INTRODUCTION TO APPENDIX D

ITEM 1 - CIRCUIT BREAKER		MC454-0026 / MC454-0032
ITEM 2 - FUSE, AXIAL LEAD / CARTRIDGE		ME451-0009
ITEM 3 - FUSE, HIGH CURRENT		ME451-0016
ITEM 4 - FUSE, PLUG-IN		ME451-0018

FAILURE MODES AND CAUSES:

THE FOLLOWING TABLE LISTS FAILURE MODES AND CAUSES WHICH WERE CONSIDERED IN DERIVING FAILURE MODES AND EFFECTS ANALYSIS (FMEA's) FOR THE ITEMS LISTED ABOVE:

FAILURE MODE	FAILURE CAUSE	CIRCUIT BREAKER	FUSE MC451-0009	FUSE MC451-0016	FUSE MC451-0018
FAILS OPEN, FAILS TO CONDUCT, FAILS TO CLOSE	(a) Structural Failure	X	X	X	X
	(b) Contamination	X	X	X	X
	(c) Vibration	X	X	X	X
	(d) Mechanical Shock	X	X	X	X
	(e) Processing Anomaly	X	X	X	X
	(f) Thermal Stress	X	X	X	X
FAILS CLOSED, FAILS TO OPEN, (MECHANICALLY)	(a) Structural Failure	X			
	(b) Contamination	X			
	(c) Vibration	X			
	(d) Mechanical Shock	X			
	(e) Processing Anomaly	X			
FAILS TO INTERRUPT UNDER OVERLOAD *	(a) Structural Failure	X			

* SEE NEXT PAGE.

APPENDIX D ITEM 3 - FUSE, HIGH CURRENT
ME451-0016-2XXX AND -3XXX

DISPOSITION & RATIONALE
(A) DESIGN, (B) TEST, (C) INSPECTION, (D) FAILURE HISTORY:

(A) DESIGN

ENCLOSURE PROTECTED, INSULATION BLOCK MOUNTED WITH CAST IN STUDS, AND CONFORMALLY COATED.

(B) TEST

QUALIFICATION/CERTIFICATION

HIGH CURRENT FUSES ARE CERTIFIED AS PART OF POWER CONTROL ASSEMBLIES AND/OR MAIN DC POWER DISTRIBUTION ASSEMBLIES. ALL PARTS CONFORM TO SCD ME451-0016 REQUIREMENTS AND ARE QUALIFIED TO MIL-F-5372C PROVISIONS.

QUALIFICATION/CERTIFICATION TEST AND ANALYSIS COMPLETE. CERTIFICATION TESTS INCLUDE:

TEST	CAUSE CONTROL					
	a	b	c	d	e	f
EXAMINATION OF PRODUCT		X			X	
LIFE TEST (1,000 HR TO 500 HR AT -54 °C AND 500 HR AT 125 °C)					X	X
AMBIENT TEMPERATURE INFLUENCE (-54 °C AND 125 °C, TIME/CURRENT AT 500 AND 1,000% OF CURRENT RATING)					X	X
MOISTURE RESISTANCE		X			X	
THERMAL SHOCK	X					X
INDICATOR MELT TIME					X	
SALT SPRAY		X			X	
RANDOM DROP	X			X		
TERMINAL STRENGTH	X				X	
OVERLOAD DAMAGE					X	X
INITIAL LOAD INFLUENCE					X	
VIBRATION (100% LOAD, 25, 125, & -54 °C; 0 TO 1,500 HZ, 0.2 TO 0.0001 IN. D.A.)	X		X		X	

APPENDIX D ITEM 3 CONT'D

TEST (CONTINUED FROM PREVIOUS PAGE)	CAUSE CONTROL					
	a	b	c	d	e	f
TIME-CURRENT CHARACTERISTICS					X	
AC CURRENT RUPTURE					X	
DC CURRENT RUPTURE					X	
EXPLOSION-PROOF TEST					X	
SAND AND DUST		X			X	
ACCELERATION	X					
MECHANICAL SHOCK	X			X		
TERMINAL VOLTAGE DROP					X	
TEMPERATURE RISE					X	X
RATED CURRENT					X	

ACCEPTANCE AND SCREENING

ALL PRODUCTION UNITS ARE SUBJECTED TO 100% ACCEPTANCE TESTING WHICH INCLUDES THE FOLLOWING SCREENS:

TEST	CAUSE CONTROL					
	a	b	c	d	e	f
VISUAL EXAM		X			X	
BURN-IN (2 HR AT 100% CURRENT)		X			X	X
DC RESISTANCE		X			X	
VOLTAGE DROP (HOT)		X			X	X

(C) INSPECTION

RECEIVING INSPECTION (FAILURE CAUSE a,b)

PERFORMS VISUAL AND DIMENSIONAL EXAMINATION OF ALL INCOMING PARTS. FUSE ELEMENT MATERIAL IS VERIFIED. CERTIFICATION RECORDS/TEST REPORTS ARE MAINTAINED CERTIFYING MATERIALS AND PHYSICAL PROPERTIES OF FUSE ELEMENTS.

CONTAMINATION CONTROL (FAILURE CAUSE b)

CONTAMINATION CONTROL PROCESSES AND CORROSION PROTECTION PROVISIONS VERIFIED BY INSPECTION.

APPENDIX D ITEM 3 CONT'D

ASSEMBLY/INSTALLATION (FAILURE CAUSE a,b,e)

ELEMENT MATERIAL REVERIFIED PRIOR TO START OF EACH LOT BUILD. FUSE ELEMENT PLATING THICKNESS VERIFIED AFTER PLATING. VISUAL INSPECTION OF CRITICAL DIMENSIONS PERFORMED IN-PROCESS AND AFTER ASSEMBLY. FUSE ASSEMBLY PERSONNEL ARE RESPONSIBLE FOR DETAILED IN-PROCESS CHECKS, INCLUDING THOSE FOR FOREIGN MATTER, CHIPPED BODY, AND LINK. ALL MANUFACTURING OPERATIONS VERIFIED BY SHOP TRAVELER MANDATORY INSPECTION POINTS (MIP'S).

NONDESTRUCTIVE EVALUATION (NDE) (FAILURE CAUSE a,b,e)

HERMETIC SEAL IS VERIFIED WITH FLUID/DYE PENETRANT UNDER 20X MAGNIFICATION.

CRITICAL PROCESSES (FAILURE CAUSE b,e)

PERIODIC EYE EXAMINATIONS FOR ALL ASSEMBLERS ARE VERIFIED.

TESTING (FAILURE CAUSE b,e,f)

ACCEPTANCE TEST OBSERVED AND VERIFIED BY QUALITY CONTROL (QC) INCLUDING VIBRATION, BURN-IN, DIMENSION CHECK, WEIGHT, DC RESISTANCE, AND CASE LEAKAGE.

HANDLING/PACKAGING (FAILURE CAUSE c,d)

PARTS PACKAGED AND PROTECTED ARE SAMPLE INSPECTED AND VERIFIED BY QC TO APPLICABLE REQUIREMENTS.

(D) FAILURE HISTORY

EXTENSIVE PRIOR PROGRAM USE HISTORY IN APOLLO, SKYLAB, AND COMMERCIAL AIRCRAFT. NO GENERIC FAILURE HISTORY EXISTS.

PREPARED BY:		APPROVED BY:	APPROVED BY (NASA):
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