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PRINT DATE: 03/30/90

FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CRITICAL HARDWARE

NUMBER: 03-3-4506-X

SUBSYSTEM NAME: ORBITAL MANEUVERING SYSTEM (OMS)

REVISION : 2 03/16/90

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|       | PART NAME<br>VENDOR NAME                    | PART NUMBER<br>VENDOR NUMBER |
|-------|---|------------------------------|
| LRU : | COUPLING, TEST POINT, GN2<br>AEROJET/STERER | MC276-DD32-0009              |

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PART DATA

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EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:  
COUPLING, TEST POINT, GN2 (MD 001)

QUANTITY OF LIKE ITEMS: 2  
SP-26  
ONE FOR EACH ENGINE SUBSYSTEM

FUNCTION:  
PROVIDES CONNECTION FOR GROUND C/O OF THE PNEUMATIC ACTUATION SYSTEM COMPONENTS. THE COUPLING IS LOCATED ON THE ENGINE GN2 PACK. THE AIRBORNE HALF COUPLING (AHC) CONSISTS OF A SPRING LOADED POPPET, REDUNDANT POPPET SEALS AND FILTER. THE AHC CAP PROVIDES A REDUNDANT SEAL AND PROTECTS THE AHC WHEN NOT IN USE.

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FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CRITICAL FAILURE MODE  
NUMBER: 03-3-4506-01

SUBSYSTEM: ORBITAL MANEUVERING SYSTEM (OMS) REVISION# 2 03/16/90  
LRU :COUPLING, TEST POINT, GN2  
ITEM NAME: COUPLING, TEST POINT, GN2 CRITICALITY OF THIS FAILURE MODE:1R3

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FAILURE MODE:  
EXTERNAL LEAKAGE (SEAL LEAKAGE)

MISSION PHASE:  
00 DE-ORBIT

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

CAUSE:  
CONTAMINATION, EXCESS OR IMPROPER USE (EXCESS TORQUE, SEAL DAMAGE),  
INADEQUATE MAINTENANCE (OF GSE HALF), NO LINE SUPPORT - SHAFT OR BORE  
BENT.

CRITICALITY I/I DURING INTACT ABORT ONLY? NO

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REDUNDANCY SCREEN A) FAIL  
B) FAIL  
C) PASS

PASS/FAIL RATIONALE:  
A)  
B)  
C)

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- FAILURE EFFECTS -

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(A) SUBSYSTEM:  
LOSS OF REDUNDANCY FOR OVERBOARD GN2 LEAKAGE - NO EFFECT UNLESS  
REDUNDANT SEALS FAIL.

(B) INTERFACING SUBSYSTEM(S):  
NO EFFECT.

(C) MISSION:  
SAME AS (B)

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(D) CREW, VEHICLE, AND ELEMENT(S):  
SAME AS (B)

(E) FUNCTIONAL CRITICALITY EFFECTS:

POSSIBLE LOSS OF CREW/VEHICLE DUE TO INABILITY TO PERFORM DEORBIT BURN, ASSUMES FAILURE OF BOTH OMS ENGINES AND INADEQUATE PROPELLANT FOR RCS DEORBIT. 1R EFFECT ASSUMES FAILURE OF COUPLING CAP SEAL AND OTHER COUPLING SEALS, ACCUMULATOR LEAK AND FAILURE OF OTHER OMS ENGINE. CAP SEAL CANNOT BE VERIFIED AFTER INSTALLATION. NO INSTRUMENTATION AVAILABLE FOR DETECTION OF FAILURE OF CAP OR COUPLING SEAL IN FLIGHT.

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- DISPOSITION RATIONALE -  
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(A) DESIGN:

TWO POPPET SEALS. PROOF PRESSURE 2 X MAX OP (900 PSI). BURST PRESSURE 4 X MAX OP (1800 PSI). COMPLETE STRESS ANALYSIS PERFORMED. GROUND HALF COUPLINGS/LINES SUPPORTED TO LIMIT STRESS ON COUPLINGS AND PREVENT DAMAGE TO SEALS AND WELD JOINTS. CAP MINIMIZES LEAKAGE POTENTIAL (PROVIDES REDUNDANT SEAL). REDUNDANT ENGINES ARE PROVIDED AND THE ACCUMULATOR PROVIDES ENOUGH PRESSURANT FOR ONE ENGINE FIRING.

■ (B) TEST:

QUALIFICATION TEST

(9 UNITS - ALL TESTS NOT PERFORMED ON ALL UNITS). RANDOM VIBRATION (POPPET OPEN AND CAP ON). ENDURANCE - 400 CYCLES, THERMAL - (+150 DEG F. TO -100 F). CERTIFIED BY MPS, PROPELLANT COMPATIBILITY. BURST (1800 PSI). PRIMARY QUALIFICATION METHOD WAS BY SIMILARITY TO APOLLO COUPLINGS. TESTING ADDRESSED SPECIFIC CONCERNS. ALSO QUALIFIED AS PART OF ENGINE AND POD ASSEMBLY - HOT-FIRE ENGINE QUAL (138 TESTS), HOT-FIRE POD QUAL (498 TESTS).

ACCEPTANCE TESTS

(EACH UNIT) - PROOF PRESSURE, LEAK AND FUNCTIONAL.

GROUND TURNAROUND

V43CB0.204 REQUIRES LEAK CHECK FOR EACH COUPLING AND CAP USED DURING TURNAROUND OPERATIONS FOR FIRST FLIGHT AND EVERY FIVE FLIGHTS THEREAFTER (NOT INCLUDING SERVICING).

V43CB0.210 PERFORMS FIRST FLIGHT EXTERNAL LEAK CHECKS.

V43GEN.110 PERFORMS CAP INSPECTION WHEN CAP IS REMOVED.

S00FJD.040 PERFORMS POST ACTUATION PNEUMATIC LEAK/FUNCTIONAL TEST EVERY FLIGHT.

GN2 ACCUMULATOR PRESSURE MONITORED EACH FLIGHT FOR LEAKAGE.

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(C) INSPECTION:

RECEIVING INSPECTION

MATERIALS AND PROCESSES CERTIFICATIONS ARE VERIFIED BY INSPECTION.

CONTAMINATION CONTROL

CLEANLINESS TO LEVEL 100A AND CORROSION PROTECTION PROVISIONS ARE VERIFIED BY INSPECTION.

ASSEMBLY/INSTALLATION

MANUFACTURING, ASSEMBLY AND INSTALLATION PROCEDURES ARE VERIFIED BY INSPECTION. CRITICAL DIMENSIONS AND SURFACE FINISHES ARE VERIFIED BY INSPECTION.

NONDESTRUCTIVE EVALUATION

PENETRANT AND RADIOGRAPHIC INSPECTION OF WELDS ARE VERIFIED BY INSPECTION.

CRITICAL PROCESSES

THE WELDING PROCESS AND VERIFICATION THAT WELDS MEET SPECIFICATION REQUIREMENTS ARE VERIFIED BY INSPECTION.

TESTING

TEST EQUIPMENT AND TOOL CALIBRATION ARE VERIFIED BY INSPECTION. ACCEPTANCE TEST IS VERIFIED BY INSPECTION.

HANDLING/PACKAGING

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

(D) FAILURE HISTORY:

NO FAILURES HAVE BEEN RECORDED AGAINST THE OMS FOR THIS COMPONENT. OTHER APPLICATIONS HAVE EXPERIENCED CONTAMINATION INDUCED LEAKAGE FAILURES. SEVERAL CASES OF QD DAMAGE DUE TO HANDLING HAVE OCCURRED AT KSC AND WSTF. PROCEDURES HAVE BEEN REVISED AND ADDITIONAL TRAINING PROVIDED. SEE FMEA 03-3-1205-1 FOR ADDITIONAL FAILURE HISTORY.

(E) OPERATIONAL USE:

NO ACTION FOR FIRST FAILURE, NOT DETECTABLE. IF GN2 TANK PRESSURE IS LOST (MULTIPLE FAILURES), AFFECTED ENGINE WILL NOT BE USED FOR ON-ORBIT BURNS. ACCUMULATOR PRESSURE WILL BE SAVED FOR DEORBIT BURN START.

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- APPROVALS -  
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DESIGN ENGINEERING : V. F. ROZNOŠ  
QUALITY ENGINEERING : O. J. BUTTNER  
NASA RELIABILITY :  
NASA SUBSYSTEM MANAGER :  
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: *V. F. Roznos*  
: *O. J. Buttner*  
: *4/12/90*  
: *5-25-90*