SYSTEM:	Electrical	FUNCTIONAL CRIT:	1R *
SUBSYSTEM:	GH2 Pressurization System	PHASE(S):	a, b
REV & DATE:	J, 12-19-97	HAZARD REF:	S.09
DCN & DATE:			
ANALYSTS:	J. McCardle/T. McKeough/A. Oser		

FAILURE MODE: Blockage

FAILURE EFFECT: a,b) Loss of mission and vehicle/crew due to tank structural failure from overpressure.
b) Loss of mission and vehicle/crew due to fire/explosion when relief valve opens.

TIME TO EFFECT: Minutes

FAILURE CAUSE(S): A: Foreign Material
B: Orifice Washer Installation

REDUNDANCY SCREENS: Screen A: PASS
Screen B: FAIL - Not detectable in flight.
Screen C: FAIL - Foreign material blocks orifice.

FUNCTIONAL DESCRIPTION: Connects the inlet port of the pressure transducer to the tank outlet port.

FMEA ITEM CODE(S)	PART NO.	PART NAME	QTY	EFFECTIVITY
3.4.8.2	32L8-1	Flexible Hoses	2	LWT-54 & Up
3.4.9.2	32L8-2	Flexible Hoses	2	LWT-54 & Up

REMARKS: * Item criticality is increased to 1 during intact abort since the ET pressurization system is not single failure tolerant with one SSME out (one FCV nonfunctional). Failure of an ullage pressure transducer such that the corresponding FCV fails open causes ullage pressure to increase until the relief valve opens. Subsequent venting of GH2 is criticality 1 since there is always a possible ignition source such as lightning.

These items are grouped since the failure mode and Rationale for Retention are the same.

SYSTEM:	Electrical	REV & DATE:	J, 12-19-97
SUBSYSTEM:	GH2 Pressurization System	DCN & DATE:	
FMEA ITEM CODE(S):	3.4.8.2, 3.4.9.2		

RATIONALE FOR RETENTION

DESIGN:

The flexible hose is designed and fabricated to Lockheed Martin Standard Drawing 32L8. These hoses provide a connection between the tank pressure ports and transducers.

A: The flexible hose is constructed of a convoluted Teflon tubing which is wrapped with Nomex aramid fiber per MIL-C-572 Type PAA or MIL-I-24204.

A: The end fittings are 57L8-4 CRES that interfaces with the ET pressure fitting and the ullage transducer.

A: All fittings are CRES per QQ-S-763.

A: All tubing is CRES per MIL-T-8606 or MIL-T-8808.

A: The detail Drawings, Assembly and Process specifications are approved and validated by Lockheed Martin.

A: The hose assemblies are ultrasonically cleaned and flushed prior to packaging and/or before moving to the next manufacturing step, the details and subassemblies have to pass NVR check.

Redundancy Description

Redundancy of the flex hoses due to blockage exists because each flex hose is isolated from the others. The flex hoses are used to connect the pressure port of each transducer to four pressure fittings of the tank, measuring the ullage pressure. Blockage of the flex hose would result in the same effect as a pressure transducer failing with low reading. The LH2 tank relief valve is standby redundant to the pressure transducers to prevent structural failure from overpressure.

The effect of blockage for the first, second (first redundancy) and third flex hoses (second redundancy) and for failure of the relief valve (third redundancy) is shown in the matrix below.

FAILURE	EFFECT
1 Xducer fails low output (1 FCV Open)	No effect
2 Xducers fail low output (2 FCV Open)	Loss of mission and vehicle/crew due to fire/explosion when relief valve opens
3 Xducers fail low output (3 FCV Open)	Loss of mission and vehicle/crew due to fire/explosion when relief valve opens
2 or 3 Xducers fail low output or relief valve fails closed	Loss of mission and vehicle/crew due to tank structural failure from overpressure

FCV - Flow Control Valve

The transducers are not used in phase C.

SYSTEM:	Electrical	REV & DATE:	J, 12-19-97
SUBSYSTEM:	GH2 Pressurization System	DCN & DATE:	
FMEA ITEM CODE(S):	3.4.8.2, 3.4.9.2		

RATIONALE FOR RETENTION

TEST:

The Flexible Hoses are qualified. Reference HCS MMC-ET-TM08-E007.

The 32L8 hoses are qualified by analysis and similarity to the 32L3 hoses which were tested during the higher level ullage pressure transducer qualification test.

MAF:

A, B: Perform Transducer Functional Test (TM04k).

Launch Site:

A, B: Perform Transducer Calibration Test (OMRSD File IV).

A, B: Perform Transducer Operation Test (OMRSD File II).

INSPECTION:

Lockheed Martin Procurement Quality Representative:

A: Inspect X-ray film (Lockheed Martin Standard Drawing 32L8).

A: Verify hoses clean (Lockheed Martin Standard Drawing 32L8 and STP5008).

MAF Quality Inspection:

A, B: Witness Transducer Functional Operation Test (TM04k).

Launch Site:

A, B: Witness Transducer Operation Test (OMRSD File II & File IV).

FAILURE HISTORY:

Current data on test failures, unexplained anomalies and other failures experienced during ground processing activity can be found in the PRACA data base.