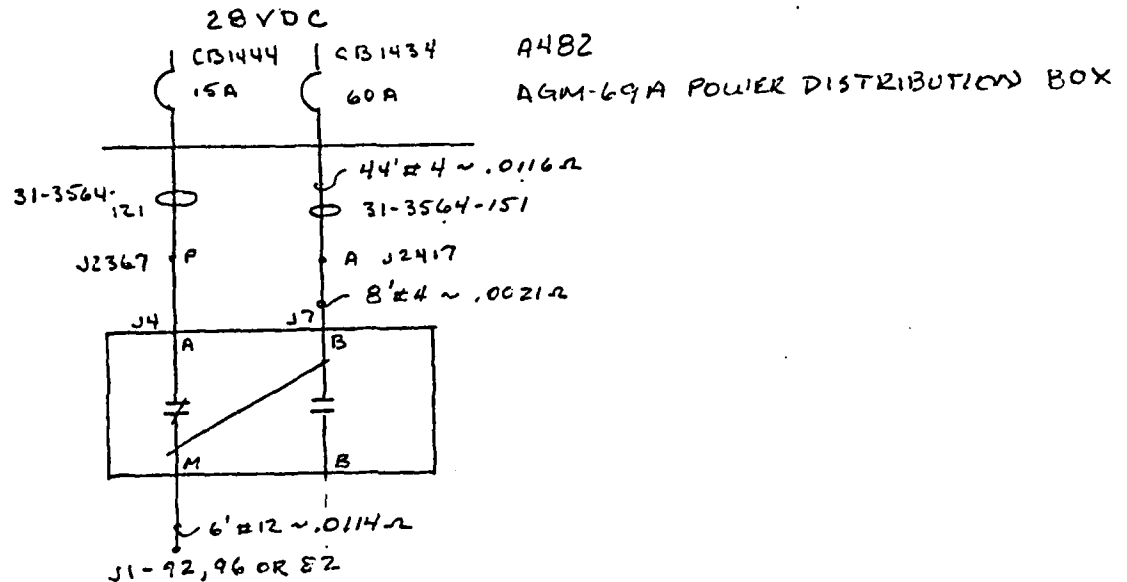
Maximum current available at 118VAC = 114A

NOTE. All circuit breakers are located in the AGM-69A Power Distribution Box.

4.1.7.6 (Continued)

c. Worst Case Path

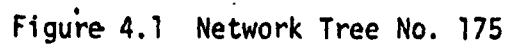
Reference path ② Damage to Relay Assembly



Pins 82, 92, 96

Total resistance = 0.0251Ω $V_{OC} = 28VDC$ $I_{SC} = 1115.5 A$

Time = Minimum trip time shown in calibration curve is 1.5 seconds
for 500 A. Trip time for 2413 A will be less than 1.5 seconds.



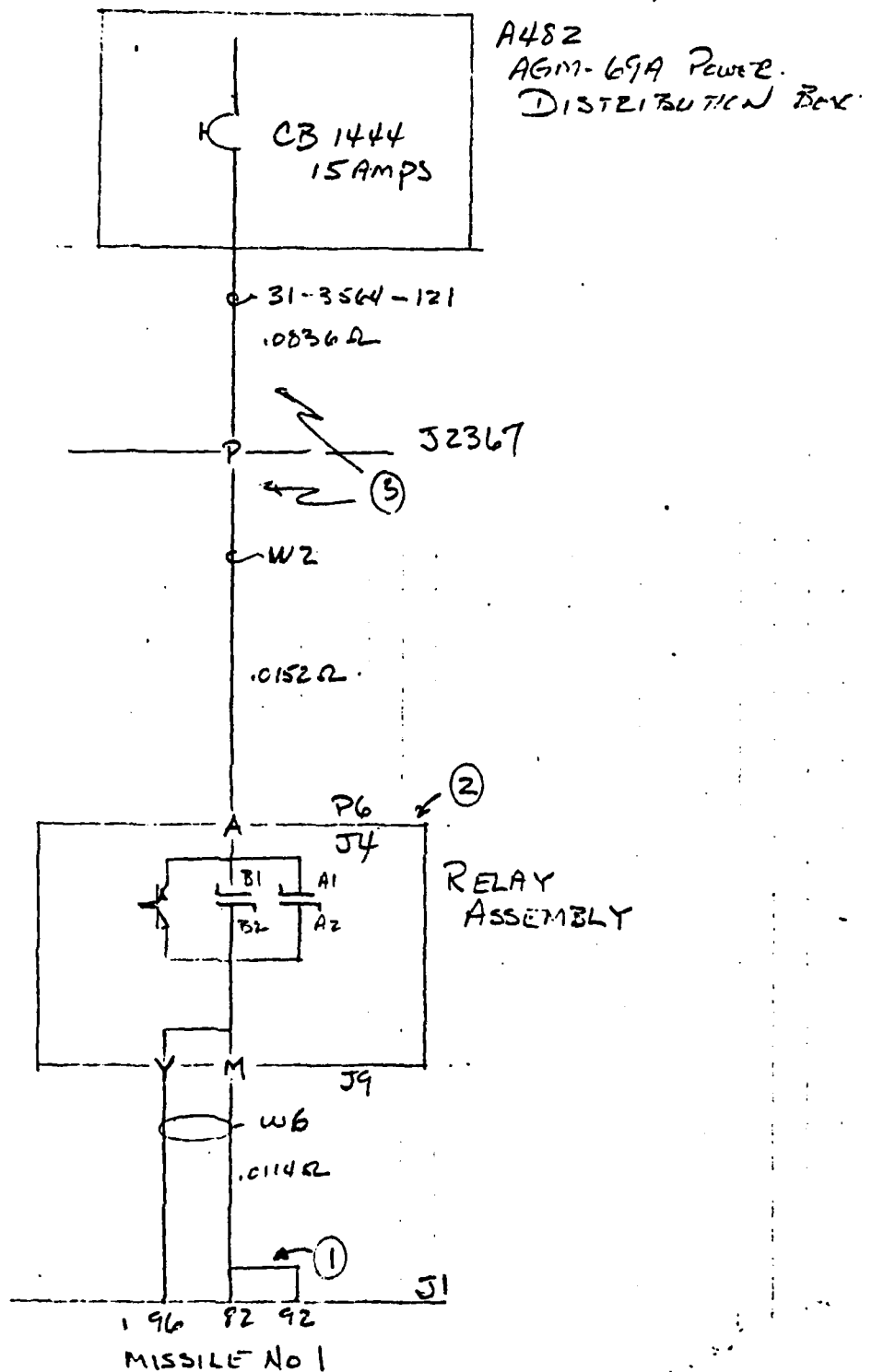


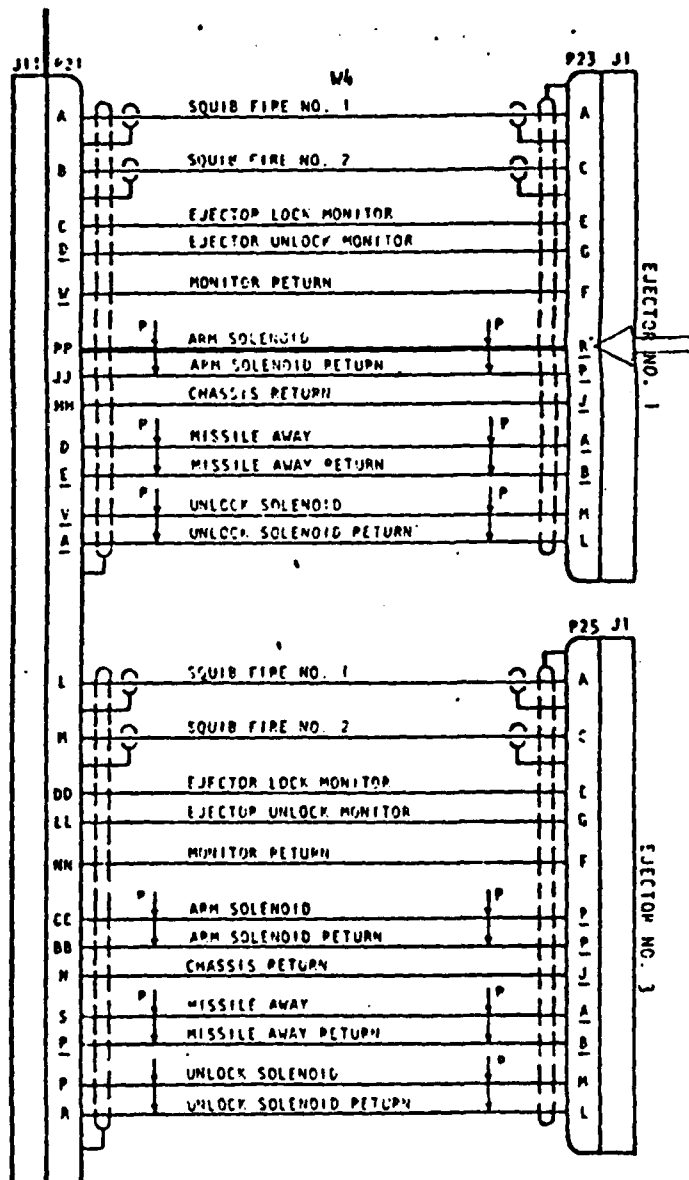
FIGURE 4.1-62. CABLE DRAWING
4-124

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4.1.7.7 Circuit Analysis Package, AGM-69A Ejector Interface pin r, Arm Solenoid, Launcher and Pylon

These interfaces are shown in Figure 5-7 of T.O. 11L1-2-8-2, Change 12. Maximum current available to this pin in a normal environment is 0 amps. Worst case current at 27VDC in an abnormal (faulted) environment for the launcher ejector pin is 54 amps and for the pylon ejector is 37 amps with the pins grounded.



Refer to Figure 2-39 of
T.O. 1B-52G-39GA-1 for
Circuit Details.

Pin r

4.1.7.7 (Continued)

a. Normal Power and Load Analysis

From an examination of Figure 4.1-64, Cable Drawing, the open circuit voltage is 0V and the short circuit current is 0A. The electronic switch is normally off prior to launch.

b. Fault Analysis

The following faults were analyzed using Figure 4.1-64.

① Cable W11 Damaged or ② W4 Damaged

Wire to pin r shorted to missile away monitor from pin a. Pin a is a ground path for the missile away monitor lamp located in the Weapon Release Indicator Panel, and a relay in the Switch Unit. Current available to the interface cannot be calculated since value of current limiting resistor and other components in the circuit is unknown (schematics in the MCU are not available).

Guidance and Logic Signals

Current output from these sources is device limited and is less than expected from the above fault.

③ Launcher MCU Damaged

Wire to pin r shorted to 27VDC from CB1484, ± 22VDC from power supply in the switch unit or guidance and logic signals. CB1484 (5A) 27VDC Essential Power

Resistance of wire from CB to MCU

44 ft of #20 wire = .405 ohms

Maximum current available = 66 amps

Power Supply in Switch Unit

Current output is less than above listed fault. Current magnitude is unknown since specification is not available.

Guidance and Logic Signals

Current from these sources is device limited to less than other sources listed.

4.1.7.7b (Continued)

④ Pylon MCU Damaged

Wire to pin r shorted to 27VDC from CB1483, + 22VDC from power supply in Switch Unit or guidance and logic signals.
CB1485 (5A) 27VDC Essential Power

Resistance of wire from CB to MCU

50 ft of #20 wire .619 ohms

Maximum current available = 43.5 amps

Power supply in switch unit

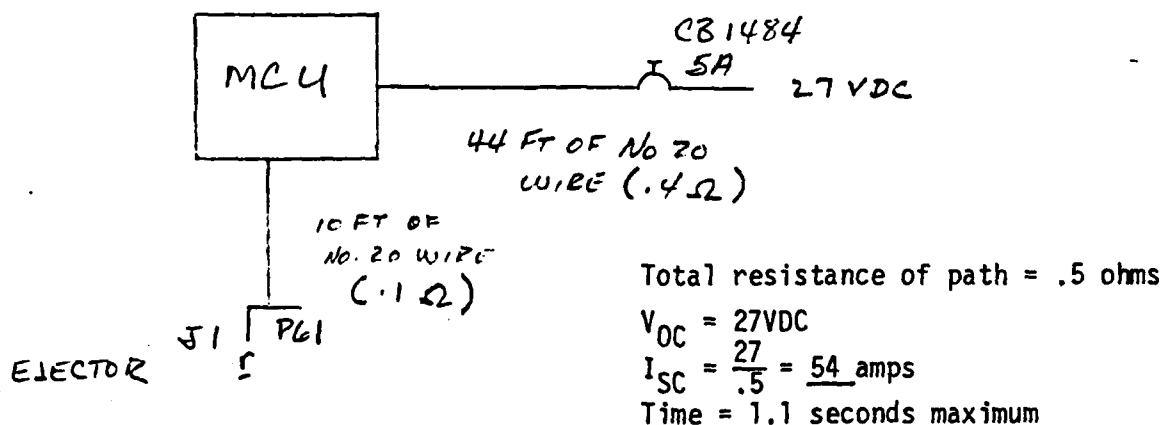
Current output is less than other listed fault circuit
magnitude is unknown since specification is not available.

Guidance and Logic Signals

Current output from these sources is device limited to less
than other sources listed.

c. Fault Analysis

For launch ejector reference path ② Launcher MCU Damaged.

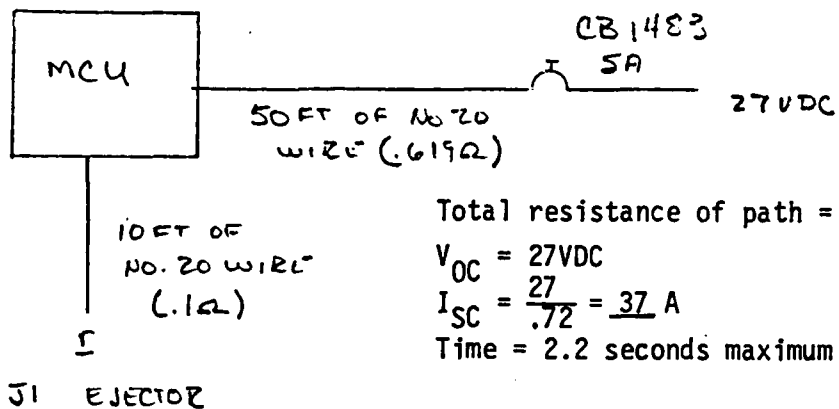


NOTE: All circuit breakers are located in the
AGM-69A Power Distribution Box.

4.1.7.7 (Continued)

c. (Continued)

For pylon ejector reference path ④ Pylon MCU Damaged.



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BOEING AEROSPACE CO HOUSTON TX

F/G 15/6

ELECTRICAL ANALYSIS OF B-52/FB-111 AMAC AND RELEASE CIRCUITRY U--ETC(U)

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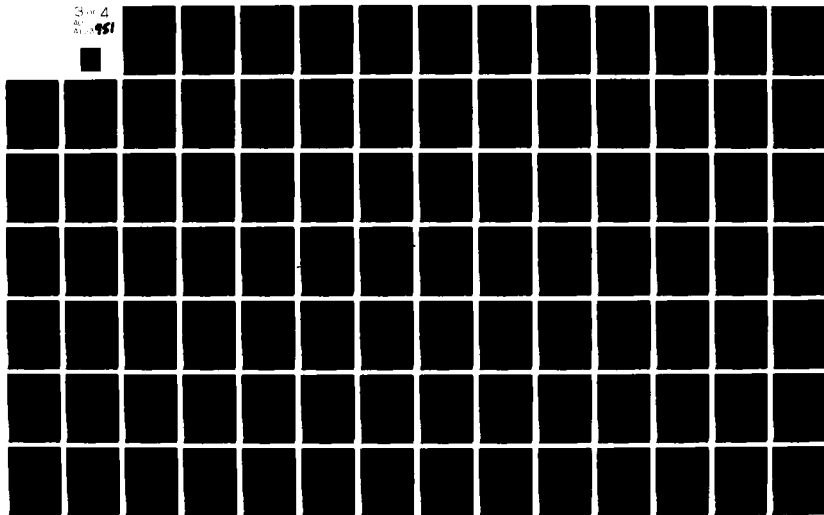
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NL

3 of 4

951



4.1.7.7 (Continued)

Launcher Ejector shown

For pylon ejector:

J11 is J11

P59 is P21

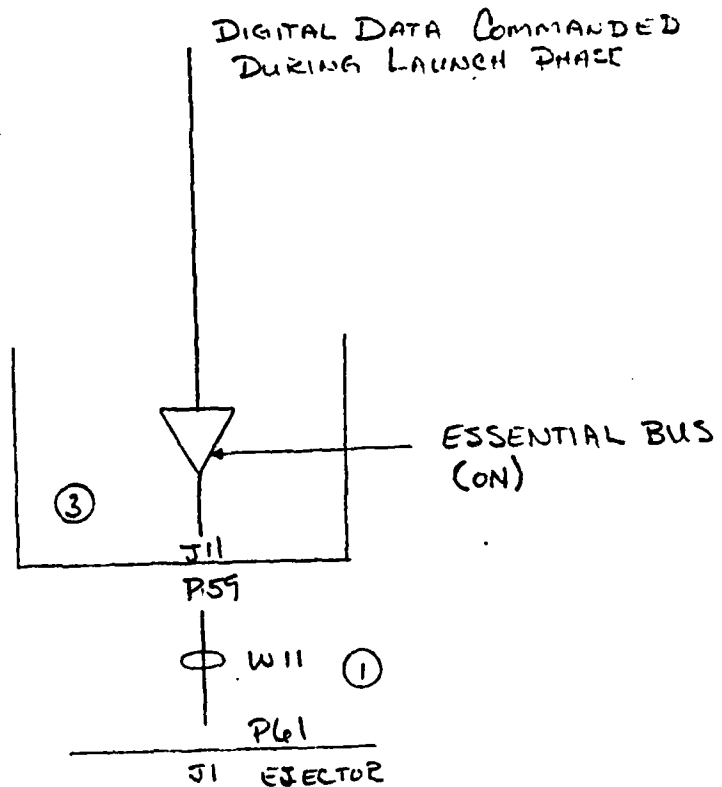
W11 is W4

P61 is P23

J1 is J1

① is ②

③ is ④



0 Faults

FIGURE 4.1-64 CABLE DIAGRAM

4.1.7.8 Circuit Analysis Package, AGM-69A Interface pins 20 and 60, Connector J1, Missile #1 On the Launcher and Left Pylon

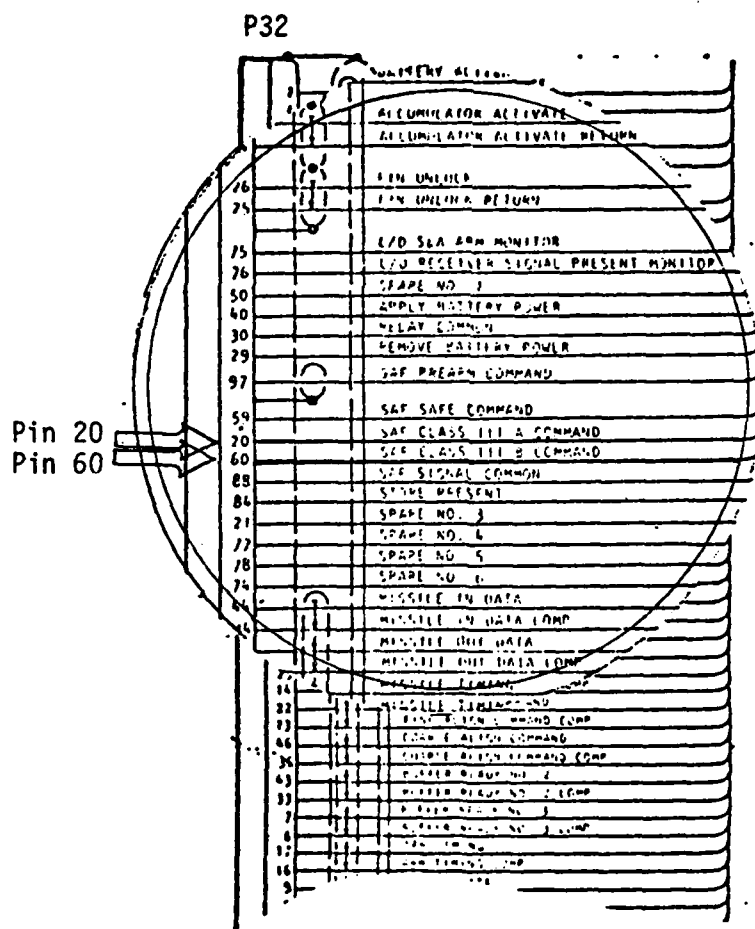
This interface is shown in Figure 5-37 and T.O. 11L1-2-8-2, (Change 12).

Maximum current available to these pins in a normal environment is 0A.

Worst case current at 118VAC in an abnormal (faulted) environment assuming the pins grounded would be:

Launcher missile pins - 900A

Pylon missile pins - 983A



Refer to Figure 2-38 of
T.O. 1B-52G-39GA-1 For
Circuit Details

4.1.7.8 (Continued)

a. Normal Power and Load Analysis

From an examination of Figure 4.1-65, Cable Drawing, the open circuit voltage is 0V and the short circuit current is 0A. The electronic switches are normally off prior to the launch phase.

b. Fault Analysis

The following faults were analyzed using Figure 4.1-65.

For Launcher Mounted Missile

① Cable W1 Damaged

Wires to pins 20 and 60 shorted to 28VDC from CB1411, 118VAC from CB1395 if heater power is on, or to guidance and logic signals.

CB1411 (15A) 28VDC Missile Electronic Power

Resistance of wire from CB to missile interface

55 ft of #10 wire = .06 Ω

switch = .01 Ω

Maximum current available = 400A

CB1395 (15A) 118VAC Missile Heater Power

Resistance of wire from CB to missile interface

47 ft of #12 wire = .095 Ω

6 ft of #16 wire = .027 Ω

Maximum current available = 940A

Guidance and Logic Signals

Currently output of these sources is device limited to less than other sources listed.

4.1.7.8b (Continued)

② Launcher MCU Damaged

Wires to pins 20 and 60 shorted to 27VDC from CB1484, $\pm$ 22VDC from Power Supply in the Switch Unit, or guidance and logic signals.

CB1484 (5A) 27VDC Essential Power

Resistance of wire from CB to MCU

44 ft of #20 wire = .405 Ω

Maximum current available = 66A

Power Supply in Switch Unit

Current output is less than the other listed faults. Current magnitude unknown, specifications not available.

Guidance and Logic Signals

Current output from these sources is limited to less than other sources listed.

For Pylon Mounted Missile

① Cable W6 Damaged

Wires to pins 20 and 60 shorted to 28VDC from CB1444, 118VAC from CB1394 if heater power is on, or guidance and logic signals.

CB1444 (15A) 28VDC Missile Electronic Power

Resistance of wire from CB to missile interface

58 ft of #20 wire = .11 Ω

switch = .01 Ω

Maximum current available = 233A

CB1394 (10A) 118VAC Heater Power

Resistance of wire from CB to missile interface

58 ft of #12 wire = .11 Ω

switch = .01 Ω

Maximum current available = 983A

4.1.7.8b (Continued)

Guidance and Logic Signals

Current output from these sources is limited to less than other sources listed.

② Left Pylon MCU Damaged

Wires to pins 20 and 60 shorted to 27VDC from CB1483, $\pm$ 22VDC from power supply in switch unit, or guidance and logic signals.

CB1483 (5A) 27VDC Essential Power

Resistance of wire from CB to MCU

50 ft of #20 wire = .619 Ω

Maximum current available = 43.5A

Power Supply in Switch Unit

Current output less than other listed fault. Current magnitude unknown, specifications not available.

Guidance and Logic Signals

Current output from these sources is limited to less than other sources listed.

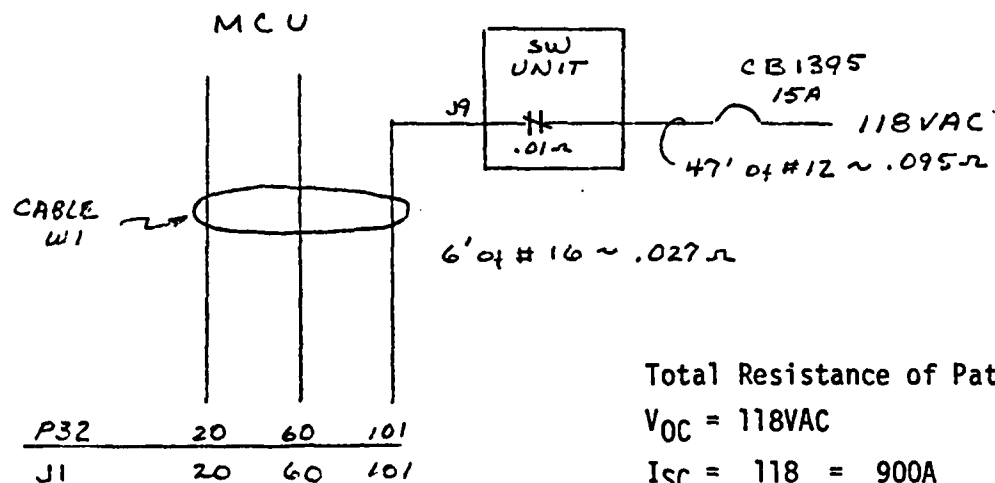
Note: All circuit breakers are located in the AGM-69A Power Distribution Box

4.1.7.8 (Continued)

c. Worst Case Paths

For Launcher Mounted Missile

Reference Path ① Cable W1 Damaged

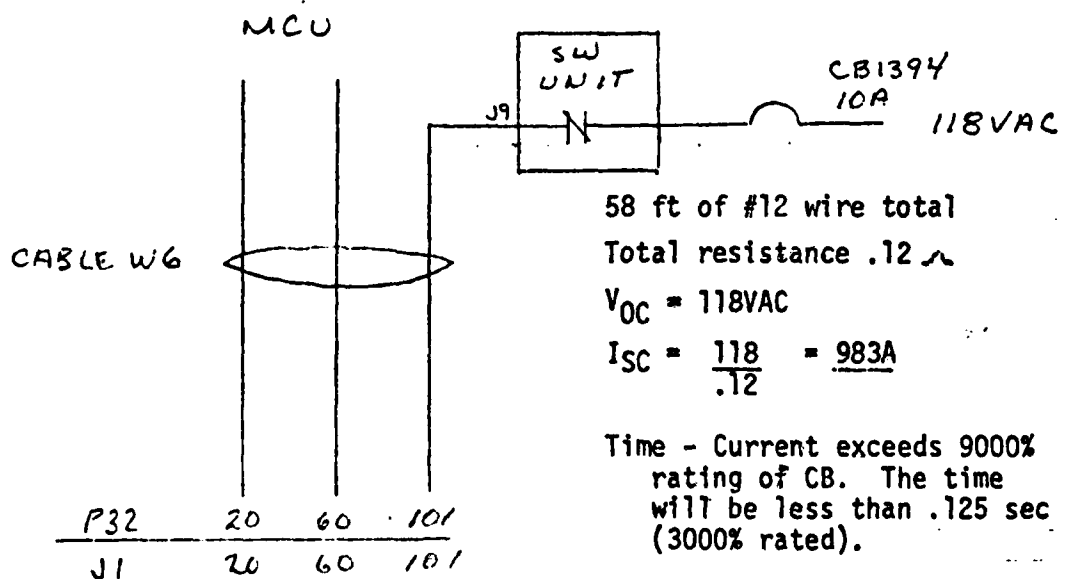
Total Resistance of Path .122 Ω $V_{OC} = 118VAC$

$$I_{SC} = \frac{118}{.122} = \underline{900A}$$

Time - Current rating exceeds 6000% rating of CB. The time will be less than .13 sec (300% rated).

For Pylon Mounted Missile

Reference path ① Cable W6 Damaged



58 ft of #12 wire total

Total resistance .12 Ω $V_{OC} = 118VAC$

$$I_{SC} = \frac{118}{.12} = \underline{983A}$$

Time - Current exceeds 9000% rating of CB. The time will be less than .125 sec (3000% rated).

4.1.7.8c (Continued)

NOTE: CABLING AND CONNECTORS ARE SHOWN FOR MISSILE #1 MOUNTED IN THE LAUNCHER. FOR MISSILE MOUNTED ON THE LEFT PYLON:

W1 IS W6
P24 IS P15
P32 IS P32
J1 IS J1

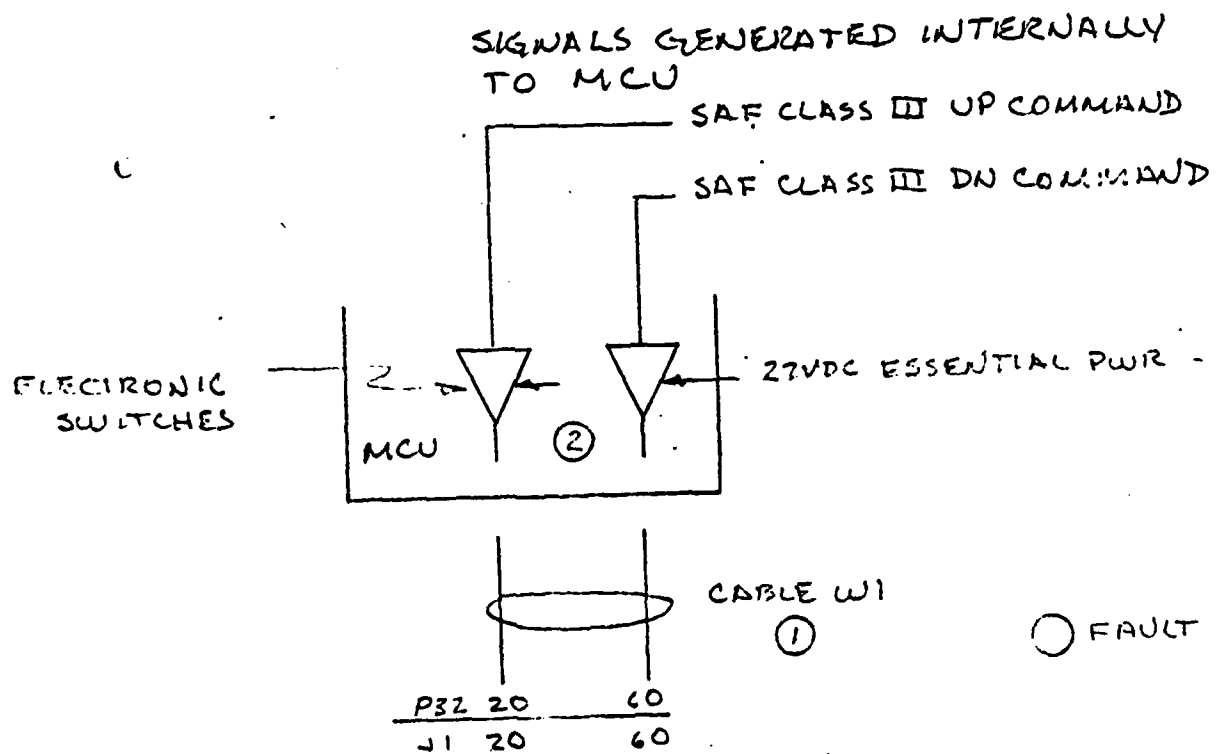


FIGURE 4.1-65. CABLE DRAWING

4.2 POWER AND LOAD ANALYSIS - FB-111A

This section describes the power and load analyses of monitor and control circuits leading to gravity weapons loaded on weapon station 3 pivot pylon and in RH weapons bay. These two weapons stations were picked as typical for all nuclear weapons stations and represent both the nearest and farthest station from the power sources. Potential worst case currents at weapon stations 4 and 5 would be slightly higher (approximately 12%) than those calculated for weapon station 3 due to differences in wire length. Figure 4.2-A is a simplified schematic diagram of the circuits to the Aircraft Monitor and Control - station program unit (AMAC SPU) interface connector. Numbers opposite the interface pins refer to circuit analysis packages in section 4.2.6 herein. Figure 4.2-B is an exploded view of an AMAC SPU, typical for all stations. Figure 4.2-C locates the pivot pylon weapon station AMAC SPU. Figure 4.2-D is a copy of Figure 1-8 from T.O. 1F-111(B)A-2-11-1 showing the circuitry to the pivot pylon weapons station. Note that the pins at the bottom of the diagram are the weapon interface pins. Figure 4.2-E locates the weapons bay AMAC SPU's. Figure 4.2-F shows weapons bay interface circuitry. Note that the pins at the bottom of the diagram interface with the weapon. The main difference between the -3 pivot pylon interface and -R right hand weapons bay interface is the presence of interconnect pins V and W at the pylon. See Appendix A for a list of all technical data utilized for the FB-111A-Power and Load Analysis.

4.2.1 SUMMARY

Power and load analyses of network trees generated by sneak circuit analysis are documented in section 4.2.6 below. Table 4.2-1A, sheets 1 and 2, provide a summary of the results.

4.2.2 CONDITIONS

The following conditions and exclusions are applicable to the FB-111A Analysis.

TABLE 4.2-1A Power and Load Analysis Results - FB-111/Station 3
(Sheet 1 of 2)

WEAPON INTERFACE		ENVIRONMENT ANALYSIS RESULTS									
DESIGNATOR		FUNCTION			NORMAL			ABNORMAL - WORST CASE			ANALYSIS PACKAGE
J479013-3 WPN STATION 3		V	I	t	V	I	t	V	I	t	Section 4.2.6
Pin A	SAFE INPUT	28V	608A	.6s	28V	608A	.6s	28V	608A	.6s	4.2.6.2
B	(NONE)							115VAC	1983A	.6s	
C	SAFE INDICATION	28V	48mA		28V	608A	.6s/-*	28V	608A	.6s/-*	4.2.6.5
D	(NONE)							115VAC	198mA		
E	GROUNDING	0	-								
F	GROUNDING	0	-								
G	WPN PRESENT (GROUND)	28V	48mA		28V	608A	.6s/-*	28V	608A	.6s/-*	4.2.6.5
H	ARM INPUT	0	0		115VAC	198mA		28V	608A	.6s	4.2.6.2
J	ARM INPUT	0	0		28V	608A	.6s	28V	608A	.6s	4.2.6.2
K	(NONE)										
L	(UNUSED)	0	0		28V	608A	.6s/.6s	28V	608A	.6s/.6s	4.2.6.3
M	(NONE)				115VAC	451A					
N	(UNUSED)	0	0		28V	608A	.6s/.6s	28V	608A	.6s/.6s	4.2.6.3
P	PAL MONITOR	28V	48mA		115VAC	451A	.6s/.6s	28V	608A	.6s/.6s	4.2.6.1
R	ARM INDICATION	28V	48mA		115VAC	451A	.6s/-*	28V	608A	.6s/-*	4.2.6.5
S	SWITCHED TO GROUND	0	0		115VAC	198mA	.6s	28V	608A	.6s	4.2.6.6
T	(NONE)										
U	(NONE)										
V	PYLON CONTINUITY	0	0		28V	608A	.6s	28V	608A	.6s	4.2.6.6
W	PYLON CONTINUITY	0	0		28V	608A	.6s	28V	608A	.6s	4.2.6.6
X	WPN DROP CONFIG. RETARD	0	0		28V	608A	.6s	28V	608A	.6s	4.2.6.2
Y	(FUTURE CAPABILITY)	0	0		28V	608A	.6s	28V	608A	.6s	4.2.6.2
Z	BURST OPTION-AIR	0	0		28V	608A	.6s	28V	608A	.6s	4.2.6.2
a	(SRAM ONLY)	0	0		28V	608A	.6s	28V	608A	.6s	4.2.6.3
b	SAFE PROVISION	28V	48mA		28V	608A	.6s/-*	28V	608A	.6s/-*	4.2.6.4
c	(SRAM ONLY)				115VAC	198mA					
d	WPN DROP CONFIG. FREE	0	0		28V	608A	.6s	28V	608A	.6s	4.2.6.3
e	FALL	0	0		28V	608A	.6s	28V	608A	.6s	4.2.6.2
f	(FUTURE CAPABILITY)	0	0		28V	608A	.6s	28V	608A	.6s	4.2.6.2
	BURST OPTION-GND	0	0		28V	608A	.6s	28V	608A	.6s	4.2.6.2

*Indefinite

TABLE 4.2-1A Power and Load Analysis Results - FB-111/Station -R
Weapon Interface (Sheet 2 of 2)

WEAPON INTERFACE		ENVIRONMENT ANALYSIS RESULTS										ANALYSIS PACKAGE
		NORMAL			ABNORMAL - WORST CASE							
DESIGNATOR	FUNCTION	V	I	t	V	I	t	V	I	t		
J479013-R	RH WPNS BAY										Section 4.2.6	
P1n A	SAFE INPUT	28V	1333A	.6s	28V	1333A	.6s	28V	1333A	.6s	4.2.6.2	
B	(NONE)							115VAC	3286A	.6s		
C	SAFE INDICATION	28V	48mA	--	28V	1333A	.6s	28V	1333A	.6s	4.2.6.5	
D	(NONE)							115VAC	198mA	Indefinite		
E	GROUNDING											
F	GROUNDING											
G	WPN PRESENT (GND)	28V	48mA	--	28V	1333A	.6s	115VAC	198mA	Indefinite	4.2.6.5	
H	ARM INPUT	0	0	--	28V	1333A	.6s	28V	1333A	.6s	4.2.6.2	
J	ARM INPUT	0	0	--	28V	1333A	.6s	28V	1333A	.6s	4.2.6.2	
K	(NONE)											
L	(UNUSED)	0	0	--	28V	1333A	.6s	115VAC	215A	.6s	4.2.6.3	
M	(NONE)											
N	(UNUSED)	0	0	--	28V	1333A	.6s	115VAC	215A	.6s	4.2.6.3	
P	PAL MONITOR	28V	48mA	--	28V	1333A	.6s	28V	1333A	.6s	4.2.6.1	
R	ARM INDICATION	28V	48mA	--	28V	1333A	.6s	115VAC	198mA	Indefinite	4.2.6.5	
S	SWITCHED TO GND	0	0	--	28V	1333A	.6s	28V	1333A	.6s	4.2.6.6	
T	(NONE)											
U	(NONE)											
V	(UNUSED IN WPN BAY)											
W	(UNUSED IN WPN BAY)											
X	WPN DROP CONFIG. RET	0	0	--	28V	1333A	.6s	28V	1333A	.6s	4.2.6.2	
Y	(UNUSED IN WPN BAY)	0	0	--	28V	1333A	.6s	28V	1333A	.6s	4.2.6.2	
Z	(FUTURE CAPABILITY)	0	0	--	28V	1333A	.6s	28V	1333A	.6s	4.2.6.2	
a	BURST OPTION-AIR	0	0	--	28V	1333A	.6s	28V	1333A	.6s	4.2.6.3	
b	(SRAM ONLY)	28V	48mA	--	28V	1333A	.6s	115VAC	198mA	Indefinite	4.2.6.4	
	SAFE PROVISION											
c	(SRAM ONLY)	0	0	--	28V	1333A	.6s	28V	1333A	.6s	4.2.6.3	
d	WPN DROP CONFIG-FF	0	0	--	28V	1333A	.6s	28V	1333A	.6s	4.2.6.2	
e	(FUTURE CAPABILITY)	0	0	--	28V	1333A	.6s	28V	1333A	.6s	4.2.6.2	
f	BURST OPTION - GND	0	0	--	28V	1333A	.6s	28V	1333A	.6s	4.2.6.2	

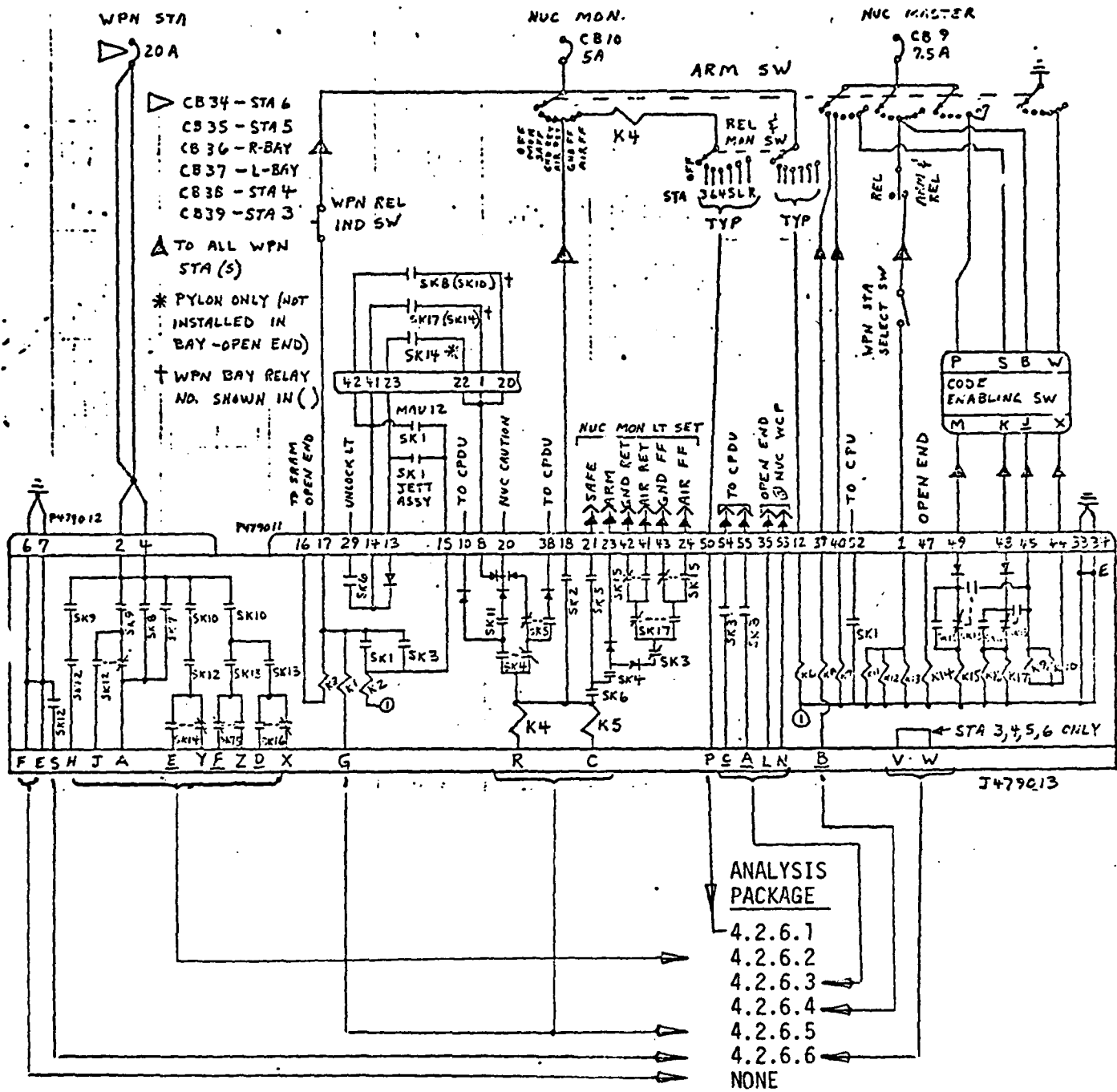


Figure 4.2-A Simplified Schematic - Circuits to AMAC SPU

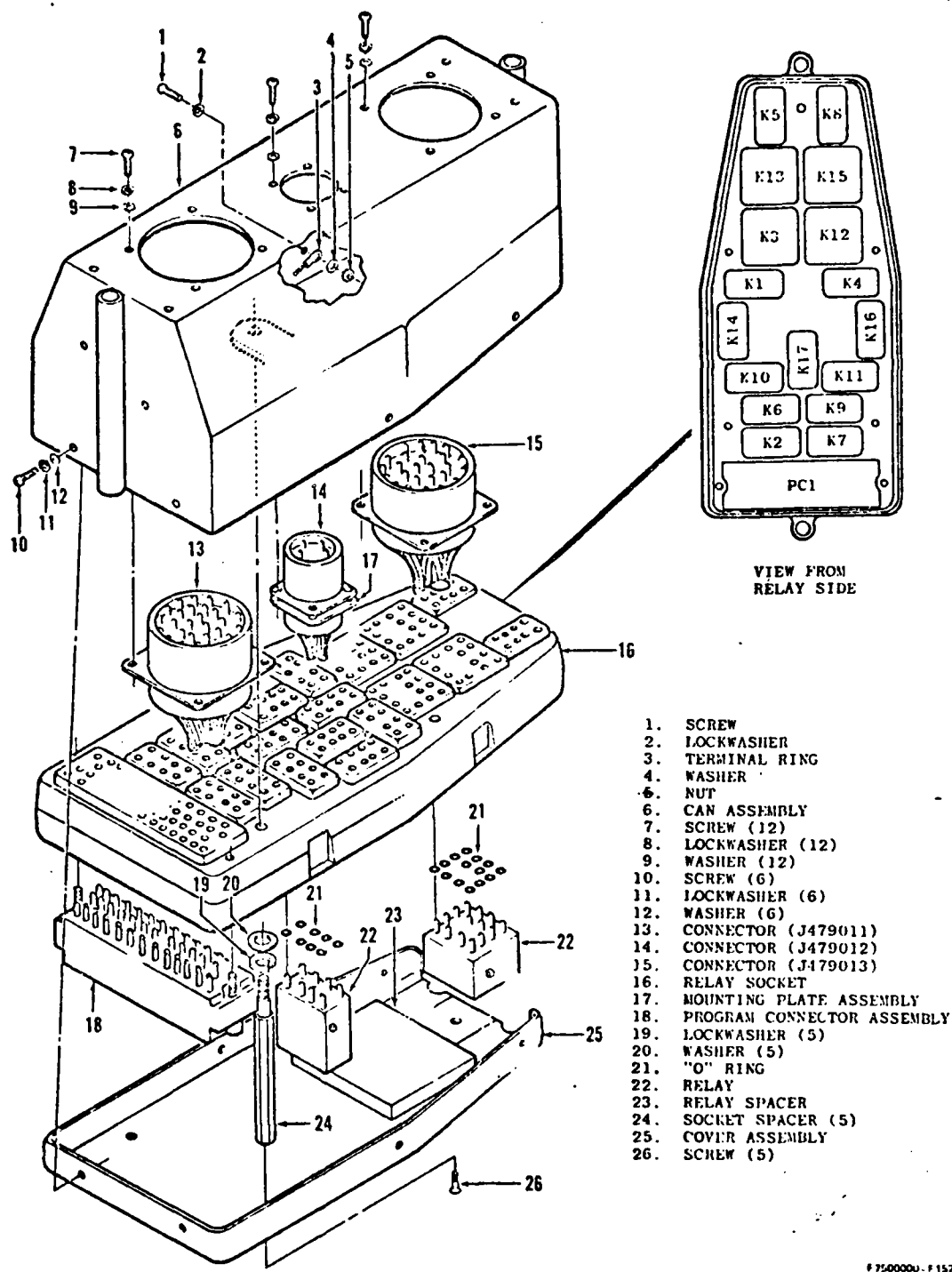
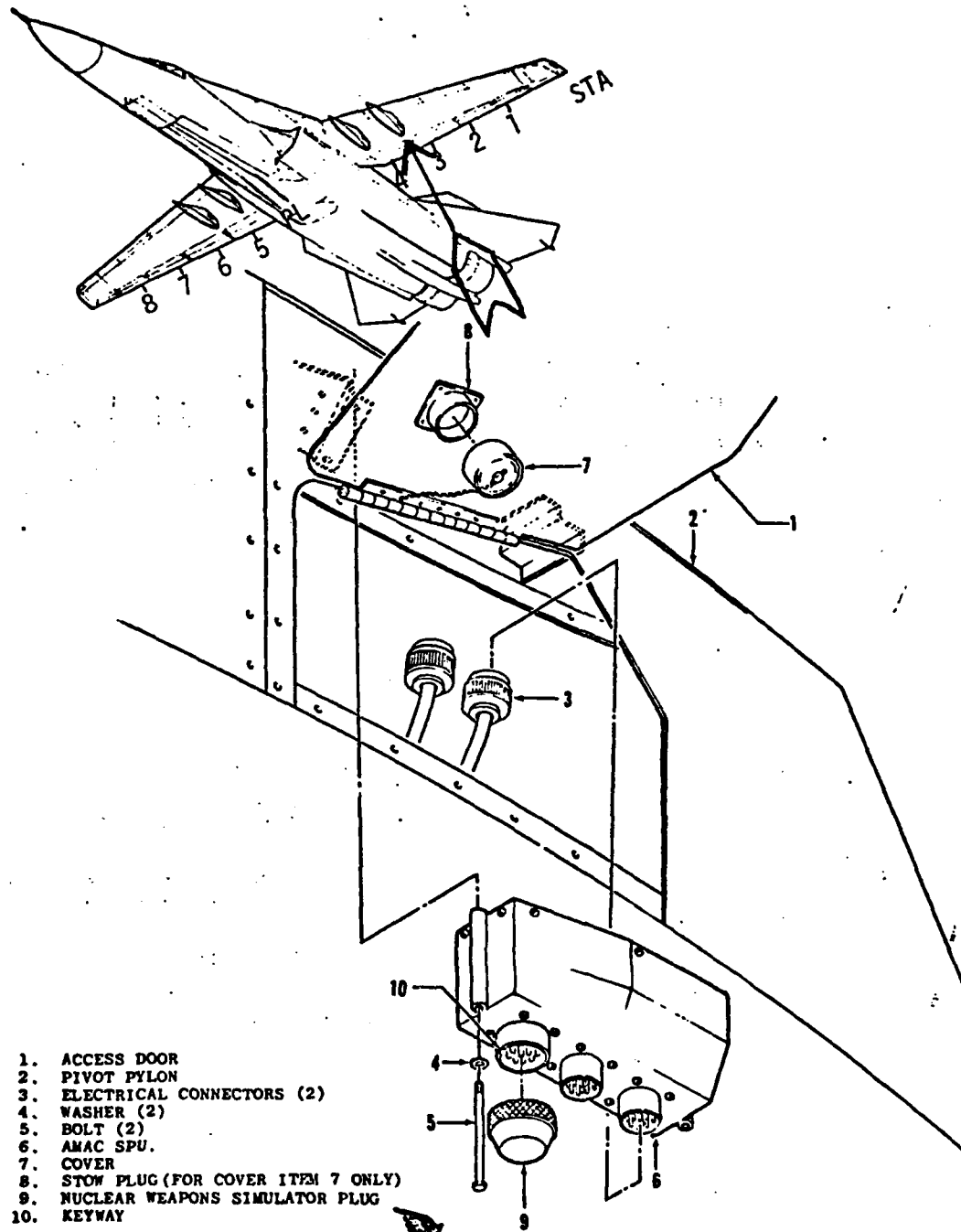


Figure 2-2. Station Program Unit Exploded View

Figure 4.2-B Typical AMAC SPU



P7900000-F0100

Figure 5-37. Pivot Pylon AMAC SPU and Nuclear Weapons Simulator Plug Removal and Installation

5-190

Figure 4.2-C Pivot Pylon AMAC SPU Location

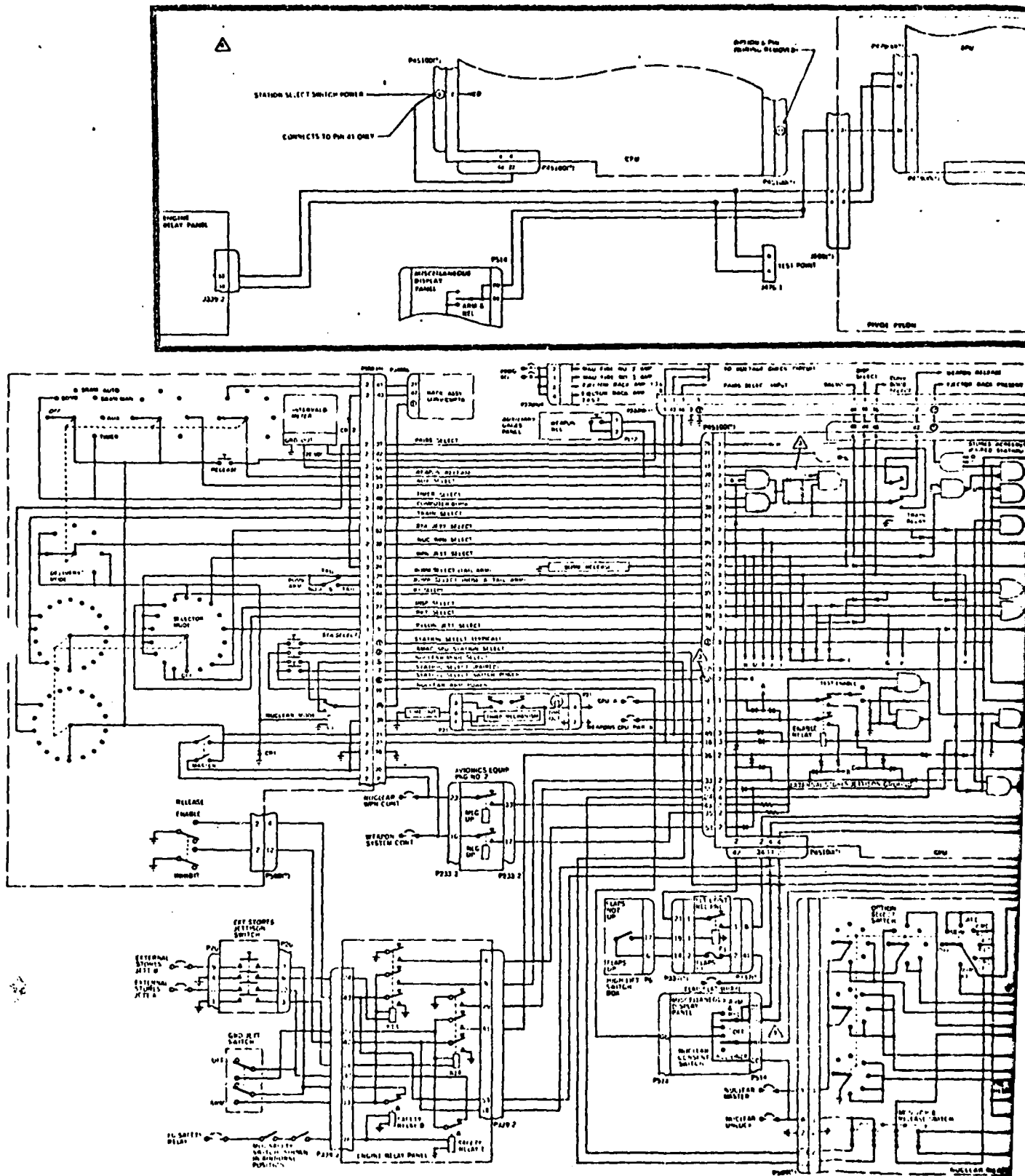
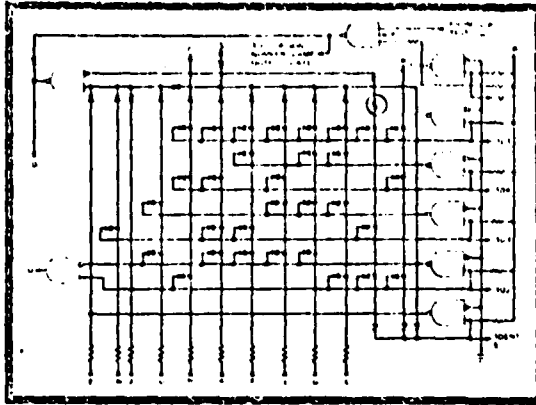


Figure 4.2-D Weapon Station 3 Circuitry
(Sheet 1 of 3)



DETAIL B

WIRE LIST		WIRE LIST		WIRE LIST		WIRE LIST	
NO.	FROM	NO.	TO	NO.	FROM	NO.	TO
1	...	1	...	1	...	1	...
2	...	2	...	2	...	2	...
3	...	3	...	3	...	3	...
4	...	4	...	4	...	4	...
5	...	5	...	5	...	5	...
6	...	6	...	6	...	6	...
7	...	7	...	7	...	7	...
8	...	8	...	8	...	8	...
9	...	9	...	9	...	9	...
10	...	10	...	10	...	10	...
11	...	11	...	11	...	11	...
12	...	12	...	12	...	12	...
13	...	13	...	13	...	13	...
14	...	14	...	14	...	14	...
15	...	15	...	15	...	15	...
16	...	16	...	16	...	16	...
17	...	17	...	17	...	17	...
18	...	18	...	18	...	18	...
19	...	19	...	19	...	19	...
20	...	20	...	20	...	20	...
21	...	21	...	21	...	21	...
22	...	22	...	22	...	22	...
23	...	23	...	23	...	23	...
24	...	24	...	24	...	24	...
25	...	25	...	25	...	25	...
26	...	26	...	26	...	26	...
27	...	27	...	27	...	27	...
28	...	28	...	28	...	28	...
29	...	29	...	29	...	29	...
30	...	30	...	30	...	30	...
31	...	31	...	31	...	31	...
32	...	32	...	32	...	32	...
33	...	33	...	33	...	33	...
34	...	34	...	34	...	34	...
35	...	35	...	35	...	35	...
36	...	36	...	36	...	36	...
37	...	37	...	37	...	37	...
38	...	38	...	38	...	38	...
39	...	39	...	39	...	39	...
40	...	40	...	40	...	40	...
41	...	41	...	41	...	41	...
42	...	42	...	42	...	42	...
43	...	43	...	43	...	43	...
44	...	44	...	44	...	44	...
45	...	45	...	45	...	45	...
46	...	46	...	46	...	46	...
47	...	47	...	47	...	47	...
48	...	48	...	48	...	48	...
49	...	49	...	49	...	49	...
50	...	50	...	50	...	50	...
51	...	51	...	51	...	51	...
52	...	52	...	52	...	52	...
53	...	53	...	53	...	53	...
54	...	54	...	54	...	54	...
55	...	55	...	55	...	55	...
56	...	56	...	56	...	56	...
57	...	57	...	57	...	57	...
58	...	58	...	58	...	58	...
59	...	59	...	59	...	59	...
60	...	60	...	60	...	60	...
61	...	61	...	61	...	61	...
62	...	62	...	62	...	62	...
63	...	63	...	63	...	63	...
64	...	64	...	64	...	64	...
65	...	65	...	65	...	65	...
66	...	66	...	66	...	66	...
67	...	67	...	67	...	67	...
68	...	68	...	68	...	68	...
69	...	69	...	69	...	69	...
70	...	70	...	70	...	70	...
71	...	71	...	71	...	71	...
72	...	72	...	72	...	72	...
73	...	73	...	73	...	73	...
74	...	74	...	74	...	74	...
75	...	75	...	75	...	75	...
76	...	76	...	76	...	76	...
77	...	77	...	77	...	77	...
78	...	78	...	78	...	78	...
79	...	79	...	79	...	79	...
80	...	80	...	80	...	80	...
81	...	81	...	81	...	81	...
82	...	82	...	82	...	82	...
83	...	83	...	83	...	83	...
84	...	84	...	84	...	84	...
85	...	85	...	85	...	85	...
86	...	86	...	86	...	86	...
87	...	87	...	87	...	87	...
88	...	88	...	88	...	88	...
89	...	89	...	89	...	89	...
90	...	90	...	90	...	90	...
91	...	91	...	91	...	91	...
92	...	92	...	92	...	92	...
93	...	93	...	93	...	93	...
94	...	94	...	94	...	94	...
95	...	95	...	95	...	95	...
96	...	96	...	96	...	96	...
97	...	97	...	97	...	97	...
98	...	98	...	98	...	98	...
99	...	99	...	99	...	99	...
100	...	100	...	100	...	100	...

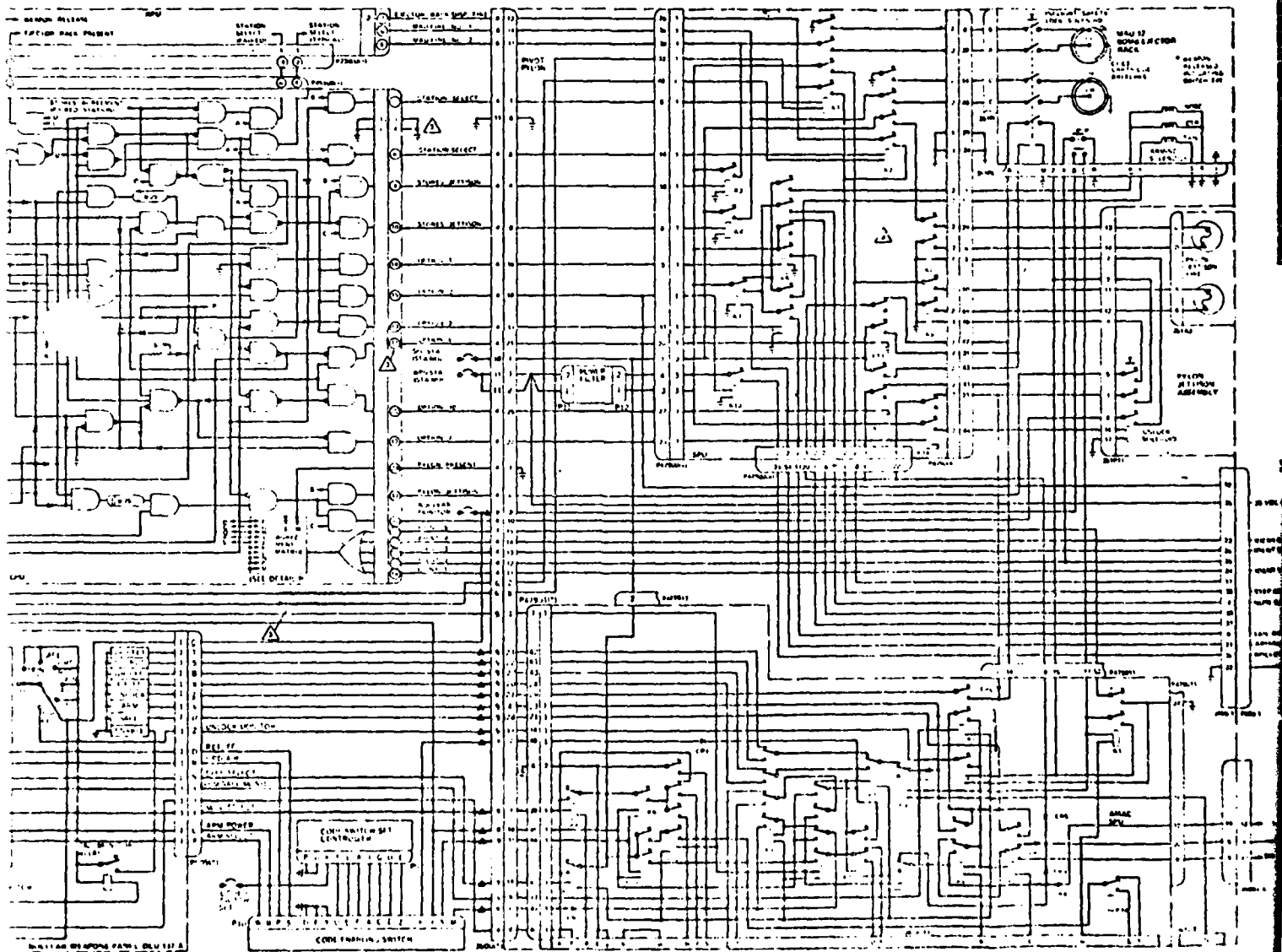
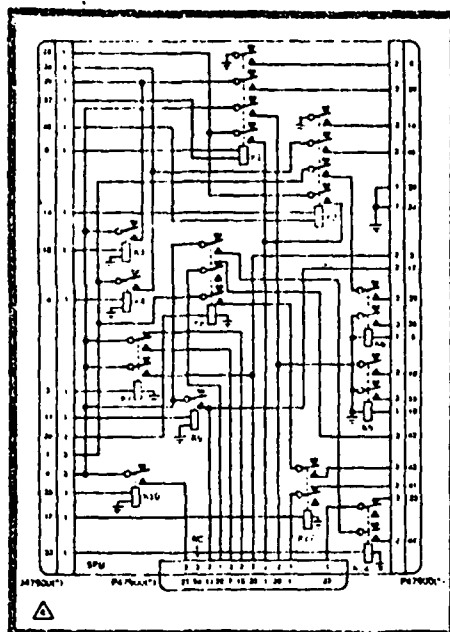
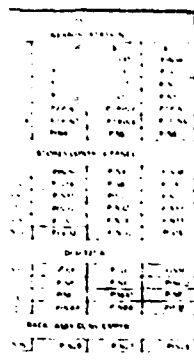


Figure 4.2-D Weapon Station 3 Circuitry
(Sheet 2 of 3)



100-442,746-100-442,746
100-442,746-100-442,746

1919

1. CAPTION: IT TIES IN THE INFORMATION FROM THE
SOURCE AND THE INFORMATION FROM THE PERSONNEL FILES
2. FOR CURRENT PERSONNEL OPERATIONS SEE PARAGRAPH 5.1
3. PRIOR TO 10 IF 111.8.4.050
4. AFTER 10 IF 111.8.4.050

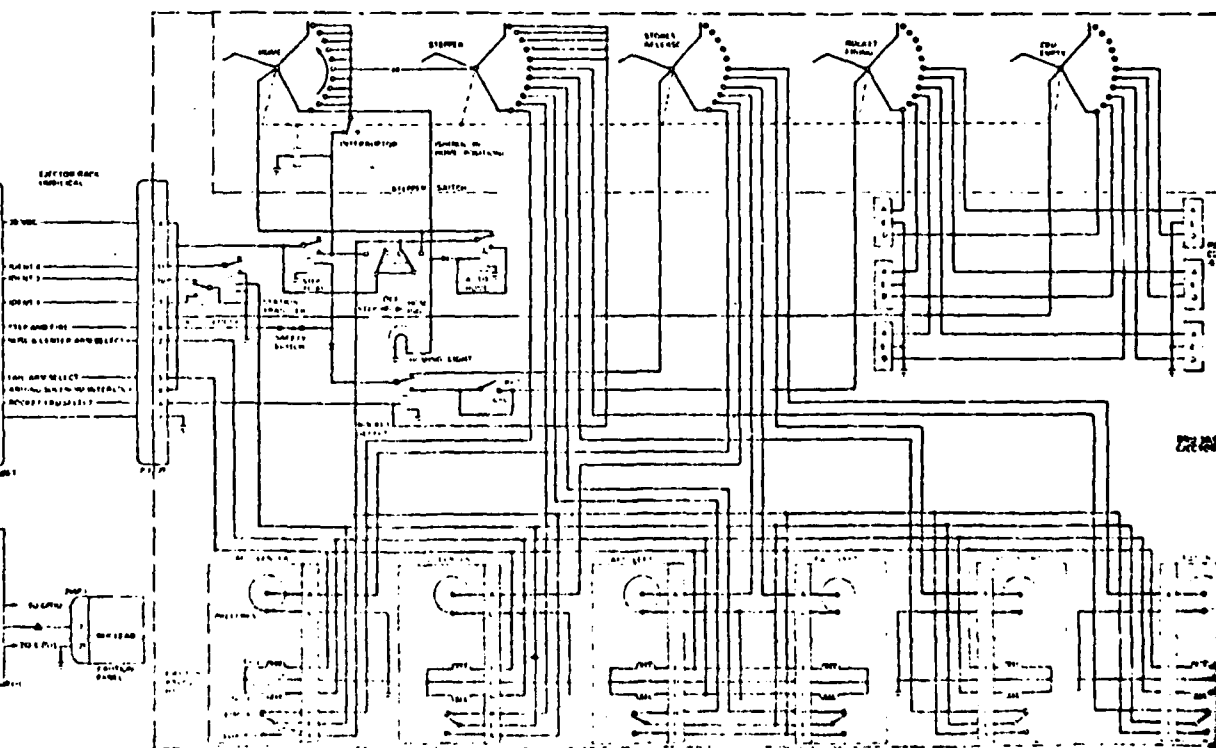
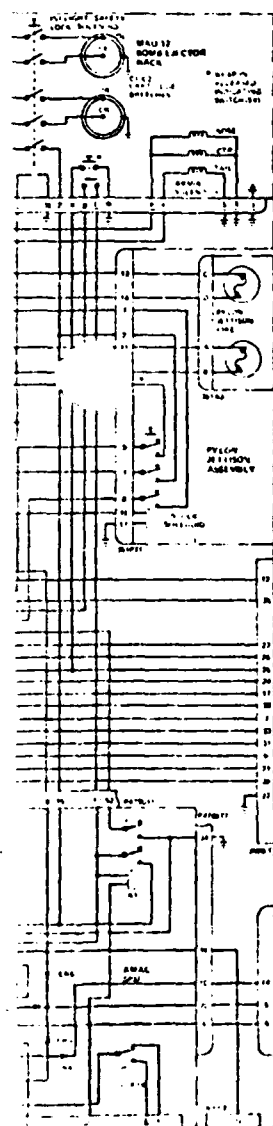
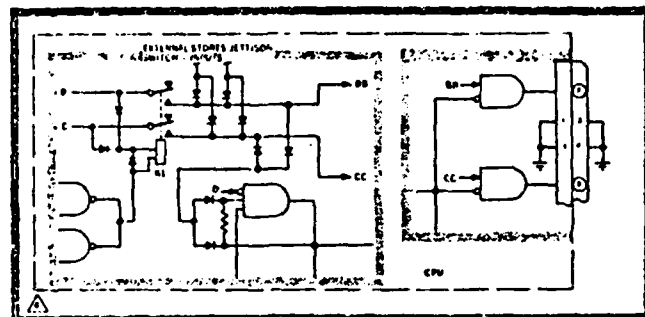
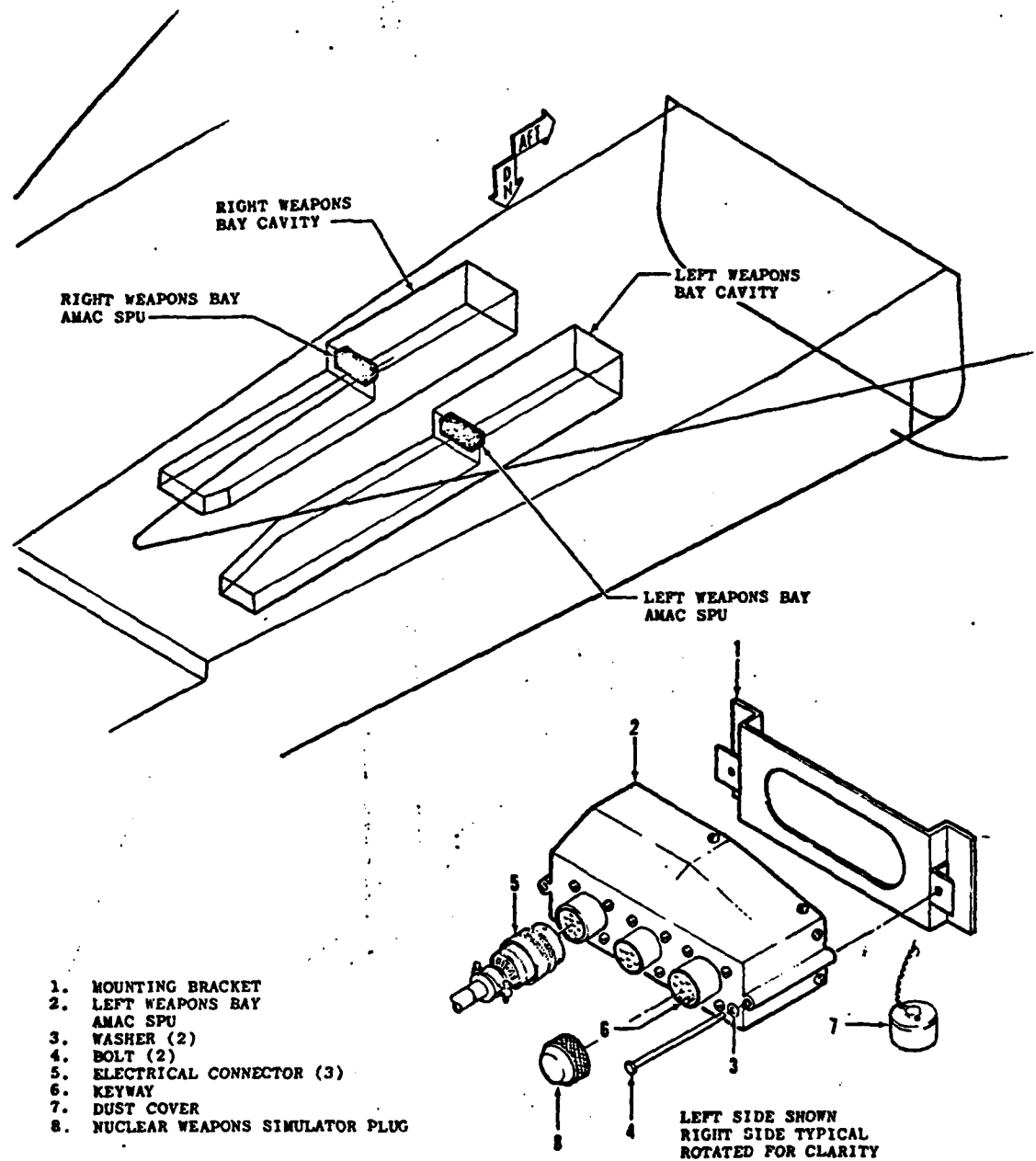


Figure 1-8. Stores Management System Pivot Pylon Integrated Schematic Diagram



P7800000-P008C

Figure 5-36. Weapons Bay AMAC SPU and Nuclear Weapons Simulator Plug Removal and Installation

5-189

Figure 4.2-E Weapons Bay AMAC SPU Location

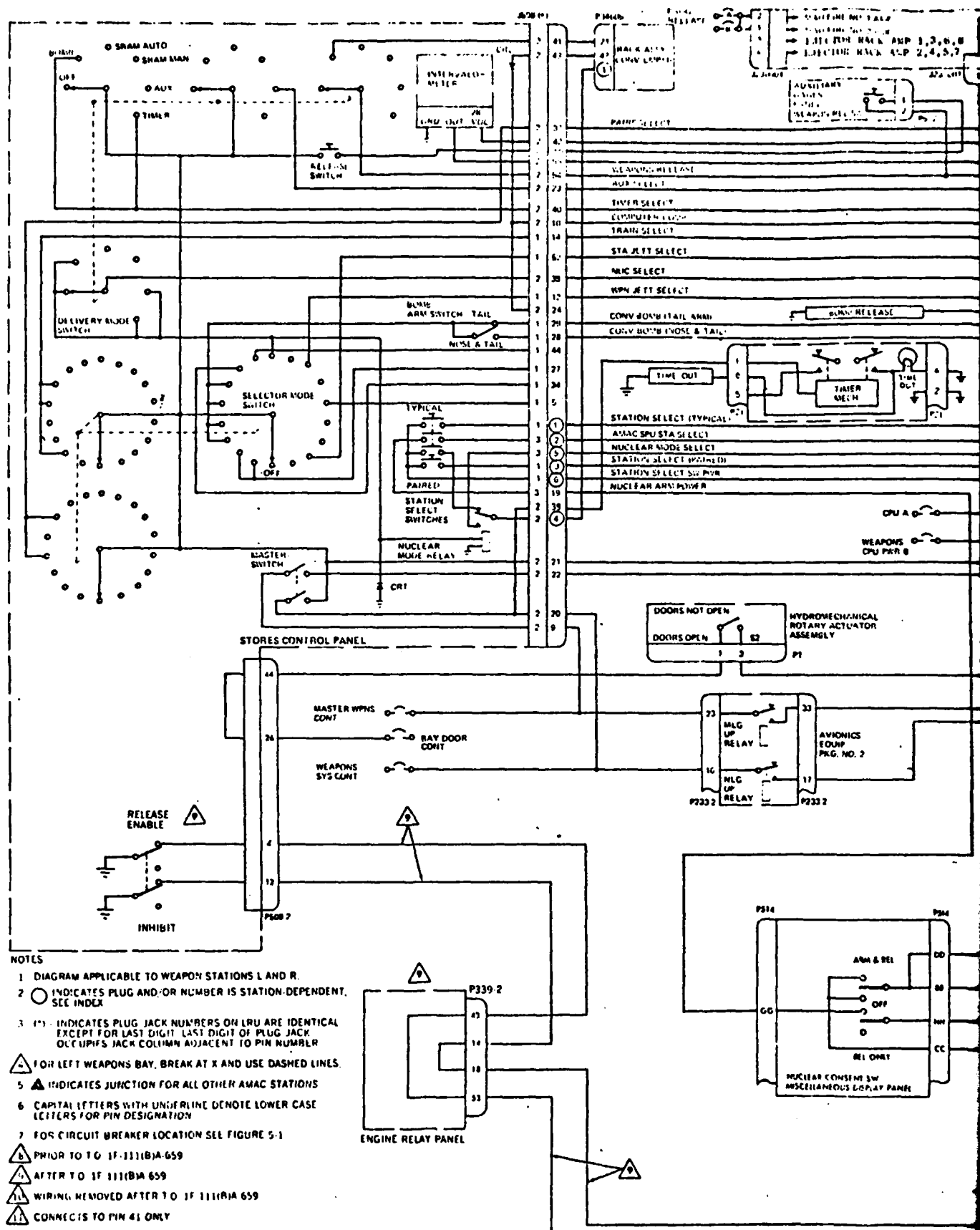


Figure 1-10. Stores Management System Weapons Day Integrated Schematic

Figure 4.2-F Weapon Station R Circuitry
(Sheet 1 of 4)

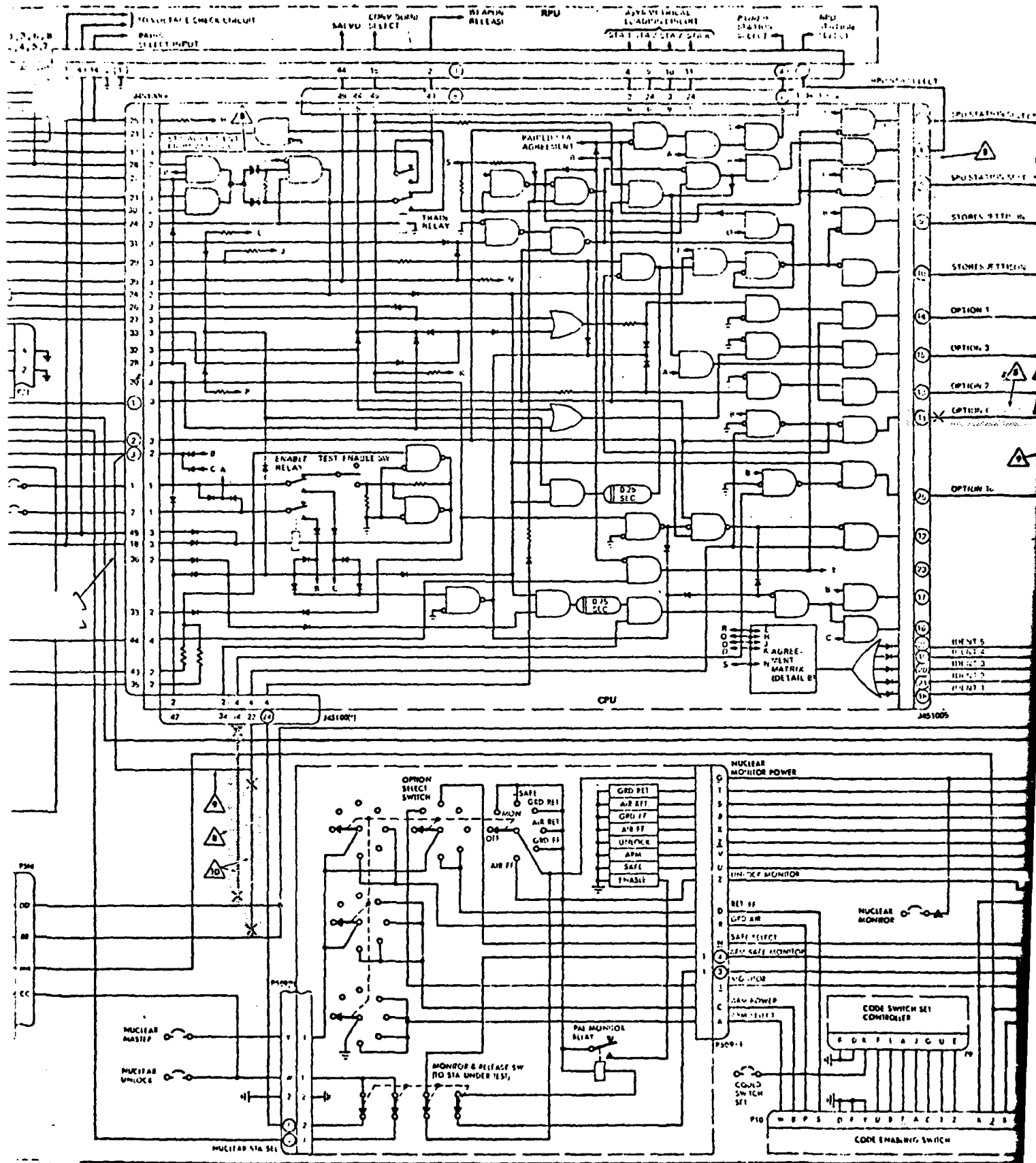


Figure 4.2-F Weapon Station R Circuitry
(Sheet 2 of 4)

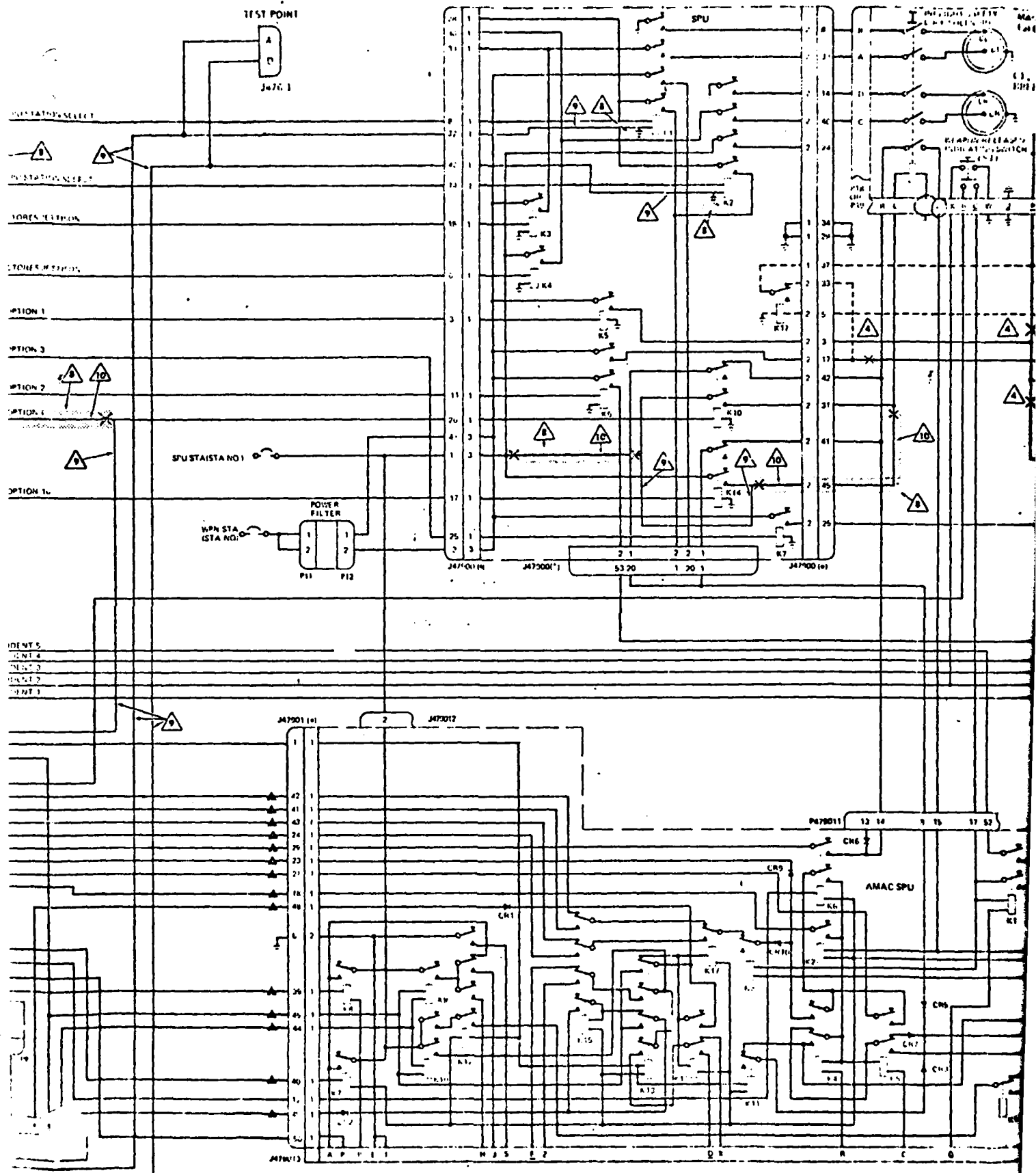
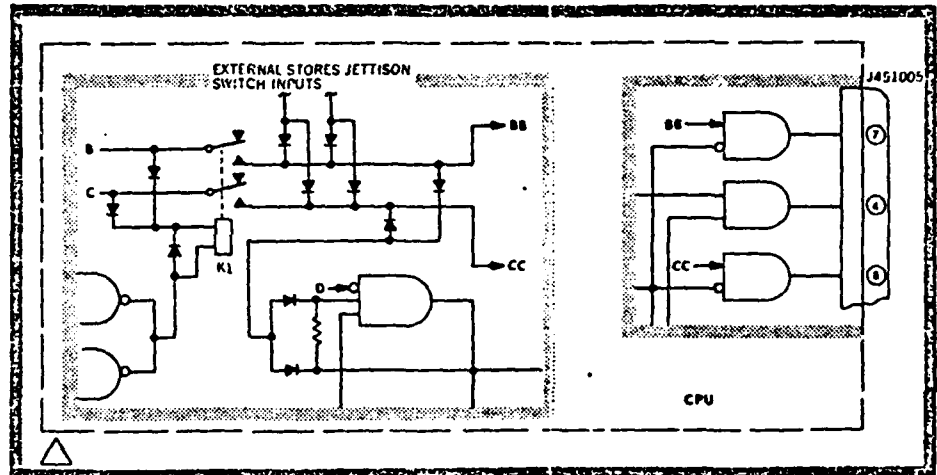
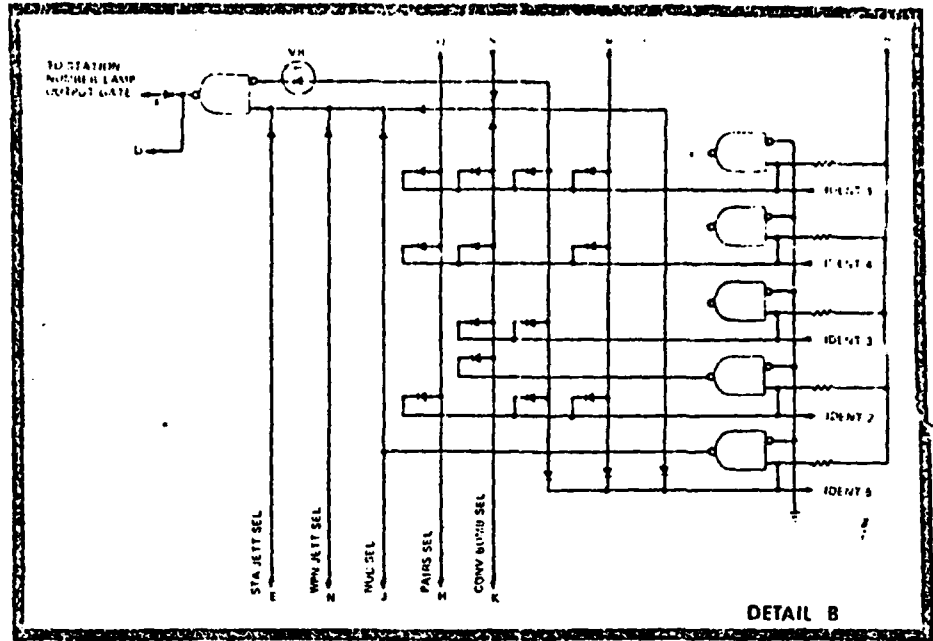
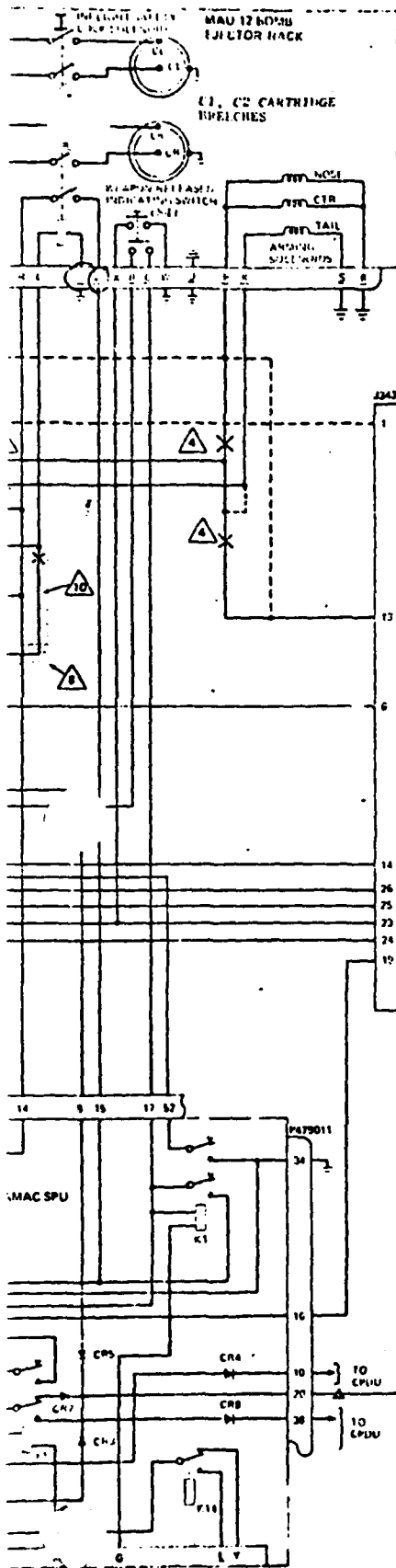


Figure 4.2-F Weapon Station R Circuitry
(Sheet 3 of 4)



INDEX TO STATION DIFFERENT PLUGS AND PIN NUMBERS					
STORES CONTROL PANEL			CPU		
INDEX	L	R	INDEX	L	R
1	PIN 21	PIN 22	1	PIN 9	PIN 10
2	PIN 12	PIN 10	2	PIN 10	PIN 9
3	PIN 22	PIN 21	3	PIN 44	PIN 41
4	PIN 52	PIN 15	4	PIN 3	PIN 23
5	PIN 13	PIN 4	5	NOT CONNECTED	
6	PIN 15	PIN 32	6	PIN 23	PIN 3
	DCU 137 A		7	PIN 1	PIN 22
1	PIN D	PIN N	8	PIN 4	PIN 31
2	PIN 5	PIN 11	9	PIN 5	PIN 24
3	PIN CC	PIN 100	10	PIN 7	PIN 32
4	PIN A	PIN 1	11	PIN 12	PIN 28
	HACK AND CONV CTRIP		12	PIN 15	PIN 24
1	PIN 32	PIN 23	13	PIN 13	PIN 34
	SPU		14	PIN 12	PIN 33
1	PIN 4	PIN 42	15	PIN 14	PIN 26
2	PIN 12	PIN 13	16	NOT CONNECTED	
3	NOT CONNECTED		17	NOT CONNECTED	
18	PIN 15	PIN 12	18	PIN 9	PIN 26
19	PIN 12	PIN 13	19	PIN 7	PIN 29
20	PIN 12	PIN 14	20	PIN 11	PIN 28
			21	PIN 10	PIN 21
			22	PIN 8	PIN 30
			23	NOT CONNECTED	
			24	PIN 5	PIN 6
			25	PIN 21	PIN 42

CHANGE LEGEND

THIS ILLUSTRATION HAS BEEN EXTENSIVELY CHANGED

Figure 4.2-F Weapon Station R Circuitry
(Sheet 4 of 4)

4.2.2 (Continued)

- 0 Interface with gravity bombs are the connectors shown in the aircraft wiring diagrams.
- 0 Analyses of abnormal environments are considered only one fault at a time.
- 0 Wiring faults within aircraft wiring harnesses were limited to those within shared cables and connectors. Cable-to-cable and bundle-to-bundle wiring faults were excluded.
- 0 Release circuits were not included as nuclear weapon interface circuits during load analysis for abnormal environments.
- 0 Short circuits in terminals and faults internal to components were not considered except in the worst-case abnormal environment analysis for each model.
- 0 The abnormal environments analysis of the FB-111A escape capsule disconnects were limited to circuits related to nuclear weapons.
- 0 FB-111A SRAM interfaces were excluded.

4.2.3 IDENTITY OF CIRCUITS

The analysis used sneak circuit network trees and Air Force technical orders to identify adjacent and interrelated circuits for fault analysis. Network trees and other diagrams used to analyze the circuits are included in the individual analysis packages in section 4.2.6 of this report.

4.2.4 NORMAL ENVIRONMENT

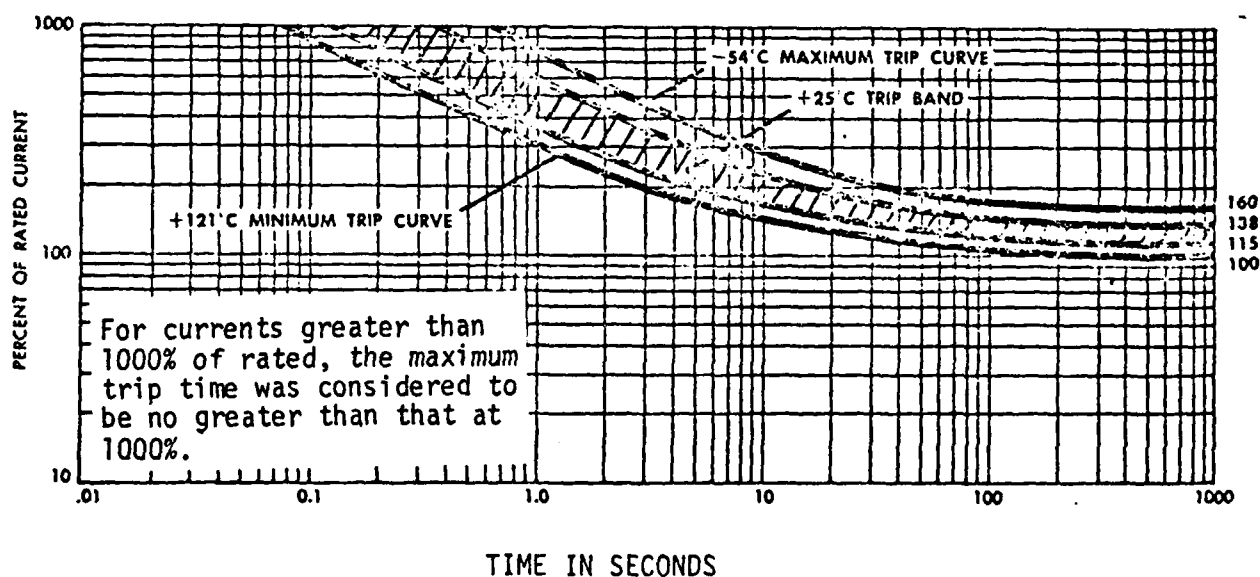
Power capability of each interfacing circuit was calculated for open circuit voltage and short circuit current at the weapon interface.

4.2.5 ABNORMAL ENVIRONMENTS

Each network tree was analyzed for postulated faults. The faults are identified in the analysis package diagrams by numbered circles. In most instances, the worst case is a postulated short circuit at the point of lowest impedance. Worst case current and circuit breaker trip times have been calculated for each interfacing circuit.

4.2.5.1 GROUND RULES

Resistances across relays and trip times of circuit breakers have been selected from available data based on standard temperatures. On the ground, a temperature of $+25^{\circ}\text{C}$ is used. In flight, a temperature of -54°C is used for components outside the crew compartment. Components inside the crew compartment were assumed to be at $+25^{\circ}\text{C}$. Most circuit breakers in this study are located outside the crew compartment. This accounts for the significantly longer trip times of faults postulated in flight. The following curve, based upon Texas Instrument data, and General Dynamic Circuit Breaker Standard C2697 were used to compute trip times.



CB TRIP TIME VS CURRENT PROFILE

4.2.5.1 (Continued)

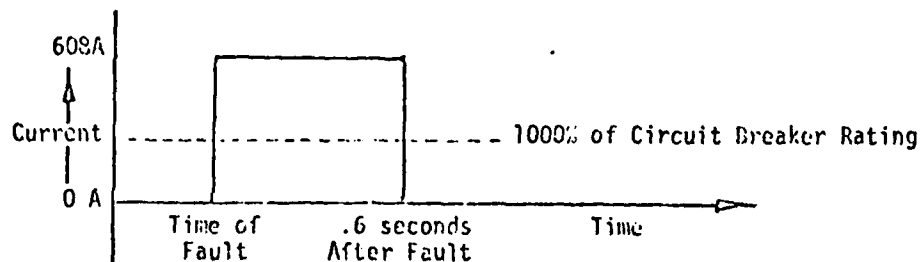
Circuits fed by TR (Transformer/Rectifier) power were assumed to carry 28 volts direct current. There are some faults to circuits carrying either 115 volts or 28 volts alternating current. In all cases, power profiles were found to be step functions, lasting until the circuit breaker trips. No current was found that was high enough to weld the circuit breaker closed, however some fault currents would be so low (mA) that they would remain indefinitely on circuits protected against much higher currents.

4.2.6 CIRCUIT ANALYSIS PACKAGES

Normal and fault analyses are documented in individual packages for the circuit groups. The following analysis packages cover all of the gravity weapon interface circuits at stations 3 and R:

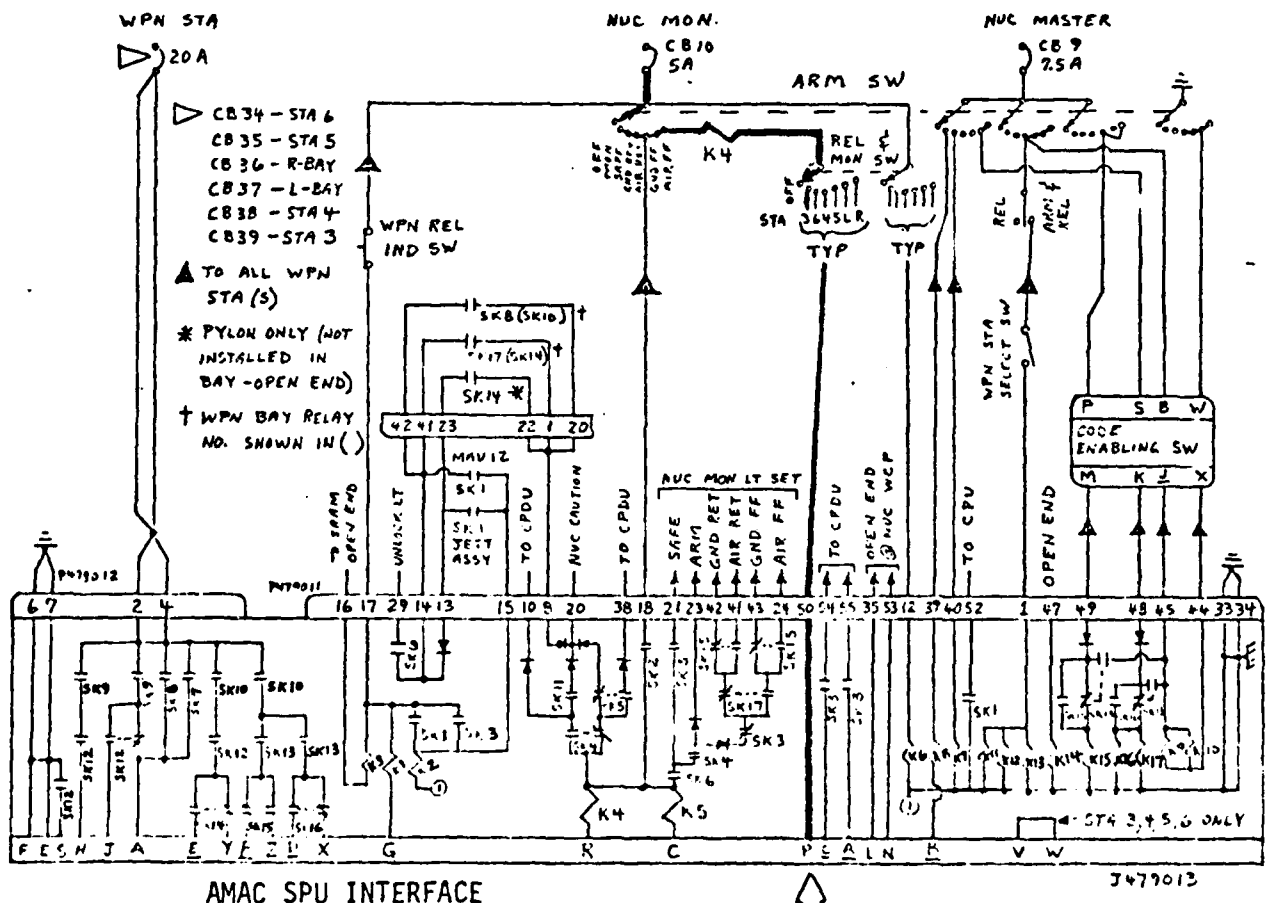
4.2.6.1	Pin P	Permissive Action Link Ground
4.2.6.2	Pins A,H,J,Y,X,Z,	Arm/Safe Inputs, Burst Options,
	<u>d</u> , <u>e</u> , <u>f</u>	Plus Weapon Drop Config.
4.2.6.3	Pins <u>L</u> ,N, <u>a</u> , <u>c</u>	Nuclear Weapons Control and
		SRAM Circuitry
4.2.6.4	Pin <u>b</u>	Master Power Distribution
4.2.6.5	Pins <u>C</u> ,G,R	Monitor & Release Plus Option
		Selector & Monitor
4.2.6.6	Pins S,V,W	Station Select

Note: Power Profiles - In all cases the short circuit current was found to be either much less than the source circuit breaker ratings or much greater than the ratings. Where the current was much less than the rating the current will remain constant until the source is removed. Where the current is much greater, the current will remain constant until the circuit breaker trips. A typical profile of this case is shown below.



4.2.6.1 Circuit Analysis Package, Weapon Interfaces Pin P of AMAC SPU-3 and -R (Weapon Station 3 Pylon and Weapon Station R Bay)

These interfaces are shown in Figure 4.2-D, which is a copy of Figure 1-8 from T.O. 1F-111(B)A-2-11-1 (Change 2) showing the circuitry to the pivot pylon weapon station AMAC SPU interfaces and Figure 4.2-F which is a copy of Figure 1-10 from T.O. 1F-111(B)A-2-11-1 (Change 2) showing the circuitry to L and R-Bay AMAC SPU interfaces. A generalized schematic highlighting pin P circuitry is attached below. Maximum current available to Pin P in a normal environment is 48 mA (direct current). Worst-case current at 28VDC in an abnormal (faulted) environment would be 608 amps for weapon station 3 and 1333 amps for weapon station R. Worst case fault current at 115VAC would be 451 amps for a weapon station 3. No faulted AC current has been identified for weapon station R.



4.2.6.1

4.2.6.1 (Continued)

a. Normal Power and Loads Analysis

Reference Figure 4.2-1 Network Tree 334 and Monitor Relay Technical Data. From examination of network tree and the Monitor Relay Technical Data; J479013-P for any weapon station

$$V_{OC} = 28\text{VDC}; I_{SC} = \frac{28}{579} = 48 \text{ mA}$$

b. Fault Analysis

Reference Figure 4.2-1 Network Tree 334, Figure 4.2-2 Fault Diagram Weapon Station 3 and Figure 4.2-3 Fault Diagram Weapon Station R. The following faults were postulated:

① Wiring Harness 247W2 Damaged

Wires to pin P shorted to 28VDC. See Table 4.2-1 for voltage sources.

② Nuclear Weapon Control Panel Damaged

Wires to pin P shorted to 28VDC. See Table 4.2-1 for voltage sources.

③ Wiring Harness 247W3, 247W14, Wing-Fuselage Disconnect 301J10 or Wing Pylon 3 Disconnect J600-9 Damaged

Wires to pin P shorted to 28VDC. See Table 4.2-1 for voltage sources.

④ Pylon 3 Wiring Harness 351W1, 351W2, 354W1, 354W2, or Wing Pylon Disconnect J613 Damaged (Worst Case -115VAC

Wires to pin P shorted to 28VDC or 115V 400Hz. See Table 4.2-1 for voltage sources.

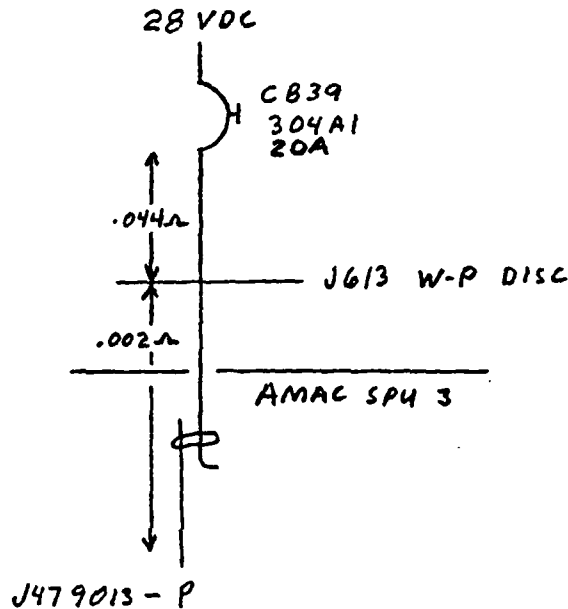
⑤ AMAC SPU Damaged (Worst Case - 28VDC

Wires to pin P shorted to 28VDC. See Table 4.2-1 for voltage sources.

4.2.6.1 (Continued)

c. Worst Case Path for Weapon Station 3 at 28VDC

Reference path (5) from paragraph b.



Total resistance at path = .046Ω

$$V_{OC} = 28VDC$$

$$I_{SC} = \frac{28}{.046} = 608 \text{ A}$$

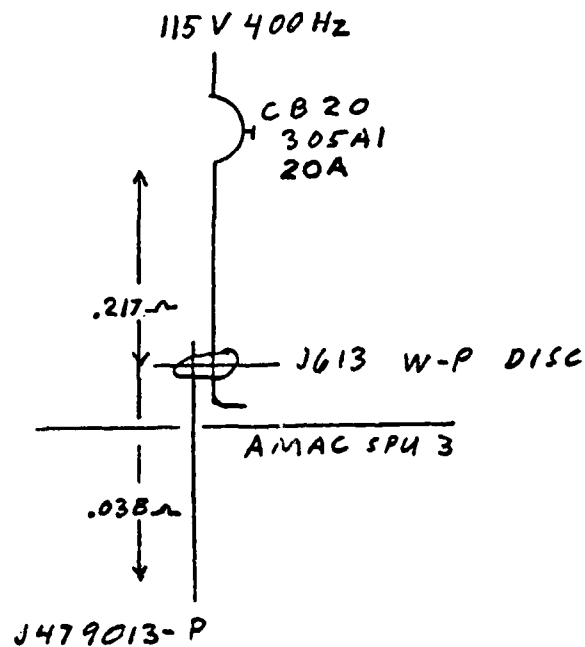
Time = Less than .6 seconds at -54°C for circuit breaker to open.

On ground alert at 25°C the time to open would be less than .35 seconds.

4.2.6.1 (Continued)

d. Worst Case Path for Weapon Station 3 at 115V 400Hz

Reference path ④ from paragraph b.



Total resistance of path .255 ~

$$V_{OC} = 115V \ 400Hz$$

$$I_{SC} = \frac{115}{.255} = 451 \text{ A}$$

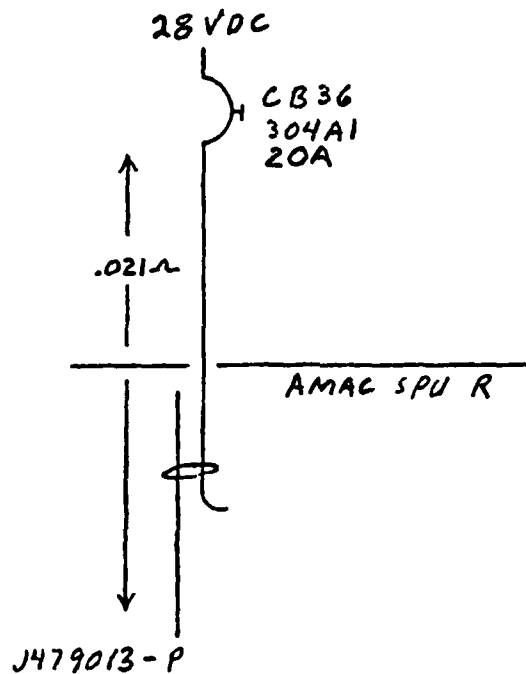
Time = Less than .6 seconds at -54°C for circuit breaker to open

On ground alert at 25°C the time to open would be less than .35 seconds.

4.2.6.1 (Continued)

e. Worst Case Path for Weapon Station R

Reference path ⑤ from paragraph b.

Total resistance of path $.021\Omega$

$$V_{OC} = 28VDC$$

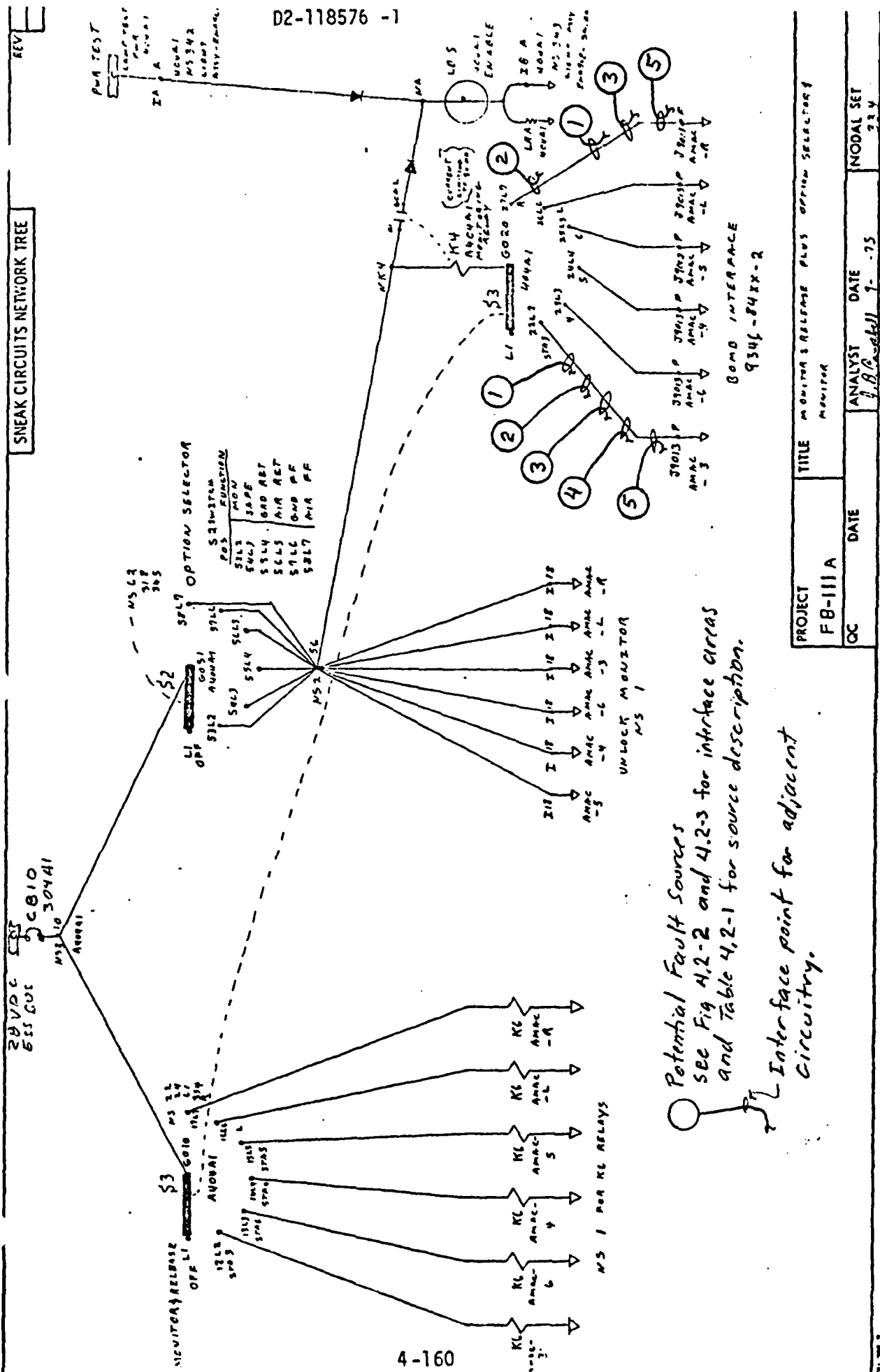
$$I_{SC} = \frac{28}{.021} = 1333 \text{ A}$$

Time = Less than .6 seconds at $-54^{\circ}C$ for circuit breaker to open.
 On ground alert at $25^{\circ}C$ the time to open would be less than
.35 seconds.

SNEAK CIRCUITS NETWORK TREE

REV

D2-118576 -1



Potential Fault Sources
see Fig 4.2-2 and 4.2-3 for interface areas
and Table 4.2-1 for source description.

Interface point for adjacent
Circuitry.

PROJECT	TITLE	ANALYST	DATE	MODAL SET
FB-111A	MONITOR'S RELEASE PLUS OPTION SELECTOR	J.B. [signature]	9-75	22V
QC	DATE	ANALYST	DATE	MODAL SET
		J.B. [signature]	9-75	22V

THE BOMBING MONITOR COMPANY - HOUSTON, TEXAS

Figure 4.2-1 NETWORK TREE 334

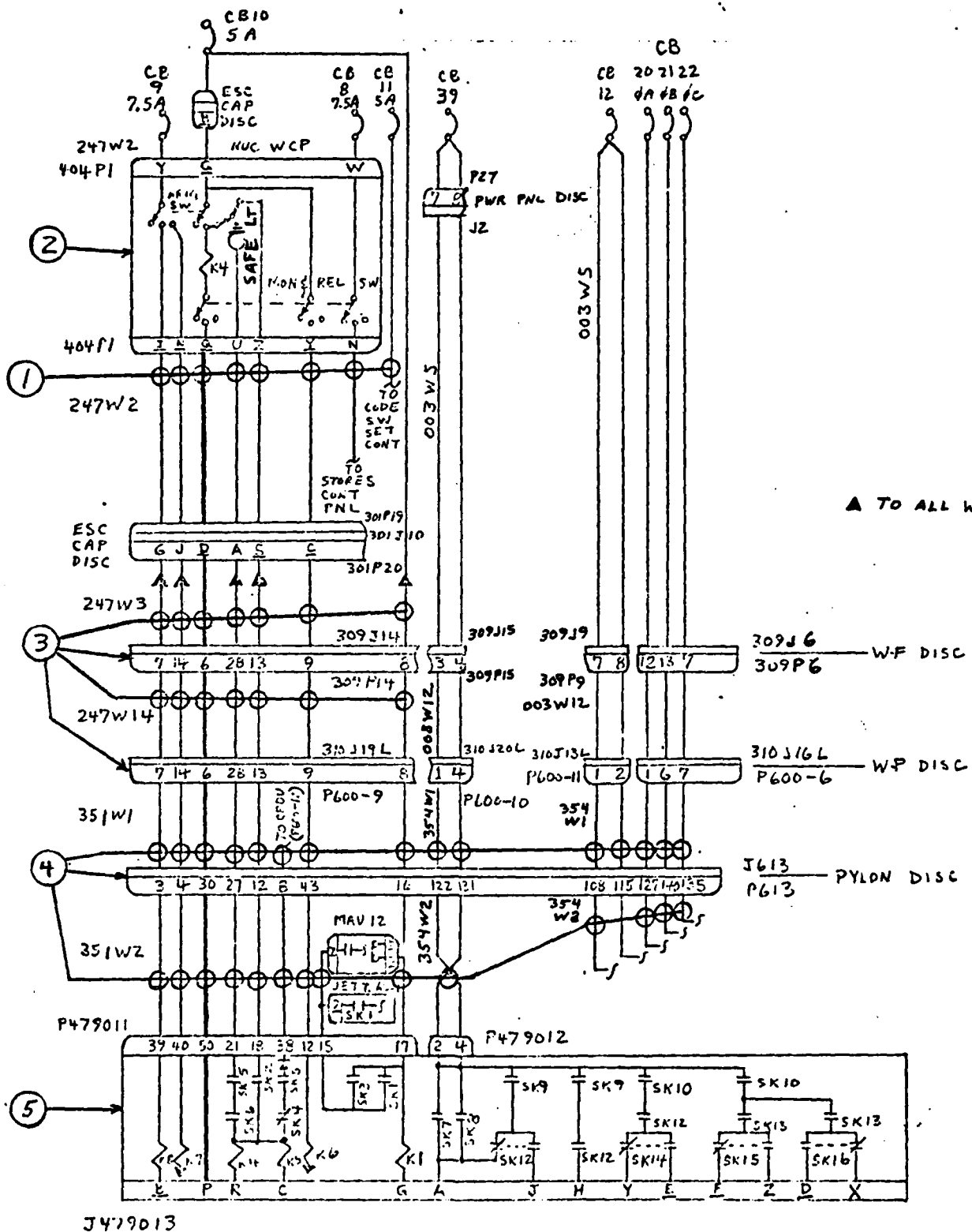


Figure 4.2-2 FAULT DIAGRAM WEAPON STATION 3

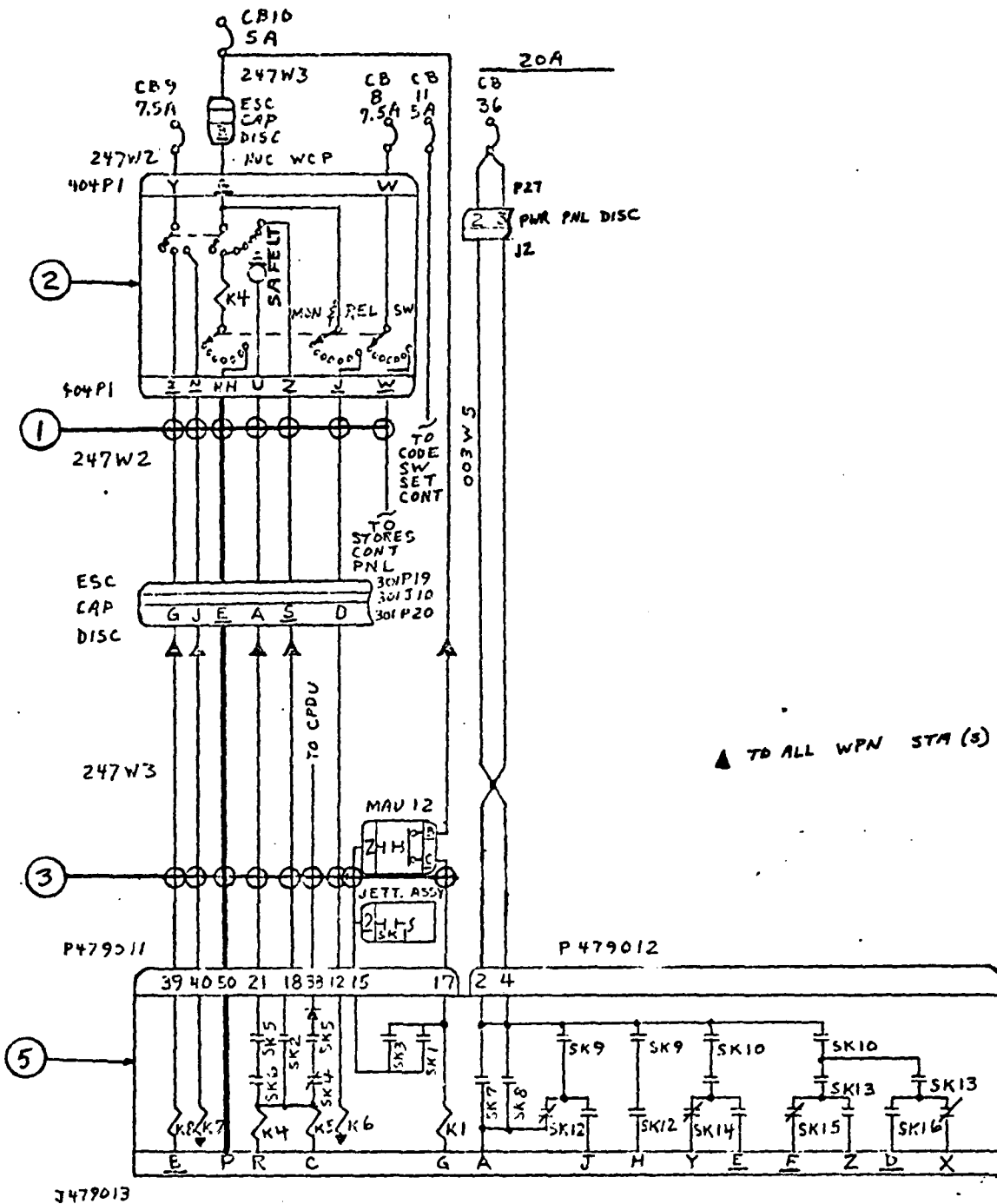


Figure 4.2-3 FAULT DIAGRAM WEAPON STATION R

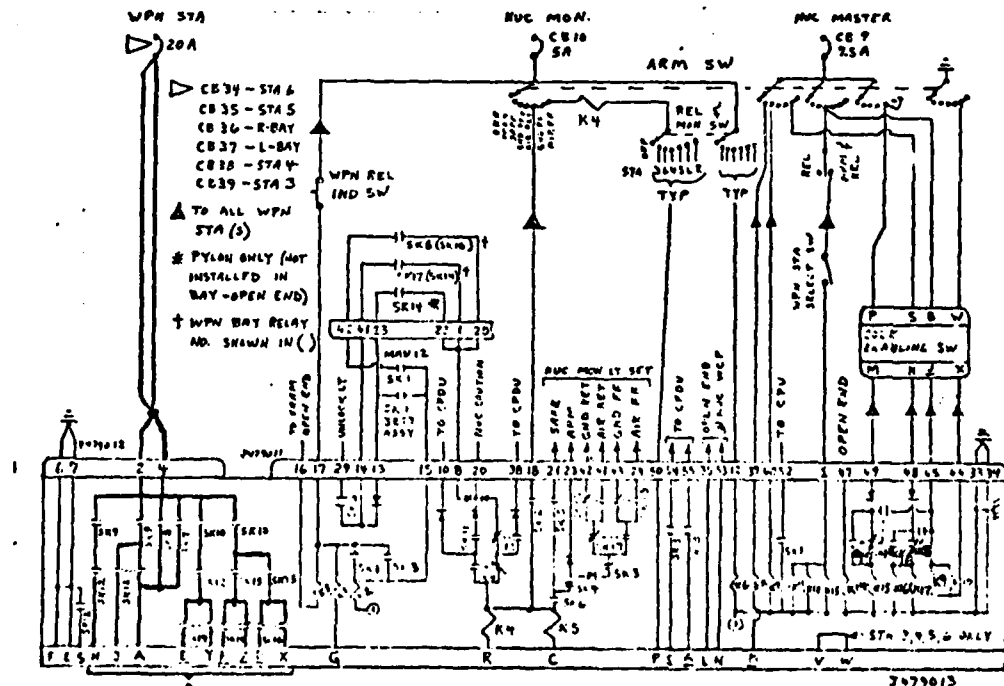
4.2.6.1 (Continued)

TABLE 4.2-1
POTENTIAL FAULT POWER SOURCES

FIGURE INDICATOR	CIRCUIT BREAKER	POWER
①	CB8 (7.5A) UNIT 314A1	28VDC CREW STA ESS BUS
	CB9 (7.5A) UNIT 314A1	28VDC CREW STA ESS BUS
	CB11 (5A) UNIT 314A1	28VDC CREW STA ESS BUS
	CB10 (5A) UNIT 304A1	28VDC ESS BUS
②	CB8 (7.5A) UNIT 314A1	28VDC CREW STA ESS BUS
	CB9 (7.5A) UNIT 314A1	28VDC CREW STA ESS BUS
	CB10 (5A) UNIT 304A1	28VDC ESS BUS
③	CB9 (7.5A) UNIT 314A1	28VDC CREW STA ESS BUS
	CB10 (5A) UNIT 304A1	28VDC ESS BUS
④	CB9 (7.5A) UNIT 314A1	28VDC CREW STA ESS BUS
	CB10 (5A) UNIT 304A1	28VDC ESS BUS
	CB20 (20A) UNIT 305A1	115VAC 400Hz L MAIN BUS
	CB21 (20A) UNIT 305A1	115VAC 400Hz L MAIN BUS
	CB22 (20A) UNIT 305A1	115VAC 400Hz L MAIN BUS
	CB12 (35A) UNIT 315A1	28VDC MAIN BUS
⑤	CB39 (20A) UNIT 304A1	28VDC ESS BUS
	CB9 (7.5A) UNIT 314A1	28VDC CREW STA ESS BUS
	CB10 (5A) UNIT 304A1	28VDC ESS BUS
	*CB36 (20A) UNIT 304A1	28VDC ESS BUS

*Station R only

**Station 3 only



4.2.6.2 (Continued)

a. Normal Power and Load Analysis

Reference Figure 4.2-4 Network Tree 365 and Figure 4.2-5 Network Tree 300. Relays K7 and K8 in the AMAC SPU can be energized by selecting Monitor and Safe options respectively on the Monitor and Control switch on the Nuclear Weapons Control Panel. From examination of the network trees: J479013 A weapon station 3

$$V_{OC} = 28VDC$$

$$I_{SC} = \frac{28}{.046 \Omega} * = \underline{608 A}$$

*Wire resistance from CB to weapon interface

J479013-A weapon station R

$$V_{OC} = 28VDC$$

$$I_{SC} = \frac{28V}{.021 \Omega} * = \underline{1333A}$$

*Wire resistance from CB to weapon interface

Actual current is assumed to be something less than 20 amps, the rating of the 28VDC circuit breaker.

J479013-H, J, X, Y, Z, d, e, f for all weapon stations

$$V_{OC} = 0V$$

$$I_{SC} = \underline{0A}$$

b. Fault Analysis

Reference Figure 4.2-4 Network Tree 365, Figure 4.2-5 Network Tree 300, Figure 4.2-6 Fault Diagram Weapon Station 3 and Figure 4.2-7 Fault Diagram Weapon Station R. The following postulated faults were analyzed.

① Wiring Harness 003W5 Damaged

Wires to pin A (assuming K7 or K8 in the AMAC SPU are energized) shorted to 28VDC or 115V 400 Hz. See Table 4.2-2 for voltage sources.

② Wiring Harness 003W14 Damaged

Wires to pin A (assuming either K7 or K8 in the AMAC SPU energized) shorted to 28VDC or 115V 400Hz. See Table 4.2-2 for voltage sources.

4.2.6.2b (Continued)

③ Connector 309J15 Damaged

Wires to pin A (assuming either K7 or K8 energized in the AMAC SPU) shorted to 28VDC from CB38 unit 304A1. See Table 4.2-2 for voltage source.

④ Pylon 3 Wiring Harness 351W1, 351W2, 354W1, 354W2 or Wing Pylon Disconnect J613 Damaged

Wires to pin A (assuming either K7 or K8 energized in the AMAC SPU) shorted to 28VDC or 115V 400Hz. See Table 4.2-2 for voltage sources.

⑤ AMAC SPU Damaged

Wires to pins A, H, J, Y, X, Z, d, e, f shorted to 28VDC. See Table 4.2-2 for voltage sources.

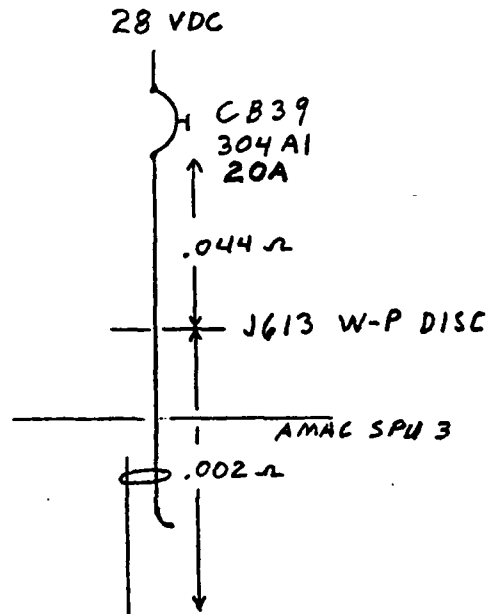
⑥ Power Panel Disconnect P27 Damaged

Wires to pin A (assuming either K7 or K8 energized in the AMAC SPU) shorted to 28VDC. See Table 4.2-2 for voltage sources.

4.2.6.2 (Continued)

c. Worst Case Path for Weapon Station 3 at 28VDC

Reference path ⑤ from paragraph b.



J479013-A (Typical for H, J, X, Y, Z, d, e, f)

Total resistance at path = .046 Ω $V_{OC} = 28VDC$

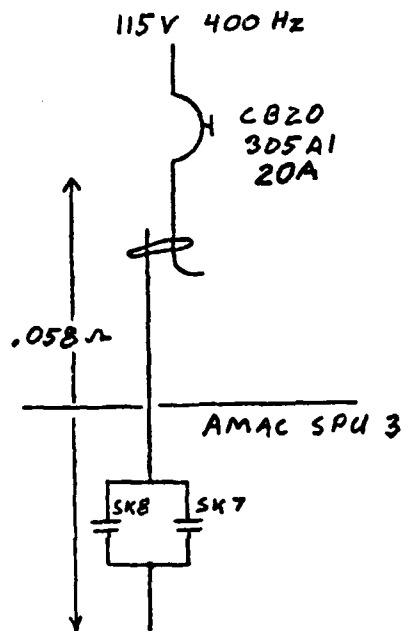
$$I_{SC} = \frac{28}{.046} = 608A$$

Time = Less than .6 seconds at $-54^{\circ}C$ for circuit breaker to open.On ground alert at $25^{\circ}C$ the time to open would be less than .35 seconds.

4.2.6.2 (Continued)

d. Worst Case Path for Weapon Station 3 at 115V 400 Hz

Reference path ① from paragraph b.



J479013-A

Total resistance of path = .058 Ω $V_{OC} = 115V\ 400\ Hz$

$$I_{SC} = \frac{115}{.058} = 1983\ A$$

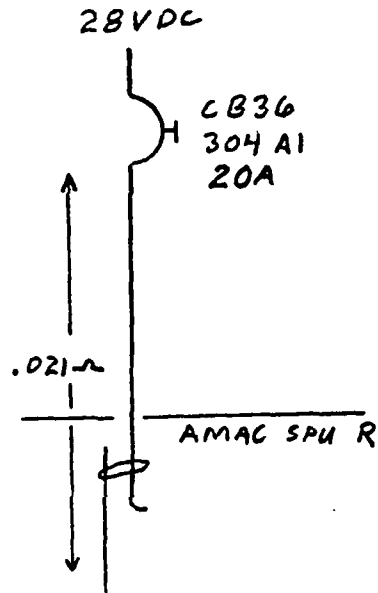
Time = Less than .6 seconds at -54°C for circuit breaker to open.

On ground alert at 25°C the time to open would be less than .35 seconds.

4.2.6.2 (Continued)

e. Worst Case Path for Weapon Station R at 28VDC

Reference path (5) from paragraph b.



J479013-A (Typical for H, J, X, Y, Z, d, e, f)

Total resistance of path = $.021 \sim$ $V_{OC} = 28VDC$

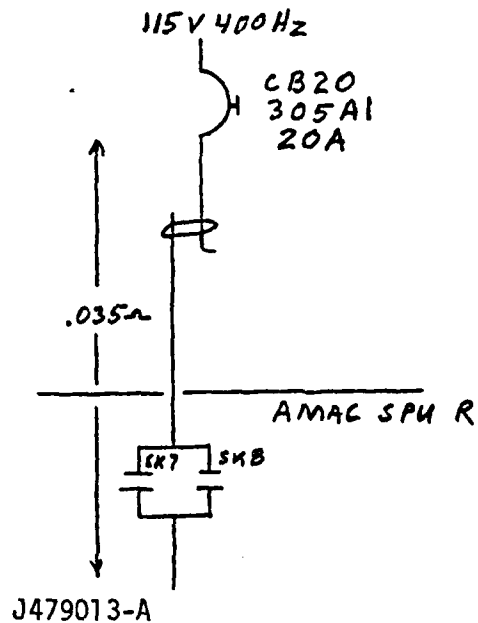
$$I_{SC} = \frac{28}{.021} = 1333 \text{ A}$$

Time = Less than .6 seconds at $-54^{\circ}C$ for circuit breaker to open.On ground alert at $25^{\circ}C$ the time to open would be less than .35 seconds.

4.2.6.2 (Continued)

f. Worst Case Path for Weapon Station R at 115V 400 Hz

Reference path ① from paragraph b.

Total resistance at path = $.035 \Omega$ $V_{OC} = 115V \ 400 \ Hz$

$$I_{SC} = \frac{115}{.035} = \underline{3286 \ A}$$

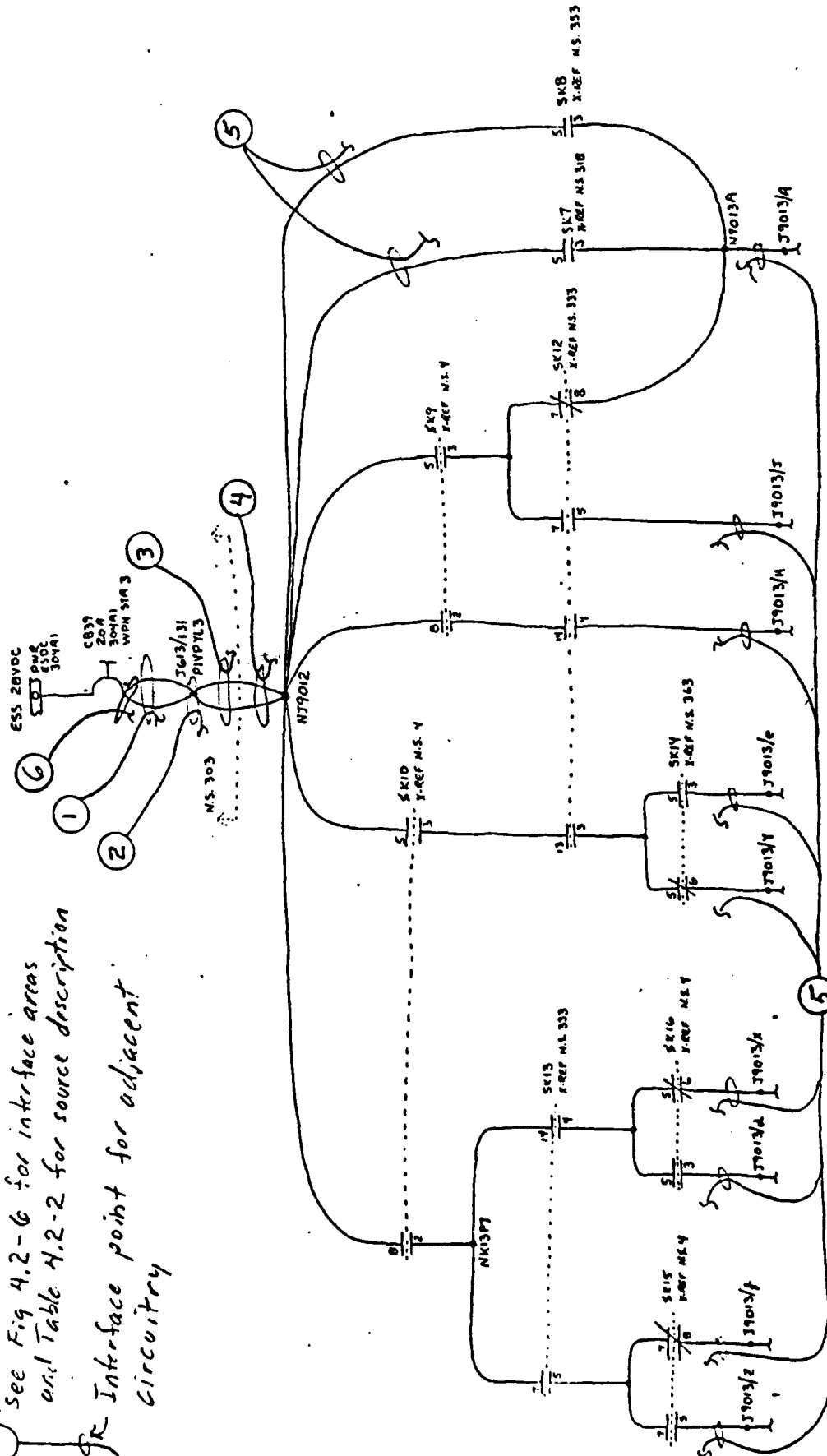
Time = Less than .6 seconds at $-54^{\circ}C$ for circuit breaker to open.On ground alert at $25^{\circ}C$ the time to open would be less than .35 seconds.

SNEAK CIRCUITS NETWORK TREE

REV

D2-118576 .1

Potential Fault Sources
See Fig 4.2-6 for interface areas
and Table 4.2-2 for source description
Interface point for adjacent
circuitry



NOTES:
1. REF DES IS AMAC-3 UNLESS OTHERWISE SHOWN
2. INCLUDES MODAL SET 303

PROJECT
FB-111A

TITLE

AMAC-3

QC

DATE

ANALYST'S

DATE

MODAL SET

365

THE BOEING RESEARCH COMPANY, MOULTON, NEAR

Figure 4.2-4 NETWORK TREE 365

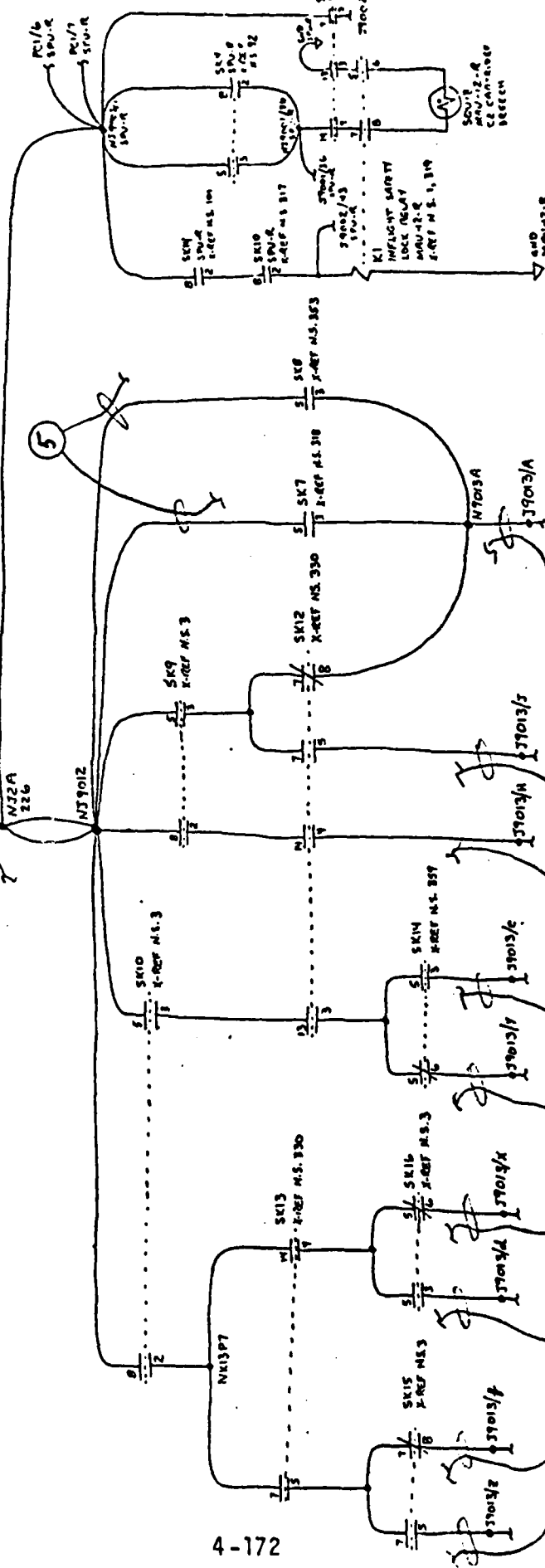
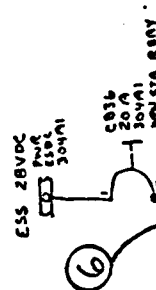
SNEAK CIRCUITS NETWORK TREE

REV E

D2-118576 -1

Potential Fault Sources
See Fig 4.2-7 for interface areas
and Table 4.2-2 for source description

Interface point for adjacent
circuitry



PROJECT	TITLE	ANALYST'S	DATE	NODAL SET
FB-111A	AMAC-R			300
QC	DATE			

NOTES:
REF DES IS AMAC-R UNLESS OTHERWISE SHOWN

THE BOEING AERONAUTICAL COMPANY, MOBILE, ALA.

Figure 4.2-5 NETWORK TREE 300

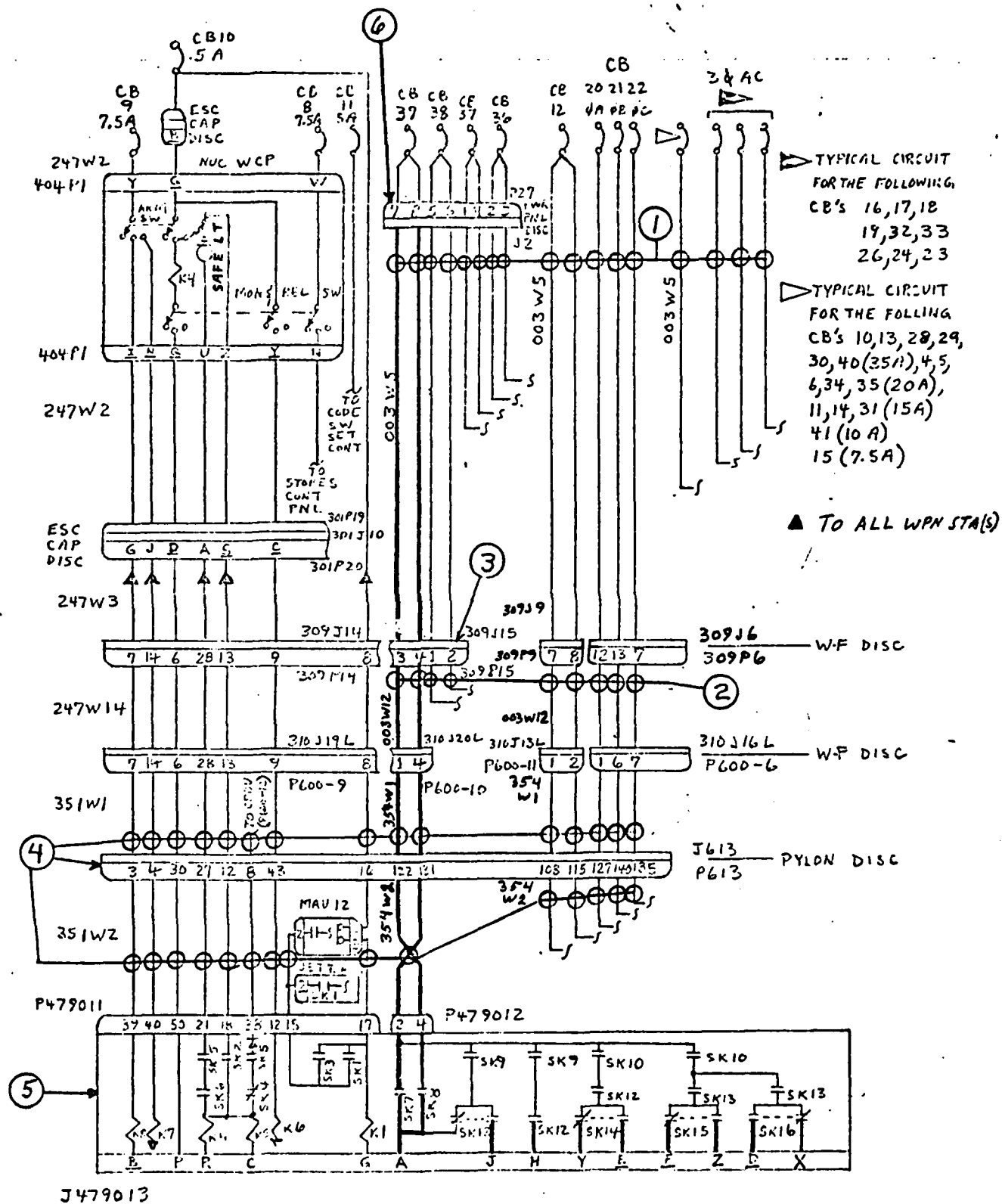


Figure 4.2-6 FAULT DIAGRAM WEAPON STATION 3

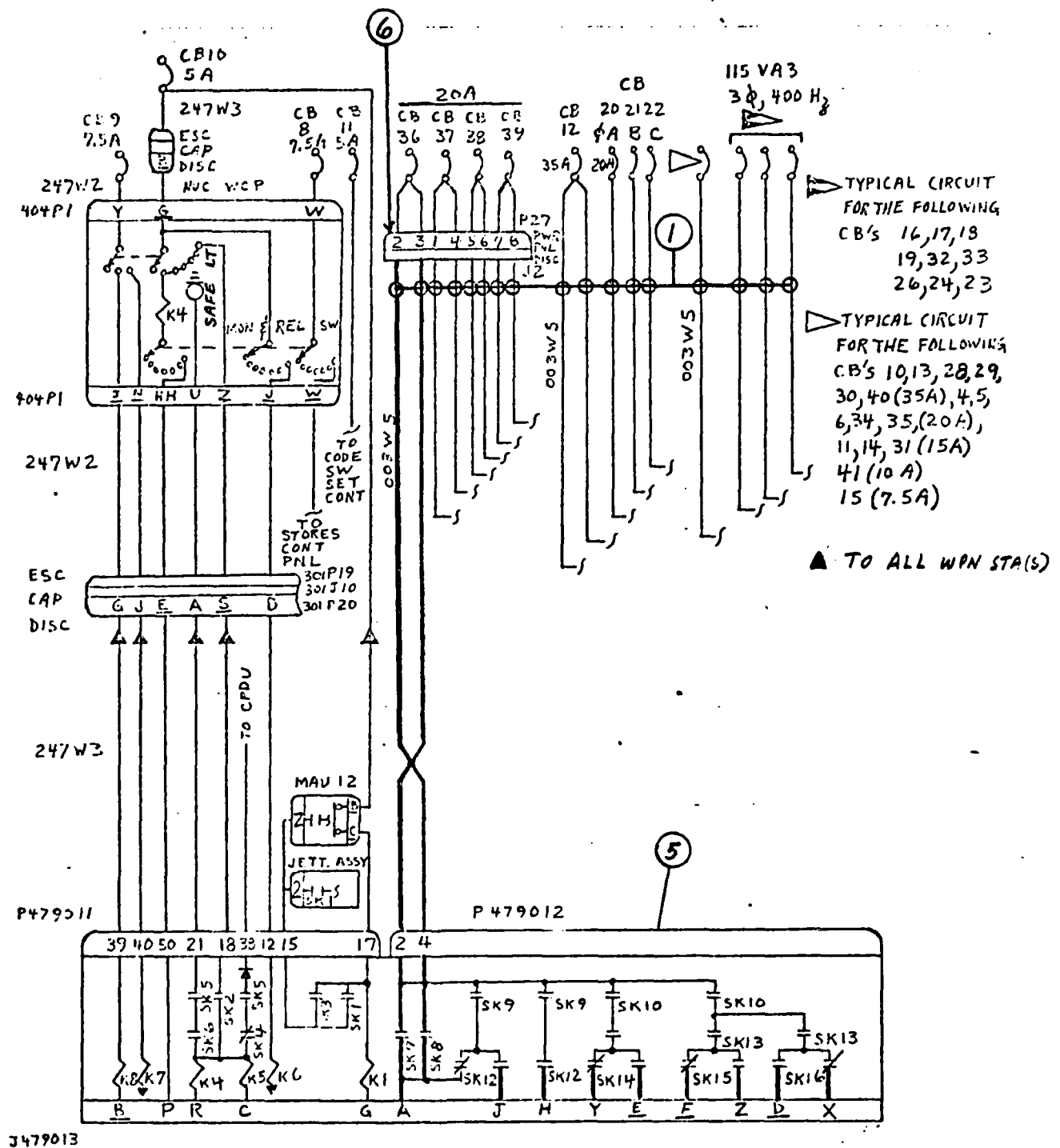


Figure 4.2-7 FAULT DIAGRAM WEAPON STATION R

4.2.6.2 (Continued)

TABLE 4.2-2
POTENTIAL FAULT POWER SOURCES

FIGURE INDICATOR	CIRCUIT BREAKER	POWER
①	CB16 (20A) UNIT 305A1	115V 400Hz R MAIN BUS
	CB17 (20A) UNIT 305A1	115V 400Hz R MAIN BUS
	CB18 (20A) UNIT 305A1	115V 400Hz R MAIN BUS
	CB19 (20A) UNIT 305A1	115V 400Hz L MAIN BUS
	CB20 (20A) UNIT 305A1	115V 400Hz L MAIN BUS
	CB21 (20A) UNIT 305A1	115V 400Hz L MAIN BUS
	CB22 (20A) UNIT 305A1	115V 400Hz L MAIN BUS
	CB23 (20A) UNIT 305A1	115V 400Hz R MAIN BUS
	CB24 (20A) UNIT 305A1	115V 400Hz R MAIN BUS
	CB26 (20A) UNIT 305A1	115V 400Hz R MAIN BUS
	CB32 (20A) UNIT 305A1	115V 400Hz L MAIN BUS
	CB33 (20A) UNIT 305A1	115V 400Hz L MAIN BUS
	CB11 (15A) UNIT 315A1	28VDC MAIN BUS
	CB14 (15A) UNIT 315A1	28VDC MAIN BUS
	CB15 (15A) UNIT 304A1	28VDC ESS BUS
	CB28 (15A) UNIT 315A1	28VDC MAIN BUS
	CB31 (15A) UNIT 315A1	28VDC MAIN BUS
	CB10 (35A) UNIT 315A1	28VDC MAIN BUS
	CB12 (35A) UNIT 315A1	28VDC MAIN BUS
	CB13 (35A) UNIT 315A1	28VDC MAIN BUS
	CB29 (35A) UNIT 315A1	28VDC MAIN BUS
	CB30 (35A) UNIT 315A1	28VDC MAIN BUS
	CB40 (35A) UNIT 315A1	28VDC MAIN BUS
	CB4 (20A) UNIT 304A1	28VDC ESS BUS
	CB5 (20A) UNIT 304A1	28VDC ESS BUS
	CB34 (20A) UNIT 304A1	28VDC ESS BUS
	CB35 (20A) UNIT 304A1	28VDC ESS BUS
	**CB36 (20A) UNIT 304A1	28VDC ESS BUS
	CB37 (20A) UNIT 304A1	28VDC ESS BUS
	CB38 (20A) UNIT 304A1	28VDC ESS BUS
	*CB39 (20A) UNIT 304A1	28VDC ESS BUS
②	CB38 (20A) UNIT 304A1	28VDC ESS BUS
	CB12 (35A) UNIT 315A1	28VDC MAIN BUS
	CB41 (10A) UNIT 315A1	28VDC MAIN BUS
	CB19 (20A) UNIT 305A1	115V 400Hz L MAIN BUS
	CB20 (20A) UNIT 305A1	115V 400Hz L MAIN BUS
	CB21 (20A) UNIT 305A1	115V 400Hz L MAIN BUS
	CB22 (20A) UNIT 305A1	115V 400Hz L MAIN BUS
	CB32 (20A) UNIT 305A1	115V 400Hz L MAIN BUS
	CB33 (20A) UNIT 305A1	115V 400Hz L MAIN BUS

4.2.6.2 (Continued)

TABLE 4.2-2 (Continued)
POTENTIAL FAULT POWER SOURCES

FIGURE INDICATOR	CIRCUIT BREAKER	POWER
③	CB38 (20A) UNIT 304A1	28VDC ESS BUS
④	CB9 (7.5A) UNIT CB10 (5A) UNIT CB12 (35A) UNIT CB20 (20A) UNIT CB21 (20A) UNIT CB22 (20A) UNIT	28VDC CREW STA ESS BUS 28VDC ESS BUS 28VDC MAIN BUS 115V 400Hz ØA L MAIN BUS 115V 400Hz ØB L MAIN BUS 115V 400Hz ØC L MAIN BUS
⑤	CB9 (7.5A) UNIT 314A1 CB10 (5A) UNIT 304A1 *CB36 (20A) UNIT 304A1 **CB39 (20A) UNIT 304A1	28VDC CREW STA ESS BUS 28VDC ESS BUS 28VDC ESS BUS 28VDC ESS BUS
⑥	**CB36 (20A) UNIT 304A1 CB37 (20A) UNIT 304A1 CB38 (20A) UNIT 304A1 *CB39 (20A) UNIT 304A1	28VDC ESS BUS 28VDC ESS BUS 28VDC ESS BUS 28VDC ESS BUS

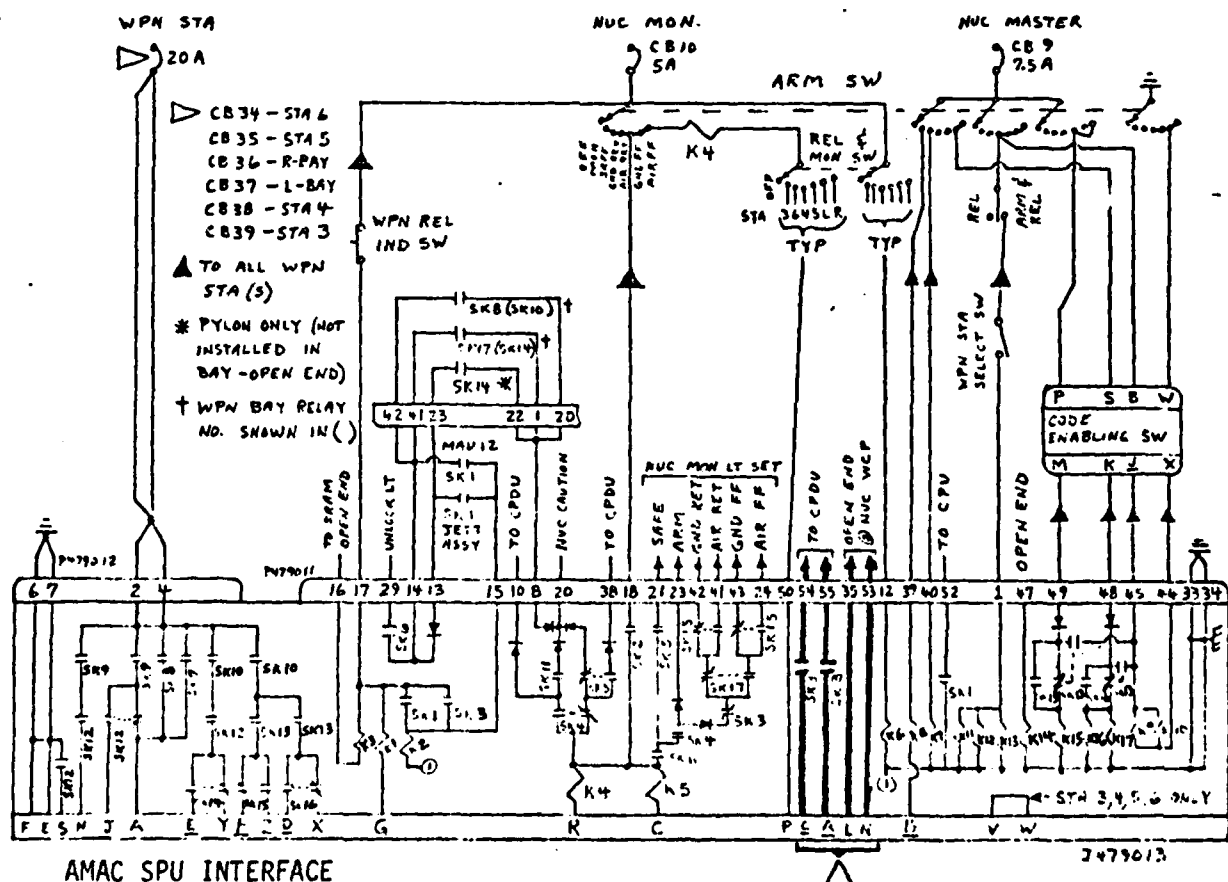
* STATION R ONLY

** STATION 3 ONLY

AMAC SPU PINS
L, N, a, c
CIRCUIT ANALYSIS PACKAGE

4.2.6.3 Circuit Analysis Package, Weapon Interface Pins L, N, a, c of
AMAC SPU-3 and -R (Weapon Station 3 Pylon and Weapon Station R Bay)

These interfaces are shown in Figures 4.2-8 through 4.2-10 Sneak Circuits Network Tree 352, T.O. 1F-111(B)A-2-14 and T.O. 11N-T5036-2. Maximum current and voltage to all of these interfaces in a normal environment is 0. This is because the wiring to pins L and N dead ends at the Nuclear Weapons Control Panel and the wiring to pins a and c is connected to SRAM circuitry and is not used for gravity weapons. Worst case current, at 28VDC in an abnormal faulted environment and assuming a ground at the weapon interface is 608 amps for weapon station 3 and 1333 amps for weapon station R. Worst case fault current at 115VAC would be 451 amps at weapon station 3, pins L and N and 215 amps at weapon station R pins L and N.



4.2.6.3 (Continued)

a. Normal Power and Load Analysis

Reference Figures 4.2-8, 4.2-9, 4.2-10, Network Trees 352, 354, 355, 356.

From examination of network trees in Figure 4.2-10 for pins L and N at any weapon station

$$V_{OC} = \underline{0} \text{ V}$$

$$I_{SC} = \underline{0} \text{ A}$$

From examination of network trees in Figures 4.2-8 and 4.2-9 for pins a and c at any weapon station.

$$V_{OC} = \underline{0} \text{ V}$$

$$I_{SC} = \underline{0} \text{ A}$$

Since relay K3 can only be energized if a SRAM is installed.

b. Fault Analysis

Reference Figures 4.2-8, 4.2-9 and 4.2-10, Network Trees 352, 354, 355, and 356 and Figure 4.2-11 Fault Diagram Weapon Station 3 and Figure 4.2-12 Fault Diagram Weapon Station R.

Since the wiring to pins L, N, a, and c are bussed to all nuclear weapons stations, any 28VDC or 115V 400 Hz power that might fault into these circuits for any weapon station will propagate to all weapon stations.

① Wiring Harness 247 W2 Damaged

Wires to pin L or N shorted to 28VDC. See Table 4.2-3 for voltage sources.

② Wiring Harness 247 W3 Damaged

Wires to pin L or N shorted to 28VDC. See Table 4.2-3 for voltage sources.

4.2.6.3 (Continued)

b. Fault Analysis (Continued)

③ Wiring Harness 247 W14, 247 W15, Wing Fuselage

Disconnect 308J13, 308J14, 309J13, 309J14 or Pylon 3, 4, 5, or 6 Wing Pylon Disconnect Damaged.

Wires to pin L or N shorted to 28VDC. See Table 4.2-3 for voltage sources.

④ Pylon 3, 4, 5, 6 Wiring Harness 351 W1, 351 W2, 354 W1 354 W2 or Pylon Disconnect J613 Damaged

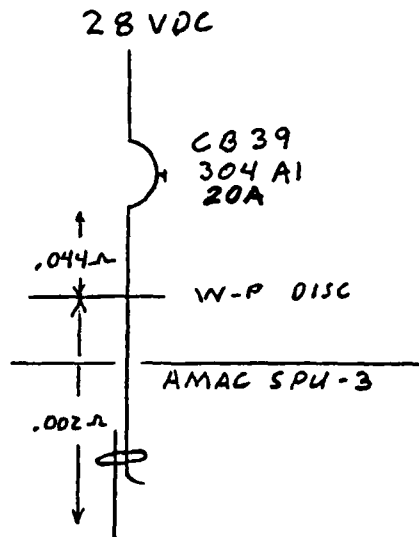
Wires to pin L or N shorted to 28VDC or 115V 400Hz. See Table 4.2-3 for voltage sources.

⑤ AMAC SPU Damaged

Wires to pin L, N, a, c shorted to 28VDC. See Table 4.2-3 for voltage sources.

4.2.6.3 (Continued)

- c. Worst Case Path for Weapon Station 3 at 28VDC
Reference path (5) from paragraph b.



J479013/L (Typical for N, a, c)

Total resistance of path = .046 ohms

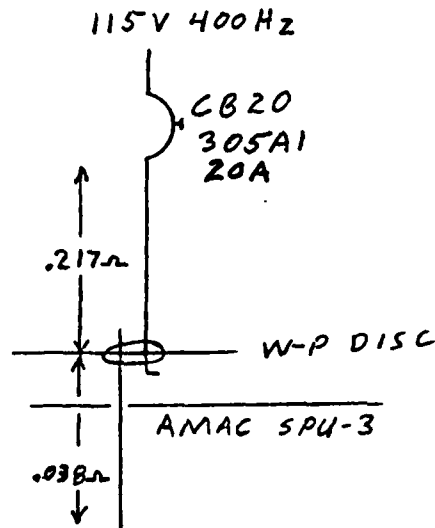
$$V_{OC} = 28\text{VDC}$$

$$I_{SC} = \frac{28}{.046} = \underline{608} \text{ amps}$$

Time = Less than .6 seconds at -54°C for circuit breaker to open.
On ground alert at 25°C the time to open would be less than .35 seconds.

4.2.6.3 (Continued)

- d. Worst Case Path for Weapon Station 3 at 115V 400Hz Pins L and N
Reference path (4) from paragraph b.



J479013/L (Typical for N)

Total resistance of path = .255 ohms

$$V_{OC} = 115V \text{ 400Hz}$$

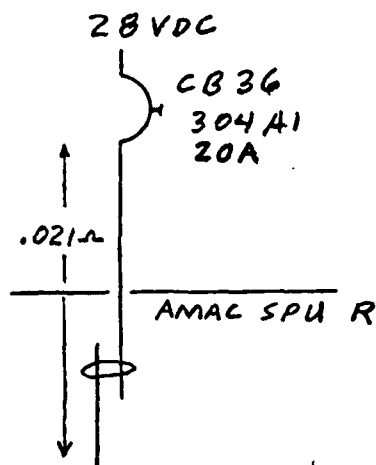
$$I_{SC} = \frac{115}{.255} = \underline{451} \text{ amps}$$

Time = Less than .6 seconds at -54°C for circuit breaker to open. On ground alert at 25°C the time to open would be less than .35 seconds.

4.2.6.3 (Continued)

e. Worst Case Path for Weapon Station R at 28VDC

Reference path ⑤ from paragraph b.



J479013/L (Typical for N, a, c)

Total resistance of path = .021 ohms

$$V_{OC} = 28VDC$$

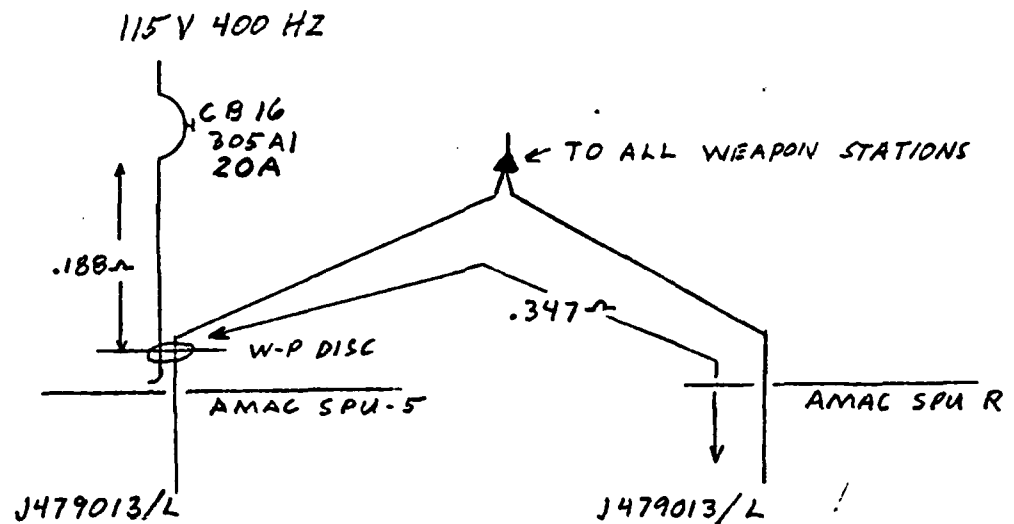
$$I_{SC} = \frac{28}{.021} = 1333 \text{ amps}$$

Time = Less than .6 seconds at $-54^{\circ}C$ for the circuit breaker to open. On ground alert at $25^{\circ}C$ the time to open would be less than .35 seconds.

4.2.6.3 (Continued)

f. Worst Case Path for Weapon Station R for 115V, 400Hz at Pins L and N

Reference path ④ from paragraph b.



Typical for N

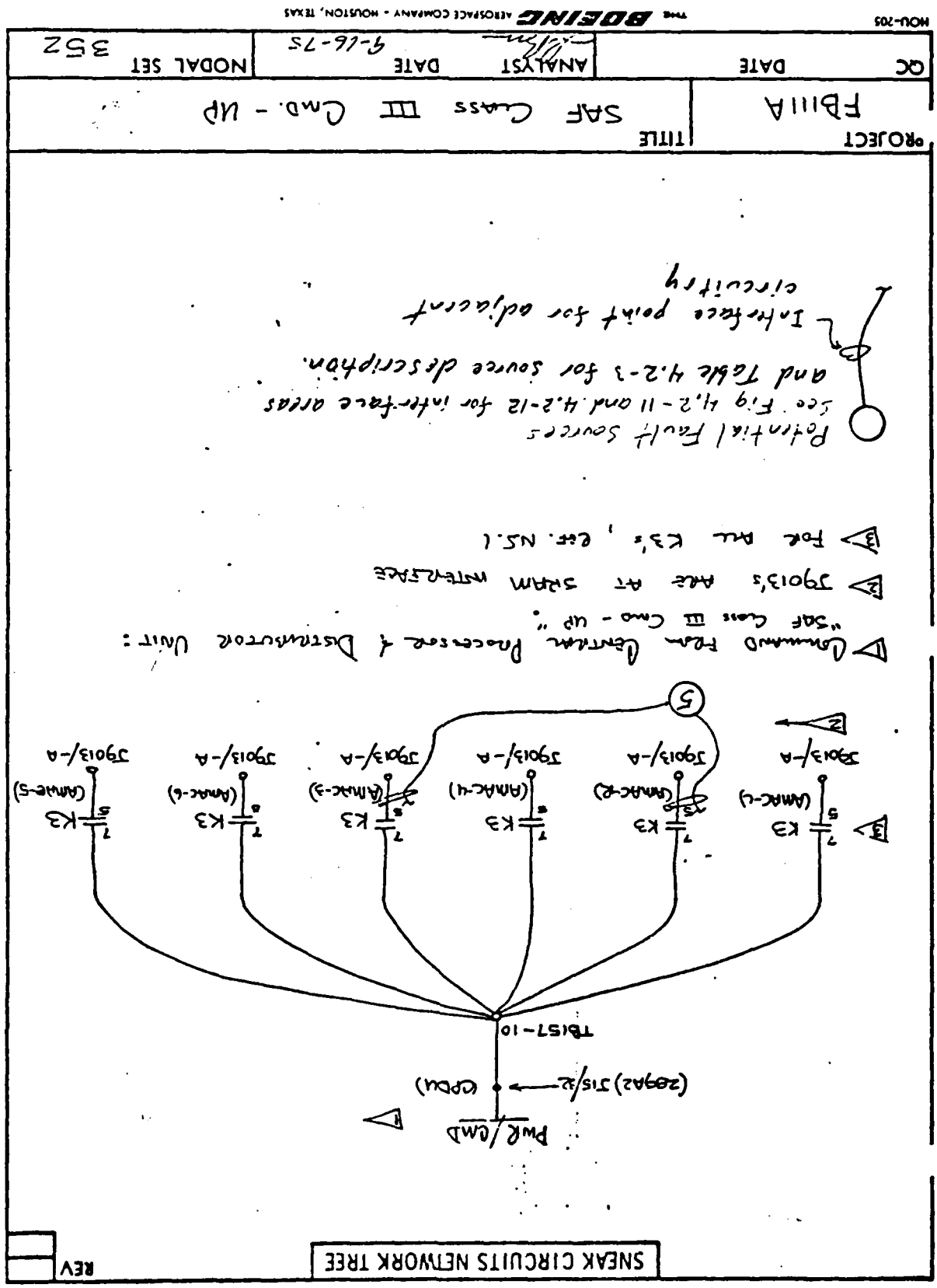
Total resistance of path = .535 ohms

$$V_{OC} = 115V \text{ 400Hz}$$

$$I_{SC} = \frac{115}{.535} = \underline{215} \text{ amps}$$

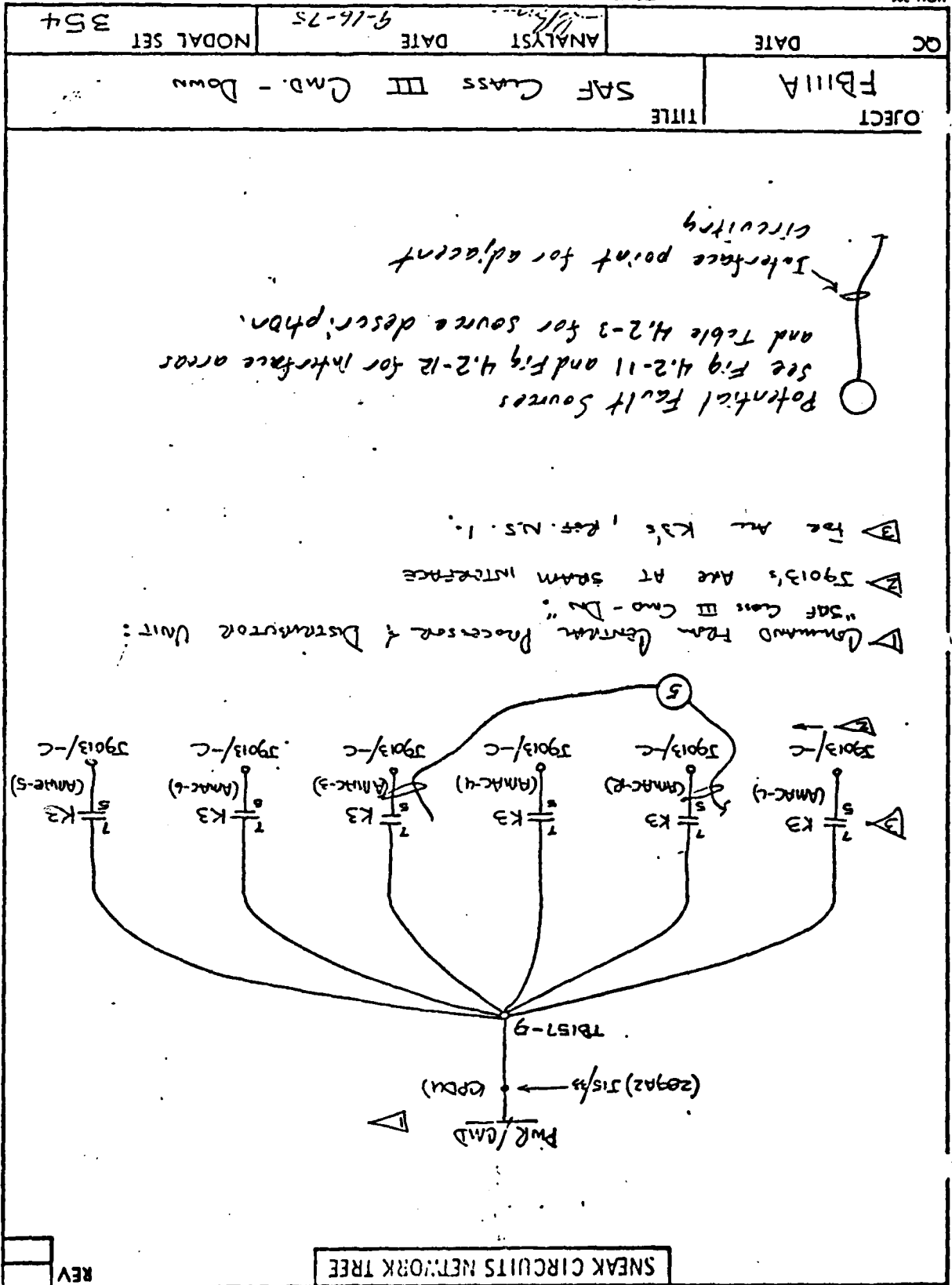
Time = Less than .6 seconds at -54°C for circuit breaker to open. On ground alert at 25°C the time to open would be less than .35 seconds.

FIGURE 4.2-8. NETWORK TREE 352



THE BELL AEROSPACE COMPANY - HOUSTON, TEXAS

HOU-205



SNEAK CIRCUITS NETWORK TREE

REV

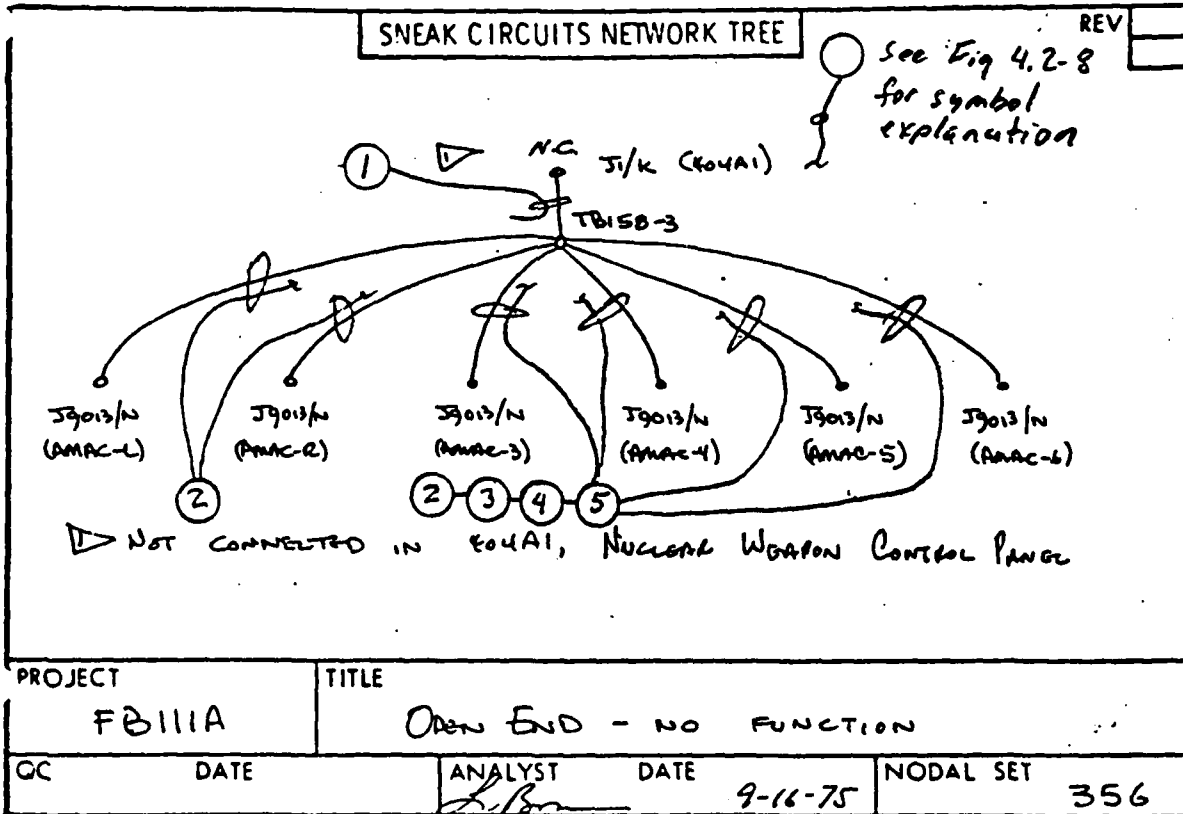
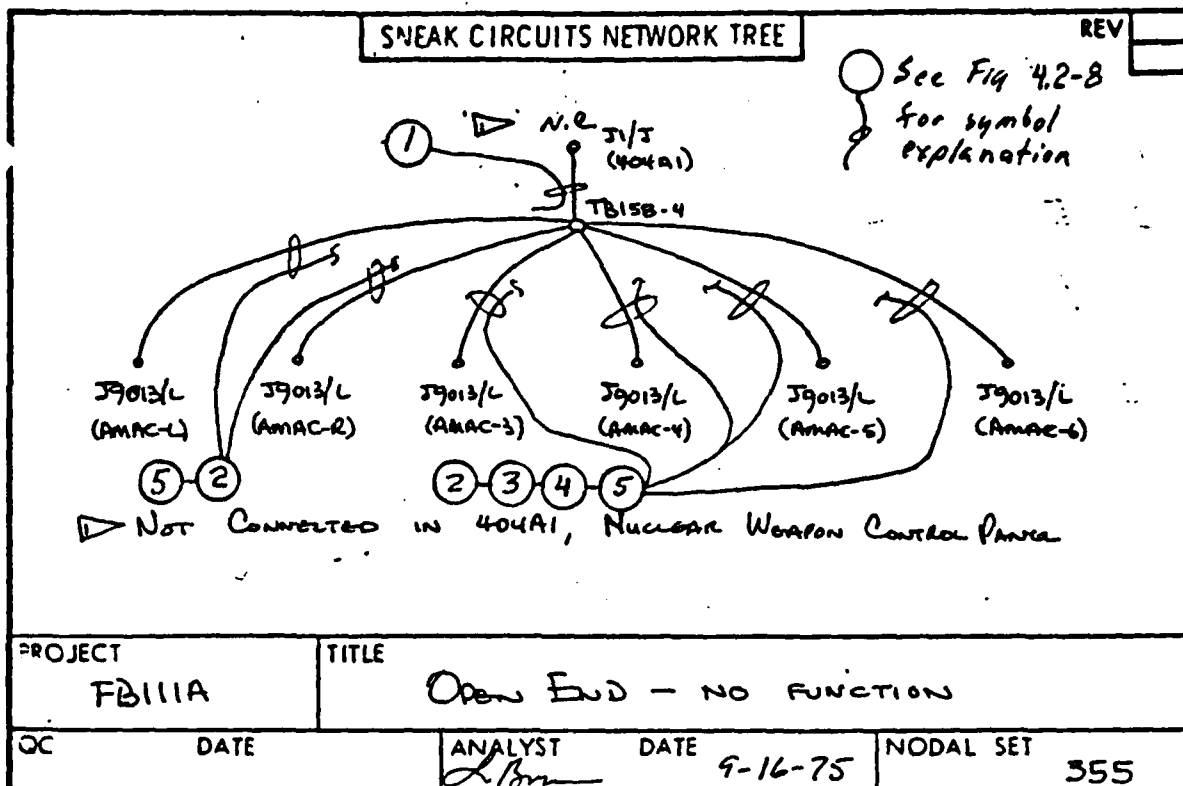
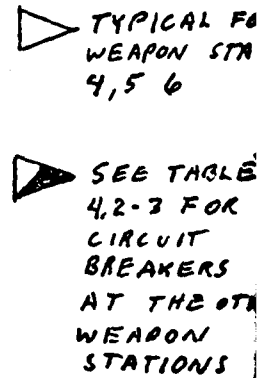


FIGURE 4.2-10. NETWORK TREES 355 AND 356



4-187

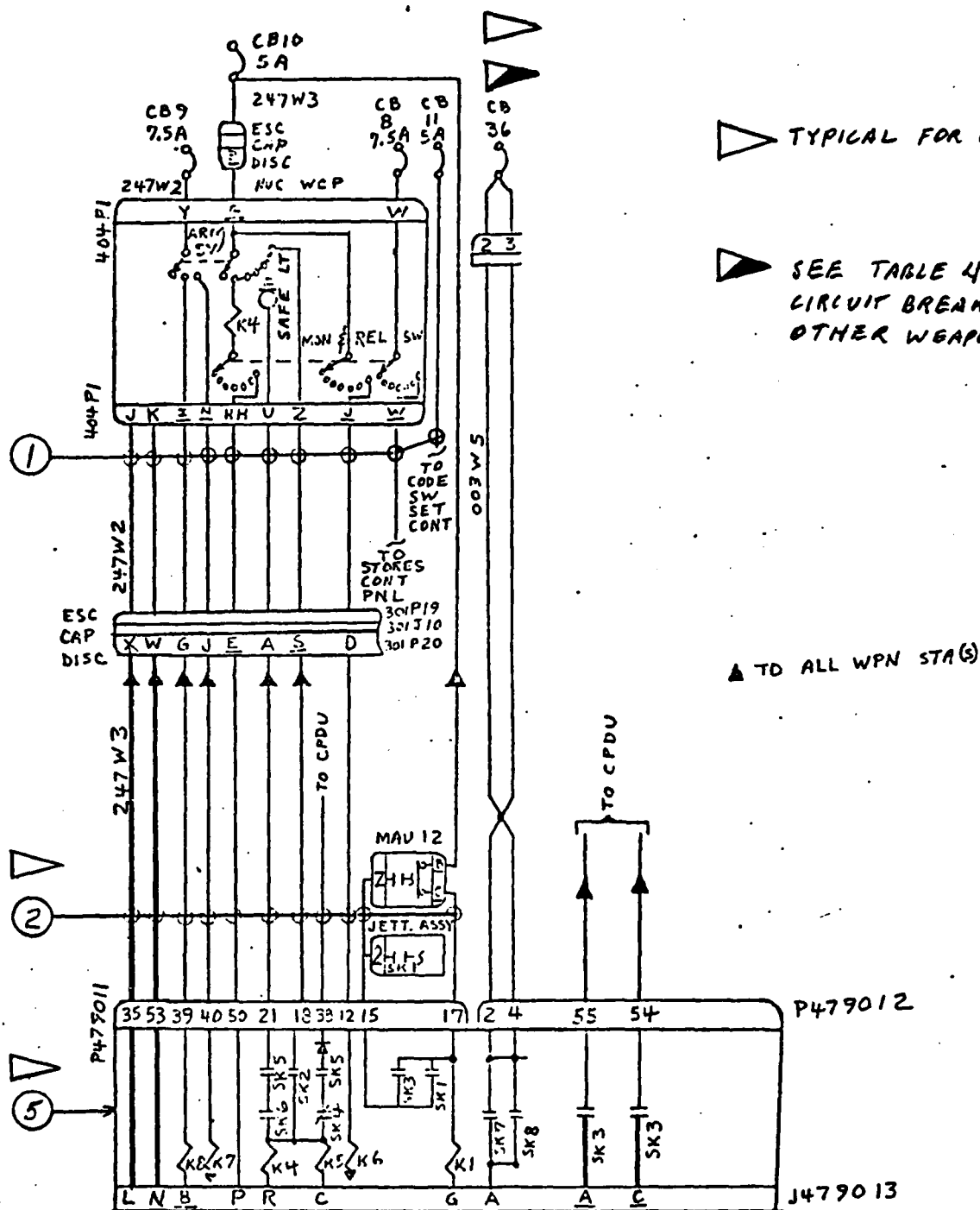


FIGURE 4.2-12. FAULT DIAGRAM WEAPON STATION R

4.2.6.3 (Continued)

TABLE 4.2-3
POTENTIAL FAULT POWER SOURCES

FIGURE INDICATOR	CIRCUIT BREAKER	POWER
①	CB8 (7.5A) UNIT 314A1	28VDC CREW STA ESS BUS
	CB9 (7.5A) UNIT 314A1	28VDC CREW STA ESS BUS
	CB11 (5A) UNIT 314A1	28VDC CREW STA ESS BUS
	CB10 (5A) UNIT 304A1	28VDC ESS BUS
② ③	CB9 (7.5A) UNIT 314A1	28VDC CREW STA ESS BUS
	CB10 (5A) UNIT 304A1	28VDC ESS BUS
④	CB9 (7.5A) UNIT 314A1	28VDC CREW STA ESS BUS
	CB10 (5A) UNIT 304A1	28VDC ESS BUS
	CB20 (20A) UNIT 305A1	115VAC 400Hz L MAIN BUS
	CB21 (20A) UNIT 305A1	115VAC 400Hz L MAIN BUS
	CB22 (20A) UNIT 305A1	115VAC 400Hz L MAIN BUS
	CB12 (35A) UNIT 315A1	28VDC MAIN BUS
	CB39 (20A) UNIT 304A1	28VDC ESS BUS
	CB38 (20A) UNIT 304A1	28VDC ESS BUS
	CB29 (35A) UNIT 315A1	28VDC MAIN BUS
	CB19 (20A) UNIT 305A1	115VAC 400Hz L MAIN BUS
	CB32 (20A) UNIT 305A1	115VAC 400Hz L MAIN BUS
	CB33 (20A) UNIT 305A1	115VAC 400Hz L MAIN BUS
	CB35 (20A) UNIT 304A1	28VDC ESS BUS
	CB13 (35A) UNIT 315A1	28VDC MAIN BUS
	CB16 (20A) UNIT 305A1	115VAC, 400Hz R MAIN BUS
	CB17 (20A) UNIT 305A1	115VAC, 400Hz R MAIN BUS
	CB18 (20A) UNIT 305A1	115VAC, 400Hz R MAIN BUS
	CB34 (20A) UNIT 304A1	28 VDC ESS BUS
	CB30 (35A) UNIT 315A1	28VDC MAIN BUS
	CB26 (20A) UNIT 305A1	115VAC, 400Hz, R MAIN BUS
	CB24 (20A) UNIT 305A1	115VAC, 400Hz, R MAIN BUS
	CB23 (20A) UNIT 305A1	115VAC, 400Hz, R MAIN BUS
⑤	CB9 (7.5A) UNIT 314A1	28VDC CREW STA ESS BUS
	CB10 (5A) UNIT 304A1	28VDC ESS BUS
	CB39 (20A) UNIT 304A1	28VDC ESS BUS
	CB36 (20A) UNIT 304A1	28VDC ESS BUS
	CB37 (20A) UNIT 304A1	28VDC ESS BUS
	CB38 (20A) UNIT 304A1	28VDC ESS BUS
	CB35 (20A) UNIT 304A1	28VDC ESS BUS
	CB34 (20A) UNIT 304A1	28VDC ESS BUS

R> STA R ONLY
6> STA 6 ONLY

L> STA L ONLY
4> STA 4 ONLY

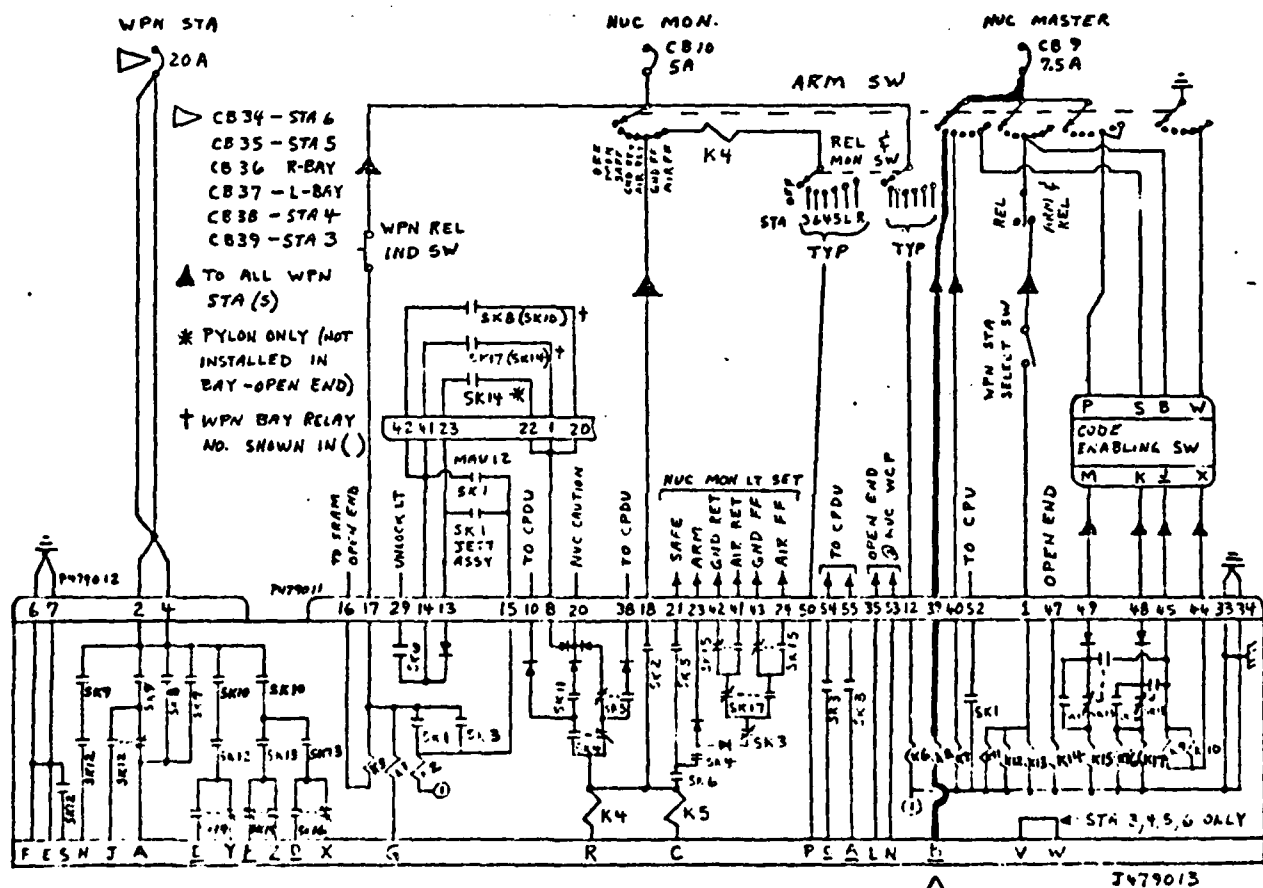
3> STA 3 ONLY

5> STA 5 ONLY

CIRCUIT ANALYSIS PACKAGE

4.2.6.4 Circuit Analysis Package, Weapon Interface Pin b of AMAC SPU-3 and -R (Weapon Station 3 Pylon and Weapon Station R-Bay)

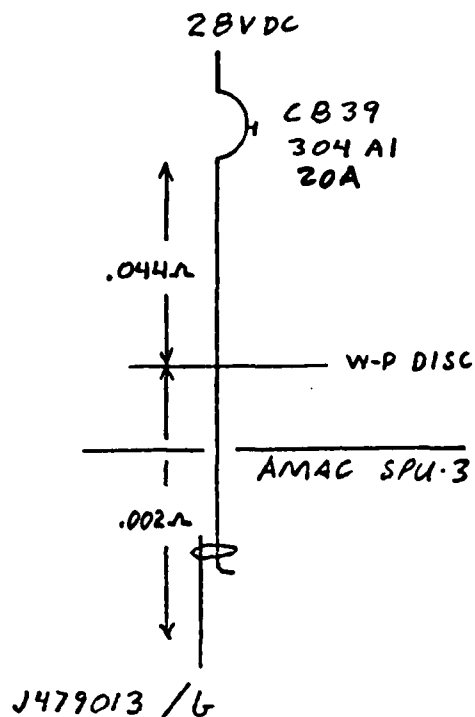
These interfaces are shown in Figure 4.2-13 Sneak Circuits Network Tree 318, Figure 4.2-D, which is a copy of Figure 1-8 from T.O. 1F-111(B)A-2-11-1 (Change 2) showing the circuitry to the pivot pylon weapon station AMAC SPU interfaces and Figure 4.2-F which is a copy of Figure 1-10 from T.O. 1F-111(B)A-2-11-1 (Change 2) showing the circuitry to L and R-Bay AMAC SPU interfaces. Maximum current available to the interfaces in a normal environment is 48 mA (direct current). Worst case current at 28VDC in an abnormal (faulted) environment would be 608 amps for weapon station 3 and 1333 amps for weapon station R. Worst case fault current at 115VAC would be 198 mA for weapon station 3 and R.



4.2.6.4 (Continued)

c. Worst Case Path For Weapon Station 3 at 28VDC

Reference: Path ⑤ from paragraph b.

Total resistance of path = $.046 \Omega$ $V_{OC} = 28VDC$

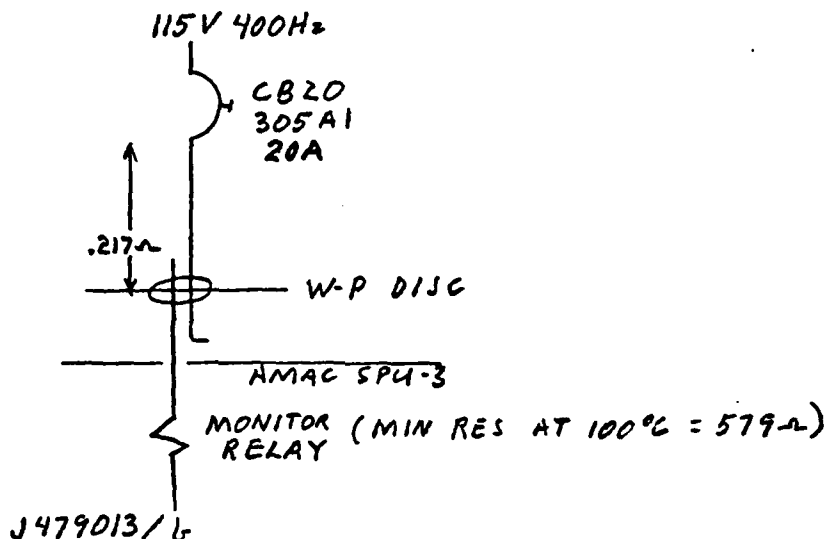
$$I_{SC} = \frac{28}{.046} = 608 \text{ A}$$

Time = Less than .6 seconds at $-54^{\circ}C$ for circuit breaker to open. On ground alert the time to open would be less than .35 seconds at $25^{\circ}C$.

4.2.6.4 (Continued)

d. Worst Case Path for Weapon Station 3 At 115V 400Hz

Reference path ④ from paragraph b.

Total resistance of path $\approx 580 \Omega$

$$V_{OC} = 115V \text{ 400Hz}$$

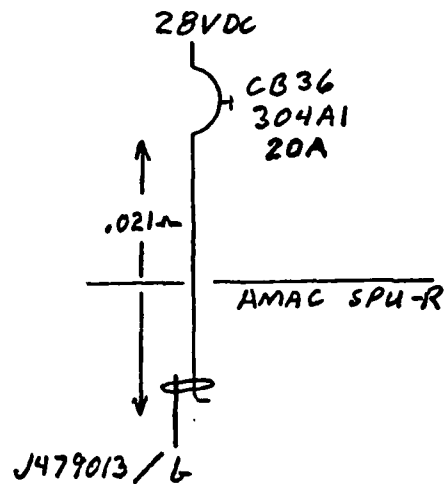
$$I_{SC} = \frac{115}{580} = 198 \text{ mA}$$

Per telecon with relay manufacturer, Leach, the thermistor and varistor inside the relay will probably open at this voltage causing a net increase in resistance. At 25°C this is 800 Ω resulting in an I_{SC} of 144 mA.

4.2.6.4 (Continued)

e. Worst Case Path For Weapon Station R At 28VDC

Reference path ⑤ from paragraph b.

Total resistance of path = .021 Ω

$$V_{OC} = 28VDC$$

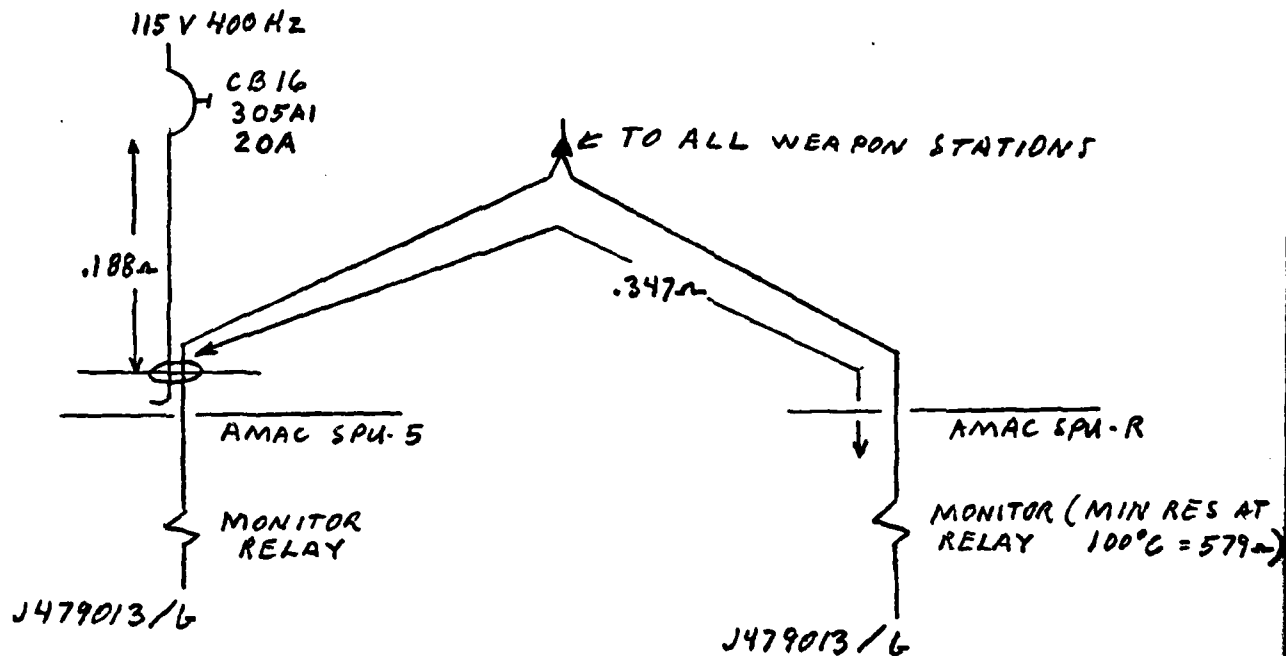
$$I_{SC} = \frac{28}{.021} = 1333 \text{ A}$$

Time = Less than .6 seconds at $-54^{\circ}C$ for circuit breaker to open.On ground alert the time to open would be less than .35 seconds at $25^{\circ}C$.

4.2.6.4 (Continued)

f. Worst Case Path for Weapon Station R at 115V 400Hz

Reference path ④ from paragraph b.

Total resistance of path $\approx 580 \Omega$

$$V_{OC} = 115V \text{ 400 Hz}$$

$$I_{SC} = \frac{115}{580} = 198 \text{ mA}$$

Per telecon with relay manufacturer, Leach, the thermistor and varistor inside the relay will probably open at this voltage causing a net increase in resistance. At 25°C this would be 800 Ω resulting in an I_{SC} of 144 mA.

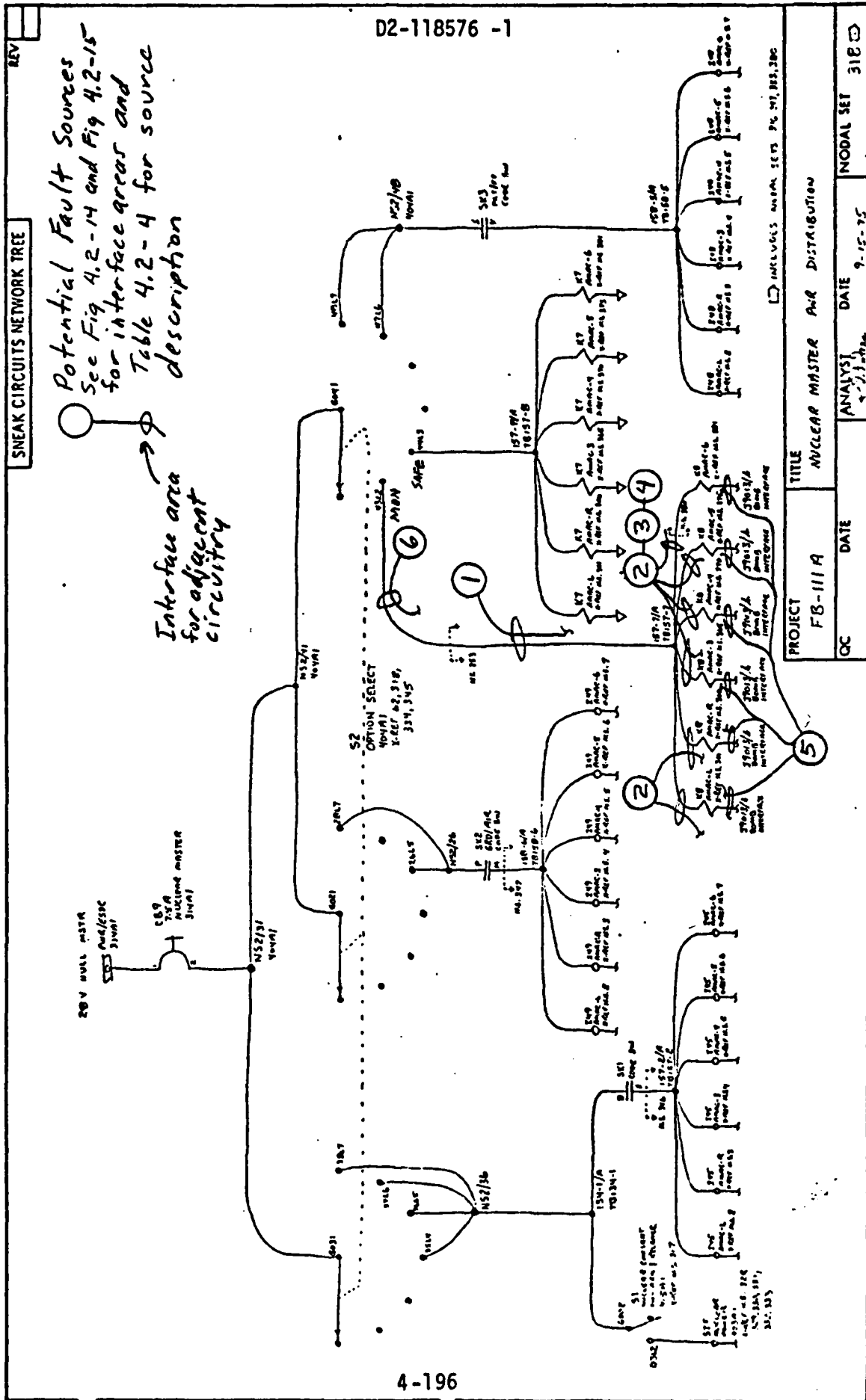
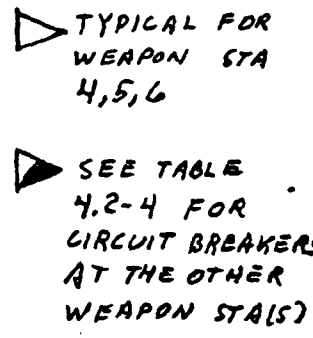


FIGURE 4.2-13. NETWORK TREE 318



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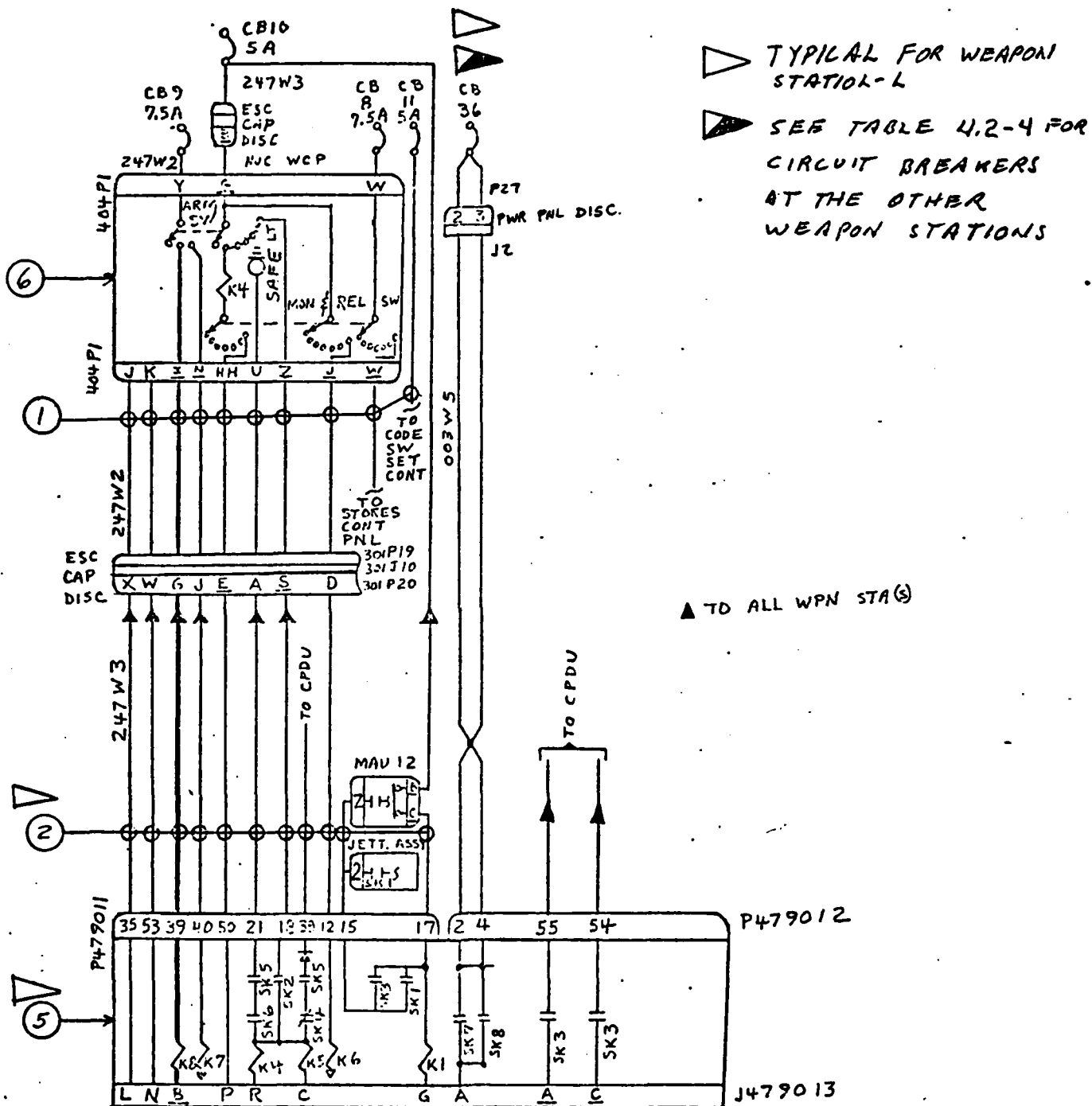


FIGURE 4.2-15 FAULT DIAGRAM WEAPON STATION R

2.6.4 (Continued)

TABLE 4.2-4
POTENTIAL FAULT POWER SOURCES

FIGURE INDICATOR	CIRCUIT BREAKER	POWER
①	CB8 (7.5A) UNIT 314A1	28VDC CREW STA ESS BUS
	CB9 (7.5A) UNIT 314A1	28VDC CREW STA ESS BUS
	CB11 (5A) UNIT 314A1	28VDC CREW STA ESS BUS
	CB10 (5A) UNIT 304A1	28VDC ESS BUS
② ③	CB9 (7.5A) UNIT 314A1	28VDC CREW STA ESS BUS
	CB10 (5A) UNIT 304A1	28VDC ESS BUS
④	CB9 (7.5A) UNIT 314A1	28VDC CREW STA ESS BUS
	CB10 (5A) UNIT 304A1	28VDC ESS BUS
	CB20 (20A) UNIT 305A1	115VAC 400Hz L MAIN BUS
	CB21 (20A) UNIT 305A1	115VAC 400Hz L MAIN BUS
	CB22 (20A) UNIT 305A1	115VAC 400Hz L MAIN BUS
	CB12 (35A) UNIT 315A1	28VDC MAIN BUS
	CB39 (20A) UNIT 304A1	28VDC ESS BUS
	CB38 (20A) UNIT 304A1	28VDC ESS BUS
	CB29 (35A) UNIT 315A1	28VDC MAIN BUS
	CB19 (20A) UNIT 305A1	115VAC 400Hz L MAIN BUS
	CB32 (20A) UNIT 305A1	115VAC 400Hz L MAIN BUS
	CB33 (20A) UNIT 305A1	115VAC 400Hz L MAIN BUS
	CB35 (20A) UNIT 304A1	28VDC ESS BUS
	CB13 (35A) UNIT 315A1	28VDC MAIN BUS
	CB16 (20A) UNIT 305A1	115VAC, 400Hz R MAIN BUS
	CB17 (20A) UNIT 305A1	115VAC, 400Hz R MAIN BUS
	CB18 (20A) UNIT 305A1	115VAC, 400Hz R MAIN BUS
	CB34 (20A) UNIT 304A1	28 VDC ESS BUS
	CB30 (35A) UNIT 315A1	28VDC MAIN BUS
	CB26 (20A) UNIT 305A1	115VAC, 400Hz, R MAIN BUS
	CB24 (20A) UNIT 305A1	115VAC, 400Hz, R MAIN BUS
	CB23 (20A) UNIT 305A1	115VAC, 400Hz, R MAIN BUS
⑤	CB9 (7.5A) UNIT 314A1	28VDC CREW STA ESS BUS
	CB10 (5A) UNIT 304A1	28VDC ESS BUS
	CB39 (20A) UNIT 304A1	28VDC ESS BUS
	CB36 (20A) UNIT 304A1	28VDC ESS BUS
	CB37 (20A) UNIT 304A1	28VDC ESS BUS
	CB38 (20A) UNIT 304A1	28VDC ESS BUS
	CB35 (20A) UNIT 304A1	28VDC ESS BUS
	CB34 (20A) UNIT 304A1	28VDC ESS BUS
⑥	CB8 (7.5A) UNIT 314A1	28VDC CREW STA ESS BUS
	CB9 (7.5A) UNIT 314A1	28VDC CREW STA ESS BUS
	CB10 (5A) UNIT 304A1	28VDC ESS BUS

③ STA R ONLY
⑥ STA 6 ONLY

④ STA L ONLY
④ STA 4 ONLY

③ STA 3 ONLY

⑤ STA 5 ONLY

4.2.6.5 (Continued)

a. Normal Power and Load Analysis

Reference: Figures 4.2-16 and 4.2-17 Network Tree 1, Figure 4.2-18 Network Tree 334, Monitor-Relay Technical Data

From examination of the network tree

$$V_{OC} = 28\text{VDC}$$

$$I_{SC} = \frac{28}{579} = 48 \text{ mA for pin G}$$

$$I_{SC} = \frac{28}{579} = 48 \text{ mA for pins R\&C when the Option Select switch on the Nuclear Weapons Control Panel is in any position except off.}$$

b. Fault Analysis

Reference: Figure 4.2-16 and 4.2-17 Network Tree 1, Figure 4.2-18 Network Tree 334, Figure 4.2-19 Fault Diagram for Weapon Station 3 and Figure 4.2-20 Fault Diagram for Weapon Station R.

Since the wiring to pins C, G, and R is bussed to all nuclear weapons stations any 28VDC or 115V 400Hz power that might fault into these circuits for any weapon station will propagate to all weapon stations.

① Wiring Harness 247 W2 Damaged

Wires to pin C or R shorted to 28VDC. See Table 4.2-5 for voltage sources.

② Wiring Harness 247 W3 Damaged

Wires to pin C, G or R shorted to 28VDC. See Table 4.2-5 for voltage sources.

③ Wiring Harness 247 W14, 247 W15, Wing Fuselage

Disconnect 308 J13, 308 J14, 309 J13, 309 J14 or Pylon 3, 4, 5, or 6 Wing-Pylon Disconnect Damaged

Wires to pin C, G, or R shorted to 28VDC. See Table 4.2-5 for voltage sources.

4.2.6.5 (Continued)

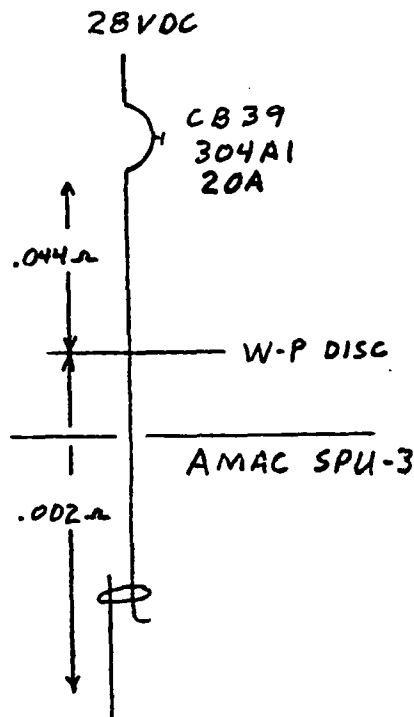
b. (Continued)

- ④ Pylon 3, 4, 5, 6 Wiring Harness 351 W1, 351 W2, 354 W1, 354 W2 or Pylon Disconnect J613 Damaged
Wires to pin C, G, or R shorted to 28VDC or 115V 400 Hz. See Table 4.2-5 for voltage sources.
- ⑤ AMAC SPU Damaged
Wires to pin C, G, or R shorted to 28VDC. See Table 4.2-5 for voltage sources.
- ⑥ Nuclear Weapons Control Panel Damaged
Wires to pin C or R shorted to 28VDC. See Table 4.2-5 for voltage sources.

4.2.6.5 (Continued)

c. Worst Case Path For Weapon Station 3 at 28 VDC

Reference path ⑤ from paragraph b.



J479013/C (Typical for G and R)

Total resistance of path = .046 Ω $V_{OC} = 28VDC$

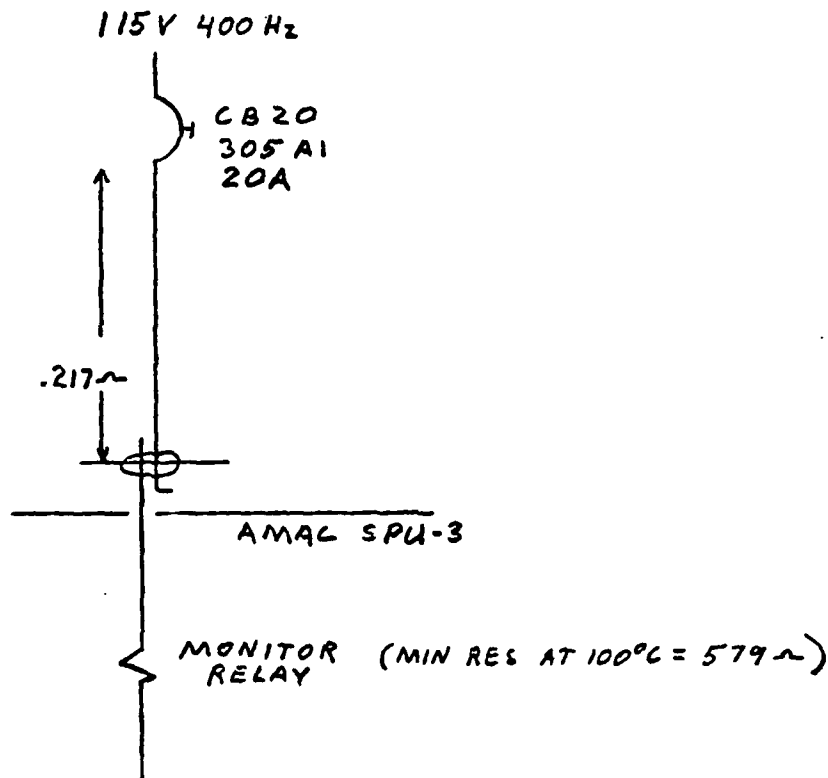
$$I_{SC} = \frac{28}{.046} = \underline{608} \text{ A}$$

Time = Less than .6 seconds at $-54^{\circ}C$ for circuit breaker to open.On ground alert at $25^{\circ}C$, the time to open would be less than .35 seconds.

4.2.6.5 (Continued)

d. Worst Case Path for Weapon Station 3 at 115V 400Hz

Reference path ④ from paragraph b.



J479013/C (Typical for G and R)

Total resistance of path $\approx 580 \Omega$

$$V_{OC} = 115V \text{ 400Hz}$$

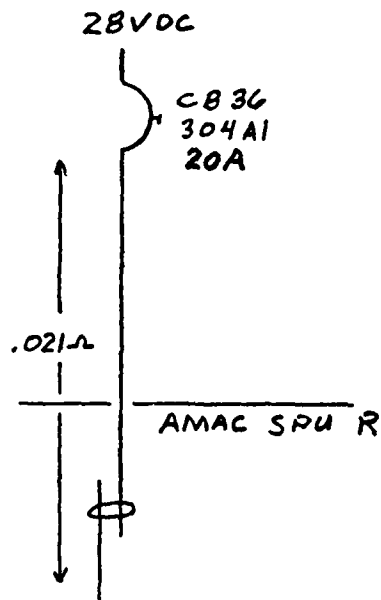
$$I_{SC} = \frac{115}{580} = 198 \text{ mA}$$

Per telecon with relay manufacturer, Leach, the thermistor and varistor inside the relay will probably open at this voltage causing a net increase in resistance. At 25°C this is 800 ohms resulting in an I_{SC} of 144 mA.

4.2.6.5 (Continued)

e. Worst Case Path for Weapon Station R at 28VDC

Reference path ⑤ from paragraph b.



J479013/C (Typical for R and C)

Total resistance of path = .021 Ω

$$V_{OC} = 28VDC$$

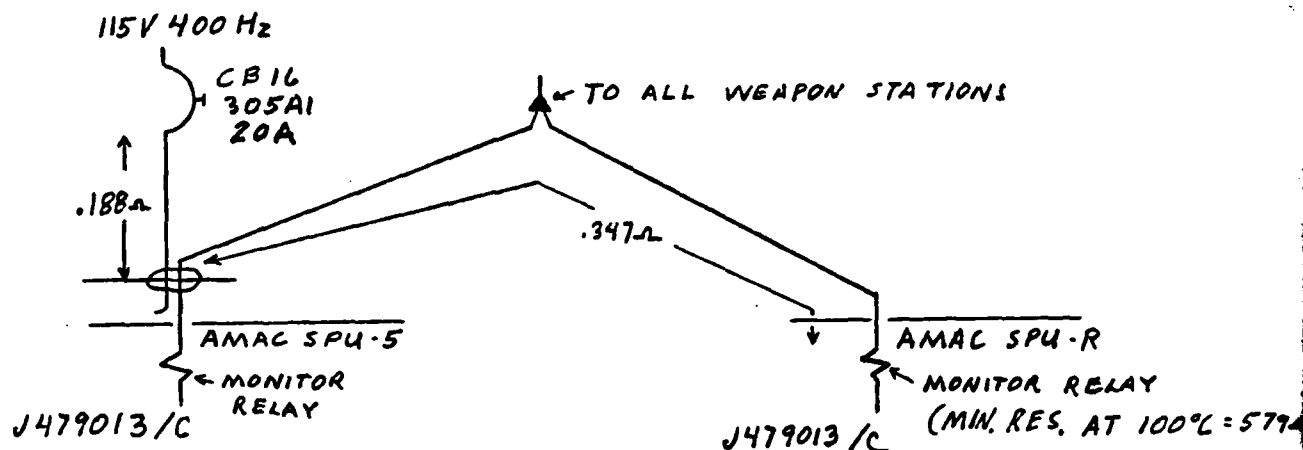
$$I_{SC} = \frac{28}{.021} = 1333 \text{ A}$$

Time = Less than .6 seconds at $-54^{\circ}C$ for circuit breaker to open.On ground alert at $25^{\circ}C$, the time to open would be less than .35 seconds.

4.2.6.5 (Continued)

f. Worst Case Path for Weapon Station R at 115V 400Hz

Reference path (4) from paragraph b.



Typical for G and R

Total resistance of path approximately 580 ohms

$$V_{OC} = 115V \text{ 400Hz}$$

$$I_{SC} = \frac{115}{580} = \underline{198 \text{ mA}}$$

Per telecon with relay manufacturer, Leach, the thermistor and varistor inside the relay will probably open at this voltage causing a net increase in resistance. At 25°C this would be approximately 800 ohms resulting in an I_{SC} of 144 mA.

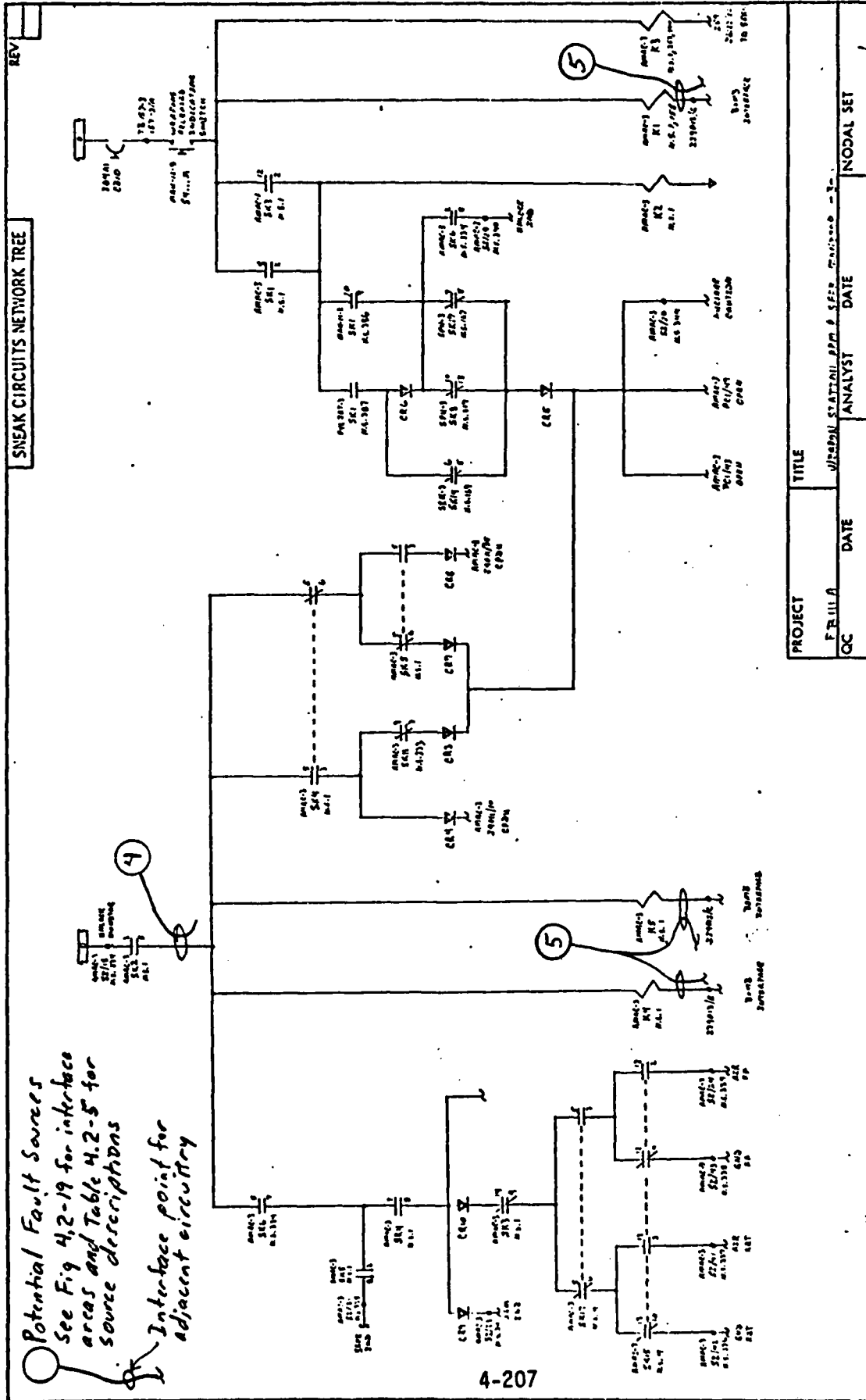


FIGURE 4.2-16 NETWORK TREE/STATION 3

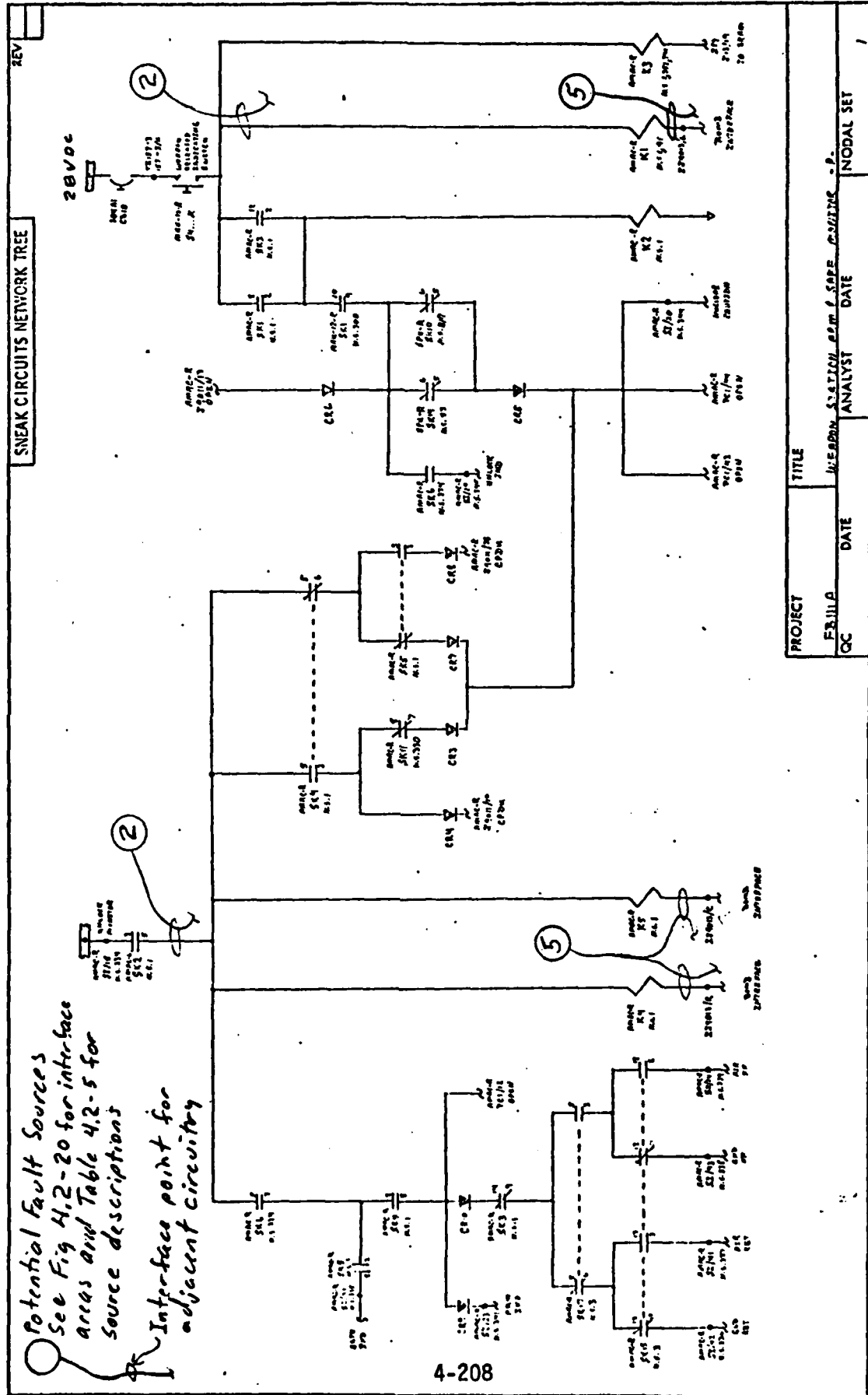


FIGURE 4.2-17 NETWORK TREE/STATION R

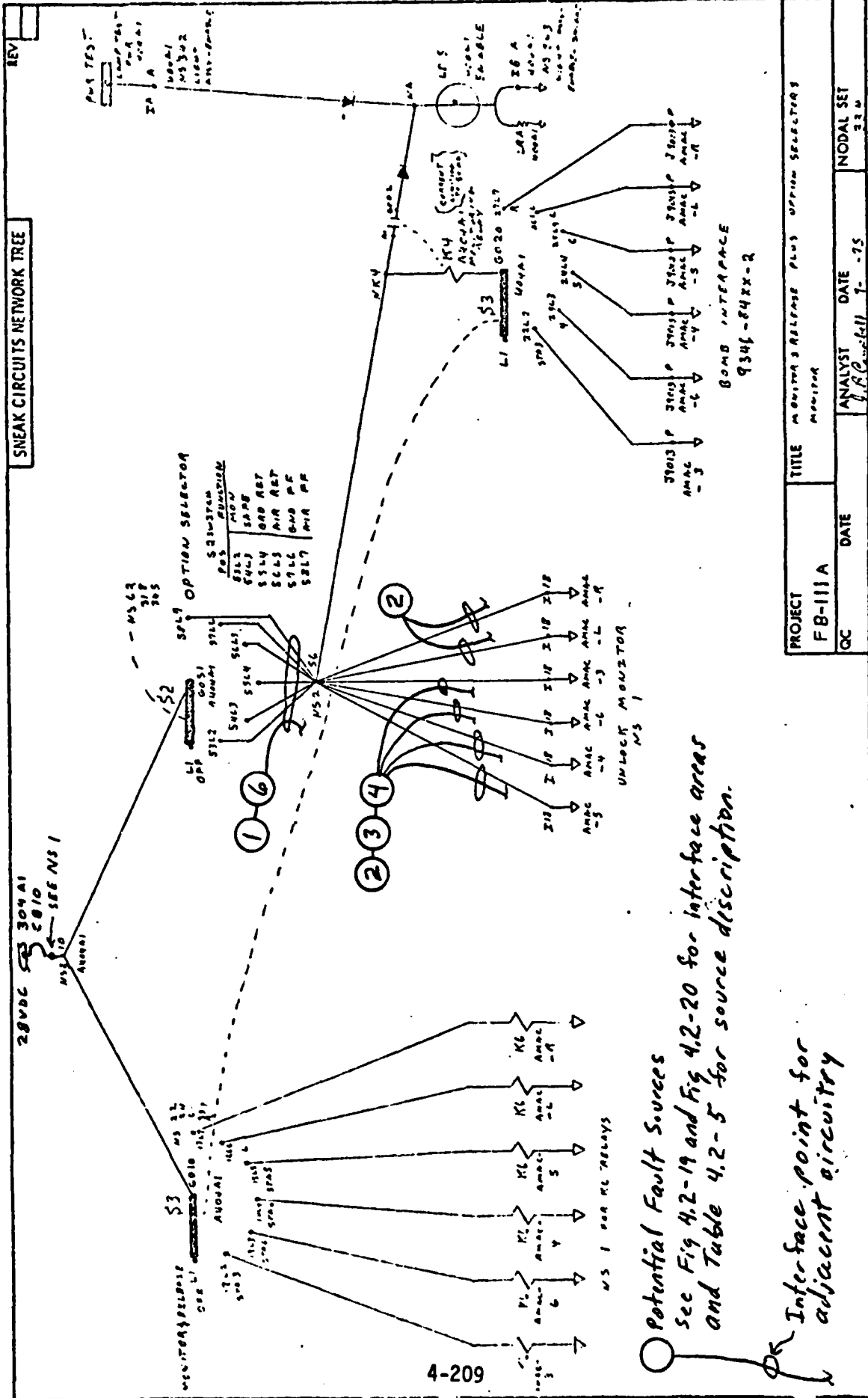
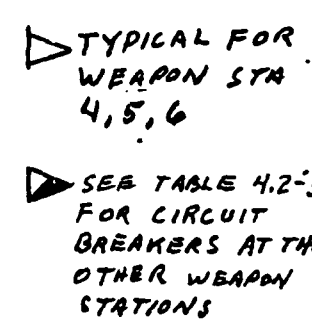


FIGURE 4.2-18 NETWORK TREE 33A



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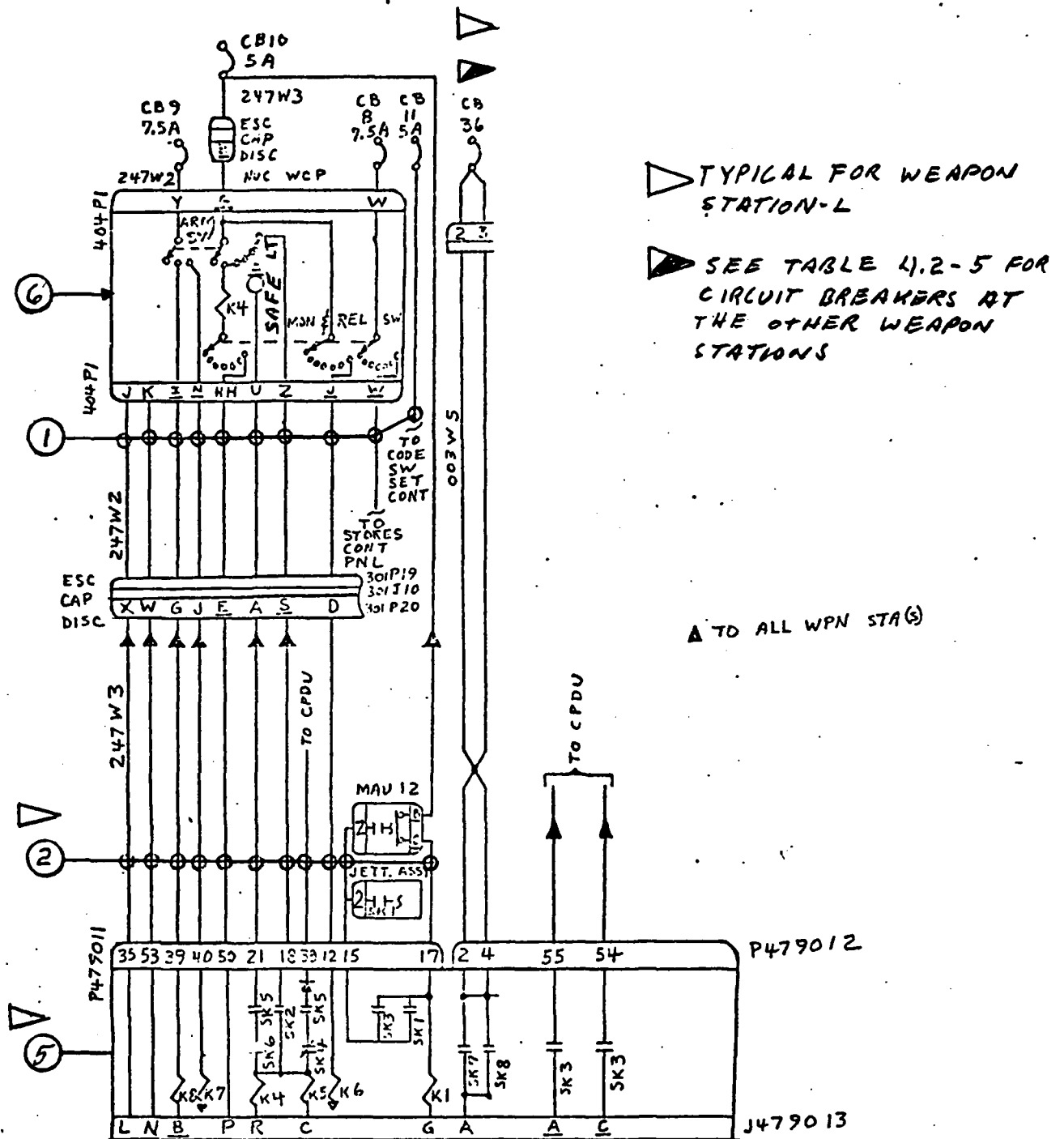


FIGURE 4.2-20 FAULT DIAGRAM WEAPON STATION R

4.2.6.5 (Continued)

TABLE 4.2-5
POTENTIAL FAULT POWER SOURCES

FIGURE INDICATOR	CIRCUIT BREAKER	POWER
①	CB8 (7.5A) UNIT 314A1	28VDC CREW STA ESS BUS
	CB9 (7.5A) UNIT 314A1	28VDC CREW STA ESS BUS
	CB11 (5A) UNIT 314A1	28VDC CREW STA ESS BUS
	CB10 (5A) UNIT 304A1	28VDC ESS BUS
② ③	CB9 (7.5A) UNIT 314A1	28VDC CREW STA ESS BUS
	CB10 (5A) UNIT 304A1	28VDC ESS BUS
④	CB9 (7.5A) UNIT 314A1	28VDC CREW STA ESS BUS
	CB10 (5A) UNIT 304A1	28VDC ESS BUS
	CB20 (20A) UNIT 305A1	115VAC 400Hz L MAIN BUS
	CB21 (20A) UNIT 305A1	115VAC 400Hz L MAIN BUS
	CB22 (20A) UNIT 305A1	115VAC 400Hz L MAIN BUS
	CB12 (35A) UNIT 315A1	28VDC MAIN BUS
	CB39 (20A) UNIT 304A1	28VDC ESS BUS
	CB38 (20A) UNIT 304A1	28VDC ESS BUS
	CB29 (35A) UNIT 315A1	28VDC MAIN BUS
	CB19 (20A) UNIT 305A1	115VAC 400Hz L MAIN BUS
	CB32 (20A) UNIT 305A1	115VAC 400Hz L MAIN BUS
	CB33 (20A) UNIT 305A1	115VAC 400Hz L MAIN BUS
	CB35 (20A) UNIT 304A1	28VDC ESS BUS
	CB13 (35A) UNIT 315A1	28VDC MAIN BUS
	CB16 (20A) UNIT 305A1	115VAC, 400Hz R MAIN BUS
	CB17 (20A) UNIT 305A1	115VAC, 400Hz R MAIN BUS
	CB18 (20A) UNIT 305A1	115VAC, 400Hz R MAIN BUS
	CB34 (20A) UNIT 304A1	28 VDC ESS BUS
	CB30 (35A) UNIT 315A1	28VDC MAIN BUS
	CB26 (20A) UNIT 305A1	115VAC, 400Hz, R MAIN BUS
	CB24 (20A) UNIT 305A1	115VAC, 400Hz, R MAIN BUS
	CB23 (20A) UNIT 305A1	115VAC, 400Hz, R MAIN BUS
⑤	CB9 (7.5A) UNIT 314A1	28VDC CREW STA ESS BUS
	CB10 (5A) UNIT 304A1	28VDC ESS BUS
	CB39 (20A) UNIT 304A1	28VDC ESS BUS
	CB36 (20A) UNIT 304A1	28VDC ESS BUS
	CB37 (20A) UNIT 304A1	28VDC ESS BUS
	CB38 (20A) UNIT 304A1	28VDC ESS BUS
	CB35 (20A) UNIT 304A1	28VDC ESS BUS
	CB34 (20A) UNIT 304A1	28VDC ESS BUS
⑥	CB8 (7.5A) UNIT 314A1	28VDC CREW STA ESS BUS
	CB9 (7.5A) UNIT 314A1	28VDC CREW STA ESS BUS
	CB10 (5A) UNIT 304A1	28VDC ESS BUS

 STA R ONLY
 STA 6 ONLY

 STA L ONLY
 STA 4 ONLY

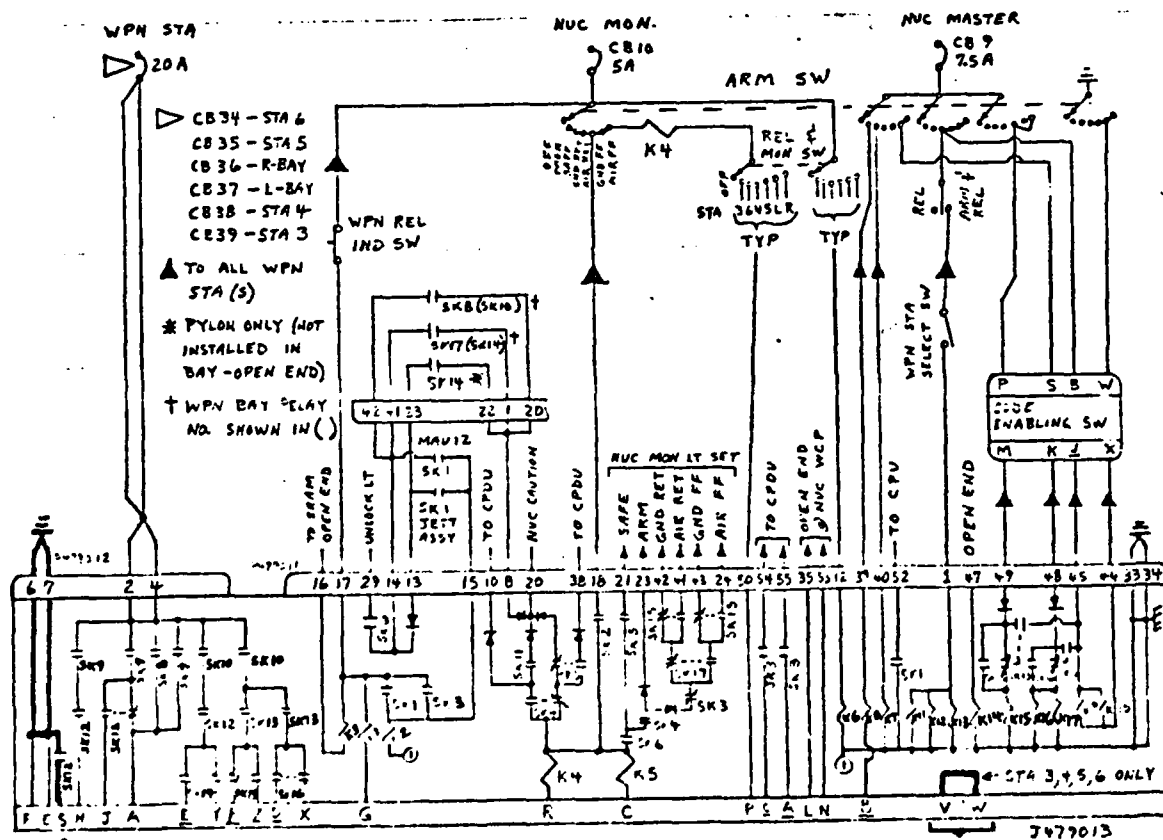
 STA 3 ONLY

 STA 5 ONLY

CIRCUIT ANALYSIS PACKAGE

4.2.6.6 Circuit Analysis Package Weapon Interface Pins S, V and W of AMAC SPU-3 and -R (Weapon Station 3 Pylon and Weapon Station R Bay)

These interfaces are shown in Figures 4.2-21 and 4.2-22 Sneak Circuit Network Trees 364 and 360, Figure 4.2-D, which is a copy of Figure 1-8 from T.O. 1F-111(B)A-2-11-1 (Change 2) showing the circuitry to the pivot pylon weapon station AMAC SPU interfaces and Figure 4.2-F which is a copy of Figure 1-10 from T.O. 1F-111(B)A-2-11-1 (Change 2) showing the circuitry to L and R-Bay AMAC SPU interfaces. Maximum current and voltage to pin S interface in a normal environment is 0. Current and voltage to pins V and W in a normal environment is controlled by the weapon itself. Worst case current at 28VDC in an abnormal faulted environment is 608 amps for Pins S, V and W for weapon station 3. Worst case fault current at 28VDC for weapon station R is 1333 amps at pin S.



AMAC SPU INTERFACE

4.2.6.6 (Continued)

a. Normal Power and Load Analysis

Pin S

Reference figures 4.2-21 and 4.2-22 Network Trees 364 and 360. Relay K12 in the AMAC SPU is only energized when an arming function is being commanded. From inspection of the network trees

$$V_{OC} = 0 \text{ V}$$

$$I_{SC} = \underline{0 \text{ A}}$$

Pins V and W

Reference Figure 4.2-23 Fault Diagram for Weapon Station 3

Pins V and W are connected only to each other only in the pylon AMAC SPU's. Thus the power is determined by the weapon circuitry.

b. Fault Analysis

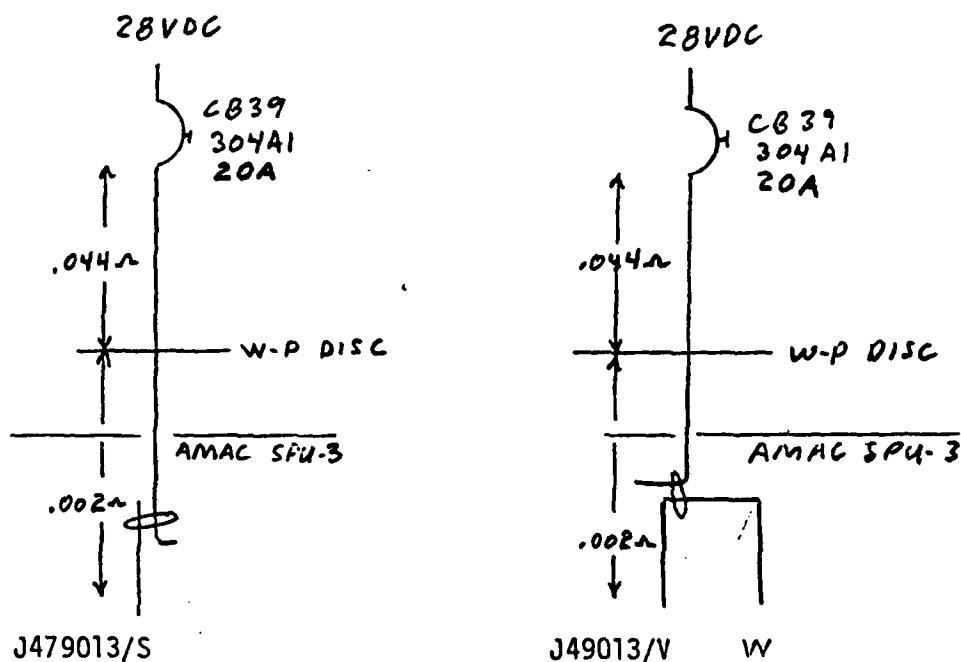
Reference Figure 4.2-21 Network Tree 364, Figure 4.2-22 Network Tree 360, Figure 4.2-23 Fault Diagram Weapon Station 3 and Figure 4.2-24 Fault Diagram Weapon Station - R.

① AMAC SPU Damaged

Wires to subject pins shorted to 28VDC. See Table 4.2-6 for the voltage sources. Since pin S is switching a ground into the weapon and K12 is only energized by an arming command the worst case fault could be relay K12 damaged such that the contacts are shorted or wires to pin S shorted to ground.

c. Worst Case Path for Weapon Station 3

Reference path ① from paragraph b.



For maximum current calculations only one pin at a time is assumed grounded at the weapon interface.

Total resistance of each path = .046 Ω

$$V_{OC} = 28VDC$$

Pin S

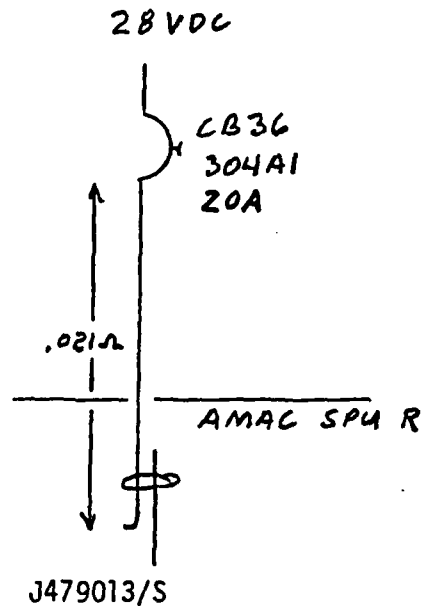
$$I_{SC} = \frac{28}{.046} = \underline{608} \text{ A}$$

Time = Less than .6 seconds at -54°C for the circuit breaker to open. On ground alert at 25°C the time to open would be less than .35 seconds.

4.2.6.6 (Continued)

d. Worst Case Path For Weapon Station R

Reference path ① from paragraph b.

Total resistance at path = $.021\Omega$

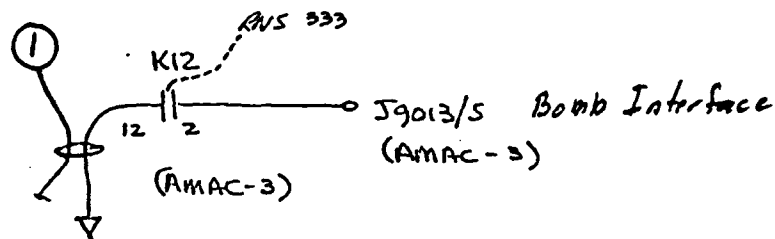
$$V_{OC} = 28VDC$$

$$I_{SC} = \frac{28}{.021} = \underline{1333A}$$

Time = Less than .6 seconds at $-54^{\circ}C$ for the circuit breaker to open. On ground alert at $25^{\circ}C$ the time for the circuit breaker to open would be less than .35 seconds.

SNEAK CIRCUITS NETWORK TREE

REV



"AMAC-3 SPA STATION SELECT" PICKS UP K12 AND SWITCHES GND INTO WEAPON WHEN "OPTION SELECT" SWX. IS IN AN "ARM" POSITION AND "NUCLEAR CONSENT" SWX. IS IN "ARM & RELEASE" POSITION.

Potential Fault Sources
See Fig 4.2- for interface areas
and Table 4.2-6 for source descriptions

Interface point for adjacent circuitry

PROJECT	TITLE		
FB111A	AMAC-3 "STATION 3 Select"		
QC	DATE	ANALYST	DATE
		L. B. M.	9-18-75
NODAL SET			364

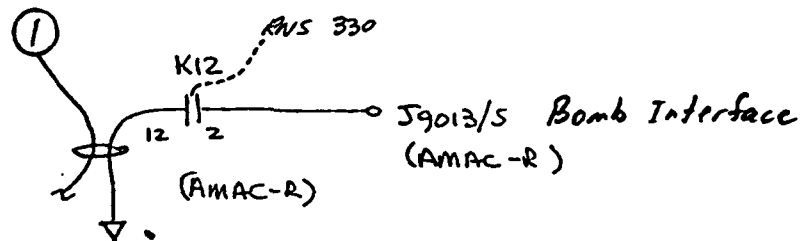
HOU-705

BOEING AEROSPACE COMPANY - HOUSTON, TEXAS

FIGURE 4.2-21. , NETWORK TREE 364

SNEAK CIRCUITS NETWORK TREE

REV



"AMAC-R SPU STATION SELECT" PICKS UP K12 AND SWITCHES AND INTO WEAPON WHEN "OPTION SELECT" SWX IS IN AN "ARM" POSITION AND "NUCLEAR CONSENT" SWX IS IN "ARM & RELEASE" POSITION.

Potential Fault Sources
See Fig 4.2- for interface areas
And Table 4.2-6 for source descriptions.

Interface point for adjacent circuitry

PROJECT FB111A		TITLE AMAC-R "STATION R SELECT"		
QC	DATE	ANALYST <i>L. B. ...</i>	DATE 4-18-75	NODAL SET 360

H011-204

BSEEING AEROSPACE COMPANY - HOUSTON, TEXAS

FIGURE 4.2-22. NETWORK TREE 360

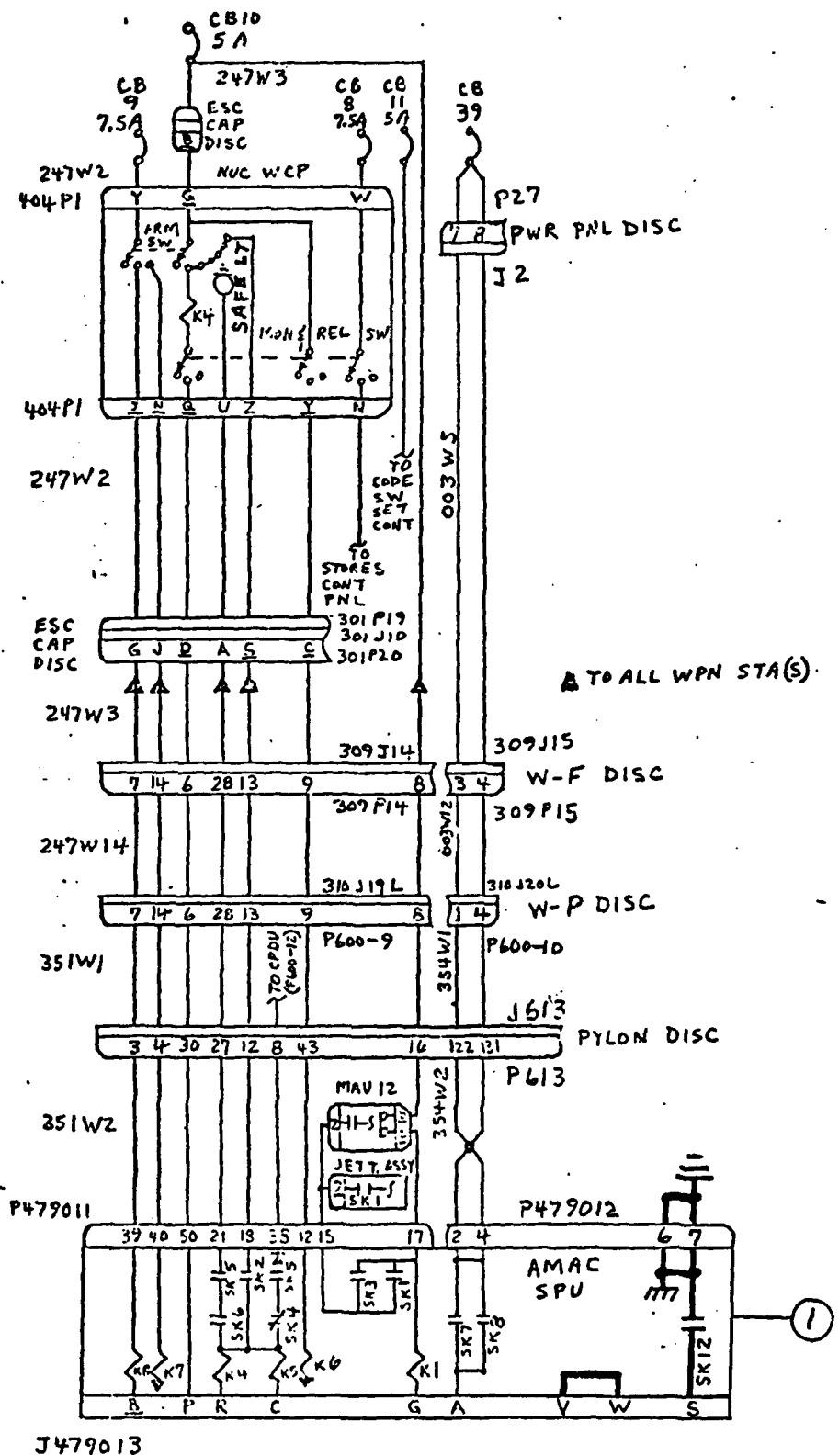


FIGURE 4.2-23. FAULT DIAGRAM WEAPON STATION 3

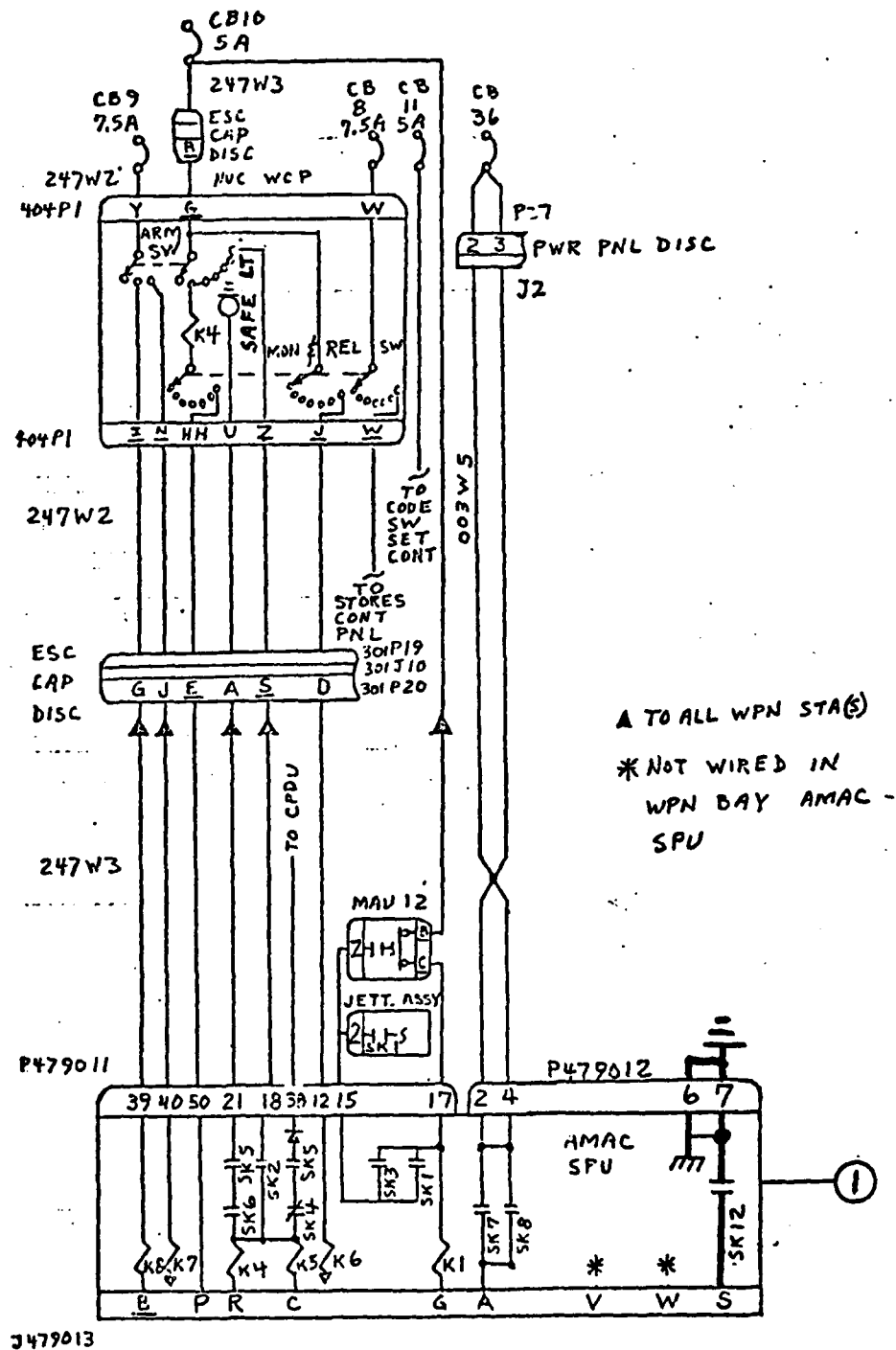


FIGURE 4.2-24. FAULT DIAGRAM WEAPONS STATION R

4.2.6.6 (Continued)

TABLE 4.2-6

FIGURE INDICATOR	CIRCUIT BREAKER	POWER
①	CB9 (7.5A) UNIT 314A1	28VDC CREW STA ESS BUS
	CB10 (5A) UNIT 304A1	28VDC ESS BUS
	*CB36 (20A) UNIT 304A1	28VDC ESS BUS
	**CB39 (20A) UNIT 304A1	28VDC ESS BUS

*STATION R ONLY

**STATION 3 ONLY

4.3 ACCIDENT ANALYSIS

Boeing performed a system safety analysis of B-52 accident data as part of the power and load analysis.

4.3.1 Purpose

The purpose of the accident analysis was to provide generalized electrical damage modes and to determine the conditions under which they are feasible. The goal was to define the abnormal environments in terms of electrical faults that could be reasonably postulated for the power and load analysis of any aircraft.

4.3.2 Source Data

Boeing-Wichita supported this effort by providing data on eleven B-52 aircraft accidents and two incidents where damage to electrical wiring was documented or where nuclear weapons were known to have been carried. Four accidents (Cases 1, 2, 4 and 8) are known to have involved aircraft loaded with nuclear weapons. None of these weapons was detonated. The source material does not show that any stray power actually reached the weapon interfaces and Boeing investigators are unaware of any such findings. It is believed that all instances of weapons departing the aircraft involved structural failure due to inflight breakups and violent gyrations. Two taxi accidents (Cases 3 and 13) involved collision with the inboard external stores station. Damage would probably have been the same if other aircraft or large vehicles had struck parked B-52 aircraft. There are two instances of wheel well fire due to tire or hydraulic line failure (Cases 10 and 12). Other feasible locations for fire are crew compartment spaces where gear can be improperly stowed (Case 2); electrical equipment compartments (Case 7) or connectors exposed to excessive moisture (Case 6). Disintegrating engine components are feasible sources of shrapnel damage (Case 11) to electrical circuitry. Table 4.3-1 is a summary of the source data.

TABLE 4.3-1 CRASH/FIRE DAMAGE-SOURCE DATA

CASE NO.	DESCRIPTION	AIRCRAFT IDENTITY	DATE	LOCATION	REMARKS
1	Wing Skin Failed during air refueling	B-52G 58-187	1-23-61	Goldsboro, N.C.	Was armed with nuclear weapons
2	Fire in rear of crew compartment lower deck	B-52G 58-188	1-21-68	Thule, Greenland	Was armed with nuclear weapons
3	Taxi collision with parked KC-97 tankers	B-52G 58-197	7-30-63	Plattsburgh, AFB	
4	Mid-air collision with KC-135 tanker	B-52G 58-256	1-17-66	SE Coast of Spain	Was armed with four nuclear weapons
5	Separation of forward fuselage due to hard nose gear landing	B-52H 60-006	6-3-74	Wright Patterson AFB	
6	Electrical fire in connector due to moisture	B-52C 54-2671	11-20-68	New Hampshire	
7	ALT/68 Power Supply fire	B-52F 57-154	12-10-70	California	
8	Structural breakup due to exceeding 80° bank angle in turbulence	B-52D 55-060	1-13-64	Cumberland, Md.	Was armed with nuclear weapons
9	Mid-air collision with tanker. Wing failed upon landing	B-52D 55-098	12-15-60	Larson AFB, Washington	
10	Brake fire	B-52D 55-115	11-3-68	Kadena AFB, Okinawa	
11	LH inboard engine starter disintegrated	B-52D 56-606	11-17-66	Pease AFB, N.H.	
12	Hydraulic/electrical fire from blown tire damage	B-52F 57-053	8-6-62	Barksdale AFB, Louisiana	
13	Collision with parked KC-135	B-52F 57-139	1-31-64	Columbus AFB, Mississippi	GAM-77 penetrated nose of KC-135

4.3.4 Crash/Fire Damage Analysis

The damage analysis shows that electrical faults in abnormal environments are usually caused by structural breakups, fire or both. Damage mechanisms are either excessive physical forces, or high temperatures. In summary, the principle causes of damages to electrical circuits are:

- o CRASH DUE TO COLLISION OR STRUCTURAL BREAKUP

- o FIRE DUE TO:

- CRASH

- TIRE/HYDRAULIC FAILURE

- ELECTRICAL FAILURE

- IMPROPER STOWAGE

Table 4.3-2 shows the causes and effects of electrical damage for the cases selected from the source data.

4.3.4 Findings

The accident analysis found that almost any electrical fault mode is feasible under conditions of crash or fire. This includes opens, shorts to power and shorts to ground. These faults can occur in wiring, components or equipment assemblies. The most likely locations are leading edges of wings and struts, wheel well areas, equipment bays and crew compartments. There is at least one instance where weapons bay components were probably damaged during initial breakup. These findings are shown in Table 4.3-3.

TABLE 4.3-2 CRASH/FIRE DAMAGE ANALYSIS

SET 1 OF 2

CASE NO.	OPERATIONAL MODE	ABNORMAL ENVIRONMENT	CAUSE	DAMAGE MECHANISM	ELECTRICAL CIRCUIT EFFECT(S)	ELECTRICAL FAULT(S)	PRIMARY LOCATION
1.	FLIGHT - REFUELING/PRELANDING CHECKS	CRASH/FIRE	STRUCTURAL BREAKUP OF RIGHT HAND WING.	TENSION ON WING WIRING FOLLOWED BY VIOLENT INERTIAL FORCES, IMPACT WITH GROUND AND FIRE.	WIRE BUNDLES SEVERED OPEN, AND GROUNDED TO STRUCTURE. COMPONENTS CRUSHED	ADJACENT WIRE BUNDLES FAULTED OPEN. ALL EQUIPMENT FAULTED TO GROUND.	ALL INBOARD WING WIRING.
2.	FLIGHT - CRUISE	FIRE	FOAM RUBBER SEAT CUSHION STONED ON NAVIGATOR'S HOT AIR SPRAY TUBE UNDER SEAT.	HEAT FROM FIRE INTENSIFIED BY AIR BLAST AFTER ESCAPE HATCH JETTISONED.	WIRE BUNDLES MELTED TOGETHER.	ADJACENT WIRE BUNDLES SHORTED TOGETHER.	CREW COMPARTMENT.
3.	GROUND - TAXI	CRASH	COLLISION WITH PARKED AIRCRAFT DUE TO BRAKE FAILURE.	IMPACT FORCES	CHARRED INSULATION IN WIRE BUNDLES.	ADJACENT WIRE BUNDLES SHORTED TOGETHER.	INBOARD LEADING EDGE AT EXTERNAL STORES MOUNT.
4.	FLIGHT - REFUELING	CRASH/FIRE	BREAKUP OF FUSELAGE AT FORWARD BOMB BAY DUE TO COLLISION WITH TANKER, FOLLOWED BY SPIN AND IN-FLIGHT FIRE, ENDING WITH SCATTERED GROUND IMPACTS AND FIRES.	VIOLENT FORCES DUE TO IMPACT, INERTIA, GRAVITY AND WIND, FOLLOWED BY INTENSE FIRE, GROUND IMPACT AND FUEL-FED GROUND FIRES.	CRUSHED AND SEVERED WIRING.	ADJACENT WIRES SHORTED TOGETHER. ADJACENT WIRE BUNDLES FAULTED OPEN OR SHORTED TO COMMON GROUND.	WEAPONS BAY IN FUSELAGE.
5.	FLIGHT - LANDING	CRASH	FORWARD FUSELAGE SEPARATED FROM REST OF AIRCRAFT ON INITIAL FRONT GEAR IMPACT DUE TO FAILURE TO FLARE AIRCRAFT.	SUDDEN TENSILE IMPACT LOADS ON WIRING.	WIRE BUNDLES SEVERED OPEN, AND GROUNDED TO STRUCTURE. COMPONENTS CRUSHED. WIRES PINCHED TOGETHER. WIRE BUNDLES MELTED TOGETHER.	ADJACENT WIRE BUNDLES FAULTED OPEN. ADJACENT BUNDLES SHORTED TO COMMON GROUND. ALL EQUIPMENT SHORTED TO GROUND. ADJACENT WIRE BUNDLES SHORTED TOGETHER.	BODY PRODUCTION BREAK BULKHEAD FORWARD OF WING CENTER SECTION.
6.	FLIGHT - LANDING APPROACH	FIRE	LOWER NOSE RADOME ELECTRICAL FIRE CAUSED BY ELECTRICAL SHORT IN CONNECTOR DUE TO MOISTURE IN THE PLUG.	HEAT AND ARCING.	WIRE BUNDLES: SEVERED OPEN AND GROUNDED TO STRUCTURE.	ADJACENT WIRE BUNDLES FAULTED OPEN. ADJACENT WIRE BUNDLES SHORTED TO COMMON GROUND.	FORWARD RADOME PRESSURIZED BULKHEAD.
7.	FLIGHT - CRUISE	FIRE	MATERIAL FAILURE OF TRANSFORMER IN POWER SUPPLY PANEL.	EXPLOSION OF POWER SUPPLY FOLLOWED BY ELECTRICAL FIRE.	CRACKED INSULATORS BETWEEN PINS IN BULKHEAD CONNECTORS.	SHORT CIRCUITS BETWEEN ADJACENT PINS. LOSS OF POWER TO CIRCUITS FED BY TRANSFORMER. SHORT CIRCUITS, OPENS AND SHORTS TO GROUND ON WIRING IN AREA.	CREW COMPARTMENT EQUIPMENT BAY.

TABLE 4.3-2 CRASH/FIRE DAMAGE ANALYSIS (SHEET 2 OF 2)

CASE NO	OPERATIONAL MODE	ABNORMAL ENVIRONMENT	CAUSE	DAMAGE MECHANISM	ELECTRICAL CIRCUIT EFFECT(S)	ELECTRICAL FAULT(S)	PRIMARY LOCATION
8.	FLIGHT-CRUISE	CRASH/FIRE	AIRCRAFT FAILED STRUCTURALLY IN TURBULENCE - EXCESSIVE BANK ANGLE	VIOLENT FORCES DUE TO INERTIA, GRAVITY & WIND FOLLOWED BY IMPACT & FIRE	WIRE BUNDLES SEVERED, PINCHED TOGETHER, GROUNDED & MELTED	ADJACENT WIRES SHORTED TOGETHER	OUTER WING AND AFT FUSELAGE. (NO WEAPON CIRCUITRY)
9.	FLIGHT-REFUELING/LANDING	CRASH/FIRE	MID-AIR COLLISION WITH TANKER WING FAILURE AND FIRE AFTER LANDING	IMPACT FORCES ON RH INBOARD WING LEADING EDGE TENSILE FORCES & GND FIRE	WIRES PINCHED TOGETHER WIRE BUNDLES SEVERED & GROUNDED TO STRUCTURE WIRE BUNDLES MELTED TOGETHER	ADJACENT WIRES SHORTED TOGETHER ADJACENT WIRE BUNDLES SHORTED TO COMMON GROUND. ADJACENT WIRE BUNDLES SHORTED TOGETHER	INBOARD WING ROOT LEADING EDGE
10.	GROUND-POST-LANDING TAXI	FIRE	PRESSURIZED HYDRAULIC FLUID LEAK ON BRAKE FRICTION SURFACE	HEAT & FLAMES FROM BURNING HYDRAULIC FLUID & TIRES	WIRE BUNDLES MELTED TOGETHER ELECTRICAL COMPONENTS HEAT DAMAGED	ADJACENT WIRE BUNDLES SHORTED TOGETHER ALL EQUIP FAULTED TO GND	MAIN GEAR WHEEL WELL
11.	FLIGHT-TAKEOFF	FIRE	NO. 4 ENGINE STARTER TURBINE DISINTEGRATED	SHRAPNEL FROM TURBINE WHEEL FOLLOWED BY FIRE	WIRE BUNDLES SEVERED WIRES PINCHED TOGETHER	ADJACENT WIRE BUNDLES OPEN ADJACENT WIRES SHORTED TOGETHER	INBOARD WING LEADING EDGE
12.	FLIGHT-TAKEOFF	FIRE	TIRE FAILURE SEVERED HYDRAULIC LINES AND ELECTRICAL WIRING	BLOWN TIRE SECTIONS STRUCK RELAYS AND WIRING	WIRING SEVERED & GROUNDED TO STRUCTURE RELAYS CRUSHED	ADJACENT WIRE BUNDLES SHORTED TO COMMON GROUND. RELAYS FAULTED OPEN AND CLOSED	MAIN GEAR WHEEL WELL
13.	GROUND-TAXI	CRASH	COLLISION WITH PARKED AIRCRAFT DUE TO FAILED BRAKES AND STEERING	METAL SHEARING & CRUSHING	WIRE BUNDLES SEVERED OPEN OR SHORTED TO COMMON GROUND WIRES PINCHED TOGETHER	ADJACENT WIRE BUNDLES FAULTED OPEN SHORTED TO COMMON GROUND ADJACENT WIRES SHORTED TOGETHER	LOWER FORWARD CREW COMPARTMENT & LEADING EDGE OF EXTERNAL STORES MOUNTING STRUCTURE

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TABLE 4.3-3 CRASH/FIRE DAMAGE ANALYSIS FINDINGS

<u>DAMAGE MODES</u>	<u>FEASIBLE LOCATIONS</u>	<u>ELECTRICAL FAULTS</u>
- o WIRE BUNDLES SEVERED - o WIRING PINCHED TOGETHER - o WIRING SHORTED TO STRUCTURE - o WIRE BUNDLES MELTED TOGETHER - o ELECTRICAL COMPONENTS HEAT DAMAGED - o RELAYS CRUSHED - o COMPONENTS CRUSHED - o WIRE BUNDLE INSULATION CHARRED - o CRACKED INSULATORS BETWEEN PINS	- o INBOARD WING LEADING EDGE - o INBOARD WING ROOT - o EXTERNAL STORES STRUT LEADING EDGE - o MAIN LANDING GEAR WHEEL WELL - o LOWER FORWARD CREW COMPARTMENT - o CREW COMPARTMENT EQUIPMENT BAYS - o WEAPONS BAY IN FUSELAGE - o BODY PRODUCTION BREAK BULKHEAD FORWARD OF WING	- o ADJACENT WIRES SHORTED TOGETHER. - o ADJACENT WIRE BUNDLES FAULTED OPEN, OR SHORTED TO COMMON GROUND. - o ALL EQUIPMENT IN AN ASSEMBLY SHORTED TO GROUND. - o SHORT CIRCUITS BETWEEN ADJACENT PINS. - o LOSS OF POWER FED BY FAULTED COMPONENT.

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BOEING AEROSPACE CO HOUSTON TX

F/G 15/6

ELECTRICAL ANALYSIS OF B-52/FB-111 AMAC AND RELEASE CIRCUITRY U--ETC(U)

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4.3.5 Conclusions

As a result of the accident analysis, the abnormal environments were defined in terms of generalized fault modes for use in the power and load analyses of B-52 and FB-111 aircraft nuclear weapon circuitry. It was concluded that under crash/fire conditions, wire-to-wire short circuits were confined to common cables and connectors in all known cases. It was also concluded that internal short circuits may result from any wire contacting any other wire in the same component. The accident analysis confirmed that faults postulated for the power and load analysis are feasible.

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APPENDIX A

B-52G/FB-111A

TECHNICAL DATA UTILIZED
FOR POWER AND LOAD ANALYSIS

TABLE A1
B-52G DOCUMENTATION

B-52G DOCUMENTS

T.O. NUMBER	DATE	REV.	TITLE
1B-52G-1	4/15/75	Change 1	B-52G Flight Manual
1B-52G-2-12	12/20/74	Change 55	Electrical Systems and Data
1B-52G-2-14	9/30/74	Change 15	Airplane Systems Wiring Diagrams and Data
1B-52G-2-23	12/15/74	Change 16	Electronic Wiring Diagrams and Data
1B-52G-2-26	5/30/75	Change 8	Bombing-Navigational System
1B-52G-2-31	3/1/75	Change 38	Bomb Release System
1B-52G-2-39GA-1	1/15/75		B-52/AGM-69A Weapon System

TABLE A1
B-52G DOCUMENTATION (Continued)

BOEING DRAWINGS

DRAWING NUMBER	REVISION	TITLE
21A13198	D	Equipment Diagram Distribution Processor Group, Signal Data, B-52
25-2866	B	Box Installation Right Hand Forward DC Power
25-3541	AA	Equipment Installation Electrical, Section 41
25-5049	F	Power Box Assembly - DC Right Hand Forward (Item A216)
25-5067	D	Power Box Assembly - DC Left Hand Forward (A217)
25-5231	G	Panel Installation Circuit Breaker, RH Load Central (A113)
25-5235	K	Panel Installation Circuit Breaker, Aft BNS Overhead (A174)
25-5557	C	Shield Installation DC Power LH Forward
25-7231	E	Electrical Bundle - Bomb IND Panel, Assy
25-7383	E	Electrical Bundle - Inflight Control & Monitor Assembly
25-7410	G	Electrical Bundle - Control Flare Programming, Assy
25-8054	P	Equipment Installation LH Side Panel, BNS Operations' Station
25-10091	A	Equipment Installation - Panel Stowage, Special Weapons
25-12066	B	Fuse Installation - TR Unit No. LH DC Power Box, Kit
25-12403	L	Electrical Installation - Armament Provisions, Kit
31-3516		Wire Harness
31-3564		Wire Harness
35-5417	D	Electrical Bundle - Section 43, Assy of

BOEING DRAWINGS

Drawing Number	REVISION	TITLE
35-5419	E	Electrical Bundle - Section 43 Assy of
35-5427	H	Electrical Bundle - Section 41, Assy of
35-5497	D	Electrical Bundle - Section 43, Assy of
35-5531	D	Electrical Bundle - Section 41, Assy of
35-11014	B	Shield Instl. DC Power, LH FWD (A217)
35-11016	L	Panel Instl. - Circuit Breaker, RH Load Central (A113)
35-11301	F	Power Shield Assy DC, LH Fwd (A217)
35-11302	F	Power Shield, Assy - DC RH Fwd
35-11362	A	Electrical Bundle - Simplified Weapon Provision - Kit, Assy of
35-12642	F	Panel Assy, Pilots Readiness SW
35-12749	C	Package Instl. - Radar Pressure, BNS
35-12778	E	Panel Installation - Pilots Readiness (D&W) Switch
35-12938	A	Electrical Bundle - Section 43, Assy of
35-12939	C	Electrical Bundle - Section 43, Assy of
35-13009	D	Electrical Bundle - Armament Prov's Wiring, Assy of
35-13562	C	Electrical Bundle - Control Flare Programming, Assy of
35-13810	A	Relay Installation - In-Flight Control, Fwd and Aft
35-13841	E	Kit Installation - Readiness P/W Switch For Nuclear Safety
35-14355	B	Electrical Bundle - Inflight Control and Monitor, Assy of

TABLE A1
B-52G DOCUMENTATION (Continued)

Page 3

BOEING DRAWINGS

DRAWING NUMBER	REVISION	TITLE
35-18096	B	Kit Installation - Resistance Improv Monitor Control Circuits
35-27389	A	Circuit Breaker Instl. Kit - LH Fwd DC Power Box, AGM69A, (A217)
35-28617	C	Controller Instal. Kit - Coded Switch Set and P/L
35-28618	B	Relay Location Instl. Kit - In-Flight Control, Fwd & Aft and P/L
35-28621	A	Switch Installation Kit - Code Enabling and P/L
35-29121	D	Wiring Harness Instal. Kit - Coded Switch Set and P/L
35-29257	T	Wiring Harness Instl. Kit - AGM-69A Missile System Provisions
35-58616	A	Interconnection Box Instl. Kit - Coded Switch System
39-24573	Basic	Panel Assy Kit - IFC Power Select, Battery & Xmfr. Rect.
39-24574	Basic	Panel Instal. Kit - DCU - 9A Power, BNS Side Console

B-52G DOCUMENTATION (Continued)

AUTONETICS DRAWINGS

Drawing Number	REVISION	TITLE
WL30892-501	A	Wire List - Network Interconnect Memory/Logic
30863-501	C	Sch. Dia.-No. 1 Input Output Network
30867-501	B	Sch. Dia.-No. 2 Input Output Network
30871-501	A	Sch. Dia.-No. 1 Arithmetic Control Network
30875-501	B	Sch. Dia.-No. 2 Arithmetic Control Network
30879-501	A	Sch. Dia. - Power Control and Clock Network
30883-501	A	Sch. Dia. - Digit Network
30887-501	B	Sch. Dia. - Selection Network
30891-501	D	Sch. Dia. - Current Source and Timing Network
31701-501	B	Sch. Dia. - Voltage Regulator
31707-501	Basic	Sch. Dia. - Filtering Network
31710-501	Basic	Sch. Dia. - Timing Network
31715-501	Basic	Sch. Dia. - Regulator, Voltage-Series
31721-501	Basic	Sch. Dia. - Power Converter

TABLE A1
B-52G DOCUMENTATION (Continued)

AUTONETICS

DRAWING NUMBERS	REVISION	SHEETS	TITLE
WL30892-501-1	A	218	Wire List - Network Interconnect Memory/Logic
30863-501	Basic	1	Schematic Diagram - No. 1 Input Output Network
	B	2	
	Basic	3	
	C	4	
	C	5	
	C	6	
	Basic	7	
	A	8	
	C	9	
	Basic	10	
	C	11	
30867-501	Basic	1	Schematic Diagram - No. 2 Input Output Network
	Basic	2	
	Basic	3	
	Basic	4	
	Basic	5	
	B	6	
	Basic	7	
	A	8	
	A	9	
	Basic	10	
	B	11	
30871-501	Basic	1	Schematic Diagram - No.1 Arithmetic Control Network
	A	2	
	A	3	
	Basic	4	
	A	5	
	A	6	
	A	7	
	A	8	
	A	9	
	A	10	
	A	11	
	A	12	
	A	13	
	A	14	
30875-501	Basic	1	Schematic Diagram - No. 2 Arithmetic Control Network
	Basic	2	
	Basic	3	
	Basic	4	
	Basic	5	
	Basic	6	
	Basic	7	
	Basic	8	
	Basic	9	
	Basic	10	

TABLE A1
B-52G DOCUMENTATION (Continued)

AUTONETICS

DRAWING NUMBERS	REVISION	SHEETS	TITLE
30875-501 (Cont.)	Basic	11	Schematic Diagram - No. 2 Arithmetic Control Network
	Basic	12	
	A	13	
	Basic	14	
	Basic	15	
	B	16	
30879-501	Basic	1	Schematic Diagram - Power Control and Clock Network
	Basic	2	
	Basic	3	
	Basic	4	
	A	5	
30883-501	Basic	1	Schematic Diagram - Digit Network
	A	2	
	A	3	
	A	4	
	A	5	
30887-501	Basic	1	Schematic Diagram - Selection Network
	Basic	2	
	Basic	3	
	A	4	
	B	5	
	B	6	
30891-501	Basic	1	Schematic Diagram - Current Source And Timing Network
	C	2	
	D	3	
31701-501	Basic	1	Schematic Diagram - Voltage Regulator
	B	2	
31707-501	Basic	1	Schematic Diagram - Filtering Network
31710-501	Basic	1	Schematic Diagram - Timing Network
31715-501	Basic	1	Schematic Diagram - Regulator, Voltage Series
31721-501	Basic	1	Schematic Diagram - Power Converter
21A11007	Basic	2001.001	Power Regulator Unit

TABLE A2
FB-111 DOCUMENTATION

DOCUMENT NUMBER	TITLE
T.O. 1F-111(B)A-2-1	General Aircraft Information
T.O. 1F-111(B)A-2-11-1	Armament Systems
T.O. 1F-111(B)A-2-13-1	Electrical Power & Lighting Systems
T.O. 1F-111(B)A-2-14	Wiring Diagrams
T.O. 11B29-3-25-2	Aircraft Bomb Ejector Rack Assy
T.O. 11B29-3-25-12	Aircraft Bomb Ejector Rack Assy
T.O. 11F9-2-2, -3, -4	Electronic Command Signals Programmer
T.O. 11F97-2-2, -3, -4	Electronic Command Signals Programmer
T.O. 11G18-2-9-2, -4	Stores Control Panel
T.O. 11N-T5036-2-3-4	Station Program Units
T.O. 11N-T5037-2-3-4	Control Monitor DCU-137A
T.O. 11N-T5054-2-3-4	Station Program Units
T.O. 11N-T5055-2-3-4	Station Program Units
T.O. 16W6-23-2	Weapons System Pivot Pylon Assy
---	Minutes of the Nuclear Weapons F-111 Model, Designation, and Series Project Officers Meeting (NW F-111 MDS POM 74-2)
Report - Leach Corp. to General Dynamics Corp. File No. 222-19-68 Dated March 26, 1968	Subject: Monitor Relay (9324-8245) Technical Data
Memo Leach Corp. to General Dynamics Corp. (No Number) Dated September 26, 1968	None - Referencing above report with corrections and additional data.
MIL-W-81044	Military Specification for Standard Silver Coated Copper Wire
C2697	General Dynamics Standard SCD for Circuit Breaker - Push-Pull, High Temperature, Trip Free
---	Texas Instrument TC Series Circuit Breaker Data