

## FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CRITICAL HARDWARE

NUMBER: M4-18G-P0015-X

SUBSYSTEM NAME: ELECTRICAL POWER GENERATION - CRYO, GENERIC

REVISION: 1 11/12/91

	PART NAME VENDOR NAME	PART NUMBER VENDOR NUMBER
■ LRU :	DISCONNECT, O2 GAS SUPPLY	MC276-0012-0110
■	FAIRCHILD	74342000-0110
■ LRU :	DISCONNECT, O2 GAS SUPPLY	MC276-0012-1110
■	FAIRCHILD	74342000-1110

## PART DATA

■ EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:  
DISCONNECT, O2 GAS SUPPLY

■ REFERENCE DESIGNATORS: 40V45P0015

■ QUANTITY OF LIKE ITEMS: 1

■ FUNCTION:  
PROVIDES O2 GAS SUPPLY FROM GSE TO FCP'S DURING GROUND OPERATIONS.

FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CRITICAL FAILURE MODE  
NUMBER: M4-1BG-20015-01

REVISION# 1 11/12/91 R  
SUBSYSTEM: ELECTRICAL POWER GENERATION - CRYO, GENERATOR  
LRU :DISCONNECT, O2 GAS SUPPLY  
ITEM NAME: DISCONNECT, O2 GAS SUPPLY  
CRITICALITY OF THIS FAILURE MODE:123

FAILURE MODE:  
FAILS OPEN OR INTERNAL LEAKAGE

MISSION PHASE:

LO LIFT-OFF  
CO ON-ORBIT  
DO DE-ORBIT  
LS ~~LANDING SAFING~~

HW

VEHICLE/PAYLOAD/KIT EFFECTIVITY: 102 COLUMBIA  
: 103 DISCOVERY  
: 104 ATLANTIS  
: 105 ENDEAVOUR

CAUSE:  
MECHANICAL SHOCK, VIBRATION, CONTAMINATION

CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO

REDUNDANCY SCREEN A) PASS  
B) FAIL  
C) PASS

PASS/FAIL RATIONALE:

- A)
- B)  
REDUNDANCY SCREEN B - POPPET SEALING INTEGRITY IS NON VERIFIABLE IN FLIGHT SINCE DISCONNECT PROVIDES A SECONDARY SEAL TO THE T-O O2 GAS SUPPLY SOLENOID VALVE.
- C)

- FAILURE EFFECTS -

(A) SUBSYSTEM:  
NO EFFECT AFTER FIRST FAILURE. THE O2 GAS SUPPLY SOLENOID VALVE PROVIDES A SECONDARY SEAL.

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- (B) INTERFACING SUBSYSTEM(S):  
SAME AS (A)
- (C) MISSION:  
SAME AS (A)
- (D) CREW, VEHICLE, AND ELEMENT(S):  
SAME AS (A)
- (E) FUNCTIONAL CRITICALITY EFFECTS:  
AN ADDITIONAL FAILURE OF THE GAS SUPPLY SOLENOID VALVE, FAILING OPEN, MAY RESULT IN LOSS OF SYSTEM PRESSURE IF BOTH MANIFOLD ISOLATION VALVES FAIL TO CLOSE. LOSS OF SYSTEM PRESSURE RESULTS IN LOSS OF ALL THREE FUEL CELL POWERPLANTS (LOSS OF CREW/VEHICLE).

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- DISPOSITION RATIONALE -  
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- (A) DESIGN:  
POPPET IS SPRING-LOADED CLOSED, SYSTEM PRESSURE AIDS IN SEALING POPPET, POPPET TRAVEL IS PERPENDICULAR TO LAUNCH ACCELERATION FORCES. LAPPED METAL-TO-METAL SEAT. GAS SUPPLY VALVE PROVIDES A DUAL SEAL. 10 MICRON FILTER AT GROUND HALF COUPLING INLET. ALL COMPONENTS COMPATIBLE WITH WORKING FLUIDS. BODY IS CONSTRUCTED OF INCONEL 718 CORROSION RESISTANT STEEL.
- (B) TEST:  
QUALIFICATION TESTS INCLUDED; MECHANICAL SHOCK (20 G AT 1060 PSIG), SINUSOIDAL VIBRATION (+/- 0.25 G PEAK), RANDOM VIBRATION (1.0 G SQ/HZ FOR 34 MINUTES AND 0.5 G SQ/HZ FOR 14 MINUTES), AND THERMAL CYCLED (4 TIMES FROM CRYO TEMPERATURE TO +350 DEG F, 5 OPERATIONAL CYCLES PER THERMAL CYCLE), AND OPERATING CYCLES (2000 AT BOTH -297 DEG F AND AMBIENT TEMPERATURE).

ACCEPTANCE TESTS INCLUDE; PROOF PRESSURE TEST IN THE UNMATED MODE AT 1525 PSIG FOR A MINIMUM OF 5 MINUTES. LEAK TEST FOR INTERNAL LEAKAGE PAST POPPET AT 1060 PSIG AND THE POPPET SPRING FORCE VERIFIED WITH THE DISCONNECT'S INTERFACE SIDE PRESSURIZED AT 20 PSIG, WITH THE DOWNSTREAM SIDE VENTED TO ATMOSPHERE.

OMRSD: LEAK CHECK PERFORMED EVERY TURNAROUND.

- (C) INSPECTION:  
RECEIVING INSPECTION  
TEST REPORTS AND MATERIALS CERTIFICATIONS ARE MAINTAINED CERTIFYING MATERIALS AND PHYSICAL PROPERTIES.

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## CONTAMINATION CONTROL

THE PART IS CLEANED PER REQUIREMENTS OF MAD110-301 LEVEL 200A AS A PART OF THE ATP. CORROSION PROTECTION AND COMPLIANCE WITH THE CONTAMINATION CONTROL PLAN ARE VERIFIED. *FLUSHED WITH FREON PRIOR TO MATING.*

## ASSEMBLY/INSTALLATION

*THEY ARE*  
MANUFACTURING PROCESSES, ASSEMBLY AND INSTALLATION REQUIREMENTS ARE VERIFIED BY INSPECTION.

## CRITICAL PROCESSES

PARTS PASSIVATION AND ALL WELDS ARE VERIFIED BY INSPECTION.

## NONDESTRUCTIVE EVALUATION

WELDS ARE FLUORESCENT PENETRANT INSPECTED, USING LOX COMPATIBLE PENETRANT MATERIAL.

## TESTING

POPPET INTERNAL LEAKAGE AND SPRING FORCE TESTS ARE VERIFIED PER ATP.

## HANDLING/PACKAGING

HANDLING, PACKAGING, STORAGE AND SHIPPING PROVISIONS ARE VERIFIED BY INSPECTION.

■ (D) FAILURE HISTORY:

CAR NO. AB4940-010 H2 KSC, OV-102, GROUND CHECK  
AC5416-010 O2 KSC, OV-099, GROUND CHECK \*  
AC5968-010 H2 KSC, OV-099, GROUND CHECK  
AC8877-010 H2 KSC, OV-103, GROUND CHECK  
AC9803-010 H2 KSC, OV-103, GROUND CHECK \*  
A00230-010 O2 KSC, OV-104, GROUND CHECK

TWO O2 AND 4 H2 GAS SUPPLY DISCONNECTS HAVE BEEN REPORTED LEAKING. LEAKAGE HAS BEEN ATTRIBUTED TO CONTAMINATION FROM THE WORKING ENVIRONMENT IN ALL CASES.

\* - IN TWO CASES, LEAKAGE FELL WITHIN SPECIFICATION ONCE THE DISCONNECT WAS CYCLED OR FLUSHED.

NOTE: A GENERAL REQUIREMENT HAS BEEN INCORPORATED IN THE FILE III EPG/PRSD OMRSD REQUIRING THE FLUSHING OF ALL AMC/GHC INTERFACES WITH FREON TF PRIOR TO DISCONNECT MATING.

■ (E) OPERATIONAL USE:

NO CREW ACTION AFTER FIRST FAILURE. AFTER SECOND FAILURE CREW WILL ATTEMPT ISOLATION OF LEAK TO MANIFOLD 2 BY CLOSING ITS MANIFOLD VALVE.

FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CRITICAL FAILURE MODE

NUMBER: M4-186-PS015-01

- APPROVALS -

RELIABILITY ENGINEERING:	H. O. WEST	:	<u>H. O. West</u>	<u>E. C. Allen</u>
DESIGN ENGINEERING	: M. M. SCHEIERN	:	<u>M. M. Scheiern</u>	
QUALITY MANAGER	: D. J. BUTTNER	:	<u>D. J. Buttner</u>	
NASA RELIABILITY	:	:	<u>Tom W. Steinsinger</u>	
NASA SUBSYSTEM MANAGER	:	:	<u>W. J. ...</u>	2/19/82
NASA QUALITY ASSURANCE	:	:	<u>...</u>	