

FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CIL HARDWARE

NUMBER: 03-1-0770 -X

SUBSYSTEM NAME: MAIN PROPULSION

REVISION: 1 08/08/00

PART DATA

	PART NAME	PART NUMBER
	VENDOR NAME	VENDOR NUMBER
LRU	:LH2 4" RECIRC RTN DISC SPHERICAL BEARING BOEING	V070-415262-005

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:BEARING, SPHERICAL, LH2 RECIRCULATION RETURN SYSTEM 4 INCH DISCONNECT,
INTERFACE CLAMPING**REFERENCE DESIGNATORS:****QUANTITY OF LIKE ITEMS:** 1**FUNCTION:**BEARING INTERFACE PROVIDES ALIGNMENT OF THE ET/ORBITER DISCONNECT HALVES
WHEN MATED TO INSURE PROPER DISTRIBUTION OF THE CLAMPING FORCE REQUIRED TO
MAINTAIN DISCONNECT IN MATED CONFIGURATION DURING ASCENT.

FAILURE MODES EFFECTS ANALYSIS FMEA -- CIL FAILURE MODE

NUMBER: 03-1-0770-01

REVISION#: 1 08/08/00

SUBSYSTEM NAME: MAIN PROPULSION

LRU: LH2 4" RECIRC RTN DISC SPHERICAL BEARING

CRITICALITY OF THIS

ITEM NAME: LH2 4" RECIRC RTN DISC SPHERICAL BEARING

FAILURE MODE: 1/1

FAILURE MODE:

FAILURE TO ALLOW AND MAINTAIN PROPER ALIGNMENT OF RECIRCULATION RETURN DISCONNECT

MISSION PHASE:

PL PRE-LAUNCH
LO LIFT-OFF

VEHICLE/PAYLOAD/KIT EFFECTIVITY:

102 COLUMBIA
103 DISCOVERY
104 ATLANTIS
105 ENDEAVOUR

CAUSE:

PIECE PART STRUCTURAL FAILURE, BINDING

CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO

REDUNDANCY SCREEN

A) N/A
B) N/A
C) N/A

PASS/FAIL RATIONALE:

A)

B)

C)

- FAILURE EFFECTS -

(A) SUBSYSTEM:

STRUCTURE FAILURE/BINDING OF THE BEARING WILL RESULT IN LH2 LEAKAGE INTO THE UMBILICAL CAVITY. MAJOR PORTION OF THE LH2/GH2 WILL ENTER THE AFT COMPARTMENT CAUSING POSSIBLE AFT COMPARTMENT OVERPRESSURIZATION AND FIRE/EXPLOSION HAZARD. LH2/GH2 LEAKAGE EXTERNAL TO THE UMBILICAL MAY CAUSE DAMAGE TO THE VEHICLE AND A FIRE/EXPLOSION HAZARD. POSSIBLE LOSS OF CRITICAL ADJACENT

**FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CIL FAILURE MODE
NUMBER: 03-1-0770-01**

COMPONENTS DUE TO CRYOGENIC EXPOSURE. LEAKAGE IS DETECTABLE DURING PROPELLANT LOADING BY HAZARD GAS DETECTION SYSTEM (HGDS).

SECONDARY SEAL IS NOT CONSIDERED REDUNDANT SINCE IT IS NOT DESIGNED TO SERVE AS A BACKUP TO THE PRIMARY SEAL. SECONDARY SEAL WILL PREVENT EXCESSIVE LEAKAGE.

(B) INTERFACING SUBSYSTEM(S):
SAME AS A.

(C) MISSION:
ON THE GROUND, VIOLATION OF THE HGDS LCC WILL RESULT IN LAUNCH SCRUB.

(D) CREW, VEHICLE, AND ELEMENT(S):
POSSIBLE LOSS OF CREW/VEHICLE.

(E) FUNCTIONAL CRITICALITY EFFECTS:
NONE.

-DISPOSITION RATIONALE-

(A) DESIGN:
THE BEARING IS FABRICATED FROM EPOXY IMPREGNATED GLASS FABRIC, THREE PADS MANUFACTURED FROM EPOXY GLASS RODS THAT CONTAIN ROSAN INSERTS. THE SPHERICAL SURFACE IS COATED WITH A DRY FILM LUBRICANT.

STRUCTURAL FAILURE OR BINDING WOULD PREVENT THE DISCONNECT FROM ALIGNING PROPERLY AND WOULD CAUSE AN UNEVEN DISTRIBUTION OF THE CLAMPING FORCE RESULTING IN LH2 LEAKING PAST THE INTERFACE SEAL.

THE BEARING IS DESIGNED TO A YIELD LOAD FACTOR OF SAFETY OF 1.0 AND AN ULTIMATE LOAD FACTOR OF SAFETY OF 1.4. STRUCTURAL ANALYSIS INDICATES POSITIVE MARGINS OF SAFETY FOR ALL CONDITIONS OF OPERATIONS.

(B) TEST:
ATP

EXAMINATION OF PRODUCT

CERTIFICATION

**FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CIL FAILURE MODE
NUMBER: 03-1-0770-01**

THE BELLEVILLE ASSEMBLY, INCLUDING THE BEARINGS, WERE CERTIFIED WITH THE PRODUCTION LH2 UMBILICAL ASSEMBLY, EACH CONTAINING INTERFACE LOADING CAPABILITY. THE UMBILICAL ASSEMBLIES WERE SUBJECTED TO THE FOLLOWING SERIES OF ENVIRONMENTAL AND STRUCTURAL TESTS:

UMBILICAL SEPARATION TESTS

28 CYCLES:

AMBIENT AND LH2 TEMPERATURES (-423 DEG F)
MAXIMUM OPERATING PRESSURES: 37 PSIG
EXTERNAL LOAD CONDITIONS

UMBILICAL VIBRATION TESTS

RANDOM VIBRATION

4.4 HOURS IN EACH OF THREE AXES

STATIC LOAD TEST

ULTIMATE LOAD TEST

GROUND TURNAROUND TEST

ANY TURNAROUND CHECKOUT IS ACCOMPLISHED IN ACCORDANCE WITH OMRSD.

(C) INSPECTION:

RECEIVING INSPECTION

INCOMING MATERIAL IS VERIFIED FOR MATERIAL AND PROCESS CERTIFICATION.

CONTAMINATION CONTROL

GENERAL CLEAN CONDITION IS MAINTAINED AND VERIFIED BY INSPECTION.

ASSEMBLY/INSTALLATION

MACHINED PARTS ARE VISUALLY INSPECTED TO MEETING TOLERANCE REQUIREMENT. LAMINATION AND FABRICATION OF PARTS ARE INSPECTED IN ACCORDANCE WITH DRAWING REQUIREMENTS. MANDATORY INSPECTION POINTS ARE INCLUDED IN THE MANUFACTURING PROCESS.

CRITICAL PROCESSES

DRY FILM LUBRICANT APPLIED ON SPHERICAL SURFACE IS VERIFIED BY INSPECTION. BONDING OF PARTS ARE CHECKED AND VERIFIED BY INSPECTION.

NONDESTRUCTIVE EVALUATION

N/A

TESTING

ATP FOR LONGITUDINAL FLEXURAL STRENGTH AND ELEVATED TEMPERATURE FLEXURAL STRENGTH IS VERIFIED BY INSPECTION.

HANDLING/PACKAGING

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

**FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CIL FAILURE MODE
NUMBER: 03-1-0770-01**

(D) FAILURE HISTORY:

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

(E) OPERATIONAL USE:

FLIGHT:
NO CREW ACTION CAN BE TAKEN

GROUND:
GROUND OPERATIONS SAFING PROCEDURES CONTAIN SAFING SEQUENCE OF EVENTS FOR MAJOR LEAKS IN THE HYDROGEN SYSTEM.

- APPROVALS -

S&R ENGINEERING	: W.P. MUSTY	:/S/ W.P. MUSTY
S&R ENGINEERING ITM	: P. A. STENGER-NGUYEN	:/S/ P.A. STENGER-NGUYEN
DESIGN ENGINEERING	: MIKE FISCHER	:/S/ MIKE FISCHER
MPS SUBSYSTEM MGR.	: TIM REITH	:/S/ TIM REITH
MOD	: BILL LANE	:/S/ BILL LANE
USA SAM	: MIKE SNYDER	:/S/ MIKE SNYDER
USA ORBITER ELEMENT	: SUZANNE LITTLE	:/S/ SUZANNE LITTLE
NASA SR&QA	: ERICH BASS	:/S/ ERICH BASS