PRINT DATE: 06/07/94

FAILURE MODES EFFECTS ANALYSIS (FMEA) – CRITICAL HARDWARE
NUMBER: 01-5B-380125-X

SUBSYSTEM NAME: PURGE, VENT, & DRAIN - ACTRS

REVISION: 1 06/02/94

		PART NAME VENDOR NAME	PART NUMBER VENDOR NUMBER
LRU	:	DOOR ASSEMBLY/HINGE BEARINGS	V070-385031

- - -

PART DATA

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:
DOOR ASSEMBLY/HINGE BEARINGS, VENTS 8 AND 9 (AFT FUSELAGE)

QUANTITY OF LIKE ITEMS: 4
(2 RH & 2 LH)
(1 PER VENT DOOR)

FUNCTION:
THIS ASSEMBLY ACTS TO OPEN AND CLOSE THE ORBITER AFT FUSELAGE COMPARTMENTS' VENT OPENINGS. THE DOOR ASSEMBLIES PROVIDE ATTACHMENT POINTS FOR HINGES AND ACTUATING RODS. THERE ARE FOUR DOOR ASSEMBLIES, TWO MOUNTED ON EACH SIDE OF THE AFT FUSELAGE (LEFT AND RIGHT). EITHER DOOR ASSEMBLY (LEFT OR RIGHT) WILL SUCCESSFULLY ACCOMPLISH VENTING/ REPRESSURIZATION.

PRINT DATE: 06/07/94

FAILURE MODES EFFECTS ANALYSIS (FMEA) – CRITICAL FAILURE MODE
NUMBER: 01-5B-380125-01

REVISION# 1 **06/02/94**

SUBSYSTEM NAME: PURGE, VENT, & DRAIN - ACTRS
LRU: DOOR ASSEMBLY/HINGE BEARINGS
ITEM NAME: DOOR ASSEMBLY/HINGE BEARINGS

CRITICALITY OF THIS FAILURE MODE: 1R3

FAILURE MODE:
FAILS TO ROTATE

MISSION PHASE:
DO. . DE-ORBIT

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

CAUSE:
ADVERSE TOLERANCES/WEAR, CONTAMINATION/FOREIGN OBJECT/DEBRIS, CORROSION, DEFECTIVE PART/MATERIAL OR MANUFACTURING DEFECT, EXCESSIVE LOAD

CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO

REDUNDANCY SCREEN
A) FAIL
B) FAIL
C) PASS

PASS/FAIL RATIONALE:
A)
FAILS REDUNDANCY SCREEN "A" SINCE THERE IS NO PRACTICAL TURNAROUND TEST TO DETECT THE FIRST FAILURE OF A HINGE BEARING; ALL BEARINGS HAVE DUAL ROTATING SURFACES.

B)
FAILS SCREEN "B" SINCE THE FIRST FAILURE OF A BEARING TO ROTATE IS NOT DETECTABLE WHILE IN FLIGHT.

C)

- FAILURE EFFECTS -

(A) SUBSYSTEM:
NONE. ALL BEARING SURFACES EMPLOY DUAL ROTATING SURFACES SO THAT ROTATIONAL CAPABILITY WILL EXIST FOLLOWING SURFACE TO SURFACE BINDING OF ONE ROTATIONAL SURFACE.

(B) INTERFACING SUBSYSTEM(S):
NO EFFECT FIRST FAILURE

(C) MISSION:

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NO EFFECT FIRST FAILURE

(D) CREW, VEHICLE, AND ELEMENT(S):
NO EFFECT FIRST FAILURE

(E) FUNCTIONAL CRITICALITY EFFECTS:
POSSIBLE LOSS OF CREW AND VEHICLE AFTER THREE FAILURES (1ST ROTATING SURFACE FAILS TO ROTATE, 2ND ROTATING SURFACE FAILS TO ROTATE, AND OPPOSITE VENT DOOR FAILS CLOSED) DUE TO LOSS OF VENTING CAPABILITY WHICH CAN RESULT IN STRUCTURAL OVERLOAD DUE TO PRESSURE DIFFERENTIAL ON ENTRY. FAILURE TO CLOSE, PRIOR TO ENTRY, WILL RESULT IN LOCALIZED THERMAL DAMAGE; THERMAL ANALYSIS (SAS-TA-RCC-78-152, -79-012 AND 79-065) SHOWS THAT CREW AND VEHICLE WILL SURVIVE.

-DISPOSITION RATIONALE-

(A) DESIGN:
DESIGN INCORPORATES DUAL ROTATING SURFACES WHICH CONSIST OF THE HINGE BEARING AND BUSHINGS IN THE HINGE CLEVIS. BEARINGS DESIGNED TO DEMONSTRATE GREATER THAN 1,000 HR B-10 LIFE IN ACCORDANCE WITH ANTI-FRICTION BEARING MANUFACTURING ASSOCIATION (AFBMA). BEARING MATERIAL IS 440C STAINLESS STEEL WITH VITROLUBE (DRY FILM) LUBRICATION. BEARING HOUSING IS FABRICATED OF 2024-T351 AND EXHIBITS A POSITIVE MARGIN OF SAFETY (0.02) WHEN SUBJECTED TO ULTIMATE LOADS. AVAILABLE TORQUE FAR EXCEEDS THE TORQUE REQUIRED FOR BEARING ROTATION.

(B) TEST:
ENDURANCE TEST PERFORMED ON AFT FUSELAGE VENT SYSTEM WHICH UTILIZES SAME BEARING DESIGN. TEST CONSISTS OF 2,000 OPERATIONAL CYCLES AND ACOUSTIC TESTING IS ACCOMPLISHED.

GROUND TURNAROUND TEST:
NO PRACTICAL OMRSD TEST IS AVAILABLE TO DETECT FIRST FAILURE.

(C) INSPECTION:
RECEIVING INSPECTION
MATERIAL AND PROCESS CERTIFICATIONS ARE VERIFIED BY INSPECTION.

CONTAMINATION CONTROL
CLEANLINESS TO LEVEL GC PER MA0110-301 IS VERIFIED BY INSPECTION. CORROSION PROTECTION PER MA0608-301 IS VERIFIED BY INSPECTION.

ASSEMBLY/INSTALLATION
MANUFACTURING PROCESSES, INCLUDING PARTS PROTECTION, VERIFIED BY INSPECTION. CRITICAL DIMENSIONS AND SURFACE FINISHES VERIFIED BY INSPECTION. BEARING HOUSING IS VERIFIED BY INSPECTION.

NONDESTRUCTIVE EVALUATION
PENETRANT INSPECTION IS VERIFIED BY INSPECTION.

CRITICAL PROCESSES
DRY FILM LUBRICATION, ELECTRICAL BOND AND TEST ARE VERIFIED BY INSPECTION.

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TESTING
ATP IS VERIFIED BY INSPECTION.

HANDLING/PACKAGING
HANDLING AND PACKAGING REQUIREMENTS ARE VERIFIED BY INSPECTION.

(D) FAILURE HISTORY:
CURRENT DATA ON TEST FAILURES, FLIGHT FAILURES, UNEXPLAINED ANOMALIES, AND OTHER FAILURES EXPERIENCED DURING GROUND PROCESSING ACTIVITY CAN BE FOUND IN THE PRACA DATABASE.

(E) OPERATIONAL USE:
THE GROUND CREW MAY USE REAL TIME COMMANDS (RTC) TO CYCLE THE VENT DOOR (TO ATTEMPT TO DISLODGE DEBRIS OR LOOSEN A STALLED/JAMMED MECHANISM), DEPENDING ON THE FAILURE MODE (OPEN, CLOSED) AND MISSION PHASE REQUIREMENT. RTC CAPABILITY IS ONLY AVAILABLE ON ORBIT AND POST-LANDING (OPERATIONS SEQUENCE 2 AND 9). THE SPEC 51 OVERRIDE PROVIDES LIMITED COMMAND CAPABILITY TO FLIGHT CREW TO OPEN OR CLOSE THE VENT DOORS IN OPS 3 TO OPEN.

- APPROVALS -

PAE MANAGER	: K. L. PRESTON	: Atell for 6/8/94
PRODUCT ASSURANCE ENG.	: T. AI	:
DESIGN ENGINEERING	: K. P. PATEL	: 6.7.94
NASA SSMA	:	: 7/6/94
NASA SUBSYSTEM MANAGER	:	: 7/6/94